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Edited by
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HERPETOFAUNA DIVERSITY OF KARIMATA ISLAND, INDONESIA

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(with four text-figures)

ABSTRACT.– A study on the herpetological diversity of Karimata Island was conducted from 27 January–7 March 2008. Eight species of amphibians, dominated by the family Dicroglossidae (*Limnonectes ingeri, L. malesianus, L. paramacrodon* and *Fejervarya cancrivora*) and 18 species of reptiles, dominated by the family Gekkonidae (*Cnemaspis kendallii, Cyrtodactylus* sp. A, *Cyrtodactylus* sp. B, *Gekko gecko, G. monarchus* and *Hemidactylus frenatus*) were recorded. Due to an impoverished fauna, unusual distribution of certain species has been observed. A *Philautus* sp. occurs from lowland up to the peak of the highest mountain in this island. Furthermore, some species that were found on Karimata Island (*Staurois guttatus, Leptolalax* cf. *gracilis* and *Tropidophorus beccarii*) were previously thought to be exclusive from Borneo. However, these species are not present in Sumatra. Some findings are predicted to be new species, which further studies will elucidate.

KEY WORDS.– Karimata, Borneo, Sumatra, Malay Peninsula, amphibians, reptiles, diversity, distribution.

INTRODUCTION

Karimata, a semi-oceanic island, situated ca. 60 km west of Kalimantan Barat Province, Borneo, is considered to have a high biodiversity and is home to several endemic animal and plant species (Yanuar et al., 1993). It covers an area of ca. 120 km^2 and has a diversity of habitats, including Mt. Cabang, which has two peaks reaching up to 1,050 m asl and are covered with stunted vegetation (Fig. 1). According to Sathiamurthy and Voris (2006), Karimata was linked to Borneo up to ca. 9,000 years before present, and was isolated as the sea levels rose during the Mio-Pliocene period.

The relatively long isolation of Karimata Island from mainland Borneo is shown in example by the presence of two subspecies of monkeys (*Presbytis rubicunda carimatae* and *Macaca fascicularis carimatensis*), which are unique to the island (Yanuar et al., 1993). The fauna of Karimata Island has been relatively understudied despite its size and proximity to Borneo. A subspecies of squirrel (*Callosciurus prevosti carimatae*) was reported from Karimata (Heaney, 1978; Corbet and Hill, 1992) and birds have been recorded since early last century but no new data can be added (Oberholser, 1924). Kopstein (1935) reported the occurrence of three snake species on Karimata. Sutcharit and Panha (2004) discussed a new tree snail from Thailand, related to those from Karimata. In addition, a tarsier (*Tarsius bancanus* subsp.) has been observed transporting her sibling during this study.

This study aims to provide baseline data on the herpetofauna of Karimata Island to bolster the existing knowledge on the biodiversity of the island. As a part of Marine Protected Areas based on Ministry of Forestry Declaration No.259/Kpts-II/2000, it is important to have reliable data about biodiversity of Karimata Island for present and future conservation measures.

MATERIALS AND METHODS

Sampling was conducted on the east side of Karimata Island which can be reached from Padang village (Fig. 1). We divided the survey area into three categories based on altitudinal gradients corresponding to general forest types: 0–300 m asl (lowland forests), 301–800 m asl (hill forests) and 801–1050 m asl (upper hill/submontane forests). The sites surveyed within the forest ecosystem

