

HERPETOFAUNA OF TAWYAGYI PROTECTED AREA, WETLET TOWNSHIP, SAGAING REGION

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Abstract

Occurrence and distribution of herpetofauna were conducted in Tawyagyi protected area embodied three study sites and commenced from July 2018 till April 2019. A total of 22 species of herptiles were recorded. The 22 species included five species of anurans (amphibia) confined to four genera and distributed among three families and a single order Anura. The remaining 17 species were reptiles distributed among two suborders, Serpentes (ophidia) snakes and Lacertalia (lizards), and confined to the order Squamata. Suborder Serpentes was represented by seven species of snakes distributed among seven genera and three families namely Colubridae, Elapidae and Viperidae. Suborder Lacertalia was represented by ten species of lizards distributed among seven genera and four families namely, Agamidae Gekkonidae, Scincidae and Varanidae. Among the recorded lizards *calotes htunwini* (Htunwin's forest lizard) happened to be the only endemic species.

Keywords: Herpetofauna, Protected Area, Endemic Species

Introduction

Amphibians and reptiles are considered important actors of biodiversity and good indicator of habitat quality as they are both present on terrestrial and aquatic habitats. Although very cosmopolitan, their highest diversity is in the tropics. Researches confirm the important pressure on reptile and amphibian population worldwide and particularly in Asia. In Southeast Asia, both reptile and amphibian populations suffer increasingly from habitat loss, intensive hunting for local consumption or trade and pollution (Calame, 2012).

Amphibians are valuable part of the biotic community. The dietary habitats of amphibians are important in ecosystem because as adults they consume vast quantities of insect and thus help to maintain a balance in the ecosystem (Duellman and Schlager, 2003). A single Blanchard cricket frog consumes approximately 4,800 insects per season (Frost, 2006). Areas where local anurans have been crminated have witnessed large population increase in some kinds of insects. Amphibians are important as prey item because they convert invertebrate "energy" they consume to useable energy in higher tropic level.

Due to their abundance and relative ease of capture, amphibians are included in the diets of a great variety of animals, especially many small mammals, birds, and many kinds of snakes (Frost, 2006).

Many amphibian and reptile populations are declining at unprecedented rates and some with extinction under the threats of global climate change, habitat loss, human exploitation, invasion species, pollution, and disease (Gibbon *et al.*, 2000; Stuart *et al.*, 2004). Yet, amphibians and reptiles are among the most understudied vertebrate taxa in Southeast Asia and the population status of most species is unknown (Rowley *et al.*, 2010). There is an urgent need to collect baseline data on population status and to initiate monitoring programs for amphibian and reptiles in the region to detect any responses to threats and environmental changes (Gibbons *et al.*, 2000) (Cited by Sung *et al.*, 2011).

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Myanmar, a country in the Southeast Asia is often considered to be the "last frontier of global biodiversity in mainland Asia" has a remarkably diverse fauna and flora and is home to many endangered reptile and amphibians. Myanmar also boasts to harbour one of the world's rarest chelonians, the Rakhine forest turtle. Moreover it is also a home for variety of lizard species and approximately 150 species of snakes and very few research works were conducted thoroughly in some protected areas covering only few species groups. Many protected areas and species have not yet been studied in detail.

The study area, Tawyagyi Protected Area is one of the protected areas of Myanmar and located in the Dry Zone belt of central Myanmar and has tropical steppe type of climate. The natural vegetations of the study area are generally tropical forest type. Although many animal species occupied and inhabited, no fauna of this area was investigated and reported previously.

This research was conducted with the following objectives;

- to identify and record the amphibians and reptiles in the study area
- to investigate the composition of amphibian and reptilian species
- to assess the relative abundance of amphibians and reptiles species

Materials and Methods

Study area and sites

Tawyagyi Protected Area is situated 19.31 km away from Wetlet Township, Sagaing Region, in central Dry Zone of Myanmar and has dry climate. The area has a length of 1.77 km from north to south and a width of 0.25 km from east to west. The area covers an area of 139 hectares. It is the first wildlife Sanctuary in Myanmar. The study area is located between 22° 15' and 22° 17' N and 95° 58' and 95° 59' E. Three study sites were allocated within protected area. Site I, Along the Ayeyawady river bank; Site II, Mixed deciduous forest and Site III, Hillock strewn open ground area.

