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Research Paper

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UPDATED CHECKLIST OF HERPETOFAUNA IN BALINSASAYAO TWIN LAKES NATURAL PARK, NEGROS ORIENTAL: A LONG-TERM ECOLOGICAL RESEARCH SITE IN THE PHILIPPINES

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ARTICLE HIGLIGHTS

- Updated checklist reveals rich amphibian and reptile diversity.
- Twenty-two endemic species found occur only in the Philippines.
- Seven threatened species highlight the area's conservation importance.
- Species richness is comparable with other long-term research sites.
- Continued monitoring may reveal more amphibian and reptile species.

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ABSTRACT

The Balinsasayao Twin Lakes Natural Park (BTLNP) is one of the established Long-term Ecological Research Sites (LTER) in the Philippines. LTER sites are valuable for providing underlying causes for changes in the environment, management of natural resources, and conservation of biodiversity. Through this, researchers could simultaneously quantify certain complex ecological interactions. The primary aim of this study was to assess the herpetofauna to update the existing data on herps and compare its species richness with other LTER sites. The survey was conducted using visual encounter and opportunistic sampling in the established 2-hectare LTER plot and other areas outside of it. A total of 224 hours of sampling effort from multiple survey visits was conducted. The findings of this study included detecting 31 herpetofauna species, composed of 11 amphibian and 20 reptile species. Of this list, 22 were Philippine endemics, seven were native species also found in neighboring countries, and two were introduced species. This overall record represented 63.2% of the total number of 49 species based on the first inventory of species found in BTLNP. There were seven species assessed as threatened, namely: *Platymantis negrosensis, Platymantis hazelae, Limnonectes visayanus, Sanguirana acai, Hydrosaurus pustulatus, Tropidonophis negrosensis,* and *Oligodon modestus*. Their presence warrants continued and steadfast protection of the area. There were also additional species observed during this study and from the previous study (Aureo *et al.* 2019), which were added to the baseline list. This included *Lipinia auriculata, Lipinia pulchella, Boiga cynodon, Dryiophiops philippinus,* and *Fejervarya vittigera*. The level of species richness at BTLNP is comparable with other LTER sites in the Philippines. Many species can benefit from the lake, which makes its presence particularly important to help meet their ecological demands. Longer monitoring and a more systematic sampling are recommended to document additional species that may occur in BTLNP.

Keywords: amphibians, ecosystem, natural park, protected area, reptiles

INTRODUCTION

Philippine forests host a substantial presence of flora and fauna (Tanalgo *et al.* 2025) with endemics typically found in isolated areas such as mountainous ranges (Alcala & Brown 1998). Such isolation has led to the diversification of numerous endemic herpetofauna species unique to each region, making it among the most biodiverse countries of the world (Sy 2023; Diesmos *et al.* 2015). With the continued faunal surveys conducted in the archipelago supplemented by the increased availability of genetic data, the understanding of herpetofauna diversity has markedly increased over the last century (Sy 2023; Diesmos *et al.* 2015).

The "Greater Negros-Panay", one of the Pleistocene Aggregate Island Complexes (PAICs), presents a variety of shared species between Masbate, Cebu, Panay, Guimaras, and Negros (Brown *et al.*, 2009). Specifically, Negros Island appears to have a high similarity with Panay in terms of amphibian species compared to reptiles. While both islands share a great degree of similarity in terms of herpetofaunal presence, many species known to occur in Panay have not yet been documented in Negros (Ferner *et al.* 2000). Herpetofauna surveys have been more thorough in Negros historically (Alcala *et al.* 2004), which have contributed to the current estimate of 19 amphibians and 80 reptile species known in the island (Sy 2025, 2026).

Negros Island is one of the regions inhabited by highly threatened species needing intensive conservation actions (Heaney *et al.* 1998). Many of the biodiversity-rich protected areas on the island included one of the Long-Term Ecological Research (LTER) sites in the Philippines, the Balinsasayao Twin Lakes Natural Park (BTLNP), because of the various habitat types formed along an elevation gradient (Aureo *et al.* 2021). LTER sites are valuable for providing information on the underlying causes of changes in the environment, management of natural resources, and conservation of biodiversity (Acma *et al.* 2018; Mohagan *et al.* 2018; 2019). Dolino *et al.* (2004) reported that the area supports 113 bird species, 27 mammals, and 53 species of amphibians and reptiles combined. For these reasons, the BTLNP was declared a protected area to protect these species from threats of habitat conversion (Dolino *et al.* 2004; Hicks 2000). Since then, only very few intensive studies have been conducted at the site, particularly focusing on the ecology of the species.

Amphibians and reptiles are similar in certain aspects. They provide a variety of functions in an ecosystem, such as bioturbation, pollination, seed dispersal, and being part of the energy flow through trophic systems (Cortéz-Gómez *et al.* 2015; Valencia-Aguilar *et al.* 2013). Apparently, the Philippines is experiencing a rapid rate of deforestation, which will likely increase, especially since only a few areas are under environmental protection (Sodhi *et al.* 2010). The consequences of such ecological disturbance include the loss of faunal diversity (Cortéz-Gómez *et al.* 2015; Alcala *et al.* 2004). If there is biodiversity decline, it may also inhibit the effective transportation of ecosystem services (Brockerhoff *et al.* 2017). Protected areas are dedicated to achieving the long-term conservation of ecosystems and the services they provide. They are designed to preserve biodiversity and prevent further loss. (Biodiversity Indicators Partnership 2010; Convention on Biological Diversity 2011).

Over the years following the legal proclamation of BTLNP as a protected area (Presidential Proclamation No. 414, 2000; Republic Act No. 11038, 2018), underlying physical changes in the habitat may have occurred, as well as changes in the resident fauna. Thus, this study aimed to assess the herpetofauna diversity of BTLNP and update the previous checklist initially compiled by Dolino *et al.* (2004). The previous study had evaluated the status of the protected area in protecting biodiversity by examining herpetofauna species occurrence. Since then, however, most subsequent surveys have focused on the anurans (Aureo *et al.* 2019) and little information was provided about reptiles. The data generated can further strengthen ongoing conservation and management efforts.

MATERIALS AND METHODS

Description of the Study Site

The study site was located in the municipality of Sibulan, Negros Oriental Province, Negros Island (Fig. 1), BTLNP (central coordinate: 9.3531° N, 123.1736° E). The area forms part of the prominent mountain range straddling the southeastern flange of Negros Island and is also known as the "Cuernos de Negros".

Several features define the volcanic origin of the area, including two deep crater-lakes, the prevalence of andesitic volcanic rocks, and steep mountainsides. The prominent mountains flanking the lakes include Mount Guintabon to the east and Mount Guinsayawan to the west. A narrow sloping ridge extending separates the two lakes before connecting with the base of Mount Guintabon. Within the area, a 2-ha of LTER plot is located (Heideman & Erickson 1987).

