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M. Rezaul Karim and M. Farid Ahsan

Department of Zoology, University of Chittagong, Chittagong-4331, Bangladesh



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M. Rezaul Karim and M. Farid Ahsan

Department of Zoology, University of Chittagong, Chittagong-4331, Bangladesh.

E-mail: helal03cu@gmail.com

Abstract

A study was carried out on the herpetofauna of the Baraiyadhala National Park in Chittagong, Bangladesh by direct field observations during August 2012 to July 2013. In total, 38 species of herpetofauna belonging to 3 orders (Anura, Testudines and Squamata), 16 families and 32 genera were recorded. Out of the 38 species, 10 (26.32%) were amphibians and 28 (73.68%) reptiles. Among the reptiles, 2 (7.14%) species were turtles, 12 (42.86%) lizards and 14 (50%) snakes while all but one (Asian Common Toad, *Duttaphrynus melanostictus*) amphibians were frogs. Among the amphibians, Cricket Frog (*Fejervarya* sp.) constituted the highest density and Bengal Leaping Frog (*Hylarana tytleri*) accounted for the lowest. The density of South Asian Giant Gecko (*Gekko gecko*) was the highest and Indian Rock Python (*Python bivittatus*), Gray Cat Snake (*Boiga siamensis*) and Banded Krait (*Bungarus fasciatus*) were the lowest among reptiles. Local status (relative abundance) of herpetofauna were assessed where 15 (39.47%) species were rare, 11 (28.95%) fairly common, 9 (23.68%) common and 3 (7.9%) were very common. Of the recorded species, 15 (39.47%; 2 amphibians and 13 reptiles) were threatened including 2 Critically Endangered (CE), 6 Endangered (EN) and 7 Vulnerable (VU).

সারসংক্ষেপ

আগস্ট ২০১২ থেকে জুলাই ২০১৩ পর্যন্ত সরাসরি পর্যবেক্ষণের মাধ্যমে বারৈয়াঢালা জাতীয় উদ্যানের হার্পেটোফনার উপর একটি গবেষণা কার্যক্রম পরিচালনা করা হয়। এতে ৩টি বর্গের (Anura, Testudines এবং Squamata) ১৬টি গোত্রভুক্ত ৩২টি গণের সর্বমোট ৩৮টি প্রজাতির হার্পেটোফনা রেকর্ড করা হয়। ৩৮টি প্রজাতির মধ্যে ১০টি (২৬.৩২%) উভচর এবং ২৮টি (৭৩.৬৮%) সরীসৃপ। সরীসৃপগুলোর মধ্যে ২টি (৭.১৪%) কাছিম, ১২টি (৪২.৮৬%) গিরিগিটি জাতীয় এবং ১৪টি (৫০%) সাপ, পক্ষান্তরে একটি কুনোব্যাঙ (*Duttaphrynus melanostictus*) ছাড়া বাকি উভচরগুলোই ছিল ফ্রগ (Frog)। উভচরগুলোর মধ্যে সাংখ্যিক ঘনত্ব ঝিঁ-ঝিঁ ব্যাঙের (*Fejervarya* sp.) সবচেয়ে বেশী এবং পানা ব্যাঙের (*Hylarana tytleri*) ছিল সবচেয়ে কম। সরীসৃপগুলোর মধ্যে তক্ষকের (*Gekko gecko*) সাংখ্যিক ঘনত্ব খুব বেশী হলেও অজগর (*Python bivittatus*), ধূসর ফণিমনসা (*Boiga siamensis*) এবং শংখিনীর (*Bungarus fasciatus*) সাংখ্যিক ঘনত্ব ছিল খুমই কম। হার্পেটোফনার স্থানীয় অবস্থা নির্ণয় করা হয়, যেখানে ১৫টি (৩৯.৪৭%) ছিল দূর্লভ (Rare), ১১টি (২৮.৯৫%) মোটামুটি কমন (Fairly Common), ৯টি (২৩.৬৮%) কমন (Common) এবং ৩টি (৭.৯%) খুব কমন (Very Common)। রেকর্ডভুক্ত ১৫টি (৩৯.৪৭%; ২টি উভচর এবং ১৩টি সরীসৃপ) হুমকির সম্মুখীন প্রজাতিগুলোর মধ্যে ২টি মহাবিপন্ন, ৬টি বিপন্ন এবং ৭টি সংকটাপন্ন।

