

## CHECKLIST OF THE HERPETOFAUNA OF THE SERIBUAT ARCHIPELAGO, WEST MALAYSIA WITH COMMENTS ON BIOGEOGRAPHY, NATURAL HISTORY, AND ADAPTIVE TYPES

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**ABSTRACT.** – The Seribuat Archipelago is an environmentally complex group of 62 islands which lie off the southeast coast of Peninsular Malaysia in the South China Sea. Its herpetofauna, which is documented herein for the first time, contains 23 species of frogs, one species of non-marine turtle, 43 species of lizards, 44 species of non-marine snakes, and represents a diverse array of adaptive types. Of these, one frog, 11 lizards and four snakes are endemic. The majority of the herpetofauna, including 14 of the 16 endemics, occurs in the outermost arc of islands which are the oldest, largest, and most environmentally diverse. Some of the species in this Outer Arc are more closely related to species from Sumatra, Java, and/or Borneo than they are to species from peninsular Malaysia, suggesting they had a vicariant origin.

**KEY WORDS.** – Seribuat Archipelago, Herpetofauna, Malaysia, Endemic, Biogeography.

### INTRODUCTION

The Seribuat Archipelago comprises an environmentally diverse array of islands located in the southern section of the South China Sea. These islands flank the southeast coast of peninsular Malaysia along the southern states of Pahang and Johor (Fig. 1). The archipelago contains 62 islands ranging in size from 0.01–110 km<sup>2</sup> (Table 1) and extends from Pulau Cebeh in the north 100 km southward to Pulau Tokong Yu. It has been demonstrated that these islands, along with the Anambas and Natuna Archipelagos of Indonesia, are part of a key phylogenetic link between the flora and fauna of peninsular Malaysia and other islands of the Sunda Shelf (Adura, 1998, L. Grismer, et al., 2003; 2004b; Kottelat, 1990; Leong et al., 2003; Tan & Mohamad, 1999; Ng, Tan and Lim, 1999; Sanders et al., 2005; Yeo & Ng, 1999; Yeo et al., 1999). Leong et al. (2003) provided preliminary checklists for the herpetofauna of the Anambas and Natuna archipelagos and we supplement these with the checklist provided herein.

Despite the extreme environmental diversity within and between the islands of this archipelago, biological studies have been relatively infrequent. In fact, there have been no archipelago-wide studies comparing broad taxonomic cross sections of any portion of the flora or fauna to one another or to taxa of the adjacent peninsula. Only the largest island, Pulau Tioman, has been the focus of several botanical studies (see Jaman & Latiff, 1999; Latiff et al., 1999 and references therein) as well as natural history expeditions which began in earnest during the mid 1960s (see Bullock & Medway,

1966). Pulau Tioman continues to be an area of active biological research (Day, 1990; Sodhi et al., 1999) and recently, the majority of published studies concerning this island have focused on its herpetofauna (Das & Grismer, 2003; Das & Lim, 2000; Diaz et al., 2004; Escobar et al., 2003c; Hendrickson, 1966a, b; J. Grismer et al., 2003a, b, c,

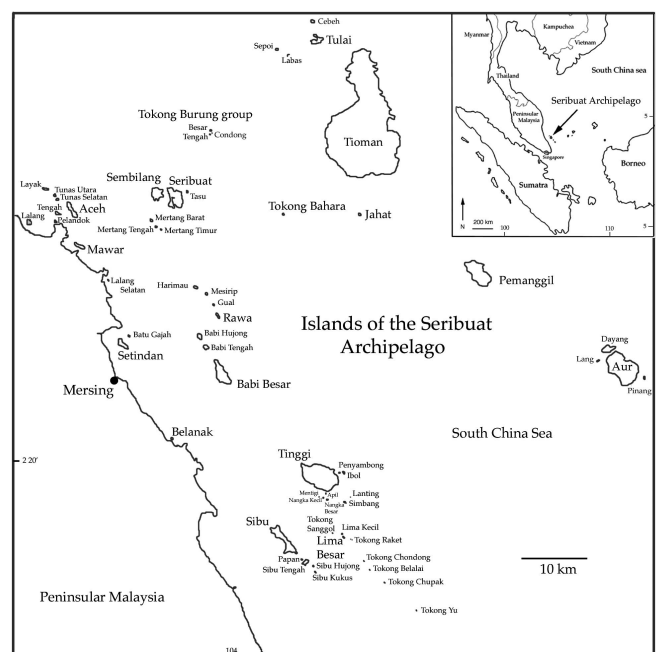


Fig. 1. Islands of the Seribuat Archipelago. Island names in large fonts represent island groups as delimited in the text.

Table. 1. Location, size, elevation, and period of the day of the survey of the islands of the Tioman Archipelago.

Island	km <sup>2</sup>	elevation (m)	location	am/pm surveys
<b>INNER ARC</b>				
<b>Aceh group</b>				
Aceh	1.32	150	02° 39.6' 103 46.3'	am,pm
Anak Aceh	0.01	~25	02° 40.9' 103 45.9'	am
Tunas Utara	0.02	44	02° 41.4' 103 44.8'	am
Tunas Selantan	0.02	31	02° 41.2' 103 45.1'	am
Layak	0.24	69	02° 41.8' 103 44.4'	am, pm
Lalang	0.07	38	02° 39.2' 103 42.8'	am
Pelandok	0.04	~30	02° 39.2' 104 45.0'	am
Tengah	0.16	58	02° 39.8' 103 45.3'	am
Mawar	0.33	72	02° 37.0' 103 47.0'	am
Lalang Selatan	0.02	~10	02° 33.9' 103 49.7'	am
<b>Setindan group</b>				
Setindan	3.8	105	02° 28.7' 103 51.0'	am
Batu Gajah	0.04	~60	02° 29.5' 103 51.4'	am
Belanak	0.01	50	02° 21.0' 103 55.2'	am
<b>MIDDLE ARC</b>				
<b>Seribuat group</b>				
Seribuat	5.52	124	02° 41.5' 103 55.0'	am, pm
Sembilang	2.51	257	02° 41.5' 103 53.3'	am, pm
Mertang Barat	0.04	44	02° 39.3' 103 52.8'	am
Mertang Tengah	0.01	27	02° 39.1' 103 53.1'	am
Mertang Timur	0.03	38	02° 38.7' 103 53.4'	am
Tasu	0.04	70	02° 41.7' 103 55.7'	am
<b>Rawa group</b>				
Rawa	0.3	97	02° 31.6' 103 58.6'	am
Harimau	0.21	91	02° 33.5' 103 56.6'	am
Mensirip	0.08	32	02° 33.0' 103 57.5'	am
Gual	0.09	56	02° 32.1' 103 58.2'	am
<b>Besar group</b>				
Babi Besar	6.38	251	02° 25.9' 103 58.7'	am, pm
Babi Tengah	0.55	83	02° 28.6' 103 07.8'	am
Babi Hujung	0.66	99	02° 29.3' 103 57.0'	am
<b>Tinggi group</b>				
Tinggi	13.5	610	02° 18.0' 104 07.0'	am, pm
Apil	0.04	13	02° 16.7' 104 07.6'	am
Mentigi	0.01	3	02° 16.5' 104 07.1'	am
Nangka Kecil	0.04	~15	02° 16.5' 104 07.5'	am
Nangka Besar	0.1	33	02° 16.2' 104 07.5'	am
Simbang	0.07	23	02° 15.0' 104 09.2'	am
Lanting	0.01	16	02° 16.5' 104 09.4'	am
Ibol	0.15	82	02° 18.4' 104 09.2'	am
Penyembong	0.04	17	02° 18.4' 104 08.0'	am
<b>Sibu group</b>				
Sibu	4.81	155	02° 13.0' 104 04.2'	am, pm
Sibu Tengah	0.45	74	02° 11.1' 104 06.1'	am
Papan	0.02	22	02° 11.3' 104 05.7'	am
Sibu Kukus	0.03	45	02° 10.3' 104 06.7'	am
Sibu Hujung	0.03	59	02° 10.9' 104 06.6'	am
<b>Lima group</b>				
Lima Besar	0.1	48	02° 13.2' 104 09.0'	am, pm
Lima Kecil	0.04	41	02° 13.4' 104 09.0'	am
Tokong Sanggol	0.01	22	02° 13.4' 104 08.1'	am
Tokong Raket	0.01	29	02° 13.0' 104 09.6'	am
Tokong Chondong	0.02	38	02° 11.6' 104 10.6'	am
Tokong Belalai	0.01	30	02° 11.4' 104 10.6'	am
Tokong Chupak	0.01	30	02° 10.6' 104 11.1'	am
Tokong Yu	0.01	28	02° 07.4' 104 14.8'	am

Table 1. Location, size, elevation, and period of the day of the survey of the islands of the Tioman Archipelago. (Continued)

Island	km <sup>2</sup>	elevation (m)	location	am/pm surveys
<b>OUTER ARC</b>				
Tioman	110	1038	02 47.0' 104 10.0'	am, pm
Pemanggil	9.2	405	02 35.0' 104 19.0'	am, pm
<b>Tulai group</b>				
Tulai	0.87	98	02 54.5' 104 06.5'	am, pm
Labas	0.01	20	02 53.3' 104 04.0'	am
Sepoi	0.03	60	02 53.9 104 03.1'	am, pm
Cebah	0.05	71	02 56.0' 104 05.9'	am, pm
<b>Aur group</b>				
Aur	12.75	521	02 27.0' 104 32.0'	am, pm
Dayang	2.09	158	02 28.3' 104 30.0'	am
Lang	0.05	38	02 27.5' 104 29.5'	am
Pinang	0.11	97	02 26.2' 104 33.3'	am
<b>Tokong Burung group</b>				
Tokong Burung Besar	0.36	54	02 47.0' 103 57.6'	am
Tokong Burung Condong	0.01	41	02 46.7' 103 57.6'	am
Tokong Burung Tengah	>0.01	32	02 46.8 103 57.6'	am
Tokong Bahara	0.02	54	02 39.7' 104 03.8'	am
Jahat	0.05	30	02 39.8' 104 10.0'	am

2004; L. Grismer, 2005a, Grismer, 2006b; L. Grismer et al., 2002, 2003, 2004a,b; Hien et al., 2001; Leong 2000; Leong & Grismer, 2004; Leong & Crane, 2001; Leong & Tan, 2000; Lim & Lim, 1999; van Rooijen, 2001; Wood et al., 2003a, d; Youmans et al., 2003). These reports provided the catalyst for a surge of herpetological exploration which has swept over much of the Seribuat Archipelago (Escobar et al., 2003a, b; L. Grismer, 2005a, b, 2006, a, b; Grismer & Das, 2006; L. Grismer et al., 2001a, b, 2003; Wood et al., 2003b, c; 2004a, b; Valdivia et al. 2004; Youmans & Grismer, 2006; Youmans et al., 2002, 2003), resulting in the addition of several new island records and the discovery of at least 13 new species. However, even with the addition of these later efforts, only 10 of the 62 islands had ever been explored. Therefore, we report here 171 new island records resulting from our surveys of the remaining 52 islands and additional surveys made on previously explored islands.

## MATERIALS AND METHODS

Two primary surveys augmenting the previous works cited above, took place from 19–25 August 2003 and from 7–15 September 2004 in an effort to generate baseline data from the unexplored islands. All islands were visited at least once during the day by seven or eight people. Some of the more heavily forested islands were surveyed at night as well (Table 1). Specimens were collected by hand and/or blow pipe, photographed, tissue for liver samples (for future molecular studies), fixed in 10% formalin, and subsequently transferred to 70% ethanol. Material collected from previous expeditions is deposited at the Forest Research Institute of Malaysia (FRIM), The Raffles Museum of Biodiversity Research, The National University of Singapore (ZRC), the Malaysian Wildlife Department (PERHILITAN), and the La Sierra

University Herpetological Collection (LSUHC). Material collected from the latter two expeditions is temporarily deposited in the LSUHC pending further study. All tissues are deposited in the LSUHC and voucher photographs are deposited in the La Sierra University Digital Photograph Collection (LSUDPC). Table 2 lists the species of the Seribuat Archipelago and the islands on which they occur. Appendix I cross-references this table and provides species checklists for each island. Appendix II provides locality and catalogue numbers for all new island records not previously published.

The surface area (km<sup>2</sup>), elevation (meters above sea level [m]), and locality for each island is provided (Table 1). To form the basis for future ecological studies, a general description of each island is given which includes topography, vegetative structure, and habitat types. Island names and spelling follow those proposed by the Director of National Mapping, Malaysia, 1995–1997.

Abbreviations used are as follows: G. = Gunung (mountain); Kg. = Kampung (village); P. = Pulau (island) S. = Sungai (river); Tk. = Telok (bay).

## VEGETATION ZONES OF THE SERIBUAT ARCHIPELAGO

Vegetation zones generally serve to highlight broad categorical differences between habitats across sizable geographic areas. These categorical differences lack well-defined geographic boundaries (Ashton, 1995) and, with the exception of mangrove communities, each zone transitions smoothly, continuously, and usually imperceptibly into one another along an altitudinal transect. The vegetation zones used here follow those of Latiff et al. (1999).

Table 2. Island checklist of species in the Tioman Archipelago. Asterisk indicates the species is endemic.

