

## No end in sight? Further new records of amphibians and reptiles from Phong Nha – Ke Bang National Park, Quang Binh Province, Vietnam

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### ABSTRACT

We report 11 new records of amphibian and reptile species and subspecies on the basis of newly collected specimens from the UNESCO World Heritage Site Phong Nha - Ke Bang National Park, Quang Binh Province, Vietnam: *Ingerophrynus macrotis*, *Limnonectes gyldenstolpei*, *Babina chapaensis*, *Theloderma corticale*, *T. stellatum*, *Scincella rufocaudata*, *Oligodon cinereus pallidocinctus*, *Parahelicops annamensis*, *Rhynchophis boulengeri*, *Sinomicrurus maclellandii* and *Protobothrops mucrosquamatus*. The record of *T. corticale* from Phong Nha - Ke Bang National Park is the southernmost record generally known, that of *T. stellatum* the northernmost record within Vietnam, and, most remarkably, the finding of *Limnonectes gyldenstolpei* represents the first country record for Vietnam. In addition, we report the second known specimen and the first adult male of *Sphenomorphus tetradactylus*, a species recently described based on a single female only. At time, 151 species of amphibians and reptiles are known from Phong Nha - Ke Bang National Park, including 50 species of amphibians, 12 species of turtles, 31 species of lizards, and 58 species of snakes. In addition, an updated list of the local herpetofauna is provided, including recent taxonomic or nomenclatural changes.

### KEY WORDS

herpetofauna; taxonomy; distribution; limestone habitat; Truong Son Mountain Range.

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### INTRODUCTION

Phong Nha - Ke Bang National Park in the Truong Son Mountain Range in central Vietnam is known as one of the country's most famous protected areas in terms of herpetofaunal diversity. Ziegler & Herrmann (2000) published a first,

preliminary list of the karst forest area's herpetodiversity, based on own fieldwork, collection-based research and first Vietnamese reports, comprising 96 amphibian and reptile species. Four years later, the total number of amphibian and reptilian species known from the area as a result of further field work was increased to 128 species (Ziegler et al., 2004).

In a third updated herpetofaunal list for the area, Ziegler et al. (2006) reported of 140 amphibian and reptilian species, demonstrating a still ongoing increase in new species records. Ziegler et al. (2007) published a comprehensive review of the snake diversity of Phong Nha - Ke Bang including nine formerly not yet recorded species, thus increasing the total number of snakes known from Phong Nha - Ke Bang to 59 species. Hendrix et al. (2008) provided an updated anuran list comprising 47 taxa recorded for the Phong Nha - Ke Bang National Park, in which five species were recorded for the first time from that karst forest area. Recently, Ziegler & Vu (2009) published an updated checklist of the amphibians and reptiles from Phong Nha - Ke Bang National Park with a total of 138 species, including 45 species of amphibians and 93 species of reptiles. The total number of recorded amphibians and reptiles has decreased in this overview, because several doubtful or unconfirmed records, e.g., mentioned in Ziegler et al. (2007) and Hendrix et al. (2008), were removed from the list provided by Ziegler & Vu (2009), viz. *Bombina maxima* (Boulenger, 1905), *Eutropis chapaensis* (Bourret, 1937), *Scincella rupicola* (Smith, 1916), *Sphenomorphus buenloicus* (Darevsky et Nguyen, 1983), and *Malayemys subtrijuga* (Schlegel et Müller, 1844). In the years 2010 and 2011, additional herpetological field surveys were conducted in Phong Nha - Ke Bang National Park and extension area which revealed the existence of a number of so far not reported amphibian and reptile species. In addition to the eleven new herpetofaunal records for Phong Nha - Ke Bang National Park we provide an updated list of amphibians and reptiles occurring in this area.

## MATERIALS AND METHODS

Field surveys were conducted in the Phong Nha - Ke Bang National Park area by Thomas Ziegler, Thanh Ngoc Vu, Kien Ngoc Dang, and Sladjana Miskovic (TZ and others) from June to July 2010, as well as from 12th July to 2nd August, and from 12th September to 1st October 2011 by Truong Quang Nguyen, Cuong The Pham, Dai Van Nguyen, Hang Thi An, and Kien Ngoc Dang (TQN and others) (Figs. 1, 2). After taking photographs, specimens were anaesthetized, fixed in 40-70% ethanol (am-



Figure 1. Map showing the location of Phong Nha - Ke Bang National Park, Quang Binh Province, Vietnam.

phibians) or 80-85% ethanol (reptiles) and subsequently stored in 70% ethanol. Measurements were taken with a digital calliper to the nearest 0.1 mm.

ABBREVIATIONS. a.s.l. = above sea level; SVL (snout-vent length) = from tip of snout to anterior margin of cloacal; TaL = tail length, from posterior margin of cloacal to tip of tail; terminology of morphological characters followed Nguyen et al. (2012) for amphibians and anuran webbing formula followed Glaw & Vences (2007) (except for forearm length, FAL = from axilla to elbow and hand length, HAL = from base of outer palmar tubercle to tip of finger III), Phung & Ziegler (2011) for lizards, and David et al. (2012) for snakes. Specimens were deposited in the collections of the Institute of Ecology and Biological Resources (IEBR), Vietnam Academy of Science and Technology Hanoi, Vietnam, Phong Nha - Ke Bang National Park (PNKB), Quang Binh Province, Vietnam, and the Zoologisches Forschungsmuseum Alexander Koenig (ZFMK), Bonn, Germany.

## RESULTS

### BUFONIDAE

*Ingerophrynus macrotis* (Boulenger, 1887)  
Big-eyed Toad / Coc tai to (Fig. 3)

EXAMINED MATERIAL. One juvenile ZFMK 94263 collected by TZ and others during night time in June 2010 in the leaf litter of karst forest near Tam Co Cave, Tan Trach Commune, Bo Trach District and one adult female IEBR A.2013.7 (SVL: 58.7 mm) collected on 15 July 2011 by TQN and others in Da Lat forest, Thuong Hoa Commune, Minh Hoa District (17°40.124'N, 105°55.031'E, at an elevation of 312 m a.s.l.).

