

P. KHIDMAT MAKLUMAT AKADEMIK  
UNIMAS



1000282075

# HISTOLOGICAL DESCRIPTION OF THE BORNEAN HORNED FROG *MEGOPHRYS NASUTA* (AMPHIBIA: ANURA: MEGOPHRYIDAE) SKIN STRUCTURE FROM DIFFERENT BODY REGIONS

ELY QUATRIN DEKA  
DEPARTMENT OF ZOOLOGY,  
FRESH UNIMAS  
100028

## INTRODUCTION

- Amphibians are characterized by their moist, permeable skin.
- Skin permeability is important for frogs and toads, which lack protective scales or feathers.
- The structure of their skin varies among species (Baskin and Collins, 2002).
- The structure of their skin varies among species with different environments.
- To date, only a few studies have documented the skin structure of the Bornean Horned Frog.

## RESEARCH QUESTION

Does *Megophrys nasuta* having differences of their skin structure in response to the changing environment?

## HYPOTHESIS

It was hypothesized that pattern of the skin properties among different body regions of *M. nasuta* species varies in response to the function of the skin itself to their natural habitat.

### Dorsal skin

consists of glands that helps in protection, excretion, and regulation of water balance, and helps in the absorption of water.



### Ventral skin

that is in contact with the ground might have more glands in relation to defense mechanisms against bacteria or any pathogen.

Morphological attributes of the frog skin particularly from anterior of the dorsal, superior of the dorsal, posterior of the dorsal, ventral surface and ventral of the frog's thigh were not well documented.

## AIM OF STUDY...

To assess skin structure variation within individual frogs of *Megophrys nasuta* from different body regions.



## RESULTS: GLANDS AS THE SKIN PROPERTIES IN DIFFERENT REGIONS

In the skin, secretions from sweat glands, sebaceous glands, mucous glands, and sweat glands.



Some glands were surrounded by a layer of cells and secretions, and some were in connective tissue.

The glands were located in P-melanophore region, M-mucous gland, S-sebaceous gland, and I-integumentary gland.

- The sebaceous glands were abundant in the dorsal region, but some glands were predominant in the ventral region with the presence of keratinized skin.
- Sebaceous glands consisted of shorter keratinized epidermal cells surrounding the sebaceous canaliculi.
- Mucous and sweat glands observed were significantly longer in size when located in tubercles of the skin as shown in Fig. 20a.
- Underneath the granular ground substance was visible at the basal of the integumentary (Fig. 20).
- Melanophores were easily identified through H&E stained with darker color using the natural keratinized of the skin (Fig. 20).
- It protects the entire integumentary system which connects all glands from direct contact with external environment when epidermis is absent. However, the melanophores function varies between regions.

## RESULTS: MICROHABITAT SELECTION OF MEGOPHRYS NASUTA



The frog observed the forest stream and forest life. The frog observed the forest stream and forest life.

4 individuals were found in vegetative area of hill primary forest, 2 individuals in secondary growth forest, 2 individuals in old forest, and 2 individuals in mixed forest.

## RESULTS: MICROHABITAT SELECTION OF MEGOPHRYS NASUTA



The frog observed the forest stream and forest life. The frog observed the forest stream and forest life.



The frog observed the forest stream and forest life. The frog observed the forest stream and forest life.



## RESULTS: MICROHABITAT SELECTION OF MEGOPHRYS NASUTA

- 4 individuals were found in vegetative area of hill primary forest, 2 individuals in secondary growth forest, 2 individuals in old forest, and 2 individuals in mixed forest.
- At horizontal position, 4 individuals were mostly found along on the bank of a permanent stream, 4 individuals were in the middle of a permanent stream, while 2 individuals were found on the bank of an intermittent stream and one individual was distant from any water body.
- This finding suggested that these species need water body for breeding site to deposit eggs, or hatching site for the larvae and habitat for the tadpoles.
- At vertical position of the microhabitat characteristic, the frogs were found abundant on the surface of leaf litter or dead leaves presented by 2 individuals, a secondary were found on the surface of bark and another 4 individuals were on a rock, while 2 individuals found were on a log.