<b>Amphibians</b>	
<b>Megophryidae</b>	
<i>Leptolalax kajangensis</i> *	Tioman
<i>Megophrys nasuta</i>	Tioman
<b>Bufoidea</b>	
<i>Ansonia tiomonica</i> *	Tioman
<i>Bufo asper</i>	Tioman
<i>Bufo melanostictus</i>	Tioman
<i>Bufo parvus</i>	Tioman
<i>Pelophryne brevipes</i>	Aur, Tioman
<b>Microhylidae</b>	
<i>Chaperina fusca</i>	Tioman
<i>Kalophrynus pleurostigma</i>	Tioman
<i>Kaloula baleata</i>	Aceh, Tioman
<i>Kaloula pulchra</i>	Tioman
<i>Microhyla borneensis</i>	Sibu
<b>Rhacophoridae</b>	
<i>Nyctixalus pictus</i>	Tioman
<i>Philautus petersi</i>	Tioman
<i>Polypedates leucomystax</i>	Aceh, Seribu, Sembilang, Babi Besar, Babi Tengah, Sibu, Tioman
<i>Theoderma horridum</i>	Tioman
<b>Ranidae</b>	
<i>Fejervarya cancrivora</i>	Seribu, Sembilang, Babi Besar, Sibu, Tioman,
<i>Limnonectes blythii</i>	Tinggi, Tioman, Aur, Pemanggil
<i>Rana erythraea</i>	Tioman
<i>Rana hosii</i>	Tinggi, Tioman
<i>Rana picturata</i>	Tioman
<i>Rana raniceps</i>	Tioman
<i>Taylorana hascheana</i>	Tioman
<b>Ichthyophiidae</b>	
<i>Ichthyophis</i> sp.	Tioman
<b>Reptiles</b>	
<b>Trionychidae</b>	
<i>Dogania subplana</i>	Tinggi, Tioman
<b>Agamidae</b>	
<i>Acanthosaura armata</i>	Aur, Tioman
<i>Aphaniotis fusca</i>	Aceh, Seribu, Sembilang, Babi Besar, Babi Hujung, Tinggi, Sibu, Tioman
<i>Bronchocela cristatella</i>	Babi Besar, Tinggi, Sibu, Sibu Tengah, Tioman, Tulai, Pemanggil, Aur
<i>Draco fimbriatus</i>	Tioman
<i>Draco formosus</i>	Tinggi
<i>Draco haematopogon</i>	Tioman
<i>Draco melanopogon</i>	Tinggi, Sibu, Tioman
<i>Draco sumatranus</i>	Babi Besar, Tinggi, Tioman
<i>Gonocephalus chamaeleontinus</i>	Tioman
<i>Gonocephalus grandis</i>	Tioman
<b>Gekkonidae</b>	
<i>Cnemaspis baueri</i> *	Aur, Dayang
<i>Cnemaspis kendallii</i>	Aceh, Seribu, Sembilang, Babi Besar, Babi Hujung, Tinggi, Ibol, Sibu, Sibu Tengah, Tioman, Tulai
<i>Cnemaspis limi</i> *	Tioman, Tulai
<i>Cnemaspis pemanggilensis</i> *	Pemanggil
<i>Cosymbotus craspedotus</i>	Tinggi, Tioman
<i>Cosymbotus platyurus</i>	Tioman, Aur
<i>Cyrtodactylus aurensis</i> *	Aur
<i>Cyrtodactylus quadrivirgatus</i>	Tioman
<i>Cyrtodactylus seribuensis</i> *	Seribu, Sembilang, Nangka Kecil, Mentigi, Sibu, Sibu Tengah, Lima Besar
<i>Cyrtodactylus tiomanensis</i> *	Tioman
<i>Gehyra mutilata</i>	Rawa, Babi Besar, Babi Tengah, Nangka Besar, Sibu, Lima Besar, Lima Kecil, Tioman, Aur
<i>Gekko monarchus</i>	Aceh, Layak, Tunas Selatan, Pelandok, Batu Gajah, Seribu, Sembilang, Mertang Tengah, Mertang Timur, Babi Besar, Babi Hujung, Babi Tengah, Tinggi, Penyambong, Ibol, Simbang, Nangka Kecil, Mentigi, Sibu, Lima Besar, Tioman, Tulai, Cebeh, Jahat, Pemanggil, Aur, Dayang
<i>Gekko smithii</i>	Tioman, Tulai

Table 2. Island checklist of species in the Tioman Archipelago. Asterisk indicates the species is endemic. (Continued)

<i>Hemidactylus frenatus</i>	Aceh, Aceh Anak, Layak, Tunas Selatan, Tunas Utara, Lalang Selatan, Lalang Utara, Pelandok, Mawar, Setindan, Belanak, Seribuat, Semilang, Tasu, Mertang Timur, Rawa, Harimau, Gual, Babi Besar, Babi Hujung, Babi Tengah, Tinggi, Penyambong, Nangka Besar, Nangka Kecil, Mentigi, Sibul, Sibul Tengah, Sibul Kukus, Lima Besar, Lima Kecil, Chondong, Belalai, Tioman, Tulai, Sepoi, Pemanggil, Aur, Dayang, Lang, Tokong Burung Besar, Tokong Burung Chondong, Tokong Burung Tengah, Tokong Bahara
<i>Hemiphyllodactylus typus</i>	Sibul
<i>Lepidodactylus lugubris</i>	Tunas Selatan, Mawar, Babi Tengah, Nangka Kecil, Mentigi, Sibul, Papan, Sanggol, Raket, Tioman, Ceben, Sepoi, Jahat
<i>Ptychozoon kuhli</i>	Aceh, Sembilang, Babi Besar, Tinggi, Tioman, Tulai
<i>Ptychozoon lionatum</i>	Sibul, Tioman
<b>Scincidae</b>	
<i>Dasia olivacea</i>	Babi Besar, Babi Tengah, Tinggi, Sibul, Tioman, Aur
<i>Emoia atrocostata</i>	Seribuat, Simbang, Nangka Besar, Sibul, Papan, Sibul Tengah, Sibul Kukus, Tulai, Aur
<i>Eutrophis longicaudata</i>	Tioman
<i>Eutrophis multifasciata</i>	Aceh, Seribuat, Sembilang, Rawa, Babi Besar, Babi Tengah, Tinggi, Sibul, Sibul Kukus, Tioman, Tulai, Sepoi, Pemanggil, Aur, Dayang, Lang, Tokong Burung Besar, Tokong Burung Chondong, Tokong Burung Tengah, Tokong Bahara
<i>Larutia seribuatensis</i> *	Tioman, Tulai
<i>Lipinia surda</i>	Tioman, Aur
<i>Lipinia vittigera</i>	Babi Besar, Tioman, Aur
<i>Lygosoma bowringii</i>	Aceh, Tunas Selatan, Mawar, Setindan, Seribuat, Sembilang, Mertang Tengah, Mertang Timur, Rawa, Harimau, Mensirip, Babi Besar, Babi Tengah, Ibol, Nangka Kecil, Mentigi, Sibul, Papan, Sibul Tengah, Lima Besar, Tioman, Pemanggil, Aur
<i>Sphenomorphus ishaki</i> *	Tioman
<i>Sphenomorphus sibuenis</i> *	Sibul
<i>Sphenomorphus scotophilus</i>	Tioman, Tulai, Pemanggil, Aur
<b>Varanidae</b>	
<i>Varanus nebulosus</i>	Tioman, Aur
<i>Varanus salvator</i>	Aceh, Anak Aceh, Layak, Tunas Selatan, Tunas Utara, Tengah, Pelandok, Mawar, Setindan, Batu Gajah, Seribuat, Sembilang, Tasu, Mertang Barat, Mertang Tengah, Rawa, Harimau, Mensirip, Babi Besar, Babi Hujung, Simbang, Sibul, Sibul Tengah, Sibul Hujung, Sibul Kukus, Tokong Belalai, Tioman, Tulai, Pemanggil, Aur, Dayang
<b>Dibamidae</b>	
<i>Dibamus tiomanensis</i> *	Tioman, Tulai
<b>Typhlopidae</b>	
<i>Ramphotyphlops albiceps</i>	Tioman
<i>Ramphotyphlops braminus</i>	Aceh, Tunas Selatan, Babi Besar, Sibul, Sibul Tengah, Tioman, Aur, Dayang
<b>Pythonidae</b>	
<i>Python reticulatus</i>	Tioman, Tulai
<b>Colubridae</b>	
<i>Ahaetulla prasina</i>	Babi Besar, Tinggi, Tioman, Tulai, Aur
<i>Asthenodipsas vertebralis</i>	Tioman
<i>Boiga cynodon</i>	Tioman
<i>Boiga dendrophila</i>	Babi Besar, Sibul
<i>Boiga drapiezii</i>	Tinggi, Tioman
<i>Boiga nigriceps</i>	Tioman, Aur
<i>Calamaria ingeri</i> *	Tioman
<i>Calamaria lovii</i>	Aur
<i>Calamaria lumbricoidea</i>	Tioman
<i>Calamaria pavimentata</i>	Tioman
<i>Cerberus rynchops</i>	Seribuat, Tioman
<i>Chrysopelea paradisi</i>	Sibul Tengah
<i>Chrysopelea pelias</i>	Tioman
<i>Dendrelaphis caudolineatus</i>	Aceh, Babi Besar, Tinggi, Sibul, Sibul Tengah, Tioman
<i>Dendrelaphis cyanochloris</i>	Tinggi, Tengah, Tioman
<i>Dendrelaphis pictus</i>	Aceh, Mawar, Babi Besar, Tioman
<i>Dendrelaphis striatus</i>	Tioman
<i>Dryocalamus subannulatus</i>	Tinggi, Sibul, Tioman
<i>Dryophiops rubescens</i>	Tioman
<i>Elaphe flavolineata</i>	Tioman
<i>Elaphe taeniura</i>	Tioman
<i>Enhydryis enhydryis</i>	Tioman

Table 2. Island checklist of species in the Tioman Archipelago. Asterisk indicates the species is endemic. (Continued)

<i>Enhydria plumbea</i>	Tioman
<i>Fordonia leucobalia</i>	Tioman
<i>Gongylosoma mukutense*</i>	Tioman
<i>Gonyosoma oxycephalum</i>	Tioman
<i>Lepturophis albofuscus</i>	Tioman
<i>Liopeltis tricolor</i>	Tioman
<i>Lycodon capucinus</i>	Rawa, Babi Besar, Babi Hujung
<i>Oligodon booliati*</i>	Tioman
<i>Oligodon purpureus</i>	Tioman
<i>Psammodynastes pulverulentus</i>	Tioman
<i>Pseudorabdion longiceps</i>	Sibu
<i>Rhabdophis chrysargos</i>	Tioman
<i>Sibynophis melanocephalus</i>	Tioman
<i>Zaocys carinatus</i>	Tioman
<b>Elapidae</b>	
<i>Bungarus flaviceps</i>	Tioman
<i>Calliophis intestinalis</i>	Tioman
<i>Ophiophagus hannah</i>	Tioman
<b>Viperidae</b>	
<i>Popeia</i> sp.	Tioman
<i>Tropidolaemus wagleri</i>	Aceh

**Mangroves (0 m).** – Mangrove swamps are usually disjunctly distributed in thin belts along many of the islands' coastlines. Characteristic plant species include Bakan Minyak (*Rhizophora apiculata*), Tumu (*Bruguiera gymnorhiza*), Buta-butua (*Excoecaria agallocha*), and Api-api Putih (*Avicennia alba*) which, in some localities on P. Tioman and P. Mawar, are unusually tall with large girth, attesting to the antiquity of the grove.

**Coastal vegetation (0–80 m).** – Coastal vegetation forms a relatively narrow zone between the mangrove swamps (when present) and the lower reaches of the lowland dipterocarp forest. It is characterized by palms, Screw Pine (*Pandanus dubius*), and moderately-sized trees such as Healing Plant (*Scaevola taccada*), Beauty Leaf (*Calophyllum inophyllum*), and Arabian Lilac (*Vitex trifolia*). Dipterocarp trees are noticeably absent.

**Lowland dipterocarp forest (usually 80–300 m).** – Lowland dipterocarp forest occurs on the alluvial slopes between coastal vegetation and hill dipterocarp forest and is usually dominated by large, non-dipterocarp trees such as Kabong Tukas (*Arenga pinnata*), Fishtail Palm (*Caryota mitis*), and Feather Palm (*Nenga macrocarpa*). A few large dipterocarp species such as Mersawa Kuning (*Anisoptera curtisii*) and Chengal (*Neobalanocarpus heimii*) exist as emergents.

**Hill dipterocarp forest (300–950 m).** – This zone is situated immediately above and adjacent to the lowland dipterocarp forest with which it is continuous. The transition from lowland dipterocarp forest to hill dipterocarp forest at approximately 300 m is almost imperceptible and many plant species common to the lowland dipterocarp forest occur at lower elevations in the hill dipterocarp forest. Hill dipterocarp forest is dominated throughout by the larger dipterocarp species of the genera *Shorea* and *Dipterocarpus*.

**Ridge forest (hill top summits between 950–1035 m).** – Ridge forest occurs on summits where mosses, ferns, lichens, and bryophytes predominate. Due to increased exposure to sun and wind, trees are relatively short. At this altitude, species such as *Garcinia penangiana*, *Licuala tiomanensis*, and *Scleria sumatrensis* dominate and presumably have adapted to live in the damp, wind-blown environment typical of ridge forests.

## GEOGRAPHY OF THE SERIBUAT ARCHIPELAGO

The environmental diversity of the Seribuat Archipelago is unparalleled by any other island groups off the coast of peninsular Malaysia. This is paramount to the generation and maintenance of the herpetofaunal diversity and its broad array of adaptive types. The large islands (> 4.0 km<sup>2</sup>) such as Aur, Babi Besar, Pemanggil, Tinggi, Tioman, and Sibu generally maintain extensive tracts of primary dipterocarp forest (Fig. 2). The largest of these islands, Tioman and Tinggi, also maintain significant sources of permanent fresh water in the form of streams (Fig. 3), which harbor aquatic and riparian species. Pulau Tioman even has a river system, S. Mentawak (Fig. 3), which serves as the only locality in the archipelago for the frog *Rana picturata*. Conversely, many of the very small islands (> 0.03 km<sup>2</sup>) such as the “Tokongs” are little more than wind-blown, arid, rocky outcrops rising precipitously out of the ocean which support only grasses and low-growing shrubs (Fig. 4). But here too, potentially endemic species have been found which occur nowhere else in the archipelago (e.g., *Eutropis* cf. *multifasciata* on P. Tokong Bahara, see below). The intermediate-sized islands may be barren (P. Layak), forested (P. Babi Hujung), or combinations of both such as in the Seribuat group (Fig. 5) and may or may not support ephemeral bodies of fresh water. Many of the islands in the archipelago,

both large and small, are fringed with broad stands of mangroves (Fig. 6).

The islands of the Seribuat Archipelago are landbridge islands which formerly comprised a series of at least three low mountain ranges paralleling the more extensive ranges running the length of the adjacent Malay Peninsula. The summits of these ranges became transformed into a series of three, parallel island arcs (Fig. 7) following the most recent rise in sea level which inundated the Greater Sunda Shelf 8–18,000 years before present (Inger & Voris, 2001; Voris, 2000). Thus, it is likely that much of the flora and fauna of these islands had a vicariant origin, being effectively isolated on these summits prior to their isolation by rising sea levels. This isolation, coupled with genetic drift and the new selection pressures attendant with living on islands, likely promoted evolutionary change in a number of these newly isolated populations. As a result, a significant portion of the flora and fauna in this archipelago are endemic (see Sodhi et al., 1999).

The Seribuat Archipelago is divisible into three island arc systems corresponding to the different mountain ranges to which each of these islands belonged prior to the mid-Pleistocene rise in sea level (Voris, 2000). These island arcs are separated from one another by a sequence of marine valleys whose depths increase eastwardly, indicating that the outer or easternmost arc of islands is the oldest (i.e., the first to be formed) and the inner or westernmost arc of islands is the youngest (i.e., latest to be formed).



