

Amphibians and Reptiles in the Vicinity of Bulusan Lake, Bulusan Volcano Natural Park, Sorsogon, Philippines

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A preliminary inventory of amphibians and reptiles from the vicinity of Bulusan Lake, Bulusan Volcano Natural Park is presented. So far, there is no existing account documenting the herpetofauna of this unique protected area. With this report, the researchers aim to provide baseline data on the identities of species of amphibians and reptiles existing in the natural park. A survey was conducted by employing visual encounter surveys. Specimens were identified *in situ* and were recorded by photographic documentation. The study resulted in the documentation of 26 species belonging to 24 genera in 14 families. This includes eight species of frogs, ten lizards, and eight snakes. The survey provides the first record of *Aplopeltura boa* (Blunthead Slug-eating Snake) from Luzon Island, and clarifies a previous point of confusion regarding species identification and use of the names *Boiga drapiezii* (White-spotted Cat Snake) and *Boiga angulata* (Philippine Blunt-headed Cat Snake) on Luzon. A novel account of a white-iris *Tropidolaemus subannulatus* (Northern Temple Pit Viper) is also presented. Considering the limited time and the confined area where the survey was conducted, a significant increase in this species list is expected as more surveys are conducted in the natural park focusing on different elevations and microhabitats. If future studies are permitted by the protected area managers, there is a high possibility of discovering several novel and endemic species.

Key words: amphibians, *Aplopeltura boa*, *Boiga drapiezii*, Bulusan Volcano, reptiles, white iris

INTRODUCTION

Recent herpetological surveys conducted in Northern and Central Luzon have revealed a startlingly rich diversity array of amphibians and reptiles (McLeod et al. 2011; Siler et al. 2011, 2012; Brown et al. 2012; Devan-Song & Brown 2012; Brown et al. 2013a). Among the hypothesized contributors to this diversity is the isolation

of Luzon's precursor paleoislands in recent geological past and their eventual accretion to form Luzon's conglomerate landscape of today (Adams & Prat 1911; Rutland 1968; Hashimoto 1981; Auffenberg 1988; Brown et al. 1996; Brown & Diesmos 2009; Yumul et al. 2009; Brown et al. 2013b). In addition, recent studies have also considered geography, atmospheric variation, and Pleistocene climate change cycles as additional factors (Brown & Diesmos 2009; Brown et al. 2012), which may have contributed to evolutionary processes of diversification.

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Southern Luzon's Bicol Region contains species that are distinct from the rest of this large island. Biogeographers previously have recognized the Bicol faunal sub-region, as a distinct sub-center of endemism. This faunal sub-region covers mainland Bicol and the islands of Alabat, Rapurapu, Catanduanes, Marinduque, and Polillo (Welton et al. 2014). Several herpetofaunal studies have been conducted in Bicol and have resulted in the discovery of several new species and new geographic distribution records (e.g., Brown & Gonzalez 2007; Siler et al. 2010a, 2010b, 2011; Linkem et al. 2013; Binaday & Lobos 2016; Sy & Binaday 2016; Siler et al. 2017). However, most of

these studies were from Northern and Central Bicol. The southern tip of Bicol remains to be explored in terms of its herpetological diversity.

Within Southern Bicol is an active volcano located in the province of Sorsogon – Bulusan Volcano (Figure 1). Most of the mountain has been declared as a protected area (PA; the Bulusan Volcano Natural Park). The PA includes a total area of 3,673.29 ha and includes parts of the municipalities of Bulusan, Irosin, Juban, Barcelona, and Casiguran. This remaining intact forest provides humans food, resources, protection from harsh weather and flood, and provide

