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TROPICAL VERTEBRATES IN A CHANGING WORLD

THE TERRESTRIAL REPTILE FAUNA OF THE BIOSPHERE RESERVE CAT BA ARCHIPELAGO, HAI PHONG, VIETNAM

T.Q. Nguyen^{1,2}, R. Stenke³, H.X. Nguyen⁴ & T. Ziegler⁵

¹Institute of Ecology and Biological Resources, 18 Hoang Quoc Viet, Hanoi, Vietnam

²Zoologisches Forschungsmuseum Alexander Koenig, Adenauerallee 160, D-53113 Bonn, Germany

³Zoologische Gesellschaft für Arten- und Populationsschutz e.V. (ZGAP),
Franz-Sennstr., 14, 81377 München, Germany

⁴Faculty of Biology, University of Natural Sciences, Vietnam National University,
334 Nguyen Trai St., Hanoi, Vietnam

⁵AG Zoologischer Garten Köln, Riehler Straße 173, D-50735 Köln, Germany

ABSTRACT

A total of 40 species of reptiles was recorded within two herpetological surveys during May 2007 and April 2008 on Cat Ba Island, Hai Phong, northeastern Vietnam: one species of turtle, 19 species of lizards, and 20 species of snakes. Nineteen species (47.5%) were new records for the island. Compared with previous herpetological surveys on Cat Ba Island, the diversity of terrestrial reptiles recorded during our field work was five times higher than given in Darevsky (1990) and two times higher than indicated by Nguyen & Shim (1997). Taxonomic comparisons revealed that one lizard is endemic, the eublepharid gecko *Goniurosaurus catbaensis* (Ziegler *et al.* 2008), and another new skink species, *Sphenomorphus tonkinensis* (Nguyen *et al.* 2011); the divergent status of other squamate species (e.g., *Pareas cf. hamptoni*, *Viridovipera cf. stejnegeri*) is still under examination.

Key words: Vietnam, Cat Ba Archipelago, diversity, new record.

INTRODUCTION

Cat Ba Island is situated in Ha Long Bay, 50 km east of Hai Phong City, northern Vietnam. It is the largest of 366 islands in the Cat Ba Archipelago, has a surface area of approximately 285 km² (FIPI 2006), and is part of an extended region of karst that stretches from southern China to northern Vietnam. The principal terrestrial ecosystem within Cat Ba National Park is tropical moist forest on limestone, which harbors a number of endemic and rare species, foremost of which is the endemic Cat Ba Langur *Trachypithecus poliocephalus poliocephalus* (Trouessart, 1911) (Nadler & Ha 2000; Furey *et al.* 2002; Nadler *et al.* 2002).

In the past two decades, several herpetological surveys have been carried out on Cat Ba Island. In his zoological analysis, Bobrov (1993) recorded 18 lizard species from islands in the Gulf of Tonkin in-

cluding Cat Ba Island. Darevsky (1990) studied the herpetofauna of some Vietnamese offshore islands and listed seven species of reptiles for Cat Ba. This number was distinctly increased by the eight-day survey conducted by Nguyen & Shim (1997), who reported of 20 species of reptiles including two species of marine turtles. In view of this increasing number of new species records on the one hand, and a still low species number compared with northern mainland Vietnam on the other, we decided to conduct additional herpetological field studies on Cat Ba Island. These led to the discovery of new species of *Goniurosaurus* (Ziegler *et al.* 2008) and *Sphenomorphus* (Nguyen *et al.* 2011). Here, we present the overall result of our reptilian surveys.

MATERIAL AND METHODS

The herpetological surveys on Cat Ba Island took place from 18 to 27 May 2007 and from 20 to 24 April 2008. All survey sites are located inside the core zone of Cat Ba National Park:

¹ Corresponding author: e-mail: nqt2@yahoo.com

Ang Vat – Me Go (20°48'N, 107°00'E; 80–100 m a.s.l.) (Fig. 4.7): Older secondary tropical moist limestone forest (recovery since 1976) with adjoining open grasslands and former agricultural land. Specimens were collected along forest paths, dry stream beds, and nearby small ponds.

Trung Trang valley near the headquarters of the National Park (20°47'N, 106°59'E; 50–70 m a.s.l.) (Fig. 4.9): Mainly open area consisting of agricultural land surrounded by plantation forest (e.g., *Acacia*). The hill slopes are covered by secondary limestone forest. Specimens were collected at the hill bases, especially in small limestone caves/crevices and nearby small water reservoirs.

Trung Trang cave (20°47'N, 106°59'E; 60–70 m a.s.l.) (Fig. 4.8): Limestone cave, accessible for tourism. A concrete path leads through the cave. The forest in the vicinity of the cave entrance is old secondary forest alternated with patches of primary forest and shrub. Night excursions were conducted both inside and outside of the cave, and also along a waterless stream bed.

Ang Nhoi – Ang Dai (20°50'N, 106°57'E; 40–50 m a.s.l.): Large seasonally inundated swamp surrounded by primary limestone forest.

Tra Bau (20°50'N, 107°02'E; 0–40 m a.s.l.) (Fig. 4.10): Seasonally inundated swamp (Ang Ong Bi) surrounded by secondary limestone forest and steep limestone cliffs with small caves. Here, we also surveyed some patches of mangrove forest and the forest edge along the coast near Tra Bau ranger station (20°49'N, 107°03'E).

Specimens were collected in May 2007 and in April 2008, and were deposited in the following collections: Institute of Ecology and Biological Resources (IEBR), Vietnamese Academy of Science and Technology Hanoi, Vietnam; Department of Herpetology and Ichthyology, Muséum d'histoire naturelle (MHNG), Geneva, Switzerland; Zoological Museum of the Vietnam National University (VNUH), Hanoi, Vietnam; Zoologisches Forschungsmuseum Alexander Koenig (ZFMK), Bonn, Germany.

To complete our inventory, we included specimens stored in the scientific collection of Cat Ba National Park, specimens collected from previous Cat Ba excursions and subsequently deposited in IEBR, and specimens recorded by us in the local trade or in local shops. Taxonomic identifications were made following Pope (1935), Bourret (1936, 1937), Smith (1935, 1943), Taylor (1963), Stuart *et al.* (2001), Ziegler (2002), Orlov & Ryabov

(2004), Spinks & Shaffer (2007), Vogel (2006), Ziegler *et al.* (2007, 2008), Dawson *et al.* (2008), and Nguyen *et al.* (2009). Ventral scales in snakes were counted according to Dowling (1951).

Abbreviations are as follows: a.s.l.: above sea level; SVL: snout-vent length (from snout tip to cloaca); TaL: tail length (from cloaca to tail tip); TL: total length (SVL + TaL).

RESULTS AND DISCUSSION

Testudines

Geoemydidae

Cuora mouhotii (GRAY, 1862) (Fig. 2.1)

Specimen examined: One medium-sized specimen confiscated in July 2003 from the illegal trade on Cat Ba Island. The specimen was released inside the forest.

Characteristic features: Carapace high with flat top, three distinct keels and a serrated rear margin; flat top of carapace usually paler than darker sides of carapace; large head with pale markings (see Stuart *et al.* 2001).