Study period

The study was conducted during a period of from July 2018 to April 2019.

Study design

The study was conducted from July 2018 to April 2019. At each sampling site, an appropriate data collection line was designated to cover the area of each sampling site. One permanent transect line running from north to south with 50 m width was established in each study site. Herpetofauna was investigated during day and night. Two methods were used for the survey of herpetofauna; visual encountered survey method and pitfall method.

Visual encountered survey method

In visual encountered survey method a slow walking along each transect line was made. During walking, species and individuals of herptiles encountered on either side of transect were recorded. Data collection was made continuous three days for each study sites monthly. Collection of data was made two times per day, morning and evening. Some species were caught and kept as voucher specimens.

Pitfall method

Pitfall trapping is a sampling technique which is widely used in studies of seasonal occurrence, to examine spatial distribution patterns, to compare relative abundance in different micro-habitats, to study daily activity rhythms, and in community surveys. Three pitfalls were set up at each study sites. The fence of plastic sheet was measured 9.09 m in length and 0.60 m in height. A total of three pits were set up along the fence. Pitfalls were set up at least 100 m away from each other. Inspection of the herptiles was made every hour of morning 6:00 am to night 8:00 pm. The species encountered in the pitfall were recorded and some species were kept as voucher specimens. Pitfall method was used monthly to analyze the herpetofauna in the study area.

Identification and classification

Species identification was followed after Cox *et al.* (1998), O'shea and Halliday (2002) and Das (2010). For confirmation of species, relevant literatures and internet sources were also used.

Analysis of data

The collected data were analyzed. The relative abundance of each species was assessed based on the method stated by Bisht *et al.* (2004).

$$\text{Relative abundance (RA)} = \frac{\text{Total number of individual s in each species}}{\text{Total number of individual s in all observed species}}$$

The status of relative abundance were categorized as,

Uncommon (uC) = having relative abundance less than 0.0100

Common (C) = having relative abundance of 0.0100 and above but less than 0.0500

Very common (vC) = having relative abundance of 0.0500 and above



(Source: Google Earth, 2018)

Figure1 Location map of study area showing study sites

Results

A total of 22 species, 18 genera, ten families, two orders belonging to two classes of herptiles were recorded in three study sites of Tawyagyi Protected Area during July 2018 to April 2019. In 22 species, five species were amphibian and the rest were reptile (Table, 2).

Occurrence and abundance of herpetofauna

The highest number of species was that of order Squamata represented by 17 species confined to 14 genera and seven families. Among the amphibians, the order Anura was represented by five species confined to four genera and three families.

During the study period, among the anurans the highest (60.00%) was that of the family Dicroglossidae, followed by (20.00%) each of family Bufonidae and Microhylidae (Fig.2). Among the reptiles, family Colubridae revealed that the highest species composition (29.42%), family Agamidae and family Gekkonidae (23.53%) each and remaining four families Elapidae, Scincidae, Varanidae and Viperidae with (5.88%) each (Fig.3).

Visual encountered survey method

In study site I, both *Hemidactylus frenatus*, and *Hemidactylus mutilata* showed the highest 26 individuals and *Trimeresurus albolabris*, and *Blythia reticulate* observed with only two individuals were the lowest. The highest 15 species and 22 individuals were found in July and the lowest five species and seven individuals were found in April.

In study site II, *Hemidactylus brookii* showed the highest 18 individual and *Trimerisurus albolabris*, *Lycodon aulicus*, *Elaphe taeniura*, and *Calotes irawadi* were recorded with one individual. The highest 11 species and 16 individuals were observed in October and the lowest three species and four individuals were found in March and April.