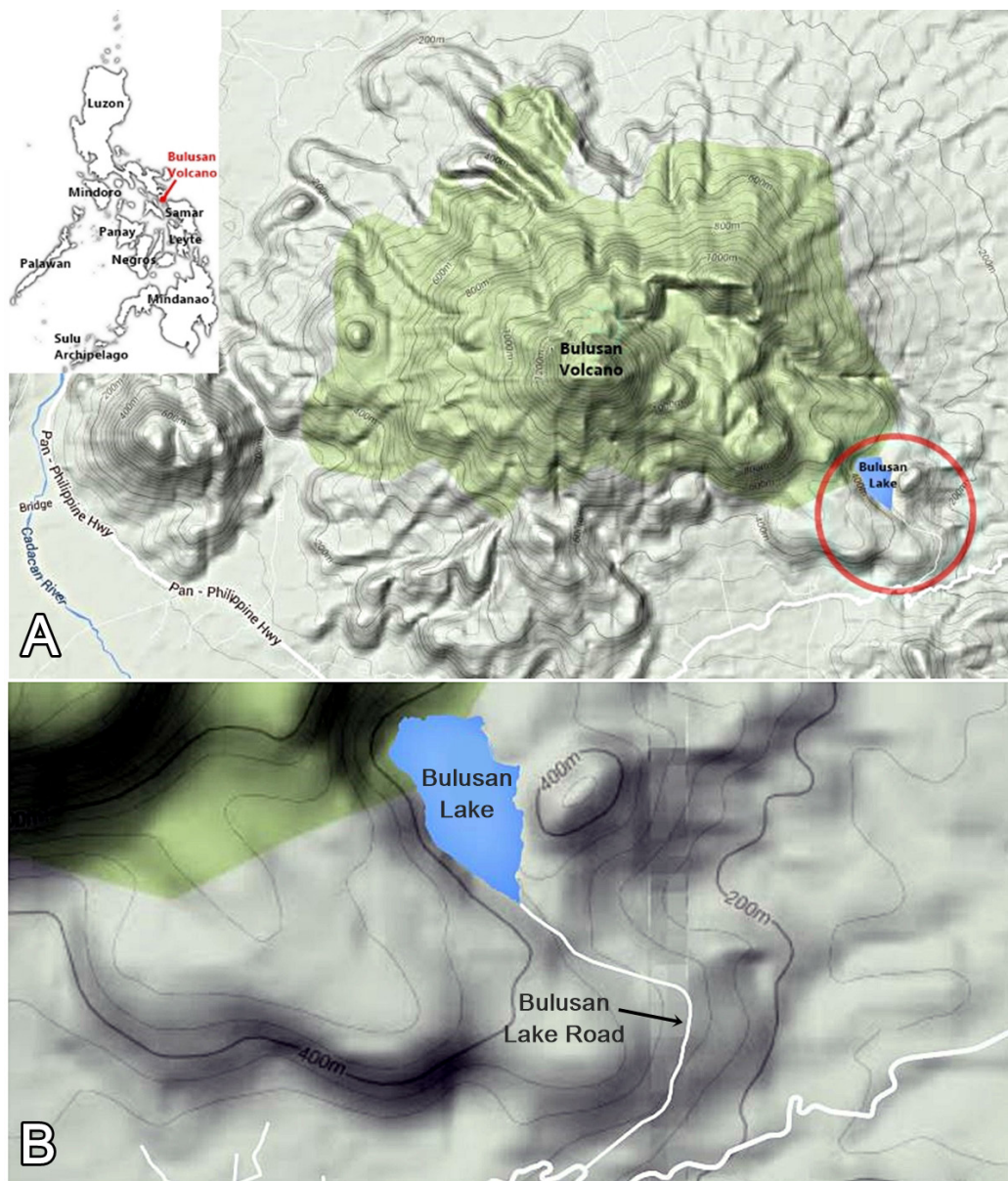


Figure 1. (A) Bulusan Volcano is an active volcano located in southern Luzon within the Bicol Faunal Sub-region. The surrounding forest of Bulusan Volcano Natural Park covers 3,673.29 ha. Study site indicated with red circle (Bulusan Lake and the road going to it). (B) Close up of the study site. Bulusan Lake road is about 1.7 km and leads to the lake. The lake itself is surrounded by dense forest vegetation.

a large amount of freshwater for irrigation and human consumption (Dudgeon 1992; Ratner 2000; Thapa 2001; Pattanayak 2004; McLeod et al. 2011). Part of the natural park includes Bulusan Lake. Located in the municipality of Bulusan, it is one of three large lakes in area and is identified as a popular tourist attraction. Because of this designation as a tourist destination, the local government has maintained most of the natural appearance of the lake and its surrounding area with minimal disturbance.

The study presents the results of a preliminary inventory of amphibians and reptiles in the vicinity of Bulusan Lake. However, because it is a federally protected area, the government strictly regulates research in the PA. Due to this restriction, no specimens could be collected during the course of this study. However, whenever possible, photographic documentation for all species encountered was performed. The tentative identification of species was provided based on high resolution images. This survey provides the first report of amphibians and reptiles of the natural park, intended to increase the understanding of local and regional microendemism as well as the distribution of Luzon's herpetological diversity. The short survey revealed new geographical distribution records and natural history observations.

METHODS

This survey was based on the several visits during May-Sep 2015 (26-29 May, 4-6 Jun, 20-22 Jun, 18-19 Jul, 21-23 Aug, 19-21 Sep, and 25-28 Sep) and 14-15 Feb 2016. Visual encounters were employed to document and assess herpetological diversity at the site. Areas such as forest trails, lake vicinity, and the road going to the lake were surveyed for one to two hours by two to three biologists during the day (9:00am-3:00pm) and night (7:00pm-12:00pm). Specimens were identified *in situ* and were photo-documented, except for eight species (i.e., *Rhinella marina*, *Bronchocela marmorata*, *Gekko* cf. *mindorensis*, *Pseudogekko* cf. *compressicarpus*, *Lipinia pulchella pulchella*, *Tropidophorus grayi*, *Oligodon ancorus*, and *Hemibungarus calligaster calligaster*) which escaped upon approach of researchers or otherwise alluded attempts to secure high quality images. No voucher specimens were collected but images representing each species have been deposited at the digital archive of the Lee Kong Chian Natural History Museum, National University of Singapore and are permanently cataloged (catalog numbers presented in Figures 3 and 4).

Bulusan Volcano at the southern end of the island of Luzon is a stratovolcano with an elevation of 1,565 m above sea level and a base diameter of 15 km. It is one of the most active volcanos in the Philippines. Bulusan Lake (Figures

1 and 2) is located in the southeastern side of Mt. Bulusan (12.75420°N, 124.09409°E) and is approximately 400 m above sea level. The area surveyed is characterized by secondary growth forest (Figure 2A & B) with large vines dangling from the canopy (C), and large boulders that serve as attachment for several epiphytes like giant ferns (D) – the most common vegetation in the park. Decaying logs are fairly abundant in the area. Many of the rocks and boulders are covered with moss. Leaf litter is fairly thick along forest edges and within the forest. Large vines hang from trees extending down to the ground. The understory is dense with tree saplings in many areas. A tourist lounge is situated on the southeast side of the lake. Furthermore, the lake is encircled by a concrete path (E) and dense forest vegetation. The road leading to the lake is also surrounded by dense forest vegetation (F) with several shallow cliffs; a very small stream is located at the entrance to the PA.

