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Assessment of Faunal Diversity on Selected Caves of the Northern Sierra Madre Natural Park (Nsmnp), Nothern Cagayan Valley, Philippines

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Abstract One of the unique features of the Northern Sierra Madre is the presence of many cave formations (Maus & Schieferli, 1989). There are more than 200 cave systems that include the nationally renowned Callao Caves Resort (PPLS, 2004). Of these caves, a number are accessible to local people and are open to tourists. However, many of these caves are subjected to different man-induced disturbances like guano extraction, treasure hunting, wildlife hunting and gathering and vandalism, conversion of some caves as potential for international tourism and many other illegal activities. Climate change which maybe manifested through occurrence of prolonged dry season and unusually high volume of rainfall is also recognized as important threats to the diversity of cave dwelling organisms. Results of the study could serve as a basis for resolving conflicts on applied policies as to conservation and protection of ecologically significant wildlife and to recommend possible, workable and simple resolution of unsolved issues regarding conservation and protection. Results revealed a variety of species in the selected caves of the NSMNP, of around 25 species of bats (Order Chiroptera), 2 species of cave birds (Class Aves); 6 species of reptiles (Class Reptilia, 5 species amphibians (Class Amphibia) and 28 species of macroinvertebrates belonging different classes. Many of which are least common, vulnerable and nearly endangered base on IUCN (2004 & 2008). The data were counter checked to validate the existence of the previously identified fauna as reported by the Philippine Biogeographic Conservation Priority Program for Luzon (2004). New findings revealed the occurrence *Platymantis* spp. in the area, was the first ever reported after several inventories made. In terms of environmental assessment, base on actual observations and analysis, the loss of habitat resulted from higher species migration of cave dwelling animals are due to unabated human activities as mentioned earlier. This has not yet been fully recognized- and if no attention can be made the soonest possible time, great potential effect on the ecological set up will be experienced, forcible migration among fauna and eventually their extinction will be uncontrollable. No extensive studies have been made on amphibians, mammals and reptiles, existing records and the results of this study show however that these caves support unique species of these kinds. It is recommended that there is a need to review existing policies on the conservation and protection of cave dwelling organisms, specifically

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the role of the stakeholders to include indigenous people and local residents on the implementation of policies.

Keywords: Chiroptera, Amphibia, Aves, *Platymantis* spp

Introduction

Scientists estimate that between 3 to 30 million different species inhabit the earth. So far 1.7 million species have been identified (Baker, *et al,* 1985). Additional wild species not yet studied by science may have potential sources of valuable products, if immediate prevention can be made before their destruction and extinction. Through species extinction, unique and complex characteristics maybe permanently lost. Natural causes of wildlife destruction include evolutionary replacement and mass extinction which had opened niches, allowing for evolution and new growth. Hence human are now causing a species extinction that could have disastrous consequences.

According to Philippine Biogeographic conservation Priority Program there were around 41 species of amphibians in Luzon, 31 are endemic, 27 of which came from the Sierra Madre Mountain ranges of around 12 endemic species, 15 species were found at Penablanca with 4 endemic species; reptiles of about 126 species with 77 endemic in Luzon, 63 species came from Sierra Madre with 24 endemic species, 10 identified from penablanca 5 being endemic; mammals of 90 with 42 endemic, 64 from SMNP with 30 endemic and lastly 21 species in PPLS, none was found to be endemic. Reports also included 5 mammals which are vulnerable and endangered, 2 species of reptiles which are critically endangered and endangered; 6 species of frogs which are vulnerable and endangered17 species of birds which are critically endangered, endangered and vulnerable (IUCN 2004). No extensive studies have been made on amphibians, mammals and reptiles, however, existing record show that the PA supports unique threatened species

Several ecosystems have been threatened to existence; among these are caves systems which have been severely damaged due to continuous access by human. Thus the purpose of the study was to mainly assess the faunal diversity of selected cave systems in the Northern Sierra Madre Mountain Natural Park and some portions of the Sierra Madre Mountain ranges. It sought to present the current inventory of wildlife, particularly the diversity of species inhabiting the systems. Results would serve as an additional information or benchmark data for database information. Likewise results would serve as a basis for conservationists to do further review on policies related to conservation and management and its implementation. And further to recommend possible and workable strategies for immediate access and adoption by the local government, local residents and the community.