In study site III, *Duttaphrynus melanostictus* showed the highest six individuals. *Boiga ochracea*, *Calotes irawadi* and *Calotes htunwini* revealed to be the lowest with one individual. The total number of seven species and eight individuals were noted in October and only one species and individual were found in February, March and April. Among them *Calotes htunwini* is endemic species observed only in site III.

In the present study of visual encountered survey method, the total numbers of species were 17 and total number of individuals are 144 in site I. In site II, total number of species were 20 and total number of individuals are 95. In site III, total number of species are 14 and total number of individuals are 39 (Table 1).

Pitfall method

Study site I, *Fejervarya limnocharis* and *limnonectes modestus* showed the three individuals and *Eutropis carinata* was recorded with only one individual. The total number of five species and five individuals were found in September and only one species and individual were recorded in July.

Study Site II, *Fejervarya greenii* was found with four individuals and *Duttaphrynus melanostictus*, *Fejervarya limnocharis* and *Varanus nebulosus* were observed with only one individual. The total numbers of species were highest in July, August and September. Four individuals were observed in October.

Study site III, all the reptiles recorded were found with only one individual. The highest total number of three species and three individuals were noted in August and the lowest only one species and individuals were recorded in July.

By pitfall method the number of species caught were eight and number of individuals were 17 in site I. In study site II, total number of species are seven and total number of individuals are 14. In site III, total number of species are six and total number of individual are six (Table 2).The number of species and individual recorded were more in visual encountered survey method than pitfall method. Based on the data of combined method, ten species of herptiles are considered as very common, six species are considered as common and six species are considered as uncommon (Table 3).