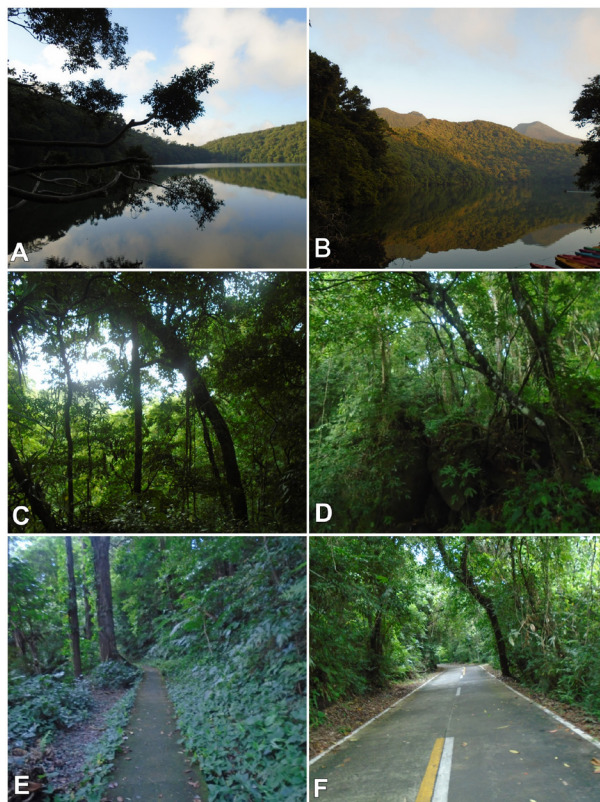


Figure 2. Habitats in Bulusan Volcano Natural Park. Bulusan Lake (A and B) is surrounded mostly by second-growth forest (C), and large boulders that serve as attachment for many epiphytes (D). A concrete path also surrounds the lake (E). Bulusan Lake road (F), which leads to the lake, is also characterized by the same habitats.

RESULTS

A total of 26 species, belonging to 24 genera, representing 14 families were documented. This includes eight species of frogs, 10 lizards, and eight snakes (Figure 3 and 4). Information on the natural history, endemism, distribution, and conservation status of these species (Brown et al. 2012, 2013a; Diesmos et al. 2015; Sanguila et al. 2016; IUCN 2015, The Reptile-Database) are indicated in Tables 1 and 2.

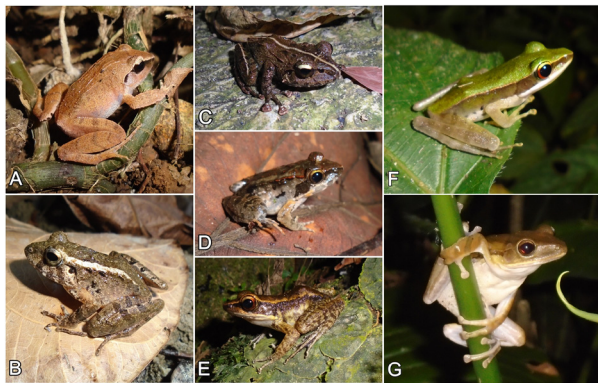


Figure 3. Anurans from the vicinity of Bulusan Lake: (A) *Platymantis corrugatus* (ZRC [IMG] 1.107), (B) *Platymantis dorsalis* (ZRC [IMG] 1.108), (C) *Platymantis luzonensis* (ZRC [IMG] 1.109), (D) *Limnonectes woodworthi* (ZRC [IMG] 1.110), (E) *Pulchrana similis* (ZRC [IMG] 1.111), (F) *Sanguirana luzonensis* (ZRC [IMG] 1.112), (G) *Polypedates leucomystax* (ZRC [IMG] 1.113), (H) *Trimeresurus flavomaculatus* (ZRC [IMG] 2.317), (I) *Tropidolaemus subannulatus* (ZRC [IMG] 2.318) with white iris.

