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Reptile diversity in Mt. Matutum Protected Landscape, South Cotabato, Philippines

Olga M. Nuñeza[1*], Maria Luisa P. Non[2], Edna P. Oconer[2], Maximo C. Aljibe[3]

[1]*Department of Biological Sciences, Mindanao State University, Iligan Institute of Technology, Iligan City, Philippines*

[2]*Department of Biology, Mindanao State University, General Santos, General Santos City, Philippines*

[3]*Commission on Higher Education, Koronadal City, Philippines*

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Abstract

Reptiles are highly diversewith high percentage of endemism in the Philippines. However, reptile diversity in Mindanao, the second largest island in the country,is poorly known. To determine the species richness, diversity, endemism and conservation status of reptiles, this study was conducted from August to December 2013in six sampling sites of Mt. Matutum Protected Landscape (MMPL), South Cotabato.Cruising methodwasdone in the six sampling sites of MMPL. Paleontological Statistics Software Package (PAST) version 3.06 was used to determine the biodiversity indices, similarity index, and Kruskal-Wallis test. Thirteen species of reptiles belonging to five families and 11 genera with percentage endemism of46.15% were documented. High species diversity of reptiles with more or less even distribution was recorded in MMPL. Among the sampled sites, sampling site 1, a disturbed lowland dipterocarp forest had the highest species diversityand endemism.*Sphenomorphusvariegatus w*as the most abundant species. *Tropidophoruspartelloi*, the only Mindanao Island endemic species was only found in the disturbed and undisturbed montane forests. Most of the documented species were under the Least Concern status. Bray-Curtis cluster analysis showed that sites 2 and 5 had the highest similarity percentage (68%) while Kruskal-Wallis test showed no significant difference between samples in disturbedand undisturbed sites. Threats to the reptiles of MMPL were observed to be the conversion of forest to farmland and hunting thus implying the need for protection of habitats and conservation of species in MMPL.

***Corresponding Author:** Olga M. Nuñeza ✉ olgamnuneza@yahoo.com

Introduction

Reptiles play a major role in ecological food webs, as both predators and prey (Marks, 2006). They are also sensitiveto habitat disturbance and because of their close contact with air, water, and soil, they are considered as good indicator of environmental health (Marks,2006). There are more than 10, 000 recorded species worldwide (Uetz, 2015) and are especially abundant in the world's tropical, sub-tropical, and warm temperate countries (Lambert, 2002).However, amphibians as well as reptile species are threatened worldwide and are declining rapidly (Stuart *et al.,* 2004) due to deforestation which lead to habitat loss, pollution, overexploitation (e.g., over-harvesting for commercial purposes, illegal wildlife trade), and introduction of invasive species (Heaney and Regalado, 1998; Diesmos*et al.,* 2006; Mallari*et al.,* 2011). These areparticularly observed in tropical environments where biodiversity and biomass arehigher (Romero, 2012) thus requiring monitoring of all reptile communities (Hutchens and DePerno, 2009).

The Philippines, a tropical country,is home to a diverse assemblage of amphibians and reptiles with high level of endemicity and is recognized as one of the most important centers of herpetofaunal diversity in Southeast Asia (Diesmos*et al.,*2002). For reptiles alone, the country has 258 species composed of six terrestrial turtle species, five species of marine turtles, 124lizard species, 106 species of terrestrial snakes, 15 species of marine snakes,and two crocodile species.One hundred seventy species or 66% are endemic (Diesmos*et al.,*2002) and about 75% species are tropical rain forest-associated that are highly dependent on forest microhabitats (Alcala *et al.,* 2006).Several studies demonstrated the rich diversity of reptiles in the Philippines.Devan –Song and Brown (2012) recorded 41 species of reptiles in Subic Bay and suggested that establishment of protected areas in the province is important for future conservation priority. Brown *et al.* (2013) documented 71 species of reptiles in northern Sierra Madre Mountain Range and found that there are some recorded species that have unresolved taxonomic issues.Brown *et al.*(2012) documented58 amphibian and reptile species inIlocos Norte Province and found that the herpetofauna still remains poorly understood, providing opportunities for future research and conservation efforts. Other studies which also showed reptilediversity in the country were by Brown *et al.*(2010); Brown *et al.*(2007); Linkem*et al.*(2010); Oliveros*et al.*(2011); Siler *et al.*(2011); Welton*et al.*(2010).