A. Duttaphrynus melanostictus



B. Fejervarya greenii



C. Fejervarya limnocharis



D. limnonectes modestus



E. Kaloula puachra

Plate 1 Recorded amphibian



A. Blythia reticulata



B. Boiga ochracea



C. Elaphe taeniura



D. Lycodon aulicus



E. Xenochrophis piscator



F. Bungarus magnimaculatus



G. *Trimeresurus albolabris*



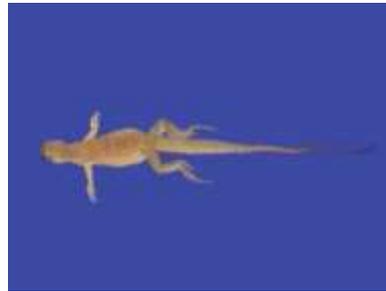
H. *Calotes htunwinii*



I. *Calotes irawadi*



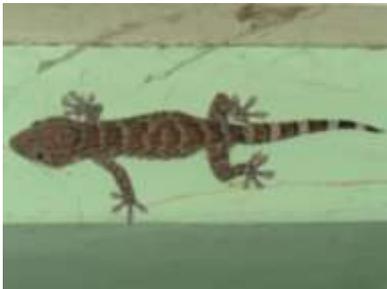
J. *Calotes mystaceus*



K. *Leiolepis belliana*



L. *Gehyra mutilata*



M. *Gekko gecko*



N. *Hemidactylus*



O. *Hemidactylus frenatus*



P. *Eutropis carinata*



Q. *Varanus nebulosus*

Plate 2 Recorded reptile species

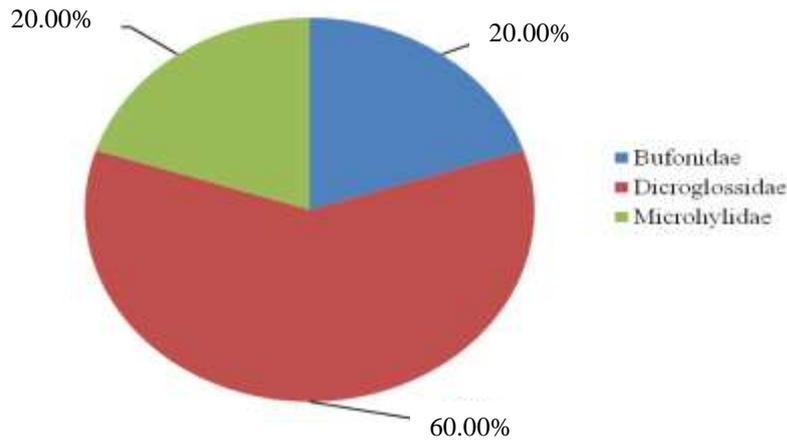


Figure 2 Percentage species composition of amphibians in different families

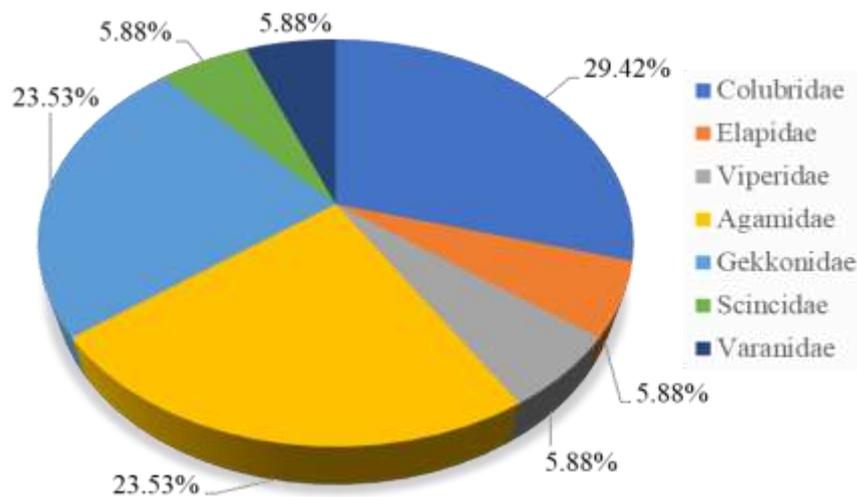


Figure 3 Percentage species composition of reptiles in different familie

Table 1 Species composition and abundance of herptiles in three study sites of study area (Visual encountered survey method)

Sr. No.	Class	Order	Family	Scientific name	Common name	Site I	Site II	Site III	Total
1	Amphibia	Anura	Bufonidae	1. <i>Duttaphrynus melanostictus</i>	Common toad	15	7	6	28
2			Discroglossidae	2. <i>Fejervarya limnocharis</i>	Paddy frog	5	6	2	13
3				3. <i>Fejervarya limnocharis</i>	Paddy frog	6	4	4	14
4				4. <i>Limnonectes modestus</i>	Grass frog	2	4	2	8
5			Microhylidae	5. <i>Kaloula pulchra</i>	Bull frog	6	6	3	15
6	Reptilia	Squamata	Elapidae	6. <i>Elaphe taeniura</i>	Beauty Ratsnake	5	1	-	6
7			Colubridae	7. <i>Boiga ochracea</i>	Tawny cat snake	-	2	1	3
8				8. <i>Blythia reticulata</i>	Iridescent snake	2	2	4	8