## DISCUSSION

- The observed abundance of various integumentary glands in different skin regions reflect the result of the species in their habitat (Lauder).
- The 2-colored forest frog (Megophrys nasuta) is a leaf frog, which always will be arboreal appearance when jumping and at most conditions. During these condition, animals with the presence of granular integumentary in one environment the species would put the body close to the substrate in the case, the sebaceous glands play an important role as a defense mechanism which synthesized to chemical defense in the dorsal region to protect the skin's surface from toxic substances or through direct body contact. The presence of sebaceous glands on the dorsal surface was also important as a protective against predators. The frog will secrete its granular integumentary with the assistance of secretory ducts to prevent the skin's surface from dry strategy to regulate the granular and maintain it to moisture.
- The care of these glands in M. nasuta species were consistent with other amphibian species which presented a subcategory dorsal and ventral skin glands (Singer & Woodley, 2008).

- Previous studies were abundant in the forest regions with larger it was that the forest region dominated that the job for the higher is much smaller is a more or less is a secondary relatively small, given the number of insect groups.
- The growth factors by means of which insects, animals exchange and maybe insects in the forest die. This correspond to the effect of direct sunlight exposure to the forest floor during drought and high temperature would suggest the species to know about and larger insect groups. This result was supported by Iwantschik & Rillig (2002) which showed that microbialist parameters influence different groups of functional insect species.
- The finding is consistent with Haddad *et al.* (2013), suggesting large insects group were related to the microbialist groups of three microbial species.

- The finding also revealed that the microbial groups varied at different body regions (Daxner *et al.*), the microorganisms associated with amphibians like actual Frensch *et al.* (2017) studied skin groups of *Urodactylodactylus* and suggested that the culture on the frog's skin is possible to host predators.
- The microbialist groups were in an extensive from the surface to the skin. Therefore, it appeared that the growth factor on the forest region particularly of the forest species was higher due to an insect exposure of the skin to its environment than other body regions. The microorganisms, responsible for reducing the skin moisture, help to avoid excessive desiccation and preventing the infection of skin from direct contact to the external environment.

- The presence of fungal fungi in 20 insect species is consistent with other leaf litter species, the *Geomyces* genus (Bell's Wooded Frog) from Jones (Abejón & Clivio, 2002) *in vitro* presence of fungal colonization of the wood progressively 24 months which occur with the leaf litter on the forest floor. The function of this challenge is still not well understood.
- The study also revealed that substrate showed increase glaucous bacteria than all other skin regions for protection against predators and microorganisms, as well with large microbial groups. The molecules were found scattered randomly throughout the skin's surface, but the most relevant is the most efficient and strategies for wood-inhabiting frog to grow itself and to maintain its different skin region. Therefore, substrate from other skin region of the wood should be examined to validate this hypothesis.

- The presence of ground substrate in the study also performed the same function as a spring moisture regions provide food to the culture of *Geomyces* sp. 25-30-134 (1976) revealed the presence of ground substrate in soil bacterial species and reported that some species may not be able to change their skin directly with their (2002) environment, that caused glaucous bacteria to remain exposed nearby by the soil. However, it was revealed that ground substrate was microorganisms like bacteria or fungi in the forest die regions.
- The microorganisms that were found within it is directly related with the substrate may give more resistance to the substrate. The suggestion was strongly supported by the occurrence of less insect groups on the forest die of its wood. This is a good basis of substrate for the microbial species and it was suggested that substrate releases are responsible for providing the system. Thus the study suggested that further investigations required on the molecular structure to study the variability of the *Geomyces* function as one of the most important from different habitats.

## CONCLUSION

The study revealed that there is a relation between forest and forest die characteristics particularly on the substrate structure and glaucous distribution.