Fig. 2. Upper.—Lowland dipterocarp forest on P. Tioman. Lower.—Hill dipterocarp forest on P. Tioman.

### The Inner Arc

The westernmost set of islands is referred to here as the Inner Arc (Fig. 7). This arc contains 13 islands lying immediately offshore in water less than 10 m deep. It extends 45 km from P. Layak in the north to P. Belanak in the south. The three largest islands of this arc, P. Aceh, P. Mawar, and P. Setindan, represent eastward extensions of prominent points of land which have become separated from the adjacent Malay Peninsula. Pulau Aceh in the north (1.32 km<sup>2</sup>; 150 m) is flanked by the smaller satellite islands of Anak Aceh, Layak, Tunas Selatan, Tunas Utara, Tengah, Pelandok, and Lalang (Fig. 1). Together with P. Aceh, these islands are collectively referred to as the Aceh group. Anak Aceh, Lalang, Tunas Selatan, and Tunas Utara are small, rocky islands (> 0.24 km<sup>2</sup>) reaching no more than 69 m in elevation (Table 1). They have small patches of beach habitat (P. Anak Aceh being the exception) backed by depauperate, coastal vegetation and barren, grassy, wind-blown interiors. Pulau Pelandok and P. Tengah are steep-sided and maintain healthy tracts of coastal vegetation and lowland dipterocarp forest. Pulau Mawar (0.33 km<sup>2</sup>; 72 m) lies 4.2 km south of P. Aceh. It is a low, elongate island supporting extensive stands of mangroves along its coastline and a thick primary coastal forest in its interior. Pulau Lalang (0.02 km<sup>2</sup>; ~10 m), 6.7 km to the south, is a small rocky island lacking beach habitat and supporting only low-growing shrubs in its interior. The Setindan group is composed of the larger P. Setindan (3.8 km<sup>2</sup>; 105 m) and the much smaller P. Batu Gajah (0.04 km<sup>2</sup>; ~60 m). Pulau Setindan has a system of beaches running nearly the entire length of its eastern side and its interior maintains coastal



Fig. 3. Upper.—Sungai Mentawak on P. Tioman. Lower.—Small stream in closed canopy forest on P. Tioman.

and lowland dipterocarp forest fringed by groves of coconut palms. Much of the low-lying portion of the forest floor has been disturbed by pigs. Pulau Batu Gajah is little more than a large rock with a small west-facing beach backed by fragmented coastal vegetation. The southernmost island of the Inner Arc is Belanak, a small (0.01 km<sup>2</sup>; 50 m) rocky island 16 km south of P. Setindan. It has a steep interior with coastal vegetation cover and a rocky shoreline lacking beaches.

#### The Middle Arc

Lying approximately 12 km east of the Inner Arc is the central set of islands referred to here as the Middle Arc (Fig. 7). This arc contains 35 islands lying in a water depth of 10–19.5 m. It extends 79 km from P. Sembilang and P. Seribuat in the north to P. Tokong Yu in the south (Fig. 1). The islands of this arc show great diversity in size, geological make-up, and vegetative structure and are divisible into six separate island groups. Each group is composed of a large, usually centrally located island flanked by a number of much smaller satellite islands.

The Seribuat group is the northernmost (Fig. 1). The two largest islands of this group, Sembilang and Seribuat are separated by a shallow, mangrove-lined channel less than 800 m wide (Fig. 5). The largest island, P. Seribuat (5.52km<sup>2</sup>; 124 m), is steep-sided, rocky, and volcanic in composition. Much of its interior is arid and covered with scrub vegetation on exposed slopes although a number of deeper canyons maintain dense lowland and coastal forest. The hilly eastern portion of the island is separated from the western low-lying section by an estuary lined with an extensive mangrove system. Pulau Sembilang (2.51 km<sup>2</sup>; 207 m) is circular and approximately 2 km in diameter. Like P. Seribuat, some of its interior is covered with low scrub and recently cut secondary forest. Both islands maintain ephemeral freshwater streams which support small permanent pools during the dry season. Wood et al. (2003b) reported on the herpetofauna of these islands.

Sembilang and Seribuat are flanked to the southwest by the small satellite islands Mertang Barat (Achi), Mertang Tengah, and Mertang Timur and to the east by P. Tasu. The Mertang

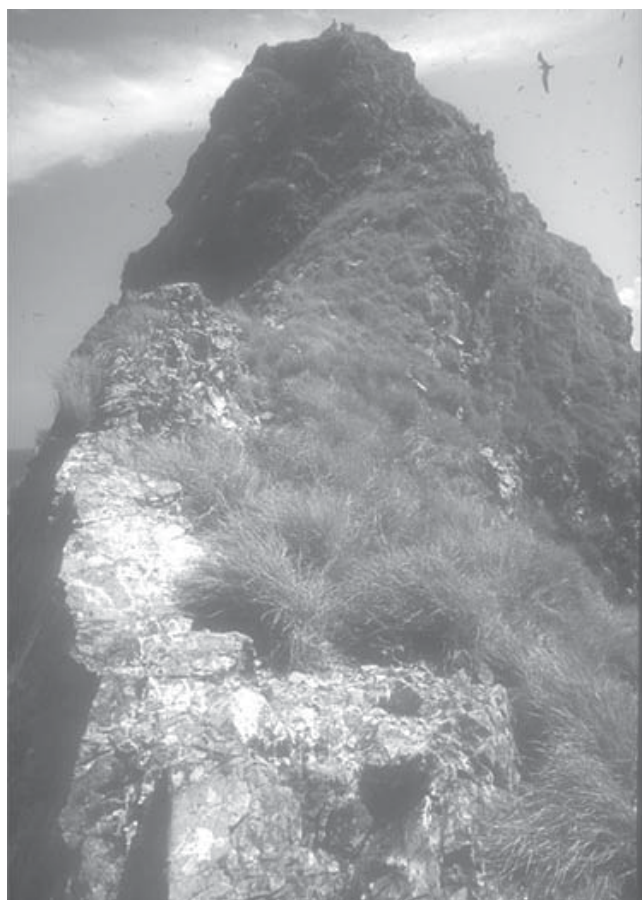


Fig. 4. Upper.—Pulau Tokong Bahara. Lower.—Pulau Tokong Chupak looking northward towards P. Tinggi in the far background. Right.—Pulau Tokong Burung Condong looking northward towards Pulau Tokong Burung Besar.



islands are small ( $> 0.04 \text{ km}^2$ ;  $> 44 \text{ m}$ ), rocky islands with small beaches edged by coastal vegetation (Fig. 5). The interiors are exposed and grassy except for Pulau Mertang Barat which maintains a low coastal forest. Pulau Tasu ( $0.04 \text{ km}^2$ ;  $70 \text{ m}$ ) is a steep-sided island lacking a sandy beach and coastal vegetation. Its interior is composed of tall grass, low shrubs, and scattered rocky outcrops.

Twenty kilometers southeast of the Seribuat group is a string of four, small volcanic islands referred to here as the Rawa

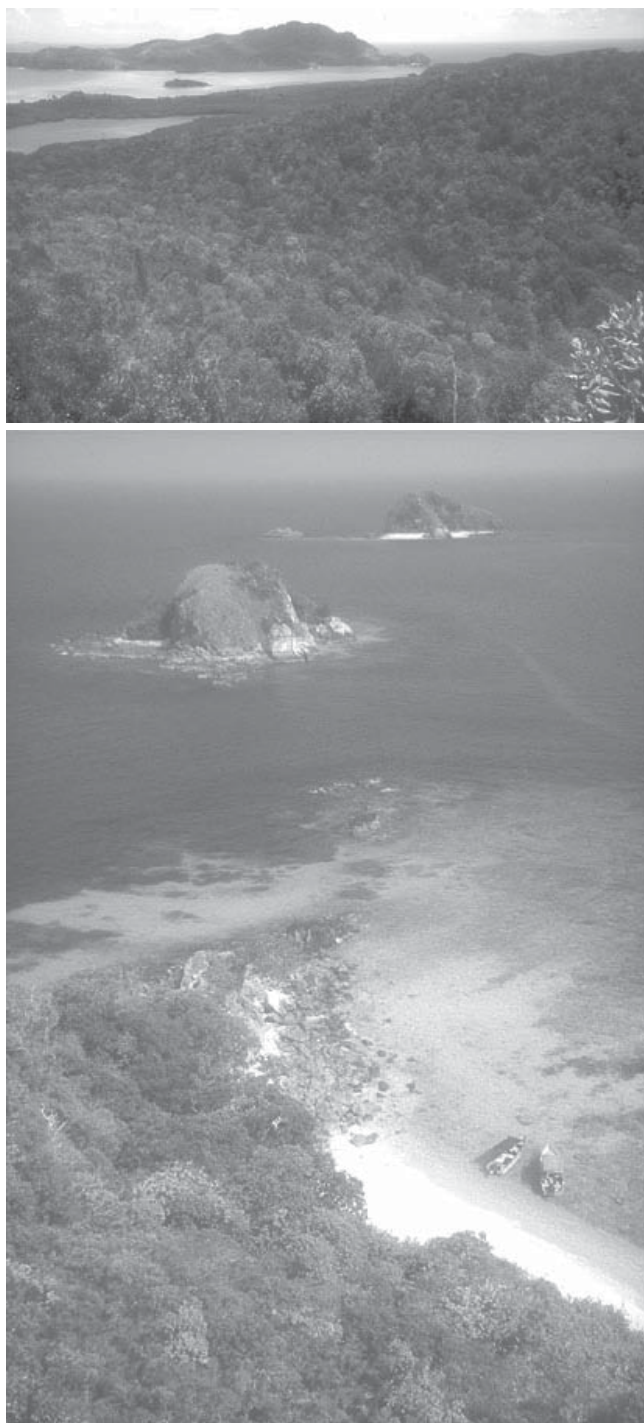


Fig. 5. Upper.—Pulau Seribuat looking westward towards Pulau Sembilang. Lower.—Pulau Mertang Barat looking southward towards Pulau Mertang Tengah (middle) and Pulau Mertang Timur (background).



Fig. 6. Upper.—Mangrove root system on Pulau Sibiu. Lower.—Mangrove forest at Telok Nipah, Pulau Tioman.

group. This group extends 6 km from P. Harimau in the north to P. Rawa in the south (Fig. 1). All are steep-sided islands with rocky, volcanic bluffs punctuated by narrow, sandy beaches. Two of these islands, P. Harimau (0.21 km<sup>2</sup>; 91 m) and P. Gual (0.09 km<sup>2</sup>; 56 m), are covered with grasses and low-growing shrubs. Pulau Mensirip (0.08 km<sup>2</sup>; 32 m) has a long, low profile with the coastal forest on the western slope opening up onto a narrow beach. Pulau Rawa (0.3 km<sup>2</sup>; 97 m) is the southernmost and largest island of the group. It is 1.8 km in length and dominated by a central ridge whose western slope is well forested, giving way to a wide beach. Much of its coastal vegetation has been disturbed for the construction of tourist lodges.

Four kilometers southwest of the Rawa group lies a chain of three islands referred to here as the Besar group (Fig. 1). The geological composition of these islands is granitic and all maintain large tracts of lowland dipterocarp forest and numerous small beaches. The largest of these islands, P. Babi Besar (6.38 km<sup>2</sup>; 251 m), is 5 km in length and dominated by a steep-sided ridge extending the length of the island that opens up onto alluvial beaches. The island's interior is covered with primary and reinvaded secondary forest with a few granitic boulder outcrops. Two large peaks occur along its central ridge: Bukit Berot in the south, reaching 251 m and Bukit Atap Zink in the north, reaching 206 m. Wood et al. (2004a) reported on the herpetofauna of this island.

Pulau Babi Tengah (0.55 km<sup>2</sup>; 83 m) and P. Babi Hujung (0.66 km<sup>2</sup>; 99 m) to the north are much smaller and do not reach the elevation of Pulau Babi Besar. Both maintain healthy tracts of primary coastal forest, lowland dipterocarp forests in their interiors, and numerous beaches.

Sixteen kilometers southeast of the Rawa group are 10 islands

which comprise the Tinggi group (Fig. 1). Pulau Tinggi, the dominant island, is one of the largest islands of the Seribut Archipelago. It is approximately 6.4 km long and 3.4 km wide (13.5 km<sup>2</sup>). The centre of the island is dominated by a 610 m high conical volcanic peak from which the island gets its name. Pulau Tinggi is mountainous and crossed by several small streams. Its coastline has wide stretches of sandy beaches, mangroves, and rocky caves, but unlike many other islands, outcroppings of granite boulders are absent. With the exception of minor cutting on the lower periphery of the west coast, the island harbors large tracts of closed-canopy, lowland dipterocarp and bamboo forests (Turner et al., 1993a). Its peak is dominated by arid-adapted grasses (Turner et al., 1993a). Escobar et al. (2003b) reported on the herpetofauna of this island.

Flanking the eastern and southern shores of P. Tinggi are eight satellite islands of varying size. The islands of Apil, Mentigi, Nangka Kecil, and Nangka Besar edge the southern end of P. Tinggi. Pulau Nangka Besar (0.1 km<sup>2</sup>; 33 m) and P. Nangka Kecil (0.04 km<sup>2</sup>; ~15 m) are the most prominent of this cluster. Pulau Nangka Besar is a low, forested hill ringed by granitic boulders whereas P. Nangka Kecil is more flat with sandy beaches and scrub vegetation. Apil (0.04 km<sup>2</sup>; 13 m) is little more than a small, forested hill and P. Mentigi (0.01 km<sup>2</sup>; 3 m) is low with coral beaches and scrub vegetation. Off the southeast end of P. Tinggi lies P. Simbang (0.07 km<sup>2</sup>; 23 m). This island has a rocky coastline punctuated by small beaches and an interior composed of low forest. Off its northern coast lies P. Lanting (0.01 km<sup>2</sup>; 16 m) which is little more than a pile of rocks with one tree growing out of the top. Penyembong (0.04 km<sup>2</sup>; 17 m) and P. Ibol (0.15 km<sup>2</sup>; 82 m) lie off the eastern coast of P. Tinggi. Penyembong is a small hump emerging above the waterline as a pile of boulders with a low forest. Ibol is much larger, steep-sided, and supports dense tracts of coastal forest in its interior.