Recently, two new species of water monitor lizards (*Varanusdalubhasa*and *Varanusbangonorum*) were discovered by Dr. Rafe Brown and colleagues in Manila's wide-ranging black market (Siler *et al.,* 2014; Lynch, 2015) indicating that the country's reptilian species diversity still remains underestimated.The high diversity of reptile species in thecountry is due to its archipelagic composition and location (i.e. its proximity to the equator), its intrinsically small landmass,and its tropical climate which enable various forms of life and entire ecosystems to flourish across its 7,000-plus islands (Foundation for the Philippine Environment, 2014). However, the Philippine reptiles as well as the amphibians face severe environmental threats(Diesmos*et al.,* 2002; Beukema, 2011) such as loss and alteration of forests through logging and conversion of land for agriculture (Mallari*et al.,* 2011) making the country one of the biodiversity hotspots in the world (Myers *et al.,* 2000) and among the top priorities for land vertebrate conservation (Brown *et al.,* 2012).Thus,a comprehensive overview(Beukema, 2011) and biodiversity surveys are important to assess the species present particularly in those areas in the country that have poor reptilian record in order to take proper action for conservation and protection of this faunal group.

There are only few published studies in Mindanao, the second largest island of the country on the diversity of reptiles leaving significant research gaps (Beukema, 2011)considering that numerous taxa are expected to await discovery (Delima*et al.,* 2006).The recent published workson reptiles of Mindanao are by

Relox*et al.* (2010) in Mt. Hamiguitan, Nuñeza*et al.* (2010) in Mt. Malindang, Beukema (2011) in Mt. Kitanglad Range, Nuñeza*et al.* (2012) in Mt. Diwata Range, Nuñeza*et al.* (2015b) in Northern Mindanao and Nuñeza and Galorio (2015) on Siargao Island.However, further studies are needed especially in the forested areas of Mindanao because habitat destruction in this region remains a major threat to its herpetofauna (Beukema, 2011).

Mt. Matutum, a protected landscape located in Mindanao hosts diverse plant and animal species including the Philippine Eagle (Rebollido, 2009) and is part of the National Integrated Protected Areas System (NIPAS) (Philippine Information Agency, 2011). However, there are only limited data on the biodiversity of fauna in Mt. Matutum and the only published studies are by Garciano*et al.* (2014) on the species richness of spiders and Nuneza*et al.* (2015a) on the species diversity of bats. In addition,conversion of forest to farmland and hunting are the threats observed in Mt. Matutum (Nuñeza*et al.,* 2015a) which are the most common causes of habitat loss in the wild (Green, 2013) and could threaten the faunal resources. In particular, no published data on reptiles are available for Mt. Matutum indicating the need for such study in this protected area.Thisresearch aimed to assess the species richness, diversity, endemism, conservation status,and threats to thereptiles of Mt. Matutum Protected Landscape (MMPL), South Cotabato.

Materials and methods

Sampling Area

The research was conducted in Mt. Matutum, South Cotabato (Fig. 1).

Fig. 1. Map of the world (A) and Philippines (B) showing the location of Mt. Matutum Protected Landscape and Seascape in South Cotabato (C) (www.google.com.ph, 2015).

It is located in the southeastern part of Mindanao, making a huge part of South Cotabato and portions of General Santos City and the provinces of Sarangani and Davao del Sur, known as SOCCSKSARGENregion. Six sampling sites were sampledwhere three samplingsites at different elevation (lowland dipterocarp, montane, and mossy forests) were considered as disturbed sites while the other three sites were considered as undisturbed sites.

Sampling Sites

Sampling site 1,a disturbed lowland mixed agricultural and secondary forest with an elevation range of 500-800 meters above sea level (masl) was located in Upper Linan, Tupi, South Cotabato. Sampling was conducted on August 19-23, 2013. Soil is loamy with thin leaf litter.

Bodies of water like river and stream were observed in the area. Dominant understory flora was "malaropit" (*Elaeocarpus spp*.) while dominant tree was "Buyo-buyo" (*Piper arborescens*). Emergent trees were *Ficusulmifolia* and *Erythrinasubumbrans*. Thissampling site is adjacent to an orchard dominated by durian at its fruiting season, corn fields ready for harvesting, and coffeeplants.

