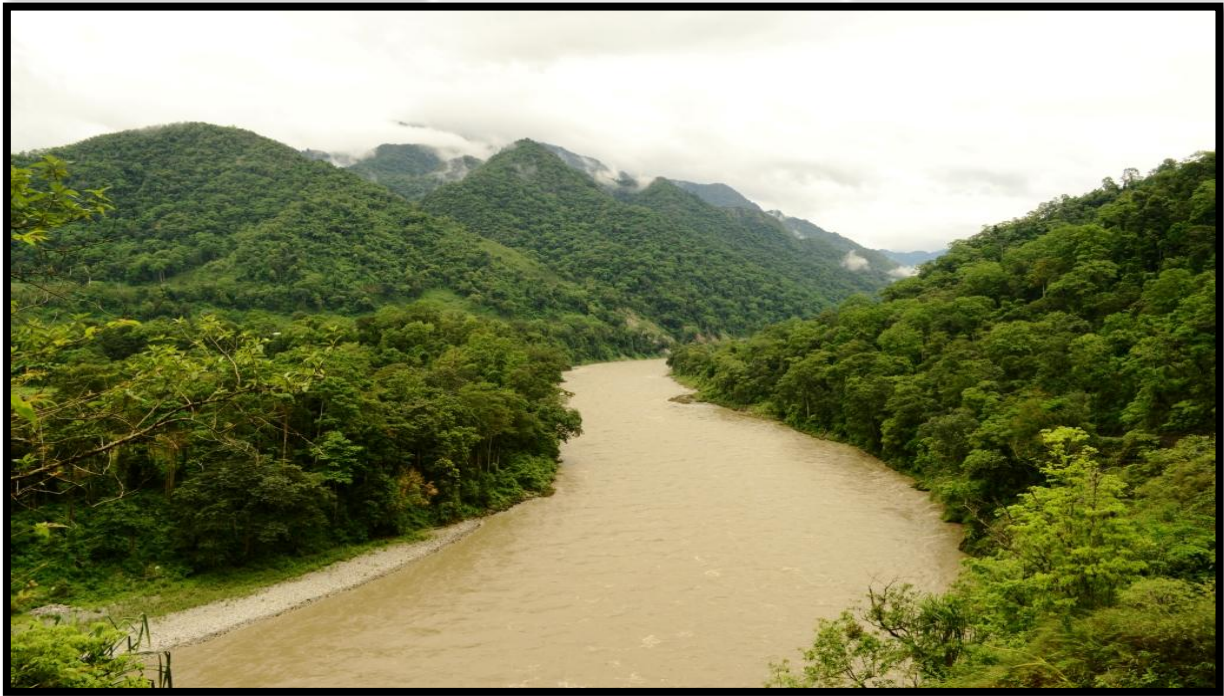


# A Rapid Assessment of Herpetofaunal Diversity in Manas-Bhutan Trans-boundary Landscape



**Report**

**Submitted to**

**Field Directorate Manas Tiger Reserve, Assam, India and  
Park Manager, Royal Manas National Park, Bhutan**

**August 2014**



**भारतीय वन्यजीव संस्थान  
Wildlife Institute of India**

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**Wildlife Institute of India**

**P.O. Box 18, Chandrabani, Dehradun 248 001, Uttaranchal, India**

**August, 2014**

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Survey Team

## Abstract

This report provides a rapid assessment of the herpetofaunal diversity at the World Heritage site Manas which acts as a transboundary complex for a variety of species. The survey was conducted between 16 June 2014-23 June 2014. In Manas National park (MNP), India we surveyed Mathanguri, Doimari, Kuribeel, Uchila, Lotajhar and Bansbari areas and in Royal Manas National Park (RMNP), Bhutan, we surveyed Manas range and Panbang area.

We used visual encounter search; opportunistic search and pitfall method to document the diversity of herpetofaunal species. Habitats surveyed include semi-evergreen forest, moist mixed deciduous forest, grassland, wetland and marshy areas.

From MNP, we recorded 17 species of amphibians belonging to 13 genera and five families. Record of *Feihyla vittatus*, *Rhacophorus maximus*, *Rhabdophis himalayanus* and *Microhyla butleri* are significant. From RMNP, we recorded 12 species of amphibians belonging to 10 genera. 31% of all the recorded species from RMNP constitute new report for Bhutan. Among amphibians, *Uperodon globulosus* and *Ingerana borealis* are a new addition to Bhutan fauna. Records of *Calotes maria*, *Cnemaspis assamensis*, *Ptyctolaemus gularis*, *Varanus salvator* from RMNP also adds to new records for Bhutan.

Among the recorded species, *Python bivittatus* and *Varanus bengalensis* have been accorded the highest legal protection status, under Schedule I of the Indian Wildlife (Protection) Act, 1972. *Naja naja*, *Ophiophagus hannah* and *Xenochrophis piscator* are listed in Schedule II, while all the other snake species are under Schedule IV of the Act.

Of the recorded species *Varanua bengalensis*, *Melanochelys tricarinata* are under Appendix I of CITES, *Varanus salvator*, *Python bivittatus*, *Hardella thurjii*, *Melanochelys trijuga*, *Indotestudo elongata*, *Ophiophagus hannah*, are listed in Appendix II of CITES. The only amphibian species *Hoplobatrachus tigerinus* is under CITES II and *Xenochrophis piscator* is under Appendix III of CITES.

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## 1. INTRODUCTION

**Manas Tiger Reserve (MTR), Assam:** with a total area of 2837.31 km<sup>2</sup> spans across the districts of Kokrajhar, Chirang, Buxa and Udalguri in north-west Assam. It is located between latitudes 26°30'N to 26°45' N and longitudes 89°45' E to 92°30' E. Manas National Park (26°35'-26°50'N, 90°45'-91°15'E) with a total area of 500 km<sup>2</sup> is the core area of Manas Tiger Reserve. It forms part of the Eastern Himalayan biodiversity hotspot and is a key conservation area in the Jigme Dorji-Manas-Bumdeling conservation landscape in the eastern Himalayan ecoregion (Wikramanayake et al., 2001).

The Reserve is situated in the eastern duars and has extensive bhabar and some terai areas, typical of Himalayan foothills. These terai like tracts are more or less flat. The natural gradient of the land is gently sloping southward. The area along the southern boundary is flatter than the northern parts and get water-logged during the rains. The landscape experiences moist tropical to sub-tropical climate with up to 76% relative humidity.

The mean annual rainfall is 3330 mm. The mean maximum summer temperature is 37°C, and the mean minimum winter temperature is 5°C. To the north, it is separated from Bhutan by the river Manas and its tributaries- Beki and Hakua, while to the west, it is separated from the Buxa Tiger Reserve in West Bengal by the river Sankosh. The area has a unique distinction of being a Natural World Heritage Site, a Tiger Reserve, an Elephant Reserve, Biosphere Reserve and Important Bird Area.

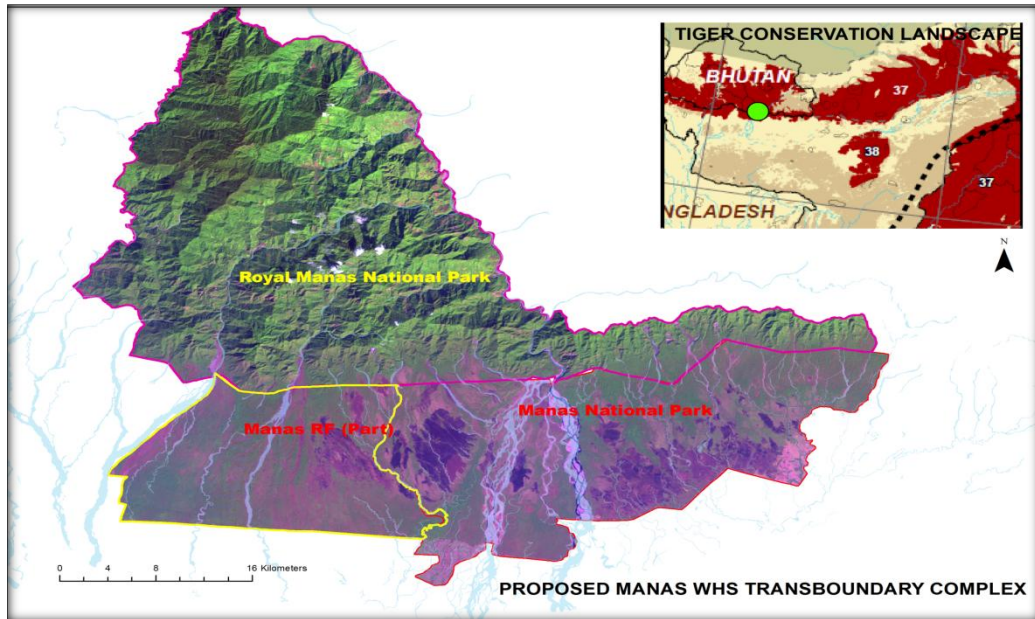
MNP known to harbour 61 species of mammals, 450 species of birds, 79 species of fishes and more than 200 species of butterflies and 100 species of invertebrates.

**Royal Manas National Park (RMNP), Bhutan:** The Royal Manas National Park (1023 sq Km) is the country oldest National Park located in southern Bhutan, that is contiguous to India's Manas Tiger Reserve in the south and Jigme Singye Wangchuck National Park in the North of Bhutan. The RMNP is the most important protected area in the country due to its outstanding unique biological reserves (900 species of plants, 60 species of mammals and 431 species of birds have been recorded) encompassing extremely diverse habitats ranging from grasslands and tropical deciduous forests to alpine meadows and perpetually snow-covered mountain tops in the north and with largest manifestation of sub-tropical forest in the Country.