Squamata: Sauria

Agamidae

Acanthosaura lepidogaster (CUVIER, 1829) (Fig. 2.2)

Specimens examined: One adult male, IEBR A.0722 (SVL: 94 mm, TaL: 181 mm); one adult female, ZFMK 88103 (SVL: 71 mm, TaL: 134 mm); two juveniles, ZFMK 88104–88105 (SVL: 30.5–31.0 mm, TaL: 45.5–46.0 mm).

Characteristic features: Head large; postorbital spine small, shorter than half the diameter of orbit; two longer spines above tympanum; nuchal crest spines 8 or 9; dorsal crest present, low; no gular pouch; supralabials 10–12; infralabials 11 or 12; mental small, pentagonal; first two or three pairs of chinshields in contact with infralabials, five posterior pairs separated from infralabials by one or two rows of small scales; body compressed; dorsum with some scattered larger keeled scales; ventral scales strongly keeled, 91–107 rows from first gular to precloacal scales; a row of small precloacal scales. Coloration in life varies from green to dark brown, occasionally a bright rhombic pattern present on the neck; dark bars across back and tail (determination after Smith 1935; Taylor 1963).

Natural history notes: Four specimens were collected during daytime on 18 May 2007. Throughout the

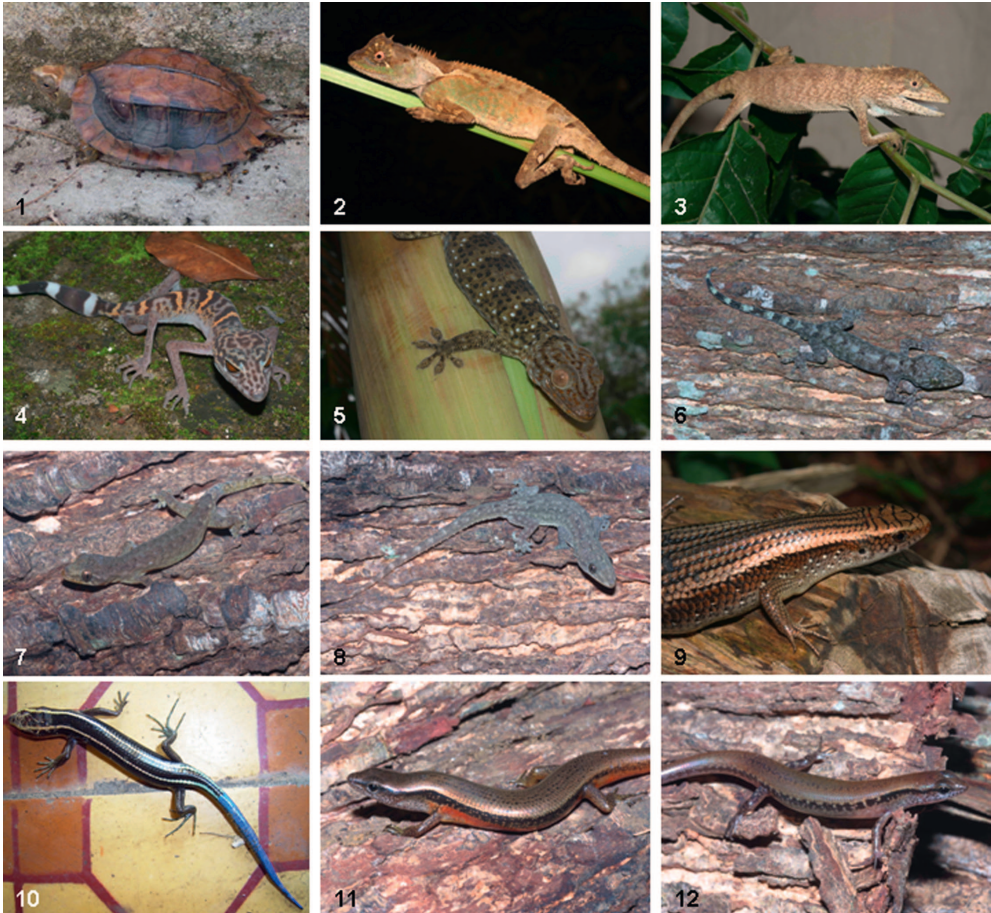


FIG. 2. 1) *Cuora moubotii*, 2) *Acanthosaura lepidogaster*, 3) *Pseudocalotes brevipes*, 4) *Goniurosaurus catbaensis*, 5) *Gekko gekko*, 6) *Gekko palmatus*, 7) *Hemidactylus frenatus*, 8) *H. garnotii*, 9) *Eutropis multifasciatus*, 10) *Plestiodon quadrilineatus*, 11) *Scincella reevesii*, 12) *Sphenomorphus tonkinensis* (1 & 10 photographs by R. Stenke, remaining photographs by T. Ziegler).

survey period, juveniles and adults were regularly observed on the forest floor, in shrub vegetation and on karst surfaces in Ang Vat – Me Go, Ang Ong Bi, Ang Nhoi, and Ang Dai. The species was one of the most frequently observed lizards on Cat Ba Island.

Draco sp.

Observed by one of the authors (RS) and also reported by rangers from Tra Bau station in Ang Ong Bi.

Remarks: Most probably *Draco maculatus* (GRAY, 1845), which was already known from Cat Ba Island by Nguyen & Shim (1997).

Pseudocalotes brevipes (WERNER, 1904) (Fig. 2.3)

Specimens examined: One female, IEBR A.0721 (SVL: 64 mm, TaL: 131.5 mm).

Characteristic features: Head large, longer than wide; supralabials 8 or 9; infralabials 7; nuchal crest spines 6, dorsal crest spines absent; subdigital lamellae of fourth toe 18 or 19; fold in front of shoulder absent; midbody scale rows 65–67; middorsal scale row which points straight backwards, lateral scales keeled, ventral scales strongly keeled. Coloration in alcohol: head and dorsal body grayish brown, gular region darker with keeled scales, ventral side gray; light spots present on elbows and indistinct on knees (determi-

nation after Hallermann 2000, Hallermann & Böhme 2000).

Natural history notes: A single specimen was found at night, on 23 May, near Tra Bau ranger station sleeping in a tree about 1.5 m above the sea.

Remarks: This is the first record for the island as well as for Hai Phong City.

Physignathus cocincinus CUVIER, 1829

Specimens examined: One subadult, IEBR A.0915 (SVL: 138 mm, TaL: 339 mm).

Characteristic features: Dorsum covered with small scales; distinctly enlarged scale row below infralabials; single enlarged scale at posterior lower jaw region; transversal skin fold in posterior gular region; nuchal, dorsal and tail crests present; laterally depressed tail; toes without distinct lobules; seven femoral pores on each side. Coloration in life green to gray-brown with transversal rows of ocelli/stripes on dorsum and tail (determination after Ziegler 2002).

Natural history notes: The specimen was collected by Nguyen Thien Tao in June 2009 near Trung Trang Cave. Specimen rested at night on a branch above a stream.