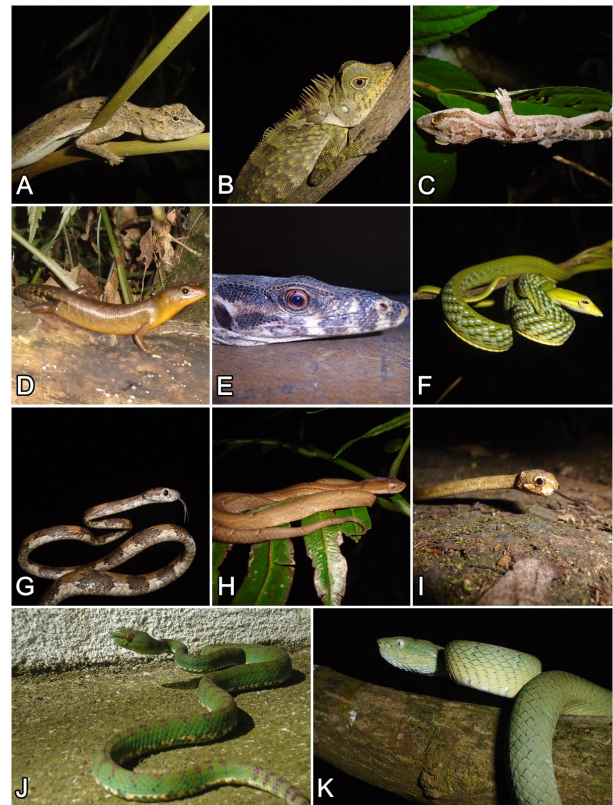


Figure 4. Reptiles from the vicinity of Bulusan Lake: (A) *Draco spilopterus* (ZRC [IMG] 2.310), (B) *Gonocephalus cf. sophiae* (ZRC [IMG] 2.311), (C) *Cyrtodactylus philippinicus* (ZRC [IMG] 2.312), (D) *Pinoyscincus cf. jagori jagori* (ZRC [IMG] 2.313), (E) *Varanus dalubhasa* (ZRC [IMG] 2.314), (F) *Ahaetulla prasina preocularis* (ZRC [IMG] 2.315), (G) *Boiga drapiezii* (ZRC [IMG] 2.285), (H) *Psammodynastes pulverulentus* (ZRC [IMG] 2.316), (I) *Aplopeltura boa* (ZRC [IMG] 2.251), (J) *Trimeresurus flavomaculatus* (ZRC [IMG] 2.317), (K) *Tropidolaemus subannulatus* (ZRC [IMG] 2.318) with white iris.

Table 1. Current distribution of anurans accounted in the vicinity of Bulusan Lake, Bulusan Volcano Natural Park, Sorsogon, Philippines and their conservation status (PAIC- Pleistocene Aggregate Island Complexes).

Taxon	Endemicity	Distribution in Philippines	Conservation Status
Bufonidae			
<i>Rhinella marina</i>	Introduced	All major islands except the Sulu Archipelago	Least Concern
Ceratrobatrachidae			
<i>Platymantis corrugatus</i>	Endemic	All major islands except the Batanes, the Palawan PAIC, and the Sulu Archipelago	Least Concern
<i>Platymantis dorsalis</i>	Endemic	Luzon and Western Visayas PAICs	Least Concern
<i>Platymantis luzonensis</i>	Endemic	Central and Southern Luzon	Near Threatened
Dicroglossidae			
<i>Limnonectes woodworthi</i>	Endemic	Luzon PAIC	Least Concern
Ranidae			
<i>Pulchrana similis</i>	Endemic	Luzon PAIC	Near Threatened
<i>Sanguirana luzonensis</i>	Endemic	Luzon PAIC	Least Concern
Rhacophoridae			
<i>Polypedates leucomystax</i>	Native	All major islands	Least Concern

Table 2. Current distribution of reptiles accounted along the vicinity of Bulusan Lake, Bulusan Volcano Natural Park, Sorsogon, Philippines and their conservation status (PAIC- Pleistocene Aggregate Island Complexes; * first account for the island of Luzon).

Taxon	Endemicity	Distribution in Philippines	Conservation Status
Agamidae			
<i>Bronchocela marmorata</i>	Endemic	Luzon PAIC, Mindoro and Sibuyan islands	Least Concern
<i>Draco spilopterus</i>	Native	Luzon and Western Visayas PAICs	Least Concern
<i>Gonocephalus cf. sophiae</i>	Endemic	Luzon PAIC	Data Deficient
Gekkonidae			
<i>Cyrtodactylus philippinicus</i>	Native	Luzon and Western Visayas PAICs, Mindoro islands	Least Concern
<i>Gekko cf. mindorensis</i>	Endemic	Luzon, Mindanao, and Western Visayas PAICs	Data Deficient
<i>Pseudogekko cf. compressicorpus</i>	Endemic	Luzon and Mindanao PAICs, Leyte, Tablas, and Masbate islands	Least Concern
Scincidae			
<i>Lipinia pulchella pulchella</i>	Endemic	Southern Luzon, Mindanao PAICs, and Polillo island	Least Concern
<i>Pinoyscincus cf. jagori jagori</i>	Endemic	Luzon and Mindanao PAICs	Least Concern
<i>Tropidophorus grayi</i>	Endemic	Luzon and Western Visayas PAICs, East Visayas faunal sub-region of the Mindanao PAIC	Least Concern
Varanidae			
<i>Varanus dalubhasa</i>	Endemic	Bicol faunal sub-region of Luzon PAIC	No Status Yet
Colubridae			
<i>Ahaetulla prasina preocularis</i>	Subspecies Endemic	Most major islands	Least Concern
<i>Boiga drapiezzii*</i>	Native	Species name previously applied only in southern Philippines (Sulu Archipelago)	Least Concern
<i>Oligodon ancorus</i>	Endemic	Luzon and Mindoro PAICs	Near Threatened
Elapidae			
<i>Hemibungarus calligaster calligaster</i>	Endemic	Luzon and Mindoro PAICs	Least Concern
Lamprophiidae			
<i>Psammodynastes pulverulentus</i>	Native	Most major islands in the country	Least Concern
Pareidae			
<i>Aplopeltura boa*</i>	Native	Previously recorded in the islands of Balabac, Basilan, Samar, Bohol, Mindanao, and Palawan	Least Concern
Viperidae			
<i>Trimeresurus flavomaculatus</i>	Endemic	Luzon, Mindanao, and Western Visayas PAICs, Mindoro island	Least Concern
<i>Tropidolaemus subannulatus</i>	Native	Luzon and Western Visayas PAICs, East Visayas faunal sub-region of the Mindanao PAIC	Least Concern

Annotated Species List

Anurans

Bufonidae

Rhinella marina (Linnaeus, 1758)

Common Name: Cane Toad

This species was first introduced on Negros Island during the industrial revolution to control pests in sugar cane plantations (Diesmos et al. 2006; Brown et al. 2013a). Since then, it has spread throughout the country and can be found in high numbers in lowland agricultural areas (e.g., foot hills of mountains), and up to elevations of 1200 masl in a few areas (Brown et al. 2013a; Diesmos et al. 2015). Only one individual was encountered at the entrance to Bulusan Lake road. Additionally, a few calls were heard around the same area.