Data Collection

The herpetofauna survey was conducted using a diurnal and nocturnal visual encounter survey and opportunistic active searching in the area, including the 2-hectare LTER plot of the site. Additional areas, such as near Mt. Guinsayawan, and existing trails along ridges near the lake were also surveyed on the first sampling visit.

The method involves walking along a transect line while intensively looking for species (Rosales *et al.* 2023). Three sampling visits were conducted regardless of the season. The first two data collection were conducted from 6 – 11 April 2014 and 26 – 31 May 2014, totaling 12 field days. A follow-up visit was conducted after 10 years, which, transpired from 7 – 11 August and 24 – 29 August 2023, and from 29 April – 3 May 2024, totaling 16 field days. Sampling was carried out twice per day: first in the morning, around 9 AM to 1 PM for the diurnal survey, and second, around 5 PM to 9 PM for the nocturnal survey. Thereby, a total of 96 hours of sampling effort was spent on the 2014 sampling, and 128 hours on 2023 and 2024. Four people participated during each fieldwork.

The species were primarily collected by handpicking, while also examining the potential microhabitats where species could be thriving. Some voucher specimens were collected and deposited at the Zoology Section of Central Mindanao University Museum. No supplementary trapping methods were employed. Reptiles and amphibians were intensively searched through the boulders, which the forest substrate is predominantly made of, and in tree crevices as well. However, the entirety of this approach may have limited the effective detection of certain species.

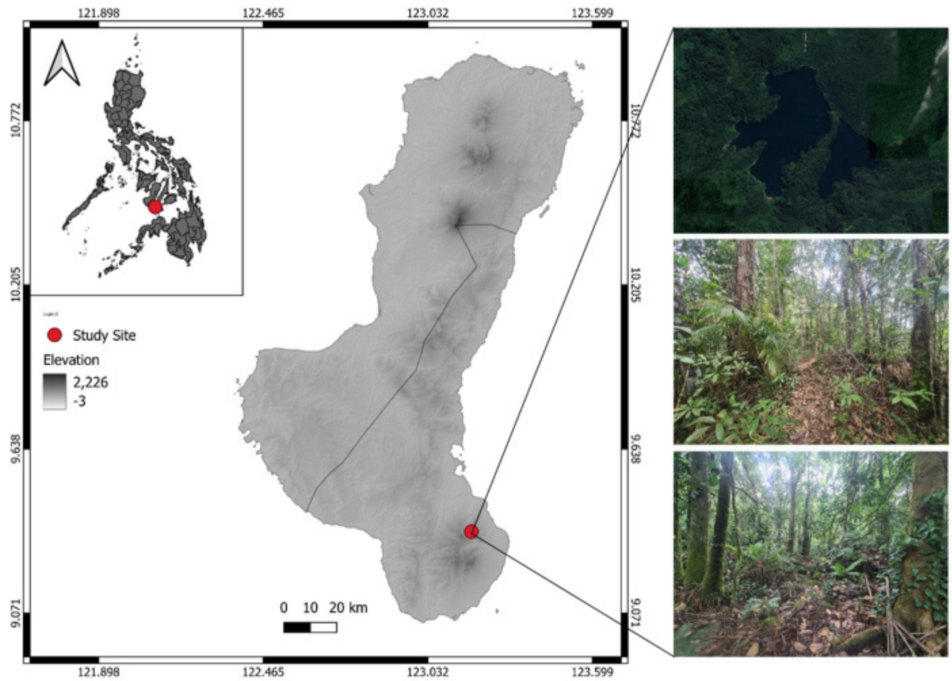

Figure 1 Location of the Balinsasayao Twin Lakes Natural Park (BTLNP)
Notes: (A) Top view of the study site taken through satellite image; (B-C) In-situ landscape images in the area.

Species Identification

Captured individuals were photographed and measured for their morphometrics, and were released afterwards. The measurements followed the protocols outlined in the Biodiversity Assessment and Monitoring System (BAMS) manual by DENR. However, only a few species were successfully subjected to this. Morphometric measurements and geographic distribution were the basis for the species identification. Herpetofauna identification was based on the "Philippine amphibians: an illustrated field guide" by Alcala and Brown (1998), "Illustrated Key to the Snakes of the Philippines" by Weinell *et al.* (2019), and "Reptiles of the Philippines" by Sy (2023). Taxonomic names were verified against databases and checklists such as Global Biodiversity Information Facility (GBIF), and Checklist of Amphibians (Sy 2025) and Reptiles (Sy 2026) of the Philippines.

Data Analysis

Data collected were analyzed using species rarefaction, species diversity, evenness, in a unified analysis called Hill numbers (Chao *et al.* 2014), and relative abundance (RA). The data used in running these analyses is the combined count data of the species from the 2014 and 2023 – 2024 survey. All analyses and data presentation were performed using RStudio 2023.9.1 and PAST5 software. Specifically, relative abundance was calculated using the formula:

RA= number of individuals of a species/total number of individuals of all species × 100

Comparing the data from 2014 to 2023 and 2024 may not be meaningful due to differences in sampling rigor. For that reason, we decided to integrate the datasets from these years, while being fully aware of the biases. The purpose was to comprehensively present the diversity and relative abundance of the species observed in the area. With this approach, the data presented herein should not be interpreted as a trend over the years. In addition, a checklist was also compiled of the surveyed years to compare and update the list by Dolino *et al.* (2004).

RESULTS AND DISCUSSION

Before being declared a protected area, the forest in BTLNP underwent years of successful restoration following extensive human pressure from agricultural expansion (Hicks 2000). Restored forests, with their structural complexity, provide habitat to numerous herpetofauna (Solania *et al.* 2021).

The findings of this study revealed a great number of herpetofauna species at BTLNP (Table 1). There was a total of 31 herpetofauna species observed during this survey, where most of the records were obtained in the 2-hectare plot. Of this number, 22 were Philippine endemics, seven were native species also found in neighboring countries, and two were introduced species. Among these were 11 amphibian species, all of which were anurans, and 20 reptile species. More specifically, in relation to the list of 49 herpetofauna known to occur in BTLNP by Dolino *et al.* (2004), which was collectively based on published surveys, previous surveys, Red Data documents, and some unpublished studies available in 1950s to 2003, the results herein represented 63.2% of the total number. Furthermore, five more species observed during this study and from the study of Aureo et al, 2019 were added to the list, namely: *Lipinia auriculata, Lipinia pulchella, Boiga cynodon, Dryiophiops philippinus,* and *Fejervarya vittigera*, totaling 54 species.

The persistence of the species known to thrive in BTLNP over the years suggests that the protection in the area may have helped maintain the diversity. With these findings, BTLNP apparently holds a comparable number of species as with the other established LTER sites in the Philippines, which include Mt. Apo, Mt. Kitanglad, Mt. Hamiguitan, and Mt. Malindang on Mindanao Island (Mohagan *et al.* 2019). However, the species composition differs, as expected from different faunal regions.