No written reports have been officially made as to the declaration of exactly how many species of wildlife has been identified to date. Reports from these study were actual findings from the cave systems, aside from those previously mentioned wildlife species, found within the premises of the mountain ranges but not specific to cave systems written in literatures.

Materials and methods

Description of the areas were sourced from the Provincial Planning and Development Office and actual description of the sites were made following variables on describing habitat such as geophysical features, vegetation conditions and other parameters needed to support the study.

Field work were conducted at four selected municipalities of Cagayan Valley, along the ranges of the Northern Sierra Madre Natural Park were caves are located.

The study used the standard methodology for Land Vertebrate Field Collection Techniques by Alcala (2009) and Guide to Insect Collection Method.

For Small Mammal Sampling and Collection Technique

Mist netting was utilized in this study. This involved setting up a series of pole-mounted monofilament nets measuring 36mm (6mm x 6mm) mesh size and 12 meters long, exactly at opening of the caves. Prior to setting up the nets, a reconnaissance on the selected caves were determined as ideal sites for catching bats.

Information on collected animals were written and stored on data sheets with specified standard measurement evaluation scheme. Proper preservation on collected/trapped sample specimens was made following one- sample per species collection as standard protocol. Data gathering also involved capture-release method, for those species of known to be more than one, sample is collected and for those species believed to be few in number are mostly photographed and released.

Herpetofaunal Sampling and Collection Technique

The Cruising Method was employed in this study, consists of walking through the study area without a pre determined path and searching for amphibians and reptiles in various microhabitats. Only those amphibians and reptiles seen within the cave premises were observed and collected. When animals are seen, they were photographed on the spot and collected to serve as voucher specimens. Some where just closely observed and photographed. Standardized format for data collection was also utilized in the study. Amphibians and reptiles were searched with the aid of simple tools such as fabricated snake tongs, shovels and flour sacks. Temporarily anesthesized for purposes of getting the actual morphometric measurements and eventually subjected to proper preservation technique.

Avifaunal sampling and collection techniques

An avifaunal sampling and collection technique employed is extractive methods of sampling animals. This was done through mist netting techniques employed in A.

Macroinvertebrates sampling and collection techniques

Cruising Method was again employed on this aspect, careful scrutiny and walking within the cave sites were done. Observation and collection were done through hand- picked method and with the use of insect hand net. Macroinvertebrates were photographed on the spot were it was found. Proper collection and preservation techniques were employed. Description and size of the organisms were also conducted.

Data Analysis

Data were analyzed taxonomically using Taxonomic Key to Identification for Bats (Heaney and Ingle 1992, 2010 version), Herpetofauna (Brown and Alcala, 1978) and Key to Macroinvertebrates (Alcala, 2009- Mock Version). specimens were brought to the national museum for validation and authentication by experts.

Actual morphometric measurements of sample specimens were also utilized as basis for identification to include approximation of bat age. Standard morph metric measurements for birds, lizards, frogs, snakes and bats were employed.

Important informations from administrators, residents, hunters and gatherers were also noted and presented in anecdotal form.

Other ecological factors such as relative humidity, temperature, light, altitude, weather conditions were all included to support to the newly gathered records of faunal species. Populations of animal species were also estimated the total number of bats per square meter divided by the total area of the cave especially for bats. Man-made disturbances were also noted as basis for recommending simple and workable strategies for conservation and management for cave systems.

Results and discussion

Seven (7) cave systems along Sierra Madre Mountain ranges were the areas of the study, one (1) cave from Penablanca Seascape and Landscape park : Cabasan, Penablanca Cagayan while five (5) cave systems from the Northern Sierra Madre Natural Park : three (3) from Sta. Victoria, Ilagan, Isabela - main, moon and adventure caves; two (2) from San Pablo , Isabela - Mannanaw and Minuri Caves; and Sinabuluan (cave 1 and 2) of Dy, Abra, Tumauini, Isabela. All areas are covered by the PAMB and PAWB, but the control of the cave systems are more on the LGU Protection within the municipality.

In these cave systems, species of bats, macroinvertebrates, herpetofauna were observed. Ecological set up of the cave systems were also taken into consideration, to support the status of the fauna identified. Accessibility of these cave systems would include long hours of trail and walk. Some were accessible by smaller vehicles or by horse.

