Herpetology Notes, volume 9: 261-278 (2016) (published online on 14 November 2016)

Additions to the herpetofauna of Royal Manas National Park, Bhutan, with six new country records

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Abstract. We present the results of a rapid herpetofaunal inventory conducted in Royal Manas National Park, Bhutan, in June 2014. Visual encounter surveys, opportunistic searches, and pitfall traps were used during four days of fieldwork to document diversity. Twelve species of amphibians and 20 species of reptiles were recorded during the survey. Six species (*Uperodon globulosus, Ingerana borealis, Calotes maria*, *Cnemaspis assamensis*, *Ptyctolaemus gularis*, *Trimeresurus properirum*) are new additions to the herpetofauna of Bhutan.

Keywords. Herpetofauna, Royal Manas National Park, Manas Transboundary Landscape, inventory, conservation, Bhutan

Introduction

Royal Manas National Park (RMNP; 1057km^2; Figs. 1, 2) is the oldest national park in Bhutan. It is located in southern Bhutan, contiguous with India's Manas Tiger Reserve to the south and Bhutan's Jigme Singye Wangchuck National Park to the north (Fig. 1). The RMNP is the most important protected area in Bhutan due to its outstanding biological diversity (4500 species of plants, 65 species of mammals, and 424 species of birds have been recorded; Gillison, 2012), and it encompasses extremely diverse habitats, ranging from grasslands and tropical deciduous forests to alpine meadows and perpetually snow-covered mountaintops in the north, and with the largest manifestation of subtropical forest in the country (Fig. 2).

The herpetofauna of the Himalayan Kingdom of Bhutan is poorly known, although a series of reptile and amphibian inventories of this country include records from RMNP (Biswas, 1975; Bustard, 1980; Bauer and Günther, 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, 2012, 2013; Wangyal and Gurung, 2012a,b). In the present study, we intended to expand our knowledge on herpetofaunal diversity of the park. We here present the result of a survey conducted in June 2014.

Materials and Methods

We inventoried the Royal Manas Range (area ca. 50 km^2), an integral part of Royal Manas National Park, Bhutan from 16–17 June 2014 and from 20–23 June 2014, using Visual Encounter Surveys and active searches (Heyer et al., 1994) to record herpetofaunal species. For frogs, we also conducted acoustic searches along trails, forest edges, and streams, starting from late afternoon until 2000–2200 h. We employed one pitfall trap array of 25 m length, with four buckets to serve as pits, and with drift fences constructed of 0.5 m tall plastic sheeting. The trap was placed near an amphibian breeding pond.

Our data collection included GPS coordinates (WGS-84), date, time, microhabitat, gender (when possible),

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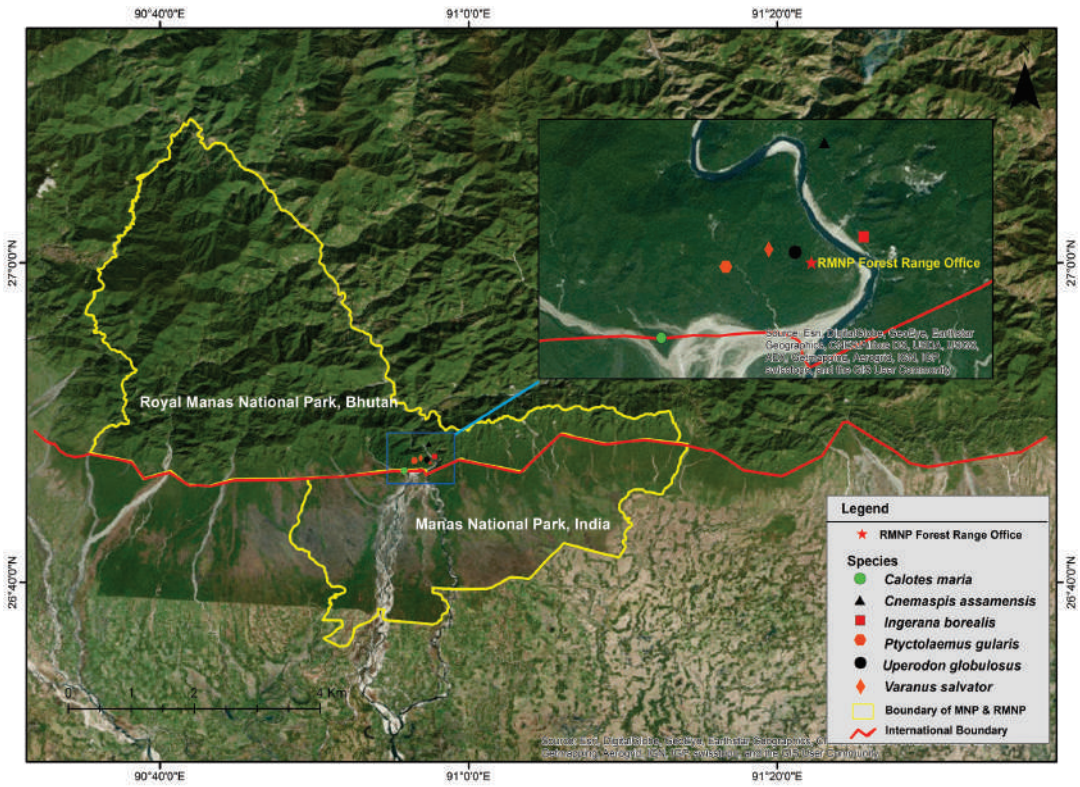

Figure 1. Map of Manas Transboundary Landscape, including Manas National Park (India) and Royal Manas National Park (Bhutan) with new herpetofaunal country records for Bhutan indicated.

