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Amphibians and reptiles from the Mt. Hamiguitan Range of eastern Mindanao Island, Philippines: new distribution records

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Abstract. Despite extensive surveys conducted in the past, many remote areas in the Philippines remain unexplored and many species are unknown to science. The Mount Hamiguitan Range (MHR) is among these areas, containing large remaining forests tracts. In this study, we report new records of amphibians and reptiles from MHR and propose removing two species from the previously listed species from this mountain range. We used standardized techniques to sample populations of amphibians and reptiles in fragmented forests of Mt. Hamiguitan. Our survey resulted in 16 new records of species (four frogs, three lizards and nine snakes). Combining our results with previous studies, the known species diversity from the MHR is now increased to a total of 61 taxa. Our results highlight the underestimated diversity of herpetofauna of Mt. Hamiguitan, and we discuss the importance of repeated surveys for determining species occurrences and assessing their conservation status.

Key words. Checklist; herpetofauna; conservation status; repeated surveys

INTRODUCTION

The herpetofauna of the Philippines is extraordinarily rich and taxonomically diverse given the country's small land area (Inger 1954; Alcala 1986; Brown et al. 2001, 2009, 2013a). Past efforts to document the natural history and biology of amphibians and reptiles by herpetologists and biogeographers have revealed the herpetological and conservation importance of the Philippines (Brown et al. 2001, 2009, 2013a). However, complete knowledge of the ecology and distribution of many species is still lacking, which is in a challenge to effective conservation planning and species-specific intervention (Smith 1993a, b; Margules & Pressey 2000). This shortfall may be due to species living in remote, unexplored areas in the country (Dickinson et al. 1991; Mallari et al. 2004). In recent years, intensive efforts have begun to address these gaps and have resulted in numerous comprehensive reports of amphibians and reptiles from areas previously unknown or poorly known to science, such as several localities on Luzon Island (Mcleod et al. 2011; Devan-Song & Brown 2012; Brown et al. 2012, 2013a), the Babuyan group of islands (Oliveros et al. 2011), Romblon group of islands (Siler et al. 2012), Panay Island (Ferner et al. 2000; Gaulke 2011) and Cebu Island (Supsup et al. 2016). On Mindanao Island, herpetological surveys are also increasing (David et al. 2006; Delima et al. 2007; Beukema 2011; Nuñeza et al. 2015; Plaza & Sanguila 2015). However, large areas of Mindanao are still unexplored (Heaney et al. 2006; Peterson et al. 2008; Siler et al. 2009; Beukema 2011; Sanguila et al. 2016), and many new species are still being described (e.g., Brown et al. 2009; Siler et al. 2009).

The Mindanao Pleistocene Aggregate Island Complex (Mindanao PAIC), including Dinagat, Siargao, Bohol, Leyte, Samar, and other neighbouring small islands (Inger 1954; Heaney 1985, 1986; Diesmos & Brown 2009a), harbors many unique and globally threatened endemic species. There are 10 areas on the island identified as conservation priority for amphibians and reptiles (PBCPP 2002). Most of these are located in eastern Mindanao, where one of the largest remaining forest tracts in the Philippines is found (Forest Management Bureau 2013). The Eastern Mindanao region was declared as a biodiversity corridor, encompassing the islands of Siargao and Dinagat, Lake Mainit, and Agusan Marsh, as well as Mount Hilong-hilong, Diwata Mountain Range, Hamiguitan Range, and other mountain peaks in between. This region has received little attention (Sanguila et al. 2016), with only few herpetological studies conducted in the past, particularly in southeast portion (Smith 1993a). Some of these are the surveys conducted by Smith (1993a, b) in Diwata Range, and Delima et al. (2007) and Relox et al. (2011) in MHR. Delima et al. (2007) documented 34 species (15 frogs, 19 reptiles) from MHR, and Relox et al. (2011) added 13 more species, completing the total of 47 species known from this mountain. In this paper, we present additional species records which document the presence of 4 amphibians and 12 reptiles (lizards, snakes). Based