There were seven species described to be of high conservation concern importance because of their threatened status namely: *Platymantis negrosensis*, *Platymantis hazelae*, *Limnonectes visayanus*, *Sanguirana acai*, and *Hydrosaurus pustulatus*, *Tropidonophis negrosensis*, and *Oligodon modestus* (International Union for Conservation Nation 2025). There were 20 species that are of least concern status, while two were data deficient. The best represented family in BTLNP was the Ceratobatrachidae, which was comprised mostly of *Platymantis* species.

Table 1 Herpetofauna checklist at BTLNP, with the initial list of species compiled by Dolino *et al.* (2004) as baseline

Family	Dolino *et al*., 2004	Current Valid Species Name	IUCN Conservation Status (2025)	Distribution	This Study (2014)	Aureo et al, 2019	This Study (2023-2024)
Bufonidae (True Toads)	*Bufo marinus*	*Rhinella marina*	LC	I	+	+	+
Dicroglossidae (Fork-tongued)	*Limnonectes (Rana) leytensis*	*Limnonectes leytensis*	LC	PE			
	Limnonectes (Rana magna) visayanus	*Limnonectes visayanus*	NT	PE	+	+	+
		Fejervarya vittigera	LC	PE		+	
	Occidozyga laevis visayanus	*Occidozyga laevis*	LC	PE		+	
Ranidae (True Frogs)	*Rana erythraea*	*Hylarana erythraea*	LC	I	+	+	+
	Rana everetti	*Sanguirana acai*	NT	PE		+	+
Ceratobatrachidae (Forest frogs)	*Platymantis corrugatus*	*Platymantis corrugatus*	LC	PE	+	+	+
	Platymantis dorsalis	*Platymantis dorsalis*	LC	PE	+	+	+
	Platymantis hazelae	*Platymantis hazelae*	VU	PE	+	+	+
	Platymantis negrosensis	*Platymantis negrosensis*	NT	PE		+	+
Rhacophoridae (Old World Tree Frogs)	*Rhacophorus pardalis pardalis*	*Rhacophorus pardalis*	LC	NPE		+	+
	Polypedates leucomystax quadrilineatus	*Polypedates leucomystax*	LC	NPE		+	+
Microhylidae (Narrow-mouthed Frogs)	*Kaloula conjuncta negrosensis*	*Kaloula conjuncta negrosensis*	LC	PE		+	+
	Kaloula picta	*Kaloula picta*	LC	PE			
Agamidae (Agamids - Lizards)	*Bronchocela cristatella*	*Bronchocela cristatella*	LC	NPE			
	Draco spilopterus	*Draco spilopterus*	LC	PE			+
	Gonocephalus sp	*Gonocephalus sp*	LC	PE			+
	Hydrosaurus pustulatus	*Hydrosaurus pustulatus*	VU	PE			+
Gekkonidae (Geckos)	*Cosymbotus platyurus*	*Hemidactylus platyurus*	LC	NPE			
	Cyrtodactylus annulatus	*Cyrtodactylus annulatus*	LC	PE			
	Cyrtodactylus philippinicus	*Cyrtodactylus philippinicus*	LC	PE			+
	Gehyra mutilata	*Gehyra mutilata*	LC	NPE			
	Gekko gecko gecko	*Gekko gecko gecko*	LC	NPE			+
	Hemidactylus garnoti	*Hemidactylus garnotii*	LC	NPE			
	Hemiphyllodactylus typus	*Hemiphyllodactylus typus*	LC	NPE			
	Lepidodactylus christiani	*Lepidodactylus christiani*	LC	PE			
	Lepidodactylus herrei herrei	*Lepidodactylus herrei herrei*	LC	PE			
	Luperosaurus cumingi	*Luperosaurus cumingii*	DD	PE			
	Pseudogekko brevipes	*Pseudogekko atiorum*	DD	PE			+
Scincidae (Skinks)	*Brachymeles boulengeri taylori*	*Brachymeles boulengeri*	LC	PE			
	Lamprolepis smaragdina philippinica	*Lamprolepis smaragdina philippinica*	LC	PE			
		Lipinia auriculata	LC	PE	+		+
		Lipinia pulchella	LC	PE			+
	Mabuya multicarinata borealis	*Eutropis borealis*	LC	PE			+
	Mabuya multifasciata	*Eutropis multifasciata*	LC	NPE	+		+
	Sphenomorphus arborens	*Insulasaurus arborens*	LC	PE			+
	Sphenomorphus jagori grandis	*Pinoyscincus jagori*	LC	PE	+		+
	Sphenomorphus steerei	*Parvoscincus steerei*	LC	PE			+

Family	Dolino *et al.*, 2004	Current Valid Species Name	IUCN Conservation Status (2025)	Distribution	This Study (2014)	Aureo et al, 2019	This Study (2023-2024)
Varanidae (Monitor Lizards)	*Varanus salvator nuchalis*	*Varanus nuchalis*	LC	PE			
Colubridae (Colubrid Snakes)	*Ahaetulla prasina preocularis*	*Ahaetulla prasina preocularis*	LC	PE			
		Boiga cynodon	NT	NPE			+
	Calamaria gervaisii	*Calamaria gervaisii*	LC	PE	+		+
	Chrysopelea paradisi	*Chrysopelea paradisi paradisi*	LC	NPE			
		Dryophiops philippina	DD	PE	+		+
	Lycodon aulicus capucinus	*Lycodon capucinus*	LC	I			
	Tropidonophis negrosensis	*Tropidonophis negrosensis*	NT	PE			+
	Oligodon modestum	*Oligodon modestus*	NT	PE			+
	Zaocys luzonensis	*Ptyas luzonensis*	LC	PE			
Cyclocoridae (Burrowing Snakes)	*Oxyrhabdium leporinus visayanum*	*Oxyrhabdium leporinum visayanum*	LC	PE			+
Psammodynastidae(Mock Vipers)	*Psammodynastes pulverulentus*	*Psammodynastes pulverulentus pulverulentus*	LC	NPE			+
Pythonidae (Pythons)	*Python reticulatus*	*Malayopython reticulatus reticulatus*	LC	NPE			
Viperidae (Vipers)	*Tropidolaemus wagleri*	*Tropidolaemus subannulatus*	LC	NPE			
Geoemydidae (Asian Hardshell Turtles)	*Cuora amboinensis amboinensis*	*Cuora philippinensis*	E	PE			
					11	13	31

Notes: Newly recorded species are highlighted. Updated names are also provided based from taxonomic databases. PE = Philippine Endemic; NPE = Non-Philippine Endemic; I = Introduced.

A species richness curve (q = 0) showed 31 species observed (Fig. 2). An upward trend, with a slightly wide confidence interval, suggesting that more sampling was needed to capture all species in the area. Shannon diversity (q = 1) showed only 10 effective number of species that were frequently observed, therefore, common and abundant. Meanwhile, Simpson's diversity (q = 2), indicated that only five of the 31 species were dominant, which suggested a low evenness. Overall, the curves showed a low to moderate diversity, with many species sampled but only a few being highly abundant.