Description of Ecological Status and Conservation status of Selected Caves

The climate in the selected sites is relatively stable, dry period usually starts from January to mid July. Annual rainfall averages between 1500mm in the lowlands to 2500 mm (PPDO, 2009) in the mountain, rainy or wet season comes within mid of July and the succeeding months. Average annual temperature lies between 24-26 degrees Celsius during cold seasons and to 30 to 35 degrees Celsius and an increase of 1 degree during summer/hot seasons within the Cagayan valley. But the average temperature within the selected sites lies between 28- 30 degrees Celsius outside and 24-27 inside the caves. Typhoon may occur anytime within the year and the areas may expect at least more than 15 typhoons a year. The relative humidity is ranging from 70 to 90% within the valley, while the relative humidity of the caves ranges from 86 to 92.5% (actual reading). Cave altitudes ranging from 186 to 770 ft. above sea level.

Among the 5 selected cave systems found in Northern Sierra Madre Natural Park, 2 has been converted as tourist spots: Sta. Victoria Caves, Ilagan, Isabela and Sinabuluan Caves, Dy-Abra, Tumauini, Isabela. The rest of the selected sites are still under the protection of Barangay Officials, and is not been well known to visitors. Sta. Victoria Caves is reachable by vehicles, while the rest of the study sites: Dy Abra Caves by dam trucks and horses; San Pablo, Isabela; and Pena Blanca Cagayan are reachable by long hours of trail walk:

The caves are located in lowland forest. Vegetation is the same in all sites, mostly covered with short growth canopy, tall and short grasses, vines and mosses. All the selected sites are accessible to everyone since its locations are within the premises of cultivated agricultural lands and adjacent to it are primary and secondary forest areas.

In terms of status, as per observation, all the caves are disturbed. Climate change which maybe manifested through occurrence of prolonged dry season and unusually high volume of rainfall are also recognized as important threats to the diversity of cave dwelling organisms in the areas of study.

Faunal Diversity in terms of Kinds of Species

Order Chiroptera

The Philippine bat fauna is very diverse, with 71 species recorded, of which 24 species are endemic to the country (Heaney et el, 1997).According to Ingle, 1992 and Heaney et al 1997, studies even at the alpha taxonomy level are lacking in the country during the start of the 1990's. The continuous access to several new methods in conducting researches related to bats, may in one way or another be very significant in answering the unattended questions related to chiropterans. Through mist netting, collection and sampling of bats were successfully done. Twenty species of cave bats were identified based on the Fieldiana (Mammalian Fauna of the Philippines) Order Chiroptera and Cave bats of the Philippines by Sedlock & Ingle (2010). Morphometric values were included and other morphological characteristics were noted.

There were five (5) families of bats namely Pteropodidae with 2 species, Rhinolophidae with 6 species, Hipposiderodae with 7 species, Emballonuridae with 2 species and 4 species of Vespertillionidae. Among these species presented three (3) species still need a validation, since the species identified are not common in the area as referred to literatures and current records.

The following are the species identified based on morphometrics and other morphological charateristics: *Ptenochirus jagori* and *Haplonycteris fischeri* (Pteropodidae); *Rhinolophus arcuatus, Rhinolophus inops, Rhinolophus rufus*, Rhinolophus philipinensis, *Rhinolophus acuminatus and Rhinolophus sp. (unknown)* (Rhinolophidae); *Hipposideros diadema, Hipposideros obscurus, Hipposideros ater,, Hipposideros coronatus, Hipposideros pygmeaeus* and Hipossideros sp. (unknown)(Hipposideridae); *Emballonura alecto* and *Taphosouz melanopogon or T. philipinensis* (Emballonuridae), *Miniopterus tristis, Miniopterus australis, Myotis* *macrotarsus* and *Pipistrellus javanicus* (Vespertilionidae) (Table 1). Identification of four (4) other species of bats are still uncertain and still a subject for validation.