Eublepharidae

Goniurosaurus catbaensis ZIEGLER, NGUYEN, SCHMITZ, STENKE & RÖSLER, 2008 (Fig. 2.4)

Specimens examined: Holotype: One adult female, IEBR A.0717; paratypes: subadult male, MHNG 2699.49; adult female, VNUH 210507; and adult male, ZFMK 87056 (for measurements see Ziegler *et al.* 2008).

Characteristic features: A new species of the genus *Goniurosaurus* recently described by Ziegler *et al.* (2008). *G. catbaensis* is characterized by the combination of the following characters: body and limbs gracile; nuchal loop thin, protracted posteriorly; three or four thin immaculate dorsal body bands between limb insertions, without dark spotting and with dark, narrow borders surrounding the body bands; dorsal surface and maculate limbs mottled; head pattern consisting of a dark marbling; iris orange-brown; postrostral scales absent; nasal scales surrounding the nares 5 or 6; supranasals meeting in midline behind the rostral suture; supraorbital tubercles enlarged; outer surface of upper eyelid composed of granular scales of about the same size of those on top of head and with a row of 6–9 enlarged tubercles; eyelid fringe

scales 52–55; supralabials 8 or 9; infralabials 6–8; body scales granular, with 8–11 granular scales surrounding the dorsal tubercles; axillary pockets deep; digits long and thin with wide subdigital lamellae, claws sheathed by four scales; precloacal pores 16–21.

Natural history notes: Specimens were found at night from 19 to 21 May 2007 in the limestone forest, one specimen was found in a small hole *c.* 2–3 m above the ground on 23 May.

Remarks: Previously, Darevsky (1999) had recorded "*Goniurosaurus lichtenfelderi*" from Cat Ba Island (with a question mark however).

Gekkonidae

Gekko gekko (LINNAEUS, 1758) (Fig. 2.5)

Specimens examined: One adult specimen was photographed and released.

Characteristic features: Head very large, snout obtusely pointed; dorsal pale gray with 7 or 8 transverse series of whitish spots.

Natural history notes: The photographed male was found at night on the road near Trung Trang Cave, on 25 May. Vocalizations were heard during late afternoon and at night, between 18–20 May, in Ang Vat – Me Go, Trung Trang Valley, and Ang Nhoi.

Gekko palmatus BOULENGER, 1907 (Fig. 2.6)

Specimens examined: IEBR A.0731–A.0732, A.0734–A.0736, A.0738: Six adult males collected from 19 to 25 May 2007; IEBR 3700–3702: one adult male, two adult females, collected on 21 April 2008 on karst outcrops in limestone forest, 80 m a.s.l.; IEBR A.0812: an adult male, collected on 18 June 2007 on karst outcrops in limestone forest; private collection of Herbert Rösler, CPHR 2380, CPHR 2381: two adult males collected from 21 to 25 May 2007.

Characteristic features: SVL up to 68.7 mm (females) and 70.1 mm (males); body and tail slightly dorso-ventrally depressed; one pair of dark roundish or somewhat elongated spots in occipital region, smaller but more distinct dark spot in nuchal region, and light broken middorsal stripe evident on body; supralabials 11–15; infralabials 10–12; nostril in contact with rostral, internasals 1 or 2, smaller than nasorostrals; 2–7 spinous ciliary scales; dorsal tubercles in 7–12 rows; extremities lacking tubercles; body scales in 133 rows around midbody (IEBR A.0731); cloacal spur single; precloacal pores 23–29; subdigital lamel-

lae 14–16 under fourth finger, 15–17 under fourth toe; finger and toes broadly webbed; subcaudals enlarged (determination followed Ziegler *et al.* 2006).

Natural history notes: The species was collected in the forest near the headquarters of the National Park, in and around Trung Trang cave, in Ang Nhoi, and in Ang Ong Bi. Specimens were found active at night, and a few also during daytime when hidden inside dark karst caves and rock crevices. One specimen was found at night on a window of Tra Bau ranger station. Numerous specimens were discovered at night on karst outcrops on the sea shore, on stones or on the sandy beach in the immediate vicinity of salt water. One gecko was discovered at night on a small rock surrounded by salt water, from where it tried to escape across the water surface to the beach, which was about 0.5 m distant.

Remarks: This is the first record for the island as well as for Hai Phong City.

Hemidactylus frenatus DUMÉRIL & BIBRON, 1836 (Fig. 2.7)

Specimens examined: Three females, ZFMK 88108–88110 (SVL: 40.5–46.5, TaL: 39–47 mm) and one male, IEBR A.0742 (SVL: 55 mm, TaL: 63.5 mm).

Characteristic features: Head large; rostral large, much broader than high; nares bordered by rostral, supranasal, two postnasals and first supralabial; supranasals in contact with each other (IEBR A.0742) or separated from each other by 1 or 2 small scales; supralabials 9–11; infralabials 8–10; mental large, triangular; two or three pairs of chinshields, anterior pair in contact and larger than the second, second pair in contact with infralabials laterally; posterior part of back with (IEBR A.0739) or without (IEBR A. 0741–0743) enlarged tubercles; skin fold from axilla to groin and along the hind border of thigh absent; hindlimb does not reach to the axilla; digits free, the first small, not half the length of the second; subdigital lamellae under fourth toe 9 or 10; tail depressed, without denticulated lateral edge; below with a median series of transversely enlarged scales; male (IEBR A.0742) with a continuous series of 36 preloacal-femoral pores. Coloration in alcohol: dorsal head and body grayish, sometimes with indistinct darker markings (determination after Smith 1935; Ziegler 2002).

Natural history notes: Specimens were found at night in buildings at the National Park headquarters, from 19 to 23 May 2007.

Hemidactylus garnotii DUMÉRIL & BIBRON, 1836 (Fig. 2.8)

Specimens examined: One adult female, IEBR A.0740 (SVL: 42 mm, tail lost).

Characteristic features: Head moderately large and broad; rostral large, nearly as high as broad; nares bordered by rostral, large supranasal, two postnasals and first supralabial; supranasals separated by a small scale; supralabials 12 or 13; infralabials 11; mental triangular; two pairs of chinshields, the anterior pair in contact with each other and larger than the posterior, posterior pair separated from infralabials by small scales; back without enlarged tubercles; ventrolateral skin fold absent but skin fold present along the hind border of thigh; hindlimbs do not reach to the axilla; digits free, subdigital lamellae under the first toe 5 or 6, under fourth toe 13; femoral area with a series of 20 slightly enlarged scales on each side; tail depressed, with denticulated lateral edge at base, posterior part lost. Coloration in alcohol: dorsal head and body grayish with many small white spots; two dark streaks from behind the eye backwards to the shoulder (determination after Smith 1935; Darevsky *et al.* 1984).

Natural history notes: Specimen was collected in the garden near the headquarters of the National Park.

Remarks: The morphological characters also fit with the description of *H. vietnamensis* DAREVSKY & KUPRIYANOVA, 1984, except for the following characteristics: supralabials 12 or 13 (9–12 in *vietnamensis*); subdigital lamellae on fourth toe 13 (10 or 11 in *vietnamensis*). This is the first record for the island as well as for Hai Phong City.

