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# Inventory of Herpetofauna in the Buffer Zone of Mt. Hamiguitan Range Wildlife Sanctuary, San Isidro, Davao Oriental, Philippines

Jireh R. ROSALES*, Julie Angela G. YU, Bernadette J. NANUAL, Amy G. PONCE

*Faculty of Agriculture and Life Sciences, Davao Oriental State University, City of Mati, Davao Oriental, 8200 Philippines. ORCID Jireh R. Rosales: https://orcid.org/0000-0002-3591-1299, Julie Angela G. Yu: https://orcid.org/ 0009-0006-5130-8912, Bernadette J. Nanual: https://orcid.org/ 0009-0001-5018-2629, Amy G. Ponce: https://orcid.org/ 0000-0003-3522-5202*

*Corresponding author email: jirehr8@gmail.com*

**ABSTRACT.** The Mount Hamiguitan Range Wildlife Sanctuary (MHRWS) is a declared national park and a wildlife sanctuary located in the province of Davao Oriental in the Philippines. Most of the herpetofauna surveys conducted in the MHRWS were located in the protected areas of the mountain. Thus, this study was done to assess the surrounding buffer zone in the northwestern part of the mountain as a crucial step toward enhancing conservation and management policies for these taxa and reinforcing the importance of buffer zones as protective barriers around the core zones. Standard sampling technique for herpetofauna survey such as the cruising method in a 1-km transect line per study area was used. Pitfall trapping was also employed for reptile fauna. A total of 25 species of herpetofauna were documented in the survey, 10 species of which are anurans and 15 species are reptiles. The majority of the species documented are endemic to the Philippines. Moreover, threatened and near-threatened species were also observed in these areas. This only shows the importance of buffer zones in providing habitats to diverse herpetofauna aside from the core zones. Hence, proper conservation and sustainable practices shall be planned in order to maintain the biodiversity in the area while also serving the people in the nearby community.

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## INTRODUCTION

Protected areas (PA) are internationally recognized solutions to combat climate change, forest degradation, and species extinction, which could threaten human beings (Treves et al., 2005). Several management strategies were employe for the PA, including the zoning principle, wherein the protected areas for conservation are called the core zone, and surrounding this zone is the buffer zone (Ebregt and Greve, 2000). This addresses the negative impact causing ressure on the forest by human settlement and activities residing near the PA. Buffer zones showed positive results on the protected areas' conservation goal since they reduce the deforestation pressure and mining activities in the PA (Jusys, 2015; Weissie and Treves, 2016). However, appropriate and effective management strategies in the buffer zones depend on several criteria, including the presence of fauna, to know the limitations of human activities within the zone (Ebregt and Greve, 2000). Hence, understanding the assemblage of species inhabiting the area is essential as a baseline information for sustainable management strategies.

Mount Hamiguitan Range Wildlife Sanctuary (MHRWS) is a proclaimed national park and wildlife sanctuary in the Philippine province of Davao Oriental. Situated within the Municipality of San Isidro, the Municipality of Governor Generoso, and the City of Mati, the mountain occupies a combined area of 16, 923 hectares and a buffer zone spanning 9, 729 hectares. It is renowned for its exceptional biodiversity and natural beauty, making it a significant ecological and cultural landmark in the country. Its unique and varied habitat types, such as the mossy pygmy forest at its peak, make it a home to several rare and endangered species, including the critically endangered Philippine eagle, Philippine cockatoo, Philippine tarsier, and several other fauna and flora species found nowhere else in the world (UNESCO World Heritage Centre 2014). In 2014, it was designated as a UNESCO World Heritage Site, the first in Mindanao to recognize its outstanding universal value.

Several faunal biodiversity assessments have been conducted in the MHRWS, including Avifauna, Mammals, Odonata, Fishes, and various insect species (Amoroso et al., 2018; Amoroso et al., 2019; Villanueva et al., 2010; Quimpang et al., 2016). Additionally, surveys on herpetofauna have been carried out in different mountain regions. Delima et al. (2007) documented 34 herpetofauna species in the Municipality of San Isidro and the City of Mati, while Relox et al. (2011) recorded 24 species. Supsup et al. (2017) documented 16 herpetofauna species, and Vidal et al. (2018) identified eight anuran species in the part of the Municipality of Governor Generoso. Combining the findings of these studies brings the total number of taxa to 61 species (Supsup et al., 2017). Herpetofauna, which refers to amphibians and reptiles, play crucial roles in natural ecosystems as predators, prey, grazers, seed dispersers, pollinators, and commensal species (Bohm et al., 2013; Hocking and Babbitt, 2014; Kriger, 2016). Moreover, they are considered valuable bioindicators of environmental quality (Manolis et al., 2002). Given their ecological significance, it is essential to determine their presence and distribution in other parts of the mountain, serving as a foundation for conservation efforts aimed at safeguarding this taxon.