Ceratrobatrachidae

Platymantis corrugatus (Duméril, 1853)

Common Name: Rough-backed Forest Frog

Platymantis corrugatus has been found throughout the Philippines except in Palawan PAIC and Sulu Archipelago islands (Diesmos et al. 2015). An endemic, it is characterized by a dark facial mask, elongate tubercular ridges across its dorsal surface, and a medium body size (Brown et al. 2013a). Individuals were usually observed either hidden under thick vegetation or hidden in leaf litter. Four color morphs were observed at the site. These were yellow-orange, maroon, brown, and grayish brown.

Platymantis dorsalis (Duméril, 1853)

Common Name: Common Forest Frog

This endemic species is widespread throughout Luzon and Western Visayas (Diesmos et al. 2015). It was the most commonly encountered species at Bulusan Lake and was usually seen on the forest floor on top of leaf litter both day and night. Numerous vocalizing males were observed perched on top of rocks. Several morphs were observed including individuals with shades of brown, red, or orange as their dominant color, individuals with no stripes, one thin or thick middorsal stripe, and individuals with two dorsal stripes.

Platymantis luzonensis Brown, Alcalá, Diesmos, and Alcalá, 1997

Common Name: Luzon Forest Frog

An arboreal species, *Platymantis luzonensis* has been recorded in Central and Southern Luzon (McLeod et al. 2011; Diesmos et al. 2015). This species can usually be found on vines, leaves, branches, and trunks of trees. Three individuals were encountered during the survey, but calls of the species were heard almost every night. Two color morphs were encountered. One was dark brown in color while two were golden brown. All three individuals had dorsolateral stripes and transverse bars on the dorsal surface of their legs. Two were encountered inside a dead hollow trunk during the day. Another was observed

perched on top of a fern at night. All three individuals had a white iris above their pupil which contrasts with the dark brown body coloration.

Dicroglossidae

Limnonectes woodworthi (Taylor, 1923)

Common Name: Woodworth's Frog

Limnonectes woodworthi has been observed all throughout Luzon and some nearby islands (Diesmos et al. 2015). This fanged frog species is more commonly encountered in riparian habitats in southern Bicol and lives sympatrically with *L. macrocephalus* (McLeod et al. 2011; Brown et al. 2013a). It can be differentiated from the latter species by its smaller size, dorsal and dorsolateral folds, and dark tympanic region (McLeod et al. 2011). Only very few individuals were encountered along the lake shore and forest floor; both large adults and smaller juveniles were encountered during the survey.

Ranidae

Pulchrana similis (Günther, 1873)

Common name: None

Previously under the genus *Hylarana*, this species of stream frog is widespread throughout Luzon (Diesmos et al. 2015). It is abundant in pristine rivers and streams in mid- and high-elevation forests (McLeod et al. 2011; Brown et al. 2012, 2013a), but can also be found in semi-disturbed streams and even in subterranean rivers. Several individuals were encountered on the shores of Bulusan Lake, after dark, either on the forest floor or perched on a rock, branch, a leaf, or a vine.

Sanguirana luzonensis (Boulenger, 1896)

Common Name: Luzon Frog

This stream frog has been recorded throughout Luzon and some nearby islands (Diesmos et al. 2015). Its habitat preference range from heavily disturbed to pristine riparian systems, but it is more common in mid- to high-elevation forests (Brown et al. 2013a). This species varies greatly in dorsal coloration, ranging from shades of green and brown, to mottled (McLeod et al. 2011). Two juveniles were encountered perched on leaves of shrubs at night and were considered noteworthy, given that the nearest stream is approximately 1.5 km away.

Rhacophoridae

Polypedates leucomystax (Gravenhorst, 1829)

Common Name: Common Tree Frog

A non-endemic species, it is widespread throughout the country (Diesmos et al. 2015) and is often found around temporary pools of water in disturbed and residential areas (McLeod et al. 2011). It is an arboreal species and is locally known as *palakang saging* or “banana frog” (Siler et al. 2012) since it is commonly found around banana plantations. Only one individual was encountered on the outskirts of the road to the lake. However, several calls

were heard from time to time during the survey in the vicinity of the observed individual.

Reptiles

Lizards

Agamidae

Bronchocela marmorata Gray, 1845

Common Name: Marbled Bloodsucker

This species is widely distributed in Luzon. It is usually encountered in the morning perched on exposed tree trunks and shrubs while basking in the sun. This species possesses the ability to change dorsal coloration from green to brown, and the researchers assume that its tendency to remain motionless contributes to its impressive camouflage abilities (Lagat 2011). One juvenile was seen basking on a giant fern frond in the early morning.

Draco spilopterus (Wiegmann, 1834)

Common Name: Philippine Flying Dragon

This species is widespread throughout Luzon and Western Visayas and is commonly observed on trunks and canopies of coconut palms in plantations where it feeds on ants and termites (McGuire & Alcala 2000; McLeod et al. 2011; Siler et al. 2012). A few individuals of this flying lizard were seen sleeping horizontally at night on vines and branches of small herbaceous plants. During the day, they have been seen gliding among trees in forests surrounding the lake.