Lacertidae

Takydromus sexlineatus ocellatus CUVIER, 1829

Specimens examined: Two adult males from the collection of the National Park: CB R3 (SVL: 52 mm; TaL: 200.5 mm) and CB R4 (SVL: 47.5 mm, TaL: 195 mm).

Characteristic features: Upper head shields rugose; nasals in contact with each other; frontonasal single; supraoculars three, the first largest and in contact with posterior loreal; supraciliaries 3; supralabials 7 or 8; infralabials 5 or 6; temporal scales strongly keeled, 2 or 3 upper rows larger than the others; chinshields in 3 pairs; 19 or 20 scales on a line from behind second chinshield to collar; dorsal scales strongly keeled, 6 rows on the nape, 4 rows across

the back; scales on flanks small, in 7–10 rows, bordered above by one and below by two rows of large scales; ventrals strongly keeled, in 10 rows; scales between collar and groin 25; preloacal single, large; one femoral pore on each side. Coloration in alcohol: back brown with two light dorsolateral stripes from behind the eye to tail base; flanks of CB R3 with a series of white black-edged ocelli (determination after Smith 1935, Ziegler & Bischoff 1999, Ziegler *et al.* 1998).

Scincidae

Eutropis longicaudatus (HALLOWELL, 1856)

Specimens examined: One adult female, ZFMK 88115 (SVL: 111 mm, TaL: 175 mm) and one male, CB R1 (SVL: 82.5 mm, TaL: 210 mm).

Characteristic features: Supranasals in contact with each other; postnasal single; frontonasal broader than long; prefrontals in contact with each other; interparietal separates parietals posteriorly; a pair of nuchals; supraoculars four; supraciliaries 6 or 7; loreals two; preocular single, small; presuboculars two; lower eyelid scaly; supralabials 7; infralabials 5 or 6; midbody scale rows 26–28, dorsal scales in 7 or 8 rows, median rows weakly keeled; subdigital lamellae on fourth toe 24–26. Coloration: black brown; lateral stripe dark brown, from behind the eye to the base of tail, margin with white spots; ventral greenish-yellow (determination after Smith 1935; Taylor 1963; Ziegler 2002).

Natural history notes: This species was commonly seen in all types of open habitat on the island.

Eutropis multifasciatus (KÜHL, 1820) (Fig. 2.9)

Specimens examined: One female, CB R.2 (SVL: 72 mm, TaL: 89 mm) and one juvenile, IE BR A.0729 (SVL: 34 mm, tail: lost).

Characteristic features: Supranasals separated from each other by rostral; postnasal single; frontonasal broader than long; prefrontals in contact with each other posteriorly; interparietal separates parietals posteriorly; a pair of nuchals; supraoculars four; supraciliaries 5 or 6; loreals two; preocular single, presuboculars two; lower eyelid scaly; supralabials 7; infralabials 6 or 7; ear opening oval; midbody scales in 30 rows, dorsal scales in 7 or 8 rows (5 or 6 rows keeled); subdigital lamellae under fourth toe 18–20. Coloration: dorsum brown; lateral stripe black with white spots; ventral whitish (determination after Smith 1935, Taylor 1963, Ziegler 2002).

Natural history notes: This species was observed in all types of open habitat on the island. One gravid female was photographed on 19 May 2007.

Lygosoma quadrupes (LINNAEUS, 1766)

Specimens examined: Two adults from the collection of the Cat Ba National Park, CB R5–R6, (SVL 58.5–62.5 mm, tail lost and regenerated).

Characteristic features: Body very elongated; snout rounded; prefrontal widely separated; parietals in contact with each other posteriorly; supraoculars four; supralabials 6; infralabials 6; postnasal single; loreals two; ear opening punctiform; midbody scales in 24–26 rows; dorsal scales smooth; limbs very short (forelimb 5 mm, hind limb 6.5–7.5 mm), widely separated when adpressed; subdigital lamellae under fourth finger 5 or 6. Coloration in alcohol: light brown above; ventral cream (determination after Smith 1935; Taylor 1963).

Plestiodon quadrilineatus BLYTH, 1853 (Fig. 2.10)

Specimens examined: One juvenile, IE BR A.0813 (SVL: 27.5 mm, TaL: 40.5 mm).

Characteristic features: Frontoparietals in contact with each other; second supraocular larger than first; nasal small, followed by a postnasal; loreals two, anterior shorter than posterior; supralabials 8; midbody scales in 20 rows, two median dorsal rows broader than the laterals; paravertebral scales 51. Coloration in alcohol: back bluish-black; two light dorsolateral stripes from the tip of snout to the tail, another pair of light stripes along upper lip to groin; posterior half of tail blue (determination after Smith 1935; Bourret 1937).

Natural history notes: One specimen was collected on 9 June 2007 in Tra Duong, Gia Luan commune, on the ground inside secondary forest.

Scincella reevesii (GRAY, 1838) (Fig. 2.11)

Specimens examined: Three males, IE BR A.0727–A.0728, 3699 (SVL: 47.1–52.9 mm, TaL: 65.0–91.4 mm).

Characteristic features: Rostral large, rounded anteriorly, visible from above; nostril in the nasal; supranasals absent; frontonasal wider than long; prefrontals large, in contact anteriorly; frontal shorter than frontoparietal and interparietal together; parietals large, in contact posteriorly; nuchals in two or three pairs; supraoculars four; supraciliaries 7 or 8; postna-

sals absent; loreals two; supralabials 7; primary temporal single; secondary temporals two; infralabials 6; ear-opening oval; lower eyelid with transparent window; midbody scales in 30 or 32 rows, smooth, $\frac{1}{2}+6+\frac{1}{2}$ or 8 rows across the dorsum between lateral stripes; paravertebral scales 67; ventral scales 59–69 rows from the first chinshields to precloacals; limbs pentadactyl, overlapping when adpressed; subdigital lamellae 11 under fourth finger, 19 or 20 under fourth toe. Coloration in alcohol: Margins of eyelids with white stripes; dorsum brown with or without dark spots; light dorsolateral stripes present but indistinct; lateral stripes black with white spots; ventral cream (determination after Smith 1935, Taylor 1963, Ouboter 1986).

Natural history notes: Two specimens were collected on 19 May 2007 and another one on 22 April 2008, during the daytime, on the ground inside a plantation forest.

Remarks: Darevsky (1990) also listed *S. melanosticta* (BOULENGER, 1887) for Cat Ba Island.

Sphenomorphus indicus (GRAY, 1853)

Specimens examined: One female, IEBR 3705 (SVL 73.6 mm, TaL 110.8 mm).

Characteristic features: Rostral rounded, visible from above; nostril in the nasal; supranasals absent; frontonasal wider than long; prefrontals separated from each other; parietals large, in contact posteriorly; one pair of nuchals; supraoculars four; supraciliaries 8; loreals 2; supralabials 7; infralabials 7; secondary temporals 2, lower one overlapping upper one; lower eyelid scaly; midbody scales smooth, in 36 rows; paravertebral scales 70; ventral scales 67; limbs pentadactyl, subdigital lamellae 11 under fourth finger, 17 or 18 under fourth toe. Coloration in alcohol: margins of eyelids with white stripes; dorsum brown without dark spots; lateral stripes black; ventral cream (determination after Smith 1935; Taylor 1963; Ziegler 2002).