The finding suggested that forest die region has a potential to be further investigated to further understand the function of the skin structure in relation to meeting their ecological needs in changing environment.

Thus, it was suggested that this study could provide a reference to well understand the effects of habitat fragmentation on amphibians.

## REFERENCES

- Abejón, C. & Clivio, A. (2002). *Bacteria y Fungi del Ambiente Terrestre y Acuático*. Santiago, Chile: Quilmes, 102 & 103. 1980. *Ecology of amphibians*. The John Wiley Company, New Jersey.
- Blair, E. (1976). *Ground substrate as microhabitat against environmental*. *Proceedings of the Academy of Natural Sciences Philadelphia*, 76(1), 1-7.
- Leppin, M., & Winkler, S. (2008). *Conservation of amphibians: current and emerging data from Germany in a worldwide perspective*. *PLoS ONE*, 3(12), 1-10.
- Palmer, S., Gomez, S., & Rillig, M. (2014). *Soil fungal communities and nematode diversity in a grassland*. *Journal of Ecology*, 102(1), 1-14.
- McIntosh, S., & Rillig, M. (2005). *Soil microbial biomass: Soil temperature and biological diversity of a temperate grassland*. *Soil Science Society of America*, 69(1), 25-31.
- Talbot, K.C., & Smith, C. (1973). *Conservation of amphibians and reptiles*. *Conservation Biology and Ecology*, 1(1), 1-25.

### ACKNOWLEDGMENTS

This project was funded by NCSG (1888/2013/03),  
TRGS (94695, 348/2013/03) and FST/07/077, 127A/2013/02.

Special thanks to the Faculty Department of Sarawak for the permit  
(NCCO/907-64) (M.12), 1106; No.234/2013/4) to collect samples from the  
protected areas. The permit for research on animal material for medicinal  
purpose was granted by the Sarawak Biodiversity Centre to conduct research on  
animal (SBC-BC-009-A-AM) given to Prof. Dr. Ahmad Huda. The animal ethics  
conducted in this study was approved by Faculty of Medicine and Health  
Science, Universiti Malaysia Sarawak.

THANK YOU

# THE ADVANCEMENT OF CAMERA TRAPPING TECHNIQUE IN UNDERSTANDING WILDLIFE ECOLOGY IN SARAWAK

Maria Aurora Mawati & Muzi Azlan Ibrahim  
Animal Resource Science and Management, Faculty of Resource & Technology, Universiti Sabah Sarawak, 4430 Kota Kinabalu, Sabah

## INTRODUCTION

- Pioneered by George Shiras, who started before 1894 (Brower 2008), Frank Chapman (1903) and Frederick Waller Champion (1927) to photograph rare and elusive animals with primitive camera technology.
- Camera trapping (CT) proven to be one of the strongest tools for researchers while posing little to no disturbance to the animals (Ancient et al. 2012).



Credit: Champion Family Archive

## EARLY TIMES (1890)

- Image often grainy, sometimes surprisingly sharp
- Film roll
- Flash powder
- Elaborate trigger mechanism



Shiras, 1894

## MODERN (1990)

- Up to 12 Megapixel digital images
- Can take up to 3 photos at once, video mode
- Large memory
- Infrared, Motion, or light sensor
- Records parameters



Source: Bushnell

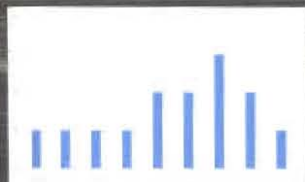
## PHOTOS – WHAT ARE THEY GOOD FOR?

- Recreation
- Scouting for game animals
- Local abundance analysis (Royle, 2004)
- Corridor analysis (McRae & Kavanagh, 2011; Brodie et al., 2014)
- Occurrence and occupancy analysis (Mackenzie et al., 2006)
- Spatial partial identity model (Augustine et al., 2016)
- Activity patterns (Mohd-Azlan & Sharma, 2006)

## MATERIALS AND METHODS

- Data was collected from 1) published studies and unpublished reports that includes 2) news paper articles, 3) thesis and 4) government reports that involved camera trapping as at least one of their methods of data collection.
- Information were obtained from Google Scholar® and web of science, ISI, etc.