Table 2a. Summary of Species Identified in selected Caves of NSMNP and Conservation Status of Order Chiroptera

Species	Conservation Status
Ptenochirus jagori	Least Concern
Rhinolophus philippinensis	Least Concern
Rhinolophus arcuatus	Least Concern
Rhinolophus macrotis	Least Concern
Rhinolophus virgo	Least Concern
Miniopterus shcreibersii	Near Threatened
Hipposideros diadema	Least Concern
Hipposideros pygmeus	Least Concern
Chaerephon plicatus	Least Concern
Rhinophus acuminatus	Least Concern
Miniopterus australis	Least Concern
Miniopterus tristis	Least Concern
Hipposideros obscurus	Least Concern
Pipistrellus javanicus	Least Concern
Rhinolophus rufus	Near threatened
Rhinolophus inops	Least Concern
Haplonycteris fischeri	Least Concern
Myotis macrotarsus	Near threatened
Taphozous melanopogon	Least concern
Emballonura alecto	Least Concern
Hipposideros ater	Least Concern
Hipposideros coronatus	Data Deficient*
Rhinolophus subrufus	Data Deficient*
Rhinolophus sp.	Unknown*
Pteropus vampyrus	Common

Validated and authenticated by the National Museum - Mammalogy Division *for validation (counter checking)

Table 2b. Species of Chiropterans present on different locations

Species of Chiroptera Present in Selected Caves	
Dy Abra Caves, Tumauini, Isabela	Tabuk, Kalinga (additional data)
Miniopterus australis	Pteropus vampyrus
Ptenochirus jagori	
Hipposideros ater	
Hipposideros diadema	
Simanu Caves, San Pablo, Isabela	Limbauan Cave, San Pablo, Isabela

Miniopterus tristis *Hipposideros coronatus* *Myotis macrotarsus* *Pipistrellus javanicus* *Hipposideros diadema* *Emballonura alecto* *Taphozous melanopogon*	*Rhinolophus inops* *Rhinolophus rufus* *Rhinolophus acuminatus* *Rhinolophus sp.* *Hipposideros pygmaeus* *Hipposideros obscurus* *Haplonycteris fischeri* *Taphozous melanopogon* *Pipistrellus javanicus* *Chaerephon plicatus*
Sta. Victoria Caves, Ilagan, Isabela *Rhinolophus inops* *Rhinolohus virgo* *Rhnlolophus arcuatus* *Rhinolophus philippinensis* *Rhinolophus rufus* *Hipposideros diadema* *Hipposideros pygmaeus* *Hipposideros obscurus* *Hipposideros ater* *Taphozous melanopogon* *Emballonura alecto* *Pterochirus jagori* *Haplonycteris fischeri* *Miniopterus schreibersii* *Rhinolophus macrotis* *Rhinolophus subrufus*	Cabasan Caves, Penablanca, Cagayan *Ptenochirus jagori*

Among the identified families of bats, Rhinolophidae (6) and Hipposiderodae (7) revealed the most number of species in all study sites. The rest of the identified species were only observed to be on specific caves. It has also been observed that species of bats seen in a specific cave are most likely dominated by female bats and very few males. Most of the catches were adult. In support to the findings of BPPLS (2005), there were about 48 species of bats in the country, and confirmed 5 species within the park of Penablanca Cagayan of the Sierra Madre Mountain Ranges, which are particularly important bats to farmers as they eat agricultural pest.

Meanwhile Table 2. presents the brief summary of captured species on different study sites. These results may include additional species not recorded in the list reported by Van der Lans (2002) in his research on Caves in Northeastern Luzon, Philippines and reports by the Biodiversity of Penablanca Protected Landscape and Seascape (2005). Reports made by Heaney et al (2010) did not include however some species of bats extracted from the Cagayan valley region, only few species were noted to be included in the report, which means that the discoveries of other species of bats surviving in the locality is a new record to be included on file.

The additional species not recorded earlier are probably those that migrated from another spot within the Philippines, and or might not have been encountered by researchers during the conduct of their researches. The suspected migration, as the case maybe, might probably have a connection with current condition of the country regarding climate change. Fluctuation of weather conditions not conducive to habits of specific species might have caused their migration from one place to another.

Since more research interests on bats is increasing (Heaney & Hiedenman 1987, Heideman & Heaney 1989, Ingle & Heaney ,1992, Utzurrum, 1992, Heaney, 1986, Heaney, et al, 1998) as cited by Turner et al (2003), more work are still waiting for studies focusing diversity, distribution, composition, behavior and status of bats in the Philippines. Studies on habitat types and conservation status are very significant areas of concern to support important bat populations. Henc, initial surveys on population bat count regardless of species were employed in this study using estimates (Table 3). The hunting of bat species in certain within the region may threaten the continued existence of local populations, and laws implying protection of these animals are not explicitly implemented, other than populations living in parks and different types of reserves (Durban, 2007).

