SEASONAL STATUS OF REPTILIAN FAUNA IN KYAIKHTIYOE WILDLIFE SANCTUARY, MON STATE

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Abstract

Kyaikhtiyo Wildlife Sanctuary in Mon State is selected as study area, lies between (17º 24′ N - 17º 34′ N) and (97º 1′ E - 97º 10′ E), and is about 137 square kilometers (38600 acre) in area. The Mountain range of Wetwun Taung and its eastern environ including Wetwun Chaung and Kadat Chaung was chosen as Site A, Yathae Taung and its western environ as Site B, Wait Sar Taung and along its south-eastern face to near the highest peak at Kyaikhtiyoe Pogada as Site C, and the visitors-walking route from near Kinmon Sakan to Ye Myaung Gyi as Site D respectively. The specimens were collected by direct observation and visual encountered survey (VES). Seventeen reptile species of 11 genera belonging to 7 families of two orders are recorded in the study area. The most seasonal abundance of reptiles was concluded as hot season. the family Gekkonidae (60 individuals) was recorded to be highest number; second Agamidae (38 individuals), third Scincidae (26 individuals), and fourth Viperidae (3 individuals) were followed orderly, Platysternidae (1), Trionychidae (1), and Colubridae (1) as lowest number.

Keywords: wildlife Sanctuary, direct observation, visual encountered survey, seasonal abundance

Introduction

The reptiles are characterized as ‘crawling’ species, breathing with lungs and showing poikilothermy, variable body temperature. The Class Reptilia contain about 6600 species in four orders. Reptiles are divided into four orders. Testudines (turtles and tortoises); Crocodilians (crocodiles, alligators, and gharials); Rhynchocephalia (tuataras) and Squamata (scaled reptiles). Squamata are further divided into three suborders; Sauria or Lacertilia (lizards); Amphisbaenia (worm-lizards); and Serpents (snakes) (O’shea and Halliday, 2002).

Myanmar is the largest in mainland Southeast Asia and contains a magnificent variety of ecosystems. Myanmar supports some of the most intact natural habitats and species communities remaining in the Indo-Myanmar Hotspot, including many globally threatened species that are found in few or no other places in the world (Tordoff et. *al.*, 2005). The country has three seasons: wet (from mid-May to mid-October), cold (from early November to late February) and dry (from March to mid-May), and 172 Snake species, 87 Lizard species, and 32 chelonian species were inhabited in Myanmar (Forestry, 2015).

In spite of decreasing forest areas all over the world, Myanmar is able to maintain coverage of nearly half of its total land area with forests. In the Indo-Myanmar (Indo-Burma) Hotspot, comprehensive global threat assessments are only available for mammals, birds, amphibians and some groups of reptiles. Baseline data on species diversity in Myanmar is incomplete for most, if not all, major taxonomic groups, and the available data of the current status of the country’s diversity is mainly the globally threatened species that are currently listed in the *IUCN Red List of Threatened Species*. Ranking of 18 Asian countries by species richness from highest to lowest results, Myanmar possesses the second position with 27 species. Ranking by percentage of endemism from highest to lowest results, Myanmar possesses the third position with 22.2% (Forestry, 2011).

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Twenty-four globally threatened reptile species have been recorded in Myanmar in 2010, most of them are turtles. The main threat to wild populations is over-exploitation, driven in most cases by the high value of turtles in the wildlife trade. According to Myanmar Biodiversity Conservation Investment Vision, there are twenty-six marine and non-marine turtle species (6-CR, 10-EN, 8-VU, 2-NT), fourteen snake species (1-EN, 1-VU, 1-NT, 11-DD), and seven lizard and gecko species (All are DD) recorded by WCS (2013) in Myanmar.