The results of the diversity analysis are also reflected on the relative abundance (Fig. 3). The relative abundance of a species in an ecosystem is determined by the availability of a resource niche, which suggests that the most abundant species have a wider range of resource use. Therefore, disturbances that disrupt resources could consequently alter the abundance of these species (McKane *et al.* 2002; Tilman *et al.* 1997).

In our study, amphibian species were more frequently observed compared to reptiles, as indicated by their high relative abundance. It appears that *Platymantis dorsalis* is considerably the most abundant, which explains its easy detectability. This is followed by *Platymantis corrugatus*, *Limnonectes visayanus*, *Rhacophorus pardalis*, and *Platymantis hazelae*. Comparing our findings with the other previous studies, we have detected the majority of the anurans reported: 11 out of 15 species from Dolino *et al.* (2004), and 11 out of 13 from Aureo *et al.* (2019), except for two (2), the *Occidozya laevis*, and *Fejevarya vittigera*. This is likely due to the little effort spent in sampling very close to the lake shore. The consistency of our result with theirs may indicate that these represents the whole anuran community in BTLNP. Among the reptiles, the species that are frequently observed were the *Parvoscincus steerei* and *Eutropis multifasciata*. Majority of the observed snake species only had single individual encounters.

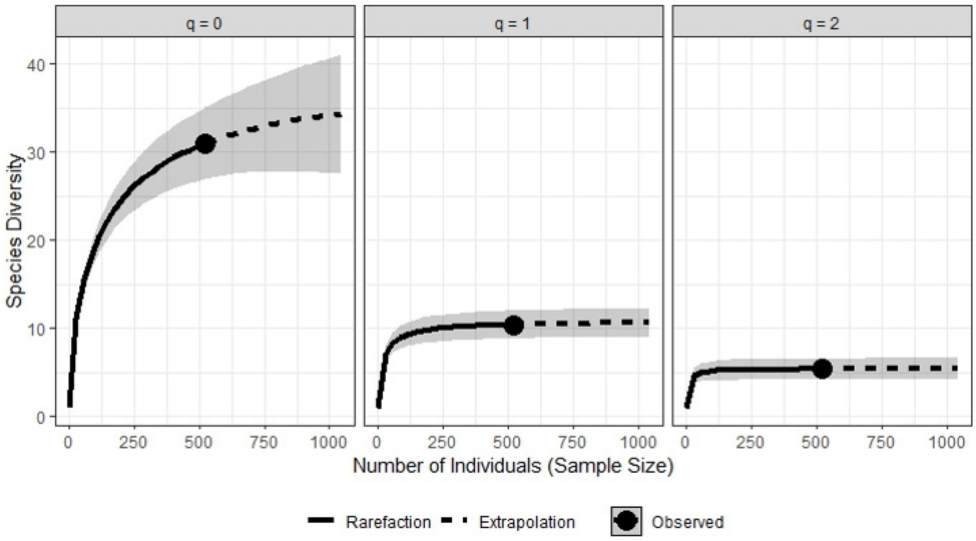

Figure 2 Measures of diversity

Notes: Species richness (q = 0) indicates 31 species observed; Shannon Diversity (q = 1) indicates 10 well sampled species, and Simpson's Diversity (q = 2) indicates 5 dominant species. Extrapolation and rarefaction curves show an asymptote which indicate sampling adequacy. Solid lines show the rarefaction curve and dashed lines the extrapolation curve. The shaded area represents the 95% confidence interval.

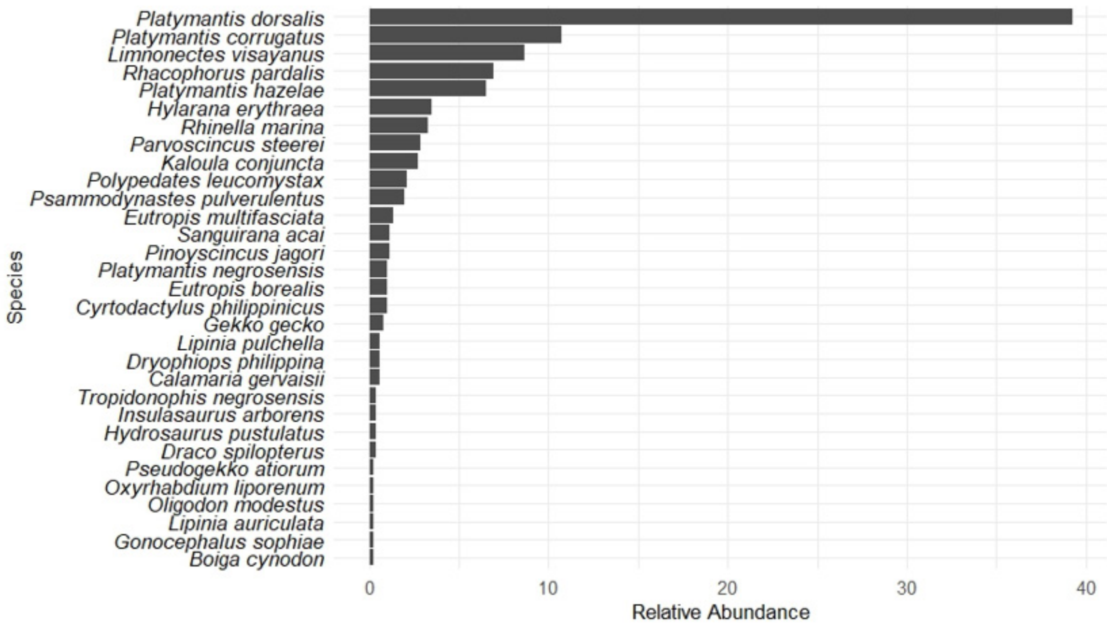

Figure 3 Relative abundance of the herpetofauna species, showing the species that are frequently found in the Balinsasayao Twin Lakes Natural Park (BTLNP), Philippines

The herpetofauna are typically elusive and would be able to hide when threatened, which adds to the difficulty of detecting them. Some are found in the upper canopy layers beyond reach, while others remain within their microhabitat and were only detected when disturbed. Their sensitivity to changes in habitat condition (Mohagan *et al.* 2019) might cause them to conceal themselves in the forest microhabitats. The environmental conditions at these sites might be considered optimal for these species to thrive in.

The elevation at BTLNP is around 900 masl. A study by Diesmos *et al.* (2005) has shown that diversity and abundance of reptiles are higher at lower elevations due to drier and hotter conditions. Conversely, amphibian diversity tends to be greater at higher elevations. One factor is the increased level of humidity, which is necessary for frogs' physiological and reproductive needs. There are even some species that do not require bodies of water to lay eggs, best exemplified by the species belonging to the genus *Platymantis* that lay eggs on land and can proceed with direct development. It could be that the lake itself has contributed to the increased humidity of the area (Hecnar SJ. 2004; Knutson, 2004), providing a safe ground for the reproduction of these frogs by minimizing competition for space and resources with other species that lay eggs in the lake. Thus, the lake may be beneficial to the survival of the reptiles, and even more so with the amphibians, as water is essential for their metabolic needs (Wu *et al.* 2025; Bickford 2005).