Table 3. Population Counts regardless of the number of species

Location	Population Count		
	No. of population per m^2	Total Area of Cave	Estimated Population
A. Simanu, San Pablo, Isabela (Cave 1)	20	210m	< > 4200
(Cave 2)	25	64 m	< >1600
B. Dy- ABRA, Tumauini, Isabela	50	320m	< >16000
C. Cabasan, Penablanca, Cagayan (only *P. jagori*)	15	32 m	< >480
D. Sta. Victoria, Ilagan, Isabela			
Adventure Cave	45	110m	< >4950
Moon Cave	25	90m	< >2250
Main Cave	35	54m	< >1890
E. SitioMinuri,Limbauan, San Pablo, Isabela	25	203m	< > 5075

On the other hand, macroinvertebrates were also observed in the cave system, mollusks are most likely to be the most common macroinvertebrates, followed by 3 species of crickets (Order Orthoptera- Family Gryllidae) and 7 species spiders (Class Arachnida), 2 species ants (Order Hymemoptera- Family Formicidae), 2 species millipedes (Order Chilopoda) , flying insects: 1 species of moth and 5 species of butterflies (Order Lepidoptera), 1 species bees (Order Hymenoptera, Family Anthophoridae), 1 species of flies (Order Diptera) 1 species of bug (Order Hemiptera) , 3 species of beetles (Order Coleoptera-Family Scarabidae), bat louse (Class hexapoda) and other migratory insects. Species of macroinvertebrate were identified up to the family level only, but some were identified up to species level and still needs further validation.

The presence of diverse species of macroinvertebrate fauna within this caves indicated a significant proportion of great support to other cave inhabitants for survival. Macroinvertebrates are actually the source of food for bats, snakes, amphibians and other mammals (Fitzpatrick, 2004).

Snakes and amphibians were also observed in the areas (Table 5A & B). Three (3) species of snakes (Class Reptilia, Order Squamata, Family Colubridae. *Coelognathus erythrurus*, *Lycodon aulicus* and *Naja philippinensis from the* Family elapidae,), 1 species of gekko (*Gekko monarchus*) and 1 species of skink (Class Reptilia – Order Scinidae: *Eutropis multifaciatus*)were identified. Meanwhile, three species of amphibian such as frog were also identified. Snake and lizards were identified up to the family level only. Cave Gecko (Family Gekkonidae). These groups of reptiles and amphibians hibernate on the darkest and coolest parts of the caves and feed on small macroinvertebrates, bats and lizards (Fitzpatrick, 2004). Species of snakes were observed only on specific caves, where ecological set up is undisturbed or slightly disturbed. The only new record taken is the existence of one species of frog which is believed to have migrated from Palawan, which is the *Platymantis sp*., the report was duly recognized since the authentication of this species was done by expert in the Philippine National Museum.

Philippine swiftlets (*Collocalia mearnsi* Fam. Apodidae) and Island swiftlet (*Collocalia vanikorensis amelis*) were also observed within the cave systems. They build their nests on dark areas of the caves and they could be immediately disturbed by noise and lights. As per information, this swiflets are also being collected by local residents as source of food. Other migratory animals include those that come in and out of the cave such as insects and birds (Table 4).

The study presents only the kinds of faunal species found and extracted from study sites, no further method were elucidated. Species composition and relative abundance as well as other biodiversity parameters were not included due to time constraints. The data presented here is only a preliminary information which could serve as baseline information for more extensive and exhaustive research project.

Man-Made Disturbances

When the richness of life inhabiting the world's ecosystems is diminished, people's well-being is diminished, too. Yet from pole to pole, these ecosystems are at risk as the result of human development. The pressure is mounting like never before, around the world, a species goes extinct every 20 minutes (C.I. 2010).

During the course of this research, workers also gathered information about threats to this fauna. It has become increasingly clear that a wide variety of bat species are harvested by local people across the areas to supplement protein in their diets and in association with other activities (e.g., removal of pests, magical properties).

It has been observed during the series of fieldworks that the selected cave systems in the Northern Sierra Madre Park are all disturbed. Of these caves, more are accessible to local people and are open to tourists. Many of these caves are subjected to different man-induced disturbances like guano extraction, treasure hunting, wildlife hunting and gathering and vandalism, conversion of some caves as potential for international tourism and many other illegal activities.