Ernst and Barbour (1989) recognized that turtle population has been declining at an alarming rate throughout the world in recent years. Adults of many turtles are harvested for food. Tordoff *et al.* (2005) examined the priority species for conservation investment in Myanmar, including 16 chelonian species which all are endangered. A recent conservation assessment made by IUCN (2010) recognized half of the Asian tortoise and freshwater turtle species to be endangered or critically endangered, primarily due to overexploitation for food and medicinal purposes. To prioritize where in Asian the most urgent attention toward conserving wild turtle populations used recently updated information to rank Asian countries according to richness, endemism, and threat level of their turtle farms. The results of biological analysis ranked China, Vietnam, Myanmar and Indonesia are the top four priority countries in Asia for turtle conservation (Stuart and Thorbjarnarson (2003). Bonin *et al.* (2006) explained that the most important message to bring to the public was the need to appreciate these delightful animals, yet to have them to remain in the wild rather than in private gardens. Protecting turtles thus requires that their habitats are protected, that commercialization be opposed, and that attitudes of certain people be encouraged to change with the times. Because turtles usually have low reproductive rates and late maturity, the exploitation of turtles and tortoises is generally considered to be unsustainable (Zhou and Jiang 2008). Win Maung and Win Ko Ko (2002) recorded 32 marine and non-marine chelonian species belonging to 28 genera from six families in Myanmar.

No fewer than 39 species of dangerously venomous snakes are currently known to inhabit Myanmar and the adjacent coastal waters. Of these, 15 are sea snakes and except for two, *Laticauda colubrina* and *Laticauda laticauda*, none voluntarily come onto land (occasionally, obligate marine species may be carried onto shore during severe weather by wave action or enter river deltas in brackish water). Of the remaining 24 species, all are terrestrial in the sense that none voluntarily enters coastal waters. And, of the terrestrial forms, several, such as *Trimeresurus albolabris*, favor arboreal habitats and are usually found resting on tree limbs. All of the terrestrial species can swim, and some are occasionally found swimming in the rivers and streams as well as in flooded rice paddies. Two families of dangerously venomous snakes are represented in the Myanmar herpetofauna: Elapidae (cobras, kraits, and coral snakes [subfamily Elapinae], and sea snakes and Australian elapids [subfamily Hydrophiinae]), and Viperidae (true vipers [subfamily Viperinae], pitvipers [subfamily Crotalinae], and *Azemiops* [subfamily Azemiopinae]) (Leviton et al. 2008).

Materials and Methods

Kyaikhtiyo Wildlife Sanctuary is located in Kyaikhto Township, Thaton district, Mon State. The selected study area lies between (17º 24′ N - 17º 34′ N) and (97º 1′ E - 97º 10′ E), and is about 137 square kilometers (38600 acre) in area. The Mountain range of Wetwun Taung and its eastern environ including Wetwun Chaung and Kadat Chaung was chosen as Site A, Yathae Taung and its western environ as Site B, Wait Sar Taung and along its south-eastern face to near the highest peak at Kyaikhtiyoe Pogada as Site C, and the visitors-walking route from near Kinmon Sakan to Yae Myaung Gyi as Site D respectively (Figure 1).

This study lasted from May 2019 to January 2020 from 7:00 am to 5:00 pm. The field survey was divided into three parts; May 2019 for hot season, September 2019 for wet season, and January 2020 for cold season. The study period of each season lasted about seven to ten days.