Most of the herpetofauna surveys conducted in the MHRWS were located in the mountain's protected areas, which increases conservation as it is protected against human exploitation. Although there is an increase in the number of herpetofauna species in the mountain, researchers would still agree that the mountain's herpetofauna remains poorly understood since a large portion of the forests are still unexplored (Supsup et al., 2017; Medina et al., 2020). Furthermore, the study of Vidal et al. (2018) revealed the importance of some parts of buffer zones of MHRWS for the habitat of endemic anurans and suggested zoning for access

and no access zones within the buffer zone. Nevertheless, the formulation of appropriate conservation strategies within this zone lies in the robustness of data to support and provide the basis for such. Thus, this study would provide additional data on the species assemblage of herpetofauna in the unexplored buffer zone of the MHRWS in part of the Municipality of San Isidro. This undertaking represents a crucial step toward enhancing conservation and management policies for these taxa and reinforces the importanceof buffer zones as protective barriers around the core zones.

## MATERIALS AND METHODS

This study employs a species assessment survey to provide an inventory of the different species of herpetofauna inhabiting the buffer zone of Mt. Hamiguitan Range Wildlife Sanctuary. This is an essential tool for understanding the species richness and distribution patterns, addressing the gaps in the lack of biological data on the mountain, especially in the buffer zones, and finding better ways to protect them (Milton et al., 2017).

### Sampling Sites

Three sampling sites with different elevational gradient were surveyed in the northwestern part of MHRWS, Sitio Panganan, Barangay Maputi, San Isidro, Davao Oriental, Mindanao Island from 23-30 January 2019 (Figure 1). This area forms the buffer zone, an identified area outside the boundaries of and immediately adjacent to designated areas requiring special development control in order to avoid or minimize harm to the protected area as stipulated in the Republic Act No. 903. The lower elevation is about 500 meters away from the locally known as Kawa-kawa, a local ecotourism spot in San Isidro which derives its name from the Visayan word kawa which means “wok” because of its 15-ft deep pan-like pool with cool, clear waters coming from a waterfall.