Hunters used bamboo sticks to disturb roosting bats and several indications on the use fire and smoke on two different bat especially fruit bats roosts. One person claimed to hunt in caves since there are valued food items relative to other bats present. Contrary to being significant, eating of bats must be strictly prohibited because there are bats that are infested with louses, this could bring harm and or cause diseases to those who consume it. Precautionary measure, is advised since actual observation on the louse infestation was seen during the conduct of this study.

In all cave within the study sites, extensive artisanal mining and some miners work in caves and may hunt bats as well, an actual observation on this activity was also encountered.

Rampant guano extraction and hunting are the major problems encountered by these caves. Since the areas are accessible to local people, extraction of fauna particularly bats which served as food is free.

Through this man made disturbances, climate change which maybe manifested through occurrence of prolonged dry season and unusually high volume of rainfall are also recognized as important threats to the diversity of cave dwelling organisms.

Amongst the information gathered, bones and skeletons are evidences that bats, ranging from large fruit bats to small insectivorous species, are much more widely harvested in the area.

All these anecdotal records are recognized problems that need immediate attention and are immediate concerns. The need to act now would be the most probable solution, before faunal diversity of these cave systems become extinct.

In many cases, the information presented herein is based on interviews and direct observation of exploitation. While in general we have confidence in the reported details, it is important to underline that certain sources of information are from second-hand sources.

Conclusion and Recommendations

There are many reasons for protecting fauna to include not only the endangered species, but also including our own survival. Beyond economics and human well-being, however, the extinction of these diverse faunal creatures also raises profound ethical and moral questions.

Each wild species depends on a particular habitat for its food and shelter, and ultimately for its survival. Over the past century, massive conversion of our natural lands and waters for economic and other uses has eliminated or degraded many of the habitats our plants and animals need to survive. By looking at this concern, conservation efforts are progressively being planned and carried out. Being appreciative of our ecosystems is therefore indispensable in protecting our imperiled wildlife. Conduct of studies related migratory species of fauna should also be encouraged since they could also become threat to the decline of many of our indigenous species, which could be regarded as second only to destruction of habitat.

Center to many wild species and endangered species, the need for reliable and objective information can be done through more conservation initiative. And should focus on:

Continuous assessment on the status of the environment for both flora and fauna to putting particular attention to cave systems;

Continuous conduct of field inventories to document where these species are found and to identify the condition and nature of habitats they need to survive; and Make scientific information readily available to help target endangered species protection efforts and to help redirect development activities away from sensitive habitats like caves. Encourage participation of local residents in conservation management should be emphasized.

Everyone should worry about extinction, when fossil records show that species have always gone extinct naturally over periods of millions of years.

For this is the era where the pace of extinction, and its cause, is dramatically different, and so with the effect of climate change. Presently, according to estimates by world-renowned conservation biologists, man's impact on the environment is causing species to vanish at a rate that is hundreds of times faster than the natural rate (Nature serve's data (2010); Iliffe (2002).

Nature Serve's own comprehensive data for North America documents that in the United States alone, more than 500 species are known to be extinct or are missing. And extinction is forever (Riordan, 2010). What about in the Philippines?

Pressures on these ecosystems, including unsustainable development for tourism, quarrying for limestone, hunting and organic pollution, are threatening these habitats. The diversity of species within each of these caves must be protected to conserve and preserve them. As compared to some other land vertebrates, there is no evidence that bats are exploited for their use in other activities. Yet the need to protect them is very significant.

Base on actual records gathered, it is evident that the loss of habitat resulted from higher species migration cave dwelling animals are due to unabated human activities (guano extraction, mining, conversion of caves to tourist spots) , this issues have not yet been fully recognized- and if no attention can be made the soonest possible time, great potential effect on the ecological set up will be experienced, forcible migration among fauna and eventually their extinction will be uncontrollable.

No extensive studies have been made on amphibians, mammals and reptiles, while the existing records and the results of this study show however that these caves supports unique quite few species of this kinds.

It is recommended that there is a need to review existing policies on the conservation and protection of cave dwelling organisms, specifically the role of the stakeholders to include indigenous people and local residents on the implementation of policies as well as workable policies on conversion of caves for tourist attractions. Continuous monitoring of fauna is also recommended, more so, that there are still many caves left for exploration in the region.