Sampling site 2, a disturbed montane secondary growth forest with elevation ranging from 1323masl to 1370masl was located in Glandang, Tupi, South Cotabato(6˚21'4.1"N, 125˚3'39.6"E). Sampling was conducted on October2-8, 2013. Soil is loamy with dense cover of leaf litter, approximately 1.5 inches thick with surface litter at initial stage of decomposition. Presence of small spring with water deposition in the pond was observed. Dominant understory plant observed was "osmunda" (*Calamusornatus*) while dominant tree was "anislag" (*Securinegaflexuosa*). Emergent tree is White Lauan (*Shoreacontorta*). Coffee was the most dominant fruiting plant in the area.

Sampling site 3, a disturbed mossy forest at elevation of 1600masl- 1714 masl was located at Glandang, Tupi (6˚21'48"N, 125˚4'15"E). Sampling was conducted on December 2-6, 2013. Soil is loamy. A wide bare ground covered approximately 25% of the sampling area while 25% of the forest floor has dense leaf litter of about 1 to 2 inches thick. Abundance of fallen logs with more than 10 cm diameter was observed. Dominant understory plant observed was *Pteridum sp*. while the most dominant and emergent tree was "igim" (*Dacrycarpusimbricatus*). Epiphytes like ferns and wild coffee seedlings were plentiful in the area.

Sampling site 4,an undisturbed lowland mixed agricultural and secondary forest with elevation of 987- 997masl was located in SitioKawit, Barangay Maligo (6˚20'39.4"N, 125˚6'5.3"E), Polomolok,South Cotabato. Sampling was conducted on September 9-15, 2013. Substrate is loamy with thin leaf litter. Small riverine system near the lowest elevated sampling station was observed. Dominant understory plant observed was *Impatiens platypetala* while dominant treewas "anabiong" (*Tremaorientalis*) and "buyo-buyo" (*Piper arborescence*). Emergent tree species was "taluto" (*Pterocymbiumtinctorium*). Few durian trees, other fruit trees,corn, and squash vines were observed.

Sampling site 5,an undisturbed montane secondary growth forest with an elevation of 1325 masl-1339 maslwas located in SitioKawit, Barangay Maligo, Polomolok, South Cotabato (6˚21'9.9"N, 125˚4'15"E). Sampling was conducted on October 13-17, 2013. Soil is loamy with dense cover of leaf litter approximately 1.5inches thick with surface litter at initial stage of decomposition. Dominant understory plant observed was *Calamusornatus* while dominant tree species was *Securinegaflexuosa*. Emergent trees observed in the area were "agoho del monte" (*Gymnostomarumphianum*) and "igim" (*Dacrycarpusimbricatus*).

Sampling site 6,an undisturbed mossy forest with an elevation of 1612 masl -1719 masl was located at SitioKawit, Barangay Maligo, Polomolok, South Cotabato (6˚21'21.1"N, 125˚5'8.0"E). Sampling was conducted on December 9-13, 2013. Leaf litter was very dense, approximately more than 2 inches thick with surface litter at initial stage of decomposition. A large part of the area was covered with bryophytes. Dominant understory plants observed were "lagulo" (*Blechnumegregium*) and "pandanbaging" (*Freycinetia maxima*) while the dominant and emergent tree species in the area was "igim" (*Dacrycarpusimbricatus*). Bryophytes were abundant on the barkor trees. Dead trees were also observed.

Collection of samples, processing, and identification

Reptile survey was done using the cruising method. Cruising method involves walking through the study area without predetermined path and searching for reptiles in various microhabitats (Alcala, 2009). Fallen logs, shrubs, tree holes, forest floor, shrubs, ferns, and other various microhabitats of reptiles were searched. All reptiles encountered within the sampling area were collected. Collection of reptiles was done during their most active time at 0900hrs to 1200hrs and continued to 1300hrs-1600hrs.Reptiles that were caught were immediately released after morphometricsand photos were taken. Significant traits such as color, head shape, snout shape, bands, or collars were also noted. Identification of specimen was based on the works of Brown *et al.* (2012; 2013) and the Photographic Guide to Amphibians and Reptiles of Mindanao, Philippines by Nuñeza(2012). Dr. Arvin Diesmos of the Philippine National Museum verified the species identification. The distribution and conservation status of reptiles was based on the IUCN Red List of Threatened Species (2015).