Gonocephalus cf. sophiae (Gray, 1845)

Common Name: Luzon Forest Dragon

Gonocephalus sophiae is thought to occur throughout Luzon and nearby islands. However, recent undergoing taxonomic work reveals that 12 major lineages exist in the Philippines and that two are native to the Bicol peninsula (Welton et al. 2016). These two lineages were from Mt. Isarog and Mt. Malinao in northern and central Bicol, respectively. The researchers consider it likely that the Mt. Bulusan population may form an additional distinct lineage. This species is very secretive in nature and is well camouflaged (Lagat 2011). Several individuals were observed sleeping vertically or diagonally from the ground, on vines and branches at night.

Gekkonidae

Cyrtodactylus philippinicus (Steindachner, 1867)

Common Name: Philippine Bow-fingered Gecko

The species is possibly the most common gecko in northern Philippines (Brown et al. 2013a), and is usually encountered in low- and mid-elevation forests (Brown et al. 1996, 2000; Diesmos et al. 2005; Siler et al. 2011; Brown et al. 2012, 2013a). Philippine members of the genus *Cyrtodactylus* can easily be distinguished from other gekkonid lizards by their bent toes. This species has been documented retreating to tree holes and rotten logs during the day (Lagat 2011). Several individuals were seen

clinging to branches, vines, trunks, and boulders at night.

Gekko cf. mindorensis (Taylor, 1919)

Common Name: Mindoro Narrow-disked Gecko

This gecko is widespread throughout the Philippines (McLeod et al. 2011; Siler et al. 2011). However, recent phylogenetic work on this species revealed eight deeply divergent clades (Siler et al. 2014), one of which is the Bicol population. This species has been known to prefer microhabitats, such as boulders, tree trunks, shrubs, and other similar structures in riparian habitats (Lagat 2011). They have also been seen in cave entrances. One individual was encountered inside a hollow trunk by the lake.

Pseudogekko cf. compressicorpus (Taylor, 1915)

Common Name: Philippine False Gecko

The *Pseudogekko compressicorpus* Complex is widely distributed throughout the Philippines, extending from Mindanao, through the eastern island arc (Leyte-Samar), and Luzon (Siler et al. 2010c; Brown et al. 2013a). This gecko can be encountered perched on large leaves, between shrub- and understory layer vegetation, at low- to mid-elevation forests, especially after heavy rains (Brown et al. 2013a). Only two individuals were encountered crawling on the same tree trunk at night by the lake.

Scincidae

Lipinia pulchella pulchella (Gray, 1845)

Common Name: Yellow-striped Slender Tree Skink

This endemic skink is easily distinguished by its small size and a bright, yellow mid-vertebral stripe, running from snout to tail, bordered laterally by black lines. This subspecies has been known to occur in southern Luzon, Polillo Islands, Leyte, Samar, and Mindanao (Brown & Alcala 1980; Sanguila et al. 2016). A few individuals of this species were seen crawling on trunks of trees and on paved walls.

Pinoyscincus cf. jagori jagori (Brown and Alcala, 1980)

Common Name: Jagor's Common Ground Skink

Pinoyscincus jagori jagori co-occurs with *Pinoyscincus abdictus aquilonius* within Mt. Isarog in Northern Bicol (Linkem et al. 2010). It is likely that the latter also occurs in Bulusan Volcano Natural Park. But, because to date, only *P. jagori jagori* has been documented on Mt. Bulusan, individuals in the study were tentatively identified as *P. jagori jagori*. This species was the most ubiquitous reptile in the area. Many individuals, ranging from juvenile to adult, were seen on the forest floor during the day. Most of which were seen basking on sunspots, especially at morning.

Tropidophorus grayi Günther, 1861

Common Name: Spiny Waterside Skink

This endemic species occurs on several major islands from Luzon down to Cebu (Brown et al. 2009). Several

individuals were seen during daylight hiding in crevices of overhanging rocks on the shores of Bulusan Lake and the road going to it.

Varanidae

Varanus dalubhasa Welton, Travers, Siler, and Brown, 2014 **Common Name: Enteng's Monitor Lizard**

This water monitor species is almost morphologically indistinguishable to *Varanus marmoratus* with which it was previously confused. However, phylogenetic studies showed that this cryptic species is more closely related to the Visayan lineage, *Varanus nuchalis* (Welton et al. 2014). Three individuals of this recently described Bicol endemic water monitor was observed during this study. One was seen along the road during midday and another was observed rushing along the trail in early afternoon. A third, the largest of the three, was encountered as it attempted to scavenge on discarded food waste, just behind the tourist lounge kitchen near the lake; this individual was captured, photographed, and subsequently released.

Snakes

Colubridae

Ahaetulla prasina preocularis (Taylor, 1922)

Common Name: Asian Vine Snake

This vine snake species is widely distributed across the country (Leviton 1967). It is usually encountered resting in branches of saplings and bushes in residential areas, edges of agroforests, disturbed and pristine second-growth forests, and logged primary growth (Brown et al. 2013a). This species has several color variation including green, yellow, and blue-green morphs (Oliveros et al. 2011). A few green morphs were encountered sleeping in branches of saplings at night. A juvenile was seen basking on a fern in the morning. One blue morph of the species was also encountered foraging along the trail around the lake.