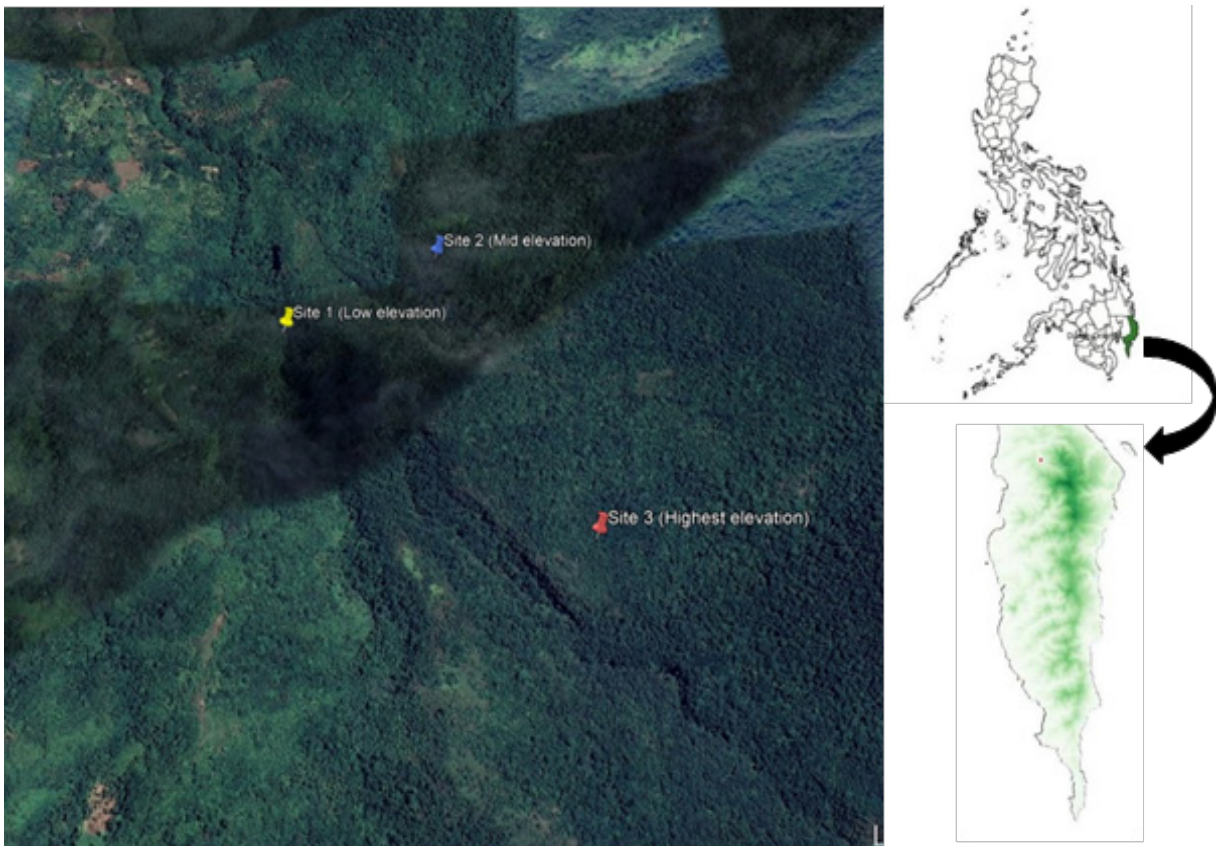


**Figure 1.** Map showing the three established sampling sites in the northwestern part of the Mt. Hamiguitan Range Wildlife Sanctuary, San-Isidro, Davao Oriental.


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Site 1 is a riparian, dipterocarp forest located at 485 masl elevation within Sitio Tibanga, Barangay Maputi, San Isidro (Figure 2, A). It has an 80° slope and coordinates of 06”46’23.6ºN and 126”08’37.5ºE. The temperature runs around 28°C. The presence of bodies of water, such as streams, rivers, and waterfalls, characterizes this site. Its river has fast-moving currents with some fallen logs and huge boulders. The soil varies from loamy to rocky substrate, with 4 mm thick leaf litter covering the forest floor and riverbanks. Understory plants, grasses, pandan, ficus, canopy vines, and canopy epiphytes such as mosses (5%) were present. Trees reach up to 25 m tall and have up to 5 to 30 inches diameter at breast height (DBH) and 20 m high canopies.

Site 2 is a secondary dipterocarp forest located at 575 masl elevation, with a 10° slope and coordinates 06”46’28.4ºN and 126”08’48.0ºE (Figure 2, B). The temperature is usually around 29°C. Soil type is humus and reddish in color with a forest floor covered in 3 to 4-mm thick leaf litter. Fallen logs and exposed rocks were also abundant, and more canopy epiphytes, understory plants, vines, pandan, and emergent trees such as pine (Pinus sp.) were present. Moreover, pitcher plants were found growing at this site while mosses were absent. Distance to the water source is approximately 900 m, indicating that this site is relatively dry. The only signs of anthropogenic disturbances observed here were forest trails.

Site 3 is a secondary-growth forest located at 645 masl elevation, with a 45° slope and coordinates 06”46’07.2ºN and 126”08’57.9ºE (Figure 2, C). The site was generally damp and humid, having 26°C dry temperature and 25°C humidity. The soil type is humus, with a thin layer of leaf litter (4-5 mm) covering the forest floor. Like Site 2, the area was marked by forest trails, abundant fallen logs, exposed rocks, moss (2%), pandan (10%), canopy epiphytes and vines, and understory plants. Emergent trees were also seen, including sagimsim (*Syzygium brevistylum*), yakal (*Shorea astylosa*), tanguile (*Shorea polysperma*), duguan (*Myristica philippensis*), agoho del monte (*Gymnostoma nemphianum*), and bitanghol (*Callophylum blancoi*).


**Figure 2.** Sampling locations: (A) Site 1- riparian dipterocarp forest, (B) Site 2- secondary dipterocarp forest, (C) Site 3- secondary growth forest with small stream.

**Sampling Technique**

*Protocol entry.*

Local permits were secured from the Local Government Unit (LGU) of the municipality of San Isidro, the Protection Area Management Board (PAMB) to conduct research in Mount Hamiguitan Range Wildlife Sanctuary and from DENR (Department of Environment and Natural Resources) for specimen protection. Wildlife Gratuitous Permit (WGP No. XI-2018-10) was secured as RA 9147, and NIPAS Act mandated. 21.

*Survey methods.*

A one-kilometer (1 km) transect line was employed per study area for three kilometers for the whole study site to standardize the survey method. Amphibians and reptiles were documented using the cruising method. It is a sampling technique that involves walking or cruising along the transect line in each study site to quantify the species richness and diversity of the area (Calo and Nuñeza, 2015). Cruising was done twice daily, diurnal from 0900 H – 1400 H and nocturnal from1800 H – 2200 H, as Baron et al. (2021) adopted. Searching and recording all individuals seen was done by carefully capturing with hands.