Figure 2. Habitat characteristic of Royal Manas National Park, Bhutan showing the Beki River that flows from Bhutan to India through the Manas Transboundary Landscape.

and reproductive condition (if it could be determined); behavioral notes were also taken. Identification of species was done using the keys in Smith (1935, 1943) and Schleich and Kästle (2002). We follow the taxonomic arrangements of Frost (2016) for amphibians and of Whitaker and Captain (2004), and Uetz and Hošek (2016) for reptiles; for common English names we follow Ahmed et al. (2009). We also report the threat status of species using IUCN Red List criteria (http://www.iucnredlist.org).

Measurements were made using dial callipers (to the nearest 0.1 mm). Abbreviations used in this paper include snout–vent length (SVL), tail length (TL), number of ventral scales (V), number of subcaudal scales (SC), and number of dorsal scale rows (DSR) at midbody.

Abbreviations include Royal Manas Snakes (RMS) and Royal Manas Lizards (RML), referring to snake and lizard specimens, respectively, kept at the Ranger Office of the Royal Manas National Park, Bhutan. Other museum records were abbreviated following

Table 1. Herpetofaunal records from Royal Manas National Park, Bhutan. IUCN Status is appreviated as Least Concern (LC), Vulnerable (VU). and Not Assessed (NA).

Taxonomic Group	Family	Scientific Name	GPS location	IUCN Status
Frogs and Toads	**Bufonidae**	*Duttaphrynus melanostictus*	N 26.7828°, E 90.9583°	LC
	Dicroglossidae	*Euphlyctis cyanophlyctis*	N 26.7855°, E 90.9612°	LC
		Fejervarya nepalensis	N 26.7847°, E 90.9600°	LC
		Fejervarya pierrei	N 26.7847°, E 90.9602°	LC
		Fejervarya teraiensis	N 26.7847°, E 90.9600°	LC
		Hoplobatrachus tigerinus	N 26.7934°, E 90.9598°	LC
		Ingerana borealis	N 26.7980°, E 90.9632°	VU
	Microhylidae	*Microhyla ornata*	N 26.7956°, E 90.9563°	LC
		Uperodon globulosus	N 26.7943°, E 90.9550°	LC
	Ranidae	*Hylarana leptoglossa*	N 26.7943°, E 90.9550°	LC
	Rhacophoridae	*Polypedates maculatus himalayensis*	N 26.7956°, E 90.9563°	NA
		Rhacophorus bipunctatus	N 26.7960°, E 90.9481°	LC
Lizards	**Gekkonidae**	*Cnemaspis assamensis*	N 26.8110°, E 90.9560°	NA
		Hemidactylus platyurus	N 26.7960°, E 90.9570°	NA
		Hemidactylus cf. *tenkatei*	N 26.7936°, E 90.9607°	NA
		Cyrtodactylus khasiensis	N 26.7950°, E 90.9570°	NA
	Agamidae	*Calotes maria*	N 26.7830° E 90.9310°	NA
		Calotes versicolor	N 26.7860°, E 90.9637°	LC
		Japalura variegata	N 26.7950°, E 90.9570°	LC
		Ptyctolaemus gularis	N 26.7930°, E 90.9413°	NA
	Scincidae	*Sphenomorphus maculatus*	N 26.7980°, E 90.9632°	NA
	Varanidae	*Varanus salvator*	N 26.7961°, E 90.9482°	LC
Snakes	**Typhlopidae**	*Indotyphlops braminus*	N 26.7954°, E 90.9576°	NA
	Colubridae	*Boiga gokool*	---	NA
		Boiga siamensis	---	NA
		Boiga ochracea	N 26.7937°, E 90.9664°	LC
		Ptyas korros	N 26.7960°, E 90.9481°	NA
		Rhabdophis himalayanus	---	NA
		Chrysopelea ornata	N 26.7950°, E 90.9560°	NA
		Psammodynastes pulverulentus	N 26.7980°, E 90.9630°	NA
	Elapidae	*Ophiophagus hannah*	N 26.7916°, E 90.9531°	VU
	Viperidae	*Trimeresurus popeiorum*	N 26.7930°, E 90.9410°	LC

Sabaj (2016). Digital images of recorded species were deposited in the Zoological Reference Collection (ZRC-IMG) at the Lee Kong Chian Natural History Museum, National University of Singapore. Records for countries other than Bhutan and India are listed without their specific administrative units and the reader may refer to the cited references to gather more detailed distribution information.

Species Accounts

We recorded twelve species of amphibians in ten genera, all of which were anurans. Lizards were represented by ten species in eight genera, whereas snakes included ten species in eight genera (Table 1).

Figure 3. Amplecting pair of *Duttaphrynus melanostictus* (ZRC-IMG 1.86) along a roadside habitat close to the Indo-Bhutanese Border.

Figure 4. *Euphlyctis cyanophlyctis* (ZRC-IMG 1.87) on a forest trail leading to the Beki River near the Forest Ranger Office, Royal Manas National Park, Bhutan.

FROGS AND TOADS

Bufonidae

***Duttaphrynus melanostictus* (Schneider, 1799) (Fig. 3), Common Asian Toad.**—Dorsal skin with large round warts, sides with smaller ones, each wart tipped with black in mature individuals. Two large ellipsoidal parotid glands behind the eyes, preorbital, postorbital, and orbitotympanic ridges present; tympanum distinct; second finger longer than first; relatively short hind limbs, which produce hopping as opposed to jumping locomotion.

We observed calling individuals and amplecting pairs (ZRC-IMG 1.86) along waterlogged roadside areas of the Mathanguri–Panbang gravel road (Zhemgang District; elev. 126 m) between 2357 h of 16 June and 0015 h on 17 June. We observed one individual (SVL 55 mm) on 21 June at 1925 h active along the forest trail in a burnt patch, near Hatilora. One earlier record for RNMP exists for Bhutan, from Maukhola (Sarphang District; Das and Palden, 2000).

Dicroglossidae

***Euphlyctis cyanophlyctis* (Schneider, 1799) (Fig. 4), Indian Skipping Frog**.—Head flat, with an elongated and ovoid body, eyes in a nearly dorsal position on the head. Body flat, elongated, dorsally covered with small tubercles. Limbs stout, tips of digits pointed, fingers free, toes completely webbed.