The Sibul group is a chain of five islands lying 6 km southwest of the Tinggi group, extending 8 km from P. Sibul in the north southward to P. Sibul Kukus (Fig. 1). The largest island of the group, P. Sibul (4.81 km<sup>2</sup>; 155 m) is an hourglass-shaped island composed of coastal forest, coconut plantations, and scattered mangrove swamps (Turner et al., 1993b). The southern end reaches an elevation of 155 m and gives way to an extensive alluvial beach to the west dominated by coconut plantations and smaller beach scrub. Wood et al. (2004b) reported on the herpetofauna of this island.

Flanking the southern end of P. Sibul is a chain of four smaller satellite islands. Of these, P. Sibul Tengah is the largest (0.45 km<sup>2</sup>; 74 m). It has a precipitous, rocky, mangrove-lined eastern side and a steep, forested, mountainous interior that gives way to beaches on its western coast. The remaining three islands, Papan (0.03 km<sup>2</sup>; 91 m), Sibul Kukus (0.03 km<sup>2</sup>; 45 m), and Sibul Hujung (0.03 km<sup>2</sup>; 59 m) are little more than heavily forested rocky humps. Of the three, only P. Sibul Kukus has beach habitat.

The southernmost island group of the Middle Arc (and of the Seribut Archipelago) is the Lima group. This group lies 6

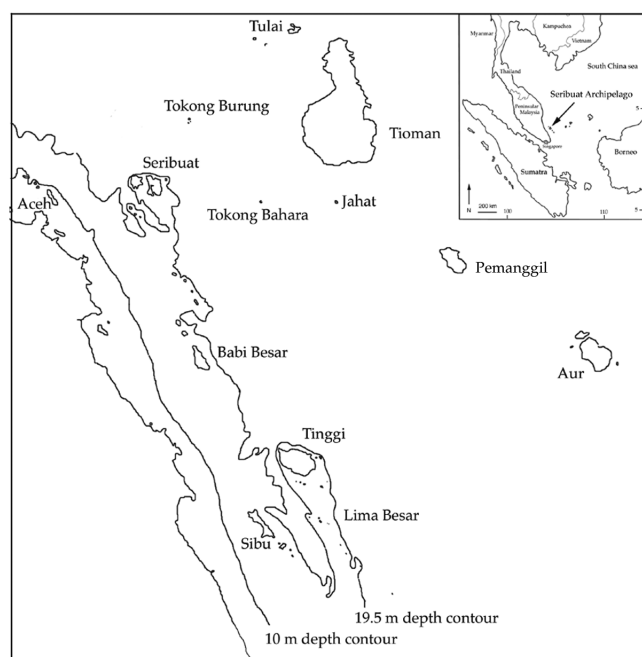


Fig. 7. The location of the Island Arcs showing the 10 m and 19.5 m depth contours. Island names represent the island groups as delimited in the text.

Table 3. Checklist of species occurring on the island arcs. Asterisk indicates the species is endemic.

	Inner Arc	Middle Arc	Outer Arc
<b>Amphibians</b>			
<b>Megophryidae</b>			
<i>Leptolalax kajangensis</i> *			X
<i>Megophrys nasuta</i>			X
<b>Bufonidae</b>			
<i>Ansonia tiomonica</i> *			X
<i>Bufo asper</i>			X
<i>Bufo melanostictus</i>			X
<i>Bufo parvus</i>			X
<i>Pelophryne brevipes</i>			X
<b>Microhylidae</b>			
<i>Chaperina fusca</i>			X
<i>Kalophrynus pleurostigma</i>			X
<i>Kaloula baleata</i>	X		X
<i>Kaloula pulchra</i>			X
<i>Microhyla borneensis</i>		X	
<b>Rhacophoridae</b>			
<i>Nyctixalus pictus</i>			X
<i>Philautus petersi</i>			X
<i>Polypedates leucomystax</i>	X	X	X
<i>Theloderma horridum</i>			X
<b>Ranidae</b>			
<i>Fejervarya cancrivora</i>		X	X
<i>Limnonectes blythii</i>			X
<i>Rana erythraea</i>			X
<i>Rana hosii</i>			X
<i>Rana picturata</i>			X
<i>Rana raniceps</i>			X
<i>Taylorana hascheana</i>			X
<b>Ichthyophiidae</b>			
<i>Ichthyophis</i> sp.			X
<b>Reptiles</b>			
<b>Trionychidae</b>			
<i>Dogania subplana</i>		X	X
<b>Agamidae</b>			
<i>Acanthosaura armata</i>			X
<i>Aphanotis fusca</i>	X	X	X
<i>Bronchocela cristatella</i>		X	X
<i>Draco fimbriatus</i>			X
<i>Draco formosus</i>		X	
<i>Draco haematopogon</i>			X
<i>Draco melanopogon</i>		X	X
<i>Draco sumatranus</i>		X	X
<i>Gonocephalus chamaeleontinus</i>			X
<i>Gonocephalus grandis</i>			X
<b>Gekkonidae</b>			
<i>Cnemaspis baueri</i> *			X
<i>Cnemaspis kendallii</i>	X	X	X
<i>Cnemaspis limi</i> *			X
<i>Cnemaspis pemanggilensis</i> *			X
<i>Cosymbotus craspedotus</i>		X	X
<i>Cosymbotus platyurus</i>		X	X
<i>Cyrtodactylus aurensis</i> *			X
<i>Cyrtodactylus quadrivirgatus</i>			X
<i>Cyrtodactylus seribuatensis</i> *		X	
<i>Cyrtodactylus tiomanensis</i> *			X
<i>Gehyra mutilata</i>		X	X
<i>Gekko monarchus</i>	X	X	X
<i>Gekko smithii</i>			X
<i>Hemidactylus frenatus</i>	X	X	X
<i>Hemiphyllodactylus typus</i>		X	
<i>Lepidodactylus lugubris</i>	X	X	X
<i>Ptychozoon kuhli</i>	X	X	X
<i>Ptychozoon lionatum</i>		X	X

Table 3. Checklist of species occurring on the island arcs. Asterisk indicates the species is endemic. (Continued)

	Inner Arc	Middle Arc	Outer Arc
<b>Scincidae</b>			
<i>Dasia olivacea</i>		X	X
<i>Emoia atrocostata</i>		X	X
<i>Eutrophis longicaudata</i>			X
<i>Eutrophis multifasciata</i>	X	X	X
<i>Larutia seribuatensis*</i>			X
<i>Lipinia surda</i>			X
<i>Lipinia vittigera</i>		X	X
<i>Lygosoma bowringii</i>	X	X	X
<i>Sphenomorphus ishaki*</i>			X
<i>Sphenomorphus sibuensis*</i>		X	
<i>Sphenomorphus scotophilus</i>			X
<b>Varanidae</b>			
<i>Varanus nebulosus</i>			X
<i>Varanus salvator</i>	X	X	X
<b>Dibamidae</b>			
<i>Dibamus tiomanensis*</i>			X
<b>Typhlopidae</b>			
<i>Ramphotyphlops albiceps</i>			X
<i>Ramphotyphlops braminus</i>	X	X	X
<b>Pythonidae</b>			
<i>Python reticulatus</i>			X
<b>Colubridae</b>			
<i>Ahaetulla prasina</i>		X	X
<i>Asthenodipsas vertebralis</i>			X
<i>Boiga cynodon</i>			X
<i>Boiga dendrophila</i>		X	
<i>Boiga drapiezii</i>		X	
<i>Boiga nigriceps</i>			X
<i>Calamaria ingeri*</i>			X
<i>Clamaria lovii</i>			X
<i>Calamaria lumbricoidea</i>			X
<i>Calamaria pavementata</i>			X
<i>Cerberus rynchops</i>		X	X
<i>Chrysopelea paradisi</i>		X	
<i>Chrysopelea pelias</i>			X
<i>Dendrelaphis caudolineatus</i>	X	X	X
<i>Dendrelaphis cyanochloris</i>		X	X
<i>Dendrelaphis pictus</i>	X	X	X
<i>Dendrelaphis striatus</i>			X
<i>Dryocalamus subannulatus</i>		X	X
<i>Dryophiops rubescens</i>			X
<i>Elaphe flavolineata</i>			X
<i>Elaphe taeniura</i>			X
<i>Enhydris enhydris</i>			X
<i>Enhydris plumbea</i>			X
<i>Fordonia leucobalia</i>			X
<i>Gongylosoma mukutense*</i>			X
<i>Gonyosoma oxycephalum</i>			X
<i>Lepturophis albofuscus</i>			X
<i>Liopeltis tricolor</i>			X
<i>Lycodon capucinus</i>		X	
<i>Oligodon booliati*</i>			X
<i>Oligodon purpurescens</i>			X
<i>Psammodynastes pulverulentus</i>			X
<i>Pseudorabdion longiceps</i>		X	
<i>Rhabdophis chrysargos</i>			X
<i>Sibynophis melanocephalus</i>			X
<i>Zaocys carinatus</i>			X
<b>Elapidae</b>			
<i>Bungarus flaviceps</i>			X
<i>Calliophis intestinalis</i>			X
<i>Ophiophagus hannah</i>			X
<b>Viperidae</b>			
<i>Popeia</i> sp.			X
<i>Tropidolaemus wagleri</i>	X		

km south of P. Tinggi and constitutes a chain of eight islands beginning with P. Tokong Sanggol in the north, extending 16.4 km southward to P. Tokong Yu (Fig. 1). With the exception of P. Lima Besar (0.10 km<sup>2</sup>; 48 m) and P. Lima Kecil (0.04 km<sup>2</sup>; 41 m), these are very small (ca. 0.04 km<sup>2</sup>), volcanic, rocky, precipitous islands that rise abruptly 22–38 m out of the water (Fig. 4). They are covered with arid-adapted, low-growing, wind-swept vegetation with little soil. Three of these islands, Tokong Sanggol and Tokong Raket (Raket is two islands side by side) support large nesting colonies of terns whereas P. Tokong Chondong, P. Tokong Belalai, and P. Tokong Chupak have only a few nests. The southernmost island of this group is P. Tokong Yu. This island was heavily bombed by the United States during World War II and its interior is covered with shrapnel and exploded bomb casings. The possible existence of unexploded ordinance makes field work on this island dangerous. The bombing changed the topography of the island significantly, leaving it covered with large, deep craters. Grasses and small shrubs are the only vegetation present. Pulau Lima Besar is the largest island of the group. This elongate, steep-sided island has an eroded rocky backbone with five conspicuous humps. The western side of the island has a large beach bordered by a healthy stand of coastal vegetation. Its eastern side is steep and rocky. The much smaller P. Lima Kecil to the north is ringed by a rocky coastline but maintains a forested, steep-sided interior.

Two maps, one published in 1996 under the superintendence of the Royal Malaysian Navy and another published in 1997 by the Director of National Mapping, report the presence of a small island named P. Tokong Gantang between P. Tokong Chondong and P. Tokong Raket. We were unable to locate this island on either visit to the Lima Group and believe it does not exist.

### The Outer Arc

The easternmost island arc in the Seribuat Archipelago is referred to here as the Outer Arc. This arc is situated approximately 20 km east of the Middle Arc (Fig. 7) and contains the oldest and largest group of islands in the Seribuat Archipelago. These islands lie in water 20–64 m deep. This system is composed of 10 islands extending 75 km from P. Cebeh in the north to P. Aur in the south (Fig. 1). The topography of all the islands in this arc is dramatic, including steep interiors dominated by extensive outcroppings of huge granitic boulders. The coastlines are ringed by massive granitic rocks with intermittent beaches backed by heavily forested interiors.

The largest islands in the arc are Tioman, Pemanggil, and Aur. Pulau Tioman, the largest of the three (110 km<sup>2</sup>; 1038 m), extends approximately 22 km in length and 11 km in maximum width at its southern end. Characterized by steep-sided mountainous terrain reaching 1038 m in elevation at G. Kajang, the island supports lowland dipterocarp forest on its alluvial foothills and hill dipterocarp forest above 300 m. Its coastline and low-lying periphery are dominated by mangrove and coastal forests. Exposed granitic outcroppings consisting of large boulders define much of the island's

rugged topography and its hillsides are cut by a number of boulder-strewn, fast-flowing streams in both open and closed canopy forest (Fig. 3). The herpetofauna of this island has been extensively studied (see J. Grismer et al., 2004 and references therein).

The Tulai group is the northernmost cluster of islands in the Outer Arc. It lies 5 km northwest of P. Tioman and is dominated by the central, large island of Tulai flanked by three smaller satellite island, Labas and Sepoi to the southwest, and Cebeh to the north (Fig. 1). Pulau Tulai is a small (0.87 km<sup>2</sup>; 98 m), T-shaped island extending 1.6 km in length along an east-west axis and 1 km in width along a north-south axis. Its interior is hilly and rocky and lacks permanent fresh water. Most of the island was cleared for coconut plantations prior to 1960 (Medway & Bullock, 1966) but some large dipterocarp trees were left and secondary growth is now extensive. Its herpetofauna was discussed by L. Grismer et al. (2001b).

Pulau Labas (0.01 km<sup>2</sup>; 20 m) is little more than a large pile of granitic boulders cresting the surface of the sea. It essentially lacks soil and small plants and supports only a few coconut palms. Its low profile subjects it to a constant buffeting by seawater during storms. The nearby P. Sepoi (0.03 km<sup>2</sup>; 60 m) is a conical island composed of large granitic boulders. It lacks beaches and its steep, rocky bluffs rise precipitously out of the water. The interior of the island is composed of an open coastal forest maintaining moderately-sized, drought resistant trees and a deep soil base. Pulau Cebeh (0.05 km<sup>2</sup>; 71 m) is a well-vegetated, small granitic pile of huge boulders lying just to the north of P. Tulai. Its interior maintains a dense coastal forest with large trees and a deep leaf-litter and soil base.

Pulau Pemanggil (9.2 km<sup>2</sup>; 405 m) is a smaller rocky island lying between P. Tioman and P. Aur (Fig. 1). Its rugged coastline and interior are dominated by large granitic boulder outcroppings which have created a number of extensive cave-like systems. Only one small patch of primary forest remains near the island's summit. The remainder of the island is covered by heavily degraded secondary forest. One small freshwater stream exists on the northeastern side. Youmans et al. (2002) is the only published report on this island's herpetofauna.

The Aur group consists of the island Aur and its smaller satellite islands, Dayang, Lang, and Pinang (Fig. 1). These are the southernmost islands in the Outer Arc. Like P. Pemanggil, P. Aur is smaller than P. Tioman (12.75 km<sup>2</sup>; 41 m), steep-sided, and rugged. Its interior has limited permanent running water and is characterized by large granitic outcrops. Two peaks, one at each end of the island, form the dominant topographical features with the southernmost peak, Bukit Makum, reaching an elevation of 521 m. Much of the forest along the low-lying coastal periphery of P. Aur has been cut and replanted with coconut palms. However, dense lowland dipterocarp forest with closed canopy remains in the island's interior on the steeper slopes at higher elevations. L. Grismer et al. (2001a) and Escobar et al. (2003a) report on the herpetofauna of this island.