Sr. No.	Class	Order	Family	Scientific name	Common name	Site I	Site II	Site III	Total
9				9. <i>Lycodon aulicus</i>	Indian wolf snake	-	1	-	1
10				10. <i>Xenochrophis piscator</i>	Chequered keel black	4	-	-	4
11				11. <i>Bungarus magnimaculatus</i>	Splendid krait	-	2	-	2
12			Viperidae	12. <i>Trimeresurus albolabris</i>	White-lipped Pit-viper	2	1	-	3
13			Agamidae	13. <i>Calotes htunwini</i>	Htunwin's forest lizard	-	-	1	1
14				14. <i>Calotes irawadi</i>	Ayeyarwady forest lizard	-	1	1	2
15				15. <i>Calotes mystaceus</i>	Blue forest lizard	4	9	5	18
16				16. <i>Leiolepis belliana</i>	Spotted ground lizard Common	4	3	2	9
17			Gekkonidae	17. <i>Gehyra mutilata</i>	four-clawed gecko	15	2	-	17
18				18. <i>Gekko gekko</i>	Tokay gecko	4	2	3	9
19				19. <i>Hemidactylus brookii</i>	Brooke's House gecko	0	0	1	1
20				20. <i>Hemidactylus frenatus</i>	Asian House gecko	26	6	-	42
21			Scincidae	21. <i>Eutropis carinata</i>	Keeled Indian Mabuya Southeast	12	4	2	18
22			Varanidae	22. <i>Varanus nebulosus</i>	Asian Monitor lizard	6	4	3	13
Total number of individuals						144	95	39	278
Total number of species						17	20	14	22
Percent composition of species (%)						77.72	90.90	63.63	

Table 2 Abundance of herptiles in three study sites of study area (Pitfall method)

Sr. No.	Scientific name	Common name	Site I	Site II	Site III	Total
1.	<i>Duttaphrynus melanostictus</i>	Common toad	2	1	1	4
2.	<i>Fejervarya greenii boulengeri</i>	Paddy frog	2	4	1	7
3.	<i>Fejervarya limnocharis</i>	Paddy frog	3	1	1	5
4.	<i>Limnonectes modestus</i>	Grass frog	3	2	1	6
5.	<i>Kaloula pulchra</i>	Bull frog	2	3	1	6
6.	<i>Leiolepis belliana</i>	Spotted Ground Lizard	2	2	1	5
7.	<i>Eutropis carinata</i>	Keeled Indian Mabuya	1	-	-	1
8.	<i>Varanus nebulosus</i>	Southeast Asian Monitor lizard	2	1	-	3
Total number of Individuals			17	14	6	37
Total number of species			8	7	6	8
Percent composition of species (%)			100	87.5	75	

Table 3 Relative abundance and status of herpetofauna by two methods in study area

Sr. No.	Scientific name	Common name	Individual by Visual encountered survey method	Individual by pitfall method	Total individual	Relative abundance	Status
1	<i>Duttaphrynus melanostictus</i>	Common toad	28	4	32	0.1015	vC
2	<i>Fejervarya greenii</i>	Paddy frog	13	7	20	0.0634	vC
3	<i>Fejervarya limnocharis</i>	Paddy frog	14	5	19	0.0603	vC
4	<i>Limnonectes modestus</i>	Grass frog	8	6	14	0.0444	C
5	<i>Kaloula pulchra</i>	Bull frog	15	6	21	0.0666	vC
6	<i>Blythia reticulata</i>	Iridescent snake	8	-	8	0.0253	C
7	<i>Boiga ochracea</i>	Tawny cat snake	3	-	3	0.0095	uC
8	<i>Elaphe taeniura</i>	Beauty Ratsnake	6	-	6	0.0190	C
9	<i>Lycodon aulicus</i>	Indian wolf snake	1	-	1	0.0031	uC
10	<i>Xenochrophis piscator</i>	Chequered keel black	4	-	4	0.0126	C
11	<i>Bungarus magnimaculatus</i>	Splendid krait	2	-	2	0.0063	uC
12	<i>Trimeresurus albolabris</i>	White-lipped Pit-viper	3	-	3	0.0095	uC
13	<i>Calotes htunwini</i>	Htunwin's forest lizard	1	-	1	0.0031	uC
14	<i>Calotes irawadi</i>	Ayeyarwady forest lizard	2	-	2	0.0063	uC
15	<i>Calotes mystaceus</i>	Blue forest lizard	18	-	18	0.0571	vC
16	<i>Leiolepis belliana</i>	Spotted ground lizard	9	5	14	0.0444	C
17	<i>Gehyra mutilata</i>	Common four-clawed gecko	18	-	18	0.0571	vC
18	<i>Gekko gekko</i>	Tokay gecko	9	-	9	0.0285	C
19	<i>Hemidactylus brookii</i>	Brooke's House gecko	44	-	44	0.1396	vC
20	<i>Hemidactylus frenatus</i>	Asian House gecko	42	-	42	0.1333	vC
21	<i>Eutropis carinata</i>	Keeled Indian Mabuya	18	1	19	0.0603	vC
22	<i>Varanus nebulosus</i>	Southeast Asian Monitor lizard	13	3	16	0.0507	vC
Total number of individual			278	37	315		