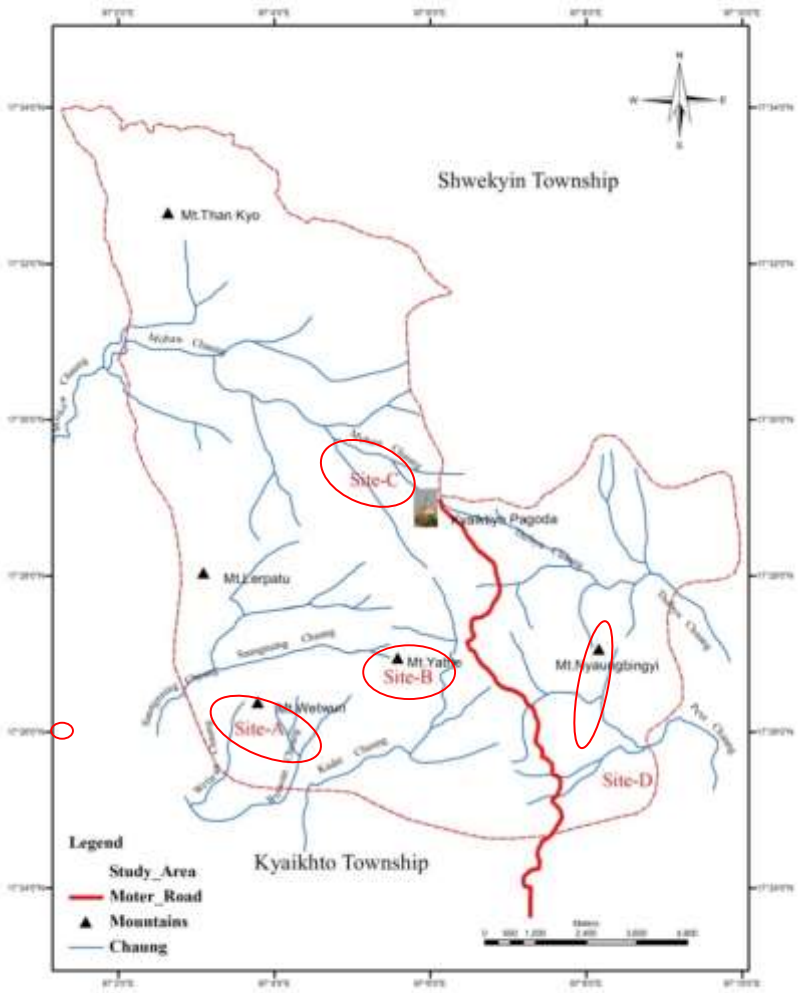
The specimens were collected from the study sites with the help of forest staffs by direct observation such as noosing and hand capturing, and visual encountered survey (VES) followed after Crump and Scott (1994). The captured specimens were treated with chloroform to record some morphometric data, and then replaced those to the detected habitats.

Hand capturing and noosing was used for geckos, skinks, and tree lizards found terrestrial and sheltered habitats to identify and record the studied specimens.

When the lizard faunas were arboreal and not easy to capture, visual encountered study (VES) was used with the help of binocular and digital camera along a survey path to identify the studied species. If the visual encountered specimens were not easy to be identified, they were not counted.

Identification of the specimens was followed after Boulenger (1890), Smith (1935), and Das (2010) by checking key characters of scalation and coloration. Identification of the turtle species was followed after Ernst and Barbour (1989), Bonin and Dupré (2006).

Body weight (BW) was taken by a digital balance to the nearest gram. Measurements such as snout-vent length (SVL), tail length (TL), head length (HL), and head width (HW) were measured by either a digital caliper or measuring tape to the nearest millimeters.



(**Source:** Kyaikhtiyoe Wildlife Sanctuary Office)

Figure1 Map of Kyaikhtiyoe Wildlife Sanctuary and its environs

Results

Species Composition of Study Area

Totally, seventeen reptile species of 11 genera belonging to 7 families of two orders were recorded in the study area. The classification of recorded species was shown in the table 1.

Seasonal abundance of reptiles in the study sites

The field survey was conducted into three seasons for the selected study sites to investigate the seasonal abundance of reptiles inhabited in Kyaikhtiyoe Wildlife Sanctuary. During this study period, 2 individuals of 2 turtle species, 4 individuals of 3 snake species, and 124 individuals of 12 lizard species were seasonally collected from various study sites (Table 2). According to the collected data, *Hemidactylus frenatus* was the most abundance in number, two turtle species (*P.megacephalum, L.scutata*) and two snake species (*P.popeiorum, M.bella*) were least in status (Fig. 2). Besides, individuals of the study species were peak number in hot season (74) and the least (23) in cool season (Fig. 3). Of these individuals, 2 individuals of turtles and 105 individuals of lizards recorded by direct observation, and 4 individuals of snakes and 19 individuals of lizards by VES (Photo-recorded).