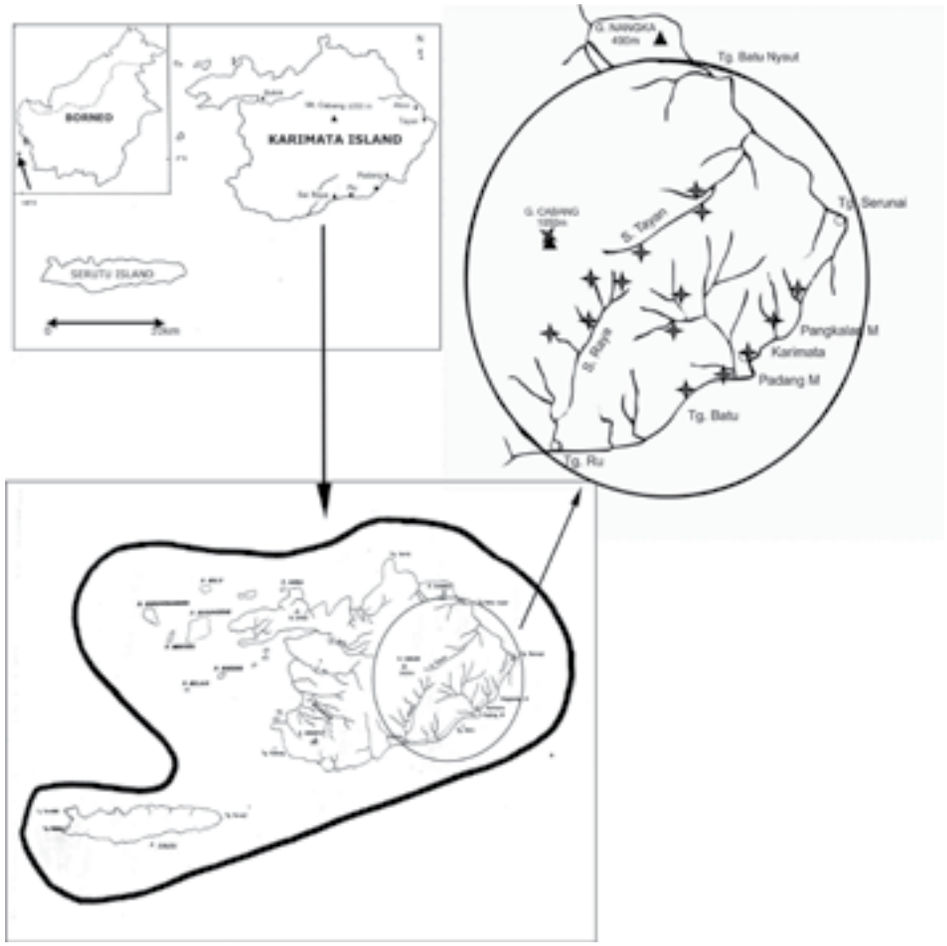

FIGURE 1: Map of Karimata Island and site surveyed.

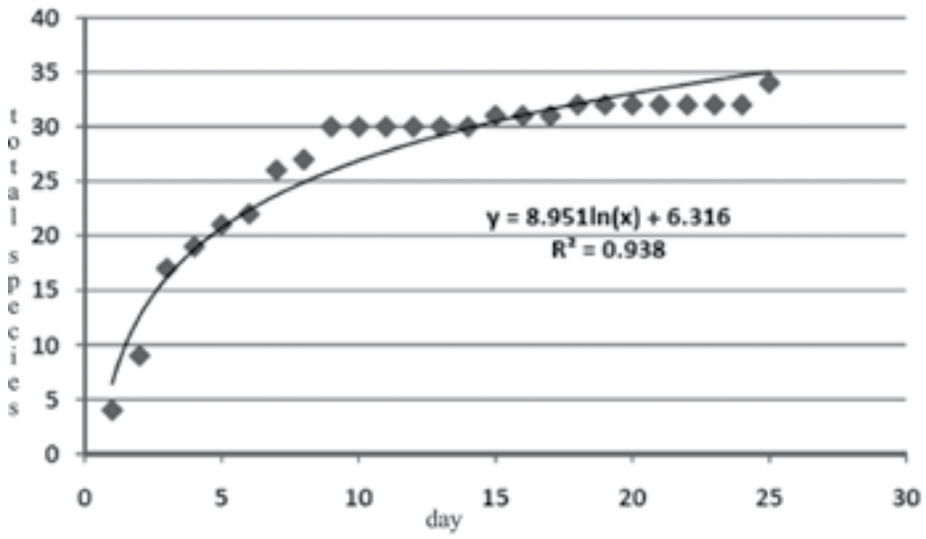

FIGURE 2: Species accumulation curve based on field survey.

FIGURE 3: Morphological variations among *Philautus* in Karimata island.

FIGURE 4: Morphological comparison between *Hylarana* cf. *raniceps* from Karimata (top left and bottom left) with *H. raniceps* from Borneo (top right and bottom right).

were mostly considered as undisturbed primary forest. Only areas close to human habitations appeared slightly disturbed and are restricted to lower altitudes. We performed transected VES (Visual Encounter Sampling) along streams and or forest trails in several localities at each sites. Methods for surveying frogs were adopted mostly taken from Heyer et al. (1994) and Simmons (1987). Searches included forest floor, water bodies, and surrounding vegetation. We also used these methods for reptiles, in addition to using rat glue as a trap and blowpipes for arboreal lizards. All specimens are temporarily deposited at the Reference Collection, School of Life Sciences and Technology, Institut Teknologi Bandung.