Natural history notes: The female was collected during the day on 22 April 2008, on the forest floor. This specimen contained nine yellowish-white eggs.

Remarks: This is the first record for the island as well as for Hai Phong City.

Sphenomorphus tonkinensis NGUYEN, SCHMITZ, NGUYEN, BÖHMER & ZIEGLER, 2011 (Fig. 2.12)

Specimens examined: Holotype: Adult male, IEBR A.0730.

Characteristic features: A representative of the genus *Sphenomorphus* based on the combination of the following morphological characters: SVL 45.3 mm; prefrontals present; supranasals absent; lower eyelid scaly; tympanum sunk; dorsal scale smooth; inner precloacals overlapping outer precloacals; tip of longest toe reaching to wrist when adpressed; hind limbs with five digits; digits with a single row of lamellae (after Shea & Greer 2002; Greer *et al.* 2006; Nguyen *et al.* 2011).

Natural history notes: The specimen was collected in open habitat, in a valley bordered by secondary limestone forest on hill slopes. It was found during daytime under leaf litter inside the secondary forest, at an altitude of *c.* 100 m.

Remarks: The specimen represents a new species which was described recently (Nguyen *et al.* 2011).

Varanidae

Varanus salvator (LAURENTI, 1768)

Specimens examined: Observed several times by one of the authors (RS).

Characteristic features: Coloration and pattern were species-specific.

Natural history notes: Observations took place inside the forest and in the shore area, e.g. at Tra Bau ranger station. One animal was observed by NQT in Ang Ong Bi, on 23 May 2007.

Remarks: *Varanus salvator* (LAURENTI, 1768) has already been documented for Cat Ba Island by Nguyen & Shim (1997).

Squamata: Serpentes

Pythonidae

Python molurus (LINNAEUS, 1758) (Fig. 3.1)

Specimens examined: One confiscated subadult specimen that was subsequently released. Another python was observed by RS on the offshore island Dong Cong, on 27 October 2007.

Characteristic features: Coloration and pattern were species-specific.

Colubridae

Ahaetulla prasina (BOIE, 1827) (Fig. 3.2)

Specimens examined: One adult female, ZFMK 88112 (SVL: 785 mm, TaL: 425 mm), and another subadult specimen, deposited in the scientific collection of Cat Ba National Park (TL: 415 mm).

Characteristic features: Horizontal pupil; head long and narrow, with a pointed snout, but snout without dermal appendage; mental groove present; loreals two; preocular single, postoculars 2 or 3; one anterior, two posterior temporal scales; supralabials 9 or 10, fourth to sixth in contact with the eye; midbody scales in 15 rows; ventral scales 2 + 184–199; subcaudal scales 152–161, divided; anal plate divided (determination after Ziegler 2002, Ziegler *et al.* 2007).

Natural history notes: One female was collected at night, on 25 May 2007 inside secondary forest, near the headquarters of the National Park. The snake was found in the branches of a small tree about 1.5 m above the forest floor. In that same night, a second adult specimen was seen but not collected.

Remarks: Our finding represents the first record of *A. prasina* for Cat Ba Island as well as for Hai Phong City.

Amphiesma stolatum (LINNAEUS, 1758) (Fig. 3.3)

Specimens examined: One adult male, deposited in the collection of the Cat Ba National Park (TL: 505 mm).

Characteristic features: Numerous large, black dorsal blotches on the nape as well as above and below the light dorsolateral stripes; postocular streak lacking; internasals narrowed anteriorly; loreal single; preocular single; postoculars three; supralabials 8, third to fifth in contact with the eye; midbody scales in 19 rows; ventral scales 3 + 147; subcaudal scales 80, divided; anal plate divided (determination after Bourret 1936; David *et al.* 2007).

Boiga guangxiensis WEN, 1998 (Fig. 3.4)

Specimens examined: One subadult, IEBR A.0904 (SVL: 467 mm, TaL: 143 mm); one adult male, ZFMK 88117 (SVL: 940 mm, TaL: 343 mm).

Characteristic features: Maxillary teeth enlarged, grooved posterior; vertebral scale row distinctly enlarged; loreal single; preocular single; postoculars two; three anterior and 3–6 posterior temporals; supralabials 8 or 9, third to fifth or fourth to sixth in contact with the eye; midbody scales in 21 rows, smooth on dorsum; ventral scales 1 + 261–266; subcaudal scales 142–144 divided; anal plate entire (determination after Tillack *et al.* 2004, Ziegler *et al.* 2007).

Natural history notes: One specimen was collected at night, on 25 May 2007, in the secondary forest

near the headquarters of the National Park. The snake was found near the main forest path in the branches of a small tree, about 1.5 m above the forest floor. Most probably we saw another, large specimen of that species approximately 10 m above the forest floor, in a large forest tree near the Trung Trang cave entrance. The adult male specimen (ZFMK 88117) was found in the rice wine collection of a local trader in Cat Ba town and bought on 25 May 2007.

Remarks: We regard the high supralabial count in the subadult specimen (especially well discernible on the right head-side) as an irregularity. The same applies for the high posterior temporal count, deriving from a very large upper anterior temporal. The latter could not be observed in the adult male specimen, which showed the normal condition of three posterior temporals. Our finding represents the first record of *B. guangxiensis* for Cat Ba Island as well as for Hai Phong City.

Chrysopelea ornata (SHAW, 1802) (Fig. 3.5)

Specimens examined: One medium-sized specimen from the rice wine collection of a local trader in Cat Ba town; the specimen was deep inside a bottle that was being offered for sale. Therefore, we were not allowed to further inspect the specimen and could only photograph it on 26 May 2007.

Characteristic features: Coloration and pattern were species-specific.

Remarks: Our finding represents the first record of *C. ornata* for Cat Ba Island as well as for Hai Phong City.

Coelognathus radiatus (BOIE, 1827) (Fig. 3.6)

Specimens examined: One specimen deposited in the scientific collection of the Cat Ba National Park (TL: 660 mm).

Characteristic features: Body with four black stripes anteriorly; head with black occipital crossbar and black lines radiating from the eye; loreal single; preocular single; postoculars two; supralabials 8, third to fifth in contact with the eye; midbody scales in 19 rows; ventral scales 2 + 227; subcaudal scales 86, divided; anal plate undivided (determination after Ziegler *et al.* 2007).

Natural history: A second dead specimen was found by RS inside a lychee plantation near the National Park headquarters, on 2 November 2003.



FIG. 3. 1) *Python molurus*, 2) *Ahaetulla prasina*, 3) *Amphiesma stolatum*, 4) *Boiga guangxiensis*, 5) *Chrysopelea ornata*, 6) *Coelognathus radiatus*, 7) *Dinodon meridionale*, 8) *Enhydryis chinensis*, 9) *Pareas cf. hamptoni*, 10) *Psammodynastes pulverulentus*, 11) *Rhabdophis subminiatus*, 12) *Rhynchophis boulengeri* (1 photograph by D. Schrudde, 7 & 8 by R. Stenke, remaining photographs by T. Ziegler).