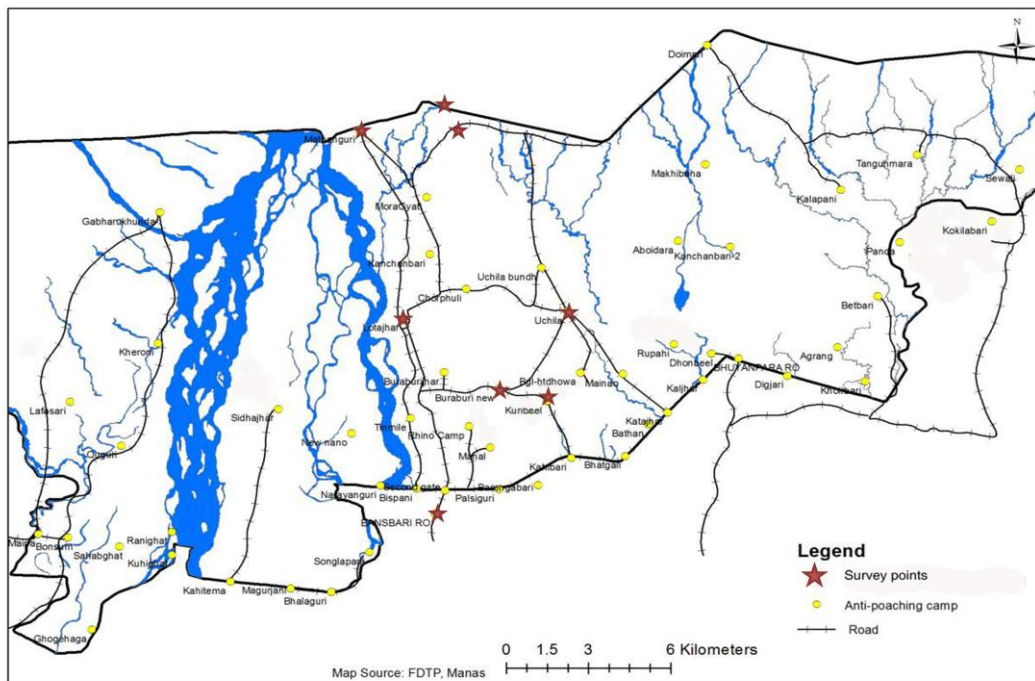
**Literature review:** Scanty information exists on the herpetofauna of Manas landscape. Hitherto no detailed herpetofaunal survey was conducted for this area. Alfred et al., (2006) listed 49 species of herpetofauna without mentioning any basis for these records. Das (1988), Narayan and Rosalind (1989), Das (1990), Bauer et al. (2007) and Ahmed and Das (2010) reported on the turtle fauna of Manas Tiger Reserve.

Herpetofauna of the Himalayan kingdom of Bhutan was dealt with by Biswas (1975), Bustard (1980), Bauer and Gunther (1992), Das and Palden (2000), Delorme and Dubois (2001), Palden (2003), Tillack (2006), Hobcroft and Schulz (2010), Wangyal and Tenzin (2009), Deuti (2010), Wangyal (2011), Wangyal and Gurung (2012a), Wangyal and Gurung (2012b), Wangyal (2012) and Wangyal (2013).

## 2. MAP SHOWING STUDY AREA:



Map 1: Manas and Royal Manas National Park



Map 2: Survey locations in Manas National Park

### **3. METHODOLOGY**

#### **3.1 Survey periods**

Manas National Park: We conducted inventories from 16 June 2014 to 19 June 2014. At Mathanguri (16-17 June 2014), Lotajhar (18 June), Kuribeel (18 June), Doimari (19 June).

Royal Manas National Park: We inventoried the Manas Range on 17 June (1100h -1530 h) and 20-23 June 2014.

#### **3.2 Survey objectives**

The objective of the study was to document species diversity from the representative lowland habitats of Manas- Bhutan trans-boundary landscape within a period of seven field days. In addition to presence records, we collected natural history, microhabitat and reproductive information of recorded taxa. We recorded geo coordinates and latitudinal distributional pattern of the recorded herpetofauna which will enable in understanding the distribution pattern of the herpetofauna of the hill range.

Another objective of the study was to impart hands-on training to the front line forest staff's of the two forest ranges in India and Bhutan part *vis a vis* theoretical class. We showed techniques to conduct visual encounter surveys, acoustic searches, active search method, installing pitfall traps, recording morphometrics and provided training on live snake handling. The preliminary result in this report will add to our hitherto poor understanding of the herpetology of this seemingly hyper-diverse region.

Based on these initial results, we can plan for a long term herpetofaunal surveys and monitoring efforts for this world heritage site and generate operational plans for trans-boundary conservation initiatives.

#### **3.3 Survey Methodology**

We spent seven field days to document the herpetofaunal diversity. In that period we surveyed semi-evergreen forest, secondary forest, mixed deciduous, grassland, and forest habitation edges. We employed visual encounter surveys (Heyer *et al.* 1994; Rödel and Ernst 2004) where we walked within an identified survey site visually searching for amphibian and reptile species. Visual encounter surveys were employed in all terrestrial sites with the effort focused on sampling particular areas which appeared to provide suitable habitat for potentially present species. However, active search involving turning rocks and logs, peeling bark, digging through leaf litter, and excavating burrows and termite mounds also produced good results. For frogs, we conducted acoustic searching along forest trails, forest edges and forest streams, starting from late evening up to 2000-2200 hrs aided by flashlight. During day time we searched for heliothermic (basking) reptiles along forest trails, forest edges and stream sides besides active search method. The aquatic searches involved examining each aquatic habitat (forest streams, sweeps, ephemeral pools and permanent pools).

We employed four pitfall trap arrays, each 25 m long, with 3-4 buckets and drift fences of 0.5 m tall plastic material. Pitfall traps were placed in different local microhabitats (to the extent possible

We made opportunistic observations any time a species was located in an area that was not actively being surveyed. GPS points were recorded at the location of the observation, and some general descriptions of the species and location were made as well.

### **3.4 Data collection**

We collected data for locality, date, time, weather condition, habitat, microhabitat, gender of each (when possible) and reproductive condition of each (if it can be determined), co-existing species if any and behavioural notes were recorded in the field data sheet. We also collected meristic and morphometric data for all individuals captured, and made taxonomic notes. Photographs were taken of representatives of each species and habitats with DSLR using 90 mm macro lens. Geographic coordinates for each survey site were determined in the field with a Garmin GPS receiver. Coordinates were recorded as latitude and longitude in decimal degrees. Identification of species was done using the keys in Smith (1935 and 1943); Schleich & Kästle (2002) and Das (1995). Common English name of herpetofaunal species follows Das & Dutta (1998), Das (2002) and Whitaker & Captain (2004). Status evaluation for the conservation status of herpetofaunal species, we referred IUCN Red List (2014), The Wildlife (Protection) Act 1972, GAA (2000), and Appendices of CITES (CITES 2014). Nomenclature and taxonomic arrangement in the text follow Frost (2014) for amphibian and Das (2003) and Uetz (2014) for reptiles.

Abbreviations used: SVL - Snout Vent length, TL - Tail length, MNP - Manas National Park, RMNP - Royal Manas National Park, asl- above sea level, IUCN- International Union of Conservation of Nature,

**Plate 1: A Glimpse from the Field**



**Figure 1: Demonstrating taxonomic keys for species identification**



**Figure 2: Releasing a Burmese Rock Python during night survey**



**Figure 3: Locating amphibian breeding pools at RMNP, Bhutan.**



**Figure 4: Demonstrating handling and scale count of snakes**



**Figure 5: Putting drift fence along the pitfall in Gharial Pokhari, Manas, India.**



**Figure 6: Putting up pitfall traps at Kuribeel grassland, Manas, India.**

## 4. SPECIES ACCOUNT

### 4.1. AMPHIBIANS

#### **Bufonidae**

*Duttaphrynus melanostictus* (Schneider, 1799)

MNP, Mathanguri, 1 ex (SVL 72 mm), N 26.780312° E 90.956811°4, 16 June 2014, 1940 h, active near forest rest house, 1 ex (SVL 48 mm), 26.77316°, 90.98699° at 116 m elevation 18<sup>th</sup> June, 1910h.

RMNP, Manas Range, Zhemgang District, 4 ex, N 26.782815° E 90.958315°, 16 June 2014, between 2357h to 0015h, calling individual and amplexing pairs along road side waterlogged areas, 21 June 1 ex, juvenile (SVL 55 mm), 1925 h, active along the forest trail of a burnt patch towards Hatilora. Earlier record from Maukhola, RMNP, Sarphang District (Das and Palden, 2000).

#### **Dicroglossidae**

*Euphlyctis cyanophlyctis* (Schneider, 1799)

MNP, Mathanguri, India, 3ex (SVL 44-48 mm), N 26.77481° E 90.99261°, 18 June 2014, 1935 h, seen along a pond (Gharial pukhri) with thick algal growth.

RMNP, Manas Range, Zhemgang district, 1ex. 16 June 2014, 1320h, on a forest trail close to Beki River. Earlier records are from Sarphang, RMNP, Sarphang district, Tshangkha lake, Dagana district, Gelephu, Bhangtar, Samdrup Jongkhar, distributed from 225-1378 m in Bhutan. (Das and Palden, 2000; Wangyal 2013)

*Zakerana pierrei* (Dubois, 1975)

MNP, Kuribeel, India, 1 ex, ♂ (SVL 34 mm), 19 June, 2014, 0900h, N 26.68367° E 91.02661°, elevation 58 m, at wetland-grassland edge.

RMNP, Manas Range, Zhemgang District, Bhutan, 2 ex. (SVL: 32 and 34 mm), 16 June, 2014, 1240 am, along gravel Panbang road. From Bhutan, known from Tshangkka Lake, Dagana district at 1378m elevation (Wangyal, 2013).

*Zakerana teraiensis* (Dubois 1984)

MNP, Mathanguri, India, 1 ex (40 mm), N 26.780312° E 90.956811°, 16 June 2014, 2315h, outside Mathanguri rest house.

RMNP, Manas Range, Zhemgang District, Bhutan, 2 ♂, 2 unsexed (SVL 42mm-47mm), 26.784782°, 90.960007°, 16 June 2014, 0029h, along gravel Mathanguri- Panbang road. In Bhutan known from Gelephu, Sarpang district at 255 m elevation (Wangyal 2013).

*Zakerana nepalensis* (Dubois, 1975)

RMNP, Manas Range, Zhemgang District, 1 ex, ♂ (SVL 28 mm), N 26.784782°, E 90.960007°, 16 June 2014, 2340h, along Mathanguri- Panbang gravel road. In Bhutan known from Ngera Ama Ri in Samdrup Jongkhar district at 356 m elevation (Wangyal 2013).

*Hoplobatrachus tigerinus* (Daudin, 1803)

MNP, Mathanguri, 1 ex, ♂ (SVL 130 mm), N 26.77481° E 90.99246°, 1935h, near pond (Gharial Pukhri); 19 June, 1 ex Juvenile (SVL 33 mm), 1225h, Kuribeel pitfall, N 26.68367° E 91.02661°, elevation 58m.

RMNP, Manas Range, Zhemgang District 1 ex (SVL 147 mm), N 26.793419° E 90.959845°, 17 June 2014. Also recorded from RMNP, Maukhola, Sarphang District (Das and Palden, 2000).