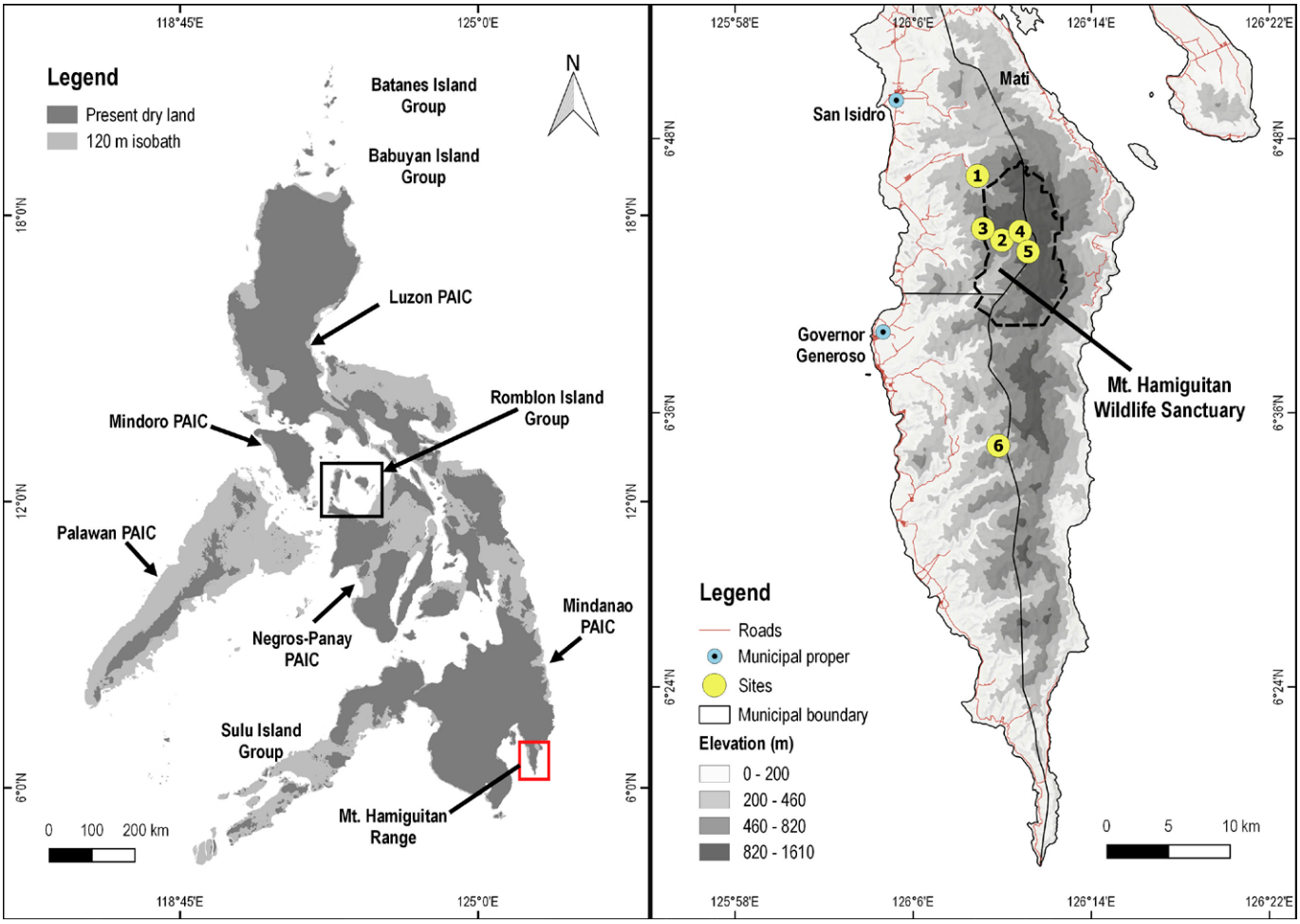

Figure 1. Map of the Philippines (right panel), showing the nine recognized Pleistocene Aggregate Island Complexes (PIACs, Inger 1954; Heaney 1985, 1986; Diesmos & Brown 2009a) and location of Mt. Hamiguitan Range within the Philippines, indicated by red box. The left panel shows Mt. Hamiguitan Range found in the southernmost tip of eastern Mindanao. Declared Mt. Hamiguitan Wildlife Sanctuary is represented by a polygon in a dashed line. Elevation contours are indicated by incremental shading, and survey sites are represented by numbered circles (in yellow).

on our critical consideration of the past records, we propose removing 2 species from the list of species from MHR. Our study increases the known herpetofauna of MHR to 61 species of amphibians and reptiles.

MATERIALS AND METHODS

Study site

The MHR is located at the southernmost tip of eastern Mindanao (Fig. 1). The native vegetation is characterized by forests growing over ultramafic rocks at high elevations (> 1200 m; Fernando et al. 2008), with lower elevations typically composed of mixed lowland dipterocarp and lower montane forest communities (Mallari et al. 2001; Relox et al. 2011). Native tree species include *Agathis philippinensis*, *Shorea negrosensis*, *Shorea guiso*, *Palaquium obovatum* and the heavy metal indicator *Scaevola micrantha* (Fernando et al. 2008; Amoroso & Aspiras 2011). The mountain range has an annual mean temperature of 26.1 °C at lower elevations (< 1200 m) and 19.2 °C in high elevations (> 1200 m); and the annual mean precipitation has been reported at approximately 2232 mm/yr (Hijmans et al. 2005; Delima et al. 2007). Only a small portion of the mountain range (6834 ha) located in the north has been declared as a protected wildlife sanctuary in 2004 (Republic Act 9303; Fig. 1).

We conducted our herpetological surveys between 23 November and 30 December 2014 in Sitio Basyao, Barangay Oregon, Municipality of Governor Generoso (06°34′33.6″ N, 126°09′43.8″ E; Fig. 1; Table 1). The site is located outside the wildlife sanctuary. During our survey, the site's temperature ranged from 26–27 °C. The area is relatively dry, but there were days with intermittent rain in the afternoon between 14:00–18:00 h. Our camp was established near a river, bounded by steep hills. The vegetation is a mosaic of cultivation and fragments of secondary growth forests, with elevation ranging from 200 to 700 m (Fig. 2). Agricultural plots of coconut and corn are dominant in the area (Fig. 2c).

Herpetofaunal surveys

Amphibian and reptile populations were surveyed by employing a 10 × 100 m standardized strip transect (Heyer et al. 1994; Delima et al 2007; Diesmos 2008). Each 10 m interval along the transect line was marked with luminous tape to serve as a guide. Eleven transects were established and positioned randomly, covering different habitat types (cultivation, early and secondary growth forests), in an effort to avoid sampling

Figure 2. Habitat types in the study site. **A.** Vegetation at higher elevation with large patch of cleared forest. **B.** Degraded secondary growth forest near camp. **C.** Coconut plantation in western side of study site. **D.** Riparian vegetation in the study site. Photos by C. Supsup.

Table 1. Survey sites in Mt. Hamiguitan Range. Sources of geographic coordinates: sites 1 and 2, Relox et al. 2011; sites 3–5, Delima et al. 2007; site 6, this study.

Site no.	General Locality	Specific Locality	Latitude (N)	Longitude (E)
1	Municipality of San Isidro	Barangay Bitaogan	06°46′22″	126°08′49″
2	Municipality of San Isidro	Barangay La Union	06°43′33″	126°09′53″
3	Municipality of San Isidro	Barangay La Union - Tumalite	06°44′3.4″	126°09′3.4″
4	Municipality of San Isidro	Barangay La Union - Tinagong Dagat	06°43′56″	126°10′41″
5	Municipality of San Isidro	Barangay La Union - Camp 3	06°43′03″	126°11′1.9″
6	Municipality of Governor Generoso	Barangay Oregon - Basyao	06°34′33.6″	126°09′43.8″

bias. Each transect was surveyed by 3 persons during daylight (07:00–11:00 h) and at night (18:00–23:00 h). To avoid disturbance, transects surveyed during the day were not traversed at night, and vice-versa, on successive days/nights. We performed acoustic and visual searches while traversing transect lines. Species observed within transects were recorded, as were associated data, including their habitat and activity upon first notice (e.g., calling, foraging, mating, etc.). General searches were also conducted around the camp and along roads and trails. Some individuals were captured to allow proper identification and body measurements (weight, snout–vent length, tail length). Specimens were photographed and released following data collection. Photo vouchers were deposited at the University of Kansas Digital Archives (KUDA). We follow Brown & Alcala (1978), Brown & Alcala (1980), and Alcala (1986) for initial species identification. These identifications were verified by R.M. Brown and A.C. Diesmos. Taxonomic arrangements of AmphibiaWeb (2016), Amphibian species of the world (Frost 2016), and the Reptile Database (Uetz et al. 2016) were adopted by us.