vC= very Common, C=common, uC-uncommon

Discussion

A total of 22 species of herptiles belonging to 10 families and distributed under two orders were recorded in Tawyagyi Protected Area during study period which commenced from July 2018 till April 2019.

In the present study, the number of species was highest along the river bank in all the three study sites. This may be due to be presence of shrub, thorn, scrub, and tall and medium tree microhabitats allowing adequate shelter. The species that were predominant in site I were *Duttaphrynus melanostictus*, *Hemidactylus frenatus* and *Gehyra mutilata*, so that it is presumed that these species prefer the habitat type of this site.

During the study period some reptiles were observed in all kinds of habitats. However, *Xenochrophis piscator* was observed only in along the river bank. *Calotes htunwinii* was observed in mixed deciduous forest area only and it is endemic species of Myanmar.

Zug *et al.* (2003) stated that 87 species of frogs and toads were recorded in Myanmar. In the present study only five species of frogs and toads were recorded. *Fejervarya greenii* recorded was the newly recorded species in Myanmar.

Hemidactylus Gray, 1845 is one of the most species-rich genera of the family Gekkonidae and comprises about 80 recorded species. *Gekko gecko* is one of the most widely distributed reptile in the world. The results in this study indicated that *Hemidactylus brookii* and *Hemidactylus frenatus* were mostly found in all study sites.

The genus *Gehyra* Gray, 1834 is a speciose taxon of gekkonid lizard found in Australia, Madagascar, Asia, the Indo- Malayan Archipelago, New Guinea and Pacific Island. *Gehyra* comprises about 33 species (Uetz *et al.*, 2005). In the present study area, *Gehyra mutilata* was commonly found among the trees and old buildings existed along the Ayeyarwady river bank.

Six species of the genus *Hemidactylus* under family Gekkonidae are reported currently from Myanmar. It is the most geographically widespread and one of the most speciose (Kluge 2001).

Modern herpetologists tend to classify the world of lizard into 23 families. Of these, 11 families are represented in the Indian and Indochina regions. According to Smith (1935) only seven of the modern lizard families are found within the boundaries of Myanmar.

Under the family of Agamidae, Smith (1935) recorded five Myanmar genera with (16) local species. In the present work, four species of agamids under two genera were recorded, *Calotes mystaceus*, *C. irawadi*, *C. htunwinii* and *Leiolepis belliana*.

Smith (1935) also recorded six Myanmar genera with 17 local species under the Family Scincidae. In the present work only one of Smith's species *Eutropis carinata* could be recorded.

The Family Varanidae is represented by a single living genus. Six species have been known to occur in the Indo-Chinese subregion of which Smith (1935) has recorded four species from Myanmar. In the present work only one species *Varanus nebulosus* could only be collected from Tawyagyi Protected Area.

Smith (1943) recorded a total of 135 species of snakes within the boundaries of Myanmar, 89 species belonging to the family Colubridae and the remaining 46 species are non-colubrid snake. In the present study 5 species of Colubrid snake and only one species of Viperid and Elaphid are recorded and identified.

Conclusion

Tawyagyi Protected Area, composed a variety of microhabitats for herptiles. Structure and composition of various sized trees, shrubs, thorns, scrubs and scattered tree influence on distribution of herptiles species. Therefore, awareness, creation, conservation and rehabilitation are essential for maintaining the habitats and herpetofauna of these study area.

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