Boiga drapiezii (Boie, 1827)

Common Name: White-spotted Cat Snake

The White-spotted cat snake has been reported from Sulu Archipelago, the southernmost extent of the Philippines (Gaulke 1994; Leong et al. 2009). However, numerous records of *Boiga angulata* (a species occurring on Luzon, Polillo, Catanduanes, Mindoro, Lubang, Samar, Leyte, Bohol, Panay, Negros, Cebu, and Mindanao) and *Boiga schultzei* (considered endemic to the Palawan PAIC landmasses) are morphologically indistinguishable from *Boiga drapiezii*, which presents a challenge when differentiating the three (Gaulke 2001; Brown et al. 2009).

Leviton (1968) has examined specimens of *B. drapiezii* from Sarawak, Borneo and compared it with specimens of *B. angulata* from various localities in the Philippines. His observation showed that there are at least two forms of *B. drapiezii* that exist in northern Borneo. One has a series of uniform light and dark crossbars and a solid white middorsal

stripe, and the other has a series of saddled-shape light brown blotches separated by dark brown crossbars which widen on the sides on the dorsum. This latter form are exemplified by *B. angulata* from the Philippines.

Leviton (1968) demonstrated that ventral scale counts of the blotched *B. drapiezii* from northern Borneo and those of *B. angulata* were not that different from each other, suggesting that if adequate samples were obtained, the union of the two taxa might be inevitable. He also emphasized a difficulty differentiating *B. schultzei* from *B. drapiezii* (the two differing primarily in color pattern). In support of Leviton's observations, the researchers predict that populations of *B. angulata* (Taylor 1917, 1922a,b; Leviton 1963; 1970 ; Ferner et al. 2000; Gaulke 2001, 2011) and *B. schultzei* (Taylor 1923; Leviton 1963, 1968; Alcalá 1986), which are morphologically similar to *B. drapiezii*, may actually best be referred to *B. drapiezii* in future analyses (*sensu* Leviton 1968; *contra* Peters 1861; Taylor 1923).

Individuals of *B. drapiezii* from Bulusan Lake and another in Catanduanes exhibited uniform light and dark crossbars but lack the solid white middorsal stipe. Another individual encountered in Mt. Labo (Camarines Norte Province) by JWB exhibited irregularly shaped and spaced, golden and dark brown blotches, leading to consideration that other forms of this highly polymorphic species exist within the country. This is the first account of this species, under the epithet *B. drapiezii*, which was deliberately used to include its suspected junior synonyms *B. angulata* from Luzon (Binaday & Lobos 2016) and *B. schultzei* from Palawan PAIC islands. This species may be common throughout its range but may rarely be seen, due to its elusive nature.

Oligodon ancorus (Girard, 1858)

Common Name: Northern Short-headed Snake

This species was reported from several sites on Luzon and Mindoro islands (Leviton 1962; Supsup 2016). One individual was seen on the ground along the trail surrounding the lake. The individual has a brown dorsum coloration.

Elapidae

Hemibungarus calligaster calligaster (Wiegmann, 1835)

Common Name: Philippine False Coral Snake

This rarely encountered false coral snake is widespread throughout the eastern seaboard of Luzon (Diesmos et al. 2005; Brown et al. 2012, 2013a). One juvenile of this species was encountered on the ground.

Lamprophiidae

Psammodynastes pulverulentus (Boie, 1827)

Common Name: Dark-spotted Mock Viper

Psammodynastes pulverulentus is a widespread species and has been documented throughout the archipelago (Leviton 1983; Brown et al. 2000; McLeod et al. 2011;

Siler et al. 2011; Brown et al. 2012, 2013a; Sanguila et al. 2016). Adults are usually encountered along the ground, while juveniles are usually seen on shrubs in secondary and primary growth forests (Brown et al. 2012). Several individuals were encountered nightly on ferns and other shrubs at the forest edge. *Psammodynastes pulverulentus* was the most common snake species encountered during the surveys. Three color morphs were encountered during the survey. One had a golden yellow dorsum, another was light- or dark-violet, while the other was brick-red. Most of the individuals observed were juveniles. Only two adults were observed: one female was crawling on the ground when encountered in the early afternoon and one male was coiled in dead vines when encountered at night.

Pareidae

***Aplopeltura boa* (Boie, 1828)**

Common Name: Blunthead Slug-eating Snake

The Blunthead slug-eating snake is widespread but considered by some to be “uncommon” (David & Vogel 1996); others have documented it frequently by focusing search efforts after rain, when its preferred prey items (snails and slugs) are active (Sanguila et al. 2016). This species has been reported from Mindanao, Bohol, Basilan, Samar, Palawan, and Balabac islands (Boulenger 1894; Taylor 1922b; Grismer et al. 2012; Sanguila et al. 2016). One was seen coiled on a dead branch on the shore of Bulusan Lake; this provided the first geographic distribution record of this species for the island of Luzon (Sy & Binaday 2016). It seems to occur in many PAs, suggesting the importance of national and natural parks in retaining and protecting the biodiversity of the country.

Viperidae

***Trimeresurus flavomaculatus* (Gray, 1842)**

Common Name: Philippine Pit Viper

This Philippine pit viper occurs throughout the island of Luzon (Leviton 1964; Brown et al. 2012). Throughout its distribution, it is a highly polymorphic species in terms of coloration (McLeod et al. 2011; Siler et al. 2011). Two color morphs have been observed at Bulusan Lake. One was brick-red and was seen crawling on the ground. The other one was a green morph with maroon dorsal stripes and was seen on a branch about 3 m high.

