Borneo J. Resour. Sci. Tech. (2011) 1: 59-62

SHORT COMMUNICATION

ASSEMBLAGES OF FROGS SPECIES AT BALAMBANGAN ISLAND, SABAH, MALAYSIA

RAMLAH ZAINUDIN*****

Faculty of Resource Science and Technology, Universiti Malaysia Sarawak, 94300 Kota Samarahan, Sarawak

ABSTRACT

Borneo is well known as a hotspot for biodiversity, yet species assemblages at smaller islands in the East Malaysian states of Sabah and Sarawak, are not well documented. The survey of frogs in Balambangan Island, which is situated at the west coast of Sabah, was the first attempt to look at the occurrence of frogs at smaller islands in the state. Sampling of frogs was conducted at the coastal areas of Kampung Selamat and limestone forest for four nights sampling period. Visual encounter survey and transect line were used to sample the frogs which were captured by hand. A total of seven species of 32 individuals were captured. This was only about 8% of the total species that occurs on the mainland Sabah. The island was dominated by the ranids (65%), rhacophoridae (22%) and microhylids (13%). Bufonids and megophryids were absent. The Mangrove frog, *Fejervarya cancrivora* (9 individuals) and the Lesser swamp frog, *Limnonectes paramacrodon* (8 individuals) were dominant on this island. No new species and endemism were noted on this island. The results from this preliminary study did not support the initial belief that the island contains high levels of endemism. On the contrary, the results appear to imply recent isolation from the Sabah mainland. Thus, a more detailed study including genetic diversity should be conducted to cover more areas on the main island and other smaller islands surrounding the Borneo Island and to obtain overall picture of biogeography of the frog species.

Keywords: Frogs, Ranidae, Rhacophoridae, Microhylidae, Balambangan

At least 150 species of frogs occur in Borneo (Inger & Stuebing 2005) and 89 species found in Sabah alone (Inger & Stuebing 1989). Nevertheless, most of collections were on the mainland of Sabah particularly at Kinabalu Parks (Inger *et al*. 1995; Inger *et al*. 2000, Malkmus *et al*. 2002; Wong 1994), Crocker Range (Inger & Stuebing 1998; Ramlah *et al.* 2001), Lower Segama (Kueh & Yambun 2006) and Kudat, the west coast of Sabah (Kueh 2006). None were sampled from any offshore islands off Sabah including the Balambangan Island. This survey was the first attempt to look at amphibian diversity on smaller islands, starting with the Balambangan Island.

Balambangan Island is situated about 5 km west of Banggi Island and 30 km north of the mainland town of Kudat. The island consists of limestones, swamps and coastal areas. From the town of Kudat in the north, chartered boats can be arranged to commute to the islands of Banggi and Balambangan.

Frog sampling was carried out for 4 nights consecutively, which were 17th to 25th of May, 2001. Two sites representing two different ecological systems were chosen. These were Kampung Selamat and campsite vicinity, which was in a limestone forest. Kampung Selamat, which was a heavily disturbed coastal area, consists of mangrove, coastal and limestone areas, while the campsite was totally a limestone forest with a little bit of mangroves. Line transects were used at both sites, since most of the rocky streams were small (less than 5m wide). The animals were located by headlamps and caught by hand. The animals were also searched along the limestone cave but only for one night. All specimens were preserved in 10% formalin and later stored in 70% alcohol. Muscle tissues from selected frogs were dissected and preserved in DMSO buffer for further studies. Specimens were then deposited at the UNIMAS Zoological Museum. The specimens were identified according to the book of 'A Field guide to the Frogs of Borneo' (Inger & Stuebing 1997; 2005).

Thirty two individual frogs belonging to seven species were caught during the survey (Table 1).

*****Corresponding author: *zramlah@frst.unimas.my*

This only makes about 8% of the total number of species that occur in Sabah. The finding is comparable to Sedilo peat swamp forest with seven species per visits (Ramlah 2002) but lower than Crocker Range (18) (Ramlah *et al*. 2001) and Bario (18) (Ramlah 1997). The low diversity may be due to the inappropriate selection of sampling areas, since most of the areas were covered by limestone and swamp forests, and surrounded by brackish water. Coastal areas and brackish water are not suitable habitats for the frog species as they are intolerance of high salinity. Moreover, short of sampling time and lack of personnel may have affected the total collections. At best, this study represents an incomplete survey of the amphibian fauna, and did not represent the overall picture for all localities found on this island.