An additional survey method was done primarily for reptile species on land. Pitfall trapping involves creating a pitfall trap, essentially a container set into the ground to capture small ground-dwelling reptiles such as chelonians, lizards, and small snakes (Dodd, 2016). For this study, five plastic gallons were prepared and installed for each site, where each one was buried in the ground such that the rim was at level with the surface. In conjunction, drift fences were built to lead passing reptiles into the trap. Holes were drilled beforehand to the bottom of the containers to allow rainwater drainage and prevent reptiles from suffocating.

*Specimen handling.*

Encountered individuals were carefully hand-captured and placed in specimen bags. Representative specimen of each species was photographed and preserved following the standard preservation processes.

*Microhabitat surveys.*

During the transect walks, various potential microhabitats were examined, including fallen logs, leaf litter, underneath rocks and boulders, nearby water sources, tree trunks, and branches. These locations are known to be habitats for amphibians and reptiles.

*Identification.*

Standard morphometric data for the captured individuals were recorded using a verier caliper for identification purposes. Various taxonomic keys and field guides such as by Diesmos et al. (2015), Supsup et al. (2017), and Baron et al. (2021) for anurans, Amphibians and Reptiles of the Philippines by A.C. Alcala, The Reptile Database by Peter Uetz (www.reptile-database.org), and A Field Guide to the Reptiles of Southeast Asia by Das (2015) for reptiles were used. An expert in this field verified all initial identification.

**RESULTS**

Overall, 25 species of herpetofauna were recorded in the northwestern buffer zone of Mt. Hamiguitan Range Wildlife Sanctuary. Ten species are anurans belonging to nine genera and seven families, including the Family Bufonidae (*Ansonia muelleri*), Ceratobatrachidae (*Platymantis sp.*) Megophyridae (*Megophrys stejnegeri*), Microhylidae (*Kalophrynus pleurostigma*), Dicroglossidae (*Limnonectes leytensis, Limnonectes magnus*), Ranidae, (*Hylarana grandocula, Staurois natator*) and Family Rhacophoridae (*Polypedates leucomystax and Rhacophorus bimaculatus*). On the other hand, 15 species are reptiles, of which 10 are lizards and five are snakes. The

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most represented Family is Scincidae, with six skink species (*Brachymeles boulen*geri, *Brachymeles taylori, Eutropis cumingi, Parvoscincus kitangladensis, Sphenomorphus sp. 1, Sphenomorphus sp. 2*). The species composition represented a diverse array of amphibians and reptiles inhabiting the area.

## Species Account

### Anurans
### Family Bufonidae

***Ansonia muelleri*** **Boulenger, (1887) (Muller's Stream Toad)** (Figure 3). This is an endemic species of anurans that can only be found in Mindanao island and is widespread in the mountains of central and western Mindanao and Dinagat Islands (Diesmos et al., 2015; Frost, 2020). Similar to other observations on their habitat, samples were encountered in the stream with free and fast-moving current at the lower elevation in this study. They were rarely seen at diurnal and were mostly observed vocalizing in the boulders near a short waterfall at night. Recently, IUCN categorized this species as least concern, but it also noted its current decreasing population trend.

**Figure 3.** *Ansonia muelleri* (Boulenger, 1887) documented from the streams in lower elevation.

### Family Dicroglossidae

***Limnonectes leytensis*** **Boettger (1893) (Leyte Swamp Frog)** (Figure 4). This species is endemic and widely distributed on the Philippine islands, particularly in Mindanao, Visayas, and Romblon PAICs (Sanguila et al., 2016). They inhabit various habitats, from agroecosystems to lower montane forests. However, they are also highly adapted to disturbed environments and can thrive in vegetated areas along the road (Gersava et al., 2020). Rare individuals of this species were observed in the lower elevation streams, particularly on the rock crevices alongside the stream. The IUCN still considers this species as least concern because of its widespread distribution.

**Figure 4.** *Limnonectes leytensis* (Boettger 1893) documented from the streams in lower elevation.

***Limnonectes magnus*** **Stejneger, (1910) (Mindanao Fanged Frog)** (Figure 5). Distinguishable by its large and stocky body, huge head, and axial region of its dorsum almost devoid of tubercles (Baron et al. 2021),

**Figure 5.** *Limnonectes magnus* (Stejneger, 1910) documented from the streams in lower elevation.

this endemic species can only be found in Mindanao Island. Individuals of this species were primarily observed in the rock crevices along a small riverbank at higher elevation and were rare in the stream at lower

elevation. This has been known to thrive in undisturbed and disturbed habitats such as agroecosystem, lowland, and upper montane forests (Solania et al., 2020). The IUCN categorized this species as near threatened due to overhunting for food (Sanguila et al., 2016; Baron et al., 2021).