Keywords: Baraiyadhala National Park; Density; Herpetofauna; Status

Introduction

The variety of life (plants, animals and microorganisms) on Earth is commonly known as biodiversity, and human beings frequently depend on it to meet basic needs like food, refuge, medicine, combustibles and industrial products (Dirzo and Raven 2003). Herpetofauna

(amphibians and reptiles) is not different one, an essential component of the biodiversity which play ecologically integral roles in food webs as herbivores, predators and prey as well as connecting aquatic and terrestrial ecosystems (Schenider *et al.* 2001). Globally now 7,384 amphibian and 10,038 reptile species are known to occur (Frost 2015, Uetz 2015), of which 32.5% of all known amphibians and 22% of reptiles are endangered, and close to 122 amphibian and 22 reptile species have currently been extinct from the wild (Dirzo and Raven 2003, Baillie *et al.* 2004, Stuart *et al.* 2004, Gascon *et al.* 2007). Bangladesh is the harbors of a total 1,041 species of wildlife including 199 herpetofauna of which 42 are amphibians and 157 reptiles (28 turtles, 32 lizards, 94 snakes and 3 crocodiles) (Khan 2010). Bangladesh like other countries also concerns about her species. Because there are 161 (18.63%) species of wildlife listed as threatened group belonging to 63 reptiles and 8 amphibians (IUCN Bangladesh 2000a). This figure indicates that reptiles are facing more critical condition because whose 39.13% of members are threatened. Habitat destruction and fragmentation along with the recklessly use of the chemical fertilizers and pesticides, and disease and overexploitation are driving herpetofauna to be threatened (Primack 1993). For this reason, Bangladesh government has taken step to protect plants and wildlife by declaring several places as 'Protected Area' (PA). According to the Forest Department (www.bforest.gov.bd) there are 38 PAs in the country of which 17 are National Parks (NPs) and 21 Wildlife Sanctuaries (WSs). Beside these PAs, there are 12 conservation sites like garden, eco-park and safari park. Baraiyadhala National Park in Chittagong is one of the important NPs in Bangladesh, which was officially notified on 6

April 2010.

In this part of the Orient, Bangladesh, mostly listing of birds was started in late 1960s with the initiation of the Late Professor Kazi Zaker Husain, for instance, birds of the Chittagong Hill Tracts (Husain 1968). Later, researchers worked with other groups of wildlife, for examples, amphibians of Bangladesh (Husain and Rahman 1978), Chittagong Hill Tracts (Chakma 1995) and snakes of Bangladesh (Montaquim *et al.* 1980), Chittagong district (Parvin 1999). But extensive works on herpetofauna in the PAs of Bangladesh is limited. Previously some works were accomplished on biodiversity in few protected areas, for instances, Rema-Kalenga WS (Feeroz *et al.* 2011), Dudpukuria-Dhopachari WS (Feeroz *et al.* 2012), and Teknaf WS (Feeroz 2013). But published/unpublished works neither exclusively on herpetofauna nor on other groups of wildlife of the Baraiyadhala National Park (BNP) is available. So an attempt was taken to study the herpetofauna of the BNP.

Materials and Methods

Fieldwork was carried out at the BNP (Figure 1) in Chittagong, Bangladesh from August 2012 to July 2013. It is located 172 km southeast of Dhaka and 45 km northwest of Chittagong City (22°40.489' and 22°48' N and 90°40' and 91°55.979' E). It covers the area of Sitakunda and Mirsharai Upazilas. The park encompasses 2,933.61 ha (29.3361 km²) of land area under the Baraiyadhala Forest Range Office. The BNP supports the following types of forest: tropical semi-evergreen; tropical wet evergreen; tropical moist deciduous; bamboo thickets; and artificial or plantation. The park area is Mio-Pliocene in origin where 3 representative geological series (Surma, Tipam and Dhupitila) are found and the soils are yellowish brown to