Nonetheless, this study has obtained exploratory data on the occurrences and domination of certain species of frogs. Clearly, the island is dominated by the family of true frogs, Ranidae (65% of the total captured), followed by the family of tree frogs, Rhacophoridae (22%) and narrow- mouthed frogs, Microhylidae (13%) (Table 1). Surprisingly, not a single Bufonidae or Pelobatidae was caught on the island. On the other hand, *Fejervarya cancrivora*, the mangrove frog was abundant at both sites, while *Limnonectes paramacrodon*, the Lesser swamp frog, was only found in abundance at Kampung Selamat. Brackish water is deadly for the frogs of Southeast Asia except for one species, the mangrove or crab-eating frog, *F. cancrivora* (Inger & Tan 1996b). Adults of this species have been shown to tolerate 80% salinity of sea water. Even their tadpoles have greater tolerance of up to 120% salinity (Inger & Tan 1996b). This may be the reason of the low diversity of the frog species and the abundance of Fejervarya cancrivora in Balambangan Island. Limnonetes paramacrodon, on the other hand. was confined to the banks of sluggish swamp streams (Inger & Tan 1996b; Inger & Voris 2001) where the same kind of habitat occurred in Kampung Selamat.

Kalophrynus pleurostigma is a frog of the leaf litter known only from primary forest at low elevations (Inger & Stuebing 1997). Thus it was not surprising that we did not find any of the individuals at Kampung Selamat but yet in the limestone forest. Previous study (Ramlah 1997) showed that the species was also found at Kerangas forest in Bario where the inter-mitten .streams and standing water were reddish in colour as in limestone forest at Balambangan Island. *Chaperina fusca*, on the other hand, lives in primary and secondary forest and abundant in flat country, the same habitats that occurred in Balambangan Island.

Overall, the results are only preliminary, thus a more detailed study should be conducted to cover more areas on the main island and other smaller islands surrounding the archipelago. Many studied have shown that herpetofauna on islands tend to have high levels of endemism due to their isolation (Chan *et al*. 2009; Grismer 2008). The preliminary results however, contrast with the assumption that the island tends to have high levels of endemism since we did not find anynew species or first records of individual frogs in this island. May be the island is not isolated enough for the. frogs to evolve differently from the mainland of Sabah It would be interesting to extend the study to any island of Sabah (especially Banggi Island) to compare the occurrence and distribution of frog species among the islands.

Table 1. List of frog species assemblages at Balambangan Island

Family	Species	Site Surveyed		
		Kampung Selamat (no. of individual)	Campsite (no. of individual)	Percent Family Recorded
Rhacophoridae	*Polypedates macrotis*	3	4	22
Ranidae	*Fejervarya cancrivora*	3	6	65
	Limnonectes paramacrodon	8	0	
	Limnonectes palavanensis	3	0	
	Limnonectes ingeri	1	0	
Microhylidae	*Kalophrynus pleurostigma*	0	2	13
	Chaperina fusca	0	2 (caves)	

ACKNOWLEDGEMENTS

The study is funded by UNIMAS Research Grant (121/98(10)). I would like to thank Professor Dr. Fatimah Abang, Professor Dr. Andrew Alek Tuen and Professor Mohd Tajuddin Abdullah for organizing the expedition to the Balambangan Island, and to Isa Sait, Besar and Wahap for field assistance.

REFERENCES

Anderson, J.A.R. (1961). The ecology and forest types of the peat swamp forests of Sarawak and Brunei in relation to their silviculture. Unpublished PhD dissertation, Vol. I (191 pp) and Vol. II (appendices). University of Edinburgh.