**Family Megophyridae**

***Megophrys stejnegeri* Taylor, (1920). (Mindanao Horned Toad)** (Figure 6). This endemic and widespread in Mindanao, Bohol, Dinagat, Leyte, and Samar species is distinguishable by the presence of a pair of prominent glands of the axial region on its ventral side and the presence of dermal projections on top of its eyelids (Sanguila et al., 2016; Baron et al., 2021). Few individuals of this species were observed alongside streams in the lower elevation. They were observed both day and night blending well on their environment's forest floor, although they are easily located at night due to their loud successive calls. The IUCN categorized this species as Least Concern. However, the Philippine Red List (2019) considered this species another threatened species due to habitat loss.

**Figure 6.** *Megophrys stejnegeri* (Taylor, 1920). documented from the streams in lower elevation.

**Family Microhylidae**

***Kalophrynus sinensis* Peters, 1867 (Black-spotted narrow-mouthed Frog)** (Figure 7). This is a non-endemic anuran species widely distributed in the Mindanao PAIC region. They can easily be identified by having two black spots on the lower ventral part of their body, a pointed mouth, and releasing sticky substances when harmed. Rare individuals were observed in the lower-elevation leaf litter beside the stream. This is the only species that was documented in the middle elevation despite having no body of water. Accordingly, this species can be observed in the agroecosystem, lowland dipterocarp forest, lower and upper montane forest, and occasionally in disturbed areas (Solania and Fernandez-Gamalinda, 2018; Pitogo et al., 2021). The IUCN categorizes this species as Least concern.

**Figure 7.** *Kalophrynus sinensis* (Peters, 1867) documented from the streams in lower elevation.

**Family Ranidae**

***Hylarana grandocula* Taylor, (1920). (Big-eyed Frog)** (Figure 8). This is an endemic frog widely distributed in the islands of Biliran, Bohol, Samar, Leyte, Camiguin, Dinagat, and Mindanao (Diesmos et al., 2015; Frost, 2020). They can be found in an agroecosystem forest, dipterocarp, montane, and mossy forest utilizing aquatic and terrestrial microhabitats, particularly in ponds, rocks near bodies of streams, fern leaves, rotten logs, and even on forest floors near rivers of cultivated areas (Coritico et al., 2018). Most of the individuals documented in this study were observed in the boulders along the stream. Some were documented on the rocks and rotten logs near the stream. Rare individual was also observed in the higher elevation in this study. They are also mostly documented at night with their calling


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activities. The IUCN categorized this species as Least concern.

**Figure 8.** *Hylarana grandocula* (Taylor, 1920). observed on the rocks along the stream in lower elevation.

***Staurois natator* Gunther, 1858 (Mindanao Splash Frog)** (Figure 9). Previously known to be widespread in the Palawan and Mindanao faunal region, this endemic species is now restricted only to Mindanao PAIC after recent genetic evidence shows distinctness between these two islands (Arifin et al., 2011; Plaza and Sanguila, 2015). Individuals of this species were observed

**Figure 9.** *Staurois natator* (Gunther, 1858). photographed on the rocks along the stream in lower elevation.

in the boulders and rocks along the streams in sites 1 and 2. They were also documented in the leaves and stems of the plants near the stream. This species is also the most abundant species documented in this study. They are active both day and night. The IUCN categorized this species as Least Concern.

**Family Rhacophoridae**

***Polypedatis leucomystax* Gravenhorst, (1829). (Common Asian Tree Frog)** (Figure 10). This non-endemic species can be observed in Southeast Asian Countries and is widely distributed in the Philippines (Diesmos et al., 2015). A rare individual of this species was observed in the tree beside the abandoned cottage for tourists. This species is known to inhabit agroecosystems in lower and upper-disturbed dipterocarp forests, beach vegetation through human habitats, and natural edge habitats to closed primary forests (Aureo and Bande, 2017). They can tolerate disturbed areas and are common in rural houses and gardens. The IUCN categorized this species as Least Concern.

**Figure 10.** *Polypedatis leucomystax* (Gravenhorst, 1829). found in the stem of a tree near the abandooned tourist house in lower elevation.