MORPHOLOGICAL CHARACTERS. SVL of adult female 58.7 mm; head wider than long (HW 20.3 mm, HL 18.7 mm); snout truncate, protruding, longer than horizontal diameter of eye (SL 6.6 mm, ED 5.9 mm); canthus rostralis rounded, loreal region concave; interorbital distance wider than internarial distance (IOD 4.7 mm, IND 4.1 mm); nostril closer to the tip of snout than to the eye (SN 1.7 mm; EN 3.6 mm); pupil rounded; tympanum distinct (TD 3.2 mm); parotoid gland 11.1 mm; vomerine teeth absent; tongue rounded posteriorly. Forelimbs: FAL 15.4 mm, HAL 30.1 mm; fingers free of webbing, relative length of fingers: II<IV<I<III; tips of fingers rounded, without discs; dermal fringe along outer finger absent; palmar tubercles distinct. Hindlimbs: femur longer than tibia and foot length (FML 26.0 mm, TBL 24.4 mm, FTL 23.2 mm); toes long and thin, relative length of toes: I<II<V<III<IV; tips of toes rounded; webbing basal; tarsal fold absent, dermal fringe along outer toe absent; subarticular tubercles present; inner metatarsal tubercle present (IMT 2.4 mm), outer metatarsal tubercle small (OMT 1.8 mm). Dorsal skin of body covered with tubercles or warts in different sizes, those on head smallest, few enlarged tubercles around vent.

Coloration in preservative: dorsal skin greyish brown with some symmetrical darker markings on snout and interorbital region; a V-shaped conversely mark in front of shoulder and dark spots near middle of back; dorsal tubercles on body, limbs grey to yellow; tympanum dark grey; upper lip with yellow and grey flecks. Ventral skin and concealed parts of limbs dirty greyish-yellow (determination after Inger et al., 1999).

DISTRIBUTION. In Vietnam, *I. macrotis* has been recorded from Thanh Hoa, Ha Tinh, Thua Thien-Hue, Da Nang, Quang Nam, Dak Lak, Lam Dong, and Dong Nai provinces. Our finding represents the first record for Phong Nha - Ke Bang National Park and for Quang Binh Province. Elsewhere, this species is known from northeastern India, Myanmar, Laos, Thailand, Cambodia, and Malaysia (Nguyen et al., 2009; Frost, 2013).

### DICROGLOSSIDAE

*Limnonectes gyldenstolpei* (Andersson, 1916)  
Gyldenstolpe's Frog / Ech gin-den-x-ton-pi (Fig. 4)

EXAMINED MATERIAL. One adult male IEBR A.2013.8 collected on 14 September 2011 in the evergreen forest, Hoa Son Commune, Minh Hoa District (17°42.166'N, 105°47.957'E, at an elevation of 449 m a.s.l.)

MORPHOLOGICAL CHARACTERS. SVL 69.6 mm; head longer than wide (HL 35.2 mm, HW 34.4 mm); snout longer than horizontal diameter of eye (SL 12.7 mm; ED 7.2 mm); canthus rostralis rounded; nostril directed laterally; loreal region concave; interorbital distance broader than internarial distance (IOD 8.5 mm, IND 7.3 mm); nostril closer to the tip of snout than to the eye (EN 7.1 mm; SN 4.7 mm); tympanum rounded, longer than tympanum-eye distance (TD 7.4 mm, TEY 6.4 mm); vomerine teeth present; tongue notched posteriorly; vocal sac indistinct in males. Forelimbs: FAL 13 mm, HAL 32 mm; fingers free of webbing, relative length of fingers: II<IV<I<III; tips of fingers rounded, without discs; dermal fringe along outer finger absent; palmar tubercles present; nuptial pad present in males. Hindlimbs: femur shorter than tibia and foot length (FML 32.7 mm, TBL 36.7 mm, FTL 34.7 mm); toes long and thin, relative length of toes: I<II<V<III<IV; tips of toes rounded; webbing formula: Io(0)-(1)iIIo(0)-(1)iIIIo(1/2)-(1)iIVo(2)-(0)iV; dermal fringe along outer toe absent; subarticular tubercles present; inner metatarsal tubercle present (IMT 4.3 mm), outer metatarsal tubercle indistinct. Dorsal skin of head smooth with a swollen flap (10.6 mm length and 10.2 mm width); dorsal surface of forelimbs, thigh and tarsus smooth; supratympanic fold distinct, from eye to shoulder; ventral surface smooth.

Coloration in preservative: head grey with a cream broad stripe between eyes; dorsum brown; dark dorsolateral spots; dark bars present on upper surface of forelimbs, tibia and thigh; venter cream with dark spots on throat (determination after Taylor, 1962; Ohler & Dubois, 1999).

**DISTRIBUTION.** The specimen from Phong Nha - Ke Bang National Park represents the first country record of *Limnonectes gyldenstolpei* for Vietnam. Elsewhere, this species is known from Laos, Cambodia, and Thailand (Frost, 2013).

**REMARKS.** The male specimen differs from the juvenile female in the description of Ohler & Dubois (1999) by having the tibia longer than femur (TBL 36.7 mm, FML 32.7 mm versus TBL 11.6 mm, FML 11.7 mm).

## RANIDAE

***Babina chapaensis*** (Bourret, 1937)  
Chapa Frog / Chang sa pa (Fig. 5)

**EXAMINED MATERIAL.** Two adult males IEBR A.2013.9 and ZFMK 94258, one adult female IEBR A.2013.10 collected on 14 September 2011 and one adult male ZFMK 94259 collected by TQN and others on 16 September 2011 in the forest near Cha Lo Village, Hoa Son Commune, Minh Hoa District (17°42.213'N, 105°47.748'E, at an elevation of 570 m a.s.l.).

**MORPHOLOGICAL CHARACTERS.** SVL 43.0-46.0 mm in males (mean  $\pm$  SE 44.2  $\pm$  1.6, N = 3), 56.9 mm in the female; head longer than wide (HL 17.3-20.4 mm, HW 14.9-18.0 mm); snout longer than horizontal diameter of eye (SL 6.9-7.8 mm; ED 4.7-5.6 mm); canthus rostralis rounded; nostril directed laterally; loreal region concave; interorbital distance narrower than internarial distance (IOD 3.3-4.5 mm, IND 5.1-6.3 mm); nostril closer to the eye than to the tip of snout (EN 2.9-4.0 mm; SN 3.5-4.2 mm); tympanum rounded, longer than tympanum-eye distance (TD 3.9-4.2 mm, TEY 0.3-1.4 mm); vomerine teeth present; tongue notched posteriorly; vocal sac present in males. Forelimbs: FAL 8.8-10.3 mm, HAL 20.2-23.7 mm; fingers free of webbing, relative length of fingers: II<I=IV<III; tips of fingers rounded, without discs; dermal fringe along outer finger absent; palmar tubercles distinct; nup-

tial pad present in males. Hindlimbs: femur shorter than tibia and foot length (FML 21.4-25.2 mm, TBL 24.5-29.5 mm, FTL 24.1-29.2 mm); toes long and thin, relative length of toes: I<II<V<III<IV; tips of toes rounded; webbing formula: Io(1)-(1)iIIo(1/2)-(2)iIIIo(1)-(2)iIVo(2)-(1/2)iV; dermal fringe along outer toe absent; subarticular tubercles present; inner metatarsal tubercle present (IMT 2.2-2.5 mm), outer metatarsal tubercle indistinct.