There are certainly species that are dependent on water and may rely on the lake to lay their eggs, such as: *Rhinella marina*, *Hylarana erythraea*, *Limnonectes visayanus*, *Rhacophorus pardalis*, *Sanguirana acai*, *Polypedates leucomystax*, and *Kaloula conjuncta*. But the latter four species can often be observed inland. Aside from being found near the lake shores, some individuals were seen on tree tops, leaf axils, and branches. In contrast, all the *Platymantis* species individuals were seen nowhere near the lake. This might be due to their ability as direct developers without requiring water to lay eggs (Diesmos *et al.* 2005).

These patterns of distribution among the frogs at BTLNP are easily noticeable owing to the large number of individuals observed. However, it remains difficult to discern patterns among reptiles, as most of them are seldomly detected, particularly the snakes. Nevertheless, the general observation is that majority of the species are terrestrial, while some are arboreal. Although, there is one exception, the *Hydrosaurus pustulatus*, which is capable of diving into the lake given its tail that is adapted for swimming (Sy 2023).

Conservation and Monitoring Implications

While BTLNP has long been designated a protected area, the presence of threatened species underscores the need for continued habitat preservation. According to Mi *et al.* (2023) and Collen *et al.* (2009), the amphibians and reptiles exhibit the highest proportion of threatened species, and their population may drastically change due to their sensitivity to environmental modification. A study in Southern Negros observed that the main factor with the greatest impact on herpetofauna is the removal of large trees, which consequently reduced canopy cover. This reduction in canopy cover can lead to cascading effects and other subsequent physical changes in the habitat, such as fragmentation. Forest patches may then occur, affecting habitat area size and potentially reducing the optimal living conditions for the herpetofauna (Alcala *et al.* 2012; Alcala *et al.* 2004).

Therefore, a dedicated long-term monitoring program for the herpetofauna in the area can also be a practical approach (Ghosh & Basu 2020), since there are species that are only seldomly represented during surveys. Short-term monitoring may not be enough to find more cryptic and rare species (Ryan *et al.* 2002). Together with this, should a long-term monitoring dedicated for the herpetofauna be implemented, it must employ a standardized monitoring method. This includes establishing of quadrats randomly spread in the entire protected area, vertical and horizontal sampling of the vegetation, and, incorporating pitfall traps and drift fences.

Determining the extent of habitat use of these organisms is also a key step critical for effective conservation (Herse *et al.* 2018). This metric can help assess the extent of the spatial distribution of the herpetofauna and determine the appropriate area size for preservation, should the current size of the area be expanded for forest cover. Thus, having an inventory of plants and incorporating measurements on habitat variables in the area can objectively evaluate the habitat condition and its influence on the existing herpetofauna (Cruz-García & Narváez 2024). Lastly, species-specific research may also be practical to gain a deeper understanding of the ecologic of certain species, especially the island endemic ones, such as the *Platymantis negrosensis*.

Several surrounding areas in BTLNP remain poorly surveyed due to the challenging terrain. Additional species are likely to be recorded when these areas are further sampled. Nevertheless, the current data may serve as basis for long term conservation and future monitoring efforts in the area.

Species Accounts

This section provides a brief narrative description of the species' appearance, behavior, and other observations supplemented by descriptions from other references. Photos of the species are included: in the caption, names with (*) are in situ photos taken for species that are easily identified in their natural habitat (Fig. 4). Ex-situ photos for species that needed to be captured to be verified using field guides.

Figure 4 Amphibians of BTLNP

Notes: Photos taken in situ are indicated with (*) on the names: A. *P. hazelae**; B. *P. negrosensis*; C. *P. dorsalis**; D. *P. corrugatus*; E. *R. marina**; F. *H. erythraea*; G. *L. visayanus**; H. *K.conjuncta negrosensis*; I. *P. leucomystax**; J. *R. pardalis**.

Family: Ceratobatrachidae

The *Platymantis hazelae* (Fig. 4A) is one of the species intensively studied in BTLNP. It is distinctly vocal especially at night. It was observed in microhabitats such as axils and leaves of screw pines (*Pandanus* sp.), and palm leaves, which characterizes the frog as arboreal. This species exemplifies the importance of having abundant epiphytes and rosette-forming plant species (Bucol *et al.* 2019). Its single morphometric measurements: SVL = 37.6 mm, TBL = 18.4 mm, HL =13.4 mm, W = 3 g.

The *Platymantis negrosensis* (Fig. 4B) being an arboreal species, was easily observed clinging to vines, leaves, and branches. It tends to be very vocal at night and can be heard around the area occasionally because its natural microhabitats are still intact, such as arboreal ferns (*Asplenium nidus*) and *Pandanus* sp. (Alcala *et al.* 2004). Oftentimes, it can be found clinging on vines at breast height levels, and fronds of *Asplenium nidus* (Bird's nest) fern. Its average morphometrics: SVL = 23.9 mm, TBL = 19.3 mm, HL = 15.8 mm, W = 1.2 g.

The *Platymantis. dorsalis* (Fig. 4C), is a common dweller found on the ground and on boulders, which is often obscured with forest litter and overhanging leaves in understory vegetation. Its average morphometrics: SVL = 30.8 mm, TBL = 19.1 mm, HL = 10 mm, W = 4.2 g.

The *Platymantis. corrugatus* (Fig. 4D), somewhat similar in behavior as the former. It is frequently seen on the ground, often hiding in forest litter, an observation that is consistent with the study of Venturina *et al.* (2020). Its average morphometrics: SVL = 33.8 mm, TBL = 20.8 mm, HL = 16.9 mm, W = 6.4 g.

Family: Bufonidae

The *Rhinella marina* (Fig. 4E) is the only representative to the family Bufonidae. It is an introduced invasive species in the country and has now become widely distributed throughout (Harvey *et al.* 2021). In the study site, most sightings occur on established ecotrails intended for tourists, and even few individuals are found within the 2-hectare LTER sampling plot.

Family: Ranidae

The *Sanguirana acai* (Fig. 4F) formerly known as Rana everetti after its taxonomic appraisal. had no other scientific accounts. Descriptions of its biology are directed to its former name (Brown *et al.* 2017; Brown *et al.* 2000). Previously, the *R. everetti* population has been described to be predominantly aquatic frogs. Succeeding studies, the population in Negros (Now *S. acai*) is observed not to be primarily aquatic in lifestyle. In fact, many individuals have been observed, even eggs, to be on plant parts away from a source of water (Brown *et al.* 2017). A similar encounter was observed in BLTNP, where a *S. acai* was seen clinging to a bamboo and tree branch situated slightly distant from the lake.