***Rhacophorus bimaculatus* Peters, 1863 (Mindanao Flying Frog)** (Figure 11). This endemic species is widespread in the country, particularly in Bohol, Catanduanes, and Mindanao PAIC (Diesmos et al., 2015). They can be found in lower dipterocarp forests, lower and upper montane forests utilizing mostly arboreal microhabitats such as among leaves, on leaves of trees and shrubs, and pocket ferns in cascading streams or waterfalls and rarely on the ground, particularly in rocks near rivers (Plaza and Sanguila, 2015; Supsup et al., 2016). Rare individuals were observed on the boulders along the stream and on the rocks beside the streambank in the lower site. A notable characteristic of this

species is the changing body coloration, from a white-colored leaf-like structure when undisturbed to a brownish-orange color when disturbed. The IUCN categorized this species as Least Concern.

**Figure 11.** *Rhacophorus bimaculatus (*Peters, 1863). documented on the rocks beside the stream in lower elevation.

**Reptiles**

**Order Squamata (Lizards)**
**Family Agamidae**

***Draco volans* Linnaeus, (1758). (Common Flying Lizard)** (Figure 12). This is a non-endemic and widely distributed species of flying lizard in the Philippines. A single juvenile male was captured from the lower elevation. It was characterized by a large head, a dark brown dorsum, a pointed dewlap, and lateral wing-like flaps called patagium. The patagium is bluish on the ventral side and brown on the dorsal side, with both sides decorated by rectangular dark spots (Van Arsdale, 1999). The IUCN categorized this species as Least Concern.

**Figure 12.** *Draco volans (*Linnaeus, 1758). observed in a tree trunk in the lower elevation.

***Gonocephalus interruptus* Boulenger, (1885). (Mindoro Anglehead Lizard)** (Figure 13). This endemic angle-head lizard is widespread throughout Mindanao (Welton et al. 2017). Two individuals were captured from the mid and higher elevations in this study. One individual fell into the pitfall trap, while the other was observed in a leaf litter. Both had large heads, short snouts, short crests, intricate scalation, a pale green gular pouch, and yellow-and-black-striped tails. One individual had a brownish-grey dorsum upon capture, while the other was distinctly green, which is part of their defense mechanism by using camouflage. The IUCN categorized this species as Least concern; however, the Philippine Red List DAO (2019) listed this as Other Threatened Species.

**Figure 13.** *Gonocephalus interruptus* (Boulenger, 1885) documented in the mid elevation.

**Family Gekkonidae (Geckos)**

***Cyrtodactylus annulatus* Taylor, 1915 (Annulated Bent-toed Gecko)** (Figure 14). Endemic to the country, this species is widely distributed in the Mindanao PAIC region. Individuals were encountered at mid-elevation on rotting logs and leaf litter. These species have a head differentiated from the neck, a short conical snout, two black lines running across its eyes, a visible tympanum, rough body scales, a brown dorsum with dark splotches, and five thick digits on each forelimb and hindlimb. The IUCN categorized this species as Least Concern.


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**Figure 14.** *Cyrtodactylus annulatus* (Taylor, 1915) observed in the mid elevation.

***Cyrtodactylus philippinicus* Steindachner, (1867).** (Philippine Bent-toed Gecko) (Figure 15). This species is endemic to the country and is widely distributed in the Philippines. Cyrtodactylus philippinicus is morphologically similar to C. annulatus but differently patterned and has long, narrow digits on hindlimbs and forelimbs. Individuals were documented in all the sampling sites, mainly river bank rocks, tree trunks, and leaf litter. The IUCN listed this species as Least Concern.

**Figure 15.** *Cyrtodactylus philippinicus* (Steindachner, 1867) found in all the sampling sites.

**Family Scincidae (Skinks)**

***Brachymeles gracilis* Fischer, 1885 (Graceful Slender Skink)** (Figure 16). This endemic species has been widespread in central, southern, and southeastern Mindanao (Siler et al., 2012). The rare individual was observed in the leaf litter at lower elevations. It had the following characteristics: a small head indistinct from the neck, reduced limbs, a short tail, and a glossy, smooth, reddish-brown body. The hindlimbs with separate digits were slightly larger than the forelimbs with compressed digits. Its body was also marked by rows of small dots on its dorsal and lateral sides and a pale tan stripe along its flanks. The IUCN categorized this species as Least Concern.

**Figure 16.** *Brachymeles gracilis* (Fischer, 1885) observed in lower elevation.

***Brachymeles taylori* Brown, (1956) (Taylor's Short-legged Skink)** (Figure 17). This is an endemic species that is distributed in the Mindanao PAIC region. Also, morphologically similar to Brachymeles boulengeri, this species has slight differences: plain, glossy, smooth brown-black body and a longer tail. A rare individual of this species was captured in the leaf litter in the lower elevation. The IUCN categorized this species as Least Concern.