Data analysis

Paleontological Statistics Software (PAST) version 3.04 was used to obtain biodiversity indices, cluster analysis, and Kruskal-Wallis test.

Results and Discussion

Species Richness, Abundance, and Endemism

Thirteen species of reptiles belonging to five families and 11 genera were recorded in Mt. Matutum Protected Landscape, South Cotabato (Table 1).

Table 1. Species composition, distribution and conservation status, and abundance of reptiles in the six sampling sites of Mt. Matutum Protected Landscape, South Cotabato, Philippines.

Scientific Name	Conservation Status	Distribution	Disturbed Sites			Undisturbed Sites			Total
			Site 1 Lowland Dipterocarp forest (500-800 masl)	Site 2 Montane Forest (1,323 -1,370 masl)	Site 3 Mossy Forest (1600 -1,714 masl)	Site 4 Lowland Dipterocarp forest (987-997 masl)	Site 5 Montane Forest (1325 -1339 masl)	Site 6 Mossy Forest (1612 -1719 masl)	
Family Agamidae									
Gonocephalussemperi (Mindoro Forest Dragon)	DD	PE	1 (11.11)	0	0	0	1 (25)	0	2 (9.52)
Family Colubridae									
Ahaetullaprasina (Asian Vine Snake)	LC	NE	1 (11.11)	0	0	0	0	0	1 (4.76)
Boigaangulata (Philippine Blunt-headed Tree Snake)	LC	PE	1 (11.11)	0	0	0	0	0	1 (4.76)
Dendrelaphiscaudolineatus (Stripe BronzebackSnake)		NE	1 (11.11)	0	0	0	0	0	1 (4.76)
Psammodynastespulverulentus (Common Mock Viper)		NE	1 (11.11)	0	0	0	0	1 (50)	2 (9.53)
Family Elapidae									
Najasamarensis (Samar Cobra)	LC	PE	0	0	0	1 (25)	0	0	1 (4.76)
Family Gekkonidae									
Cyrtodactylusannulatus(Small Bent-toed Gecko)	LC	PE	0	1 (50)	0	0	1 (25)	0	2 (9.53)
Family Scincidae									
Brachymeles spp. 1			0	0	0	1(25)	0	0	1 (4.76)
*Brachymeles*spp. 2			0	0	0	1(25)	1(25)	0	2 (9.53)
Eutropisindeprensa(Brown's Mabuya)		NE	1 (11.11)	0	0	0	0	0	1 (4.76)
Sphenomorphusfasciatus (Banded sphenomorphus)	LC	PE	2 (22.22)	0	0	0	0	0	2 (9.53)
Sphenomorphusvariegatus (Black-Spotted Sphenomorphus)		NE	1 (11.11)	0	0	1(25)	0	1 (50)	3 (14.29)
Tropidophoruspartelloi(Partello's Waterside Skink)	LC	MIE	0	1 (50)	0	0	1 (25)	0	2(9.53)
Total Number of Individuals			9	2	0	4	4	2	21 (100)
Total Number of Species			8	2	0	4	4	2	13
Total Number of Endemic Species			3	2	0	1	3	0	6

Legend:DD - Data Deficient; LC - Least Concern; NE - Non –endemic; E – Endemic, PE - Philippine Endemic; MIE – Mindanao Island Endemic, ( ) –Relative Abundance.

This result is higher than the recorded number of reptile species in Mt. KitangladRange byBeukema (2011), in Sarangani Province and Lanaodel Sur by Belleza and Nuñeza(2014) and on Siargao Island Protected Landscape and Seascape by Nuñezaand Galorio (2015). However, this result was lower than the recorded number of reptile species in Northern Cordillera Mountain Range by Brown *et al.*(2012), in Mt. Diwata Range by Nuñeza*et al.*(2012), and in Mt. Hamiguitan by Relox*et al.*(2010).In this study, sampling site 1, a disturbed lowland dipterocarp forest had the highest number of species (S=8) and abundance.

Table 2. The biodiversity indices of the six sampling sites of Mt. Matutum Protected Landscape.