Of the three satellite islands, P. Dayang (2.09 km<sup>2</sup>; 158 m), located 0.08 km north of P. Aur, is the most significant. It consists of a low range of granitic rock outcroppings with an elevated middle section consisting of a large granitic peak. The majority of P. Dayang is covered with degraded coastal vegetation. Small streams occur at its northern end. Wood et al. (2003c) reports on the herpetofauna of this island. Pinang (0.11 km<sup>2</sup>; 38 m) and Lang (0.05 km<sup>2</sup>; 38 m) are small, vegetated granitic outcrops rising out of the water.

There are four sets of very small (>0.05 km<sup>2</sup>), isolated, outlying islands that occur in the 20 km wide deep-water channel separating the Middle and Outer Arcs. The northernmost of these, the Tokong Burung group consists of three small islands (0.005–0.36 km<sup>2</sup>; 32–54 m) lying midway between P. Seribuat and P. Tioman (Fig. 1). These islands are separated from each other by less than 100 m. They are precipitous rocky peaks which emerge out of the ocean from underwater sea mounts (Fig. 4). They are covered with short grasses and arid-adapted, windblown vegetation. Various species of terns use these islands as rookeries. The grasses are periodically burned off by egg collectors in order to kill the hatchlings and near-term eggs. This stimulates the females to lay fresh eggs which the collectors gather one week later, ensuring the eggs contain only yolk and no embryos. Pulau Tokong Bahara (0.02 km<sup>2</sup>; 54 m) is also isolated, lying midway between P. Seribuat and P. Tioman south of the Tokong Burung group (Fig. 1). Its shape and interior are like those islands of the Tokong Burung group and the grasses on this island are also periodically burned to facilitate egg collecting. The remaining island, P. Jahat (0.05 km<sup>2</sup>; 30 m), lies 7 km south of P. Tioman (Fig. 1). It is a low pile of huge granitic boulders supporting a low-growing forest with a modest soil base.

## RESULTS AND DISCUSSION

It is certain that the results reported herein are an underestimate of the herpetofaunal diversity of the Seribuat Archipelago and more species will be found on many of the islands. We expect snakes to be the most under represented group of our collecting efforts. Most of the islands were visited only during the day (Table 1) which biased collecting towards lizards. Had we spent equal time on these islands at night we could have found many more snakes. Even diurnal snakes are most easily found at night while sleeping in vegetation where their camouflage is ineffective in torch light. Another problem was that during our second collecting season from 7–15 September 2004 the weather was extremely dry. No appreciable precipitation had fallen in the Seribuat Archipelago since 4 July 2004. As a result, we found fewer species than we expected on many of the larger, well-vegetated islands such as Mawar, Tengah, Tinggi, and Setindan. These islands still require much more intensive field research. We found no species on P. Labas, P. Lanting, and P. Tokong Yu. Nonetheless, the completeness of these surveys provides a foundation for the following biogeographical and ecological observations.

**Biogeography.** – Surveys from other archipelagos and islands surrounding the Malay Peninsula are still not complete. Only preliminary work has been done on the Langkawi Archipelago (L. Grismer et al., 2006; Ibrahim et al., in press), Penang (Das and Lim, in prep) and work on Redang and Perhentian is still preliminary (Tamblyn et al., 2005.). Thus any meaningful comparisons of species richness between these areas and the Seribuat Archipelago would be premature.

The herpetofauna of the Seribuat Archipelago is composed of 23 species of frogs, one species of caecilian, one species of non-marine turtle, 43 species of lizards and 44 species of non-marine snakes. The relationships of these species are diverse. Some, such as *Gonocephalus chamaeleontinus*, *Cnemaspis limi*, *Calamaria ingeri*, *Gongylosoma mukutense*, and *Popeia* sp. occurring on the Outer Arc, are most closely related to Bornean, Sumatran, or Javan species (see L. Grismer et al., 2003; 2004b) rather than species from Peninsular Malaysia, indicating their geographic regions of origin are from areas much further to the south or east as opposed to just 42 km to the west in Peninsular Malaysia. This biogeographical pattern is not restricted to amphibians and reptiles but has been reported in mosses (Tan and Mohamad, 1999), a balitorid loach (Kottelat, 1990), freshwater gobies (Ng, Tan and Lim, 1999), decapods (Yeo and Ng, 1999; Yeo et al., 1999), and mouse deer (Adura, 1998). This indicates these species had a vicariant origin in the Outer Arc as a result of rising sea levels separating an ancient mountain system which extended from the Riau Archipelago northeastward through the Seribuat, Anambas, and Natuna archipelagos to Borneo (Voris, 2000; Inger, pers. comm., 2003). Species in the Seribuat Archipelago that are most closely related to peninsular Malaysian forms may also have had a vicariant origin but overwater dispersal cannot be ruled out.

Sixteen species in the Seribuat Archipelago are endemic: two species of frogs (*Leptotalax kajangensis* and *Ansonia tiomanica*); 10 species of lizards (*Cnemaspis baueri*, *C. limi*, *C. pemanggilensis*, *Cyrtodactylus tiomanensis*, *Cyrtodactylus seribuatensis*, *Cyrtodactylus aurensis*, *Larutia seribuatensis*, *Sphenomorphus ishaki*, *Sphenomorphus sibuensis* and *Dibamus tiomanensis*); and four species of snakes (*Calamaria ingeri*, *Gongylosoma mukutense*, *Oligodon booliati*, and *Popeia* sp.). Two of these, *Cyrtodactylus seribuatensis* and *Sphenomorphus sibuensis*, are endemic to the Middle Arc whereas the remaining 14 species are endemic to the Outer Arc. This is in accord with the Outer Arc islands' older age and more complex environment. With the exception of *L. seribuatensis*, *Calamaria ingeri*, *O. booliati*, and *Popeia* sp., the relationships, and hence geographic origins, of these species are yet unknown.

The majority of the species in the Seribuat Archipelago occur on islands of the Outer Arc. Here, 96% of the frogs (22 species), 100% of the caecilians (one species), 88% of the lizards (38 species), and 95% of the snakes (42 species) are found (Table 3). This high diversity is maintained by the environmental heterogeneity of these islands which is in part, related to their larger size and extreme topography. This is

most notable on the largest island of Tioman which has 75% (96 species) of the species found in the archipelago. The Outer and Middle Arc share two species of frogs, one turtle, 17 species of lizards, and five species of snakes (Table 3). Only one species of frog, nine species of lizards, and three species of snakes are shared by all three arcs. Much more will be revealed about the historical biogeography and historical patterns of dispersal and colonization upon the completion of our molecular studies.

MacArthur & Wilson (1967) provided a model of island biogeography which attempts to explain insular diversity as a function of rates colonization and extinction based on an island's size and distance from a continental source. However, their model considers only a single continental source of origin for colonizing taxa whereas the Seribuat Archipelago has multiple continental sources as demonstrated by the phylogenetic studies that have been done on a handful of species. Considering only a single source of origin will inflate species index values for islands with multiple sources of origins (L. Grismer, 1994b). Until the relationships of this herpetofauna are better understood, entertaining the MacArthur & Wilson (1967) model of island biogeography may obscure more knowledge than it would reveal.

**Natural History Observations.** – Reported here are anecdotal natural history observations made on a number of species at the time of their collection. Often, insular populations of essentially continental species will expand the repertoire of what is considered to be their general behavior (see L. Grismer, 1990, 1994a, 2002; and references cited therein). This is usually the result of adapting to a new environment with different combinations of predators, competitors, and resources or absences thereof. The observations here are offered as qualitative rather than quantitative bookmarks for the formulation and testing of future hypotheses.

## Amphibia

### Microhylidae

*Kaloula baleata*. – This species is generally active following periods of precipitation when individuals are found congregating in the vicinity of temporary water. During intermittent dry periods, this species usually resides in burrows, treeholes, or beneath surface objects. No rain had fallen on P. Aceh within weeks of our first collection period and in 2004, no rain had fallen for two months prior to our visit. On 29 August 2003, two specimens (LSUHC 5712–13) were collected from the trunks of separate trees sitting 1.5 m above the forest floor facing head-up. During the evening, both were pale grey and both had turned dark brown by morning. On 9 September 2004, a single specimen (LSUHC 6954) was found in a small tree cavity filled with putrid water 2.5 m above the ground.

## Reptilia

### Agamidae

*Aphaniotis fusca*. – This species is an arboreal, diurnal lizard commonly found in undisturbed closed canopy forests where it perches on the sides of trees and vines. Its inability to glide notwithstanding, it occupies microhabitats very similar

to those of the smaller species of *Draco* such as *D. melanopogon*. On the islands of Babi Besar, Babi Tengah, Babi Hujung, and Aceh, *A. fusca* occurs in unusually high densities. Although the forest is dense and closed canopy, *D. melanopogon* is absent from the interiors of these islands (*D. sumatranus* occurs in the coastal, coconut groves on P. Babi Besar). On islands where *Draco* and *Aphaniotis* both exist (i.e. Tioman, Tinggi, Sibul), *A. fusca* occurs in much lower densities. Given the similar ecologies of *A. fusca* with some of the smaller species of *Draco*, it is likely that *A. fusca* competitively excludes *Draco* from the Besar group and P. Aceh.

## Gekkonidae

*Gekko monarchus*. – *Gekko monarchus* expresses a modest degree of morphological and colour pattern variation on some of the small islands. On Mertang Barat, Mertang Tengah, and Mertang Timur, *G. monarchus* is nearly melanistic with large, white tubercles. On P. Cebeh, *G. monarchus* is the only species of gekko occurring in the interior of the island. Its density is extremely high and it occupies every conceivable niche (both terrestrial and arboreal). Specimens from this population generally lack the paired, paravertebral blotches which diagnose this species and their tubercles are unusually numerous and large. Investigations of this population's morphology, colour pattern, and genetics are currently underway to determine its species status and relationship to other *G. monarchus*. Like *Hemidactylus frenatus* on P. Sepoi (see below), *G. monarchus* appears to restrict the distribution of *Lepidodactylus lugubris* to large boulders in the splash zone of the intertidal.

*Hemidactylus frenatus*. – *Hemidactylus frenatus* is an extremely adept over-water disperser, human facilitated (Bauer, 1994) or otherwise. Many authors have documented this species' relatively recent arrival all over the world. Its colonizing abilities are illustrated well within the Seribuat Archipelago, being that it occurs on at least 41 of the 62 islands. Some of these islands are little more than barren rocks (i.e., P. Tokong Bahara) whereas others are large and environmentally diverse (i.e., P. Tioman). Two other adept colonizing gekkos, *Gehyra mutilata* and *Lepidodactylus lugubris*, also occur within the Seribuat Archipelago. The latter shows some interesting distribution patterns with respect to *H. frenatus* which suggests that on some small islands, competition between these two species may be intense. In the Lima group, eight small islands are inhabited by one or the other of these two species (Table 2) and they basically alternate in occurrence in a north to south directional trend (P. Sanggol – *L. lugubris*; P. Lima Kecil and P. Lima Besar – *H. frenatus*; P. Tokong Raket – *L. lugubris*; P. Tokong Condong and P. Tokong Belalai – *H. frenatus*; and P. Tokong Chupak – *L. lugubris*) suggesting that whichever species colonizes the island first will eventually exclude the other species. On P. Sepoi, this apparent phenomenon is even more striking. Here, *H. frenatus* occupies every conceivable niche (terrestrial and arboreal) within the island's interior and occurs in an extremely high density. *Lepidodactylus lugubris*, however, occurs only on the periphery of the island amongst the larger boulders in the splash zone within the intertidal

areas. On P. Layak, *H. frenatus* is also found in the intertidal areas and *L. lugubris* has not been found on that island. Similar observations have been made on islands in the South Pacific (Petren & Case, 1996). Yet on P. Mawar, a relatively large island (Table 1) with a high degree of environmental diversity, *H. frenatus* and *L. lugubris* can be found syntopically beneath the bark of dead trees in the mangrove forest.

### Scincidae

*Emoia atrocostata*. – *Emoia atrocostata* is a specialized species found in intertidal areas, usually in the vicinity of mangroves. It occurs on at least nine islands in the Seribuat Archipelago and although its distribution appears random, it is predictable. For this species to be present, a rocky shore backed by vegetation is required. The rocks must be of moderate size (~ 1 m diameter) usually not giant boulders (with the exception of P. Tulai) and the vegetation does not necessarily have to be mangrove. Therefore, this species' absence from the large island of Tioman and others, which at first seems perplexing, is explainable because these islands lack the two fundamental characteristics (with the exception of a few small isolated places on the east coast at Tk. Dalam on P. Tioman). Yet its presence on very small islands such as P. Sibu Kukus is easily explainable.

*Eutropis multifasciata*. – *Eutropis multifasciata* is a common, diurnal, forest-floor skink that spends much of its time basking and foraging in relatively open areas with direct sunlight. In the Seribuat Archipelago, many populations manifest significant departures from this behavior and/or morphology. On P. Cebeh and P. Sepoi, this species occurs in high densities and is active at night. Specimens on both islands were observed crawling and running through the leaf litter during the evening hours. It was originally believed these lizards were frightened out of hiding by our lights. But with lights off, lizards could be heard moving through the leaf litter. The skinks from P. Cebeh are inordinately thick and robust and from a distance, do not even appear to be *E. multifasciata*. On P. Sepoi and the Tokong Burung group, *E. multifasciata* occur in the intertidal, living and foraging in and among the rocks and crevices. At first glance we mistook these skinks for *Emoia atrocostata*. *Eutropis multifasciata* has a relatively modest degree of colour pattern variation in its continental forms (see Chan-Ard et al., 1999). On small islands in the Seribuat Archipelago, this variability is often fixed and taken to extremes. On the large islands of Tioman, Aur, Tinggi, Sibu, and Babi Besar, *E. multifasciata* has the typical pattern of a bronze-coloured dorsum, dark flanks with black-edged white spots, and a cream-coloured venter. On P. Sepoi, adult males are uniformly grey in colour whereas females and juveniles are greyish with light green flanks bearing yellow spots. On P. Seribuat and P. Sembilang all skinks have a grey dorsum and bright orange flanks. On the Tokong Burung group, males and females are a uniform greenish gold. The juveniles, however, have metallic green flanks. Skinks from P. Tokong Bahara are the most distinctive of all. The head, forepart of the body, and forelimbs are coppery orange; the posterior of the body, hind limbs, and legs are olive green. The posterior of the jaws are bright orange, and the chin and

throat are yellow. The body is relatively narrow (especially when compared to those of P. Cebeh) and original tails are nearly twice the length of the body. Morphological investigations indicate that each one of these populations differ significantly from one another and from mainland populations (A. Ponce, unpublished). Molecular analyses are currently underway to determine their species status and relationships.