**Figure 17.** *Brachymeles taylori* (Brown, 1956) observed in the lower elevation.

***Eutropis cumingi* Brown & Alcala 1980 (Cumings's mabuya)** (Figure 18). This species is endemic to the country and is

known to be distributed in the Philippine islands. Individuals were observed in the lower and mid-elevation tree trunk and leaf litter. This species has a robust body, a flattened head, and a moderate snout. The dorsum was keeled, smooth, and dark brown. A broad dark streak runs from its eyes to its flanks and tail, edged with light stripes. Moreover, it broke off its tail when a perceived predator grabbed it. The IUCN categorized this species as Least Concern.

**Figure 18.** *Eutropis cumingi* (Brown & Alcala 1980) photographed in the mid elevation.

***Parvoscincus kitangladensis* Brown, 1995 (Kitanglad mountain skink)** (Figure 19). This species is endemic and can be found only in the Mindanao island. Individuals were observed in the low-lying vegetation near the stream bank at higher elevations. A single black stripe runs along their vertebra, lined by white dots. Another set of stripes was found on the upper portion of its flanks. The IUCN still considers this species as Least Concern.

**Figure 19.** *Parvoscincus kitangladensis* (Brown, 1995) documented in higher elevation.

***Sphenomorphus sp.* 1** (Figure 20). Individuals of this species were observed in the tree bark, leaf litter, stream rocks, and forest floor in mid and higher elevations. Their body lengths ranged from 5 to 21 cm long. They have small-sized heads, rounded snouts, and a smooth, flat gray dorsum with white markings.

**Figure 20.** *Sphenomorphus sp.* 1 documented in mid elevation.

***Sphenomorphus sp.* 2** (Figure 21). Three individuals of this juvenile skink were captured, measuring up to 2.85 cm SVL. It has a sleek, black, slender body, an elongated head, and five digits per limb. In addition, they cannot be further identified up to their species level due to insufficient information and samples needing to be more significant to be distinguished.

**Figure 21.** *Sphenomorphus sp.* 2 documented in mid elevation.

**Order Squamata (Snakes)**
**Family Colubridae**

***Ahaetulla prasina prasina* Boie, 1827 (Asian Vine Snake)** (Figure 22). This is a non-endemic species of vine snake widespread in


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the Mindanao PAIC region and Palawan. A rare individual was observed in a tree branch at a lower elevation. It has a long, slender green body with a yellow stripe along its lower flanks (Das 2015). Its head is angular and elongated, with yellow eyes and vertical pupils. The ventral side of its body is bright yellow-green. The IUCN categorized this species as Least Concern.

**Figure 22.** *Ahaetulla prasina prasina* (Boie, 1827) photographed in lower elevation.

***Dendrelaphis sp.*** **(Bronzeback snake).** According to Vogel & van Rooijen (2011), members of the genus Dendrelaphis are thin, diurnal species that are primarily arboreal and prey primarily on lizards and amphibians. In this study, an individual was sighted scurrying down to the edge of a cliff. No pictures were photographed during the survey due to the unreachable height of the sample.

***Hologerrhum philippinum*** **Gunther, (1858). (Philippine Stripe-lipped Snake)** (Figure 23). This species is endemic and is widespread in the country. Individuals were

**Figure 23.** *Hologerrhum philippinum* (Gunther, 1858). documented in the rocks near the stream in lower elevation.

observed in the rocks near the stream at lower elevations. This species was characterized by its long cylindrical body, a distinct head, a black-and-white collar, small eyes, round pupils, red to reddish-brown dorsum with alternating black spots, and a light pink underbelly. The IUCN categorized this species as Least Concern.

**Family Elapidae**

***Hemibungarus calligaster*** **Wiegmann, 1835 (Barred Coral Snake)** (Figure 24). This endemic species is known to be a wildlife resident of Mt. Hamiguitan. A rare individual of this species was encountered along a lower elevation river, with long gray and short brown bands edged with white. Because this species belongs to a family of venomous snakes, morphometrics were not taken about safety. However, it was still photo-documented and released subsequently. The IUCN categorized this species as Least Concern.