Dorsal surface of head and dorsum smooth; dorsolateral fold distinct; lateral sides smooth; a small fold present along arm; ventral surface smooth. Coloration in preservative: head and dorsum light brown with a cream vertebral stripe, edged in dark brown, running from behind the eye to vent; posterior part of dorsum with some dark spots; upper jaw with a cream stripe, from below the nostril to axilla; dorsolateral fold yellowish brown, edged in black laterally; upper surface of tibia and thigh with some dark bars; venter cream (determination after Bourret, 1942; Chuaynkern et al., 2010).

**DISTRIBUTION.** In Vietnam, *B. chapaensis* has been recorded from Lao Cai, Bac Giang, Ha Tinh, Kon Tum, Gia Lai, and Dak Lak provinces (Nguyen et al., 2009). This is the first record of this species from Phong Nha - Ke Bang National Park as well as from Quang Binh Province. Elsewhere, this species is known from Laos and Thailand (Nguyen et al., 2009).

## RHACOPHORIDAE

***Theloderma corticale*** (Boulenger, 1903)  
Tonkin Bug-eyed Frog / Ech cay san bac bo (Fig. 6)

**EXAMINED MATERIAL.** Three adult males IEBR A.2013.11, ZFMK 94262 collected on 21 July 2011 by TQN and others in Da Lat forest, Thuong Hoa Commune, Minh Hoa District (17°39.032'N, 105°54.774'E, at an elevation of 516 m a.s.l.) and PN-KB 2011.204 collected by TQN and others on 28 July 2011 in Cha Noi forest, Xuan Trach Commune, Bo Trach District (17°37.758'N, 106°05.893'E, at an elevation of 470 m a.s.l.).

**MORPHOLOGICAL CHARACTERS.** SVL of males 61.3-69.7 mm; head wider than long (HL 24.1-27.5 mm, HW 26.3-28.6 mm); snout longer than horizontal diameter of eye (SL 9.0-10.0 mm; ED 6.2 mm); canthus rostralis rounded; loreal region concave; interorbital distance wider than internarial dis-



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Figure 2. Karst forest in Thung Hoa Commune, extension area of Phong Nha - Ke Bang National Park. Figure 3. Big-eyed Toad, *Ingerophrynus macrotis*. Figure 4. Gyldenstolpe's Frog, *Limnonectes gyldenstolpei*. Figure 5. Chapa Frog *Babina chapaensis*. Figure 6. Tonkin Bug-eyed Frog, *Theloderma corticale*. Figure 7. Taylor's Bug-eyed Frog, *Theloderma stellatum*. Photos: T. Q. Nguyen & T. Ziegler.

tance (IOD 6.1-6.5 mm, IND 3.7-4.4 mm); nostril closer to tip of snout than to eye (SN 2.5 mm; EN 7.1-8.3 mm); vocal sac absent; tympanum oval, greater than tympanum-eye distance (TD 4.0-4.9 mm, TEY 3.3-3.9 mm); vomerine teeth present; tongue notched posteriorly. Forelimbs: FAL 12.2-14.8 mm, HAL 33.2-34.7 mm; relative length of fingers: I<II<IV<III; tips of fingers and toes enlarged into round discs; webbing present at base of fingers III and IV; dermal fringe along outer finger present; palmar tubercles distinct; nuptial pad present. Hindlimbs: tibia longer than femur and foot length (TBL 31.8-34.0 mm, FML 25.5-32.2 mm, FTL 27.8-30.5 mm); relative length of toes: I<II<III<V<IV; webbing formula: Io(0)-(0)iIIo(0)-(0)iIIIo(0)-(1)iIVo(1)-(0)iV; dermal fringe along outer toe absent; subarticular tubercles present; inner metatarsal tubercle present (IMT 3.1-4.9 mm); outer metatarsal tubercle absent.

Dorsal surface of body covered with tubercles or warts of different sizes, those on head and back biggest; ventral skin with small tubercles. Coloration in preservative: dorsal colour olive-green marbled with red-brown spots; dark brown bars present on upper surface of fore and hind limbs; ventral surface greyish yellow (determination after Inger et al., 1999; Orlov et al., 2006).

**DISTRIBUTION.** *T. corticale* is currently known only from northern Vietnam: Ha Giang, Tuyen Quang, Cao Bang, Lang Son, Vinh Phuc, and Son La provinces (Nguyen et al., 2009; Frost, 2013). This is a new record for Phong Nha - Ke Bang National Park and for Quang Binh Province as well as the southernmost known record of the species.

***Theلودerma stellatum*** Taylor, 1962

Taylor's Bug-eyed Frog / Ech cay san tay-lo (Fig. 7)

**EXAMINED MATERIAL.** One adult female ZFMK 94261 collected by TZ and others during night time on a tree trunk nearby a forest stream and one adult male IEBR A.2013.12 collected by TQN and others on 28 July 2011 in Cha Noi forest, Xuan Trach Commune, Bo Trach District (17°37.649'N, 106°05.806'E, at an elevation of 517 m a.s.l.).

**MORPHOLOGICAL CHARACTERS.** SVL 32.7-35.0 mm; head as long as wide (HL 13.5-13.9 mm, HW 13.6-14.0 mm); snout longer than horizontal diameter of eye (SL 5.3-5.4 mm; ED 4.5-4.7 mm); canthus rostralis rounded; loreal region concave;

interorbital distance wider than internarial distance (IOD 3.6-3.9 mm, IND 2.0-2.1 mm); nostril closer to tip of snout than to eye (SN 1.6-1.7 mm; EN 3.2-4.0 mm); tympanum rounded, greater than tympanum-eye distance (TD 2.2-2.9 mm, TEY 1.0 mm); vomerine teeth present; tongue notched posteriorly. Forelimbs: FAL 7.9-8.4 mm, HAL 17.5-17.9 mm; relative length of fingers: I<II<IV<III; tip of fingers and toes enlarged into large discs; webbing basal; dermal fringe along outer finger absent; palmar tubercles indistinct; nuptial pad present. Hindlimbs: tibia longer than femur and foot length (TBL 17.6-18.3 mm, FML 16.6-16.9 mm, FTL 15.6-16.0 mm); relative length of toes: I<II<III=V<IV; webbing formula: Io(1)-(1)iIIo(1/2)-(2)iIIIo(1)-(2)iIVo(2)-(1/2)iV; dermal fringe along outer toe absent; subarticular tubercles present; inner metatarsal tubercle present (IMT 1.3-1.5 mm).