*Ingerana borealis* (Annandale, 1912)

RMNP, Manas Range, Panbang Road, Zhemgang district, N 26.79801° E 90.96329°, 20 June 2014, 2 ex, ♂ (SVL 27 and 31 mm), calling from edges of a first order rocky stream in moist evergreen forest. One individual was found in a seepage area close to a forest stream.

Known from India: Northern West Bengal, Sikkim, Assam, Arunachal Pradesh, Meghalaya, Manipur, Mizoram, and Nagaland, China: Tibet, Nepal: Eastern part, Bangladesh: Cox's Bazaar District, and Myanmar: Chin and Rakhine states (Ao et al., 2003; Devi and Shamungou, 2006; Wogan et al., 2008; Sailo et al., 2009; Ahmed et al. 2009; Hasan et al., 2011, Fei et al., 2012). Frost (2014) included Bhutan in its distribution range without any reference. This study confirms his speculation.

**Microhylidae**

*Microhyla ornata* Duméril & Bibron, 1841.

MNP, Mathanguri, N 26.78004°, E 90.97318°, 1 ex (SVL 24 mm), 17<sup>th</sup> June, 0845h, under leaf litter close to stream; Lotajhar, 26.78159°, 90.95872°, calling aggregation, 19 June, 1940h, from thick leaf litter around waterlogged area in the forest interior.

RMNP, Manas range, Zhemgang District, N 26.79561° E 90.95633°, 1545 h, egg-mass and tadpoles observed in the water puddle, small ponds with thick algal growth, adults observed in the vicinity.

*Microhyla cf. butleri* Boulenger, 1900

MNP, Kuribeel grassland, India, 1 ex (SVL 28 mm), N 26.68367°, E 91.02661°, 18 June 2014, 1500h, Under log in open grassland area near forest antipoaching camp.

In India, known from Assam and Mizoram (Das et al., 2009; Lalremsanga et al., 2007). This species is also known from Southern China from Yunnan and eastern Sichuan to Zhejiang (including Hainan and Taiwan); north-eastern India; Myanmar; Vietnam; Thailand; Malay Peninsula and Singapore (Frost, 2014).

*Micryletta cf. inornata* (Boulenger, 1890)

MNP, Lotajhar, 1 ex (SVL 32 mm), 26.78159°N, 90.95872°E, 19 June 2014, on a rotten tree stump at ca. 10 cm above in the forest interior. The surrounding area was waterlogged and with thick leaf litter. We provisionally kept this taxon under 'innornata'. Similar specimens were also observed in Orang National Park of Assam and may represent an undescribed taxon.

*Uperodon globulosus* (Günther, 1864)

MNP, Songrong road, N 26.77942° E 90.96675°, elevation 87 m, 19 June, 2014, 2030h, calling aggregation along waterlogged forest road. Observed along with *Humerana humeralis* in a heavily raining night.

RMNP, calling aggregation near waterlogged area around Geylongkhola pond, N 26.79433°, E 90.95501°, 1 ex, ♂ (SVL 57mm), in the pitfall trap inside semi-evergreen forest near a pond.

Known from Terai and Central Nepal, Northeastern India (Assam, Arunachal Pradesh), Bihar, West Bengal, Madhya Pradesh, Orissa, Gujarat, Andhra Pradesh, Karnataka and Kerala, Bangladesh. (Choudhury et al., 2002; Daniels, 2005; Schleich and Kastle; 2002, Srinivasulu et al., 2006; Sarker et al., 2012; Frost, 2014). First record for Bhutan.

### **Ranidae**

*Hylarana tytleri* Theobald, 1868

MNP, Bansbari, 1 ex (SVL 38 mm), N 26°42.654'N, E 90°59.847'E, elevation 72 m, 1845 h, near tea garden- forest edge close to habitation. In Assam known from Cachar, Kamrup, Golaghat districts (Dey and Gupta 1999; Das et al., 2009). Also known from Arunachal Pradesh, West Bengal, Orissa, Uttar Pradesh, Northeastern India, Bangladesh and Nepal (Ohler and Mallick 2002). Frost (2014) suggested its possible occurrence in lower elevation of Bhutan.

*Hylarana leptoglossa* (Cope, 1868)

MNP, Lotajhar, 1 ♂ (SVL 48 cm), 1 ♀ gravid (SVL 60 mm), N 26.77859°, E 90.97215°, 17 June 2014, 1920 h, on rock and leaf litter along a slow flowing stream. Calling aggregation on (SVL 48-52 mm), 17 June 2014, 2040 h, Gharial Pukhri, N 26.78051° E 90.96489°.

RMNP, 20 June 2014, Geylongkhola pond, N 26.79435° E 90.955001°, 1920h, calling aggregation in waterlogged areas at forest edges. Also reported from Dungkarling, Phuntshothang, Samdrup Jongkhar, elevation 150 m (Wangyal, 2013). Distributed throughout lowland of Northeast India, Bangladesh, Myanmar and Thailand (Ahmed et al., 2009).

*Humerana humeralis* (Boulenger, 1887)

MNP, Mathanguri, 1 ex (SVL 83 mm), 17 June 2014, N 26.78051° E 90.96489°, elevation 118 m, 2037h, Near Gharial pokhri; 19 June, 1940 h. calling aggregation, 26.77942, 90.96675, elevation 87 m, waterlogged area along the forest road. Four individual measured ranged from 79-87 mm in SVL. In India reported from Nagaland, Assam and Arunachal Pradesh states (Ao et al., 2003; Hussain et al., 2007, Das et al., 2009). Also occurs in Myanmar and Nepal (see Schleich and Kastle, 2002).

### **Rhacophoridae**

*Polypedates teraiensis* (Dubois, 1987)

MNP, Doimari road, 1 ex (SVL 56 mm), N 26.77481° E 90.99261°, 18 June 2014, 1930h, on a plant ca. 1.2 m above; Lotajhar, 1 ex (SVL 50 mm), 19 June 2014, N 26.78159° E 90.95872°, 1940h, calling from understory shrubs around waterlogged forest floor.

*Rhacophorus maculatus himalayensis* Annandale, 1912

MNP, Lotajhar, calling aggregation, N 26.78159°, E 90.95872°, 19 June 2014, 1945h, calling aggregation, individuals calling from underground vegetation or leaf litter at the edges of waterlogged area.

RMNP, Manas Range, Zhemgang District, N 26.79561° E 90.95633°, 17 June 2014, 1621h, 1 ex ♂ (SVL 53 mm), among grass near waterlogged area. Foam nests were found under rocks close to water logged area in Bhutan. Calling aggregation, 500 m away from the beginning of Geylongkhola walking trail, 22 June 2014, 2025 h.

This is a cryptic species that is still considered as a subspecies of the widespread *Polypedates maculatus*. However, its call characteristics and breeding microhabitats are distinct from *P. maculatus* and a detailed taxonomic assessment is under preparation (Saibal Sengupta, Pers. Comm.)

*Rhacophorus maximus* Günther, 1858

MNP, Lotajhar, 1 ex ♀ (SVL 120 mm), N 26.77873°, E 90.97203°, elevation 102 m, 17 June, 1930h. It was sitting on a tree (GBH 1.8 m) at 7 m above a slow flowing stream. In India, the species was reported from Assam, Arunachal Pradesh, Meghalaya, Mizoram, Nagaland (Chanda 1994; Pawar and Birand, 2001; Das et al., 2009) between elevations 30m-1895 m elevation.

*Rhacophorus bipunctatus* Ahl, 1927

RMNP, Manas Range, Zhemgang District, 2 ex, ♂ (SVL 47 and 51 mm), N 26.796061° E 90.948153°, 20 June, 2014, calling from understory lianas ca. 2.5 m above ground around water puddle in semi-evergreen forest interior.

Known from Northeast India (Assam, Arunachal Pradesh, Meghalaya, Manipur, Tripura, Nagaland and Mizoram), Bangladesh, China, Cambodia, Myanmar, Thailand, Malaysia (Ohler et al., 2002, Chan-ard, 2003; Nguyen et al., 2005; Grismer et al., 2006; Stuart, 2005; Devi and Shamungou, 2006; Reza and Mukul, 2009; Fei et al., 2012). This is a new record for Bhutan.

*Feihyla vittata* (Boulenger, 1887)

MNP, Lotajhar, calling aggregation, two ♂ measured (SVL 23 and 25 mm), N 26.78159° E 90.95872°, 19 June, 2014, 1940 h. Among overhanging leaf of understory plants, 2-3 m above submerged leaf litter, one clutch contained 104 eggs; eggs are light green in colour.

In Northeast India this species was reported from Assam, Mizoram, and Nagaland. Also Bangladesh, Myanmar and Thailand through Laos, southwestern Cambodia, and Vietnam, South eastern Xizang, southern China (Deuti and Dutta 2002; Ao et al., 2003; Frost 2014). Bain et al. (2007) observed eggs in foam nest in Vietnam. However, Manas population did not have foam nest.

*Philautus* cf *garo* (Boulenger, 1919)

MNP, Doimari road, 1 ex (SVL 20 mm), N 26.77325° E 90.98694°, elevation 113 m, 18 June, 2014, 2100h, calling from shrub 1 m above ground, in a semi-evergreen patch.

**PLATE 2: Amphibians of MNP and RMNP**



**Figure 7: *Duttaphrynus melanostictus***



**Figure 8: *Euphlyctis cyanophlyctis***



**Figure 9: *Hylarana leptoglossa***



**Figure 10: *Feihyla vittata***



**Figure 12: *Rhacophorus maximus***



**Figure 11: *Rhacophorus bipunctatus***

**Plate 3: Amphibians of MNP and RMNP**



**Figure 13:** *Uperadon globulosus*



**Figure 14:** *Ingerana borealis*



**Figure 15:** *Philautus* sp



**Figure 16:** *Philautus* cf. *garo.*



**Figure 17:** *Zakerana teraiensis*



**Figure 18:** *Hoplobatrachus tigerinus*

**Plate 4: Amphibian of MNP and RMNP**



**Figure 19: *Hylarana tytleri***



**Figure 20: *Polypedates cf. himalayensis***



**Figure 21: *Microhyla ornata***



**Figure 22: *Polypedates teraiensis***



**Figure 23: *Micryletta cf. inornata***



**Figure 24: *Humerana humeralis***

## 4.2. LIZARDS

### Gekkonidae

*Cnemaspis assamensis* Das and Sengupta 2000

RMNP, Manas Range, Zhemgang District, Bhutan, 1 ex ♀, gravid, with two eggs (SVL 35.38 mm, head length 5.1 mm, eye diameter 2.5 mm, eye to snout 3 mm, fore arm length 12 mm, femur 7.1 mm, tibia 6.2 mm, foot length 6.6 mm), N 26.81100° E 090.95676°, 21 June, 2014, 1245h, Elevation 229 m, found on bark of a large tree at 1.5 m above on the way to Panbang.