We observed individuals of this species (ZRC-IMG 1.87) on a forest trail leading to the Beki River near the RMNP Forest Ranger Office (Zhemgang District, elev. 143 m) on 16 June at 1320 h. Earlier records are from RMNP at Gelephu (Sarpang District), Gelephu town (Sarpang District), Tshangkha Lake (Dagana District), and Bhangtar (Samdrup Jongkhar District). The species is known to occur at elevations of 225–1378 m in Bhutan (Das and Palden, 2000; Wangyal, 2013).

***Fejervarya nepalensis* (Dubois, 1975) (Fig. 5), Nepal Cricket Frog**.—Body elongated and oval, head pointed in dorsal view; tympanum small and rounded. Dorsal colouration greyish brown with dark irregular spots, the dorsum always with a cream-coloured middorsal line and reddish dots, limbs distinctly barred.

We found one individual (♂, SVL 28 mm; ZRC-IMG 1.88) along the Mathanguri–Panbang gravel road (Manas Range, Zhemgang District, elev. 189 m) on 16 June at 2340 h. In Bhutan this species is also known from Samdrup Jongkhar District (Wangyal, 2013).

***Fejervarya pierrei* (Dubois, 1975), Pierre's Cricket Frog**.—Head triangular. Dorsum with broken longitudinal skin folds. Hind limbs weakly barred. Brownish olive dorsum with irregular dark brown marks, dark bars along margins of lower jaw. This record is unvouchered and the species is identified based on combination of above mentioned characters

Figure 5. *Fejervarya nepalensis* (♂, 28 mm SVL; ZRC-IMG 1.88) along the Mathanguri–Panbang gravel road, Bhutan.

Figure 6. *Ingerana borealis* (♂, SVL 31 mm; ZRC-IMG 1.89) calling from a stream.

and body size, which is larger than *F. syhadrensis* and *F. nepalensis* and smaller than *F. teraiensis*.

We observed two individuals (SVLs 32 and 34 mm) on 17 June at 0040 h along the Mathanguri–Panbang gravel road (Zemgang District, elev. 141 m). From Bhutan the species was already known from Tshangkka Lake (Dagana District, 1378 m elevation; Wangyal, 2013).

***Fejervarya teraiensis* (Dubois, 1984), Terai Cricket Frog**.—First finger longer than second finger. Dorsum olive with dark irregular spots, middorsal line absent. Males have a diagnostic W-shaped mark on the throat.

We observed two individuals (both ♂, SVLs 42 and 47 mm) on 17 June at 0029 h along the Mathanguri–Panbang gravel road (elev. 191 m). In Bhutan the species is also known from Gelephu (Sarpang District; elev. 255 m; Wangyal, 2013). This record is unvouchered and the species was identified based on a combination of the above-mentioned characters as well as body size, which is larger than for all other syntopic *Fejervarya* species.

***Hoplobatrachus tigerinus* (Daudin, 1802), Indian Bullfrog**.—Head almost triangular; dorsum with short, irregular glandular folds and with a cream-coloured middorsal line. Large tympanum partly covered above by a supratympanic fold.

We recorded one individual (SVL 147 mm) on 16 June at 1630 h within the campus of the RMNP Forest Ranger Office (Zhemgang District, elev. 126 m). The species was also recorded elsewhere in RMNP, at Maukhola (Sarpang District; no elevation provided) by Das and Palden (2000). This record is unvouchered and the species was identified based on combination of the above-mentioned characters.

***Ingerana borealis* (Annandale, 1912) (Fig. 6), Boreal Floating Frog**.—Body short and stout; dorsal skin is honeycombed. Limbs stout, tips slightly dilated. Fingers free, toes almost two-thirds webbed. Dorsum including limbs light to dark brown. Darker spots on flanks and limbs. Light brown V-mark on back touching eye and vent. Tips of digits white.

We recorded two individuals (♂, SVLs 27 and 31 mm; ZRC-IMG 1.89) along the Panbang Road (Zhemgang District, elev. 163 m) on 20 June. One individual was calling from the edge of a first order rocky stream in moist evergreen forest. The other was found in a seepage area close to a forest stream. These individuals are the first country record for Bhutan. Previously the species was known from India (northern West Bengal, Sikkim, Assam, Arunachal Pradesh, Meghalaya, Manipur, Mizoram, Nagaland), Nepal (Eastern Nepal), China (Tibet), 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 (2016) included Bhutan in the range of the species without any reference.

Figure 7. *Microhyla ornata* (♂, SVL 21 mm; ZRC-IMG 1.90) calling from moist grass within the Forest Ranger Office Campus, Royal Manas National Park, Bhutan.

Figure 8. *Uperodon globulosus* (♂, SVL 57 mm; ZRC-IMG 1.91) collected from a pitfall trap inside semi-evergreen forest near a pond.

Microhylidae

***Microhyla ornata* (Duméril and Bibron, 1841) (Fig. 7), Ornate Pygmy Frog**.—A small frog with a triangular body, tympanum indistinct, fingers free, toes with rudimentary webbing. Dorsally reddish to dark brown. A large, dark brown, irregular mark extending from eye level to the lower part of the back, sides, and hind limbs. Ventrally white. Dark throat present in males.

We recorded a chorus within the campus of the RMNP Forest Ranger Office (Zhemgang District, elev. 133 m), among moist grass and close to a temporary water puddle on 16 June at 1900 h. A single individual (♂, SVL 21.2 mm; ZRC-IMG 1.90) was photographed. Egg-masses and tadpoles were observed in the water puddle and small ponds with thick algal growth and few adults were observed in the vicinity.

***Uperodon globulosus* (Günther, 1864) (Fig. 8), Indian Balloon Frog**.—The body is globular in shape, the head small, and the snout rounded. Dorsum uniformly brown, marbled with small grey or white spots. Flanks light brown to grey.