The *Hylarana erythraea* (Fig. 4G) is one of the introduced species in the country, and with a stable population. It is highly adaptable to various kinds of habitat, such that it could be seen in forests, plantations, and farms (Samaniego 2016), but it is more commonly seen in bodies of water (Alcala *et al.* 2012). For instance, many individuals were seen near the banks of the lake in BTLNP. Its presence in an ecosystem might pose a threat to the endemic frogs it can interact with (Samaniego 2016).

Family: Dicroglossidae

The *Limnonectes visayanus* (Fig. 4H) is relatively larger than the other species observed. In some studies, it is observed near streams of water and is very much known to hide under rock crevices and is capable of laying eggs outside bodies of water (Ferner *et al.* 2000). In BTLNP, individuals of this species were easily detected around and on established trails of the lake. When threatened, they quickly jump into the lake and/or find their way into rock crevices and other debris.

Family: Microhylidae

The *Kaloula conjuncta* negrosensis (Fig. 4I) is heavily dependent on water, but despite this characteristic, it does not seem to be commonly found in or near the lake. It prefers to be in water puddles or in stagnant waters held in a container, such as the barrel of water found in one of the transects. It lays thick foam all over the barrel rim, but we suspect that the tree frogs might have also deposited their foam on it, given their presence around it as well. This species was also observed moving slowly climbing upwards on a coconut tree Its average morphometrics: SVL = 38.5 mm, TBL = 15.5 mm, HL = 10 mm, W= 4.6 g.

Family: Rhacophoridae

The *Polypedates leucomystax* (Fig. 4J) is a widespread species in the Philippines, and it is described to be commensal with humans. In Twin Lakes, it was often seen in close aggregation with other frog species clinging to stems, branches, and leaves above bodies of water. Other studies have documented it to be on nearby puddles of water in a grassland (Oliveros *et al.* 2011).

The *Rhacophorus pardalis* (Fig. 4K). Typically, like other tree frogs, this species is frequently seen on branches hanging over the banks of the lake. We also suspect that many more individuals were on the tops of the trees hidden from view. There was another instance where around 25-30 individuals aggregated near a drum filled with water, probably engaged in a reproduction, as pairs were seen in an amplexus position. It's morphometric from a single individual: SVL = 50.8 mm, TBL = 23.5 mm, HL = 20.2 mm, W = 5.6 g.

Figure 5 Reptiles of BTLNP

Notes: Photos taken in-situ are indicated with (*) on the names: A. *E. multicarinata**; B. *P. steerei*; C. *L. pulchella**; D. *I. arborens**; E. *C. philippinicus*; F. *P. atiorum*; G. *G. gecko*; H. *D. spilopterus**; I. *G. sophiae*; J. *C. gervaisii*; K. *O. leporinum*; L. *T. negrosensis*; M. *O. modestus*; N. *P. pulverulentus**.

Family: Scincidae

The *Eutropis multicarinata* (Fig. 5A) can be spotted almost everywhere at the site. It may occur along the ecotrail, roadsides, basking on boulders, and scurrying through the forest litter inside the forest. It hides quickly inside crevices when threatened.

The *Parvoscincus steerei* (Fig. 5B) is the smallest skink among the others. It is a ground-dwelling skink and quick to hide in the forest litter when disturbed. Its average morphometrics: SVL = 35.8 mm, TL = 48.9 mm, W = 0.8 g.

The *Lipinia pulchella* (Fig. 5C) is rarely found in the site. It is observed to be elusive and very quick to hide when startled by moving vertically along tree trunks.

The *Insulasaurus arborens* (Fig. 5D) is usually seen on stems, often with crevices and epiphytic plants, probably used as a microhabitat of this species. Very little information about this species is available.

Family: Gekkonidae

The *Cyrtodactylus philippinicus* (Fig. 5E) is a widely distributed species (Welton *et al.* 2009). It is an arboreal species and can reach the highest levels of the forest. It was seen to go as high as near the sub-canopy of a tree, while some may settle near the bottom within reach. SVL = 92 mm, TL = 145 mm, W = 12.2 g.

The *Pseudogekko atriorum* (Fig. 5F) is distributed is in the central Visayas and in the Panay islands (Davis *et al.* 2015). The ones found in the study site were seen on the fern branch, thus, arboreal. In other studies, the species can be found along stream banks. Still, information about this species is limited (Sy & Nava 2023). Its morphometric measurement from a single individual is: SVL = 50.3 mm, TL = 90.6 mm, W = 1.8 g.

The *Gekko gecko* (Fig. 5G) is the most common among the geckos. It can be found in the forest, hiding in the bark of trees and other tight spaces, or often clinging to the surface of a tree exposed in the open. Some individuals were even seen in infrastructures.

Family: Agamidae

The *Draco spilopterus* (Fig. 5H) can be seen in a wide range of habitats, from urban to the forest. On the study site, it can be seen gliding from tree to tree. Occasionally seen near or on the ground, probably in search of food. Their coloration pattern ensures their safety while at rest at night, as some individuals were seen clinging to stems free from cover. SVL = 74 mm, TL = 202 mm, W = 7 g.

The *Gonocephalus* sp. (Fig. 5I) was only seen resting on the branches of Binunga tree (*Macaranga* sp.) in a forest edge adjacent to the road. It was observed as greenish, mimicking the green leaves in the substory, while reddish-brown on the forest floor, blending with the litter, rocks, and woody matter. Literature on its ecology and taxonomy is scanty due to its elusive behavior.

Family: Cycloridae

The *Oxyrhabdium leporinum visayanum* (Fig. 5K) was only recorded once. No direct observation was done as it was taken by the local guide. But as described in the literature, it is commonly seen in near river banks, vegetation along streams, and fallen logs far from water sources (Cruz *et al.* 2018). With this information, it can be inferred that it likely frequents near the lake.

Family: Colubridae

The *Calamaria gervaisii* (Fig. 5J) is a relatively small, harmless snake species. Seen crawling on the forest litter. Other studies have mentioned that it can be found taking shelter inside decayed logs, in between tree buttresses, and crawling in between tight spaces in stones (Meneses 2020)

The *Oligodon modestus* (Fig. 5L) is described to inhabit primary and secondary forest habitats (Sy 2023), a fitting description of BLTNP. The individual observed was found dead along the road near the entrance of the park. Puncture wounds were visible, indicating that it could have been preyed upon by birds of prey with powerful talons (e.g., owls).

The *Tropidonophis negrosensis* (Fig. 5M) was found deep within the forested ridgetop area of the site. Adjacent to this ridge is the bank of the lake, a conventional habitat for it to reside, one reason likely for its presence.

Family: Psammodynastidae

The *Psammodynastes pulverulentus* (Fig. 5N) is widespread among Southeast Asian countries. Perhaps the most frequently seen snake species in the site, which was mostly observed on leaves and fern fronds. Similar to some studies, the snake was almost always in its striking position, ready to ambush any prey (Asad *et al.* 2020).