The species is known from Assam: Mayeng Reserved Forest, Garbhanga reserved forest, Amchang Wildlife Sanctuary, Nilachal hills, Kaziranga National Park, Ultapani reserved forest and Meghalaya: Nongkhellym Wildlife Sanctuary (Das and Sengupta 2000; Sengupta et al., 2000; Das, 2002; Das and Ahmed, 2007; Purkayastha and Das, 2011, pers. Obs.). This is the only known species of day gecko in eastern India. Present record from Bhutan constitutes new country record for the species.

*Hemidactylus platyurus* (Schneider, 1792):

MNP, Bundh road, 1 ex, gravid, ♀ (SVL 61 mm), N 26.77789°, E 90.95881°, 18 June 0830h, under rotten log in mixed deciduous forest floor, with thick undergrowth.

RMNP, Manas Range, Zhemgang District, 1 ex (SVL 55 mm), N 26.79610° E 090.95719°, elevation 147m, 21 June 2014, 1855h, found on tree bark/trunk.

Also known from Serzhong, Mongar dist. 1500-1540 m. Also recorded by Bauer and Gunther (1992) from Phuntsholing, Wangdi Phodrang.

*Hemidactylus frenatus* (Duméril & Bibron, 1836):

MNP, Mathanguri, 1 ex (SVL 48 mm), N 26.782205°, E 90.956929°, 19 June 2014, 1847h, other individuals seen feeding on insects around light sources of rest house wall.

*Hemidactylus brookii* (Gray, 1845)

RMNP, Manas Range, Zhemgang District, 1 ex (SVL 42 mm), N 26.793641° E 90.960772°, 1530h, 21 June 2014, under a boulder at the base of a tree close to range forest office.

Also known from road between Sershong and Gelephu Town and Samchi (Das and Palden 2000; Bauer and Günther 1992).

*Gekko gecko* (Linnaeus, 1758)

MNP, Mathanguri, Barpeta district, 4 ex, N 26.780312° E 90.956811°, 16 June 2014, seen inside the wooden crevices at Manthaguri forest rest house.

RMNP, Manas range, photographic record on a tree by Wangyal (2012).

*Gekko gecko* is the second largest extant gecko species that growing upto 400 mm in length and over 300 g in weight (Manthey and Grossmann, 1997). Tokay geckos are distributed across Cambodia, Indonesia (excluding territory in Borneo and New Guinea), Lao PDR, Peninsular Malaysia, the Philippines, Singapore, Thailand and Vietnam), Southern China, Hong Kong SAR and Northeastern India and Nepal (Das, 2010).

In Bangladesh populations are estimated to have recently declined by 50% as a result of collection for the Novel Medicinal Claims trade (M.H. Khan, in litt). In China, tokay geckos are listed as an endangered species in that country's Red Data Book and population declines have been recorded with over-harvesting for traditional medicine (Zhao, 1998; Chan et al., 2006). Similarly, population declines have also been reported in Java, Indonesia (Anon., 2011a) and north-eastern Thailand. Tokay geckos are considered to be rare in Nepal (Shrestha, 2000) and are listed as a threatened species in Viet Nam's Red Data Book. Recently sporadic cases of *Gekko gecko* trade was recorded from eastern and northeast India and looking at the seriousness and volume of the trade the species was proposed to be included in the Wildlife (protection) act, 1972.

*Cyrtodactylus khasiensis* (Jerdon, 1870):

MNP, Doimari, Assam, India, 1 ex (SVL 62 mm), N 26.77481° E 90.99261°, 18 June 2014, 1940h, elevation 99 m, on shrub ca. 1.5 m above ground; Doimari, 1 ex (SVL 29 mm), N 26.78442° E 90.99874°, elevation 131 m, 19 June, 2014, 0930h, found under rocks 3 m away from stream.

RMNP, Manas Range, Zhemgang District, 1 ex (SVL 38 mm), N 26.79546° E 90.95764°, found under abandoned tin shed lying on the ground near range office; 1 ex (SVL 65.3 mm), 1055 h, 21 June 2014, found under rock near Panbang road side slope; 1 ex (SVL 62 mm), N 26.80963°, E 90.95667°, elevation 202 m, 1320 h, under rotten log of a burnt patch; 1 ex (SVL 64 mm), 22 June, 2014, 2155 h, found on tree bark at 1.5 m above ground. 3 ex, among low vegetation 1-2.5 m above ground along Hatilora trail.

Earlier record from RMNP, Sershong, Sarphang District, inside rotting tree trunk (Das and Palden, 2000).

## Agamidae

*Ptyctolaemus gularis* (Peters, 1864)

RMNP, Manas Range, Zhemgang District, 1 ex ♀, (SVL 78 mm TL 179 mm), N 26.79355°, E 90.94133°, 22 June, 2014, 2015h, found sleeping on a dry branch of understory plant, approximately 1.5 m above ground, semi-evergreen forest, burnt understory.

Distributed in Myanmar, Northeast India, Bangladesh and Tibet (Das, 2010). First record for Bhutan.

*Calotes versicolor* (Daudin, 1802):

MNP, Mathanguri, 1 ex ♂ (SVL 72 mm) N 26.77789° E 90.95881°, 17 June 2014 0830h, on bush at 1 m above ground near forest trail; 1 ex, ♀ (SVL 90 mm), 18 June 2014, 1350h, on roadside vegetation near Songrang river; Pagli doha, 1 ex, (SVL 103 mm), 19 June 2014, N 26.77558° E 90.96212°, 1350 h, basking among vegetation at 1.5 m height along forest road; 17 June 2014, 0921h, 1 ex, ♂ near forest rest house; 18 June 2014, 0830h, 1 ex, ♀ (SVL 76 mm), 26.77789°, 90.95881°, roadside vegetation; 18 June, 1 ex, ♀ (SVL 90 mm), 1350 h.

RMNP, Manas Range, Zhemgang District, 1 ex, gravid ♀ (SVL 81 mm), 16 June 2014 at 1145 h, sleeping on a dry branch at 1 m above along roadside slope, 1 ex ♂ (SVL 78 mm),

1320h, among forest roadside vegetation. RMNP, Manas Range, Zhemgang district, Hatilora trail, 4 ex (SVL 32-44 mm), 22 June 2014, all juveniles found sleeping on the branch of dry shrubs along forest trail, 22 June, 2010 h, 1 ♀ (SVL 87 mm), sleeping on branch at 1.5 m above.

Earlier records are from Sheripam, Mongar district, Wangdiphodrang, Samdrup Jongkhar, Gelephu town, Sarpang district, Phuntsholing, Bale Jhura, Wangdi Phodrang (Biswas, 1975; Bauer & Gunther 1992, Das & Palden, 1999).

*Calotes maria* Gray, 1845

RMNP, Manas Range, Zhemgang district, 1 ex, ♀ (SVL 88 mm, TL 275 mm), N 26.78355° E 90.93120°, 22 June 2014, 2100 h, Approximately 2 m above ground, sleeping on a branch, about 10 m away from a evergreen forest stream.

Known from Khasi Hill, Meghalaya and Garbhanga Reserved Forest, Assam (Smith, 1935, Sengupta et al., 2000)

*Japalura variegata* Gray, 1853

RMNP, Manas Range, Zhemgang District, Bhutan, 1 ex (SVL 62 mm), N 26.79546° E 090.95764°, 20 June, 2014, 1250h, on forest floor close to a rocky area, elevation 138 m; 21 June 2014, Hatilora trail, 2005 h, 1 ex ♂ (SVL 73 mm); 22 June, 2014, 2010 h, 1 ex ♀ (SVL 65 mm) sleeping on the branch.

Earlier records from Phuntsholing, Batase, Bumdeling wildlife sanctuary head office, Serzhong Range office, Monger district (Biswas, 1975; Bauer and Gunther, 1992; Wangyal, 2011).

Hora 1926 & Smith (1935) reported this species from 330-2970 m. The recorded specimens showed similarity with *Japalura bengalensis* that was described from Buksa Duars by Annandale (1906) and currently considered as a synonym of *Japalura variegata*.

**Scincidae**

*Sphenomorphus maculatus* (Blyth, 1853)

MNP, Mathanguri, Pagli Doha, 1 ex, ♂ (SVL 55 mm, TL 89 mm ), N 26.77558° E 90.96212°, elevation 95m, found in pitfall trap at mixed deciduous forest edge.

RMNP, Manas Range, Zhemgang District, 1 ex, ♂ (SVL 55 mm, TL 60 mm), N 26.79801° E 090.96329°, 21 June, 2014, 0955 h, found under the rocks in a flowing stream on way to Panbang at 170 m. Also reported by Wangyal (2012) from Manas forest range.

*Lygosoma albopunctata* (Gray, 1846)

MNP, Mathanguri, Barpeta district, India, 18 June, 2014, collected from an old building near Mathanguri IB; 1 ex, 18 June, 2014, 0920h, N 26.77590° E 90.96111°, juvenile individual, juvenile, under a rock at forest grassland edge. India, MNP.

*Eutropis dissimilis* (Hallowell, 1857)

MNP, Mathanguri, 1 ex (SVL 64 mm TL 48 mm), N 26.77558° E 90.96212°, 19 June, 2014, 1350h, basking on leaf at 50 cm above among roadside vegetation on road side at Pagli Doha;

One of the most widely distributed species of Skink in South Asia from Eastern Afghanistan, Pakistan, Kashmir, Punjab, Bihar, Madhya Pradesh, West Bengal Bihar and Rajasthan, Nepal, India, Bangladesh, Myanmar.

Bauer et al. (2008) reported it from Manas National Park and also opined that the species may also occur in Bhutan part at least in the immediately adjacent Royal Manas National Park.

### **Varanidae**

*Varanus bengalensis* (Daudin, 1802):

MNP, Mathanguri, India, 17 June, 2014, 0921h, N 26.73020° E 90.99769°, crossing forest road near a mixed deciduous patch; 18 June, 2014, 1313 h, N 26.69748° E 90.99828°, crossing road at Kuribeel grassland, 19 June, 2014, 1300 h seen on forest road near Bura-buri area. It climbed a roadside *Ficus* tree for refuge.

RMNP, Not recorded in this survey. Bauer and Gunther (1992) recorded it from Phuntsholing.