	Disturbed Sites				Undisturbed Sites				Over-all Total
	Site 1 Lowland dipterocarp Forest	Site 2 Montane Forest	Site 3 Mossy Forest	Total	Site 4 Lowland dipterocarp Forest	Site 5 Montane Forest	Site 6 Mossy Forest	Total	
Species richness	8	2	0	10	4	4	2	8	13
Number of individuals	9	2	0	11	4	4	2	10	21
Dominance	0.1358	0.5	0	0.1047	0.25	0.25	0.5	0.14	0.08844
Shannon diversity	2.043	0.6931	0	2.272	1.386	1.386	0.6931	2.025	2.491
Evenness	0.9644	1	0	0.9698	1	1	1	0.9473	0.9292

The high species richness and individuals in sampling site 1 could be due to its low elevation, the presence of bodies of water like rivers and stream, its loamy soil, the presence of leaf litter and the partially open canopy which allows sunlight to pass through. The study of Beukema (2011) and Relox*et al.* (2010) also found high species richness and diversity of reptiles in the lowland area of Mt. Kitanglad and Mt. Hamiguitan, respectively. Alcala (1986) also found that reptiles prefer lowland elevated areas. According to Relox*et al.*(2010), reptile richness and diversity decline as elevation increases specifically at cool higher elevations. This was also the same observation in Mt. Matutum.Low-elevation areas support large population of insects which could serve as food for some reptile species (Angell *et al.,* 2013). Marks (2006)reported that reptiles require thermal gradients ranging from cool shelters to warm basking areas that receive exposure to full sunand these requirements are shown in site 1 which explains the high species richness and abundance in site 1.Furthermore, the loamy soil, fallen leaves, crevices, and rotting logs which are also present in the sampling site 1 serve as microhabitats of reptiles.

Table 3. Kruskal-Wallis testbetween disturbed and undsiturbed sites in Mt. Matutum.

Test	Kruskal-Wallis Test		Interpretation
	H (chi 2)	P (same)	
Species Diversity	4.714	0.4159	No significant difference between sample
Evenness	3.571	0.4159	No significant difference between sample

Reptiles unlike amphibians can survive in man-made microhabitats and can withstand drier areas better than amphibians (Alcala *et al.,* 2006) which could also be the reason for the richness of sampling site 1 despite being a disturbed site.

Sampling site 4, an undisturbed lowland dipterocarp forest and site 5,an undisturbed mossy forest were second in species richness (S=4) and abundance. Most of the recorded reptile species in these two sites are Philippine endemic which is expected since endemic reptiles require a habitat that is not disturbed although some species can toleratedisturbance. Reptiles were absent in sampling site 3, a disturbed mossy forest.According to Wathen*et al.* (2014) reptiles have their highest species richness values at low elevation and in undisturbed areas.

*Sphenomorphusvariegatus*commonly known as Black-Spotted Sphenomorphusis the most abundant and widespread reptile species in MMPL. This species was encountered in sampling sites 1, 4, and 6 and is commonly found in rotten logs and leaf litter which serve as their microhabitat. The same result was also obtained by Lubis*et al.* (2008) where *S.variegatus* was the most abundant and widespread species in the six sampling sites they sampled in Indonesia. Smith (1993) found this species to be common in diurnal leaf-litter of the primary forest. Furthermore, *S.variegatus*was recorded in the disturbed lowland diptecorap forest and montaneforest of Mt. Hamiguitan(Relox*et al.,*2010).