We observed a large calling aggregation near a waterlogged area around the Geylongkhola Pond (Zhemgang District, elev. 134 m) on 20 June at 2210 h. One individual (♂, SVL 57 mm; ZRC-IMG 1.91) was found in a pitfall trap ca. 5 m away from a pond on 21 June at 2015 h (Zhemgang District, elev. 134 m). This is the first time the species has been recorded in Bhutan. It was previously known from Nepal (Terai and Central Region), India (Assam, Arunachal Pradesh, Bihar, West Bengal, Madhya Pradesh, Orissa, Gujarat, Andhra Pradesh, Karnataka, Kerala), and Bangladesh (Choudhury et al., 2002; Daniels, 2005; Schleich and Kästle, 2002; Srinivasulu et al., 2006; Sarker et al., 2012; Frost, 2016).

Ranidae

***Hylarana leptoglossa* (Cope, 1868) (Fig. 9), Assam Forest Frog**.—Dorsum uniformly granulated, cream coloured dorsolateral granular fold from behind eye to vent. Limbs long, tips of all digits slightly dilated. Fingers free, toes two-third webbed. Dorsum and limbs chocolate brown in colour, sprayed with black spots. Skin in the flank region is granular, grey brown, spotted with blackish spots.

We observed choruses in waterlogged areas in and around Geylongkhola Pond (Zhemgang District, elev. 134 m) on 20 June at 1920 h. One individual (♂, SVL 30.7 mm; ZRC-IMG 1.92) was photographed. This species has also been reported from Dungkarling, Phuntshothang (Samdrup Jongkhar District, elev. 150 m; Wangyal, 2013). This species is distributed throughout the lowland localities in northeast India, Bangladesh, Myanmar, and Thailand (Ahmed et al., 2009).

Figure 9. *Hylarana leptoglossa* (♂, SVL 31 mm; ZRC-IMG 1.92), calling from a large chorus.

were found under rocks close to the waterlogged area. Chorusing was observed 500 m away from the entry point of the Geylongkhola walking trail on 22 June 2014 at 2025 h.

Eastern Himalayan, Northeastern Indian, and Chinese populations of *P. maculatus* were assigned to *P. m. himalayensis* by Annandale (1912). This may be a cryptic species, as its call characteristics and breeding microhabitats are distinct from *P. m. maculatus* and a detailed taxonomic assessment is currently being prepared (Saibal Sengupta, pers. comm.)

***Rhacophorus bipunctatus* Ahl, 1927 (Fig. 11), Twin-spotted Tree Frog**.—Dorsum green; two distinct black spots on each side of the flanks; fingers two third webbed, toes webbed, bright orange-red in colour.

On 20 June at 2045 h, we observed two individuals (both ♂, SVLs 47 and 51 mm; ZRC-IMG 1.94) calling from understory lianas ca. 2.5 m above a water puddle in the forest interior at Geylongkhola trail (Zhemgang District, elev. 137 m). This is the first country record for Bhutan of this species. It was previously known from India (Assam, Arunachal Pradesh, Meghalaya, Manipur, Tripura, Nagaland, Mizoram), Bangladesh, China, Cambodia, Myanmar, Thailand, and 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).

Rhacophoridae

***Polypedates maculatus* (Annandale, 1912) (Fig. 10), Himalayan Tree Frog**.—No webbing among fingers, fingers and toes with disc, skin on the snout free (not co-ossified), foam nest on ground close to water, dorsally brown, darker postorbital stripe present.

On 16 June 2014 at 1621 h we found one individual (♂, SVL 53 mm; ZRC-IMG 1.93) among grass near a seasonally inundated area within the RMNP Forest Ranger Office campus (elev. 133 m). Foam nests

Figure 10. *Polypedates maculatus* (♂, SVL 53 mm; ZRC-IMG 1.93) from grass near a waterlogged area within theForest Range Office campus, Royal Manas National Park, Bhutan.

Figure 11. *Rhacophorus bipunctatus* (♂, SVL 51 mm; ZRC-IMG 1.94) calling from understory lianas ca. 2.5 m above a water puddle in semi-evergreen forest.

Figure 12. *Cnemaspis assamensis* (gravid ♀, SVL 35 mm; ZRC-IMG 2.272) found on the bark of large tree 1.5 m above-ground along the Panbang Road.

LIZARDS

Gekkonidae

***Cnemaspis assamensis* Das and Sengupta, 2000 (Fig. 12), Assam Day Gecko**.—Diurnal gecko with round pupils. Dorsally grey-brown. With a distinct black spot on the neck and a blurry vertebral stripe. Brown patches on the flanks.

We encountered one individual (♀, gravid, with two eggs, SVL 35.4 mm; ZRC-IMG 2.272) on 21 June at 1245 h at Pangbang Road (Zemgang District, elev. 229 m). The individual was found on the bark of a large tree 1.5 m above ground on the way to Panbang. This is the first country record for Bhutan. The species is also known from Assam and Meghalaya in India (Das and Sengupta, 2000; Sengupta et al., 2000; Das, 2002; Das and Ahmed, 2007; Purkayastha and Das, 2010). This is the only species of day gecko known from eastern India.

***Cyrtodactylus khasiensis* (Jerdon, 1870) (Fig. 13), Khasi Hills Bent-toed Gecko**.—Digits are long, bent, and sharply clawed, without broadened digital lamellae. Dorsum light brown with dark brown spots. Tail with dark brown and white bands. Belly cream-coloured.

We observed one individual (unsexed, SVL 38 mm; ZRC-IMG 2.274) under a layer of tin sheeting near the RMNP Forest Ranger Office (elev. 133 m) on 16 June at 1730 h. Additional individuals were found under rocks on a slope along the Pangbang Road (e.g., ♀, SVL 62 mm; 21 June at 1320 h), and on a tree at 1.5 m above-ground along the Pangbang Road (unsexed, SVL 64 mm; 22 June at 2155 h). Three individuals were seen among low vegetation 1–2.5 m above-ground along the Hatilora Trail on 22 June at 2330 h. One earlier record from RMNP exists (Sershong, Sarphang District; Das and Palden, 2000).