*Varanus salvator* (Laurenti, 1768)

RMNP, Manas Range, Zhemgang District, 1 ex, N 26.796061° E 90.948153°, 20 June 2014, found in a small waterlogged puddle in the semi-evergreen forest interior.

Known from Sri Lanka, India, southern China, Myanmar, Thailand, Laos, Cambodia, Vietnam, Peninsular Malaysia, Singapore, Sumatra, Indonesia, Java, Lesser Sundas and Bali. This widely distributed species is represented by four subspecies (Das 2010) and Indian and South China population is referred to *Varanus salvator macromaculatus*.

This is a new addition to the herpetofauna of Bhutan.

**Plate 5: Lizards of MNP and RMNP**



**Figure 25: *Calotes maria***



**Figure 26: *Gekko gecko***



**Figure 27: *Cyrtodactylus khasiensis***



**Figure 28: *Hemidactylus platyurus***



**Figure 29: *Japalura variegata* (female)**



**Figure 30: *Japalura variegata* (male)**

**Plate 6: Lizards of MNP and RMNP**



**Figure 31:** *Cnemaspis assamensis*



**Figure 32:** *Ptyctolaemus gularis*



**Figure 33:** *Eutropis dissimilis*



**Figure 34:** *Sphenomorphus maculatus*



**Figure 35:** *Lygosoma albopunctata*



**Figure 36:** *Lygosoma albopunctata* (Juvenile).

### 4.3 SNAKES

#### Typhlopidae

*Indotyphlops braminus* (Daudin, 1803)

MNP, Mathanguri, Barpeta District, Assam, India, 1 ex (SVL 150mm), 26.77590°N, 90.96111°E, 18 June 2014, 0930 h, Under rock of a forest open grassland edge.

RMNP, Manas Range, Zhemgang District, 1 ex (SVL 144 mm.), 26.79546° N, 90.95764° E, 20 June 2014, 1330 h., under abandoned tin sheet near range office, Earlier records from Bhutan includes College campus, Punakha district and Samchi, Phuntsholing (Wangyal 2012; Bauer and Gunther 1992). In Bhutan recorded up to 1406 m asl. A parthenogenetic species that established itself to subtropical and tropical parts of Asia (Das 2002; Whitaker & Captain 2004)

#### Pythonidae

*Python bivittatus* Kuhl, 1820

MNP, rescued from fringe area and released near Songrong stream, Mathanguri, 1 ex ♂ (~1.5 m). Earlier records (27 December, 2006 and 8 March 2007) are from Bhuyapara range, Buraburi camp.

RMNP, Manas Range, Zhemgang District, Not recorded during this survey. Harris et al., (1964) reports Python as common inhabitants of duar plains of Bhutan. This species was reported from Gortey and Kanamakura at 245 m in Sarpang district by Wangyal (2012).

#### Colubridae

*Boiga gokool* (Gray, 1835)

RMNP, Manas Range, Zhemgang District, Bhutan, 1 ex (SVL 610 mm, TL 163 mm, V 221, SC 108 ), preserved specimen in the collection in Manas Range office, fed on *Calotes* cf. *versicolor*.

Little is known about the natural food of *B. gokool*. Greene (1989) summarized the sparse information given by Shaw et al., (1941, 1999) and Wall (1910) who reported a mouse as stomach content. A specimen examined from Sylhet (MCZ R58261) contained a juvenile *Calotes* sp. In captivity *Boiga gokool* fed on *Hemidactylus frenatus*, *Hemidactylus platyurus* and juvenile *Calotes versicolor* (personal observation).

*Boiga gokool* is a South Asian endemic species and known with certainty only from India and Bangladesh. In India, *Boiga gokool* is reported with certainty from Arunachal Pradesh, Assam, Manipur, Meghalaya, Nagaland and West Bengal. In Bangladesh *Boiga gokool* is known from Divisions of Khulna, Sylhet, and Chittagong. No explicit record of the species exists from Myanmar (Das et al., 2010). An addition to the herpetofauna of Bhutan.

*Boiga siamensis* Nutaphand, 1971

RMNP, Manas Range, Zhemgang District, 1 ex, ♀ (SVL 1260 mm, TL 390 mm), preserved specimens in the collection in Manas Range office, Chick ingestro, was killed inside human habitation; 1 ex ♂ (SVL 1400 mm TL 405 mm, V 251, MSR 23, A 1, SC 121), preserved specimen, it was killed near human reported to be killed from near Manas Range office.

Known from Arunachal Pradesh, Assam, Meghalaya, Nagaland, Sikkim Northern West Bengal (Sclater, 1891; Wall, 1909; Wall, 1910; Wall, 1924; Smith, 1943; Kroon, 1973; Sclater, 1891; Mathew, 1992; Mathew, 1995; Captain and Patel, 1997; Swan and Leviton, 1962; Jha and Thapa, 2002; Chettry and Bhupathy, 2007; Inglis et al., 1920; Shaw et al., 1941; Ahmed and Dasgupta, 1992; Whitaker and Captain, 2004; David and Mathew, 2005; Borang et al., 2005; Sanyal and Gayen 2006; Dasgupta and Raha, 2006; Bhupathy, 2007).

*Boiga ochracea* (Günther, 1868)

RMNP, Manas Range, Zhemgang District, 1 ex (SVL 580 mm, TL 166 mm), 1815h, near a rocky stream among stream-side vegetation, about 2.5 m above ground; 1 ex, 1845h, crossing a gravel road close to a landslide area ~ 1 km away from Indian Manas part. Both individual were active while it was raining.

Known from Assam, Arunachal Pradesh, Meghalaya, Sikkim, Darjeeling (Schleich and Kästle, 2002; Whitaker and Captain, 2004; Günther, 1868; Sclater, 1891; Wall, 1924; Smith, 1943; Captain and Patel, 1997; Borang et al., 2005; Athreya, 2006; Sanyal and Gayen 2006; Pawar and Birand 2001; Swan and Leviton, 1962; Tillack, 1999; Jha and Thapa, 2002; Chettry and Bhupathy, 2007; Wall, 1909; Inglis et al., 1920; Shaw et al., 1941; Smith, 1943; Swan and Leviton, 1962; Ahmed and Dasgupta, 1992).

Earlier records from Phuntsholing, Serzhong, Mongar dist, elevation 1766 m, recorded from maize field (See Tillack, 2006; Wangyal, 2011).

*Boiga ochracea* is currently regarded as a species complex. Orlov and Ryabov (2002) recognized three subspecies [*Boiga ochracea ochracea* (Günther 1868), *Boiga ochracea stoliczkae* (Wall, 1909) and *Boiga ochracea walli* Smith 1943]. A re-examination of specimens throughout the range of the species revealed that south of Brahmaputra forms have 19 DSR at midbody and northern population has 21 DSR. So, Smith's subspecies 'walli' is a subjective junior synonym of *Boiga ochracea*. So we have two form: a northern *Boiga ochracea stoliczkae* and a southern *Boiga ochracea ochracea*. Both forms are distinguished by its DSR count 19 in *B. o. ochracea* and 21 in *B. o. stoliczkae*. Nepal, Bhutan and Western Arunachal Pradesh population comes under the later form.

*Boiga cyanea* (Duméril, Bibron & Duméril, 1854)

MNP, not recorded during this survey. Our earlier survey recorded it from Ultapani Reserved Forest at the fringe of Manas Tiger Reserve. In India, known from Assam, Arunachal Pradesh, Meghalaya, Sikkim, Darjeeling (Whitaker and Captain, 2004; Borang et al., 2005; Sclater, 1891; Wall, 1924; Smith, 1943; Das, 2009; Wall, 1908; Mathew, 1992, 1995; Jha and Thapa, 2002; Schleich and Kästle, 2002; Stoliczka, 1871; Wall 1909; Shaw et al., 1941; Chettri and Bhupathy, 2007).

RMNP: Not recorded during this survey. Tillack (2006) showed that specimens collected from Phuntsholing, elevation 200-400 m and mentioned as *Boiga ochracea ochracea* by Bauer and Gunther (1992) in fact represented *Boiga cyanea*. Wangyal (2011) reported highest elevational distribution (1929 m) for the species from Bumdeling Wildlife Sanctuary, Shingdogor, Sherimung, Mongar district.

*Ptyas korros* (Schlegel, 1837)

RMNP, Manas Range, Zhemgang District, 1 ex, ♂ (SVL 980 mm, TL 400 mm), N 26.796043° E 90.948113°, 20 June 2014, roosting at a height of 1.5 m among thick bush, about 50 m away from a forest trail.

Other record of the species is from Bumdeling Wildlife Sanctuary, Rollong, Trashi gang district, elevation 694 m. Juvenile recorded in the month of November (Wangyal, 2011).

*Rhabdophis himalayanus* (Günther 1864)

MNP, Lotajhar, India, 1 ex, ♂ (SVL 504 mm, TL 190 mm), N 26.78169° E 90.95872°, 19 June 2014, 2030h, found roosting on a shrub at 2 m height near an amphibian breeding spot. It regurgitated one *Polypedates* cf. *himalayensis* after capture.

RMNP, Bhutan, 1 ex, ♀ (SVL 704 mm, tail incomplete.) preserved specimen, 23 June, 2014, reported to be collected from near range office. Also known from Bumdeling Wildlife Sanctuary, Tingtibi, Zhemgang district at 1945 m elevation (Wangyal, 2011).

*Xenochrophis piscator* (Schneider, 1799):

MNP, Uchila Grassland area, 1 ex (SVL 550, TL 230 mm), N 26.77300° E 90.96071°, 17 June 2014, 0750h, among moist grass near a slow flowing first order stream.

RMNP: Not recorded in this survey. Bauer and Gunther (1992) recorded it from Phuntsholing.

*Lycodon jara* (Shaw, 1802)

MNP, Mathanguri, Barpeta district, India, 1 ex (SVL 420 mm, TL 80 mm), 18 June, 2014, 2314h, found inside an old abandoned house near Mathanguri Forest rest house.

RMNP: Not recorded in this survey. Known from Gelephu town, Sarpang district at elevation 255m (Wangyal, 2012).

*Chrysopelea ornata* (Shaw, 1802)

RMNP, Manas Range, Zhemgang District, 1 ex ♀ (SVL 740 mm, TL 275 mm, V 214, A 1, SC 116), 17 June 2014, 1040 h, N26.79561° E90.95633°; gravid female (SVL 1050 mm, TL 330 mm), preserved specimen, range office of Royal Manas National Park.

Also known from RMNP, Range office, at elevation 124 m (Wangyal 2012).