Dorsal skin of head and body, upper surface of fore-arm, tibia, and tarsus, with tubercles covered in whitish granular asperities; ventral skin smooth. Coloration in preservative: dorsal head and body brownish with cream speckles; black spots present on snout and black marking present between shoulders; upper surface of thigh, tibia, tarsus, and foot with transverse dark bars; discs pinkish; chin and venter dark brown with light flecks (determination after Taylor, 1962; Inger et al., 1999; Orlov et al., 2006; Nguyen & Nguyen, 2008).

**DISTRIBUTION.** In Vietnam, *T. stellatum* has been recorded from Kon Tum, Gia Lai, Dak Lak, Dong Nai, and Kien Giang provinces (Nguyen et al., 2009). This is the first record of the species from Phong Nha - Ke Bang National Park as well as from Quang Binh Province, which at the same time is the northernmost country record. Elsewhere, this species is known from Thailand, southern Laos and Cambodia (Nguyen et al., 2009).

SCINCIDAE

***Scincella rufocaudata*** (Darevsky et Nguyen, 1983)  
Red-tailed ground skink / Than lan phe-no duoi do (Fig. 8)

**EXAMINED MATERIAL.** One adult male IEBR A.2013.13 collected on 21 July 2011 by TQN and others in Da Lat forest, Thuong Hoa Commune, Minh Hoa District (17°39.665'N, 105°55.800'E, at

an elevation of 448 m a.s.l.), 2 adult females IEBR A.2013.14 collected on 29 July 2011 by TQN and others in Khe Ma forest, Thuong Hoa Commune, Minh Hoa District (17°39.410'N, 106°03.592'E, at an elevation of 300 m a.s.l.), and ZFMK 94256 collected on 20 July 2011 by TQN and others in Hoa Son Commune, Minh Hoa District (17°39.120'N, 105°59.678'E, at an elevation of 250 m a.s.l.) and one juvenile ZFMK 94257 collected on 18 July 2011 by TQN and others in Thuong Hoa Commune, Minh Hoa District (17°40.057'N, 105°56.049'E, at an elevation of 513 m a.s.l.).

**MORPHOLOGICAL CHARACTERS.** SVL 45.5 mm in the male, 45.9-47.2 mm in females; TaL 51.0 mm in one female, regenerated or lost in others; snout obtuse; rostral wider than long, nostril in the nasal; frontonasal large; prefrontals separated from each other; frontal longer than frontoparietal; parietals large, in contact posteriorly; nuchals absent; supraoculars 4; supraciliaries 8; loreals 2; supralabials 7; temporals 2 + 2, upper overlapped by lower one; infralabials 6; ear-opening oval; lower eyelid with a transparent window; midbody scales in 30-34 rows, smooth; paravertebral scales 67-69; ventral scales 61-66; enlarged preloacals 2; limbs pentadactyl; subdigital lamellae under fourth toe 15-20.

Coloration in preservative: dorsal head and body brown with a row of dark vertebral spots, a black stripe present on upper part of the side; upper surface of tail reddish; venter cream (determination after Stuart & Emmett, 2006; Nguyen et al., 2011a).

**DISTRIBUTION.** In Vietnam, *S. rufocaudata* is known from Thua Thien - Hue, Quang Nam, Kon Tum, Gia Lai, Dak Lak, and Ba Ria - Vung Tau provinces (Nguyen et al., 2009). Records of this species in northern Vietnam (Bac Kan, Thai Nguyen and Vinh Phuc provinces) were reidentified as *S. tonkinensis* by Nguyen et al. (2011a). Elsewhere, this species is recorded from Laos and Cambodia (Nguyen et al., 2009).

**REMARKS.** The red-tailed ground skink was transferred from the genus *Sphenomorphus* to *Scincella* by Nguyen et al. (2011a).

***Sphenomorphus tetradactylus*** (Darevsky et Orlov, 2005)

Four-fingered skink / Than lan phe-no bon ngon (Fig. 9)

**EXAMINED MATERIAL.** One adult male IEBR A.2013.15 collected on 17 July 2011 by TQN and others in Thuong Hoa Commune, Minh Hoa District (17°40.057'N, 105°56.049'E, at an elevation of 513 m a.s.l.).

**MORPHOLOGICAL CHARACTERS.** Size small, SVL 36 mm, TaL 49.9 mm, tail tip lost; rostral wider than high, in contact with frontonasal; frontonasal broader than long; prefrontals small, separated from frontal; supraoculars 4/4, first two in contact with frontal on each side; loreal single; lower eyelid scaly; external ear openings hidden with slightly recessed auricular depression; supraciliaries 7/7, first in contact with frontal; supralabials 6/6, third to fifth



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Figure 8. Red-tailed Ground Skink *Scincella rufocaudata*. Figure 9. Four-fingered Skink *Sphenomorphus tetradactylus*. Photos: K. N. Dang & T. Q. Nguyen.

below the eye; infralabials 7/7; nuchals 2/3; mid-body scale rows 20; paravertebral scales 48; ventral scales 51; enlarged precloacals 2; limbs very short, forelimb tetradactyl, first shortest; hind limbs pentadactyl; subdigital lamellae under fourth toe 9/10.

Coloration in preservative: dorsal head and body brown with longitudinal dark stripes along dorsum; venter cream with brown spots; legs dark above with indistinct black marks; free margins of upper and lower eyelids not edged in white (determination after Darevsky & Orlov, 2005; Nguyen et al., 2011a).

DISTRIBUTION. *S. tetradactylus* is currently known only from Phong Nha - Ke Bang National Park, Quang Binh Province, Vietnam (Nguyen et al., 2011a).

REMARKS. *S. tetradactylus* was originally described by Darevsky & Orlov (2005) as a member of the genus *Leptoseps* based on the holotype collected from Phong Nha - Ke Bang National Park. However, Nguyen et al. (2011a) removed this species from the genus *Leptoseps* to the genus *Sphenomorphus*. This is the second known specimen and the first reported adult male of the species.