Dendrelaphis ngansonensis (BOURRET, 1935)

Specimens examined: One adult female, ZFMK 88116 (SVL: 845 mm, TāL: 407 mm).

Characteristic features: Absence of a light lateral stripe along the flanks framed with black; loreal single; preocular single; postoculars two; two anterior, three posterior temporals; supralabials 9, fourth to sixth in contact with eye; midbody scales in 15 rows; vertebral scales enlarged; ventral scales 2 + 181; subcaudal scales 138, divided, anal plate divided

(determination after Ziegler 2002; Ziegler *et al.* 2007).

Natural history notes: The female specimen, a road-kill, was collected by RS about 1 km north of the National Park headquarters, beginning of May 2007. The road is bordered by bamboo plantations and shrub.

Remarks: Nguyen & Shim (1997) list *D. pictus* as occurring on Cat Ba Island. *D. ngansonensis* was considered a synonym of *D. pictus*. However, Ziegler

& Vogel (1999) demonstrated that *D. ngansonensis* warrants distinct taxonomic status. At this stage it remains unclear whether *D. pictus* occurs on Cat Ba Island or was merely confused with *D. ngansonensis* by Nguyen & Shim (1997). Our finding represents the first record of *D. ngansonensis* for Cat Ba Island as well as for Hai Phong City.

Dinodon meridionale BOURRET, 1935 (Fig. 3.7)

Specimens examined: One adult photographed by RS in May 2004.

Characteristic feature: Scallation (keeled dorsals, anal consisting of a single plate), coloration and pattern were species-specific.

Natural history notes: One specimen was found killed on 7 May 2004, without a head, inside a part of Ang Dai valley that is used for agriculture. Another specimen was seen and photographed in October 2009 by TZ inside a karst cave crevice at a height of about 3.5 m.

Remarks: Our finding represents the first record of *Dinodon meridionale* for Cat Ba Island as well as for Hai Phong City.

Enhydris chinensis (GRAY, 1842) (Fig. 3.8)

Specimens examined: One adult photographed by RS on 28 March 2005.

Characteristic features: Scallation of head, coloration, and pattern were species-specific.

Natural history notes: The snake was caught at a fish/shrimp farm on a small offshore island (Dong Cong) NW of the main island Cat Ba and was subsequently released.

Remarks: This is the first record for Cat Ba Archipelago as well as for Hai Phong City.

Oligodon chinensis (GÜNTHER, 1888)

Specimens examined: One adult female, IEBR 1226 (SVL: 452 mm, TaL: 89 mm).

Characteristic features: Rostral distinctly visible from above, dorsal scales smooth; head short; indistinct, body cylindrical; dorsal pattern consisting of transversely placed, narrow dark blotches, separated by dark crossbars; loreal single; preocular single; subocular absent; postoculars two; one anterior and one posterior temporals; supralabials 8, fourth to fifth in contact with eye; midbody scales in 17 rows; ventral scales 1 + 182; subcaudal scales 53, divided; anal plate

entire (determination after Bourret 1936; Ziegler *et al.* 2007).

Natural history notes: The specimen was collected on 22 June 2002 by NQT on the ground, near the headquarters of the National Park.

Pareas cf. hamptoni (BOULENGER, 1905) (Fig. 3.9)

Specimens examined: One adult female, IEBR A.0905 (SVL: 440 mm, TaL: 143 mm).

Characteristic features: Mental groove absent; prefrontals in contact with eye; loreal single; preoculars two; suboculars two; postoculars two; supralabials 8; midbody scales in 15 rows; anterior vertebral scales slightly enlarged, posterior upper dorsal scales slightly keeled; ventral scales 192; subcaudal scales 93, divided; anal plate entire (determination after Bourret 1936; Ziegler 2002; Ziegler *et al.* 2007).

Natural history notes: We collected the female specimen at night, on 22 May 2007, in a dry stream bed inside secondary forest near the headquarters of the National Park. The snake was found in the branches of a small tree about 1 m above the forest floor.

Remarks: Ziegler (2002) summarized the complicated taxonomic history of the *Pareas hamptoni* group (including the taxon *tonkinensis*). The high numbers of ocular and temporal scales (2 or 3 anterior temporals, four posterior temporals) and the six maxillary teeth of the single record from Cat Ba Island do not allow a proper identification at this stage. Pope (1935) listed 7–9 maxillary teeth as characteristic for the taxon *tonkinensis* (nowadays *P. hamptoni*), whereas 4–6 maxillary teeth are diagnostic for the taxa *chinensis* and *kuangtungensis* (= *P. chinensis*). However, Pope (1935) stated that his key may not be expected to work in every case because many characters are extremely unstable in this genus. Only further studies, including molecular approaches, on *Pareas* samples from northern Vietnam and southern China, including insular populations, may lead to a better understanding of the often complicated taxonomy. Our finding represents the first record of *Pareas cf. hamptoni* for Cat Ba Island as well as for Hai Phong City.

Psammodynastes pulverulentus (BOIE, 1827) (Fig. 3.10)

Specimens examined: One adult male, ZFMK 88113 (SVL: 335 mm, TaL: 91 mm), one adult female, IEBR A.0906 (SVL: 420 mm, TaL: 96 mm), and one

subadult, ZFMK 88114 (SVL: 266 mm, TaL: 56 mm).

Characteristic features: Viperid-like, triangular-shaped head; maxillary teeth enlarged, grooved posterior; pupil vertically elliptic; mental groove present; loreal single; preoculars 1 or 2, postoculars 2 or 3; 1 or 2 anterior, 2 or 3 posterior temporals; supralabials 8, third to fifth in contact with eye; midbody scales in 17 rows; dorsal scales smooth, vertebral scale row not enlarged; ventral scales 2–3 + 164–168; subcaudal scales 49–61, divided; anal plate entire (determination after Bourret 1936; Ziegler 2002; Ziegler *et al.* 2007).

Natural history notes: The subadult specimen was collected during the day in a dry stream bed of the secondary forest near the headquarters of the National Park. The adult male specimen was collected in the same habitat but at night in a small tree approximately 1 m above the forest floor. The female specimen, again a roadkill, was collected by RS about 700 m north of the National Park headquarters, on 7 May 2007. The road in this area is bordered by bamboo plantations and shrub. With three additional records from daytime and five additional records during the night this species was the commonest recorded snake on Cat Ba Island throughout our survey in May 2007, regularly observed by RS prior to and after the survey, in different types of habitats.

Remarks: Our finding represents the first record for Cat Ba Island as well as for Hai Phong City.

Ptyas korros (SCHLEGEL, 1837)

Specimens examined: One adult male, deposited in the scientific collection of the Cat Ba National Park (TL: 1128 mm).

Characteristic features: Dorsum brown, posterior dorsal scales with blackish brown margins; eye large; loreals 2; preoculars 3 (one presubocular plus one very large scale); postoculars 2; supralabials 8, fourth and fifth in contact with the eye; midbody scales in 15 rows; dorsals smooth; ventral scales 165; subcaudal scales 128, divided; anal plate divided (determination after Ziegler 2002, Ziegler *et al.* 2007).