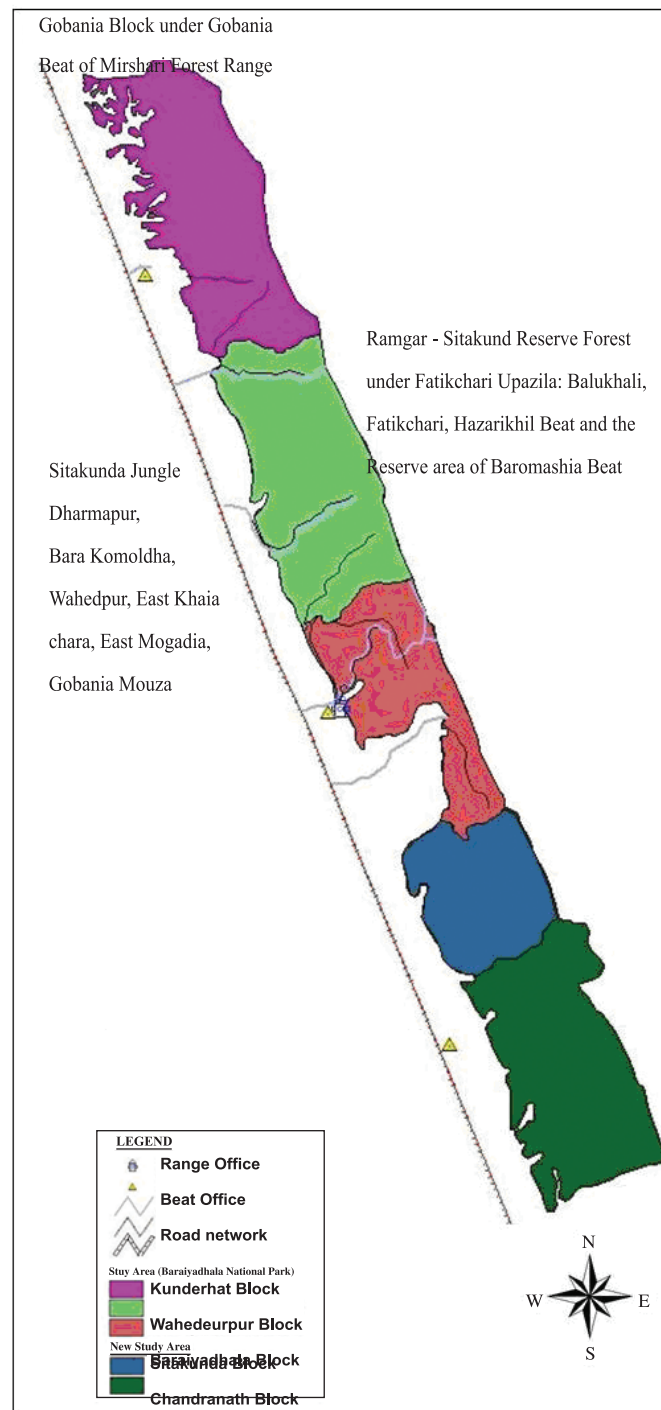


Figure 1. Baraiyadhala Forest Range (Study Area: Baraiyadhala National Park)
Source: Based map Collected from Baraiyadhala Forest Range office, 2013

strong brown (high hills), strong brown to yellowish red (low hills) (Hassan 1994), and brown colored foot hill (piedmont) soils are usual, slightly acid or neutral, with high base status (Champion *et al.* 1965). The park is interspersed with valleys, gullies and streams. Most of the streams are seasonal and dry up during off-monsoon season. In general Bangladesh prevails tropical monsoon climate, characterized by marked seasonal variations. There are three conspicuous seasons in Bangladesh (former East Pakistan) (Ahmad 1968) such as the pre-monsoon (summer/hot): March to May, the monsoon (rainy season): June to October, and the winter (dry): November to February. The park area enjoys a moist tropical maritime climate and rainfall is frequent and heavy during the monsoon season (May to October) ranging between 115.2 mm and 561.1 mm (Total 1,891 mm). The average maximum annual temperature was 31.50°C and the minimum 20.67°C, whereas the average maximum and minimum range of relative humidity were respectively 99.10 and 49.86% (Sitakunda Agro-met. Office, 2012-13).

Monthly minimum three and maximum five days were spent in the field during the study period. The observations were usually started early in the morning specifically from after half an hour of sunrise and continued to 1100 h, and in the afternoon session from 1500 h to dusk. Three to four hours were spent during mid-evening to early night to observe nocturnal species and on an average of 10 hrs were spent in a day.