*Psammodynastes pulverulentus* (Boie, 1827)

RMNP, Manas Range, Zhemgang District, 1 ex (SVL 435 mm, TL 92 mm), N 26.79801° E 090.96329°, 21 June 2014, 1005 h, on stream-side boulder covered in herbaceous vegetation, wet evergreen forest.

Das and Palden (2000) recorded a gravid female (383 mm, TL 80 mm) containing three neonates in the month of July from Sershong, Sarphang district from the edge of a secondary forest at 15 m from a hill stream.

The species is distributed in Assam, Arunachal Pradesh, Mizoram, Meghalaya, Uttar Pradesh, Northern West Bengal, Northern Orissa, Northern Andhra Pradesh (Ahmed et al., 2009; Das

et al., 2010; Mohapatra et al., 2010). Also known from Nepal, South China, Southeast Asia (Smith, 1943; Swan and Leviton, 1962; Zhao and Adler, 1993).

### **Elapidae**

*Ophiophagus hannah* (Cantor, 1836)

MNP, Not recorded during this survey. Previous reports of the species are from Bansbari, Kasimdaha and the Kuribeel grassland of Manas National Park (Narayan and Rosalind, 1989).

RMNP, Manas Range, Zhemgang District, present record of the species is based on a skin shed obtained from near Range office. The area is open with scattered tree with thick ground cover.

Other records from Bhutan include Gomkora, Trashiyangtse district and Khoma, Lhuentse district. Juvenile obtained in September. Also reported by Biswas (1975) from Manas Valley.

### **Viperidae**

*Trimeresurus popeiorum* Smith, 1937

RMNP, Manas Range, Zhemgang District, 1 ex ♂ (SVL 357 mm, TL 85 mm, V 167, Subcaudals 71, 1 scales between supra oculars:, inter-nasals separated by one scale, 10/10 supralabials, 1st supralabial separated from nasal completely, 3<sup>rd</sup> touches eye; 4 and 5 separated by 1 row of scales 13/13 infralabials, post-ocular stripe red above and white below), N 26.79356°, E 90.94173°, Elevation: 156 m, 22 June, 2130 h, on a tree among leaf at 3 m above near a seasonal stream.

In India this species is reported from Sikkim, Darjeeling, Meghalaya (Smith, 1943; Regenass and Kramer 1981; Ahmed and Dasgupta 1992), Arunachal Pradesh, Mizoram, Assam (A. Captain, S. Sengupta and A. Das unpublished). Also known Myanmar, Northern Laos, northern and western Thailand (Vogel et al. 2004; Das, 2010; Whitaker and Captain, 2004). First record of the species from Bhutan.

**Plate 7: Snakes of MNP and RMNP**



**Figure 37:** *Lycodon jara*



**Figure 38:** *Psammodynastes pulverulentus*



**Figure 39:** *Ptyas korros*



**Figure 40:** *Boiga ochracea*



**Figure 41:** *Rhabdophis himalayanus*



**Figure 42:** *Trimeresurus popeiorum*

**Table 1: Herpetofauna recorded from Manas National Park, Assam, India**

Species	Common Name	Microhabitat	IUCN	WLPA
<b>Amphibians</b>				
<i>Duttaphrynus melanostictus</i>	Common Asian Toad	near forest rest house, along trail	LC	NL
<i>Euphlyctis cyanophlyctis</i>	Indian skipping frog	Ponds, waterlogged area	LC	Sc IV
<i>Zakerana teraiensis</i>	Terai Cricket frog	ground vegetation along forest road	LC	NL
<i>Zakerana pierrei</i>	Pierre's Cricket Frog	moist grasses near human habitation	LC	NL
<i>Hylarana leptoglossa</i>	Assam forest frog	near water puddle, pond	LC	Sc IV
<i>Hylarana tytleri</i>	Leaf Frog	aquatic plants at forest edge	LC	Sc IV
<i>Humerana humeralis</i>	Bhamo frog	along waterlogged forest road	LC	Sc IV
<i>Hoplobatrachus tigerinus</i>	Indian Bull frog	grassland-wetland edge (Pitfall)	LC	Sc IV
<i>Microhyla ornata</i>	Ornate narrow Mouth Frog	leaf litter near waterlogged forest interior	LC	NL
<i>Microhyla butleri</i>	Butler's Pigmy Frog	Under log of open grassland	LC	NL
<i>Micryletta cf. inornata</i>	False Narrow-mouthed Frog	rotten tree stump, forest understory	LC	NL
<i>Uperodon globulosus</i>	Balloon frog	along waterlogged forest road	LC	NL
<i>Feihyla vittatus</i>	Two Striped Pigmy Tree Frog	on leaf around waterlogged forest interior	LC	NL
<i>Polypedates teraiensis</i>	Terai Tree frog	on shrub; ca. 1 m above the ground	NA	NL
<i>Polypedates cf. himalayensis</i>	Himalayan Tree Frog	along waterlogged forest interior	NA	NL
<i>Rhacophorus maximus</i>	Large tree frog	tree at 5.6 m height	LC	NL
<i>Philautus cf. garo.</i>	Garo Hill Bush Frog	on fern, at 3 feet above ground		
<b>Lizards</b>				
<i>Calotes versicolor</i>	Common garden lizard	branch, leaf above ground	NA	NL
<i>Cyrtodactylus khasiensis</i>	Bent Toed Gecko	tree bark, dry branch, under rock	NA	NL
<i>Eutropis dissimilis</i>	Striped grass skink	Leaf litter along forest road	NA	NL
<i>Eutropis macularia</i>	Bronze Grass Skink	Leaf litter along forest road	NA	NL
<i>Sphenomorphus maculatus</i>	Spotted litter Skink	Pitfall at Moist deciduous forest edge	NA	NL
<i>Hemidactylus platyurus</i>	Flat tailed gecko	under rotten log; mixed deciduous forest	NA	NL
<i>Hemidactylus frenatus</i>	Asian House Gecko	Rest House Wall	NA	NL
<i>Gekko gekko</i>	Tokay Gecko	Rest House crevices	NA	NL
<i>Varanus bengalensis</i>	Bengal Monitor	forest road near grassland; <i>Ficus</i> tree bark	LC	Sc I
<i>Lygosoma albopunctata</i>	White spotted Supple Skink	under hay inside abandoned house	NA	NL
<b>Snakes</b>				
<i>Indotyphlops brahminus</i>	Brahminy Blind Snake	under rocks, tin shed, loose soil	NA	Sc IV
<i>Python bivittatus</i>	Burmese Rock Python	grassland, near river	VU	Sc I
<i>Rhabdophis himalayanus</i>	Himalayan Keelback	understory shrub ca. 2 m above	NA	Sc IV
<i>Lycodon jara</i>	Twin Spotted Wolf Snake	Inside abandoned house	LC	Sc IV
<i>Xenochrophis piscator</i>	Checkered Keelback	Near small stream	NA	Sc II
<i>Ophiophagus hannah</i>	King Cobra	Grassland, Wetland	VU	Sc II
<i>Naja naja</i>	Spectacled Cobra	Grassland near forest road	NA	Sc II

**Table 2: Herpetofauna recorded from Royal Manas National Park, Bhutan**

Species	Common Name	Microhabitat	IUCN
<b>Amphibians</b>			
<i>Duttaphrynus melanostictus</i>	Common Asian Toad	Slow flowing water along road, forest trail	LC
<i>Zakerana nepalensis</i>	Nepal Cricket Frog	slopes along gravel road	LC
<i>Zakerana teraiensis</i>	Terai Cricket Frog	Seasonal pool, forest trail	LC
<i>Zakerana pierrei</i>	Cricket frog	Roadside habitat	LC
<i>Microhyla ornata</i>	Ornate Narrow Mouth Frog	Among moist grass	LC
<i>Uperodon globulosus</i> +	Indian Balloon Frog	Waterlogged areas	LC
<i>Hoplobatrachus tigerinus</i>	Indian Bull frog	aquatic edge of seasonal pool	LC
<i>Hylarana leptoglossa</i>	Assam Forest Frog	Waterlogged areas along forest edges	LC
<i>Ingerana borealis</i> +	Trickle Frog	Forest stream edges and seepage areas	VU
<i>Polypedates teraiensis</i>	Terai Tree Frog	on bushes and shrubs around waterlogged area	NA
<i>Polypedates himalayensis</i>	Himalayan Tree Frog	Under rock, leaf litter along seasonal water pool	NA
<i>Rhacophorus bipunctatus</i> +	Twin spotted Tree frog	On lianas in forest interior	LC
<i>Philautus</i> sp	Bush Frog	On leaf forest interior	
<b>Lizards</b>			
<i>Calotes versicolor</i>	Common garden lizard	branch at ~1.5 m above	NA
<i>Calotes maria</i> +	Gray's forest lizard	branch 2 m above ground, near stream	NA
<i>Japalura variegata</i>	Variiegated Mountain Lizard	leaf litter near rocky patch, dry branch	LC
<i>Ptyctolaemus gularis</i> +	Blue fan-throat lizard	dry branch, approximately 1.5 m above ground	NA
<i>Sphenomorphus maculatus</i>	Spotted litter skink	under moss covered rocks of streambed	NA
<i>Cnemaspis assamensis</i> +	Assamese Day gecko	tree bark, ca. at 1.6 m height	NA
<i>Hemidactylus platyurus</i>	Flat tailed gecko	tree bark at 1 m height	NA
<i>Hemidactylus brookii</i>	Brook's House Gecko	Under rock near range office	NA
<i>Cyrtodactylus khasiensis</i>	Khasi Hill Bent-toad Gecko	under rock, rotten log, on shrubs	NA
<i>Varanus salvator</i> +	Water Monitor	Water puddle inside forest	LC
<b>Snakes</b>			
<i>Indotyphlops braminus</i>	Brahminy blind snake	Under tin sheet on the ground	NA
<i>Psammodynastes pulverulentus</i>	Mock viper	Bush along the stream	NA
<i>Ptyas korros</i>	Indo Chinese Rat Snake	Among thick bushes at 2 m above	NA
<i>Boiga siamensis</i> +	Siamese cat snake	Human habitation near forest edge	NA
<i>Boiga gokool</i> +	Eastern cat snake	No data	NA
<i>Rhabdophis himalayanus</i>	Himalayan keelback	Open grassy area near habitation	NA
<i>Crysopelea ornata</i>	Ornate flying snake	Thatched house forest edge	NA
<i>Ophiophagus hannah</i>	King Cobra	edge of semi-evergreen forest	VU
<i>Trimeresus popeiorum</i> +	Pope's Pit Viper	branch at ~3 m above near a seasonal stream	LC

**Annotation:** “+ “ indicates new addition to the Herpetofauna of Bhutan.

LC - Least Concern, NA - Not Assessed, , VU - Vulnerable, in IUCN assessment

Sc I, Sc II, Sc IV, NL: Schedule I, Schedule II, Schedule IV and Not Listed respectively in of Indian Wildlife (Protection) act

## 5. DISCUSSION

From MNP we recorded 17 species of amphibians belonging to 13 genera and five families, viz., Bufonidae (1 species), Dicroglossidae (4 species), Ranidae (3 species), Microhylidae (4 species) and Rhacophoridae (5 species). 10 species of lizards recorded belonging to 8 genera and four families, viz., Agamidae (1 species), Gekkonidae (4 species), Scincidae (4 species) and Varanidae (1 species). Snakes were represented by 7 species belonging to 7 genera viz., Typhlopidae (1 species), Pythonidae (1 species), Colubridae (3 species) and Elapidae (2 species).