Table1 The classification of the recorded species in the study area

Sr.	Order	Suborder	Family	Genus	Species	Common name
1	Testudines	Cryptodira	Platysternidae	*Platysternon*	*P.megacephalum*	Big headed turtle
2			Trionychidae	*Lissemys*	*L.scutata*	Myanmar flapshell turtle
3	Squamata	Serpentes	Viperidae	*Cryptelytrops*	*C.erythrurus*	Spot-tailed pit viper
4				*Popeia*	*P.popeiorum*	Popes's pit viper
5			Colubridae	*Maculophis*	*M.bella*	Dice-like trinket snake
6		Sauria	Agamidae	*Acanthosaura*	*A.crucigera*	Masked spiny lizard
7				*Calotes*	*C.htunwini*	Htunwin's forest lizard
8					*C.mystaceus*	Blue forest lizard
9					*C.versicolor*	Garden lizard
10			Gekkonidae	*Gekko*	*G.gecko*	Tokay gecko
11				*Hemidactylus*	*H.brookii*	Brooke's house gecko
12					*H.bowringii*	Bowring's house gecko
13					*H.frenatus*	Asian house gecko
14					*H.garnoti*	Garnot's house gecko
15			Scincidae	*Sphenomorphus*	*S.maculatus*	Spotted forest skink
16				*Eutrophis*	*E.multifasciata*	Common sun skink
17					*E.macularia*	Little ground skink

Morphometric data of the collected species

Two individuals of turtles and 105 individuals of lizards could be captured and recorded for some morphometric data. Some morphometric data such as body weight (BW), snout-vent length (SVL), tail length (TL), head length (HL), and head width (HW) are recorded for saurian specimens (Table 3); and body weight (BW), curved carapace length (CCL) and curved carapace width (CCW) for turtle specimens are measured nearest grams, millimeters and centimeters (Table 4).

Table 2 Seasonal occurrence of reptilian fauna in the study sites

Sr.	Specimen	Site A			Site B			Site C			Site D			Total
		H	W	C	H	W	C	H	W	C	H	W	C	
1	*P.megacephalum*	1	-	-	-	-	-	-	-	-	-	-	-	1
2	*L.scutata*	-	-	-	-	1	-	-	-	-	-	-	-	1
3	*C.erythrurus*	1	-	-	-	-	-	-	1	-	-	-	-	2
4	*P.popeiorum*	-	1	-	-	-	-	-	-	-	-	-	-	1
5	*M.bella*	-	-	-	1	-	-	-	-	-	-	-	-	1
6	*A.crucigera*	-	-	-	-	1	-	-	-	-	1	-	-	2
7	*C.htunwini*	1	-	1	1	-	-	1	1	-	3	1	1	10
8	*C.mystaceus*	2	1	1	1	-	-	3	1	-	2	-	1	12
9	*C.versicolor*	2	2	-	1	1	1	2	-	-	2	2	1	14
10	*G.gecko*	-	-	-	2	1	-	1	1	1	-	-	-	6
11	*H.brookii*	-	-	-	1	-	-	2	1	-	3	1	2	10
12	*H.bowringii*	1	-	-	2	1	1	1	-	-	2	2	1	11
13	*H.frenatus*	-	-	-	4	2	-	3	-	-	6	4	4	23
14	*H.garnoti*	1		-	3	1	1	1	-	-	2	-	1	10
15	*S.maculatus*	2	2	1	3	-	2	2	1	1	1	-	1	16
16	*E.multifasciata*	1	1	-	1	-	-	1	-	-	-	-	-	4
17	*E.macularia*	-	1	1	2	-	-	-	1	-	1	-	-	6
Total		**12**	**8**	**4**	**22**	**8**	**5**	**17**	**7**	**2**	**23**	**10**	**12**	**130**