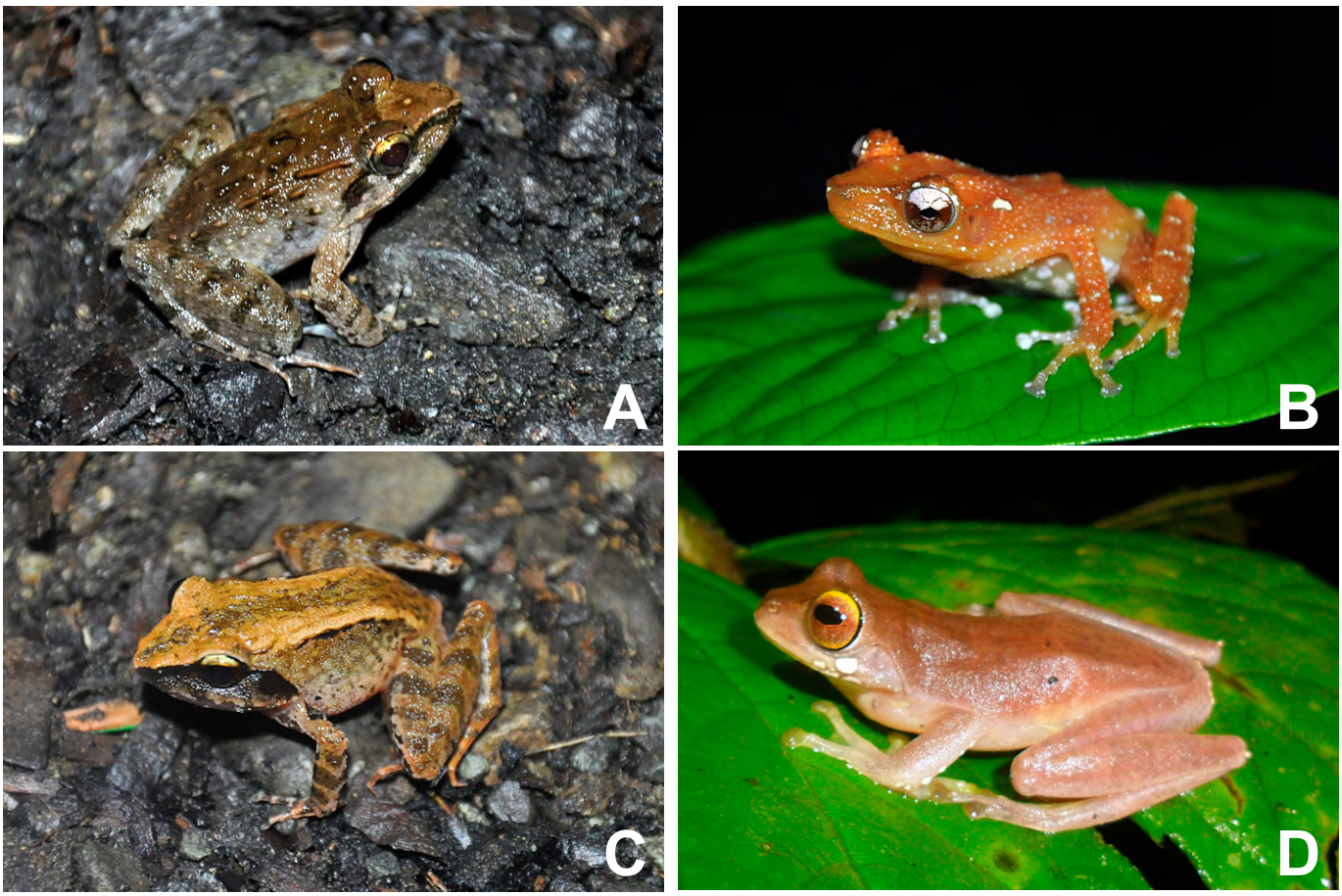

Figure 3. Species of frogs. **A.** *Limnonectes leytensis*. **B.** *Theloderma spinosum*. **C.** *Platymantis* sp. **D.** *Rhacophorus bimaculatus*. Photos by C. Supsup and N. Baron.

RESULTS

We present new records of 4 amphibian and 12 reptile species (3 lizards, 9 snakes) for the single site surveyed in the MHR. These additional records increase the number of taxa recorded for this mountain range to 61 species, excluding the 2 putatively misidentified or doubtful species *Parvosincus beyeri* and *Oxyrhabdium leporinum* (Table 2). Species accounts and notes on distribution, conservation status, and habitat are provided below.

Amphibia (frogs)

Limonectes leytensis (Boettger, 1893)
Figure 3a

This endemic species is known to occur in the Visayan and Mindanao PAICs (Diesmos & Brown 2009a). We observed this species on rocks along the river, in the northeast side of our campsite. It was previously thought to be uncommon and considered as a swamp species (Alcala & Brown 1998) until recent surveys (Denzer et al. 1994; Beukema 2011; Siler et al. 2011). Observations on the Sibuyan and Leyte islands (Siler et al. 2012; Mallari et al. 2013a, b, 2014) revealed that this species is abundant and common in localities where it is known to occur (particularly in habitats such as flooded areas, stream banks and temporary pools). *Limnonectes leytensis* is currently classified as Least Concern (IUCN 2016), and we conform to this status. However, we suspect that the population from MHR could be declining because of forest degradation, which makes habitats (especially undisturbed river and streams) vulnerable to disturbance. Observed individuals had the following characters: snout–vent length 32–35 mm; small body; snout obtusely pointed, ridges or tubercles visible on back; tips of toes and fingers slightly dilated into small and rounded disks; life-color brown in upper dorsal body, fading progressively on vent and ventral region. Photo voucher: KUDA 012504.

Theloderma spinosum (Taylor, 1920)
Figure 3b

There are 2 species of *Theloderma* in the Philippines: *T. pictum* and *T. spinosum* (Alcala & Brown 1998). *Theloderma pictum* is distributed mostly in Singapore, Malaysia, Indonesia, Borneo and the Philippines (Palawan Island). *Theloderma spinosum* is endemic to the Philippines, and known to occur only on the Mindanao PAIC Islands (Alcala & Brown 1998). During our night survey, we observed an individual of *T. spinosum* on a plant leaf ca. 0.15 m above the ground, in a patch of secondary growth forests adjacent to cultivated areas. The species current conservation status is Vulnerable (IUCN 2016). We suspect that their distribution has been confined to small fragmented forests and that it may naturally occur at low densities (or that it is less easily detected by field research-

Table 2. Amphibians (anurans) and reptiles (lizards and snakes) recorded from the Mt. Hamiguitan Range. Published reports of the species (marked by Xs) are shown in columns including the new records during this study. Double asterisks (**) indicate putatively misidentified or doubtful species that should be removed from the mountain. Numbers in sites column denote the location of species observations (see Table 1).