RESULTS

The result of our survey at Karimata Island is considered a significant contribution to the knowledge of the anuran amphibian fauna of the Sunda region. We are confident that the most common species have been sampled and the data will be beneficial as a baseline for long term monitoring in the future. This assumption was based on our observations that the trend of increase of species per collecting days did not show significant increase during the last week of our survey (see Fig. 2).

Four families, comprising eight amphibian species and seven families, comprising 18 reptile species, were documented (Table 1). Dicroglossidae and Gekkonidae were the dominant amphibian and reptilian families, respectively. The family Dicroglossidae consisted of four species: *Fejervarya cancrivora, Limnonectes ingeri, L. malesianus* and *L. paramacrodon*, whereas the family Gekkonidae were represented by six species: *Cnemaspis kendallii, Cyrtodactylus* sp. A, *Cyrtodactylus* sp. B, *Gekko monarchus, Gekko gecko* and *Hemidactylus frenatus*.

Table 2 shows the species composition of amphibians on Karimata for each altitudinal gradient. A total of 246 specimens were collected. The number of specimens collected from 301–800 m asl and 801–1050 m asl, altogether were more or less equal to the lower altitudinal gradient. Three frog species were collected at lowland only and two species (*Limnonectes ingeri* and *Staurois guttatus*) were collected from low to medium altitude. However, the remaining species were collected from all altitudinal gradients, although only one species (*Philautus* sp.) could be observed near the peak of Mt. Cabang. *Limnonectes malesianus* and *Leptolalax* cf. *gracilis* occur in all three altitudinal gradients, although they fail to reach the summit region.

Among reptiles, most species are represented by a few specimens. However, no reptile were collected from higher altitudes. Seven reptiles species were collected from low to mid altitudes, while other species were found to occur in the lowlands. *Cnemaspis kendallii* was abundant during the fieldwork and 13 specimens were collected, contributing to the total number of reptile specimen (42 in total; see Table 3). Some species not collected or not found during the fieldwork were *Gekko gecko, Hemidactylus frenatus, Draco* sp., *Orlitia borneensis* and *Batagur affinis*, although these species were observed, or should be present according to local inhabitants.

DISCUSSION

Karimata not only has relatively rich herpetofaunal diversity but also demonstrates unusual biogeographic species composition. The altitudinal distribution of many amphibians and reptiles on Karimata may be misleading. Many species that usually occur in low elevations on the mainland can be found at higher altitude and vice versa. Whether it is caused by the lack of competitors and/or predators is unclear. Data supporting this phenomenon has been reported for other islands (McGuire et al., 2007). Unusual altitudinal distribution was shown by *Limnonectes*. As can be seen from Table 2, each *Limnonectes* species in this island has their own range from lowland to highland, while *Limnonectes* on other islands are usually found in lowland area (Inger, 1966; Inger and Greenberg, 1966; Inger and Stuebing, 2005). *Limnonectes paramacrodon* was found only in lowland area (0–300 m asl), while *L. ingeri* occurs at low to medium altitude (0–800 m asl), and *L. malesianus* existed in almost all altitudes (0–1050 m asl), although not reaching the summit.

As explained in the Results section, the *Philautus* species from Karimata were also interesting because they were found from lowlands (0–300 m asl), up to the highest altitude on Karimata (1,050 m asl). Moreover, these frogs tend to be more abundant with increasing altitude. Based on known species/records in the Sunda region, frogs in the genus *Philautus* appear to have a strong preference for higher altitudes (Inger, 1966; Dring, 1987). Altogether, we found at least six morphological variations of *Philautus* from Karimata Island, as shown in Fig. 3. As we could not find the differences among them, enforced with the presence of intermediate colour variations, they are treated as a single species until a more detailed analysis is conducted.

Furthermore, we suspect that several of our findings are potentially new species that would require further study. Those species were not only first recorded outside of Borneo, but may be considered as different forms or morphological characters compared to similar species found in Borneo or Sumatra as the closest mainland. For example, *Hylarana* cf. *raniceps* is a member of the *Hylarana chalconota* group, which comprised of about seven species (Stuart et al., 2006). The species represented on Borneo include *H. raniceps* and *H. megalonesa*, in Peninsular Malaysia by *H. labialis* and *Hylarana* cf. *labialis*, and in Sumatra by three forms, *H. parvacola, H. rufipes* and *H. chalconota*, the last form shared with the Javan form in Lampung, southern Sumatra (Inger et al., 2009). The present study is unable to resolve the form the Karimata population is identical to, being similar to *H. raniceps* with dark sides and bold black dots, although body mass is larger and comparable to *H. megalonesa* from Borneo (Fig. 4).