Figure 13. *Cyrtodactylus khasiensis* (unsexed, SVL 38 mm; ZRC-IMG 2.274) found under an abandoned, flattened tin shed on the ground near the RMNP Forest Ranger Office.

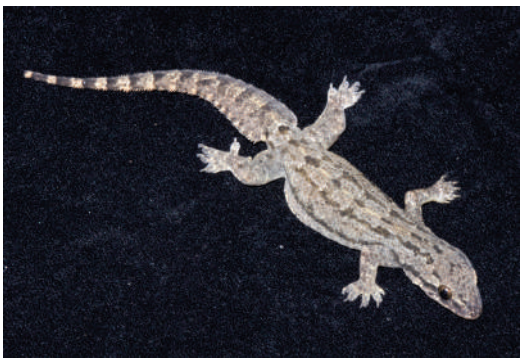

Figure 14. *Hemidactylus platyurus* (SVL 55 mm; ZRC-IMG 2.273) found on the bark of a tree along the Panbang Road.

***Hemidactylus platyurus* (Schneider, 1792) (Fig. 14), Flat-tailed Gecko**.—Dorsal coloration variable from light to dark grey with dark brown patterns; belly yellowish. A flap of skin on the side of body and back of hind limbs distinguishes it from other geckos.

We found one individual (unsexed, SVL 55 mm; ZRC-IMG 2.273) on the bark of a tree on the way to Panbang on 21 June 2014 at 1855 h (elev. 147 m). The species is also known from Serzhong (Mongar District, elev. 1500–1540 m). It was reported by Bauer and Günther (1992) in Phuntsholing and Wangdi Phodrang Districts.

Hemidactylus* cf. *tenkatei.—Dorsal skin rough with rows of tubercles. Original tail with large tubercles on sides and enlarged subcaudals distally.

We recorded one individual (♂, SVL 42 mm) at 1530 h on 21 June, under a boulder at the base of a tree close to the RMNP Forest Ranger Office campus (elev. 123 m). The species is also known from the Sershong Gelephu Road and from Samchi (Bauer and Günther, 1992; Das and Palden, 2000).

The specimen observed conforms to the "litter dwelling morph" of *H. brookii sensu lato*, which was reported as a widespread species in India, Bangladesh, and Nepal (Mahony, 2011). This specimen falls into the variation known for *H.* "*brookii*" as reported by Mahony (2011). However, Kathriner et al. (2014) showed *H. brookii sensu stricto* to be a Borneo endemic, with *H. tenkatei* van Lidth de Jeude, 1895 the oldest name available for other forms hitherto considered to be part of *H. brookii*.

Agamidae

***Calotes maria* Gray, 1845 (Fig. 15), Gray's Forest Lizard**.—This lizard can be identified by two parallel rows of compressed spines above the tympanum, and by its distinct green colour. It does not have a black patch above the forearm.

We observed one individual (♀, SVL 88 mm, TL 275 mm; ZRC-IMG 2.275) at Panbang Road, 5 km from India-Manas Border on 22 June at 2100 h (elev. 122 m). The individual was approximately 2 m above-ground, sleeping on a branch, about 10 m away from a stream, along the Panbang Road. This is the first country record for Bhutan. The species is also known from Meghalaya and Assam states in India (Smith, 1935; Sengupta et al., 2000).

***Calotes versicolor* (Daudin, 1802) (Fig. 16), Indian Garden Lizard**.—The species can be identified by its light brown dorsal colour, with black lines radiating from eye, and with two separated spines above the ear.

We observed one gravid female (SVL 81 mm) on 16 June at 1145 h, on a dry branch 1 m above ground on the side of trail leading to Beki River, near the RMNP Forest Ranger Office, and one male (SVL 78 mm; ZRC-IMG 2.276) was found among forest roadside vegetation on 16 June at 1320 h (elev. 171 m). Four juveniles (SVLs 32–44 mm) were found on 22 June at 2010 h, all sleeping on branches of dry shrubs along a forest trail at Hatilora, and one female (SVL 87 mm) was found on 22 June at 2200 h sleeping on a branch 1.5 m above-ground, close to the RMNP Forest Ranger

Figure 15. *Calotes maria* (♀, SVL 88 mm, 275 mm TL; ZRC-IMG 2.275) found 2 m above ground, sleeping on a branch, about 10 m away from a stream.

Figure 16. *Calotes versicolor* (unsexed, SVL 78 mm; ZRC-IMG 2.276) photographed among forest roadside vegetation.

Office. Earlier records for Bhutan are from Sheripam (Mongar District), Wangdiphodrang (Samdrup Jongkhar District), Gelephu town (Sarpang District), Phuentsholing (Chukha District), Bale Jhura (Chukha District), Wangdue Phodrang District (Biswas, 1975; Bauer and Günther, 1992; Das and Palden, 2000).

***Japalura variegata* Gray, 1853 (Fig. 17), Variegated Mountain Lizard**.—Body laterally compressed, dorsal scales small and unequal, Head scales sharply keeled; back of head with scattered conical tubercles. Olive brown above, with lighter and dark markings. A series of light chevron-shaped stripes along the back corresponding to the enlarged scales and a white stripe along the side of the neck; upper lip white, gular pouch bluish in colouration.

We observed one individual (♂, SVL 62 mm) on 20 June at 1250 h on the forest floor close to a rocky area at locality (elev. 138 m), another (♂, SVL 73 mm; ZRC-IMG 2.277) on 21 June at 2005 h along the Hatilora Trail, and a third (♀, SVL 65 mm) on 22 June at 2010 h, sleeping on a branch (Hatilora, elev. 132 m). Earlier records from Bhutan exist from

Figure 17. *Japalura variegata* (♂, SVL 73 mm; ZRC-IMG 2.277) found roosting on low branches along the Hatilora Trail.