Taxa	Delima et al. 2007	Relox et al. 2011	This study	Sites
AMPHIBIA				
Bufonidae				
Ansonia muelleri (Boulenger, 1887)	X	X		1, 3
Ceratobatrachidae				
Platymantis corrugatus (Duméril, 1853)	X	X		1, 3
Platymantis guentheri (Boulenger, 1882)	X			4
Platymantis sp.			X	6
Dicroglossidae				
Limnonectes diuatus Brown & Alcala, 1977	X			3
Limonectes leytensis (Boettger, 1893)			X	6
Limnonectes magnus (Stejneger, 1910)	X	X		1, 2, 3, 5
Megophryidae				
Leptobrachium lumadorum Brown et al. 2009	X			3, 5
Megophrys stejnegeri (Taylor, 1920)	X	X		1, 3, 4
Microhylidae				
Kalophrynus sinensis Peters, 1867		X		1
Ranidae				
Pulchrana grandocula (Taylor, 1920)	X	X		1, 2, 3, 4
Sanguirana albotuberculata (Inger, 1954)	X			4
Staurois natator (Günther, 1858)	X	X		1, 2, 3
Rhacophoridae				
Theloderma spinosum (Taylor, 1920)			X	6
Philautus sp.	X			4, 5
Philautus acutirostris (Peters, 1867)	X	X		1, 2, 4, 5
Philautus surdus (Peters, 1863)	X			4, 5
Philatus poecilius Brown & Alcala, 1994	X			4
Polypedates leucomystax (Gravenhorst 1829)	X	X		1, 3, 4
Rhacophorus bimaculatus (Peters, 1867)			X	6
REPTILIA (LIZARDS)				
Agamidae				
Bronchocela sp.			X	6
Draco bimaculatus Günther, 1864	X			3
Draco cyanopterus (Peters, 1867)			X	6
Gonocephalus semperi (Peters, 1867)		X		1, 2
Gekkonidae				
Cyrtodactylus annulatus (Taylor, 1915)	X			3
Cyrtodactylus philippinicus (Steindacher, 1867)	X			3
Gecko mindorensis Taylor, 1919		X		1, 2
Scincidae				
Brachymeles hilong (Brown & Rabor, 1967)	X			3
Brachymeles schadenbergi (Fischer, 1885)	X			3
Eutropis englei (Taylor, 1925)		X		2
Eutropis cf *indeprensa* (Brown & Alcala, 1980)			X	6
Eutropis borealis (Brow & Alcala, 1980)		X		1
Lamprolepis smaragdina (Mertens, 1929)	X			3
Lipinia pulchella Gray, 1845	X	X		2, 3
Lipinia quadrivittata (Peters, 1867)	X			3
Parvoscincus beyeri (Taylor, 1922a) **		X		2
Pinoyscincus coxi Taylor, 1915	X			3, 4 ,5
Parvoscincus decipiens (Boulenger, 1895)	X			3
Sphenomorphus diwata Brown & Rabor, 1967	X			3, 5
Sphenomorphus fasciatus (Gray, 1845)	X			4
Sphenomorphus variegatus (Peters, 1867)	X	X		1, 2, 3
Tropidophorus davaoensis Bacon, 1980	X			4
REPTILIA (SNAKES)				
Colubridae				
Ahaetulla prasina preocularis (Taylor, 1922c)			X	6
Boiga cynodon (Boie, 1827)			X	6
Boiga dendrophila (Boie, 1827)		X		1
Calamaria gervaisi Duméril & Bibron, 1854		X		1, 2
Cylclocorus nuchalis taylori Leviton, 1967			X	6
Dendrelaphis marenae Vogel & Van Rooijen, 2008			X	6
Gonyosoma oxycephalum (Boie, 1827)			X	6
Lycodon dumerili (Boulenger, 1893)		X		1
Oligodon maculatus (Taylor, 1918)		X		1, 2
Psammodynastes pulverulentus (Boie, 1827)	X	X		1, 2, 3, 4, 5
Elapidae				
Calliophis intestinalis (Laurenti, 1768)	X			5
Lamprophildae				
Oyxrhabdium leporinum (Günther, 1858) **		X		1
Oxyrhabdium modestum (Duméril, 1853)			X	6
Natricidae				
Rhabdophis auriculata (Günther, 1858)	X			3, 4, 5
Rhabdophis lineatus (Peters, 1861)	X			3
Tropidonophis dendrophiops (Günther, 1883)			X	6
Pareatidae				
Aplopeltura boa (Boie, 1828)			X	6
Pythonidae				
Malayopython reticulatus (Schneider, 1801)		X		2
Typhlopidae				
Ramphotyphlops cumingii (Gray, 1845)			X	6
Viperidae				
Trimeresurus flavomaculatus (Gray, 1842)	X			3, 5
Tropidolaemus subannulatus (Gray, 1842)		X		1

ers because of its quiet, difficult to locate advertisement call). This has been apparent in recent observations in southern Leyte (Mallari et al. 2013). An immediate reassessment of its status is needed. To date, there are no existing conservation efforts focusing on this unique species. The only individual we observed had the following characters: snout–vent length is 36 mm; slightly elongated thin body; tiny tubercles-like on skin; fingers and toes pads are present; in life color is brownish-red, with yellow spots. Photo voucher: KUDA 012508–09.

***Platymantis* sp.**

Figure 3c

This unidentified *Platymantis* could be a new species from MHR (A.C. Diesmos personal communication). At first glance,