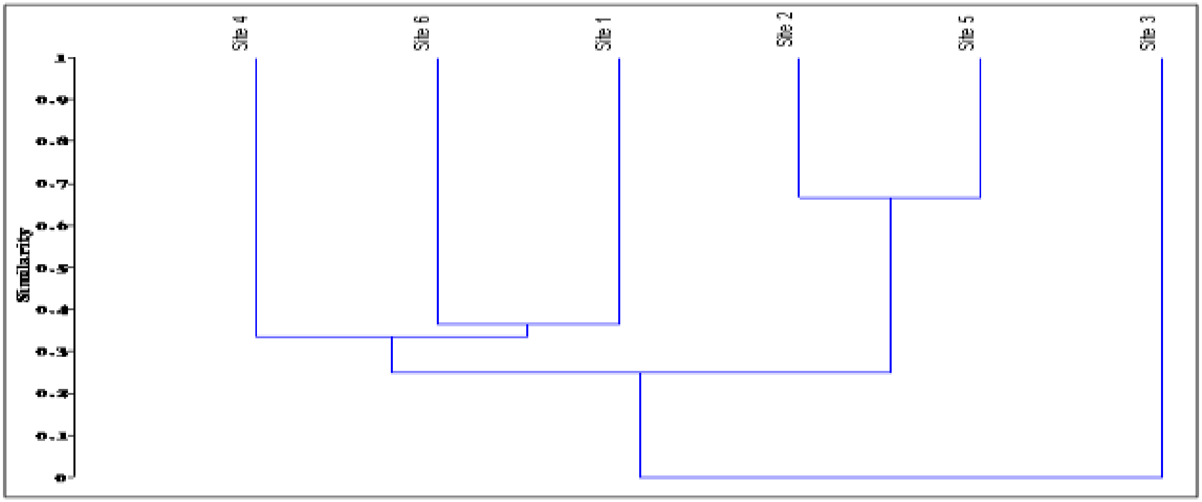

Fig. 2. Cluster analysis (Bray-Curtis: Single Link) of reptiles in the six sampling sites of Mt. Matutum.

The Mindanao Island endemic species, *Tropidophoruspartelloi* (Partello's Waterside Skink) was only found in the disturbed and undisturbed montane forests of sampling sites 2 and 4, respectively.The presence of*T. partelloi* in sites 2 and 4 could be due to the presence of water system. According to the United States Environmental Protection Agency (2003) the presence of water bodies in the area could serve as a primary habitat for reptiles, supplying an ample source of food and serving as habitat as well as breeding and nursingsite. Moreover, the presence of dense leaf litter cover, logs and loamy soil in the two sites which could serve as the skink's microhabitat and hiding place could also be one of the reasons for its presence. This observation concurs with the findings of Brown and Alcala (1980) that this species could be found from damp soil under logs or rocks in tropical moist forest. This species was also recorded by Beukema (2011) in the primary forest of Mt. Kitanglad.

Diesmos and Demegillo (2009) reported that *T. partelloi* is not known to adapt to habitat modification but in this study it was found to be present in the disturbed site. The two species,*Brachymeles*spp. 1and *Brachymeles*spp. 2were only found in the undisturbed sites of MMPL but not in site 6 where elevation is high.

The Philippine endemic species, *Najasamarensis*(Samar Cobra) was only found in site 4, an undisturbed lowland dipterocarp forest. This species was also recorded by Middeljans (2014) in the mangrove forest of Abatan River in Lincod, Bohol.Sy*et al.*(2009) reported that *N. samarensis*has a wide range of habitats from tropical moist forest to various modified habitats including rice fields and coconut groves and is locally threatened through direct persecution and collection for traditional medicinal use and food. This indicates that the absence of this species in other sampled sites could be due to hunting and conversion of forest to farmland which were documented in the area.

Six endemic reptile species (46.15% endemism) of which five are Philippine endemic and one Mindanao Island endemic were recorded in MMPL. Sites 1 (lowland dipterocarp forest) and 5 (montane forest) had the highest number of endemic species whileno endemic species was found in sites 3 and 6(mossy forest). The same result was obtained by Relox*et al.*(2010) in Mt. Hamiguitanwhere there were more endemic reptile species in lowland dipterocarp forest and montane forest. On the other hand, the absence of endemic species in sites 3 and 6 could be due to the high elevation of the areaespecially in site 3 were the site is already disturbed. According to Sanchez-Gonzalez and Lopez-Mata(2005), the presence and distribution of species on mountains are influenced mostly by the decrease in temperature resulting from increasing elevation, precipitation patterns, and soil type. Moreover, environmental conditions might be more favorable for life at low to middle elevations, thus allowing for a greater number of species to exist there, but that fewer species can persist under harsher conditions at higher elevations (Williams *et al.,*2005).Most of the documented reptiles are considered Least Concern by IUCN Red List of Threatened Species(2015).