Data were collected through direct field observations along the selected transect lines. Nine transect lines were established to observe wildlife and their different activities. Each transect was about one km long and 10 m wide on both sides. Active searches involving turning rocks and logs, peeling bark and digging through leaf litter. During the day, besides active search, basking reptiles were also search along forest trails, forest edges and along stream bank. For frogs, observations were sometimes made on the basis of

calls heard along forest trails, forest edges and along stream bank at early night. Records of road kills, dead specimens in various activities by locals and cast off snakes were also studied and incorporated in this paper. Individuals of the species were captured by hand and released at the point of capture after examination.

Animal occurrence was also confirmed sporadically through interviewing local people, forest workers, farmers, fire wood collectors and elderly people (who were over 40 years old) to gather important information about the past and present status of wildlife. Usually photographs were shown to them to confirm identification of the species. One camera (Sony 16x optical zoom, HD movie 720 p) was also used for photography of the animals, their habitats and activities. Note book, pencil, pen and scale were used for recording data in the field. Field data on herpetofauna were sorted into taxonomic orders following Kabir *et al.* (2009).

There are several formulas in estimating population density from line transect data. The following formula has preferably been applied by wildlife scientists (e.g., Harris and Burnham 2002, Kabir 2012) for population density:

$$D = \frac{ns}{2LW}$$

Where, D = estimated density of animals; n = total number of animals; s = mean group size (if present); L = length of transect line (s); and W = mean perpendicular distance of animals (naively transect width).

The local status of species was assessed based on relative occurrence following Khan (1982): (1) very common- species seen 80 to 100% of the field visits and in good number; (2) common- species seen during 50-79% of the visits; (3) fairly common/uncommon- species seen during 20-49% of the visits; and (4) rare- species observed less than 19% of the visits in very small number.

Results

Species composition and population density

Herpetofauna of the BNP represented by 38 species belonging to 10 amphibians and 28 reptiles of the three orders including Anura, Testudines and Squamata, of which the Family Colubridae (Squamata) supported the highest number of species (7 spp.) followed by Scincidae (5 spp.) (Appendix 1).

The estimated total population of amphibians and reptiles were respectively 1,314 (mean 109.50 in each month) and 764 (mean 63.67 in each month) in the surveyed area and the overall total population density was respectively 304.62/km² and 176.86/km². Among the amphibian species, the Cricket Frog (*Fejervarya* sp.) represented the highest number (340, mean 28.33 in each month) and its density was 78.7/km² and Yellow Stripped Frog (*Hylarana tyleri*) symbolized the lowest

(Appendix 1). On the other hand, among the reptilian species, the South Asian Giant House Gecko (*Gekko gecko*) symbolized the highest number (134, mean 11.17 in each month) and its density was 31.01/km², and the Indian Rock Python (*Python bivittatus*), Gray Cat Snake (*Boiga siamensis*) and Banded Krait (*Bungarus fasciatus*) stood the lowest (Appendix 1).

Monthly and seasonal variation of species composition

The number of species of amphibian and reptilian were counted in the line transect method (LTM) varied monthly from 2 to 10 (mean 6.17 species) and 5 to 18 (mean 14.25) respectively in the BNP during the study period. On the other hand, the total counted population of herpetofauna also varied in each month (Figure. 2 & 3). Further there was a significant variation in the number of species and individuals across seasons (Table 1).

Table 1. Seasonal variation in the no. of herpetofaunal species & population in the BNP

Groups	Summer		Rainy		Winter	
	No. of Spp.	No. of Indv.	No. of Spp.	No. of Indv.	No. of Spp.	No. of Indv.
Amphibians	9	382	10	879	5	53
Reptiles	22	254	23	401	14	109

Note: No.= Number; Spp.= Species and Indv.= Individuals

The number of species and population of amphibians became peaked (10 spp. & 879 indiv.) in rainy season and sharply fluctuated in winter season (5 spp. & 53 indiv.). On the other hand, the highest number of reptilian species and individuals (23 spp. & 401 indiv.) were found in rainy season while the lowest in winter (14 spp. & 109 indiv.).

Local status

The local status (relative abundance) of

herpetofauna in the BNP was assessed as 15 (39.47%) species were Rare/Few, 11 (28.95%) Fairly Common, 9 (23.68%) Common and 3 (7.9%) were Very Common (Appendix 1).