## COLUBRIDAE

*Oligodon cinereus pallidocinctus* (Bourret, 1934)  
Guenther's Kukri Snake / Ran khiem xam (Fig. 10)

EXAMINED MATERIAL. One male, PNKB S.0154, collected by K.D. Ngoc in 2009.

MORPHOLOGICAL CHARACTERS. SVL 495 mm; TaL 90 mm; maxillary teeth 16/16; loreal 1/1; supralabials 8/8, fourth and fifth entering orbit; infralabials 8/8; preoculars 2; postoculars 2; temporals 1/2+2; dorsal scale rows 17 : 17 : 15, smooth; cloacal entire; ventral scales 3 + 167, subcaudals 42, divided.

Coloration in preservative: dorsal head with a grey chevron; dorsal surface of body yellowish brown with 38 grey, black-edged bands on body, 6 bands on tail; ventral surface cream with dark spots (identification after Bourret, 1936; Smith, 1943).

DISTRIBUTION. In Vietnam, this subspecies is known from Thua Thien - Hue, Ba Ria - Vung Tau, and Ho Chi Minh City ("Form IV" in Smith, 1943). This is the first record of *O. cinereus pallidocinctus* from Phong Nha - Ke Bang National Park, Quang Binh Province.

REMARKS. The male specimen differs from the description of Smith (1943) in having more light

bands on body (38 versus 27-34) and more bands on tail (6 versus 3-4).

*Parahelicops annamensis* Bourret, 1934  
Annam Keelback / Ran binh mui trung bo (Fig. 11)

EXAMINED MATERIAL. Two males IEBR A.2013.16-A.2013.17 collected on 23 July 2011 by TQN and others in Hoa Son Commune, Minh Hoa District (17°42.612'N, 105°52.571'E, at an elevation of 537 m a.s.l.) and one female ZFMK 94255 collected on 16 September 2011 in Hoa Son Commune, Minh Hoa District (17°42.208'N, 105°46.970'E, at an elevation of 641 m a.s.l.).

MORPHOLOGICAL CHARACTERS. SVL 358-430 mm in males, 455 mm in the female; TaL 165-177 mm in males, 102 mm in the female; head distinct from neck; maxillary teeth 21/21; rostral flat, broader than high; nostril in the nasal; internasals narrowed anteriorly; prefrontals 2/2, slightly broader than long; frontal narrowed posteriorly, about half the length of the parietals; loreal single, elongated; preoculars 2/2, upper larger; postoculars 2/2; temporals 1 + 1; supralabials 8 or 9; fourth to sixth (in one male) or fifth and sixth bordering orbit; infralabials 10, first to fifth in contact with first chin shield; first pair of chin shield shorter than second pair, second pair divided by an elongated scale posteriorly; body scales rows 19 : 17 : 17, median rows strongly keeled posteriorly; dorsal scales on tail strongly keeled, eight longitudinal keel rows at base, decreasing to four rows distally; ventrals 167-169; cloacal divided; subcaudals divided, 95 and 121 in two males, 51 in the female.

Coloration in preservative: dorsal head with irregular brown markings; a yellow stripe present from posterior margin of eye to neck, continuing onto body as broken dorsolateral stripe, being less distinct posteriorly; tail iridescent yellowish-brown; ventral and subcaudal surface cream, outer margin of ventrals dark brown (determination after Bourret, 1936; Stuart, 2006; Ziegler et al., 2007).

DISTRIBUTION. In Vietnam, the species is only known from Da Nang and Kon Tum provinces (see Stuart, 2006; Nguyen et al., 2009). This is the first record from Phong Nha - Ke Bang National Park as well as from Quang Binh Province. Elsewhere, this species is reported from Laos (Xe Kong) (Nguyen et al., 2009).

REMARKS. *P. annamensis* was previously listed as *Amphiesma* sp. by Ziegler & Vu (2009).



***Rhynchophis boulengeri*** Mocquard, 1897  
Rhinoceros snake / Ran voi (Fig. 12)

EXAMINED MATERIAL. Two males deposited in PNKB.

MORPHOLOGICAL CHARACTERS. SVL 940-950 mm; TaL 350-360 mm; presence of a long pointed nasal appendage covered with small scales; internasals much smaller than the prefrontals; frontal narrowed posteriorly; loreal single, longer than wide; preocular single; postoculars 2; temporals 2+3; supralabials 8 or 10, fourth to fifth or fifth to seventh in contact with the eye; infralabials 11; midbody scale rows 19, slightly keeled dorsally; ventral scales 1 + 211 or 1 + 208; subcaudal scales 122 or 126, divided; cloacal plate divided.

Coloration in preservative: dorsum green, venter paler; thin black stripe behind eye; interstitial skin on the sides of the body bluish-black and white; light stripes on subcaudal fold (determination after Smith, 1943; Nguyen et al., 2011b).

DISTRIBUTION. In Vietnam, *R. boulengeri* has been recorded from the provinces of Son La, Thai Nguyen, Vinh Phuc, Ha Noi, Quang Ninh, Hai Phong, and Ha Tinh (Nguyen et al., 2009; Nguyen et al., 2011b). This is a new record for Phong Nha - Ke Bang National Park as well as for Quang Binh Province. Elsewhere, this species is known only from China (Nguyen et al., 2009).

ELAPIDAE

***Sinomicrurus macclellandii*** (Reinhardt, 1844)  
MacClelland's Coral Snake/ Ran la kho thuong (Figs. 13-14)

MORPHOLOGICAL CHARACTERS. Morphological characters based on photographic record: vertebral scales not larger than adjacent scales; subcaudals divided; dorsal surface reddish brown with 31 black cross-bands from behind head to tip of tail; head black with a wide, white cross-band behind eyes; ventral surface cream with black bands and black squarish marks (determination after Ziegler et al., 2007).

DISTRIBUTION. In Vietnam, this species is known from Lao Cai and Cao Bang provinces in the North southwards to Lam Dong and Dong Nai provinces (Nguyen et al., 2009). This is the first confirmed record for Phong Nha - Ke Bang National Park. Elsewhere, this species is reported

from India, Nepal, Myanmar, Thailand, China, Japan, Taiwan (Nguyen et al., 2009).