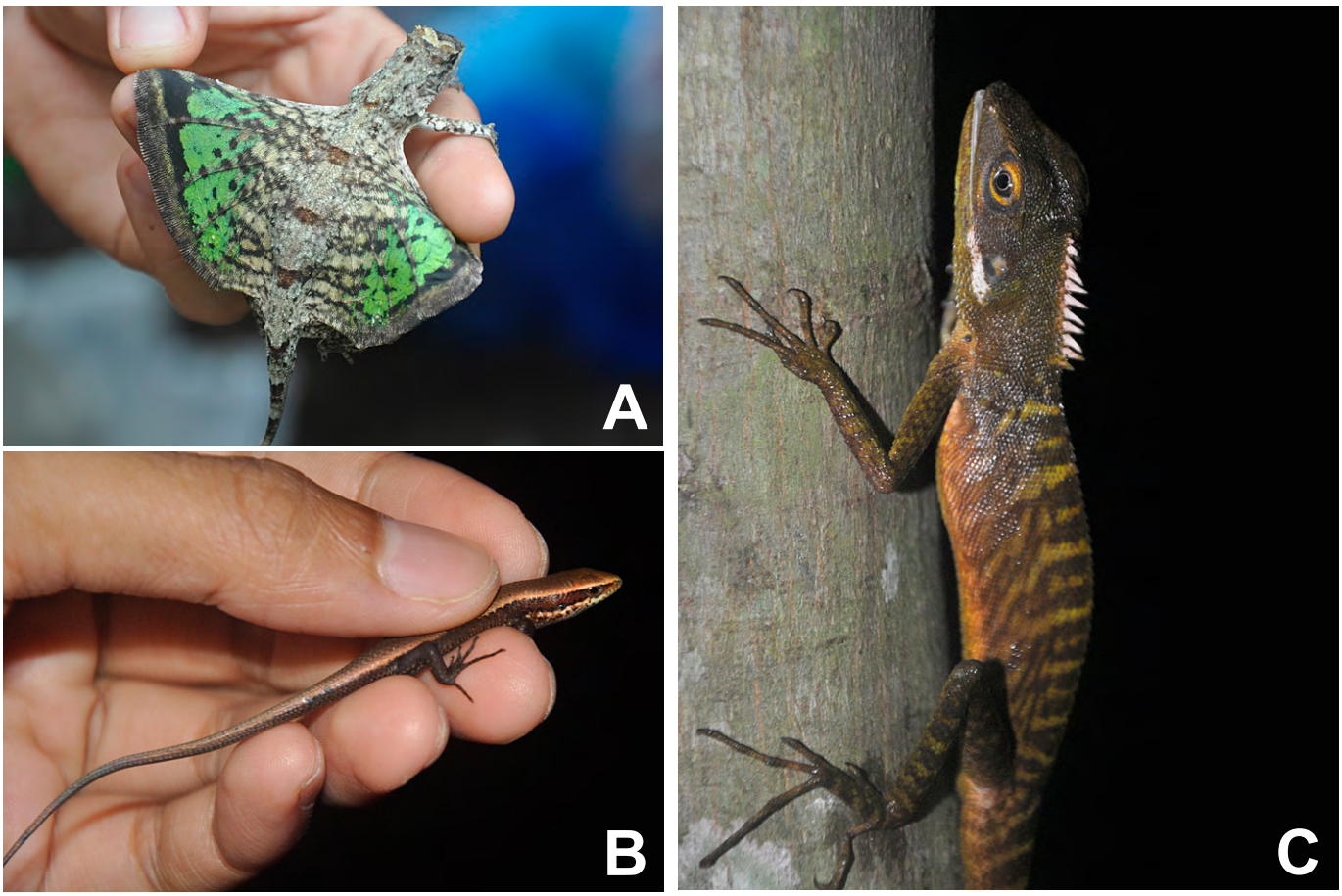

Figure 4. Species of lizards. **A.** *Draco cyanopterus*. **B.** *Eutropis* cf. *indeprensa*. **C.** *Bronchocela* sp. Photos by C. Supsup.

this species may look similar to *P. corrugatus* because of its black facial mask, but it differs significantly in terms of body size and other morphological characters. For instance, fingertips are not swollen and ridges on dorsal surface are small, as supposed to long ridges of *P. corrugatus*. We observed this species along a riverbank near our campsite. A taxonomic study is urgently needed to describe the species properly. Only one individual was observed, it had the following characters: snout–vent 30 mm; slightly pointed snout; small ridges on back; significantly reduced webs on both fingers and toes; tips of fingers and toes slightly dilated; life-color is brownish-yellow. Photo voucher: KUDA 01250.

Rhacophorus bimaculatus (Peters, 1867)
Figure 3d

The species is historically considered native to Borneo, Thailand and the Philippines (Inger 1954; Brown & Alcala 1994; Alcala & Brown 1998). However, a recent study suggested that the population from outside the Philippines is a distinct species (*R. cynopunctatus*; Manthey & Steiof 1998; Gonzalez et al. 2014). *Racophorus bimaculatus* is now restricted to the Philippines and presently recognized to occur in southern Luzon and the Mindanao PAIC (van Dijk et al. 2004; Gonzalez et al. 2014). Several individuals of this species were observed in secondary growth forest, on leaves of *Schismatoglottis* sp. found on the banks of undisturbed streams. Other studies have reported that this species can be observed perching on trees, shrubs and other plants found above spray zones, in cascading streams and waterfalls (Gonzalez et al. 2014; Plaza & Sanguila 2015). Its current conservation status is Vulnerable (IUCN 2016). A reassessment of its status is needed because of its wide distribution (Diesmos et al. 2015), which is inconsistent with its current status assessment (IUCN 2016). Individuals observed had the following characters: snout–vent length between 29–40 mm; blunt snout; smooth skin; webs present on both fingers and toes; life-color is brown, a white spot is often found below the eyes, males typically have irregular yellow green spots on back. Photo voucher: KUDA 012506–07.

Reptilia (lizards)

***Bronchocela* sp.**
Figure 4c

Bronchocela cristatella was previously considered to be widely distributed in Southeast Asia and the Philippines (Hallermann 2013; Grismer et al. 2015, 2016; Zug et al. 2017). At present, taxonomic issues plague the understanding of Philippine populations (see Brown et al. 2012, 2013b). Brown et al. (2013b) suggested that the group from Luzon could be recognized as *B. marmorata*, but Mindanao populations may not necessarily be associated with this name and they are likely not conspecific with *B. cristatella* (type locality: Sulawesi, Indonesia). We observed this species on degraded secondary growth forest ca. 500 m south from our camp, on tree foliage. Brown et al. (2012) assessed the species conser-

vation status as Least Concern. The individual we observed had the following characters: snout-vent length 96 mm, tail 384 mm; nine upper and lower labials; slender body; scales keeled; life-color when undisturbed is yellow green, dorsal crest on neck is white, an elongated white spot is often found below its tympanum. Photo voucher: KUDA 012510.

Draco cyanopterus (Peters, 1867)
Figure 4a

This endemic flying lizard has been recorded in central and eastern Mindanao, Camiguin and Dinagat Islands (McGuire & Alcala 2000). Surprisingly, records are lacking from the Zamboanga peninsula (western Mindanao; McGuire & Alcala 2000). We observed the species in both secondary growth forest and cultivated area (coconut plantation). One individual was encountered while it was in the process of burying its eggs (4 pieces) in the sand along a riverbank. Its current conservation status is Least Concern (IUCN 2016) and we conform to this assessment because it is common and abundant in our experience. Observed individuals had the following characters: snout–vent length of matured female 76 mm, juvenile 26 mm; tail often three or four times the snout–vent length; a thorn-like supraciliary scale is present; scales in both body and arms are strongly keeled; tympanum slightly large; dorsal life-color gray from head to tail, with black or brown blotches; white ventral surface with small brown blotches; patagial color is chartreuse-green boarded by black or brown. Photo voucher: KUDA 012511–13.