All the skinks living on the three islands of the Tokong Burung group and P. Tokong Bahara reside within the tern rookeries, taking refuge in the rocks, cracks, and grass hummocks. Other insular lizard populations living within seabird rookeries derive a significant portion of their resources from the birds in the form of regurgitated food and the arthropods attracted to the nests (e.g., Barrett et al., 2005; L. Grismer, 2002; Hews, 1990; Rounsevell et al., 1985). We suspect the same is happening with Seribuat Archipelago populations. One of us (LLG) observed a skink eating a portion of regurgitated fish from a nest on Tokong Burung Condong.

*Lygosoma bowringii*. – *Lygosoma bowringii* is another very successful overwater colonizer of the Seribuat Archipelago. Unlike *Hemidactylus frenatus* which is a renowned human commensal, the colonization of *Lygosoma bowringii* is most likely the result of natural events. This species occurs on 23 of the 62 islands. Some of the islands are extremely small (i.e., P. Tunas Selatan) whereas others are large and diverse (i.e., P. Tinggi and P. Tioman). What all these islands have in common is sandy beaches. Islands with rocky shorelines lacking sandy beach habitats are not inhabited by *L. bowringii*. Sandy beaches likely serve as an appropriate habitat for initial colonization. Although this species occurs in the leaf-litter of some of the islands' interiors, it is extremely common beneath the surface debris and flotsam found along beaches. Its short limbs, elongate body, and smooth shiny scales facilitate this species ability to "sand-swim" to escape capture. On several occasions we have observed this species escaping by burrowing into and swimming through the sand. On P. Ibol, *L. bowringii* were also found to be common above ground moving about in the leaf litter following periods of precipitation.

### Varanidae

*Varanus salvator*. – *Varanus salvator* (or the tracks thereof) were observed on 31 islands ranging in size from 0.01–110 km<sup>2</sup>. The presence of this large, top predator on small, isolated islands relatively far out at sea suggests monitors are periodically swimming to them because there are not enough resources on these small islands to support permanent populations of the large carnivores. We observed a 2 m specimen on P. Tokong Belalai (0.01 km<sup>2</sup>) where the only conceivable food source were terns and their chicks and eggs. On another small island, P. Layak (0.24 km<sup>2</sup>), we observed the tracks of *V. salvator* near a large circular depression in the sand where it had been digging up sea turtle eggs. We suggest that *V. salvator* have knowledge of the food resources on these islands and make periodic visits to exploit them.



**Adaptive types.** – Another way to underscore environmental diversity of an area is to look at it in terms of the number of adaptive types present (as opposed to a simple tally of the number of species). Logically, regions with high environmental diversity will support a greater range of species manifesting a broader array of adaptive types. In contrast, more homogeneous environments will have less diversity and fewer adaptive types. The relatively high species diversity in the Seribuat Archipelago coupled with its environmental heterogeneity lends itself well to this type of qualitative interpretation. The observations below are restricted to Seribuat Archipelago populations.

The herpetofauna of the Seribuat Archipelago contains a number of species with diverse ecologies and adaptations as well as many species that are microhabitat specialists. Most of the frogs, (*Megophrys nasuta*, *Bufo parvus*, *Chaperina fusca*, *Kalophrynus pleurostigma*, *Kaloula baleata*, *Microhyla borneensis*, and *Taylorana hascheana*) are forest floor species. Of these, some are highly specialized. *Megophrys nasuta* is a leaf-mimic; *C. fusca* breeds in tree and root holes and palm fronds; and *K. baleata* often resides in tree holes. *Leptotalax kajangensis* and *Ansonia tiomanica* are principally cave dwelling, cloud forest inhabitants; whereas *Bufo asper*, *Rana hosii*, and *Rana picturata* are riparian species. The four species of rhacophorids on the island are arboreal, of which *Nyctixalus pictus* and *Theloderma horridum* are tree-hole breeders. Additionally, *T. horridum* is a tree bark mimic and *Philautus petersi* only occurs in the cloud and ridge forests. One species, *Fejervarya cancrivora*, can live and breed in brackish water along the coast and eats crabs.

All frogs have toxic skin secretions but the secretions of some (*Ansonia tiomanica*, *Rana picturata*, and *Rana hosii*) can kill other frogs when kept in close proximity. *Rana hosii* has secretions that can even be dangerous to humans. *Kalophrynus pleurostigma* uses its extremely adhesive skin secretions as a defense mechanism.

Many of the archipelago's arboreal lizards (nocturnal and diurnal) live almost exclusively on trees, coming down to the ground only to nest or get from one tree to the next, the exception of course being the gliding species of *Draco* and *Ptychozoon*. These include *Acanthosaura armata*, *Aphaniotis fusca*, *Broncochela cristatella*, all five species of *Draco*, *Gonocephalus chamaeleontinus*, *Gehyra mutilata*, *Gekko smithii*, *Hemiphyllodactylus typus*, *Dasia olivacea*, and *Lipinia vittigera*. One species of lizard, *Gonocephalus grandis*, is a riparian specialist which jumps from rocks and trees into the water to escape. Other species live only on vegetation and rocks in the intertidal zone (*Cyrtodactylus seribuatensis*; *Emoia atrocostata*). One small species of gecko (*Gehyra mutilata*) has tear-away skin that remains in the predator's grasp while the lizard runs off and yet another species (*Varanus salvator*) inhabits coastal waterways, reaches nearly 3 m in length, and is one of the archipelago's top predators. All but one species of *Cnemaspis*, *C. kendallii*, are specialized for living on the flat surfaces of large boulders. Many other species are generally scansorial and are found on rocks and vegetation (i.e., *Cnemaspis kendallii*,

*Cyrtodactylus aurensis*, *C. quadrivirgatus*, *C. tiomanensis*, *Gekko monarchus*, *Lepidodactylus lugubris*, and *Sphenomorphus scotophilus*). One nearly limbless species, *Dibamus tiomanensis*, barely surpasses 4 cm in length and spends most of its time underground eating the eggs of ants and termites. Another nearly limbless species, *Larutia seribuatensis*, forages through the leaf litter. There is a montane, leaf litter specialist restricted to G. Kajang on P. Tioman (*Sphenomorphus ishaki*) and one all-female species of gecko (*Lepidodactylus lugubris*) found on 13 islands that spontaneously lays eggs, producing genetic clones. Lastly, there are general terrestrial species that exist in a range of habitats (*Eutropis multifasciata*, *Lygosoma bowringii*, and *Varanus nebulosus*).

Snakes show an equally impressive diversity of adaptive types. Many are arboreal shrub and trunk-specialists (diurnal and nocturnal) that prey on lizards and frogs (*Ahaetulla prasina*, *Boiga*, *Chrysopelea*, *Dendrelaphis*, *Dryocalamus subannulatus*, *Dryophiops rubescens*, *Lepturophis albofuscus*, *Psammodynastes pulverulentus*, *Popeia* sp., and *Tropidolaemus wagleri*). *Ahaetulla prasina* even has evolved a concave, elongate, pointed snout and horizontal pupils that allow it to see forward. Two species are confined to the interface between land and sea (*Cerberus rynchops* and *Fordonia leucobalia*). Other species (*Calamaria* and *Pseudorabdion longiceps*) are small, leaf-litter semi-fossorial specialists that emerge only at night to feed on earthworms (Stuebing and Inger, 1999). Conversely, *Python reticulatus* reaches 6 m in length and eats mouse deer and monkeys. *Chrysopelea* launch themselves from branches, expand their rib cages, and glide for considerable distances to the next tree. Dietary specialists include an estuarine species, *Fordonia leucobalia*, that preys on mud lobster and crabs; a montane species, *Asthenodipsas vertebralis*, that eats slugs and pulls snails out of their shells; and two fossorial species, *Ramphotyphlops albiceps* and *R. braminus*, which eat only the larvae of ants and termites. The genus *Oligodon* specializes in eating primarily reptile eggs by slicing them open with an enlarged, razor-sharp tooth on each side of the upper jaw.

## CONSERVATION

Although the majority of the Seribuat Archipelago is uninhabited, all the larger islands support a rapidly growing tourism industry which is largely inspired by their natural beauty. The need to responsibly manage these islands' biodiversity and maintain their ecotourism value is apparent; but this can only be achieved with an informed understanding of their flora and fauna. The basis for this understanding will ultimately come from field studies that augment university and museum collections with adequate series of specimens and the careful examination and study of those collections. These specimens serve as permanent records of what was on the islands at a particular time, and where these species occurred. Molecular studies, which is the next phase of our analysis, will identify unique, insular, gene pools, advance our knowledge of the history of this faunas

colonization and subsequent inter-island dispersal patterns, and document their phylogenetic relationships and centres of geographic origin.

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Islands are listed in alphabetical order. Significant portions of the large island of Tioman are currently proposed for development. Therefore, the checklist of this island's species is given for each locality from which specimens are known. The documentation for these localities can be found in J. Grismer et al. (2004) and references cited therein.

#### **Pulau Aceh**

*Kaloula baleata*, *Aphaniotis fusca*, *Cnemaspis kendallii*, *Gekko monarchus*, *Hemidactylus frenatus*, *Ptychozoon kuhli*, *Eutropis multifasciata*, *Lygosoma bowringii*, *Varanus salvator*, *Ramphotyphlops braminus*, *Dendrelaphis caudolineatus*, *Dendrelaphis pictus*, *Tropidolaemus wagleri*

#### **Pulau Aceh Anak**

*Hemidactylus frenatus*, *Varanus salvator*

#### **Pulau Aur**

*Pelophryne brevipes*, *Limnonectes blythii*, *Acanthosaura armata*, *Bronchocela cristatella*, *Cnemaspis baueri*, *Cosymbotus platyurus*, *Cyrtodactylus aurensis*, *Gehyra mutilata*, *Gekko monarchus*, *Hemidactylus frenatus*, *Dasia olivacea*, *Emoia atrocostata*, *Eutropis multifasciata*, *Lipinia surda*, *Lipinia vittigera*, *Lygosoma bowringii*, *Sphenomorphus scotophilus*, *Varanus nebulosus*, *Varanus salvator*, *Ramphotyphlops braminus*, *Ahaetulla prasina*, *Boiga nigriceps*, *Calamaria lovii*

#### **Pulau Babi Besar**

*Polypedates leucomystax*, *Fejervarya cancrivora*, *Aphaniotis fusca*, *Bronchocela cristatella*, *Draco sumatranus*, *Cnemaspis kendallii*, *Gehyra mutilata*, *Gekko monarchus*, *Hemidactylus frenatus*, *Ptychozoon kuhli*, *Dasia olivacea*, *Eutropis multifasciata*, *Lipinia vittigera*, *Lygosoma bowringii*, *Varanus salvator*, *Ramphotyphlops braminus*, *Ahaetulla prasina*, *Boiga dendrophila*, *Dendrelaphis caudolineatus*, *Dendrelaphis pictus*, *Lycodon capucinus*

#### **Pulau Babi Hujung**

*Aphaniotis fusca*, *Cnemaspis kendallii*, *Gekko monarchus*, *Hemidactylus frenatus*, *Varanus salvator*, *Lycodon capucinus*

#### **Pulau Babi Tengah**

*Polypedates leucomystax*, *Gehyra mutilata*, *Gekko monarchus*, *Hemidactylus frenatus*, *Lepidodactylus lugubris*, *Dasia olivacea*, *Eutropis multifasciata*, *Lygosoma bowringii*

#### **Pulau Batu Gajah**

*Gekko monarchus*, *Varanus salvator*

#### **Pulau Belanak**

*Hemidactylus frenatus*

#### **Pulau Cebeh**

*Gekko monarchus*, *Eutropis multifasciata*, *Lepidodactylus lugubris*

#### **Pulau Dayang**

*Cnemaspis baueri*, *Gekko monarchus*, *Hemidactylus frenatus*, *Eutropis multifasciata*, *Varanus salvator*, *Ramphotyphlops braminus*

#### **Pulau Gual**

*Hemidactylus frenatus*

#### **Pulau Harimau**

*Hemidactylus frenatus*, *Lygosoma bowringii*, *Varanus salvator*

#### **Pulau Ibol**

*Cnemaspis kendallii*, *Gekko monarchus*, *Lygosoma bowringii*

## **APPENDIX I**

The following are species-checklists of all islands in the Seribuat Archipelago from which specimens have been recorded. The species are listed in the order of frogs, caecilians, turtles, lizards, and snakes.