CONCLUSION

Balinsasayao Twin Lakes Natural Park hosts several amphibian and reptile species, including some of the threatened species known to have limited habitat ranges. The presence of the lake is highly valuable, as it is an important ecological resource for most amphibians and reptiles. With these results, ensuring a continued protection through regular monitoring is necessary for the survival of these species. This updated checklist of the herpetofauna of the LTER site shows that the site is self-sustaining, and additional species could be discovered. It also provides a foundation in monitoring programs that might involve quantifying changes in the habitat alongside the herpetofauna species thriving in it. Overall, information generated herein may also serve as basis for strengthening of policies and long-term community action plans.

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REFERENCES

Alcala EL, Alcala AC, Dolino CN. 2004. Amphibians and reptiles in tropical rainforest fragments on Negros Island, the Philippines. Environ Conserv 31(3):254–261.

Alcala AC, Brown WC. 1998. Philippine amphibians: An illustrated field guide. Makati City (PH): Bookmark. 116 p.

Alcala E, Bucol AA, Alcala AC. 2012. A reassessment of three species of herpetofauna in Silliman University Campus, Dumaguete City, Philippines. Development Education Journal of Multidisciplinary Research.

Alcala AC, Bucol AA, Diesmos AC, Brown RM. 2012. Vulnerability of Philippine amphibians to climate change. Philipp J Sci 141(1):77–87.

Asad S, Wilting A, Siku J, Rödel MO. 2020. Possible spatial separation at macro-habitat scales between two congeneric Psammodynastes species, including observations of fishing behaviour in Psammodynastes pictus. Salamandra 56(4):411-415.

Aureo WA, Jose RP, Reyes TD, Bucol LA. 2019. Anurans species diversity and composition along the elevational gradient of the Balinsasayao Twin Lakes Natural Park, Negros Oriental, Philippines. J Biodiv Environ Sci 14(6):161–167.

Aureo W, Reyes Jr. T, Mutia FC, Tandang D, Jose R. 2021. Floristic composition and community structure along the elevational gradient of Balinsasayao Twin Lakes Natural Park in Negros Oriental, Philippines. One Ecosyst 6:e56536.

Bickford D. 2005. Long-term frog monitoring by local people in Papua New Guinea and the 1997–98 El Niño Southern Oscillation. In Donnelly MA, Crother BI, Guyer C, Wake MH, White ME (Editors), Ecology and evolution in the tropics: A herpetological perspective. Chicago (US): University of Chicago Press. p. 260–283.

Brockerhoff EG, Barbaro L, Castagneyrol B, Forrester DI, Gardiner B, González-Olabarria J.R, Jactel H. 2017. Forest biodiversity, ecosystem functioning and the provision of ecosystem services. Biodivers Conserv 26:3005–3035. DOI: 10.1007/s10531-017-1453-2

Brown RM, Prue A, Onn CK, Gaulke M, Sanguila MB, Siler CD. 2017. Taxonomic reappraisal of the Northeast Mindanao Stream Frog, Sanguirana albotuberculata (Inger 1954), validation of Rana mearnsi, Stejneger 1905, and description of a new species from the Central Philippines. Herpetol Monogr 31(1):182–203. DOI: 10.1655/HERPMONOGRAPHS-D-16-00009.1

Brown RM, Siler CD, Diesmos AC, Alcala AC. 2009. Philippine frogs of the genus Leptobrachium (Anura: Megophryidae): Phylogeny-based species delimitation, taxonomic review, and descriptions of three new species. Herpetol Monogr 23:1–44.

Biodiversity Indicators Partnership. 2010. Biodiversity indicators and the 2010 biodiversity target: Outputs, experiences and lessons learnt from the 2010 Biodiversity Indicators Partnership. CBD Tech Ser 53. 196 p. Montreal (CA): Secretariat of the Convention on Biological Diversity.

Bucol LA, Bucol AA, Arche NC. 2019. Abundance and microhabitat use by the frog *Platymantis hazelae* (Anura: Ceratobatrachidae). Rev Biol Trop 67(3):518–533

[CBD] Convention on Biological Diversity. 2011. [Accessed 9 March 2026]. Available from: http://www.cbd.int/sp/targets/rationale/target-11/.

Chao A, Gotelli NJ, Hsieh TC, Sander EL, Ma KH, Colwell RK, Ellison AM. 2014. Rarefaction and extrapolation with Hill numbers: A framework for sampling and estimation in species diversity studies. Ecol Monogr 84(1):45–67.

Collen B, Ram M, Dewhurst N, Clausnitzer V, Kalkman V, Cumberlidge N, Baillie J. 2009. Broadening the coverage of biodiversity assessments. In: Vié J., Hilton-Taylor C, Stuart S (Editors), Wildlife in a Changing World. An Analysis of the 2008 IUCN Red List of Threatened Species. Gland (CH): International Union for Conservation of Nature. p.67–76.

Cortéz-Gómez AMM, Ruiz-Agudelo CA, Valencia-Aguilar A, Ladle RJ. 2015. Ecological functions of neotropical amphibians and reptiles: A review. Univ Sci 20(2):229–245.

Cruz PHPG, Afuang LE, Gonzalez JCT, Gruezo WS. 2018. Amphibians and reptiles of Luzon Island, Philippines: The herpetofauna of Pantabangan-Carranglan watershed, Nueva Ecija Province, Caraballo Mountain range. Asian Herpetol Res 9(4):201–223.

Cruz-García K, Narváez AE. 2024. Herpetofauna diversity and habitat use assessment in two remnant forests of western Ecuador. South Am J Herpetol 33(1):1–9.

Davis DR, Watters JL, Köhler G, Whitsett C, Huron NA, Brown RM, …, Siler CD. 2015. Redescription of the rare Philippine false gecko Pseudogekko brevipes (Reptilia: Squamata: Gekkonidae) and description of a new species. Zootaxa 4020(2):357–374.

Diesmos AC, Brown RM, Gee GV. 2005. Preliminary report on the amphibians and reptiles of Balbalasang-Balbalan National Park, Luzon Island, Philippines. Sylvatrop 13(1/2):63–80.

Diesmos AC, Watters JL, Huron NA, Davis DR, Alcala AC, Crombie RI, …, Cameron D. 2015. Amphibians of the Philippines, Part I: Checklist of the species. Proc California Acad Sci Ser 4, 62(20):457–539.

Dolino CN, Cariño AB, Cadeliña AM. 2004. Threatened wildlife of the Twin Lakes Balinsasayao and Danao Natural Park, Negros Oriental, Philippines. Silliman J 45(2).

Ferner JW, Brown RM, Sison RV, Kennedy RS. 2000. The amphibians and reptiles of Panay Island, Philippines. Asiat Herpetol Res 9:1–37.

[GBIF] Global Biodiversity Information Facility. 2026. GBIF. org. [Accessed: 6 April 2026]. Available from: https://www.gbif.org.

Ghosh D, Basu P. 2020. Factors influencing herpetofauna abundance and diversity in a tropical agricultural landscape mosaic. Biotropica 52(5):927–937.