Phuentsholing (Chukha District), Bumdeling Wildlife Sanctuary, and Mongar District (Biswas, 1975; Bauer and Günther, 1992; Wangyal, 2011). Hora (1926) and Smith (1935) reported this species from elevations of 330–2970 m. The recorded specimens show similarity with *J. bengalensis*, a species described from Buksa Duars (West Bengal, India) by Annandale (1906) and currently considered a synonym of *J. variegata*.

***Ptyctolaemus gularis* (Peters, 1864) (Fig. 18), Blue-throated Lizard**.—Head long and narrow. Body elongated and somewhat laterally compressed. Nuchal crest distinct in males and dorsal crest poorly developed. Gular pouch bluish laterally compressed and folded in a U-shaped pattern.

We observed one individual (♀, SVL 78 mm, TL 179; ZRC-IMG 2.278) on 22 June at 2015 h (Hatilora Trail, elev. 162 m). The individual was found sleeping on a dry branch of an understory plant, approximately 1.5 m above-ground, in forest with a burnt understory. This is the first country record for Bhutan. The species is distributed in Myanmar, northeastern India, Bangladesh, and Tibet (Das, 2010).

Scincidae

***Sphenomorphus maculatus* (Blyth, 1853) (Fig. 19), Spotted Litter Skink**.—Dorsum bronze-brown with a vertebral row of dark brown spots. Dark brown lateral band from snout tip to hind limb. Temporal region of male had orange coloured patches.

Figure 18. *Ptyctolaemus gularis* (♀, SVL 78 mm, 179 mm TL; ZRC-IMG 2.278). The individual was found sleeping on a dry branch of an understory plant.

Figure 19. *Sphenomorphus maculatus* (♂, SVL 55 mm,ZRC-IMG 2.279 from under the rocks in a flowing stream along the Panbang Road.

We found one individual (♂, SVL 55 mm, TL 60 mm; ZRC-IMG 2.279) on 21 June at 0955 h, under a rock near a stream 5 km from the international border with India on the way to Panbang Road (Zhemgang District, elev. 170 m). The species was also reported by Wangyal (2012) from the RMNP Forest Ranger Office.

Varanidae

***Varanus salvator* (Laurenti, 1768), Water Monitor**.—Head triangular, snout elongated and flat. Snout black barred,dorsum darker with indistinct yellow ocelli.

We observed one individual in a temporary waterlogged area inside a liana-dominated forest on 20 June at 2100 h (Geylongkhola trail, Zhemgang District, elev. 94 m). The species was seen but we could not photograph the individual as it escaped quickly. Identification is based on distinct yellowish rounded spots on olive dorsal background arranged transversely. The spots are not joined with each other. The individual was found close to a breeding chorus of *Uperodon globulosus*. If confirmed, this would be the first record for Bhutan. The species is also known from much of South and Southeast Asia and four subspecific names have been applied (Das, 2010). The populations from India and Southern China have been referred to as *V. s. macromaculatus*.

SNAKES

Typhlopidae

***Indotyphlops braminus* (Daudin, 1803), Brahminy Blindsnake**.—This is a small (total length < 250 mm), slender, worm-like snake. The head is blunt and the tail very short, with a small spine at its tip. Rudimentary eyes are visible as black spots under the head scales. Scales are smooth, giving the species a glossy appearance. Individuals are uniform blackish brown above, somewhat lighter below.

We found one specimen (SVL 144 mm) on 20 June at 1330 h on the RMNP Forest Ranger Office campus (Zhemgang District, elev. 165 m), under abandoned tin sheeting. Earlier records from Bhutan include the campus of the College of Natural Resources (Punakha District) and Samchi (Phuentsholing District) (Bauer and Günther, 1992; Wangyal, 2012). In Bhutan it has been recorded upto an elevation of 1406 m (Wangyal, 2012). A parthenogenetic species, the Brahminy blindsnake has become widely established in subtropical and tropical parts of Asia (Das, 2002; Whitaker and Captain, 2004).

Colubridae

***Boiga gokool* (Gray, 1835), Eastern Cat-eyed Snake**.—Head distinct from neck with dark brown arrow mark on top. Y-shaped markings on either side of the body. Ventral scales whitish with series of black spots on side of each scale.

We studied one preserved specimen (SVL 610 mm, TL 163 mm, V 221, SC 108), which was kept at the RMNP Forest Ranger Office (specimen number RMS 001). The individual was reported to have been killed in the year 2013 near the Office. This is a new country record for Bhutan. One specimen of *Calotes* cf. *versicolor* was found in its stomach.

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 a prey item. A specimen from Sylhet (MCZ R-58261) contained a juvenile *Calotes* sp. In captivity, *B. gokool* feed on *Hemidactulus frenatus*, *H. platyurus*, and juvenile *C. versicolor* (pers. obs.). *Boiga gokool* is a South Asian endemic and until now known with certainty only from India and Bangladesh. In India, *B. gokool* has been reported from Arunachal Pradesh, Assam, Manipur, Meghalaya, Nagaland, and West Bengal. In Bangladesh, *B. gokool* is known from Khulna, Sylhet, and Chittagong Divisions. No explicit

Figure 20. *Boiga ochracea* (unsexed, SVL 580 mm; ZRC-IMG 2.280) caught near a rocky stream among stream-side vegetation.

record of the species exists from Myanmar (Das et al., 2010).

***Boiga siamensis* Nutaphand, 1971, Siamese Cat-eyed Snake**.—Dorsal scales in 23 rows at midbody; dark postocular stripe present, dorsum with checkered pattern on grayish-brown ground color, longitudinal dark marking absent on pileus.

We observed one formalin-preserved female specimen (RMS 003[1], SVL 1260 mm, TL 390 mm) and one male (RMS 003, SVL 1400 mm, TL 405 mm, 23 DSR, V 251, SC 121, single cloacal plate), kept at the RMNP Forest Ranger Office. These were reported to have been killed inside a human habitation close to the office during 2013. The female had one domestic fowl chick in its stomach. This species is also known from parts of India (Arunachal Pradesh, Assam, Meghalaya, Nagaland, Sikkim, Northern West Bengal; Das et al., 2010).