REMARKS. *S. macclellandii* was mentioned as unconfirmed record for Phong Nha - Ke Bang by Ziegler et al. (2007) and thus was subsequently removed from the herpetofaunal list of Phong Nha - Ke Bang by Ziegler & Vu (2009).

VIPERIDAE

***Protobothrops mucrosquamatus*** (Cantor, 1839)  
Chinese Habu / Ran luc cuom (Fig. 15)

EXAMINED MATERIAL. One specimen was found at night of 27 October 2009 by TZ and others in the vegetation nearby a forest path in the Cha Noi region and one male IEBR A.2013.18 (PN-KB 2011.51), collected on 16 July 2011 by TQN and others in Thuong Hoa Commune, Minh Hoa District (17°40.405'N, 105°56.656'E, at an elevation of 260 m a.s.l.).

MORPHOLOGICAL CHARACTERS. SVL 950 mm; TaL 225 mm; head long, narrow; single loreal pit; supralabials 10; gular scales smooth; mental bordering infralabial posteriorly; elongated subocular scales, divided from supralabials; dorsal scales strongly keeled, midbody scale rows 27; ventral scales 3 + 216; subcaudals 98; cloacal undivided.

Coloration in preservative: dorsal head brown, paler below; dorsum greyish brown, with a series of large brown, dark-edged spots; ventral surface cream, with light brown, light areas appearing as squarish spots; dorsal tail light brown, with a series of conspicuous black spots (determination after Smith, 1943; Ziegler et al., 2007; Nguyen et al., 2011b).

DISTRIBUTION. In Vietnam, *P. mucrosquamatus* has been recorded from Lao Cai, Ha Giang, Cao Bang, Bac Kan, Lang Son, Thai Nguyen, Vinh Phuc, Quang Ninh, Hai Phong, Hai Duong, Ha Noi, Ninh Binh, Nghe An, Ha Tinh, Quang Tri, Thua Thien-Hue, Kon Tum, and Gia Lai provinces (Nguyen et al., 2009). This is the first record of the species for Phong Nha - Ke Bang National Park and for Quang Binh Province. Elsewhere, this species is known from India, Bangladesh, China, Taiwan, and Myanmar (Nguyen et al., 2009).

REMARKS. The male specimen differs from the description of Smith (1943) in having more subcaudals (98 versus 76-91).



10



11



12



13



14



15

Figure 10. Guenther's Kukri Snake, *Oligodon cinereus pallidocinctus*. Figure 11. Annam Keelback, *Parahelicops annamensis*. Photos: K. N. Dang & T. Q. Nguyen. Figure 12. Rhinoceros Snake, *Rhynchophis boulengeri*. Figures 13-14. MacClelland's Coral Snake, *Sinomicrurus macclellandii*. Figure 15. Chinese Habu, *Protobothrops mucrosquamatus*. Photos: K. N. Dang, T. Q. Nguyen & T. Ziegler.

**Check-list of amphibians and reptiles recorded from Phong Nha - Ke Bang**

Current check-list of amphibians and reptiles recorded from Phong Nha - Ke Bang after Ziegler & Vu (2009), including the herein listed new records (\*), additions (\*\*), according to Ziegler et al. (2010), Nguyen et al. (2011a), Hoang et al. (2012), and taxonomic reassignments (\*\*\*) according to Blanck et al. (2006), Stuart & Fritz (2008), Fritz et al. (2008, 2010), Inger & Stuart (2010), McLeod (2010), Yu et al. (2010), David et al. (2011), Nguyen et al. (2011b, ), Ohler et al. (2011), Rösler et al. (2011), Kuraishi et al. (2012), Uetz (2013), Frost (2013), Siler et al. (2013), and Patrick David (pers. comm. to replace *Amphiesma khasiense* in central Vietnam with *A. boulengeri*); snake species which have been previously listed but could not be confirmed as occurring in Phong Nha - Ke Bang by Ziegler et al. (2007) are excluded from the list: *Typhlops diardi* Schlegel, 1839, *Calamaria pavementata* Duméril, Bibron et Duméril, 1854, *C. septentrionalis* Boulenger, 1890, *Dendrelaphis pictus* (Gmelin, 1789), *Lycodon septentrionalis* (Günther, 1875), *Orthriophis moellendorffi* (Boettger, 1886), and *Sibynophis collaris* (Gray, 1853).

AMPHIBIA  
ANURA  
MEGOPHRYIDAE

*Brachytarsophrys intermedia* (Smith, 1921)  
*Leptobrachium chapaense* (Bourret, 1937)  
*Leptotalax aereus* Rowley, Stuart, Richards, Phimmachak et Sivongxay, 2010 (\*\*\*)  
*Ophryophryne hansii* Ohler, 2003  
*Xenophrys major* (Boulenger, 1908)

BUFONIDAE

*Duttaphrynus melanostictus* (Schneider, 1799)  
*Ingerophrynus galeatus* (Günther, 1864)  
*Ingerophrynus macrotis* (Boulenger, 1887) (\*)

HYLIDAE

*Hyla simplex* Boettger, 1901

MICROHYLIDAE

*Kalophrynus interlineatus* (Blyth, 1854)

*Kaloula pulchra* Gray, 1831  
*Microhyla berdmorei* (Blyth, 1856)  
*Microhyla butleri* Boulenger, 1900  
*Microhyla fissipes* Boulenger, 1884  
*Microhyla heymonsi* Vogt, 1911  
*Microhyla inornata* (Boulenger, 1890)  
*Microhyla marmorata* Bain et Nguyen, 2004  
*Microhyla pulchra* (Hallowell, 1861)

DICROGLOSSIDAE

*Fejervarya limnocharis* (Gravenhorst, 1829)  
*Hoplobatrachus rugulosus* (Wiegmann, 1834) (\*\*\*)  
*Limnonectes bannaensis* Je, Fei et Jiang, 2007 (\*\*\*)  
*Limnonectes gyldenstolpei* (Andersson, 1916) (\*)  
*Limnonectes limborgi* (Sclater, 1892) (\*\*\*)  
*Limnonectes poilani* (Bourret, 1942)  
*Occidozyga lima* (Gravenhorst, 1829)  
*Occidozyga martensii* (Peters, 1867)

RANIDAE

*Amolops cremnobatus* Inger et Kottelat, 1998  
*Babina chapaensis* (Bourret, 1937) (\*)  
*Hylarana attigua* (Inger, Orlov et Darevsky, 1999)  
*Hylarana guentheri* (Boulenger, 1882)  
*Hylarana maosonensis* Bourret, 1937  
*Hylarana nigrovittata* (Blyth, 1856)  
*Odorrana chloronota* (Günther, 1876)  
*Odorrana tiannanensis* (Yang et Li, 1980)  
*Rana johnsi* Smith, 1921