In addition, the existence of granitic rocks in several areas, especially around river Tayan is interesting geologically. These granitic rocks obscure the water body in many places along gullies, therefore, it was the only running water heard but not observed, because of the underground movement of water.

Despite being located between Sumatra and Borneo, our data could not verify if the island serves as landbridge between Sumatra and Borneo. However, a number of species and genera, such as *Staurois guttatus, Leptolalax* cf. *gracilis* and *Tropidophorus beccarii* do not occur on Sumatra. *Philautus*, a number of *Cnemaspis*, and *Draco* have been previously recorded from Natuna Island (Leong et al., 2003). It will be important to compare specimens between Natuna and Karimata, in order to reconstruct how effective landbridges within the Sundaland have been to facilitate faunal as well as floral distribution between Sumatra and Borneo or Peninsular Malaysia and Borneo.

According to Voris (2000) and Sathiamurthy and Voris (2006), Karimata had land connection to Borneo up to 9,000 years before present, while Natuna separation from Borneo started about 13,000 years before present. Another island with somewhat similar history, Tambelan, lost its connection with Borneo at about 10,000 years before present. As it is about the same size as Karimata and situated between Natuna and Karimata, it will be important to have information about this island in order to understand the biogeography surrounding Borneo within the Sunda Shelf.

TABLE 1: List of amphibian and reptile species recorded from Karimata during the present survey. Abbreviation: * = not collected during the survey.

AMPHIBIANS		**REPTILES**	
Dicroglossidae	*Fejervarya cancrivora*	Crotalidae	*Tropidolaemus subannulatus*
	Limnonectes ingeri	Gekkonidae	*Cnemaspis kendallii*
	Limnonectes malesianus		*Cyrtodactylus* sp. A
	Limnonectes paramacrodon		*Cyrtodactylus* sp. B
Megophryidae	*Leptolalax* cf. *gracilis*		*Gekko monarchus*
Ranidae	*Hylarana* cf. *raniceps*		*Gekko gecko**
	Staurois guttatus		*Hemidactylus frenatus**
Rhacophoridae	*Philautus* sp.	Scincidae	*Lygosoma bowringii*
			Emoia atrocostata
REPTILES			*Tropidophorus beccarii*
Colubridae	*Ahaetulla prasina*	Agamidae	*Draco* sp*
	Cerberus rynchops		*Gonocephalus liogaster*
	*Gonyosoma oxycephalum**	Geoemydidae	*Orlitia borneensis**
	*Oligodon purpurascens**		*Batagur affinis**

TABLE 2: Number of specimens for each amphibian species collected during the survey in Karimata.

Family	Species	Altitude (m asl.)			Total specimens
		0–300	301–800	801–1050	
Dicroglossidae	*Fejervarya cancrivora*	3	0	0	3
	Limnonectes paramacrodon	10	0	0	10
	Limnonectes ingeri	31	13	0	44
	Limnonectes malesianus	2	8	3	13
Ranidae	*Hylarana* cf. *labialis*	20	0	0	20
	Staurois guttatus	37	24	0	61
Megophryidae	*Leptolalax* cf. *gracilis*	11	3	3	17
Rhacophoridae	*Philautus* sp.	12	19	47	78
	Total specimens	**126**	**67**	**53**	**246**
	Total species	**8**	**5**	**3**	**8**

TABLE 3: Number of specimens for each reptile species collected during the survey in Karimata. Abbreviation: * = not collected during the survey.

Family	Species	Altitude (m asl.)			Total specimens
		0–300	301–800	801–1050	
Colubridae	*Ahaetulla prasina*	1	0	0	1
	Cerberus rynchops	1	0	0	1
Viperidae	*Tropidolaemus subannulatus*	1	1	0	2
Gekkonidae	*Cyrtodactylus* sp. A	4	4	0	8
	Cyrtodactylus sp. B	1	2	0	3
	Cnemaspis kendallii	5	8	0	13
	Gekko monarchus	1	0	0	1
	*Gekko gecko**				present
	*Hemidactylus frenatus**				present
Scincidae	*Tropidophorus beccarii*	7	2	0	9
	Lygosoma bowringii	1	0	0	1
	Emoia atrocostata	2	0	0	2
Agamidae	*Gonocephalus liogaster*	0	1	0	1
	Draco sp.*				present
Geoemydidae	*Ortilia borneensis**				present
	*Batagur affinis**				present
	Total specimens	**24**	**18**	**0**	**42**
	Total species	**10**	**7**	**0**	**16**

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