National conservation status (IUCN Bangladesh 2000a, b)

Among the 10 amphibian species recorded in BNP, 2 (20%) species are considered as Vulnerable, 4 (40%) Not Threatened, and 4 (40%)

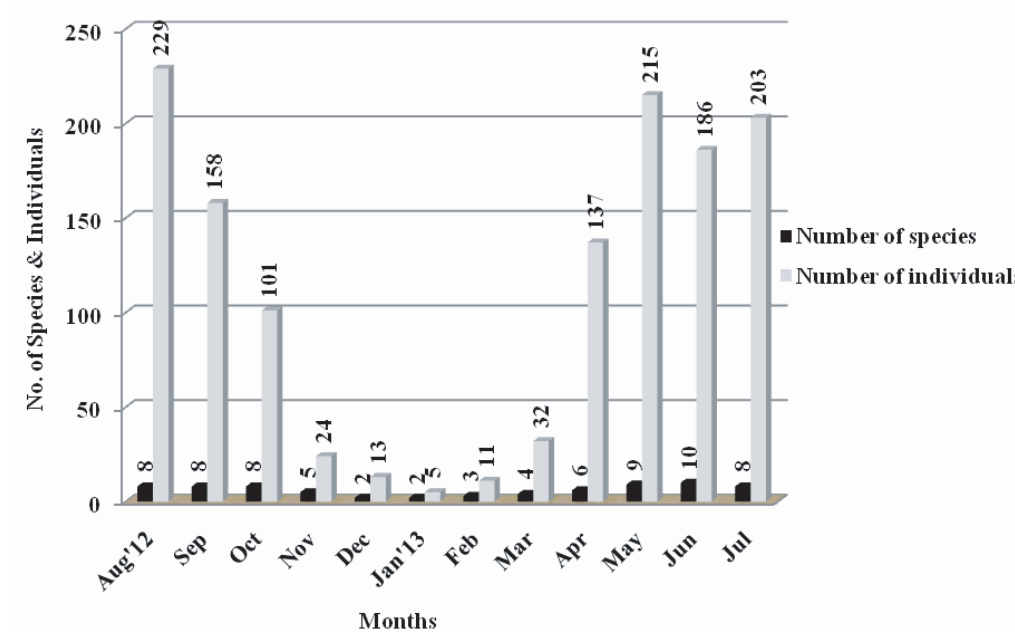


Figure 2: Monthly number of amphibian species & individuals observed in the BNP

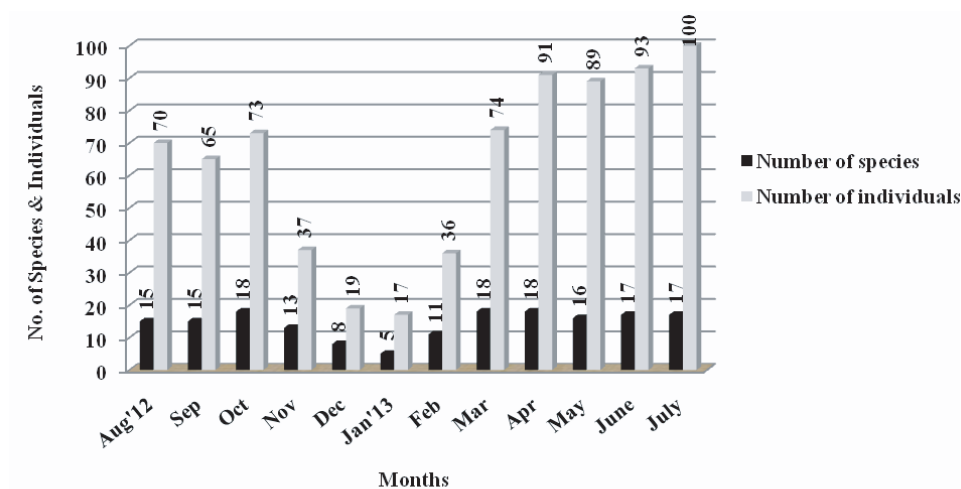


Figure 3: Monthly variation of reptilian species composition observed in the BNP

were not reported in IUCN Bangladesh (2000b). On the other hand, among the 28 reptilian species, 2 (7.14%) species are assessed as Critically Endangered, 6 (21.42%) Endangered, 5 (17.86%) Vulnerable, 4 (14.28%) Data Deficient and 7(25%) Not Threatened species in the BNP, and the

remaining ones (4 spp.) are not cited in IUCN Bangladesh (2000b).