• 15 Journals + 2 reports - 10 years  
(2006 to 2016)



Number of CT studies published per year

## RESULTS

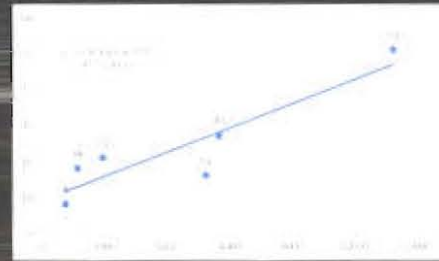
**Small mammal is a logging companion in the Upper Rain Forest, Borneo**  
Journal of Animal Ecology

**Tropical Parasitism by Arivah Young Salt Lake**  
Journal of Animal Ecology

**Evaluating Multispecies Landscape Connectivity in a Threatened Tropical Mammal Community**  
Journal of Animal Ecology

**Local extinction and recolonization of a tropical rain forest bird**  
Journal of Animal Ecology

## NUMBER OF DETECTED SPECIES CORRELATING WITH CAMERA TRAP DAY EFFORT



SATELLITE IMAGE OF SARAWAK SHOWING LOCATIONS OF THE REVIEWED STUDIES THAT INVOLVED CAMERA TRAPPING



- TPA: 8
- Non-TPA: 10



VIDEO MODE CAN PROVIDE DATA ON INTER- AND INTRASPECIFIC BEHAVIOUR, ACTIVITY PATTERN AND ECOLOGICAL INFORMATION OF UNDISTURBED ANIMALS



## DISCUSSION & CONCLUSION

- Sophisticated software enables thorough insight into wildlife ecology
- Superior to human observation
- Revolutionized wildlife research

## WHERE DO WE GO FROM NOW?

- Shift to less studied areas
- Aboreal camera traps



Credit: Nature ITs

## REFERENCES

1. ...
2. ...
3. ...
4. ...
5. ...
6. ...
7. ...
8. ...
9. ...
10. ...
11. ...
12. ...
13. ...
14. ...
15. ...
16. ...
17. ...
18. ...
19. ...
20. ...
21. ...
22. ...
23. ...
24. ...
25. ...
26. ...
27. ...
28. ...
29. ...
30. ...
31. ...
32. ...
33. ...
34. ...
35. ...
36. ...
37. ...
38. ...
39. ...
40. ...
41. ...
42. ...
43. ...
44. ...
45. ...
46. ...
47. ...
48. ...
49. ...
50. ...
51. ...
52. ...
53. ...
54. ...
55. ...
56. ...
57. ...
58. ...
59. ...
60. ...
61. ...
62. ...
63. ...
64. ...
65. ...
66. ...
67. ...
68. ...
69. ...
70. ...
71. ...
72. ...
73. ...
74. ...
75. ...
76. ...
77. ...
78. ...
79. ...
80. ...
81. ...
82. ...
83. ...
84. ...
85. ...
86. ...
87. ...
88. ...
89. ...
90. ...
91. ...
92. ...
93. ...
94. ...
95. ...
96. ...
97. ...
98. ...
99. ...
100. ...