**Pulau Jahat**

*Gekko monarchus*, *Lepidodactylus lugubris*

**Pulau Lalang**

*Hemidactylus frenatus*

**Pulau Lalang Selatan**

*Hemidactylus frenatus*

**Pulau Lang**

*Hemidactylus frenatus*, *Eutropis multifasciata*

**Pulau Layak**

*Gekko monarchus*, *Hemidactylus frenatus*, *Varanus salvator*

**Pulau Lima Besar**

*Cyrtodactylus seibuatensis*, *Hemidactylus frenatus*, *Gehyra mutilata*, *Gekko monarchus*, *Lygosoma bowringii*

**Pulau Lima Kecil**

*Gehyra mutilata*, *Hemidactylus frenatus*

**Pulau Mawar**

*Hemidactylus frenatus*, *Lepidodactylus lugubris*, *Lygosoma bowringii*, *Varanus salvator*, *Dendrelaphis pictus*

**Pulau Mensirip**

*Lygosoma bowringii*, *Varanus salvator*

**Pulau Mentigi**

*Cyrtodactylus seribuatensis*, *Gekko monarchus*, *Hemidactylus frenatus*, *Lepidodactylus lugubris*, *Lygosoma bowringii*

**Pulau Mertang Barat**

*Gekko monarchus*, *Varanus salvator*

**Pulau Mertang Tengah**

*Gekko monarchus*, *Lygosoma bowringii*

**Pulau Mertang Timur**

*Gekko monarchus*, *Hemidactylus frenatus*, *Lygosoma bowringii*

**Pulau Nangka Besar**

*Gehyra mutilata*, *Hemidactylus frenatus*, *Emoia atrocostata*

**Pulau Nangka Kecil**

*Cyrtodactylus seribuatensis*, *Hemidactylus frenatus*, *Emoia atrocostata*

**Pulau Papan**

*Lepidodactylus lugubris*, *Emoia atrocostata*, *Lygosoma bowringii*

**Pulau Pelandok**

*Gekko monarchus*, *Hemidactylus frenatus*, *Varanus salvator*

**Pulau Pemanggil**

*Limnonectes blythii*, *Bronchocela cristatella*, *Cnemaspis pemanggilensis*, *Gehyra mutilata*, *Gekko monarchus*, *Hemidactylus frenatus*, *Dasia olivacea*, *Eutropis multifasciata*, *Lygosoma bowringii*, *Sphenomorphus scotophilus*, *Varanus salvator*

**Pulau Penyambong**

*Gekko monarchus*, *Hemidactylus frenatus*

**Pulau Rawa**

*Gehyra mutilata*, *Hemidactylus frenatus*, *Eutropis multifasciata*, *Lygosoma bowringii*, *Varanus salvator*, *Lycodon capucinus*

**Pulau Simbang**

*Gekko monarchus*, *Emoia atrocostata*, *Varanus salvator*

**Pulau Sembilang**

*Polypedates leucomystax*, *Fejervarya cancrivora*, *Aphaniotis fusca*, *Cnemaspis kendallii*, *Cyrtodactylus seribuatensis*, *Gekko monarchus*, *Hemidactylus frenatus*, *Ptychozoon kuhli*, *Eutropis multifasciata*, *Lygosoma bowringii*, *Varanus salvator*

**Pulau Sepoi**

*Hemidactylus frenatus*, *Lepidodactylus lugubris*, *Eutropis multifasciata*

**Pulau Seribuat**

*Polypedates leucomystax*, *Fejervarya cancrivora*, *Aphaniotis fusca*, *Cnemaspis kendallii*, *Cyrtodactylus* sp. 1, *Gekko monarchus*, *Hemidactylus frenatus*, *Emoia atrocostata*, *Eutropis multifasciata*, *Lygosoma bowringii*, *Varanus salvator*, *Cerberus rynchops*

**Pulau Setindan**

*Hemidactylus frenatus*, *Lygosoma bowringii*, *Varanus salvator*

**Pulau Sibuh**

*Microhyla borneensis*, *Polypedates leucomystax*, *Fejervarya cancrivora*, *Aphaniotis fusca*, *Bronchocela cristatella*, *Draco melanopogon*, *Cnemaspis kendallii*, *Cyrtodactylus seribuatensis*, *Gehyra mutilata*, *Gekko monarchus*, *Hemidactylus frenatus*, *Hemiphyllodactylus typus*, *Lepidodactylus lugubris*, *Ptychozoon lionatum*, *Dasia olivacea*, *Emoia atrocostata*, *Eutropis multifasciata*, *Lygosoma bowringii*, *Sphenomorphus ishaki*, *Varanus salvator*, *Ramphotyphlops braminus*, *Boiga dendrophila*, *Dendrelaphis caudolineatus*, *Dryocalamus subannulatus*, *Pseudorabdion longiceps*

**Pulau Sibuhjong**

*Lepidodactylus lugubris*, *Varanus salvator*

**Pulau Sibuhkukus**

*Hemidactylus frenatus*, *Emoia atrocostata*, *Eutropis multifasciata*, *Varanus salvator*

**Pulau Sibuh Tengah**

*Bronchocela cristatella*, *Cnemaspis kendallii*, *Cyrtodactylus seribuatensis*, *Hemidactylus frenatus*, *Emoia atrocostata*, *Lygosoma bowringii*, *Varanus salvator*, *Chrysopelea paradisi*

**Pulau Tasu**

*Hemidactylus frenatus*, *Varanus salvator*

**Pulau Tengah**

*Varanus salvator*

**Pulau Tinggi**

*Polypedates leucomystax*, *Limnonectes blythii*, *Rana hosii*, *Dogania subplana*, *Aphaniotis fusca*, *Bronchocela cristatella*, *Draco formosus*, *Draco melanopogon*, *Draco sumatranus*, *Cnemaspis kendallii*, *Cosymbotus craspedotus*, *Gekko monarchus*, *Hemidactylus frenatus*, *Ptychozoon kuhli*, *Dasia olivacea*, *Eutropis multifasciata*, *Ahaetulla prasina*, *Boiga drapiezii*, *Dendrelaphis caudolineatus*, *Dendrelaphis cyanochloris*, *Dryocalamus subannulatus*

**Pulau Tioman**

**Cross-island trail (near 300 m).** *Leptolalax kajangensis*, *Megophrys nasuta*, *Kalophrynus pleurostigma*, *Ansonia tiomanica*, *Bufo melanostictus*, *Bufo parvus*, *Pelophryne brevipes*, *Chaperina fusca*, *Kaloula pulchra*, *Nyctixalus pictus*, *Polypedates leucomystax*,

*Theلودerma horridum*, *Limnonectes blythii*, *Taylorana hascheana*, *Rana raniceps*, *Rana hosii*, *Dogania subplana*, *Acanthosaura armata*, *Aphaniotis fusca*, *Bronchocela cristatella*, *Draco fimbriatus*, *Draco melanopogon*, *Draco sumatranus*, *Gonocephalus chamaeleontinus*, *Gonocephalus grandis*, *Cnemaspis kendallii*, *Cnemaspis limi*, *Cosymbotus craspedotus*, *Cyrtodactylus quadrivirgatus*, *Cyrtodactylus tiomanensis*, *Gehyra mutilata*, *Gekko monarchus*, *Gekko smithii*, *Ptychozoon kuhli*, *Ptychozoon lionatum*, *Dasia olivacea*, *Eutropis multifasciata*, *Larutia seribuatensis*, *Lipinia vittigera*, *Sphenomorphus scotophilus*, *Varanus nebulosus*, *Dibamus tiomanensis*, *Ramphotyphlops albiceps*, *Ramphotyphlops braminus*, *Ahaetulla prasina*, *Boiga cynodon*, *Boiga drapiezii*, *Boiga nigriceps*, *Calamaria ingeri*, *Calamaria lumbricoidea*, *Calamaria pavimentata*, *Chrysopelea pelias*, *Dendrelaphis caudolineatus*, *Dendrelaphis cyanochloris*, *Dendrelaphis pictus*, *Dryocalamus subannulatus*, *Dryophiops rubescens*, *Gongylosoma mukutense*, *Lepturophis albofuscus*, *Liopeltis tricolour*, *Oligodon booliati*, *Oligodon purpurascens*, *Psammodynastes pulverulentus*, *Rhabdophis chrysargos*, *Zaocys carinatus*, *Bungarus flaviceps*, *Calliophis intestinalis*, *Popeia* sp.

**G. Kajang (near the summit or at Gua Tengkok Air at 980-1035m).**

*Leptolalax kajangensis*, *Megophrys nasuta*, *Ansonia tiomanica*, *Pelophryne brevipes*, *Kalophrynus pleurostigma*, *Philautus petersi*, *Acanthosaura armata*, *Draco haematopogon*, *Draco melanopogon*, *Cnemaspis kendallii*, *Cnemaspis limi*, *Cyrtodactylus quadrivirgatus*, *Cyrtodactylus tiomanensis*, *Sphenomorphus ishaki*, *Sphenomorphus scotophilus*, *Asthenodipsas vertebralis*, *Ahaetulla prasina*, *Calamaria lumbricoidea*, *Pareas vertebralis*, *Psammodynastes pulverulentus*, *Calliophis intestinalis*, *Popeia* sp.

**G. Kajang (below 980m to S. Mentawak).** *Leptolalax kajangensis*, *Megophrys nasuta*, *Ansonia tiomanica*, *Bufo parvus*, *Pelophryne brevipes*, *Chaparina fusca*, *Kalophrynus pleurostigma*, *Limnonectes blythii*, *Rana picturata*, *Nyctixalus pictus*, *Acanthosaura armata*, *Aphaniotis fusca*, *Draco melanopogon*, *Gonocephalus chamaeleontinus*, *Gonocephalus grandis*, *Cnemaspis kendallii*, *Cnemaspis limi*, *Gekko smithii*, *Eutropis multifasciata*, *Larutia seribuatensis*, *Lipinia vittigera*, *Sphenomorphus ishaki*, *Sphenomorphus scotophilus*, *Calamaria lumbricoidea*, *Chrysopelea pelias*, *Dryophiops rubescens*, *Liopeltis tricolour*, *Oligodon purpurascens*, *Rhabdophis chrysargos*, *Calliophis intestinalis*

**G. Rokam.** *Cnemaspis limi*

**Kg. Air Batang.** *Rana erythraea*, *Bronchocela cristatella*, *Draco sumatranus*, *Cyrtodactylus tiomanensis*, *Gekko monarchus*, *Lygosoma bowringii*, *Varanus nebulosus*, *Varanus salvator*, *Dibamus tiomanensis*, *Python reticulatus*, *Cerberus rynchops*, *Dendrelaphis caudolineatus*, *Dryophiops rubescens*, *Enhydris plumbea*, *Psammodynastes pulverulentus*, *Calliophis intestinalis*, *Ophiophagus hannah*

**Kg. Asah.** *Aphaniotis fusca*, *Draco melanopogon*, *Gonocephalus grandis*, *Dasia olivacea*, *Sphenomorphus scotophilus*, *Varanus salvator*

**Kg. Berjaya.** *Bufo melanostictus*, *Kaloula pulchra*, *Polypedates leucomystax*, *Rana raniceps*, *Rana erythraea*, *Rana hosii*, *Aphaniotis fusca*, *Bronchocela cristatella*, *Draco melanopogon*, *Draco sumatranus*, *Gonocephalus chamaeleontinus*, *Cnemaspis kendallii*, *Cnemaspis limi*, *Gekko monarchus*, *Hemidactylus frenatus*, *Eutropis multifasciata*, *Lygosoma bowringii*, *Sphenomorphus scotophilus*, *Varanus salvator*, *Ramphotyphlops braminus*, *Python reticulatus*, *Ahaetulla prasina*, *Cerberus rynchops*, *Dendrelaphis caudolineatus*, *Dendrelaphis cyanochloris*, *Oligodon purpurascens*, *Psammodynastes pulverulentus*, *Rhabdophis chrysargos*, *Zaocys carinatus*

**Kg. Genting.** *Limnonectes blythii*

**Kg. Juara.** *Bufo melanostictus*, *Bufo parvus*, *Polypedates leucomystax*, *Rana raniceps*, *Draco sumatranus*, *Cyrtodactylus tiomanensis*, *Hemidactylus frenatus*, *Dasia olivacea*, *Eutropis*

*longicaudata*, *Lygosoma bowringii*, *Varanus nebulosus*, *Ramphotyphlops braminus*, *Python reticulatus*, *Boiga cynodon*, *Chrysopelea pelias*, *Dendrelaphis caudolineatus*, *Dendrelaphis cyanochloris*, *Dendrelaphis pictus*, *Dendrelaphis striatus*, *Dryophiops rubescens*, *Elaphe taeniura*, *Gonyosoma oxycephalum*, *Rhabdophis chrysargos*, *Sibynophis melanocephalus*

**Kg. Lalang.** *Fejervarya cancrivora*, *Cerberus rynchops*

**Kg. Mukut.** *Megophrys nasuta*, *Bufo melanostictus*, *Chaperina fusca*, *Limnonectes blythii*, *Aphaniotis fusca*, *Bronchocela cristatella*, *Draco melanopogon*, *Draco sumatranus*, *Cnemaspis kendallii*, *Gehyra mutilata*, *Lygosoma bowringii*, *Eutropis multifasciata*, *Varanus nebulosus*, *Ahaetulla prasina*

**Kg. Paya.** *Bufo melanostictus*, *Limnonectes blythii*, *Rana erythraea*, *Rana hosii*, *Draco melanopogon*, *Gonocephalus chamaeleontinus*, *Cnemaspis kendallii*, *Cyrtodactylus tiomanensis*, *Gekko monarchus*, *Dasia olivacea*, *Eutropis multifasciata*, *Lygosoma bowringii*, *Varanus nebulosus*, *Varanus salvator*, *Dibamus tiomanensis*, *Ramphotyphlops braminus*, *Python reticulatus*, *Dendrelaphis formosus*, *Enhydris enhydris*, *Enhydris plumbea*, *Lepturophis albofuscus*

**Kg. Salang.** *Acanthosaura armata*, *Draco melanopogon*, *Draco sumatranus*, *Gonocephalus chamaeleontinus*, *Gonocephalus grandis*, *Cnemaspis kendallii*, *Cnemaspis limi*, *Cosymbotus platyurus*, *Dasia olivacea*, *Eutropis multifasciata*, *Lipinia vittigera*, *Varanus nebulosus*, *Varanus salvator*

**Kg. Tekek.** *Bufo melanostictus*, *Bufo parvus*, *Kaloula baleata*, *Kaloula pulchra*, *Polypedates leucomystax*, *Fejervarya cancrivora*, *Limnonectes blythii*, *Rana raniceps*, *Rana erythraea*, *Bronchocela cristatella*, *Draco melanopogon*, *Draco sumatranus*, *Cosymbotus platyurus*, *Cyrtodactylus tiomanensis*, *Gehyra mutilata*, *Gekko monarchus*, *Hemidactylus frenatus*, *Lepidodactylus lugubris*, *Dasia olivacea*, *Eutropis longicaudata*, *Lygosoma bowringii*, *Varanus nebulosus*, *Varanus salvator*, *Ramphotyphlops braminus*, *Python reticulatus*, *Boiga cynodon*, *Cerberus rynchops*, *Dendrelaphis caudolineatus*, *Dryocalamus subannulatus*, *Elaphe flavolineata*, *Enhydris plumbea*, *Fordonia leucobalia*

**Monkey Bay.** *Limnonectes blythii*, *Acanthosaura armata*, *Aphaniotis fusca*, *Bronchocela cristatella*, *Draco fimbriatus*, *Draco melanopogon*, *Draco sumatranus*, *Cnemaspis kendallii*, *Cnemaspis limi*, *Cyrtodactylus tiomanensis*, *Gehyra mutilata*, *Ptychozoon kuhli*, *Dasia olivacea*, *Eutropis multifasciata*, *Lipinia vittigera*, *Sphenomorphus scotophilus*, *Varanus nebulosus*, *Ahaetulla prasina*, *Chrysopelea pelias*, *Dendrelaphis striatus*, *Elaphe taeniura*, *Oligodon booliati*