Harvey JA, Ambavane P, Williamson M, Diesmos A. 2021. Evaluating the effects of the invasive cane toad (*Rhinella marina*) on island biodiversity, focusing on the Philippines. Pac Conserv Biol 28(3):199–210.

Heaney LR, Balete DS, Alcala A, Ong P, Dans AL, Rickart E, …, Oliver WR. 1998. A Synopsis of mamalian fauna of the Philippine Islands. Fieldiana Zool 88:1–61. DOI: 10.5962/bhl.title.3419

Hecnar SJ. 2004. Great Lakes wetlands as amphibian habitats: A review. Aquat Ecosyst Health Manag 7(2):289–303. DOI: 10.1080/14634980490461542

Heideman PD, Erickson KR. 1987. The climate and hydrology of the Lake Balinsasayao watershed, Negros Oriental, Philippines. Silliman J 34:82–107.

Herse MR, With KA, Boyle WA. 2018. The importance of core habitat for a threatened species in changing landscapes. J Appl Ecol 55(5):2241–2252.

Hicks N. 2000. The national parks and other wild places of the Philippines. London (UK): New Holland Publishers Ltd. 176 p.

[IUCN] International Union for Conservation of Nature. 2025. The IUCN Red List of Threatened Species. Available from: https://www.iucnredlist.org

Knutson MG, Richardson WB, Reineke DM, Gray BR, Parmelee JR, Weick SE. 2004. Agricultural ponds support amphibian populations. Ecol Appl 14(3):669–684. DOI: 10.1890/02-5305

McKane RB, Johnson LC, Shaver GR, Nadelhoffer KJ, Rastetter EB, Fry B, …, Murray G. 2002. Resource-based niches provide a basis for plant species diversity and dominance in arctic tundra. Nature 415:68–71. DOI: 10.1038/415068a

Meneses CG. 2020. Ophiophagy in the Philippine endemic Luzon False Coral Snake Hemibungarus calligaster (Wiegmann, 1834) on Gervais' Reed Snake *Calamaria gervaisii* Dumeril, Bibron, and Dumeril, 1854 and the importance of the Rabor Collection in Philippine natural history. Laksambuhay 7:18–21.

Mohagan AB, Nuñeza OM, Alcala AC, Escarlos Jr. JA, Gracia Jr. AG, Selpa ECT, …, Amoroso VB. 2019. Species richness and endemism of reptilian fauna in four long-term ecological research sites in Mindanao, Philippines. Biodivers J 10(3):237–248. DOI: 10.31396/Biodiv.Jour.2019.10.3.237.248

Mohagan AB, Nuñeza OM, Diesmos AC, Escarlos Jr. JA, Gracia Jr. AG, Selpa ECT, …, Amoroso VB. 2018. Anuran species richness and endemism in four long-term ecological research sites in Mindanao, Philippines. Asian J Conserv Biol 7(2):83–91.

Oliveros CH, Ota H, Crombie RI, Brown RM. 2011. The herpetofauna of the Babuyan Islands, northern Philippines. Scientific Papers Natural History Museum the University of Kansas 43:1–20.

Republic of the Philippines. 2018. Republic Act No. 11038: Expanded National Integrated Protected Areas System Act of 2018. Lawphil

Rosales JR, Yu JAG, Nanual BJ, Ponce AG. 2023. Inventory of herpetofauna in the buffer zone of Mt. Hamiguitan range wildlife sanctuary, San Isidro, Davao Oriental, Philippines. Davao Res J 14(2):50–65.

Ryan TJ, Philippi T, Leiden YA, Dorcas ME, Wigley TB, Gibbons JW. 2002. Monitoring herpetofauna in a managed forest landscape: effects of habitat types and census techniques. For Ecol Manage 167(1-3):83–90.

Samaniego EVG. 2016. Introduced frogs in buffer zone and adjacent areas of Mt. Banahaw de Lucban, Quezon Province, Luzon Island, Philippines. Sylvatrop 26(1).

Sodhi NS, Posa MRC, Lee TM, Bickford D, Koh LP, Brook BW. 2010. The state and conservation of Southeast Asian biodiversity. Biodivers Conserv 19:317–328.

Solania CL, Cuadrado JT, Galolo ARV, Gamalinda EF. 2021. Species richness and community structure of amphibians and reptiles in Andanan Watershed Forest Reserve, Caraga Region, Philippines. Biodivers J 12(3):673–694.

Sy EY. 2025. Checklist of amphibians of the Philippines, version 2025-1. Reptile & Amphibian Database Philippines. Manila, Philippines.

Sy EY. 2026. Checklist of reptiles of the Philippines, version 2026-1. Reptile & Amphibian Database Philippines. Manila, Philippines.

Sy EY. 2023. A naturalist's guide to the reptiles of the Philippines. Oxford (UK): John Beaufoy Publishing Ltd. 120 p.

Sy EY, Nava FA. 2023. Ati False Gecko Pseudogekko atiorum on Panay Island, Philippines. SEAVR 2023: 019–020. Available from: https://ecologyasia.com

Tanalgo KC, Dela Cruz KC, Agduma AR, Lidasan AK, Edradan J, Dumayas RKL, …, Gatoc GKP. 2025. Drivers of extinction risks and shortfalls across terrestrial vertebrates in the Philippine global biodiversity hotspot. Sci Total Environ:180274. DOI: 10.1016/j.scitotenv.2025.180274

Tilman D, Lehman CL, Thomson KT. 1997. Plant diversity and ecosystem productivity: Theoretical considerations. Proc Natl Acad Sci USA 94(5):1857–1861. DOI: 10.1073/pnas.94.5.1857

Valencia-Aguilar A, Cortés-Gómez AM, Ruiz-Agudelo CA. 2013. Ecosystem services provided by amphibians and reptiles in Neotropical ecosystems. Int J Biodivers Sci, Ecosyst Serv Manage 9(3):257–272.

Venturina REL, Del Prado YLC, Kamir RAC, Balmores MN, Diesmos AC. 2020. A revised checklist of amphibians and reptiles in Camiguin Sur, Misamis Oriental, Mindaanao, Philippines. Asian Herpetol Res 11(1):28–43.

Weinell JL, Hooper E, Leviton AE, Brown RM. 2019. Illustrated key to the snakes of the Philippines. Proc Calif Acad Sci 66(1):1–49. DOI: 10.5281/zenodo.11512680

Welton LJ, Siler CD, Diesmos A, Brown RM. 2009. A new bent-toed gecko (genus Cyrtodactylus) from southern Palawan Island, Philippines and clarification of the taxonomic status of C. annulatus. Herpetologica 65(3):328–343.

Wu NC, Anderson RO, Borzée A, Buttimer S, Dezetter M, Dubiner S…., Bovo RP. 2025. A user's guide for understanding reptile and amphibian hydroregulation and climate change impacts. Conserv Physiol 13(1):coaf038. DOI: 10.1093/conphys/coaf038