***Boiga ochracea* (Günther, 1868) (Fig. 20), Tawny Cat-eyed Snake**—Dorsum without pattern or with indistinct dark transverse dorsolateral bands on yellowish-brown or reddish-brown ground; 19 or 21 midbody dorsal scale rows. One individual (SVL 580 mm, TL 166 mm; ZRC-IMG 2.280) was caught near a rocky stream among stream-side vegetation, about 2.5 m above-ground at 1815 h on 23 June, 3 km away from the international border with India on the Panbang Road (elev. 150 m). Subsequently, another individual was observed crossing a gravel road close to a landslide area ca. 1 km from the international border with India at 1845 h. Both individuals were active during a rainfall. Earlier records exist from Phuntsholing, Serzhong (Mongar District, elev. 1766 m; see Tillack, 2006; Wangyal, 2011). The species is also known from the Indian states of Assam, Arunachal Pradesh, Meghalaya, Sikkim, and Darjeeling.

Boiga ochracea is currently regarded as a species complex. Orlov and Ryabov (2002) recognized three subspecies, *B. o. ochracea* (Günther, 1868), *B. o. stoliczkae* (Wall, 1909), and *B. o. walli* Smith, 1943. Based on scale counts, the population in Bhutan can be identified as *B. o. stoliczkae.*

***Ptyas korros* (Schlegel, 1837) (Fig. 21), Indo-Chinese Ratsnake**.—Head small, eyes large, labial scales without black markings. Body grey brown. The scales on the posterior part of the body and tail are edged with black with lighter centres that appear as spots. The underside is uniformly yellowish white.

We found one male individual (SVL 980 mm, TL 400 mm; ZRC-IMG 2.281) on 20 June at around 1130 h (Hatilora Trail, Zemgang District, elev. 139 m). It was roosting at a height of 1.5 m in thick bush. An earlier record of this species is from Bumdeling Wildlife Sanctuary, Rollong (Trashi Gang District, elev. 694 m; Wangyal, 2011).

Figure 21. *Ptyas korros* (♂, SVL 980 mm; ZRC-IMG 2.281) discovered roosting at a height of 1.5 m among thick brush.

[1] The male and female specimens are tied together and kept in same jar with the same specimen number.

Figure 22. *Chrysopelea ornata* (unsexed, SVL 740 mm; ZRC-IMG 2.282) from near the Forest Ranger Office, Royal Manas National Park, Bhutan.

***Rhabdophis himalayanus* (Günther, 1864), Himalayan Keelback**.—Eyes large with round pupil, scale strongly keeled, 19 rows at midbody, 8 supralabials (4-5 touch the eye on both side). Dorsum olive brown, anterior part of dorsum with whitish checkering, posteriorly dorsolateral series of small yellowish or cream spots present. Neck with a pinkish collar which is broad at the middle, small black bars from eye to the labials and one large bar from behind the eye to angle of mouth, ventral with light mottling that increases posteriorly.

We examined one formalin-preserved female specimen (RMS 006, SVL 704 mm, tail incomplete), reported to have been collected near the RMNP Forest Ranger Office. The species is also known from Bumdeling Wildlife Sanctuary, Tingtibi (Zhemgang District, elev. 1945 m; Wangyal, 2011).

***Chrysopelea ornata* (Shaw, 1802) (Fig. 22), Ornate Flying Snake**.—This is a long, slender, and colourful snake. The dorsum is light green with alternate black crossbars and reddish spots. The head is painted with black and yellow crossbands. The venter is light green, with a series of ventrolateral spots.

Figure 23. *Psammodynastes pulverulentus* (unsexed, SVL 435 mm; ZRC-IMG 2.283) found on a stream-side boulder on herbaceous vegetation.

Figure 24. *Trimeresurus popeiorum* (♂, SVL 357 mm; ZRC-IMG 2.284) found among foliage of a tree close to a stream.

We examined one freshly killed female specimen (RMS 005, SVL 740 mm, TL 275 mm, V 214, SC 116, single cloacal plate; ZRC-IMG 2.282) on 16 June at 1040 h from near the RMNP Forest Ranger Office (elev. 134 m). We also studied one preserved gravid female specimen (RMS 004, 1050 mm SVL, 330 mm TL), kept at the RMNP Forest Ranger Office. An earlier record exists from the same area (elev. 124 m; Wangyal, 2012).

***Psammodynastes pulverulentus* (Boie, 1827) (Fig. 23), Common Mock Viper**.—Head broad, distinct from neck, covered with large scales. Pupil vertically elliptical. Darker Y- shaped mark on head and two elongated dark marks on side of body.

We recorded one individual (SVL 435 mm, TL 92 mm; ZRC-IMG 2.283) on 21 June at 1005 h (Panbang Road, elev. 167 m). It was discovered on a stream-side boulder with herbaceous vegetation in an evergreen forest. Das and Palden (2000) recorded a gravid female (SVL 383 mm, TL 80 mm) containing three neonates in the month of July at Sershong (Sarphang District) from the edge of a secondary forest near a stream. The species is also known from India (Assam, Arunachal Pradesh, Mizoram, Meghalaya, Uttar Pradesh, northern West Bengal, Orissa, Northern Andhra Pradesh; Ahmed et al., 2009; Das et al., 2009; Mohapatra et al., 2010). It is also known from Nepal, southern China, and from throughout Southeast Asia (e.g., Smith, 1943; Swan and Leviton, 1962; Zhao and Adler, 1993).

