A Preliminary Assessment of Herpetofaunal Diversity in the Taal Volcano Protected Landscape (TVPL) Luzon Island, Philippines

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Abstract

The Taal Volcano Protected Landscape (TVPL) encompasses a prehistoric volcano caldera harboring numerous endemic species. Although regarded as a unique area with a diverse ecological community, biodiversity research in TVPL is still found to be wanting. In light of the numerous undocumented terrestrial faunal species in TVPL, the present study was conducted to provide baseline information and increase research interests on the herpetofaunal diversity. Twelve sites within the municipalities of Tanauan, Mataas na kahoy, and Balete were surveyed between May and November 2015. A combination of transect and opportunistic sampling techniques were utilized, with morphometric data and sexual maturity recorded for each specimen collected. This preliminary survey documented 24 newly documented species of amphibians and reptiles occurring within TVPL. A total 10 frog species (Bufonidae, Ceratobatrachidae, Microhylidae, Dicroglossidae, Ranidae, and Rhacophoridae) and 14 reptile species (Agamidae, Gekkonidae, Scincidae, Varanidae, Acrochordidae, Colubridae, Elapidae, and Trionychidae) were documented. Of the 14 reptiles recorded, three are endemic species and widespread throughout the Philippines: *Gekko mindorensis*, *Hydrosaurus pustulatus,* and *Draco spilopterus*. Also recorded were the Philippine endemic frogs *Kaloula picta* and *Limnonectes woodworthi* along with the Luzon endemic *Platymantis mimulus* and *Varanus marmoratus.* The species-effort curve of amphibians showed a distinct plateau whereas the species-effort curve of reptiles showed an increasing trend, suggesting that additional sampling efforts will most likely detect several more undocumented species.

Key words :

Amphibians
Biodiversity
Reptiles
Batangas
Lake Taal

Introduction

The Taal Volcano Protected Landscape (TVPL) is a protected area encompassing the renowned Taal Volcano located in southern Luzon and is known to harbor different endemic species, including the Taal sea snake, *Hydrophis semperi* Garman, 1881 and the fresh water sardine, *Sardinella tawilis* (Herre, 1927). The TVPL is also known for its scenic view and is shared by several municipalities in Batangas, including Talisay, Tanauan, Mataas na Kahoy, Lipa, and Balete, as well as Tagaytay in Cavite. Although the TVPL bears unique geographical features that make it a noteworthy area of study, there is still a scarcity of information. This has led us to conduct a preliminary study on the herpetofaunal diversity of TVPL to determine the diversity and establish a baseline data for this area. In turn, this study can also shed more light in the herpetofauna found in southern Luzon, since herpetofaunal studies of Luzon in the past have been more concentrated in the northern part (Brown et al., 2000; Siler et al., 2011; McLeod et al., 2011; Brown et al., 2012; Brown et al., 2013).

Our attempt to document the herpetofaunal diversity within TVPL will contribute to a greater understanding of this unique and highly threatened faunal group in the Philippines. With a preliminary data on the distribution and abundance of the amphibians and reptiles in the TVPL, the researchers intend to create awareness and improve the conservation efforts not only in the scientific community but also for the locals and tourists as well.

Materials and Methods

Sampling Sites. Twelve study sites were established in three municipalities of Batangas, including the Taal Volcano Island itself (Figure 1). Summaries of locations with GPS coordinates and elevations are listed in Tables 1

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and 2. The sampling sites cover terrestrial and arboreal strata intensively.

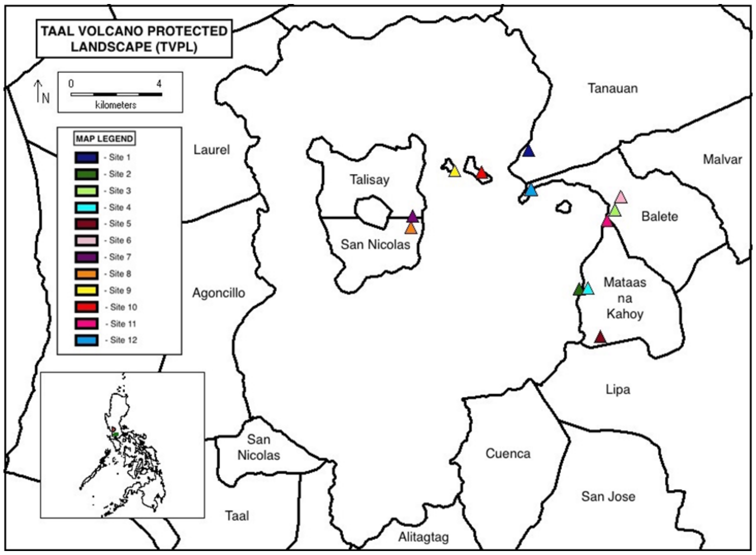

Figure 1. Map of the Taal Volcano Protected Landscape (TVPL) labeled with the 12 sampling sites