**Figure 24.** *Hemibungarus calligaster* (Wiegmann, 1835) observed near the stream in lower elevation.

**Family Lamprophiidae**

***Psammodynastes pulverulentus*** **Bole, (1827). (Common Mock Viper)** (Figure 25). This non-endemic species is known to be widespread in the Philippine islands. The triangular head was distinct from the neck, which is typical for this species. The shape of its head is the reason it is often confused with pit vipers and also the reason for its common English name. In comparison to real vipers, the mimic viper's venom is significantly weaker and less dangerous to people. The teeth are suited for eating vertebrates with thick scales, such as skinks

and snakes. It also exhibits various colors; some are very dark chocolate in hue, while others are reddish-brown, gray, yellow, or nearly black. Others display tiny dots or stripes, while others hardly have head or body patterns (Breuer and Murphy, 2009–2010). The color morph of P. pulverulentus found in the study was gray with white markings and brown spots on its back. The IUCN categorized this species as Least Concern.

**Figure 25.** *Psammodynastes pulverulentus* (Bole, 1827) documented in the tree branch in the lower elevation.

## DISCUSSION

Data on the amphibians and reptiles documented in this study significantly contribute to the existing data for the Mt. Hamiguitan Range Wildlife Sanctuary and the Philippines. As mentioned by Supsup et al. (2017), the herpetofauna diversity of the MHRWS has remained underestimated despite several surveys. Moreover, Milton et al. (2019) emphasized the need for biological data on the mountain to map the population of these threatened faunas to find better ways to protect them. Thus, more surveys of other areas not covered by other studies should be employed to get the bigger picture of the diversity of herpetofauna in the mountain and to formulate appropriate conservation measures for these taxa. Surveys not only in the core zones but also in the buffer zones should be done in order to provide proper conservation measures in these areas.

The total recorded amphibians and Reptiles in MHRWS has reached 61 species (Supsup et al., 2017). In this buffer zone where the study was conducted, 25 herpetofauna species were documented, accounting for 40% of the total herpetofauna in the mountain. This only highlights the significance of this area for herpetological conservation. Furthermore, a remarkable aspect observed in this study is the high proportion of endemic species. Of all the amphibians and reptiles recorded in this study, 21 species, or approximately 84%, are endemic in the country (9 amphibians and 12 reptiles). This again indicates the importance of preserving this area as a habitat for the herpetofauna that can only be found in the country or even on Mindanao island alone. The presence of threatened species within the observed herpetofauna also provides strong evidence for conservation in the area. Threatened species due to declining population caused by habitat loss that was recorded in this study include the Mindanao Horned Toad (Megophrys stejneger) and the Mindoro Anglehead Lizard (Gonocephalus interruptus). The near-threatened Mindanao Fanged frog (Limnonectes magnus) was also present in the area. The identification of threatened species in the buffer zone of Mt. Hamiguitan Range serves as a valuable indicator of this area's ecological significance and vulnerability. It emphasizes the need for conservation efforts that aim to protect and restore their habitats, mitigate threats, and raise awareness about the importance of these species.

Buffer zones play a crucial role in supporting the overall biodiversity of the area by providing habitat connectivity and protection for various species (Alexandre et al., 2010). Additionally, it serves as a barrier of defense, protecting the core zones from natural and man-made disturbances. Although buffer zones are created to avoid or minimize harm to the protected area, they can also provide additional habitat for a broader range of species. This increases the total area available for wildlife and promotes the persistence of diverse assemblages of plants and animals. Given that the study area at a lower elevation has been considered an ecotourism spot, this

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may negatively affect the existence of the herpetofauna, primarily since most documented species rely on the streams as their habitat. Thus, establishing and effectively managing buffer zones are critical for maintaining ecological connectivity, protecting species and habitats, sustaining ecosystem services, and promoting biodiversity conservation in and around core zones. By appreciating the value of buffer zones, we can work toward a more thorough and all-encompassing strategy for conservation that balances the requirements of both human and wildlife communities.

## CONCLUSION

This study highlights the inventory of herpetofauna species inhabiting the buffer zone in the northwestern part of the Mt. Hamiguitan Range Wildlife Sanctuary. It was revealed that the area harbors 25 species of herpetofauna. This comprises ten species of anurans and 15 species of reptiles. The majority of the documented species are also endemic to the Philippine Islands. Moreover, this area also provides habitat for vulnerable and other threatened species of herpetofauna. Despite being considered an ecotourism spot, the lower elevation and the outermost part of the buffer zone are still homes for endemic species that can also be found in the core areas of the forest. Hence, these data only emphasize preserving these buffer zones as a habitat for unique Philippine and Mindanao island species. Since this study is only one of the few species inventory in the buffer zones of the mountain, further research on the species composition of these taxa in other parts of the buffer zones shall be done to formulate accurate and sustainable conservation measures for these regions of the MHRWS.

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