# INFLUENCES OF HUMAN ACTIVITIES ON MALAY CIVET'S (*Viverra tangalunga*) OCCUPANCY IN SARAWAK

Thaqifah Syaza Jailan, Melynda Cheok Ka Yi, Sally Soo  
Kaicheen, Floriane Bouard & Mohd-Azlan Jayasilan

Animal Resource Utilization and Management Programme, Faculty of Bioscience and Technology,  
Universiti Malaysia Sarawak, 94300 Kota Samarahan, Sarawak

## INTRODUCTION

- Increasing demands for land, agriculture and resources has caused depletion of virgin forests in Borneo (Gaveau et al., 2014)
- In 2015, intact forest areas plunged to approximately 1.7 mil. ha compared to logged forests of approximately 5 mil. ha (Gaveau et al., 2016).
- In attempt to thwart the shrinkage of forested landscape, gazettements of protected areas has increased over the years (Mathai et al., 2010).
- Protected areas were then publicize as tourism attractions for country's socio-economic growths though species existence remains scarce within these areas

## SPECIES BACKGROUND

- Ground-dwelling Carnivora species.
- Classified as least concern by IUCN.
- Wide geographic distribution and occurs in many protected areas.
- Past studies suggests high densities, large and stable population.
- Among the most recorded terrestrial carnivore using camera traps (Duckworth et al., 2016).



## MATERIALS AND METHODS

### Field Techniques

- Camera trapping (Camtrapper & Bushnell Trophy Cam) in Samunsam Wildlife Sanctuary, Gunung Gading National Park, Santubong National Park, Lanjak Entimau Wildlife Sanctuary, Pelagus National Park & Sungai Meliang National Park.
- Mounted approximately 30-40cm above ground.
- GPS coordinates for each camera sites recorded.



### Data Analysis

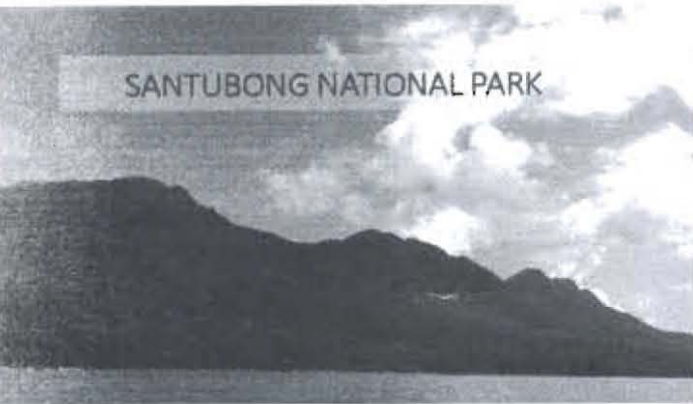
- ReNamer, DataOrganize, DataAnalyze
- PRESENCE software (ver. 11.8)
- RStudio (ver. 1.0.143)
- QGIS (ver. 2.18.7)

## SAMUNSAM WILDLIFE SANCTUARY



## GUNUNG GADING NATIONAL PARK

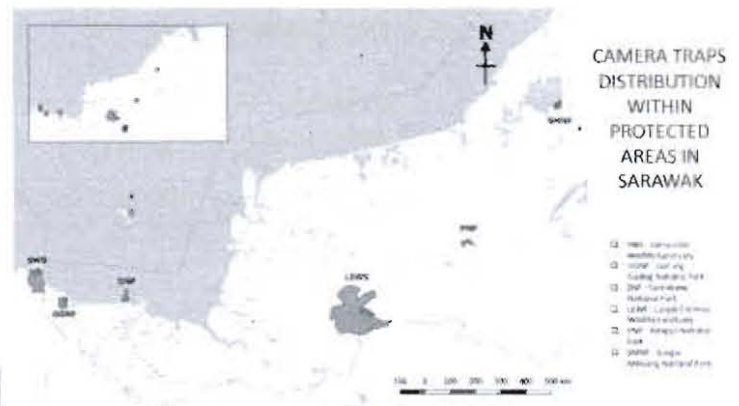




## MATERIALS AND METHODS

### Protected Areas Classifications Based On Human Activities

LEVELS	PROTECTED AREAS	DESCRIPTIONS
LOW	Sarawak Wildlife Sanctuary Lanjak Entimau Wildlife Sanctuary	Locations that are restricted and inaccessible to the public.
MEDIUM	Pelagus National Park Sungai Meluang National Park	Open yet difficult to access by the public due to the remoteness of the location with no facilities or infrastructures available.
HIGH	Gaming Gading National Park Santubong National Park	Locations that are open and easily accessed by the public for tourism and recreation.