Collection Method. Four series of research efforts were conducted from May to November 2015. Each research period was comprised of three to five days (May 21-23, July 15-19, August 29-31 and November 20-22, 2015) for a total of a 14-day effort. Information on the time of collection, elevation, habitat and microhabitat where an individual was caught, seen, or heard were also noted. Standard field techniques utilized includes extensive (timed and free time) night visual surveys along transect line as well as walking transects and opportunistic encounters. Herpetological encounters outside transect, but still within the TVPL, were also took into account, noting the exact location (if possible, with GPS coordinates) of the encounter. Incidental sampling was done in order to capture the softshell turtles and sea snakes with the help of the local fishermen.

Voucher Specimen Preparation. All specimens encountered were documented and voucher specimens were collected and preserved using standard collection and preservation techniques (Simmons, 1987). Preserved specimens were then catalogued and deposited to the Philippine National Museum (PNM).

Species Identification. Species identification was conducted in the field with the help of experts and field guides including sir Jason Fernandez, and herpetology graduate students. The taxonomic key of Alcala (1980) was used to determine the identity of each voucher specimen collected and was verified by Ma'am Mae Diesmos and Sir Arvin Diesmos.

Dissection of the Pelodiscus sinensis turtles. An incision tracing the plastron was made and the bridge was cut to expose the visceral organs, mesenteries were carefully cut to not destroy the internal organs. The gut was traced by using the small intestine as reference. It was cut at the esophagus until the end of the small intestine and was collected for gut analysis. The gut was placed on a 5% Saline solution and was observed under a dissecting microscope and the contents of the gut were recorded. After observation, the gut was stored in a vial with Ethanol for preservation. The remains of the turtle were placed in 70% ethanol.

Results and Discussion

A total of 10 amphibians and 14 reptiles (10 lizards, 3 snakes, 1 turtle) were documented in the 12 study sites within the TVPL and are listed below together with their corresponding ecological and threat status (according to IUCN, 2016).

All 10 species of amphibians together with 13 out of 14 reptilian species were considered in the species effort curve, excluding the *Hydrophis semperi*, which was not encountered for the duration of the study but was documented in Lake Taal (Garcia et al., 2014). The species-effort curve for amphibians showed a distinct asymptote whereas the species-effort curve for reptiles was not able to achieve the same trend of leveling off which may indicate the insufficiency of the preliminary assessment to document all reptilian species occurring within TVPL. We presume that if additional herpetofaunal surveys are to be done in this area, these efforts will not only reveal reptilian species that are not included in this preliminary report, but might also unveil newly discovered species which have a potential to be endemic to the Taal area, the island of Luzon, or to the Philippines. Furthermore, although the species-effort curve of amphibians is seen to have leveled off, the number of conducted field surveys (4 series of surveys) as well as of municipalities (3 municipalities) covered in this study makes it insufficient for concluding that our study had encompassed all amphibian species present in TVPL.

The distribution of *P. sinensis* is likely to be found in 3 municipalities around Lake Taal, namely Talisay, Mataas na Kahoy, and Balete. From the 21 turtles collected, 13 were caught from Mataas na Kahoy, 5 from Balete and 3 from Talisay. The movement of the spread was observed to move southeast to the municipalities of Balete and Mataas na Kahoy. The aquaculture inventory conducted by BFAR in 2010 shows that Mataas na Kahoy and Balete have a limited count of aquaculture structures (0 and 29 respectively). Thus, this may not be the factor for the spread of the species around the vicinity of the lake. Gut analysis showed remnants of fish and insects but the turtles are predominantly carnivorous in nature. Given its status as a recently introduced species (Diesmos et al., 2008), little to no information is known regarding *P. sinensis* in the Philippines, more so on those found around the lake.