Biodiversity Indices

High species diversity (H'=2.491) with more or less even distribution (E=0.9292) was recorded in MMPL (Table 2). Site 1, a disturbed lowland dipterocarp forest had the highest diversity (H'=2.043) among the sampled sites. The leaf litter cover, vegetation structure, a relatively high temperature,and the partially open canopy in site 1 could be the factors for its high species diversity. According to Edgar *et al.*(2010) reptiles do not raise theirbody temperatures by metabolic processes, but instead rely on the external environment, which they can use to maintain relatively high temperatures when they are active. They also need diverse vegetation structure, creating open areas and nearby cover, to provide protection from predators (Edgar *et al.,*2010) which are all seen in site 1. Furthermore, the absence of reptiles in site 3 could be due to its high elevation, low temperature,and degree of disturbance in the area. According toTheisinger and Ratianarivo (2015) reptile species richness and diversity decrease with increasing degradation.The other sites with low reptile species diversity have different habitat requirements (Glaw and Vences, 2007)and sensitivity to habitat modification (D'Cruze and Kumar, 2011). McCain (2010) and Kryštufek*et al.*(2008) found that species diversity and richness of reptiles gradually decline as elevation increases since temperature also decreases.Sites 2 and 6 had the highest dominance index value of 0.5 which indicates that there aredominant species (*Cyrtodactylusannulatus* and *Sphenomorphusvariegatus*) inhabiting the area. Gaines *et al.* (1999) reported that dominance is an index of vegetation type composition and equitability, thus the type of vegetation structure in the area which is a montane forest could be the factor for the presence of dominant species.

Similarity of Sites

Fig. 2 is the cluster analysis showing the similarity of the six sampling sites in Mt. Matutum Protected Landscape. Sampling sites 2 (disturbed, lowland dipterocarpforest) and 5 (undisturbed, montane forest) formed the first clade with the highest similarity of 68% which means that these two sites share mostly the same reptile species. This might be because sites 2 and 5 almosthavethe same habitat characteristics such as soil type which are both loamy, the dense leaf litter cover of approximately 1.5inches thick with surface litter at initial stage of decomposition,and the presence of the samedominant understory plant species and elevation. This result coincides with the observation of Tubelis and Cavalcanti (2001) thatsites having a high percentage of similarity could have similar type of habitat and has a tendency of having similar species composition.The Philippine endemic, *Cyrtodactylusannulatus*and the Mindanao Island endemic, *Tropidophoruspartelloi*are the species shared by sites 2 and 5. According to Brown and Rico (2009), *C. annulatus* hasa wide variety of microhabitats, including detritus on the forest floor, under rotten logs in forests, beneath bark and on the surface of stumps, and living trees which are the observed microhabitats in the sampling sites where this species was found. Sites 1 and 6 formed the second clade having a similarity of 38% due to the presence of shared species, *Psammodynastespulverulentus*and *Sphenomorphusvariegatus*. Site 4, an undisturbed lowlanddipterocarp forest clustered with sites 1 and 6 due to the presence of *Sphenomorphusvariegatus,* theshared species of the three sites.

Kruskal-Wallis test showedno significant difference between disturbed and undisturbed sites in terms of diversity and evenness in Mt. Matutum (Table 3). This indicates that reptile species in Mt. Matutum inhabit both disturbed and undisturbed sites and have high tolerance to habitat disturbance.

Existing local Threats in Mt. Matutum

Huntingand habitat loss due to conversion of forest to farm land were the threats to the reptile species in Mt. Matutum Protected Landscape. It was found that hunting of wildlife in MMPLappears to be a source of livelihood for some locals inhabiting the area. This finding concurs with the study conducted by Nuneza*et al.* (2015a) also in Mt. Matutumwhere local accounts revealed that batsand other non-volant mammals are hunted as source of food and few species are sold in the market as traditional medicine. Moreover, hunting of wildlife is due to the social and cultural reasons for many tropical forest people (Bennett and Robinson, 2000). Conversion of forest to farmland which leads to habitat loss is also one of the most common anthropogenic activities that affect the distribution of reptile speciesin the area. This indicates that continuous hunting of wildlife and conversion of forest to farmland could lead to the decrease of population of a certain group or speciesin the area (Conover, 2001).

Conclusion

Low species richness of reptiles but high species diversity of reptiles was recorded in Mt. Matutum Protected Landscape. Sampling site 1, a disturbed lowland dipterocarp forest had the highest species richness, diversity, abundance, and endemism. The most abundant species was *Sphenomorphusvariegatus* while the only Mindanao Island endemic species, *Tropidophoruspartelloi*was only found in disturbed and undisturbed montane forests of MMPL. Conversion of forest lands to farms lands which leads to habitat loss and hunting of wildlife are the existing local threats to reptile diversity indicating the need strengthen protection of Mt. Matutum Protected Landscape.

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