Discussion

Species composition and population density

The recorded herpetofauna from the BNP

covered 19.09% of the country's herpetofauna (total species 199 [Khan 2010]) of which, amphibians are evidenced by one (2.63%) toad and nine (23.68%) frogs, and reptiles by two (5.26%) turtles, 12 (31.58%) lizards and 14 (36.84%) snakes. Among these species, five (2 amphibians & 3 reptiles) (Appendix 1) are reported through interviewing the locals. Feeroz (2003) conducted same type of study in the Satchari Reserve Forest now National Park where he recorded 24 species of herpetofauna including six amphibians, and seven lizards and 11 snakes.

The number of turtle species is very low (only 2) and it may be the result of capturing by the poachers and indigenous people for both consumption and local trade. Two (Bengal lizard [*Varanus bengalensis*] and ring lizard [*V. salvator*]) of the three species of varanids in Bangladesh were recorded in the BNP. Six of the 14 species were poisonous snakes, which include two species of krait, one cobra and three vipers (including reported Russell's viper) (see Appendix 1).

Monthly and seasonal variation of species composition

It is true that the increase, decrease or sustain of species composition depend on seasons, environmental factors, natural calamities, anthropogenic activities, etc. The occurrence of amphibians and reptiles was significantly less in the BNP during winter than summer and rainy seasons (see Figs. 2 & 3). This is because of these two groups of animal are cold-blooded and have a

relation with temperature, humidity and rainfall. However, two of the amphibian species, (Common Toad [*Duttaphrynus melanostictus*] and Large Pygmy Frog [*Microhyla berdmorei*]), were found throughout the year, though their population was sharply decreased during winter season. Among the reptiles, a continuous drop in the number of species and population (Fig. 3) was observed from November 2012 to January 2013 were related to low temperature and rainfall.

Amphibian and reptile populations are sensitive and respond strongly to changes and variability in air and water temperatures, precipitations and the hydro period (length of time and seasonality of water presence) of their environments (Carey and Alexander 2003). This is partly because they are ectothermic that is why their body temperatures and activity cycles are depended on the presence of optimal environmental conditions. During the present study reptiles were more active in the rainy season than others because during that time insects are available as their food sources.

National conservation status

There are 13 (46.42%) reptilian species are threatened in the BNP. In the comparison of this finding to the country's level (63 spp.) (IUCN Bangladesh 2000a), it is clear that the study area supports 20.63% of the threatened reptilian species of Bangladesh. These indicate that the wild habitat of the Park is rich and still provides the key requirements for the conservation of these threatened species.

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Appendix 1. Systematic list of the recorded species of herpetofauna, and their local status and population density at the BNP. (* Reported species)