H = Hot season, W = Wet season, C = Cool season

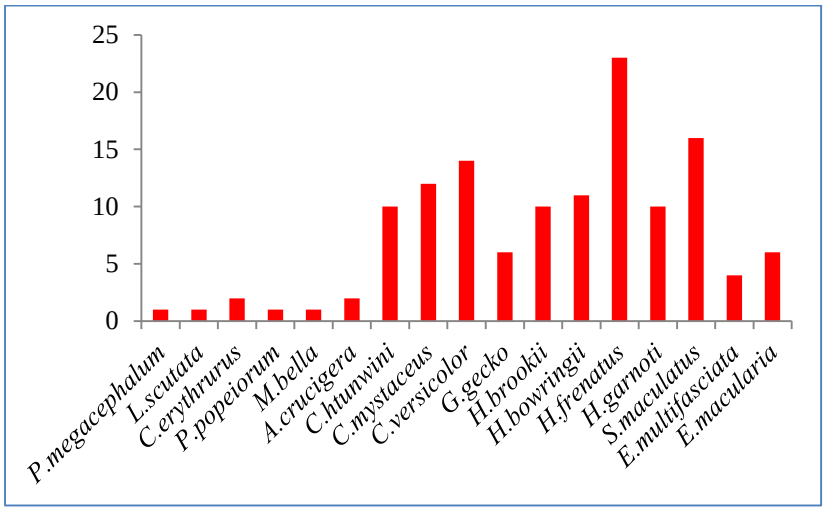


Figure 2 Abundance of reptile species in the study

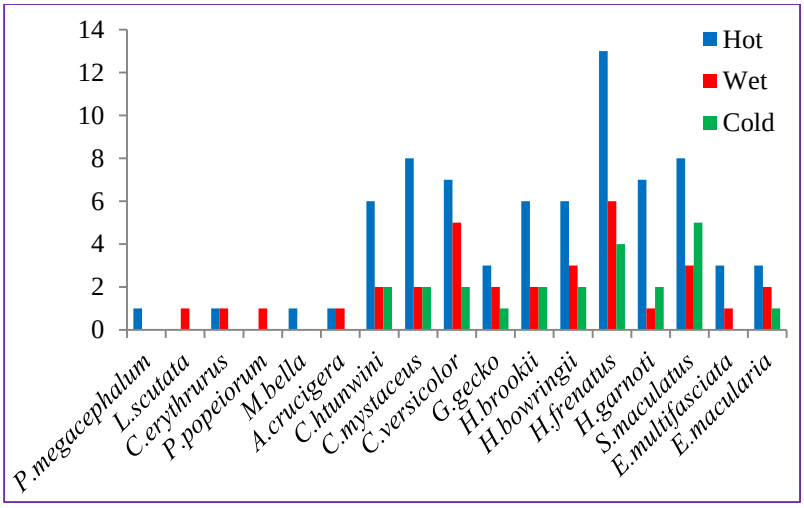


Figure 3 Seasonal abundance of reptiles in different study sites

Table 3 The morphometric data of the captured lizard specimens

Sr.	Species	n	BW (g) Min-Max	SVL (mm) Min-Max	TL (mm) Min-Max	HL (mm) Min-Max	HW (mm) Min-Max
1	*A.crucigera*	2	16.0 - 17.5	84.9 – 87.6	129.8 – 133.2	19.1 – 20.4	13.8 – 14.2
2	*C.htunwini*	9	2.5 – 8.0	48.2 – 68.7	134.0 – 207.2	14.9 – 18.6	9.4 – 11.2
3	*C.mystaceus*	9	9.5 – 10.5	78.5 – 89.2	172.4 – 194.9	16.8 – 22.1	13.6 – 15.1
4	*C.versicolor*	11	8.5 – 9.5	73.0 – 84.6	152.2 – 219.8	15.7 – 19.4	9.7 – 12.8
5	*G.gecko*	5	9.5 – 130	78.3 – 193.2	67.5 – 218.3	23.9 – 50.4	17.8 – 41.3
6	*H.brookii*	7	2 – 5.5	40.9 – 58.4	44.5 – 55.6	10.1 – 14.5	7.5 – 12.2
7	*H.bowringii*	19	2.5 – 4.5	44.9 – 55.7	46.0 – 56.3	11.1 – 12.7	8.0 – 10.8
8	*H.frenatus*	16	2 – 5.0	43.6 – 56.2	45.5 – 56.1	10.6 – 13.4	7.8 – 11.8
9	*H.garnoti*	8	2 – 5.5	44.2 – 56.6	45.8 – 56.8	10.7 – 14.9	7.8 – 11.3
10	*S.maculatus*	11	1. 5 – 6.0	27.7 – 58.4	45.5 – 90.5	6.6 – 12.7	4.0 – 6.1
11	*E.multifasciata*	3	5.5 - 6.5	74.2 - 83.7	119.3 - 137.8	11.7 - 12.8	5.9 - 6.7
12	*E.macularia*	5	0.5 – 4.5	34.3 – 52.5	49.8 – 88.6	7.0 – 9.5	4.8 – 5.8

n = numbers of captured specimens, BW = body weight, SVL = snout vent length, TL = tail length, HL = head length, HW = head width, Min = minimum, Max = maximum

Table 4 The morphometric data of the captured turtle specimens

Sr.	Species	n	BW (g)	CCL (cm)	CCW (cm)	IUCN status
1	*Platysternon megacephalum*	1	823	17.2	12.8	Endangered
2	*Lissemys scutata*	1	988	19.4	18.5	Data deficient