**Sedagong.** *Limnonectes blythii*, *Rana raniceps*, *Aphaniotis fusca*, *Draco melanopogon*, *Draco sumatranus*, *Gonocephalus grandis*, *Eutropis multifasciata*, *Varanus nebulosus*, *Varanus salvator*, *Rhabdophis chrysargos*

**S. Asah (behind K. Asah).** *Gonocephalus grandis*, *Dasia olivacea*, *Lipinia vittigera*

**S. Air Besar.** *Megophrys nasuta*, *Dogania subplana*, *Sphenomorphus scotophilus*

**S. Air Raja (behind K. Genting).** *Limnonectes blythii*

**S. Air Surin.** *Megophrys nasuta*

**S. Baharu.** *Limnonectes blythii*, *Dogania subplana*

**S. Benuang.** *Chaperina fusca*, *Aphaniotis fusca*, *Draco melanopogon*, *Gonocephalus chamaeleontinus*, *Gonocephalus grandis*, *Cnemaspis kendallii*, *Sphenomorphus scotophilus*

**S. Besar.** *Taylorana hascheana*

**S. Durian Kallang (behind K. Paya).** *Limnonectes blythii*, *Rana hosii*

**S. Keliling.** *Megophrys nasuta*, *Bufo parvus*, *Limnonectes blythii*, *Rana raniceps*, *Ichthyophis* sp., *Dogania subplana*, *Gekko monarchus*, *Dendrelaphis formosus*

**S. Mentawak.** *Megophrys nasuta*, *Bufo asper*, *Pelophryne brevipes*, *Chaperina fusca*, *Limnonectes blythii*, *Taylorana hascheana*, *Rana raniceps*, *Rana hosii*, *Rana picturata*, *Nyctixalus pictus*,

*Acanthosaura armata*, *Aphanotis fusca*, *Bronchocela cristatella*, *Draco melanopogon*, *Draco sumatranus*, *Gonocephalus chamaeleontinus*, *Gonocephalus grandis*, *Cnemaspis kendallii*, *Cnemaspis limi*, *Gekko smithii*, *Ptychozoon kuhli*, *Dasia olivacea*, *Eutropis multifasciata*, *Lipinia vittigera*, *Sphenomorphus scotophilus*, *Varanus nebulosus*, *Varanus salvator*, *Ahaetulla prasina*, *Chrysopelea pelias*, *Dryocalamus subannulatus*, *Lepturophis albofuscus*, *Oligodon purpureus*, *Rhabdophis chrysargos*, *Bungarus flaviceps*, *Calliophis intestinalis*

**S. Pasal.** *Limnonectes blythii*, *Eutropis multifasciata*

**S. Paya.** *Bufo parvus*, *Limnonectes blythii*, *Taylorana hascheana*, *Ichthyophis* sp., *Hemidactylus frenatus*, *Cerberus rynchops*, *Enhydryis enhydryis*

**S. Raya (2 km east of Kg. Mukut).** *Rana raniceps*, *Rana hosii*, *Cnemaspis limi*, *Eutropis multifasciata*, *Lipinia vittigera*, *Sphenomorphus scotophilus*, *Enhydryis plumbea*, *Gongylosoma mukutense*, *Rhabdophis chrysargos*, *Zaocys carinatus*

**Tk. Dalam.** *Bufo parvus*, *Fejervarya cancrivora*, *Taylorana hascheana*, *Aphanotis fusca*, *Bronchocela cristatella*, *Draco melanopogon*, *Draco sumatranus*, *Cnemaspis kendallii*, *Cnemaspis limi*, *Ptychozoon kuhli*, *Eutropis multifasciata*, *Varanus nebulosus*, *Lepturophis albofuscus*, *Python reticulatus*,

**Tk. Dungun.** *Bufo parvus*, *Polypedates leucomystax*, *Taylorana hascheana*, *Rana raniceps*, *Rana hosii*, *Draco melanopogon*, *Draco sumatranus*, *Bronchocela cristatella*, *Gonocephalus chamaeleontinus*, *Gonocephalus grandis*, *Cnemaspis kendallii*, *Cnemaspis limi*, *Hemidactylus frenatus*, *Dasia olivacea*, *Eutropis multifasciata*, *Lipinia vittigera*, *Varanus nebulosus*, *Python reticulatus*, *Ahaetulla prasina*, *Oligodon purpurascens*, *Rhabdophis chrysargos*

**Tk. Nipah.** *Bufo asper*, *Chaperina fusca*, *Rana raniceps*, *Aphanotis fusca*, *Draco melanopogon*, *Draco sumatranus*, *Gonocephalus grandis*, *Cnemaspis limi*, *Cyrtodactylus tiomanensis*, *Hemidactylus frenatus*, *Dasia olivacea*, *Eutropis multifasciata*, *Lipinia surda*, *Lipinia vittigera*, *Sphenomorphus scotophilus*, *Varanus nebulosus*, *Varanus salvator*, *Python reticulatus*, *Lepturophis albofuscus*, *Calliophis intestinalis*

**Tk. Penut.** *Bufo parvus*

**U. Lalang.** *Ansonia tiomanica*, *Pelophryne brevipes*, *Philautus petersi*, *Oligodon booliati*, *Oligodon purpurascens*

#### **Pulau Tokong Bahara**

*Hemidactylus frenatus*, *Eutropis multifasciata*

#### **Pulau Tokong Belalai**

*Hemidactylus frenatus*, *Varanus salvator*

#### **Pulau Tokong Burung Besar**

*Hemidactylus frenatus*, *Eutropis multifasciata*

#### **Pulau Tokong Burung Condong**

*Hemidactylus frenatus*, *Eutropis multifasciata*

#### **Pulau Tokong Burung Tengah**

*Hemidactylus frenatus*, *Eutropis multifasciata*

#### **Pulau Tokong Chondong**

*Hemidactylus frenatus*, *Varanus salvator*

#### **Pulau Tokong Chupak**

*Lepidodactylus lugubris*

#### **Pulau Tokong Raket (two islands)**

*Lepidodactylus lugubris*

#### **Pulau Tokong Sanggol**

*Lepidodactylus lugubris*

#### **Pulau Tulai**

*Bronchocela cristatella*, *Cnemaspis kendallii*, *Cnemaspis limi*, *Gekko monarchus*, *Gekko smithii*, *Hemidactylus frenatus*, *Ptychozoon kuhli*, *Emoia atrocostata*, *Eutropis multifasciata*, *Larutia seribuatensis*, *Sphenomorphus scotophilus*, *Varanus salvator*, *Dibamus tiomanensis*, *Ahaetulla prasina*, *Python reticulatus*

#### **Pulau Tunas Selatan**

*Gekko monarchus*, *Hemidactylus frenatus*, *Lepidodactylus lugubris*, *Lygosoma bowringii*, *Varanus salvator*, *Ramphotyphlops braminus*

#### **Pulau Tunas Utara**

*Hemidactylus frenatus*, *Varanus salvator*

## APPENDIX II

Catalogue numbers for voucher specimens and non-vouchered site records for all new island records from the Tioman Archipelago, West Malaysia are reported below. All records for *Varanus salvator* are sight records (or track records) because the legal status of this species does not allow its collection.

*Kaloula baleata* — Pahang, P. Aceh; LSUHC 5712–13, 6954. *Polypedates leucomystax* — Pahang, P. Aceh calls heard. *Dogania subplana* — Johor, P. Tinggi LSUHC 6332. *Aphanotis fusca* — Pahang, P. Aceh LSUHC 5699–702; Johor, P. Babi Hunjong LSUHC 5743–47. *Cnemaspis kendallii* — Pahang, P. Aceh LSUHC 5703; Johor, P. Babi Hujung LSUHC 5749–52; P. Ibol LSUHC 6380–83; P. Sibu Tengah seen on side of tree. *Crytodactylus seribuatensis* — Johor, P. Nangka Kecil LSUHC 6348–54; P. Mentigi LSUHC 6348; P. Sibu LSUHC 6398–99; P. Sibu Tengah LSUHC 6410; P. Lima Besar LSUHC 6413–21. *Cyrtodactylus aurensis* — Johor, P. Aur LSUHC 7015, 7022–23. *Gehyra mutilata* — Johor, P. Rawa seen on side of building. P. Babi Tengah LSUHC 5754–59; P. Nangka Besar LSUHC 6334; P. Lima Besar LSUHC 5834, 5837–38; P. Lima Kecil LSUHC 5825; Pulau Pemangggil LSUHC 7518, 7521. *Gekko monarchus* — Pahang, P. Aceh LSUHC 6955–57; P. Layak LSUHC 6976–79; P. Tunas Selatan LSUHC 6967; P. Pelandok LSUHC 6982–83; Johor, P. Batu Gajah LSUHC 6997; P. Seribuat LSUHC 5214–16; P. Sembilang LSUHC 5588; P. Mertang Tengah LSUHC 6950; P. Mertang Timur LSUHC 6944–49; P. Babi Hujung LSUHC 5740–42; P. Penyambong LSUHC 7006–09; P. Ibol LSUHC 6384–87; P. Simbang LSUHC 6367–76; P. Nangka Kecil LSUHC 6360; P. Mentigi LSUHC 6338–41; P. Lima Besar LSUHC 5839–41; P. Cebeh LSUHC 6908–15; P. Jahat LSUHC 6285–6288. *Hemidactylus frenatus* — Pahang, P. Aceh LSUHC 5703; Aceh Anak LSUHC 6960–62; P. Layak LSUHC 6972–75; P. Tunas Selatan LSUHC 6963–66; P. Tunas Utara LSUHC 6971; Johor, P. Lalang Selatan LSUHC 6994; Pahang, Lalang Utara LSUHC 6980–81; P. Pelandok LSUHC 6984–85; Johor, P. Mawar LSUHC 6989–90; P. Setindan LSUHC 6999; P. Belanank LSUHC 7000–02; P. Tasu LSUHC 6935–36; P. Mertang Timur LSUHC 6937–39; P. Rawa seen on houses; P. Harimau seen on radar tower; P. Gual seen in rock crack; P. Babi Hujung LSUHC 5738; P. Babi Tengah LSUHC 5753; P. Penyambong LSUHC 7010–11; P. Nangka Besar LSUHC 6335–36; P. Nangka Kecil LSUHC 6355–57; P. Mentigi LSUHC 6342–44; P. Sibu Tengah LSUHC 6409; P. Sibu Kukus LSUHC 5802; P. Lima Besar seen on trees; P. Lima Kecil LSUHC 5824; P. Chondong LSUHC 5821–23; P. Belalai LSUHC 5827–29; Tuali seen on trees; P. Sepoi LSUHC 5685–86; P. Lang seen in bungalow; Pahang, P. Tokong Burung Besar LSUHC 5691; P. Tokong Burung Condong LSUHC 5695–96; P. Tokong Burung Tengah LSUHC 6933; P. Tokong Bahara LSUHC 5843–47. *Lepidodactylus lugubris* — Pahang, Pulau Tunas Selatan LSUHC 6968; Johor, P. Mawar LSUHC 6991–92; P. Babi Tengah LSUHC 5761; P. Nangka Kecil

- LSUHC 6358–59; P. Mentigi LSUHC 6347; P. Papan LSUHC 5819; P. Sibu Hujung LSUHC 5803–04; P. Sanggol LSUHC 5830–31; P. Raket LSUHC 5826; Pahang, P. Cebeh LSUHC 6924–28; P. Sepoi LSUHC 6891–99; P. Jahat LSUHC 6289. *Ptychozoon kuhli* — Pahang, P. Aceh LSUHC 5708; P. Tinggi LSUHC 6321. *Ptychozoon lionatum* — Johor, P. Sibu LSUHC 5539, 5583, 6697; Pahang, P. Tioman LSUHC 6437. *Dasia olivacea* — Johor, Pulau Babi Besar LSUHCPC 0246; Pulau Babi Tengah LSUHC 5748; P. Pemanggil LSUHC 7513–14. *Emoia atrocostata* — Johor, P. Nangka Besar LSUHC 6333; P. Papan LSUHC 5814–16; P. Sibu Tengah LSUHC 5806; P. Sibu Kukus LSUHC 5800–01. *Eutropis multifasciata* Pahang, P. Aceh LSUHC 5716; Johor, P. Rawa seen on forest floor; P. Babi Tengah LSUHC seen at edge of forest; P. Sibu Kukus seen on forest floor, Pahang, P. Sepoi LSUHC 5867–68; Johor, P. Lang seen on forest floor; Pahang, P. Tokong Burung Besar LSUHC 5692–94; P. Tokong Burung Condong LSUHC 6929; P. Tokong Burung Tengah LSUHC 6933; P. Tokong Bahara LSUHC 6134–35. *Larutia seribuatensis* — Pahang, P. Tioman LSUHC 7074. *Lygosoma bowringii* — Pahang, P. Aceh LSUHC 5697–98; P. Tunas Selatan LSUHC 6970; Johor, P. Mawar LSUHC 6986–88; P. Setindan LSUHC 6998; Mertang Tengah LSUHC 6950–51; P. Mertang Timur LSUHC 6940–43; Rawa LSUHC 5723–25; P. Harimau LSUHC 5717; P. Mensirip LSUHC 5718–19; P. Babi Tengah seen beneath surface debris on beach; P. Ibol LSUHC 6377–79; P. Nangka Kecil LSUHC 6361; P. Mentigi LSUHC 6345–46; P. Papan LSUHC 5817–18; P. Sibu Tengah LSUHC 5810–11; P. Lima Bear LSUHC 5835–36. *Ramphotyphlops braminus* — Pahang, P. Aceh LSUHC 5705; P. Tunas Selatan LSUHC 6969; Johor, P. Sibu Tengah LSUHC 6411–12. *Python reticulatus* — P. Tulai LSUDPC 266–69. *Boiga drapiezii* — Pahang, P. Tioman LSUHC 6400. *Boiga nigriceps* — Johor. P. Aur LSUHC 2020–21. *Chrysopelea paradisi* — Johor, P. Sibu Tengah LSUHC 5848. *Dendrelaphis caudolineatus* — Pahang, P. Aceh LSUHC 6958; Johor, P. Sibu Tengah LSUHC 6408. *Dendrelaphis cyanochloris* — Johor, P. Tinggi LSUHC 6401. *Dendrelaphis pictus* — Pahang, P. Aceh LSUHC 6959; Johor, P. Mawar LSUHC 6993. *Lycodon capucinus* — Johor, P. Rawa LSUHC 5725; P. Babi Besar LSUHC 5768; P. Babi Hujung LSUHC 5767. *Pseudorabdion longiceps* — Johor. P. Sibu LSUHC 6388. *Tropidolaemus wagleri* — Pahang, P. Aceh LSUHC 5714–15.