Table 1. 12 Study sites in TVPL, Batangas Province

Site No.	Location	Natural Habitat	Artificial Habitat	Microhabitat	Remarks
1	Tambo, Brgy. Maria Paz	primary growth secondary growth coastal area		water hyacinths large rocks	anthropogenic disturbance cut trees and lumber
2	Sitio Kay Matanda, Brgy. Nangkaan	riparian forest dried streambank secondary growth	residential area fish pond	decaying fruits on ground mossy rock formations	
3	Munting Ilog, Brgy. Kinalaglagan	river	residential area	rocky riverbed	variety of plants
4	Sitio Kay Romandan, Brgy. Nangkaan	dried river secondary growth riparian forest		rock formations	variety of trees and plants (coffee, mango, coconut trees; lipa plants) presence of trash
5	Romandan Falls, Manggahan	river falls		leaf litter decaying logs	coconut trees variety of plants presence of trash
6	Palsara River, Brgy. Palsara	river	residential area		variety of plants
7	Sitio Tuuran, Brgy. Calauit	volcano secondary forest dry river	residential area	high parched wall rocks on the ground leaf litter	presence of high bushes and weeds few trees presence of burnt wood presence of animals (goats, dogs)
8	Taal Volcano, Crater Lake, Brgy. Calauit	volcano	school		variety of plants and trees (bamboo trees) dry grass and weeds
9	Bubuin Island	coastal area primary forest		rock formations	
10	Napayung Island		residential area		site for development anthropogenic disturbance
11	Taal Lake Conservation Center, Brgy. Kinalaglagan	coastal area	highly developed area residential area		abundance of trees and water hyacinths
12	San Sebastian				visited by our fellow undergraduates

Table 2. Sampling locations with corresponding GPS coordinates, elevation, and sampling date

Site No.	Location	Municipality	GPS Coordinates	Elevation (m)	Date
1	Tambo, Brgy. Maria Paz	Tanauan	N 14°02'21.6" E 121°03'43.4"	7 m	May 21-23, 2015
2	Sitio Kay Matanda, Brgy. Nangkaan	Mataas na Kahoy	N 13°58'58.34" E 121°04'57.3"	32 m	July 15 and 18, 2015
3	Munting Ilog, Brgy. Kinalaglagan	Mataas na Kahoy	N 14°00'38.8" E 121°05'38.8"	33 m	July 16, 2015
4	Sitio Kay Romandan, Brgy. Nangkaan	Mataas na Kahoy	N 13°59'0.57" E 121°05'09.6"	100 m	July 17, 2015
5	Romandan Falls, Manggahan	Mataas na Kahoy	N 13°37'47.4" E 121°04'57.2"	32 m	November 21, 2015
6	Palsara River, Brgy. Palsara	Balete	N 14°00'53.9" E 121°05'49.9"	10 m	August 29, 2015
7	Sitio Tuuran, Brgy. Calauit	Balete	N 14°00'45.7" E 121°00'52.8"	28 m	August 30, 2015
8	Taal Volcano, Crater Lake, Brgy. Calauit	Balete	N 14°00'28.8" E 121°00'49.6"	126 m	November 20, 2015
9	Bubuin Island	Tanauan	N 14°01'82.3" E 121°01'79.1"	11 m	November 21, 2015
10	Napayung Island	Tanauan	N 14.030398° E 121. 042888°	-	November 21, 2015
11	Taal Lake Conservation Center, Brgy. Kinalaglagan	Mataas na Kahoy	N 14°00'35.0" E 121°05'37.1"	14 m	May 21-23 July 16 and 18 November 20 and 21, 2015
12	San Sebastian	Balete	N 14°01'25.45" E 121°03'50.27"	-	September 25, 2015

Conclusions and Recommendations

This preliminary herpetofaunal survey provided 24 newly recorded species of amphibians and reptiles occurring within TVPL. The species-effort curve for reptiles lacks an asymptote, implying that additional efforts are likely to unfold more undocumented species not covered in this survey. The presence of the introduced *Pelodiscus sinensis* turtle in several sites within the lake is also noteworthy because of its highly invasive nature. The spread of the species must be given importance and immediate notice. We highly encourage future researches to provide an assessment of the herpetofaunal diversity of those municipalities within TVPL that were not covered by this study, focusing especially on the diversity of reptiles. This can provide information needed for reassessing the diversity estimate of the area as well as the abundance of these amphibians and reptiles. Also, future research efforts are important in discovering other ecologically important species that may be present in the area. With a more adequate knowledge on the herpetofaunal diversity of TVPL, the researchers expect that this information can contribute to more carefully planned conservation efforts for these species within the Taal Volcano Protected Landscape.

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