n = numbers of captured specimens, BW = body weight, CCL = Curved carapace length, CCW = Curved carapace width

Discussion

During this study, a total of 17 reptile species of 11 genera belonging to 7 families of two orders were observed as the species composition in Kyaikhtiyoe Wildlife Sanctuary, Mon State.

Mar Mar Thein (1981) was studied 27 species of 16 genera belonging to 7 families of lizards in Shwebo, Zee Gone, Alskapa, Let-Kha-Bin, Kyawt-Min (Sagaing Division); Taunggyi, Heho, Inpaw Khone- Inlay (Shan State); Matupi, Falum, Kale (Chin State); Mandalay, Maymyo (Mandalay Division); Moulmein, Set-se (Mon State); Mongmagan (Tenasserim Division).

Aye Aye Myat (2007) recorded a total of 17 lizard species belonging to 8 genera of 3 families in the study areas of Yangon, Bago, Mandalay, Ayeyarwaddy, Tanintharyi Divisions and Mon State.

Khin Than Kywe (2010) expressed that total 43 reptile species of 33 genera belonging to the 13 families of two orders were recorded in the Kyaikhtiyoe Wildlife Sanctuary from February 2005 to January 2009.

Kyaw Swar Aung (2012) observed 14 lizard species belonging to 8 genera of 2 families from Bago Region.

Thanda (2012) recorded a total of 15 lizard species of 3 families belonging to the order Squamata were recorded from in Hlegu and Hmawbi Environs.

Htay Htay Maw (2015) stated 18 species belonging to 5 families of lizards in Taungtha Reserved Forest area in Mandalay Region.

20 reptile species of 16 genera belonging to 7 families of two orders were collected in Sittway environs by San Htet San (2017).

Thu Zar Win (2018) recorded a total of seven species of six genera belonging to four lizard families in Hlawga Wildlife Park, Yangon Region.