Eutropis* cf. *indeprensa (Brown & Alcala, 1980)
Figure 4b

This ground dwelling lizard is found on most of the major islands of the Philippines (Brown & Alcala 1980; Gaulke 2013; Barley et al. 2013). We observed individuals on fallen trees and under leaf litter, in secondary growth forest. The conservation status of the species is not presently available. Following the IUCN category, we recommend the species status as Least Concern (IUCN 2016) because they are common and abundant in localities where they have been recorded, and the species has a wide distribution (Gaulke 2011; Barley et al. 2013). The juvenile observed has the following characters: snout-vent length 30 mm; 6 upper and 6 lower labials (5th is large and beneath the eye); tail 3 times the snout–vent length; slender body; blunt snout; life-color brown, with a dark brown band extending from eye region to vent. Photo voucher: KUDA 012514.

Reptilia (snakes)

Ahaetulla prasina preocularis (Taylor, 1922c)
Figure 5a

This endemic subspecies of *Ahaetulla prasina* is common and widely distributed throughout the Philippines (Leviton 1967a; Alcala 1986). We encountered an individual on a tree branch, in secondary growth forest adjacent to a coconut plantation. Brown et al. (2012) assessed this species as Least Concern (IUCN 2016). The encountered individual has the following characters: snout–vent length 780 mm; 1 preocular; 2 postoculars; 10 supralabials; loreal present; slender and compressed body; pointed snout; elongated head and distinct from neck; in life color is green, ventral is greenish-yellow. Photo voucher: KUDA 012520.

Aplopeltura boa (Boie, 1828)
Figure 5b

Aplopeltura boa is a widespread species, distributed throughout Southeast Asia (Grismer et al. 2010). In the Philippines, the species was previously considered rare and not often encountered (Alcala 1986; CES personal observation). In the past 5 years of our herpetological surveys in the country, we encountered the species only twice, on Palawan and Leyte, with a few specimens from each locality (Supsup et al. unpublished). The observation in the MHR is our third encounter of the species. We observed *A. boa* on a tree branch ca. 3 m high, in secondary growth forest. The species present status is Least Concern (IUCN 2016), and we might recommend to reassess its conservation status given its apparent rarity. However, since it is a snail-eating species, its activity pattern involves active hunting exclusively following rain. Thus, we suspect that despite of wide distribution, the species is really only detected by biologists on nights immediately following heavy rains. As such this species activity pattern involves a strong negative detection bias unless trained herpetologists target it under appropriate atmospheric conditions. Caught individual had the following characters: snout-vent length 450 mm; 8 upper labials; 11 lower labials; 2 loreals present; head is short and distinct from neck; blunt snout; large eye; slender and compressed body; smooth scales; dorsal life-color brown; ventral is cream with irregular brown blotches; cream labials, with yellowish-brown patch beneath the eye. Photo voucher: KUDA 012521.

Boiga cynodon (Boie, 1827)
Figure 5c

This non-endemic snake is common and widespread throughout Southeast Asia. The Philippine population occurs in almost all major islands (Alcala 1986; Gaulke 2011). We encountered the species in secondary growth forest, attempting to eat a species of bat trapped in a mist net. Its current conservation status is Least Concern (IUCN 2016). The individual caught has the following characters: snout–vent length 1201 mm; 1 preocular; 2 postoculars; 8 upper labials; loreal present; head distinct from neck; snout short; smooth scales; in life, dorsal color is brown with yellow crossbars-like boarded by black; a black strip is present from the eye to the angle of jaw. Photo voucher: KUDA 012522.

Cyclocorus nuchalis taylori Leviton, 1967b
Figure 6

Clycocorus nuchalis has 2 recognized subspecies: *C. n. nuchalis* and *C. n. taylori* (Leviton, 1967b). These subspecies are both found on Mindanao, *C. n. taylori* distributed mostly on the east while *C. n. nuchalis* on the west. We found this species crawling under leaf litter along a riverbank, in secondary growth forest. The species conservation status is listed pres-