RHACOPHORIDAE

*Chiromantis vittatus* (Boulenger, 1887)  
*Gracixalus quyeti* (Nguyen, Hendrix, Böhme, Vu, et Ziegler, 2008)  
*Kurixalus banaensis* (Bourret, 1939)  
*Kurixalus bisacculus* (Taylor, 1962) (\*\*\*)  
*Polypedates megacephalus* Hallowell, 1861 (\*\*\*)  
*Polypedates mutus* (Smith, 1940)  
*Rhacophorus annamensis* Smith, 1924  
*Rhacophorus dennysi* Blanford, 1881  
*Rhacophorus exechopygus* Inger, Orlov et Darevsky, 1999  
*Rhacophorus kio* Ohler et Delorme, 2006  
*Rhacophorus orlovi* Ziegler et Köhler, 2001  
*Rhacophorus rhodopus* Liu et Hu, 1960  
*Theloderma asperum* (Boulenger, 1886)  
*Theloderma corticale* (Boulenger, 1903) (\*)  
*Theloderma stellatum* Taylor, 1962 (\*)

REPTILIA  
TESTUDINES  
PLATYSTERNIDAE

*Platysternon megacephalum* Gray, 1831

GEOEMYDIDAE

*Cuora cyclornata* Blanck, McCord et Le, 2006 (\*\*\*)

*Cuora galbinifrons* Bourret, 1939

*Cuora mouhotii* (Gray, 1862)

*Cyclemys oldhamii* Gray, 1863 (\*\*\*)

*Heosemys grandis* (Gray, 1860)

*Mauremys mutica* (Cantor, 1842)

*Ocacia sinensis* (Gray, 1834)

*Sacalia quadriocellata* (Siebenrock, 1903)

TESTUDINIDAE

*Manouria impressa* (Günther, 1882)

TRIONYCHIDAE

*Palea steindachneri* (Siebenrock, 1906)

*Pelodiscus cf. parviformis* Tang, 1997 (\*\*\*)

SQUAMATA: SAURIA

GEKKONIDAE

*Cyrtodactylus cryptus* Heidrich, Rösler, Vu, Böhme et Ziegler, 2007

*Cyrtodactylus phongnhakebangensis* Ziegler, Rösler, Herrmann et Vu, 2003

*Cyrtodactylus roesleri* Ziegler, Nazarov, Orlov, Nguyen, Vu, Dang, Dinh et Schmitz, 2010 (\*\*)

*Gehyra mutilata* (Wiegmann, 1834)

*Gekko palmatus* Boulenger, 1907

*Gekko reevesii* Gray, 1831 (\*\*\*)

*Gekko scientiadventura* Rösler, Ziegler, Vu, Herrmann et Böhme, 2004

*Hemidactylus frenatus* Dumérilet Bibron, 1836

*Ptychozoon lionotum* Annandale, 1905 (\*\*)

AGAMIDAE

*Acanthosaura lepidogaster* (Cuvier, 1829)

*Calotes emma* Gray, 1845

*Calotes versicolor* (Daudin, 1802)

*Physignathus cocincinus* Cuvier, 1829

ANGUIDAE

*Dopasia gracilis* Gray, 1845 (\*\*)

VARANIDAE

*Varanus salvator* (Laurenti, 1768)

LACERTIDAE

*Takydromus hani* Chou, Nguyen et Pauwels, 2001

*Takydromus kuehnei* van Denburgh, 1909

*Takydromus sexlineatus* Daudin, 1802

SCINCIDAE

*Eutropis longicaudata* (Hallowell, 1856)

*Eutropis macularia* (Blyth, 1853)

*Eutropis multifasciata* (Kuhl, 1820)

*Lygosoma boehmei* Ziegler, Schmitz, Heidrich, Vu et Nguyen, 2007

*Lygosoma quadrupes* (Linnaeus, 1766)

*Plestiodon elegans* (Boulenger, 1887)

*Plestiodon quadrilineatus* Blyth, 1853

*Scincella melanosticta* (Boulenger, 1887)

*Scincella rufocaudata* (Darevsky et Nguyen, 1983) (\*)

*Sphenomorphus indicus* (Gray, 1853)

*Sphenomorphus tetradactylus* (Darevsky et Orlov, 2005) (\*\*\*)

*Tropidophorus cocincinensis* Duméril et Bibron, 1839

*Tropidophorus noggei* Ziegler, Vu et Bui, 2005

SQUAMATA: SERPENTES

TYPHLOPIDAE

*Ramphotyphlops braminus* (Daudin, 1803)

XENOPELTIDAE

*Xenopeltis hainanensis* Hu et Zhao, 1972

*Xenopeltis unicolor* Boie, 1827

BOIDAE

*Broghammerus reticulatus* (Schneider, 1801) (\*\*\*)

*Python molurus* (Linnaeus, 1758)