Species composition of family Gekkonidae 74 percent, Agamidae and Scincidae 13 per cent were conducted by Thanda (2012) respectively. Aye Aye Myat (2007) discussed that species composition of family Agamidae was recorded to be the highest percentage (47 percent) in her study, and the remaining species composition were of the family Gekkonidae (35 percent), Scincidae (18 per cent) respectively. The highest relative abundance of lizard families conducted by San Htet San (2017) was Gekkonidae and Colubridae (18.52 percent), and followed by Agamidae (7.41 percent), Scincidae (3.7 percent) respectively. Zug (2013) said that no lizard is more familiar with us than the geckos in the tropics.

Htay Htay Maw (2015) concluded that agamids were regarded as dominant because they were recorded in the highest number (65) individuals in her study.

According to the species composition of the present study, the family Gekkonidae (60 individuals) was recorded to be highest number; the second Agamidae (38 individuals), third Scincidae (26 individuals), and fourth Viperidae (3 individuals) were followed orderly, Platysternidae (1), Trionychidae (1), and Colubridae (1) as lowest number.

Concerning with the seasonal abundance of reptiles, Khin Than Kywe (2010) stated that 180 individuals of reptile species recorded in hot season, 161 individuals in wet season, and 69 individuals in cool season respectively.

In this study, one individual of one respective turtle species was individually recorded in hot (*P.megacephalum*) and wet (*L.scutata*) seasons, four individuals of three snake species also in hot (*C.erythrurus, M.bella*) and wet (*C.erythrurus*, *P.popeiorum*) seasons. 71 individuals of lizards were occurred in hot, 30 individuals in wet, and 23 individuals in cool seasons respectively.

As shown in result, the most abundance of reptiles was recorded in hot season as 23 individuals of 10 species in study Site D and 22 individuals of 12 species in Site B, the least abundance in cool season as 2 individuals in Site C.

Aye Aye Myat (2007) recorded that the snout-vent length of *Gekko gecko* was measured about 150 mm as the longest body. Das (2010) expressed that the mean snout-vent length of *Gekko gecko* was measured about 185mm. Kyaw Swar Aung (2012) discussed that on the aspect of the mean morphometric measurement, the total length of *Gekko gecko* (34 cm, 30 – 38 cm) was observed as the longest body. G*ekko gecko* (TL = 13-16 cm) and *Sphenomorphus maculatus* (TL = 8-13 cm) were ranged as the species with long tail.

As the present study was expressed in result, the total length (SVL = 193.2 mm and TL = 218.3 mm) of *Gekko gecko* was recorded in 41.15 cm.

Conclusion

In the present study, the recorded reptile species of *Lissemys scutata* and *Calotes htunwini* were noted as the endemic species in Myanmar, and *Platysternon megacephalum* was endangered species in the conservation status of IUCN Red List.

According to the result, the species occurrence of reptiles in the present study was concluded as little in species number in contrast with that of San Htet San (2017) and Khin Than Kywe (2010). Besides, the collected number of lizard species in this study was fewer than that of above authors, except Thu Zar Win (2018).

The most seasonal abundance of reptiles was concluded as hot season.

According to the morphometric data, it was concluded that the maximum measurement of *Gekko gecko* in this study was the longest body than that species of Aye Aye Myat (2007), Das (2010), and Kyaw Swar Aung (2012) stated. In the present study, the maximum tail length (90.5 mm) of *Sphenomorphus maculatus* was shorter than that of Kyaw Swar Aung (2012) recorded

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References

Aye Aye Myat**,** (2007). Community Ecology of Some Lizards In Some Areas of Myanmar. *Ph.D Thesis*. Department of Zoology, University of Yangon.

Bonin, F., Devaux, B., Dupré, A., (2006). Turtles of the world. *Translated from the French by Peter C. H. Pritchard.* The Johns Hopkins University Press, Baltimore, Maryland.

Boulenger, G. A., (1890).The Fauna of British India Including Ceylon and Burma. *Reptilia and Batrachia*. Taylor and Francis, London.