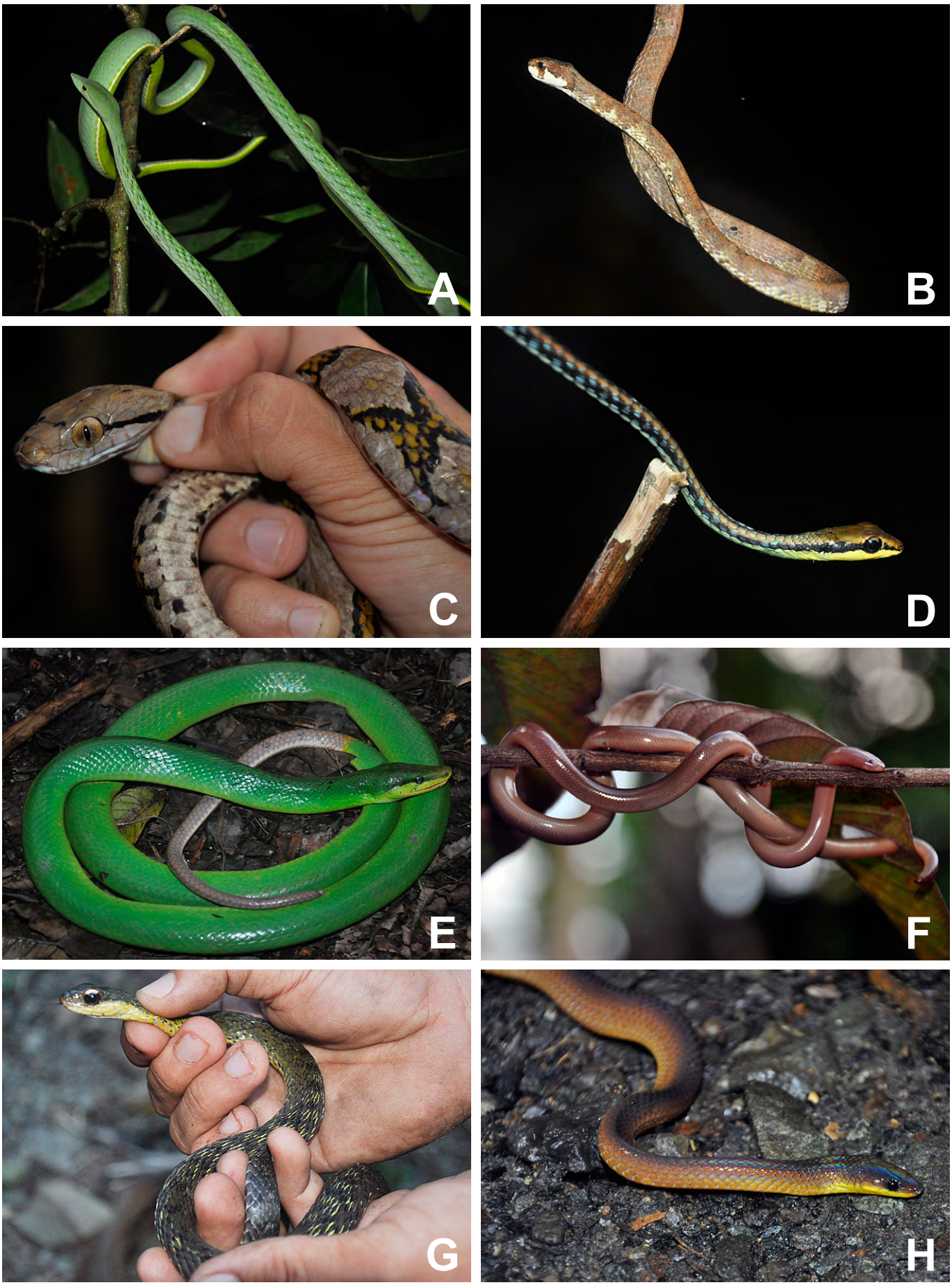

Figure 5. Species of snakes. **A.** *Ahaetulla prasina preocularis*. **B.** *Aplopeltura boa*. **C.** *Boiga cynodon*. **D.** *Dendrelaphis marenae*. **E.** *Gonyosoma oxycephalum*. **F.** *Ramphotyphops cumingii*. **G.** *Tropidonophis dendrophiops*. **H.** *Oxyrhabdium modestum*. Photos by C. Supsup.

Figure 6. *Cyclocorus nuchalis taylori*. Photo by C. Supsup.

ently as Least Concern (IUCN 2016). The individual caught has the following characters: snout–vent length 281 mm; 2 preoculars; 2 postoculars; 8 upper labials (3rd, 4th and 5th bordering the eye); life-color is brown, with few white spots on dorsal surface (mostly in mid-body); cream ventral with dark brown triangle blotches. Photo voucher: KUDA 012523.

Dendrelaphis marenae Vogel & Van Rooijen, 2008
Figure 5d

This snake occurs throughout the Philippines and on Suluwesi (Leviton 1968; Vogel & Rooijen 2008). It can be found in a variety of habitats, from cultivated to forested areas (Brown et al. 2012, 2013). We observed the species actively coiled on a tree branch, in secondary growth forest adjacent to a coconut plantation. Based on recent conservation status assessment done by Brown et al. (2012), the species is classified as Least Concern (IUCN 2016). Caught individual has the following characters: snout–vent length 457 mm; 2 preoculars; 3 postculars; 9 upper labials (5th and 6th are beneath the center of the eye); loreal present; head distinct from neck; relatively large eyes; smooth scales; life-color, yellowish-bronze, yellow labials, bronze dorsal, emerald-green venter; a black strip is present extending from loreal to the body, but fading progressively. Photo voucher: KUDA 012524.

Gonyosoma oxycephalum (Boie, 1827)
Figure 5e

This arboreal snake is a widespread species, found throughout Southeast Asia. It is known to occur in almost all major islands of the Philippines (Alcala 1986). In recent years, there have been increasing reports on new distribution records for the species (Ferner et al. 2000; Gaulke 2011). We observed this species in secondary growth forest. Its present conservation status is Least Concern (IUCN 2016). The individual caught has the following characters: snout–vent length 1100 mm; 1 preocular; 2 postoculars; 8 upper labials; loreal present; head distinct from head; pointed snout; scales smooth, but slightly keeled; in life color, dorsal surface is green and progressively becomes yellowish-green towards the sides; bright yellowish-green labials; half of the scale on tail is gray and beige on the keeled part. Photo voucher: KUDA 012515.

Ramphotyphlops cumingii (Gray, 1845)
Figure 5f

This unique arboreal blind snake is an endemic species, occurring throughout the Philippines. Although widespread, the species is rare and difficult to find. Only few specimens are available in collections (Diesmos & Brown 2009b). We observed this species during our daytime survey in secondary growth forest while searching a dead standing tree, ca. 1.5 m high. The species was also recently reported on Cebu, where it was found on a tree branch (Supsup et al. 2016). The species conservation status is Data Deficient (IUCN 2016). We recommend the maintenance of its present status because, so little is known about its population biology and extent of occurrence. The individual observed has the following characters: snout–vent length 325 mm; head round, not distinct from neck; tip of the tail has a pointed needle-like part; smooth scales; life-color is light brown. Photo voucher: KUDA 012517.

Tropidonophis dendrophiops (Günther, 1883)
Figure 5g

This semi-aquatic snake is distributed throughout the Philippines (Leviton 1963; Alcala 1986). We observed this species during our daytime survey on a small dried stream, in secondary growth forest located near a Mahogany (*Swietenia macrophylla*) plantation. The species was first observed crawling among rocks, after which it rapidly retreated under a dead log. The species conservation status is Least Concern (IUCN 2016). Observed individual has the following characters: snout–vent length 425 mm; 2 preoculars (upper is nearly reaching the surface of the head); 3 postoculars; 9 upper labials; 10 lower labials; loreal present; head distinct from neck; eyes are large; life-color brown on the head, dorsum greenish-black from neck to mid-body and turning black toward the tail, yellowish labials, venter yellowish with black blotches. Photo voucher: KUDA 012518–19.

Oxyrhabdium modestum (Duméril, 1853)
Figure 5h

Oxyrhabdium modestum has been recorded mostly on Mindanao PAIC (Leviton 1965; Alcala 1986). The records from Calamianes, Negros and Luzon are doubtful (Leviton 1965; Wallach et al. 2015). We observed the species in secondary growth forest near the river. Its current conservation status is Least Concern (IUCN 2016). The individual we observed has the following characters: snout–vent length 435 mm; 1 preocular; 1 postocular; 8 upper labials; loreal present; head slightly distinct from neck; pointed snout; smooth scales; dorsal life color brown, becoming yellowish-brown towards the sides; yellowish labials and throat; beige venter. Photo voucher: KUDA 012516.