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Table 1. Summary of Average Morphometric Measurements of Order Chiroptera on Selected Caves (Updated)

Species	HF (mm)	FA (mm)	HL (mm)	Eye (mm)	Wing SL (cm)	Ear (mm)	SVL (mm)	TV (mm)	TL (mm)
1. Ptenochirus jagori	19.20	81.60	37.30	7.00	56.00	19.20	101.40	14.70	116.10
2. Rhinolophus philippinensis	11.75	56.65	23.65	1.25	36.00	35.00	60.35	29.60	89.95
3. Rhinolophus arcuatus	11.05	46.05	23.30	1.30	30.50	20.70	48.70	19.05	67.75
4. Rhinolophus macrotis	8.95	43.90	___	___	___	24.95	___	23.00	72.95
5. Rhinolophus virgo	6.60	39.30	15.70	1.10	26.00	___	31.30	22.66	53.96
6. Miniopterus shcreibersii	6.00	45.00	___	___	___	6.00	___	30.00	__
7. Hipposideros diadema	15.30	86.85	34.05	1.80	55.00	30.65	77.23	38.63	115.85
8. Hipposideros pygmaeus	7.20	39.55	22.18	1.96	32.70	12.60	49.05	22.25	71.30
9. Chaerophon plicatus	10.00	41.oo	___	___	___	18.00	___	30.00	97.00
10. Taphozous melanopogon	13.65	63.50	___	9.10	___	21.20	83.20	22.65	105.85
11. Rhinophus acuminatus	10.37	46.60	19.47	1.47	29.40	20.43	54.63	22.17	76.80
12. Miniopterus australis	9.15	44.45	17.00	1.10	32.50	11.15	55.15	31.95	87.10
13. Miniopterus tristis	11.25	52.85	28.10	1.20	42.88	22.95	78.10	53.15	131.25
14. Hipposideros obscurus	10.85	45.05	20.40	1.60	3067.00	19.90	55.60	21.20	76.80
15. Pipistrellus javanicus	7.10	34.60	24.50	1.50	32.00	34.60	59.90	31.10	91.00
16. Rhinolophus rufus	15.40	72.90	38.50	1.60	43.00	35.60	91.80	33.00	124.80
17. Rhinolophus inops	10.20	46.25	20.08	1.05	29.00	23.90	50.85	18.35	69.20
18. Haplonycteris fischeri	12.15	76.35	36.13	7.10	50.85	20.23	73.35	9.05	82.40
19. Rhinolophus sp.	11.85	50.05	30.85	2.05	44.00	19,10	63,80	14,75	78,55
20. Hipposideros ater	6.35	37.60	16.60	1.20	25.00	___	38.50	28.20	66.70

Species	HF (mm)	FA (mm)	HL (mm)	Eye (mm)	Wing SL (cm)	Ear (mm)	SVL (mm)	TV (mm)	TL (mm)
21. Hipposideros coronatus	9.28	48.77	25.33	0.93	31.50	16.57	54.78	28.10	82.88
22. Emballonura alecto	8,10	46.00	17.30	2.10	34.00	13.50	49.10	10.60	59.70
23. Myotis macrotarsus	16.19	46.86	31.44	1.11	__	18.34	46.85	56.90	103.75
24Rhinolophus subrufus	12.00	53.00	____	___	____	25.00	____	22.00	84.00
25. Pteropus vampyrus	261.80	188.25	77.03	11.73	143.60	53.00	263.80	29.85	293.65

Table 4. Summary for Macroinvertebrates

Phylum Arthropoda					
Class	Order	Family	Scientific name	Common Name	Location/Distribution
Arachnida	Araneida	Pholcidae	*Pholeus dentifous*		found in all cave sites
		Heteropodidae	*Neosparasus sp.*	Huntsman spider	found in all cave sites
		Amblypygidae	*Damon medius*	Tanzanian giant spider	found in all cave sites
		Lycosidae	*Lycosa sp*	Wolfspider	found in all cave sites
		Tetragratidae	*Tylorida neutralis.*	Long-jawedorbweaver	found in all cave sites
		Pholmicidae	*Pholeusphalangioides*	Dadly long legger spider	found in all cave sites
Insecta	Diptera	Salticidae	*Plexipus paykulli*	Jumping spider	found in all cave sites
		Otitiidae	*Eusxesta stigmatis*	Antlion	found in all cave sites
		Nycteribiidae	*Nycteribia pedicularia*	Bat flies	found in all cave sites
		Prygotidae	*Prygota undata.*		found in all cave sites
		Uliviidae	*Platyderma recticorn*	Darkling beetles	found in all cave sites
	Hemiptera	Riviidae	*Metapterus uhbri*	Assasin bug	found in all cave sites