Natural history notes: We discovered one specimen on 21 May 2007 during daytime in an agricultural area near the headquarters of the National Park.

Rhabdophis subminiatus (SCHLEGEL, 1837) (Fig. 3.11)

Specimens examined: One adult female, deposited in the scientific collection of Cat Ba National Park (TL: 730 mm).

Characteristic features: Body uniformly olive green; a black line stretching from the eye to the supralabials; loreal single; preocular single; postoculars three; supralabials 8, third to fifth in contact with the eye; midbody scales in 19 rows; dorsals keeled, except outermost row in anterior body half; ventral scales 3 + 160; subcaudal scales 65, divided; anal plate divided (determination after Ziegler 2002, Ziegler *et al.* 2007).

Natural history notes: The female contained large eggs (up to 2.5 cm in diameter).

Remarks: This is the first record for Cat Ba Island as well as for Hai Phong City.

Rhynchophis boulengeri MOCQUARD, 1897 (Fig. 3.12)

Specimens examined: One adult female, IEBR A.0902 (SVL: 706 mm, TaL: 228 mm).

Characteristic features: Presence of a long pointed nasal appendage covered with small scales; interstitial skin on the sides of the body bluish-black and white; loreal single; preocular single; postoculars 2; two anterior and two posterior temporals; supralabials 9, fourth to sixth in contact with eye; midbody scales in 19 rows; ventral scales 3 + 206; subcaudal scales 102, divided; anal plate divided (determination after Ziegler 2002, Ziegler *et al.* 2007).

Natural history notes: The specimen was collected during the night, on 23 May 2007, at the forest edge along the coast near Tra Bau ranger station. This specimen was discovered on a tree approximately 3 m above the shore. While trying to capture the specimen, it dumped down into the water and tried to escape by swimming towards the open sea.

Remarks: This is the first record for Cat Ba Island as well as for Hai Phong City.

Xenochrophis flavipunctatus (HALLOWELL, 1860) (Fig. 4.1)

Specimens examined: One female, ZFMK 88111 (SVL: 365 mm TaL: 74+ mm).

Characteristic features: Dorsal pattern consisting of small dark blotches and streaks, larger on the sides; dorsolateral dots small, white to yellow; a well-defined nuchal V-shaped marking; two well-defined subocular streaks, the posterior one extending from the eye to the corner of the mouth then meeting the V-marking; ventral and subcaudal scales all with entire, broad dark markings; midbody scales in 19 rows; ventral scales 2 + 138; subcaudal scales 36+,

divided; anal plate divided (determination after Vogel & David 2006, Ziegler *et al.* 2007).

Natural history notes: The specimen was found on 18 May 2007 in the immediate vicinity of the headquarters of the National Park. It was killed by local people near the guesthouse.

Remarks: The species was listed under the name *X. piscator* by Nguyen & Shim (1997).

Elapidae

Bungarus multicinctus BLYTH, 1861 (Fig. 4.2)

Specimens examined: One adult male, ZFMK 88118 (SVL: 1225 mm, TaL: 125 mm); in addition, we were able to make some scale counts [marked by *] of an adult female (TL: 780 mm), that was found preserved in the rice wine collection of a local trader in Cat Ba town, on 26 May 2007.

Characteristic features: Back with black and white rings, white body bands not entirely encircling the body, venter white; tail tip not distinctly blunt but somewhat pointed; 26*–38 narrow white crossbars on body and 9* or 10 on tail; loreal absent; preocular single; postoculars two; 1 or 2 anterior, 2 or 3 posterior temporals; supralabials 7, third to fourth in contact with eye; midbody scales in 15 rows; vertebral scale row enlarged, not distinctly keeled; ventral scales 2*–3 + 213*–224; subcaudal scales 40–49*, undivided; anal plate entire (determination after Ziegler 2002, Ziegler *et al.* 2007).

Natural history notes: The specimen was collected during the night, on 22 May 2007, in the secondary forest near the headquarters of the National Park. The snake was found near the main forest path crawling in the undergrowth of the forest ground, about 3 m from a small pond. A second large specimen, which was not collected, was discovered immediately after the capture of the adult male in the same habitat, at only a few meters distance.

Naja atra CANTOR, 1842 (Fig. 4.3)

Specimens examined: One adult female, found in the rice wine collection of a local trader in Cat Ba Town, on 25 May 2007 (TL: 1320 mm).

Characteristic features: Dark dorsum, spectacle-shaped dorsal neck pattern between ventrals 5 and 10, not connected with light gular region; gular region with dark fleck on each side, followed by dark transversal band; loreal absent; preocular single; postoculars three; supralabials 7; two anterior, 2 or 3

posterior temporals; midbody scales in 21 rows; dorsals smooth; ventral scales 2 + 171; subcaudal scales 48, divided; anal plate undivided (determination after Ziegler 2002, Ziegler *et al.* 2007).

Natural history notes: We discovered an escaping specimen on 19 May 2007. Characteristic were the dark dorsum and the gray venter. The large specimen was seen at night in the undergrowth of secondary forest, near the main entrance of Trung Trang cave.

Remarks: Most probably this species was listed under the name *Naja naja* by Nguyen & Shim (1997). Our finding represents the first record of the species for Cat Ba Island.

Sinomicrurus maccllellandi (REINHARDT, 1844) (Fig. 4.4)

Specimens examined: One adult was photographed on the ground in a bathroom at the headquarters of Cat Ba National Park, in the morning of 1 October 2002.

Characteristic features: Coloration and pattern were species-specific (e.g., Vogel 2006).

Remarks: This is the first record for Cat Ba Island as well as for Hai Phong City.

Viperidae

Protobothrops mucrosquamatus (CANTOR, 1839) (Fig. 4.5)

Specimens examined: One adult male was discovered preserved in the rice wine collection of a local trader in Cat Ba town, on 25 May 2007 (TL: 995 mm).

Characteristic features: Head long, narrow; dorsum gray to reddish brown; supralabials 10; dorsal scales strongly keeled, midbody scales in 25 rows; ventral scales 216; subcaudal scales 90; anal plate undivided (determination after Ziegler 2002, Ziegler *et al.* 2007).

Natural history: We saw a medium-sized specimen at night, on 19 May 2007, inside the forest in the vicinity of Trung Trang cave. The specimen was hanging in a tree about 1.6 m above the ground, but was able to escape before collecting. Another specimen, a roadkill, was photographed on 3 December 2005. It was discovered at night on the ground next to the entrance of a house. Furthermore, RS observed this species at many different places – at Viet Hai ranger station (in secondary forest and shrub), on Cat Dua Island (on rocks and in a shrub), in the primary forest west of Gia Luan, and close to agricultural land in the vicinity of Hien Hao and around Gia Luan.



FIG. 4. 1) *Xenochrophis flavipunctatus*, 2) *Bungarus multicinctus*, 3) *Naja atra*, 4) *Sinomicrurus maccllelandi*, 5) Portrait of *Protobothrops mucrosquamatus* (road kill), 6) *Viridovipera* cf. *stejnegeri*, 7) Secondary limestone forest in Ang Vat – Me Go, 8) Trung Trang Cave, 9) Open habitat and plantation forest, bordered by secondary limestone forest, 10) Coastal habitat near Tra Bau ranger station (1, 4, 5 photographs by R. Stenke, remaining photographs by T. Ziegler).