XENODERMATIDAE

*Fimbrios smithi* Ziegler, David, Miralles, Doan et Nguyen, 2008

## COLUBRIDAE

*Ahaetulla prasina* (Boie, 1827)  
*Amphiesma andreae* Ziegler et Le, 2006  
*Amphiesma boulengeri* (Gressitt, 1937) (\*\*\*)  
*Amphiesma leucomystax* David, Bain, Nguyen, Orlov, Vogel, Vu et Ziegler, 2007  
*Amphiesma stolatum* (Linnaeus, 1758)  
*Boiga bourreti* Tillack, Ziegler et Le, 2004  
*Boiga guangxiensis* Wen, 1998  
*Boiga multomaculata* (Boie, 1827)  
*Calamaria thanhi* Ziegler & Le, 2005  
*Chrysopelea ornata* (Shaw, 1802)  
*Coelognathus radiatus* (Boie, 1827)  
*Cyclophiops major* (Günther, 1858)  
*Cyclophiops multicinctus* (Roux, 1907)  
*Dendrelaphis ngansonensis* (Bourret, 1935)  
*Dryocalamus davisonii* (Blanford, 1878)  
*Enhydris plumbea* (Boie, 1827)  
*Liopeltis frenatus* (Günther, 1858)  
*Lycodon fasciatus* (Anderson, 1897)  
*Lycodon futsingensis* (Pope, 1928)  
*Lycodon paucifasciatus* Rendahl, 1943  
*Lycodon cf. rufozonatum* Cantor, 1842 (\*\*\*)  
*Lycodon ruhstrati* (Fischer, 1886)  
*Oligodon chinensis* (Günther, 1888)  
*Oligodon cinereus pallidocinctus* (Bourret, 1934) (\*)  
*Oreocryptophis porphyraceus* (Cantor, 1839)  
*Orthriophis taeniurus* Cope, 1861  
*Parahelicops annamensis* Bourret, 1934 (\*)  
*Pareas carinatus* Wagler, 1830  
*Pareas hamptoni* (Boulenger, 1905)  
*Pareas macularius* Blyth, 1868  
*Pareas margaritophorus* (Jan, 1866)  
*Psammodynastes pulverulentus* (Boie, 1827)  
*Pseudoxenodon macrops* (Blyth, 1854)  
*Ptyas korros* (Schlegel, 1837)  
*Ptyas mucosa* (Linnaeus, 1758)  
*Rhabdophis chrysargos* (Schlegel, 1837)  
*Rhabdophis subminiatus* (Schlegel, 1837)  
*Rhadinophis prasinus* (Blyth, 1854) (\*\*\*)  
*Rhynchophis boulengeri* Mocquard, 1897 (\*)  
*Sinonatrix percarinata* (Boulenger, 1899)  
*Xenochrophis flavipunctatus* (Hallowell, 1860)

## ELAPIDAE

*Bungarus candidus* (Linnaeus, 1758)  
*Bungarus fasciatus* (Schneider, 1801)  
*Naja cf. atra* Cantor, 1842

*Ophiophagus hannah* (Cantor, 1836)  
*Sinomicrurus maccllellandii* (Reinhardt, 1844) (\*)

## VIPERIDAE

*Protobothrops cornutus* (Smith, 1930)  
*Protobothrops mucrosquamatus* (Cantor, 1839) (\*)  
*Protobothrops sieversorum* (Ziegler, Herrmann, David, Orlov et Pauwels, 2000)  
*Trimeresurus albolabris* (Gray, 1842) (\*\*\*)  
*Trimeresurus truongsoneensis* (Orlov, Ryabov, Bui et Ho, 2004) (\*\*\*)  
*Trimeresurus vogeli* (David, Vidal et Pauwels, 2001) (\*\*\*)

## DISCUSSION

This study brings the confirmed species number of amphibians and reptiles recorded from Phong Nha - Ke Bang National Park to 151, including 50 species of amphibians (5 Megophryidae, 3 Bufonidae, 1 Hylidae, 9 Microhylidae, 8 Dicroglossidae, 9 Ranidae, 15 Rhacophoridae), 12 species of turtles (1 Platysternidae, 8 Geoemydidae, 1 Testudinidae, 2 Trionychidae), 31 species of lizards (9 Gekkonidae, 4 Agamidae, 1 Anguinae, 1 Varanidae, 3 Lacertidae, 13 Scincidae), and 58 species of snakes (1 Typhlopidae, 2 Xenopeltidae, 2 Boidae, 1 Xenodermatidae, 41 Colubridae, 5 Elapidae, 6 Viperidae), see also fig. 16. An updated list, including recent taxonomic/nomenclatural changes since the last review by Ziegler & Vu (2009), is provided. The research history of the herpetofauna of Phong Nha - Ke Bang clearly shows that even after more than a decade of very intensive herpetological surveys, additional species can be recorded or even discovered as new to science. Since the description of the first herpetological discovery from Phong Nha - Ke Bang, *Cyrtodactylus phongnhakebangensis* by Ziegler et al. (2002), a series of new species descriptions took place to date, amongst others eight snake and four gecko taxa, to mention only the most outstanding examples (see overview in Ziegler & Vu, 2009). And we are aware of further new discoveries to be described from the region in the near future. This does not only underline the importance of Phong Nha - Ke Bang National Park in a regional scale and the Truong Son Mountain Range along the border between Vietnam and Laos

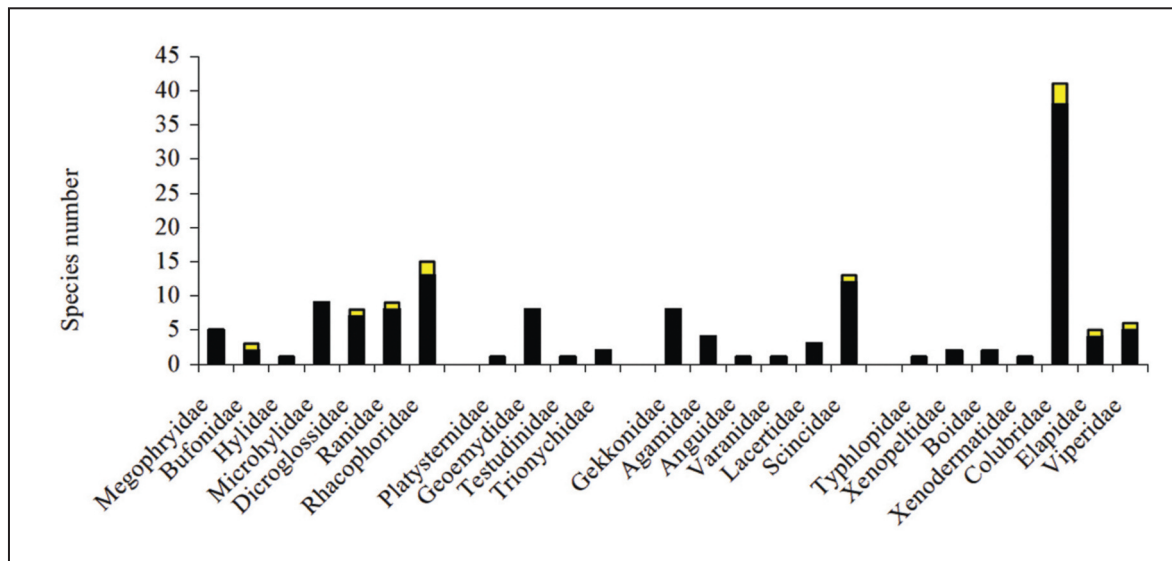


Figure 16. Species richness of amphibian and reptile families from Phong Nha – Ke Bang National Park (new records are marked by open rectangles).

in a wider geographical scale as centres of biodiversity and endemism, but also shows that longterm biodiversity research is crucial for covering the total species richness in tropical environment, which is prerequisite for appropriate evaluation of the conservation status and application of adequate protection measures.

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