Crump, M.L., and Scott, JR., N. J., (1994). *Visual encounter survey*. In: Heyer, W.R., Donnelly, M.A., Mcdiarmid, R.W., Hayek, L.C, & Foster R. M.S. (Eds). *Measuring and monitoring biological diversity: standard methods for amphibians*. Smithsonian Institution Press, Washington DC: 84-92.

Das, I., (2010). *A field guide to the Reptiles of South-East Asia*. Asia Books Co. Ltd., Thailand.

Ernst, C. H., Barbour, R.W., (1989). *Turtles of the world.* Smithsonian Institution Press, Washington, D.C.

Forestry, D., (2011). *National Biodiversity Strategy and Action Plan*. MECF, Myanmar.

Forestry, D., (2015). *National Biodiversity Strategy and Action Plan 2015-20*. MECF, Myanmar.

Htay Htay Maw, (2015). Occurence and Distribution of Some Reptilians In Taungtha Reserved Forest, Mandalay Region *Ph.D Thesis*. Department of Zoology, University of Yangon.

Khin Than Kywe, (2010). Species Diversity of Reptilian Fauna in Kyaikhtiyoe Wildlife Sanctuary, Mon State. *PhD.Thesis.* Department of Zoology, Sittway University.

Kyaw Swar Aung, (2012). Distribution and Abundance of Lizard Species (Lacertilia; Gekkonidae and Scincidae) in some area of Bago region. *Ph.D Thesis*, Department of Zoology, University of Yangon.

Mar Mar Thein, (1981). The Taxonomy of some Saurians of Burma, *M.Sc Thesis*. Department of Zoology, University of Mandalay.

Leviton, A. E., G. R. Zug, J. V. Vindum, and G. O. U. Wogan, (2008). *Handbook of The Dangerously Venomous Snakes of Myanmar.* Allen Press, copy right CAS, USA. ISBN-978-940-228-76-4

O'shea, M. and T. Halliday, (2002).*Reptiles and Amphibians*, first published in Great Britain in 2001 by Dorling Kindersley Ltd., 80 Strand, London WC2r ORL Reprinted with correction in 2002.

San Htet San, (2017).Relative Abundance and Habitat Utilization of Herpetofauna In Sittway Environs, Rakhine State. *M.Sc Thesis*. Department of Zoology, Sittway University.

Smith, M. A., (1935). *The Fauna of British India including Ceylon and Bruma. Reptilia and Amphibia, vol.II. Sauria*. Taylor and Francis, London.

Stuart**,** B.L., Thorbjarnarson, J., (2003). Biological prioritization of Asian countries for turtle conservation. Chelonian conservation and biology *International Journal of Turtle and Tortoise Research.* 4(3): 642-647.

Thanda, (2012). Distribution pattern and Reproduction Ecology of Some Lizards in Hlegu and Hmawbi Environs. *Ph.D Thesis*, Department of Zoology, University of Yangon.

Tordoff, A.W., Eames, J.C., Eberhardt, K., Baltzer, M.C., Davidson, P., Leimgruber, P., Uga, Aung Than, (2005). Myanmar investment opportunities in biodiversity conservation. *Draft Document.* The Office of the United Nations Resident Coordinator, UNDP, Yangon.

Thu Zar Win, (2018). Species Composition and Relative Abundance of Lizards in Hlawga Wildlife Park, Yangon Region. *MSc. Thesis*, Department of Zoology, University of Yangon.

Wildlife Conservation Society, (2013). *Myanmar Biodiversity Investment Vision.* Wildlife Conservation Society, Yangon, Myanmar.

Win Maung, Win Ko Ko, (2002). *Turtles and tortoises of Myanmar.* Wildlife Conservation Society. Myanmar Program, Yangon.

Zhou, Z., Jiang, Z., (2008). Characteristics and risk assessment of international trade in tortoises and freshwater turtles in China. *Chelonian Conservation and Biology.* 7 (1):28-36.