Chan, K.O, L.L Grismer, P.L. Wood Jr, J.L. Grismer & Norhayati A. (2009). Preliminary checklist of the herpetofauna of Pulau Besar, Melaka, Malaysia. *Tropical Life Sciences Research*, 20: 81-87.

Grismer, L.L. (2008). Field Guide to the Amphibians and Reptiles of the Seribuat Archipelago, Peninsular Malaysia. Kuala Lumpur : Forestry Department, Peninsular Malaysia, 236 pp.

Inger, R.F (1966). The systematic and zoogeography of the Amphibia of Borneo. *Fieldiana Zoology*. 52: 1-402

Inger, R.F & Stuebing R.B. (1989). *Frogs of Sabah*. Sabah Parks Publication No. 10. Kota Kinabalu: Sabah Parks Trustees.

Inger, R.F & Voris H.K. (1993). A comparison of amphibian communities through time and from place to place in Bornean forests. *Journal of Tropical Ecology*, 9: 409-433.

Inger, R.F & Tan F.L (1996a). Checklists of the frogs of Borneo. *The Raffles Bulletin of Zoology*, 44(2): 551-574.

Inger, R. F & Tan F.L (1996b). *The natural history of amphibians and reptiles in Sabah*. Kota Kinabalu: Natural History Publications (Borneo) Sdn. Bhd, 101 pp.

Inger, R.F & Stuebing R.B. (1997). *A Field Guide to the frogs of Borneo*. Kota Kinabalu : Natural History Publications (Borneo) Sdn Bhd Kota Kinabalu in association with Science and Technology Unit, Sabah.

Inger, R.F & Stuebing R.B. (2005). *A Field Guide to the frogs of Borneo*. 2nd Edition. Kota Kinabalu : Natural History Publications (Borneo) Sdn. Bhd. in association with Science and Technology Unit, Sabah.

Inger R. F. & Voris, H. K. (2001). The biogeographical relations of the frogs and snakes of Sundaland. *Journal of Biogeography*., 28: 863-891.

Inger, R.F., Stuebing, R.B. & Tan F.L. (1995). New species and new records of Anurans from Borneo. *Raffles Bulletin of Zoology*, 43: 115-131.

Inger R.F., Tan F.L. & Yambun, P. (2000). The frog fauna of three Parks in Sabah, Malaysia-Kinabalu Park, Crocker Range Park, and Tawau Hills Park. *Sabah Parks Nature Journal*, 3: 7-28.

Kueh, B. H. (2006). Frogs of populated localities at West Coast and Kudat Divisions, Sabah, Malaysia. Assemblage of merely commensal species or not? *Journal of Tropical Biology and Conservation*, 2: 9-16.

Kueh, B.H. & Yambun, P.I. (2006). Herpetofauna in Lower Segama. In. Maryati, M., Bernard, H., Sofian, A.B. & Matsunaga, R. *Lower Segama scientific expedition*. Kota Kinabalu : Universiti Malaysia Sabah, pp 23-29.

Malkmus, R., Manthey, U., Vogel, G., Holfmann, P. & Kosuch, J. (2002). *Amphibians and reptiles of Mount Kinabalu (North Borneo)*. Münster : Ruggell ARG Gantner Verlag KG.

Ramlah Z.(1997). A brief notes on frogs of Bario, Kelabit Highland, Sarawak. In G. Ismail, & L. Din (Eds.), *A scientific journey through Borneo: Bario, the Kelabit Highland of Sarawak*, Kuching, Malaysia: Pelanduk Publication, pp. 201-206.

Ramlah Z., Wasly, L., & Ali, H., (2001). An Account of Anuran at Crocker Range National Park, Sabah. In G. Ismail, & L. Ali (Eds.), *Scientific Journey through Borneo: The Crocker Range National Park Sabah Volume 1: Natural Ecosystems and Species Components*, London: ASEAN Academic Press Ltd., pp. 137-146.

Ramlah Z. (2002). Frog diversity at Sedilu Peat Swamp forest Reserve, Sarawak. *Malayan Nature Journal*, 56: 217-223.

Wong, A. (1994). Population ecology of amphibians in different altitudes of Kinabalu Park. *Sabah Museum Journal*, 1: 29-38.