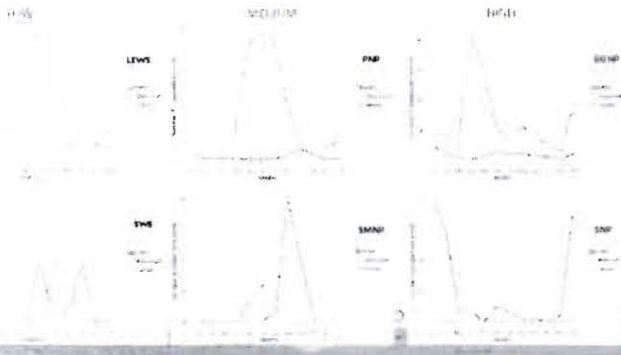




## RESULTS & DISCUSSION

Protected areas	Occupancy estimate (p)	Detection estimate (p)
LEWS (n=27)	0.684	0.093
SWS (n=7)	0.604	0.069
PNP (n=50)	0.748	0.242
SMNP (n=24)	0.863	0.123
GGNP (n=156)	0.685	0.262
SNP (n=0)	NA	NA

### *Viverra zangalunga* vs *Homo sapiens*



### Visitors Records In SNP and GGNP (2015 & 2016)



## CONCLUSION

- Malay Civet occurrences decreased with the increased of human activities
- Absence in SNP may due to the intensity of human activities dated back to the 5<sup>th</sup> century and insular nature of the Mount Santubong landscape.
- Environmental risks resulted from human activities should be assessed and minimized to ensure the health of the forest ecosystem.
- The carrying capacity of a protected area in Sarawak needs to be identified and properly managed in order to ensure the protection and sustenance of species survival.

## ACKNOWLEDGEMENTS

- Ministry of Higher Education (NRGS/1087/2013(01), FRGS/STWN 10(04)/990/2013(31))
- Forestry Department Sarawak (NCCD.907.4.4(I.D.12)-69 & NCCD.907.4.4(I.D.13)-221)
- Sarawak Forestry Corporation
- Sarawak Energy Berhad
- Participated local communities and field assistants
- Animal Resource Science & Management Programme, Faculty of Resource Science and Technology, UNIMAS
- *T*wo anonymous reviewers

## REFERENCES

- Uricapoth, I. W., Maffei, J., Wiffing, A., Holden, J., Hearn, A. and Ross, J. (2016). *Viverra zibethus*. The IUCN Red List of Threatened Species 2016. e [A1708445220284]. <http://dx.doi.org/10.2305/IUCN.N.LI.K.2016.1.R315741708445220284.en>
- Forest Department Sarawak. (2017). Retrieved Jun 19, 2017 from <http://www.forest.sarawak.gov.my>
- Gaveau, D. L. A., Sheil, D., Huisman, M., Meijaard, A. S., Aijasaikultra, S., Anrenaz, M., Pacheco, F. and Meijaard, E. (2016). Rapid conversions and avoided deforestation: examining four decades of industrial plantation expansion in Borneo. *Scientific Reports*, 6, 33017.
- Gaveau, D. L. A., Sloan, S., Muldjaja, I., Yeh, H., Sheil, D., Abram, N. K., Anrenaz, M., Nasir, B., Gumores, M., Wicaksono, N. and Meijaard, E. (2014). Four decades of forest persistence, clearance and logging in Borneo. *PLoS ONE*, 9(7), e101634.
- Multha, J., Hoi, J., Taat, N., Peter, A. and Gurnal, M. (2010). Small Carnivores in a logging concession in the Upper Baram, Sarawak, Borneo. *Small Carnivore Conservation* 42, 1-9.