The families Bufonidae, Typhlopidae, Viperidae and Pythonidae are represented by one species each viz., *Duttaphrynus melanostictus*, *Indotyphlops brahminus*, *Trimeresurus popeiorum* and *Python bivittatus* respectively. Records of poorly known forest species such as *Feihyla vittatus*, *Rhacophorus maximus*, *Microhyla butleri*, *Lycodon jara*, *Rhabdophis himalayanus* etc., from MNP is of significance. *Micryletta cf inornata* is probably an undescribed taxon found in this survey. Bush frogs of the genus *Philautus* were conferred to its closely related species, and one skink species could not be identified. The positive identification of these species will need additional studies. *Polypedates maculatus himalayensis* and *Cyrtodactylus khasiensis* encountered during the survey are regarded as members of cryptic species complexes. Among the recorded species, *Python bivittatus* and *Varanus bengalensis* have been accorded the highest legal protection status, under Schedule I of the Indian Wildlife (Protection) Act, 1972. *Naja naja*, *Ophiophagus hannah* and *Xenochrophis piscator* are listed in Schedule II while all the other snake species are included under Schedule IV of the Act.

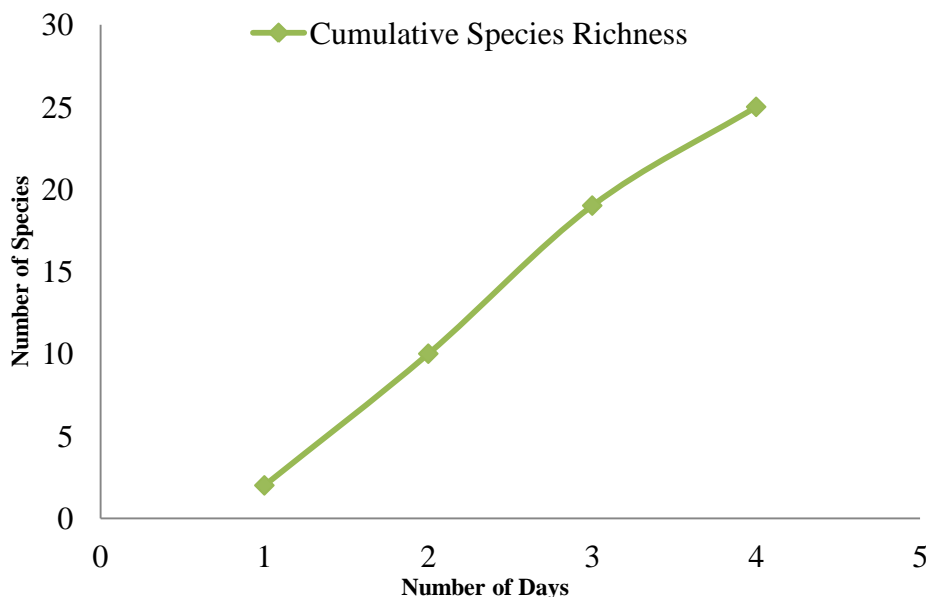


Figure 43: Species accumulation curve for MNP

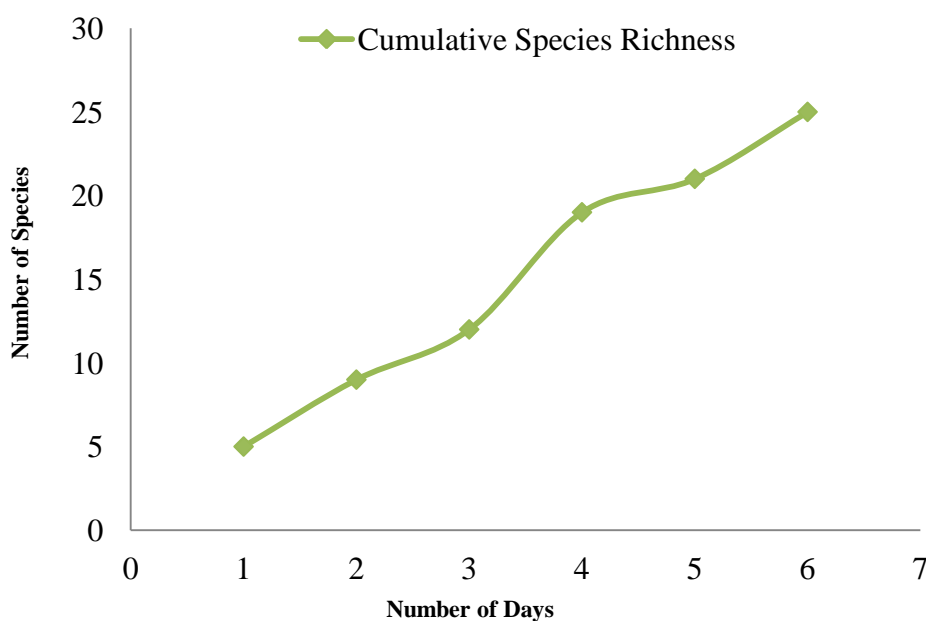
Manas National Park is known to be the habitat of turtles such as *Cuora amboiensis* (Vulnerable), *Melanochelys tricarinata* (Vulnerable), *Melanochelys trijuga* (near threatened), *Indotestudo elongata* (Endangered), *Pangshura sylhetensis* (Endangered) and *Pangshura smithii* (near threatened).

Habitat patches at Lotajhar and Doimari inside Manas National Park were found to be particularly rich in forest species whereas grassland-wetland areas such as Kuribeel under Bansbari Range were identified as critical turtle habitat in the park.

No chelonian fauna was recorded during this survey. However, Ahmed and Das (2010) recorded *Indotestudo elongata* (Endangered) from Kalamati, *Cuora amboiensis* (Vulnerable) from Seed Farm, *Hardella thurjii* (Vulnerable) from Amlaitenga, *Melanochelys tricarinata* (Vulnerable) from Kalamati areas of Manas Tiger Reserve. Das (1988) reported six species of turtles viz *Cuora amboiensis*, *Melanochelys tricarinata*, *Melanochelys trijuga*, *Pangshura smithii*, *Pangshura tentoria* and *Pangshura sylhetensis* from Manas Tiger Reserve.

Alfred et al. (2006) listed 34 reptiles and 15 amphibian species from Manas National Park. However, they did not provide any locality or source of these records. The list includes species such as *Manouria emys* (distributed south of river Brahmaputra), *Japalura andersoniana* (Dafla Hill endemic), *Macropisthodon plumbicolor* (not known from Northeast India) and *Ptyas nigromarginatus* (high altitude species) that are unlikely to occur in Manas National Park.

In RMNP, we recorded 12 species of amphibians belonging to 10 genera. All recorded species of amphibians were anurans belonging to families Bufonidae (1 species), Dicroglossidae (5 species), Microhylidae (2 species) and Rhacophoridae (4 species). Lizards were represented by 10 species and 8 genera belonging to four families viz., Agamidae (4 species), Gekkonidae (4 species), Scincidae (1 species), Varanidae (1 species). Snakes fauna of RMNP represented by 9 species belonging to 8 genera and four families namely Typhlopidae (1 species), Colubridae (6 species), Elapidae (1 species) and Viperidae (1 species).

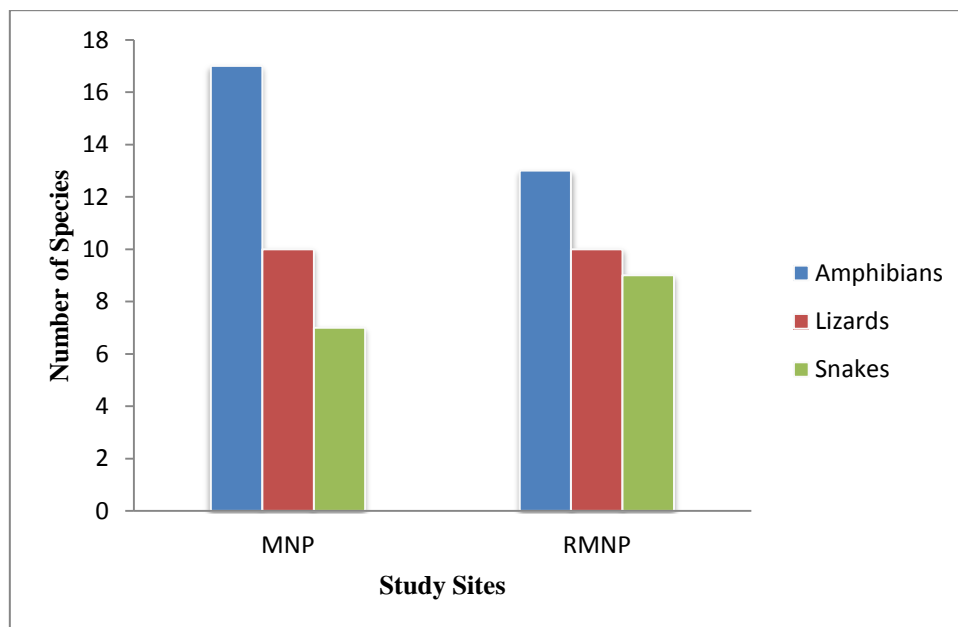


**Figure 44: Species accumulation curve for RMNP**

31% of all recorded species from RMNP constitute new report for Bhutan. Among amphibians, *Uperodon globulosus* and *Ingerana borealis* are the new addition to Bhutan fauna. Records of *Calotes maria* which is recorded from Meghalaya and Assam is reported in this survey and provides a new country record of the species from Bhutan. Also *Cnemaspis assamensis*, the only day gecko so far known from Northeast India is reported from Bhutan boundary for the first time. Nearest record of the species is from Ultapani Reserved Forest (pers. Obs.). Record of *Ptyctolaemus gularis*, *Varanus salvator* from RMNP also adds to the new country record for Bhutan.