Family	SN	Scientific Name	Common Name	Local Status	Monthly Total Pop. (sp. Wise)	Average	Pop. Density /Km ²
Class: Amphibia							
Order: Anura Fischer von Waldheim, 1813							
Bufonidae Gray, 1825	1	<i>Duttaphrynus melanostictus</i> Schneider, 1799	Asian Common Toad	VC	216	18	50
Dicroglossidae Anderson, 1871	2	<i>Euphlyctis cyanophlyctis</i> (Schneider, 1799)	Skipper Frog	C	269	22.41	62.26
	3	<i>Fejervarya</i> sp.	Cricket Frog	VC	340	28.33	78.70
	4	<i>Hoplobatrachus tigerinus</i> (Daudin, 1802)	Indian Bullfrog	C	192	16	44.44
Megophryidae Bonaparte, 1850	5*	<i>Leptobrachium smithi</i> Matsui <i>et al.</i> , 1999	Smith's Litter Frog	R	7	0.58	1.62
Microhylidae Gunther, 1858	6	<i>Microhyla berdmorei</i> (Blyth, 1856)	Large Pygmy Frog	C	101	8.41	23.37
	7	<i>M. ornata</i> (Dumeril and Bibron, 1841)	Ornamented Pygmy Frog	FC	59	4.91	13.66
Ranidae Rafinesque, 1814	8	<i>Amolops marmoratus</i> (Blyth, 1855)	Torrent Frog	FC	42	3.5	9.72
	9*	<i>Hylarana tytleri</i> Theobald, 1868	Bengal Leaping Frog	R	2	0.17	0.46
	10	<i>Hydrophylax leptoglossa</i> (Cope, 1868)	Cope's Frog	C	86	7.17	19.90
Class: Reptilia							
Order: Testudines Batsch, 1788							
Testudinidae Batsch, 1788	11*	<i>Indotestudo elongata</i> (Blyth, 1853)	Elongated Tortoise	R	2	0.17	0.47
Geoemydidae Theobald, 1868	12	<i>Pangshura tecta</i> (Gray, 1831)	Indian Roofed Turtle	FC	40	3.33	9.25
Order: Squamata Oppel, 1811							
Agamidae Gray, 1827	13	<i>Calotes versicolor</i> (Daudin, 1802)	Garden Lizard	C	50	4.17	11.57
Gekkonidae Smith, 1935	14	<i>Gekko gekko</i> (Linnaeus, 1758)	South Asian Giant House Gecko	VC	134	11.17	31.01
	15	<i>Hemidactylus brookii</i> Gray, 1845	Spotted House Lizard	C	94	7.83	21.75
	16	<i>H. frenatus</i> Schlegel, 1836	Spotted House Lizard	C	87	7.25	20.13
Lacertidae Gray, 1825	17	<i>Takydromus khasiensis</i> Boulenger, 1917	Long tailed Lizard	R	13	1.08	3
Scincidae Gray, 1825	18	<i>Eutropis carinatus</i> (Schneider, 1801)	Common Skink	C	70	5.83	16.20
	19	<i>E. macularius</i> (Blyth, 1853)	Bronze Grass Skink	C	47	3.91	10.88
	20	<i>Lygosoma punctata</i> (Gmelin, 1799)	Spotted Supple Skink	R	2	0.17	0.47
	21	<i>Scincella reevesii</i> (Gray, 1838)	Reeves's Ground Skink	FC	51	4.25	11.80
	22	<i>Sphenomorphus maculatus</i> (Blyth, 1853)	Spotted Litter Skink	FC	48	4	11.11
Varanidae Gray, 1827	23	<i>Varanus bengalensis</i> (Daudin, 1802)	Bengal Monitor	FC	22	1.83	5.09
	24	<i>V. salvator</i> (Laurenti, 1768)	Ring Lizard	FC	16	1.33	3.70
Boidae Gray, 1825	25	<i>Python bivittatus</i> (Linnaeus, 1758)	Indian Rock Python	R	1	0.08	0.22
Colubridae Oppel, 1811	26	<i>Amphiesma stolata</i> (Linnaeus, 1758)	Striped Keelback	FC	15	1.25	3.47
	27	<i>Boiga siamensis</i> Nutaphand, 1971	Gray Cat Snake	R	1	0.08	0.22

Appendix 1 Continued

	28	<i>Coelognathus radiatus</i> (Boie, 1827)	Copper Head Trinket Snake	R	3	0.25	0.69
	29	<i>Dendrelaphis tristis</i> (Daudin, 1803)	Common Bronze -back Tree Snake	R	3	0.25	0.69
	30	<i>Ptyas mucosa</i> (Linnaeus, 1758)	Indian Rat Snake	FC	8	0.66	1.85
	31	<i>Rhabdophis subminiatus</i> (Schlegel, 1837)	Red -necked Keelback	R	5	0.41	1.16
	32	<i>Xenochrophis piscator</i> (Schneider, 1799)	Checkered Keelback	FC	26	2.16	6.01
Elapidae F. Boie, 1827	33	<i>Bungarus fasciatus</i> (Schneider, 1801)	Banded Krait	R	1	0.08	0.22
	34*	<i>B. niger</i> Wall, 1908	Black Krait	R	3	0.25	0.69
	35	<i>Naja naja</i> (Linnaeus, 1758)	Binocellate Cobra	R	4	0.33	0.91
Viperidae Oppel, 1811	36*	<i>Daboia russellii</i> (Shaw and Nodder, 1797)	Russell's Viper	R	3	0.25	0.69
	37	<i>Trimeresurus albolabris</i> Gray, 1842	White -lipped Tree viper	FC	12	1	2.78
	38	<i>T. erythrurus</i> (Cantor, 1839)	Spot -tailed Pit Viper	R	3	0.25	0.69