Viridovipera cf. *stejnegeri* (SCHMIDT, 1925) (Fig. 4.6)
 Specimens examined: One adult male, IEBR A.0903 (SVL: 515 mm, TaL: 130 mm); one adult female, ZFMK 88106 (SVL: 415, TaL: 88 mm); one juvenile, ZFMK 88107 (SVL: 210, TaL: 50 mm).

Characteristic features: Eyes orange in juveniles and females, reddish orange in males; postocular streak lacking in adult males, females, and in juveniles; tail surface mottled with rusty brown or reddish brown; spinose hemipenis; separation of the first supralabial

from the nasal; midbody scales in 21 rows; ventrals 4 + 162 (male), 164 (female) and 163 (juvenile); subcaudal scales 71 (male), 65 (female) and 72 (juvenile); anal plate entire (determination after Campden-Main 1970; David *et al.* 2001).

Natural history notes: The male and female were collected at night, on 18 May 2007. Specimens were found in a secondary forest tree near the main forest path close to the headquarters of the National Park. The snakes were *c.* 1 m distant from each other, *c.* 1–1.5 m above a small pond. The male was digesting an adult *Polypedates leucomystax*, that were abundant in the shrubs and trees around the pond. The female contained large eggs. The juvenile was collected at night, on 26 May 2007, on leaves at about a height of 1 m in secondary forest. Another juvenile was found in the same habitat at night, on 25 May 2007, but was not collected.

Remarks: Most probably this species was listed under the name *Trimeresurus albolabris* by Nguyen & Shim (1997). Our findings represent the first record of the species for Cat Ba Island as well as for Hai Phong City. However the taxonomic status, compared with mainland populations, is currently under morphological and molecular research.

FURTHER RECORDS AND SPECIES OF CONSERVATION CONCERN

In comparison with results of previous surveys on Cat Ba Island, the diversity of terrestrial reptiles recorded during our field work was five times higher than that given in Darevsky (1990) and twice as high as indicated by Nguyen & Shim (1997) (Fig. 1). Additionally, Nguyen & Shim (1997), Darevsky (1990, 1999), and Orlov *et al.* (2003) list the following five species as occurring on Cat Ba Island: Dibamidae: *Dibamus bourreti* ANGEL, 1935; Scincidae: *Scincella melanosticta* (BOULENGER, 1887); Typhlopidae: *Ramphotyphlops braminus* (DAUDIN, 1803); Colubridae: *Dendrelaphis pictus* (GMELIN, 1789) (but see discussion above); *Opisthotropis andersonii* (BOULENGER, 1888); Elapidae: *Bungarus fasciatus* (SCHNEIDER, 1801); and Viperidae: *Cryptelytrops albolabris* (GRAY, 1842) (but see discussion above). Adults of *Ophiophagus hannah* (CANTOR, 1836) and *Bungarus fasciatus* (SCHNEIDER, 1801) were observed by us in the rice wine collection of a local trader in Cat Ba town. However, these animals may also originate from the mainland so we did not list them as part of the reptilian fauna of Cat Ba Island. Further evidence (i.e., photographs or specimens with locality data) is still

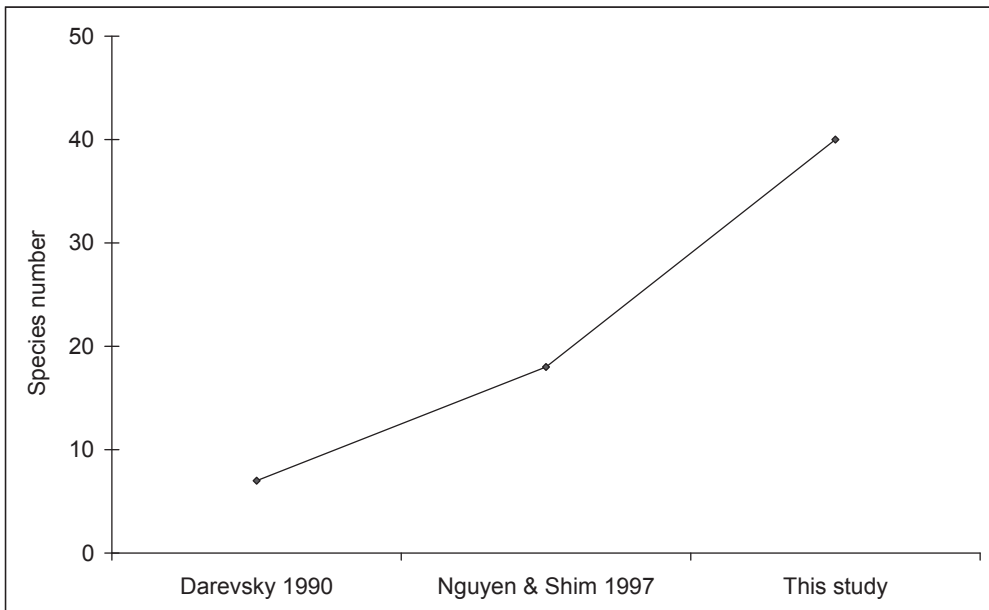


FIG. 1. Terrestrial reptile species accumulation from Cat Ba Island.

TABLE 1. List of threatened reptile species recorded from Cat Ba Island.

Scientific name	IUCN 2008	VNRB 2007	CITES 2008	Dec. 32 2006
<i>Physignathus cocincinus</i>		VU		
<i>Gekko gecko</i>		VU		
[<i>Varanus salvator</i>]		EN	II	IIB
[<i>Python molurus</i>]	LR/nt	CR	I	IIB
<i>Coelognathus radiatus</i>		EN		IIB
<i>Ptyas korros</i>		EN		
<i>Bungarus multicinctus</i>				IIB
<i>Naja atra</i>		EN	II	IIB
<i>Cuora mouhotii</i>	EN		II	

Notes: IUCN: IUCN Red List, VNRB: Vietnam Red Data Book; CR: critically endangered, EN: endangered, VU: vulnerable, LR/nt: near threatened; CITES: I, II = Appendix I and II; Dec. 32: Governmental Decree No 32/2006/ND-CP; IB = Group IB (prohibited exploitation and use for commercial purpose), IIB = Group IIB (limited exploitation and use for commercial purpose); []: Only photographic record or observation

needed. In addition, it is likely that a dead juvenile king cobra of about 80 cm total length was seen as a road kill by trained project staff close to Khoan Cao ranger station in August 2003. The snake had yellow rings and bright yellow ventral scales, but there is no specimen or photograph available for confirmation.

Among the 40 reptile species recorded from Cat Ba Island, two species are listed in the IUCN Red List (2008), seven species are listed in the Vietnam Red Data Book (Tran *et al.* 2007), four in the CITES appendices (2008), and five species are protected by governmental law (Decree No 32/2006/ND-CP) (Table 1).

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