***Tropidolaemus subannulatus* (Gray, 1842)**

Common Name: Northern Temple Pit Viper

The Northern temple pit viper is encountered in the Luzon and Visayan regions and is common in forested areas between sea level and mid-elevation (Brown et al. 2013a). It has also been reported from Palawan and Mindanao regions (Alcala 1986; Vogel et al. 2007; Sanguila et al. 2016). This species seems to have great dorsal pattern variation (Vogel et al. 2007). Five individuals were encountered at night and one in the late afternoon, with

three perched on vines and another on a woody shrub. One male possessed a notably white iris (Binaday 2017). Two juveniles were encountered foraging along in shrubs.

DISCUSSION

The southern volcanic mountains of Luzon have proved to be yet another haven for countless discoveries, in terms of biodiversity of amphibians and reptiles. The brief survey resulted in the documentation of eight amphibians and 18 reptiles and is the first account of the herpetofauna of Bulusan Volcano Natural Park. Survey effort was focused at low in elevation and limited only to the immediate vicinity of Bulusan Lake. As such, it provides only a glimpse of species diversity resident to Bulusan Volcano Natural Park. Nevertheless, the survey results demonstrate several interesting discoveries. These include a new geographic distribution record for *Aplopeltura boa* which was only previously recorded on the islands of Mindanao, Basilan, Bohol, Samar, Palawan, and Balabac (Boulenger 1894; Taylor 1922b; Grismer et al. 2012; Sanguila et al. 2016). Such discoveries show that some of the species considered “rare” or restricted might be widespread but only undocumented due to their elusive nature.

The researchers have attempted to clarify that the numerous accounts and populations of *Boiga angulata* in Luzon actually refers to *B. drapiezii*, the name formerly applied only to records from the Sulu Archipelago (Gaulke 1994; Leong et al. 2009). In addition to these new distribution records, it was also observed that *Tropidolaemus subannulatus* was more common in the study area than *Trimeresurus flavomaculatus* in contrast to some areas, where the latter is more commonly encountered (Brown et al. 2012; Devan-Song & Brown 2012; Brown et al. 2013a). Moreover, the encounter of a white-iris *Tropidolaemus subannulatus* is a first account of this coloration possibly representing color pattern occurring at low frequency in the Southern Bicol population.

The purpose of this study is to provide preliminary data on the herpetological diversity of Bulusan Volcano Natural Park. Considering that the sampling area was limited, a more extensive survey that will cover more sites and habitats across several elevations will undoubtedly increase the number of species included in the species list, which may surpass the well-surveyed sites in Northern and Central Luzon (Brown et al. 2000; Diesmos et al. 2005; McLeod et al. 2011; Siler et al. 2011, 2012; Devan-Song & Brown 2012; Brown et al. 2012, 2013a). In previous studies, follow-up visits to pre-surveyed sites focusing on different habitats, forest communities, varying atmospheric conditions, and geological features of the landscapes, a significant increase in the herpetological

diversity is often documented (Diesmos et al. 2005; Siler et al. 2011; Devan-Song & Brown 2012) highlighting the need for additional studies.

Among the amphibian and reptiles species that are expected to be encountered in Mt. Bulusan and surrounding areas as more surveys will be conducted include certain species of frog (*Fejervarya moodiei*, *Fejervarya vittigera*, *Hoplobatrachus rugulosus*, *Limnonectes macrocephalus*, *Occidozyga laevis*, *Kaloula conjuncta*, *Kaloula kokacii*, *Kaloula picta*, *Philautus surdus*, *Rhacophorus bimaculatus*, and *Rhacophorus pardalis*); lizard (*Brachymeles boulengeri*, *Brachymeles brevidactylus*, *Brachymeles makusog*, *Eutropis multifasciata*, *Eutropis multicarinata borealis*, and *Lamprolepis smaragdina philippinica*); snake (*Boiga cynodon*, *Boiga dendrophila divergens*, *Calamaria gervaisii*, *Chrysopelea paradisi variabilis*, *Coelognathus erythrurus*, *Cyclocorus lineatus*, *Dendrelaphis marenae*, *Dendrelaphis philippinensis*, *Gonyosoma oxycephalum*, *Lycodon capucinus*, *Lycodon muelleri*, *Malayopython reticulatus*, *Oxyrhabdium leporinum*, *Ptyas luzonensis*), and *Indotyphlopys braminus*; and turtle (*Cuora amboinensis*). This would be the case since most of these species are found consistently throughout the Luzon faunal region (Brown et al. 2000; Diesmos et al. 2005; McLeod et al. 2011; Siler et al. 2011, 2012; Devan-Song & Brown 2012; Brown et al. 2012, 2013a). In addition to these species, the researchers expect that there is a great possibility that several new species, especially of the genus *Platymantis*, may be discovered in this mountain and surrounding areas.

Amphibians and reptiles are important indicators of ecological health. They are sensitive to disturbance and are fragile which is excellent for indicating ecosystem function (Pechmann et al. 1991; Hager 1998; Welsch & Ollivier 1998; Lawler et al. 2003; McLeod et al. 2011). An ecological community that is both taxonomically and functionally diverse represents a healthy local community (Sodhi et al. 2008; Sodhi & Ehrlich 2010; McLeod et al. 2011). However, the herpetofauna of southern Luzon is facing several threats, both natural and manmade. They include climate change, habitat modification and destruction, natural disasters, wildlife and pet trade, and threats from invasive species. Never has there been a more important time to protect and conserve the country's unique herpetological diversity—in particular, the distinct fauna of the southern tip of Luzon Island.

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