Elapidae

***Ophiophagus hannah* (Cantor, 1836), King Cobra**.—Our record of the species is based on theshed skin of an adult individual (> 3 m total length)obtained near the RMNP Forest Ranger Office (elev. 128 m). The head portion of the skin clearly shows the characteristic enlarged occipital shields. Scales smooth, juxtaposed, large ventral scales (12 cm wide). The area where the skin was found is open with scattered trees and thick ground cover. Other records from Bhutan include Gomkora (Trashiyangtse District) and Khoma (Lhuentse District). Earlier records from Bhutan include a juvenile in the month of September. This species was also reported by Biswas (1975) from Manas Valley and Narayan and Rosalind (1989) from the grasslands of Manas National Park.

Viperidae

***Trimeresurus popeiorum* Smith, 1937 (Fig. 24), Pope's Pitviper**.—21 scale rows at midbody. The individual had the following characteristics: SVL 357 mm, TL 85 mm, V 167, SC 71, internasals separated by one row scale, 10R/10L supralabials, first supralabial separated from nasal completely, third touches eye; 13R/13L infralabials. Colour overall green dorsally, light green venter. Eyes deep red, bicoloured postocular streak, bicolour wide ventrolateral stripe red ventrally and white dorsally, rusty red tail.

We observed one male individual (ZRC-IMG 2.284) on 22 June at 2130 h (Hatilora Trail, Zemgang District, elev. 158 m). It was found on a tree among foliage at 3 m above-ground, near a seasonal stream (elev. 156 m). This is the first country record for Bhutan. In India this species has been reported from the states of Sikkim,

Darjeeling, Assam, Meghalaya, Arunachal Pradesh, and Mizoram (Smith, 1943; Ahmed and Dasgupta, 1992; A. Captain, S. Sengupta, and A. Das, unpubl.). This species is also known from Myanmar, northern Laos, and northern and western Thailand (Vogel et al., 2004; Whitaker and Captain, 2004; Das, 2010).

Discussion

Thirty-one percent of the species from RMNP reported herein are new records for Bhutan. This includes the frogs *Rhacophorus bipunctatus*, *Uperodon globulosus*, and *Ingerana borealis,* as well as the lizard *Calotes maria*, which previously had been recorded from Meghalaya and Assam. Furthermore, *Cnemaspis assamensis*, the only day gecko so far known from northeastern India, is reported from the Bhutan border region for the first time. The closest record for this species is from Ultapani Reserved Forest, Western Assam (A. Das, pers. obs.), a distance (by air) of ca 75 km. Records of *Ptyctolaemus gularis* and *Varanus salvator* from RMNP are also new country records for Bhutan. Our examination of the preserved specimens kept at the RMNP Forest Ranger Office also revealed first country reports for two cat-eyed snake species, *Boiga gokool* and *B. siamensis*.

The known reptile diversity in the national park consists predominantly of Indomalayan genera (*Chrysopelea, Cnemaspis, Indotyphlops, Ophiophagus, Ptyctolaemus, Psammodynastes, Rhabdophis*, *Varanus*), followed by transitional elements (*Boiga, Indotestudo, Lycodon, Sibynophis*), Tibeto-Yunnanese elements (*Cuora, Gekko, Japalura*), and Indian radiations (*Calotes, Hemidactylus, Melanochelys*). Das and Palden (2000) reported seven amphibian and 12 reptilian species from Royal Manas National Park. Of these, seven species (*Duttaphrynus melanostictus, Euphlyctis cyanophlyctis, Hoplobatrachus tigerinus, Cyrtodactylus khasiensis, Hemidactylus* cf. *tenkatei, Calotes versicolor, Psammodynastes pulverulentu*s) were also recorded during this survey.

In addition to hitherto recorded amphibian species from Bhutan, Frost (2016) listed the possible occurrence of *Amolops gerbillus, A. monticola, A. formosus, Clinotarsus alticola, Duttaphrynus himalayanus, Hylarana tytleri, Ichthyophis sikkimensis, Nanorana blanfordii, N. parkeri, Philautus annandalii,* and *Scutiger sikkimensis* from Bhutan.

Wangyal et al. (2012) listed five turtle species (*Cuora amboinensis, C. mouhotii, Cyclemys gemeli, Melanochelys tricarinata*, *Indotestudo elongata*) as new country records from Bhutan (see Fig. 1 for localities). They also provided a list of fifteen species that are likely to occur in Bhutan.

This rapid herpetological assessment provides baseline natural history information for all the recorded species that may help in further research and conservation. Our results are based on surveys constrained by time, and presumably represent a small subset of actual diversity, indicating only parts of a presumably hyper diverse nature of the landscape, much of which still holds undetected diversity. Reptiles and amphibians are important components of biodiversity, especially amphibians, which are valuable bioindicators (Hyne et al., 2009). These species are often under-represented in conservation planning (e.g., Pawar et al., 2007) despite having the highest threat status of all terrestrial vertebrates, with significantly more species at risk than either birds or mammals (Gascon et al., 2005; Cuttelod et al., 2008). This rapid assessment provides baseline information for conservation prioritization of the RMNP. We recommend that a long term herpetofaunal inventory be established at RMNP, and that ecological studies are conducted to better understand the diversity, biogeography, and ecology of herpetofaunal species in RMNP.

Acknowledgements. We would like to thank A. Swargiary (Field Director, Manas Tiger Reserve, India) and T. Wangchuk (Park Manager of Royal Manas National Park, Bhutan) for granting permission and logistics support to undertake this rapid survey. Special thanks to D.D. Boro (Assistant Conservator of Forest, Manas Tiger Reserve) for giving his valuable time and being a support system for the survey team. We also thank V.B. Mathur, P.K. Mathur, G.S. Rawat, and B. Pandav of the Wildlife Institute of India for their support of our research. Thanks to V. Sarkar for photo-editing. We also take this opportunity to express a deep sense of gratitude to Aaranyak, Guwahati (NGO), and Saibal Sengupta of Guwahati for their support. We thank Hinrich Kaiser and Frank Tillack for extensive reviews and editorial comments that greatly improved the manuscript. Lastly we thank Jigme Tshelthrim Wangyal for his pioneering work and discussions on Bhutan's herpetofauna.

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Accepted by Hinrich Kaiser