	Hymenoptera	Stenopelmatidae	*Odonfamaclusinfantus*	Jerusalem cricket	found in all cave sites
	Blattodae	Blattidae	*Blatta orientalis*	American cockroach	found in all cave sites
	Orthoptera	stenopelmatidae	*Opaciumaustralestoma*	Ant	found in all cave sites
Diplopoda	Polydesmida		*Oxidus Gracilis*		found in all cave sites
Chilipoda	Scolopendromorpha		*Scolopendra sp.*		found in all cave sites
			Phylum Mollusca		
Gastropoda		Achatinidae	*Achatina fulica*		found in all cave sites
		Bradybaenidae	*Helicostyla rollei*		found in all cave sites
		Cyclophonidae	*Cyclophorus apendiculatus*		found in all cave sites
		Bradybaenidae	*Helicostyla sp.*		found in all cave sites
		Bradybaenidae	*Hemitrichiella setigera*		found in all cave sites

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Table 5. Summary for Herpetofauna

Class Amphibia

	Kingdom	Phylum	Class	Order	Family
1	Animalia	Chordata	Amphibia	Anura	Bufonidae
2		Chordata	Amphibia	Anura	Ceratrobatrachidae
3		Chordata	Amphibia	Anura	Rhacophoridae
4		Chordata	Amphibia	Anura	Microhyllidae

	Genus	Species	SN	Common Name	Author
1	Bufo	marinus	*Bufo marinus*	Cane Toad	Linnaeus, 1758
2	Platymantis	spp.	Platymantis spp.	Forest rain frog	
3	Polypedates	leucomystax	Polypedates leucomystax	Asiatic tree frog	Gravenhorst, 1829
4	Kaloula	picta	Kaloula picta		Dumeril and Bibron, 1841

* spotted only, and as mentioned by some field guide, also reported by BPPLS (2005)

Class Reptilia

	Kingdom	Phylum	Class	Order	Family	Genus	Species
1	Animalia	Chordata	Reptilia	Squamata	Gekkonidae	Gekko	mindorensis
2	Animalia	Chordata	Reptilia	Squamata	Scincidae	sphenomorphus	cumingi
3	Animalia	Chordata	Reptilia	Squamata	Colubridae	Coelognathus	erythrurus manillensis
4	Animalia	Chordata	Reptilia	Squamata	Colubridae	Dryophiops	philippina
5	Animalia	chordata	Reptilia	Squamata	Colubridae	Lycodon	aulicus capucinus
6	Animalia	chordata	Reptilia	Squamata	Agamidae	Draco	spilopterus
7	Animalia	Chordata	reptilia	Lacertilia	Scinidae	Eutrophis	multifasciatus

Cont. Table 5B

	SN	Common Name	Author	CS	Distribution
1	Gekko mindorensis	Common forest gecko	Taylor, 1919	Least concern	found in all cave sites
2	Sphenomorphus cumingi	Philippine giant forest skink	Gray, 1845	Least concern	found in all cave sites
3	Coelognathus erythrurus manillensis	Luzon red-tailed rat snake	Jan, 1863	common	found in all cave sites
4	Dryophiops philippina	Philippine dryophine snake	Boulenger, 1896	vulnerab le	only in simanu cave
5	Lycodon aulicus capucinus	Common wolf snake	Boie, 1827	common	found in all cave sites
6	Draco spilopterus	common flying lizard	Weigmann, 1834	common	only in Sta victoria caves
7	Eutrophis multifasciatus	Striped bronze skink	Kuhl, 1820	common	Sta. victoria / but suspected to be common to all caves

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Cont. Table 5B

	Snout vent length	Tail to vent	Head length	Hind limb	Total length
Gekko mindorensis	81.1 mm	72.5 mm	25.1 mm	12 mm	153.6 mm
Sphenomorphus cumingi	58.9 mm	88.4 mm	16.3 mm	12.8 mm	147.3 mm
Coelognathus erythrurus manillensis	33 cm	114 cm	4 cm	147 cm	147 cm
Dryophiops philippina	21 56 cm	47 11 cm	2 2 cm		68 cm 67 cm
Lycodon aulicus capucinus	maximum SVL of males = 89.5 mm [n=101], females = 103.0 mm [n=62]				
Draco spilopterus	62.5	66.9	18	24	116