Our examination of the preserved specimen kept at RMNP range office also revealed first country report for two cat snake species namely *Boiga gokool* and *Boiga siamensis*.

The reptile diversity recorded predominantly consisting on Indomalayan genera (*Chrysopelea*, *Cnemaspis*, *Lygosoma*, *Naja*, *Ophiophagus*, *Ptyctolaemus*, *Psammodynastes*, *Python*, *Indotyphlops*, *Rhabdophis*, *Varanus*, *Xenochrophis*) followed by Transitional elements (*Boiga*, *Indotestudo*, *Lycodon*, *Sibynophis*), Tibeto-Yunnanese (*Cuora*, *Gekko*, *Japalura*) and Indian radiation (*Calotes*, *Hemidactylus*, *Melanochelys*).



**Figure 45: Recorded Species diversity of herpetofaunal species in MNP and RMNP**

Das and Palden (2000) reported 7 amphibian and 12 reptilian species from Royal Manas National Park. Of these seven species (*Duttaphrynus melanostictus*, *Euphlyctis cyanophlyctis*, *Hoplobatrachus tigerinus*, *Cyrtodactylus khasiensis*, *Hemidactylus brookii*, *Calotes versicolor*, *Psammodynastes pulverulentus*) recorded during this survey. Appendix I depict species that are recorded from MNP and RMNP during this study and also earlier records of these species from Bhutan. As reported by Wangyal (2011), we did not consider the validity of the record of *Lithobates catesbeianus* (American Bullfrog) from RMNP as valid and is not listed. In addition to hitherto recorded amphibian species from Bhutan, Frost (2014) mentioned possible occurrence of *Hylarana tytleri*, *Clinotarsus alticola*, *Amolops gerbillus*,

*Amolops monticola*, *Amolops formosus*, *Scutigera sikkimensis*, *Nanorana parkeri*, *Nanorana blanfordii*, *Duttaphrynus himalayanus*, *Philautus annandalii* and *Ichthyophis sikkimensis* from Bhutan.

Wangyal et al. (2012) reported five species of Chelonian (*Cuora amboinensis*, *Cuora mouhotii*, *Cyclemys gemeli*, *Melanochelys tricarinata* and *Indotestudo elongata*) as new country records from Bhutan. They also provided a list of fifteen species that are likely to occur in Bhutan. We presume that all of them may occur in RMNP.

Among the recorded species, *Python bivittatus* and *Varanus bengalensis* have been accorded the highest legal protection status, under Schedule I of the Indian Wildlife (Protection) Act, 1972. Four species- *Naja naja*, *Ophiophagus hannah*, *Ptyas mucosa* and *Xenochrophis piscator* are listed in Schedule II, all other snake species are listed under Schedule IV of the Act. Of the recorded species *Varanua bengalensis*, *Melanochelys tricarinata* are under Appendix I of CITES, *Varanus salvator*, *Python bivittatus*, *Hardella thurjii*, *Melanochelys trijuga*, *Indotestudo elongata*, *Ophiophagus hannah*, are listed in Appendix II of CITES and Only amphibian species *Hoplobatrachus tigerinus* is under CITES II and *Xenochrophis piscator* is under Appendix III of CITES.

Visual encounter survey and opportunistic observation resulted in record of most of the species. Five species (*Sphenomorphus maculatus*, *Hoplobatrachus tigerinus*, *Uperodon globulosus*, *Indotyphlops brahminus* and *Zakerana* sp) were recorded in the pitfall trap.

This rapid biological assessment provides baseline natural history information for all the recorded species that may help in further research and conservation. Our results are based on the survey constrained by time, and presumably represent a small subset of the actual diversity. Considering the scarcity of knowledge on diversity and distribution of herpetofaunal taxa, the present study assumes significance. Extensive and long term field surveys will no doubt significantly add to the herpetofaunal records of this area. This assumption is supported by the sharp slope of the species accumulation curve from the present survey (Fig. 43 and 44). This prevents us from making any approximation of the true species diversity in the study area. We recommend long term herpetofaunal inventory of this rich transboundary landscape to better understand the diversity, biogeography and ecology of herpetofaunal species in this region.

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## 7. Appendix

Species	MNP	RMNP	Bhutan	Reference
<i>Duttaphrynus melanostictus</i>	✓	✓	✓	This study, Das and Palden (2000)
<i>Uperodon globulosus</i>	✓	✓	✓	This study
<i>Micryletta inornata</i>	✓			This study
<i>Microhyla ornata</i>	✓	✓	✓	This study
<i>Microhyla butleri</i>	✓			This study
<i>Euphlyctis cyanophlyctis</i>	✓	✓	✓	This study, Wangyal (2013)
<i>Zakerana pierrei</i>	✓	✓	✓	This study
<i>Zakerana teraiensis</i>	✓	✓	✓	This study
<i>Zakerana nepalensis</i>		✓	✓	This study
<i>Hoplobatrachus tigerinus</i>	✓	✓	✓	This study
<i>Ingerana borealis</i>		✓		This study
<i>Xenophrys parva</i>		✓	✓	Das and Palden (2000)
<i>Amolops marmoratus</i>		✓	✓	Das and Palden (2000)
<i>Humerana humaralis</i>	✓	✓	✓	This study
<i>Hylarana tytleri</i>	✓			This study
<i>Hylarana leptoglossa</i>	✓	✓	✓	This study
<i>Feihyla vittatus</i>	✓			This study
<i>Philautus cf. garo</i>	✓			This study
<i>Philautus sp</i>		✓	✓	This study
<i>Polypedates himalayensis</i>	✓	✓	✓	This study
<i>Polypedates teraiensis</i>	✓	✓	✓	This study
<i>Rhacophorus bipunctatus</i>		✓	✓	This study
<i>Rhacophorus maximus</i>	✓			This study
<i>Calotes versicolor</i>	✓	✓	✓	This study, Wangyal (2011), Bauer and Gunther (1992)
<i>Calotes maria</i>		✓		This study
<i>Japalura variegata</i>		✓	✓	This study, Wangyal (2011), Bauer and Gunther (1992)
<i>Ptyctolaemus gularis</i>		✓	✓	This study
<i>Cnemaspis assamensis</i>		✓		This study
<i>Cyrtodactylus khasiensis</i>	✓	✓	✓	This study
<i>Gekko gekko</i>	✓	✓	✓	This study, Wangyal (2012)
<i>Hemidactylus frenatus</i>	✓			This study, Bauer and Gunther (1992)
<i>Hemidactylus brookii</i>		✓	✓	This study, Bauer and Gunther (1992)
<i>Hemidactylus garnotii</i>		✓	✓	Das and Palden (2000)
<i>Hemidactylus platyurus</i>	✓			This study, Wangyal (2011), Bauer and Gunther (1992)
<i>Eutropis macularia</i>	✓			This study
<i>Eutropis quadratilobus</i>	✓		✓	Bauer and Gunther (1992)
<i>Eutropis sp.</i>	✓			This study
<i>Eutropis dissimilis</i>	✓			This study

Species	MNP	RMNP	Bhutan	Reference
<i>Lygosoma albopunctata</i>	✓			This study
<i>Sphenomorphus maculatus</i>	✓	✓	✓	This study, Wangyal (2012)
<i>Sphenomorphus indicus</i>		✓	✓	Das and Palden (2000)
<i>Varanus bengalensis</i>	✓		✓	This study, Bauer and Gunther (1992)
<i>Varanus salvator</i>		✓	✓	This study
<i>Indotyphlops brahminus</i>	✓	✓	✓	This study, Wangyal (2012), Bauer and Gunther (1992)
<i>Indotyphlops jerdonii</i>		✓	✓	Das and Palden (2000)
<i>Python bivittatus</i>	✓	✓		This study, Wangyal (2012), Bauer and Gunther (1992)
<i>Lycodon aulicus</i>	✓	✓	✓	Wangyal (2012)
<i>Amphiesma stolatum</i>			✓	This study, Bauer and Gunther (1992), Biswas (1973)
<i>Boiga cyanea</i>		✓	✓	This study, Bauer and Gunther (1992)
<i>Boiga ochracea</i>		✓	✓	This study, Wangyal (2011)
<i>Boiga gokool</i>		✓		This study
<i>Boiga siamensis</i>		✓		This study
<i>Chrysopelea ornata</i>		✓	✓	This study, Wangyal (2012)
<i>Dendrelaphis tristis</i>		✓	✓	Wangyal (2012)
<i>Lycodon jara</i>	✓		✓	This study, Wangyal (2012)
<i>Oligodon dorsalis</i>		✓	✓	Das and Palden (2000)
<i>Psammodynastes pulverulentus</i>		✓	✓	This study, Das and Palden (2000)
<i>Ptyas korros</i>		✓	✓	This study, Wangyal (2011)
<i>Rhabdophis himalayanus</i>	✓			This study, Wangyal (2011)
<i>Rhabdophis subminiatus</i>		✓		Wangyal (2012)
<i>Sibynophis sagittarius</i>		✓	✓	Das and Palden (2000)
<i>Xenochrophis piscator</i>	✓		✓	This study, Bauer and Gunther (1992)
<i>Bungarus fasciatus</i>		✓	✓	Das and Palden (2000)
<i>Bungarus niger</i>			✓	Bauer and Gunther (1992)
<i>Naja naja</i>	✓	✓	✓	Das and Palden (2000), Wangyal (2012)
<i>Ophiophagus hannah</i>	✓	✓	✓	This study, Biswas (1975), Narayan and Rosalind (1989), Wangyal (2011)
<i>Trimeresurus albolabris</i>		✓		Wangyal (2012)
<i>Trimeresurus popeiorum</i>		✓	✓	This study
<i>Cuora amboinensis</i>	✓	✓	✓	This study
<i>Cuora mouhotii</i>	✓	✓	✓	Wangyal et al. (2012)
<i>Cyclemys gemeli</i>	✓	✓	✓	Wangyal et al. (2012)
<i>Melanochelys tricarinata</i>	✓	✓		Das (1988), Wangyal et al. (2012)
<i>Melanochelys trijuga</i>	✓			Das (1988)
<i>Pangshura sylhetensis</i>	✓	✓		Das (1988)
<i>Pangshura smithii</i>	✓	✓		Das (1988)
<i>Pangshura tentoria</i>	✓	✓		Das (1988)
<i>Indotestudo elongata</i>	✓	✓		Ahmed and Das (2010), Wangyal et al. (2012)