Doubtful or misidentified species

Parvoscincus beyeri (Taylor, 1922a) and *Oxyrhabdium leporinum* (Günther, 1858): these two species were reported by Relox et al. (2011) as new records from MHR. However, we are in doubt of these records and propose the removal of these species from the mountain's faunal list. *Parvoscincus beyeri* is known only from Luzon Island (Alcala 1986;

Brown & Alcala 1980; Brown et al. 1995, 2010). Relox et al. probably misidentified the species. We believe that their specimen should be identified as *Sphenomorphus diwata*. These two closely related species could be misidentified if not carefully examined, because they have similar morphological characters, for example, scale numbers, body size, lamellae, tympanum (Brown & Alcala 1980; Linkem et al. 2011). *Oxyrhabdium leporinum* presently has 2 recognized subspecies: *O. l. leporinum* which is restricted to Luzon PAIC and *O. l. visayanum* occurring only on Visayan PAIC (Alcala 1986; Leviton 1964). To the best of our knowledge, there are no available records of *O. leporinum* from Mindanao yet. Although Relox et al. (2011) reported their specimens of *P. beyeri* and *O. leporinum* were deposited at the University of the Philippines in Mindanao, we were not able to examine them, because the authors did not provide any accession numbers and we could not locate the specimens. The authors also did not provide other evidence for the species identification, such as photographs and information on morphological characters in their report. If these doubtful species are in fact occurring on Mindanao, specimens from Mt. Hamiguitan must be provided and examined thoroughly to confirm their occurrence.

DISCUSSION

Despite several surveys conducted in the past few years (Delima et al. 2007; Relox et al. 2011), herpetofaunal diversity of the MHR has remained underestimated. Although we surveyed only one locality, in which natural habitats are already degraded and most sampling plots were positioned in small patches of secondary growth forests, we added a significant number of species (nearly 30%) to the total list for the MHR. This includes a rarely seen species of blind snake, *Ramphotyphlops cumingii,* and a possible new species of frog in the genus *Platymantis*. Our survey contributes to documented species distributions and information on habitat preferences, and may help refining conservation status assessments. These data are vital in designing or implementing conservation planning (Margules & Pressey 2000). However, a lack of information related to these topics could hinder effective conservation (Brown et al. 2001, 2013a; Diesmos & Brown 2009a). Most of our newly recorded species are distributed widely throughout the Philippines. However, our observations suggest that they may occur at low population densities, except by *Draco cyanopterus* and *Eutropis* cf. *indeprensa*. The low population density could be attributed to relatively dry conditions of our site during the survey. As documented in previous studies (Alcala & Brown 1998; Brown et al. 2001, 2012; Alcala et al. 2012), many species are more active during the rainy season, especially amphibians (and snakes that feed on them and/or other humid forest prey items). A follow-up study conducted at the onset of the rainy season should be conducted, targeting in particular the same small pockets of remaining forests that we surveyed in the dry season. Such an approach will likely uncover additional and possible new undocumented species.

Alternatively, we suspect that habitat disturbance observed in the area brought by forest clearing is likely having a negative impact on the populations, but a further study is needed to establish robust evidence or to determine which species are affected by habitat changes. For instance, in recent surveys on Leyte and Sibuyan islands (Mallari et al. 2013a, 2013b, 2014), amphibian and reptile species were observed to have varying niche position (habitat preference) and niche width (level of tolerance). Some species appear to be associated with pristine forest habitats, seemingly intolerant of disturbance; others appear to tolerate moderate levels of disturbance quite well. This suggests that forest clearings may be beneficial to some species (i.e., "edge species" or open-area taxa like frogs typically encountered in rice fields), but possibly also that forest clearings may negatively affect species from forests. Such information is crucial to inform conservation management; these kinds of data can only be made available through analyzing actual data collected from the field.

Only a few studies relating to habitat preference of amphibians and reptiles in the Philippines exist, most of which are only descriptions of habitats where the specimens were collected (Brown et al. 2001). Species habitat preference, microhabitats in particular, are important to amphibians and reptiles (Brown et al. 2012, 2013b), yet these are often neglected or overlooked in most protected areas in the Philippines, being absent or not even considered in management plans (Supsup 2014; Fauna & Flora International Philippines unpublished data). The species habitat characterizations we provided here are preliminary, but provide a general initial view of the habitats utilized by recorded species. Important habitats we observed that are critical to species survival include riparian vegetation, leaf litter, tree stumps, dead logs, fallen trees, tree foliage, swamps, and creeks, all of which are found in forested areas. Our observations are consistent with those from other studies (Ferner et al. 2000; Brown et al. 2001, 2012, 2013b; Mcleod et al. 2011; Siler et al. 2011, 2012; Gaulke 2011; Devan-Song & Brown 2012; Plaza & Sanguila 2015; Siler et al. 2016), emphasizing how these habitats are among the highest priority for research and conservation value.

Some species we recorded are in need of immediate reassessment of their conservation status. However, as emphasized by Brown et al. (2012), conservation status of species cannot solely be based on single visit of a site, extent of occurrence, or secondarily inferred degree of disturbance (e.g., fragmentation inferred from aerial measurements of forest cover; IUCN 2016). Repeated surveys in different seasons or times per year, focusing on variety of habitats, and systematic analysis of natural populations are necessary to determine if the species populations are increasing or declining. If these data are not available, assessment of species conservation status will be of limited value, incomplete, or much worse, providing incorrect information, which can mislead conservation planning (e.g., the case of *Platymantis polillensis* in the Philippines; Siler et al. 2011; Brown et al. 2012, 2013b).

Our study highlights how a single survey is insufficient to determine the species presence or absence in any given site. In recent work of Siler et al. (2011) in Aurora Province, the authors demonstrated that a single survey is not sufficient to assess the species diversity of an area (Brown et al. 2000; Siler et al., 2011). In these and several other studies, authors

nearly doubled species diversity for a given site with subsequent survey efforts (Brown et al. 2000, 2012, 2013b; Siler et al. 2011).

Despite repeated, follow-up surveys at various sites in the MHR, the area's herpetofauna remains poorly understood. We urge future field researchers focusing on this region to revisit and resample (during variable atmospheric conditions) the area studied here. No classically characterized Mindanao sites (Taylor 1921, 1922b, 1922c) have been the focus of temporally variable resurvey efforts. Understanding how Mindanao's diverse amphibian and reptile communities (Taylor 1921, 1922b, 1922c, 1966) respond to environmental perturbations is a subject of deeply important environmental and conservation concern and a challenge for future generations.

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