Journal of Threatened Taxa | www.threatenedtaxa.org | 26 December 2015 | 7(15): 8185–8194

Cave-dwelling bats (Mammalia: Chiroptera) and conservation concerns in South central Mindanao, Philippines

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ISSN 0974-7907 (Online)
ISSN 0974-7893 (Print)

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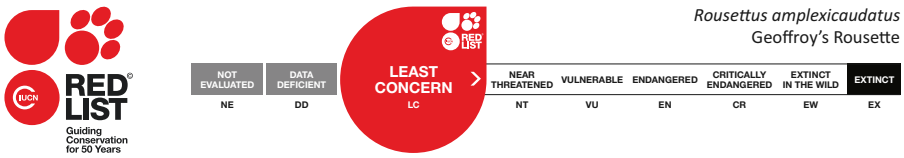
Abstract: The stable microclimate in caves provides a relatively constant habitat for many bat species in the Philippines, but human encroachment continues to disrupt this habitat and imperil many of the species roosting in the caves. In South central Mindanao, the diversity and conservation status of cave bats remain undocumented and unexplored. We employed mist-netting to capture bats from five different caves within the town of Kabacan, northern Cotabato, Philippines. A total of 14 bat species were identified including the Philippine endemics *Hipposideros pygmaeus* and *Ptenochirus jagori* and the threatened *Megaerops wetmorei.* However, despite the declining conservation status of the bats, local disturbance such as bat hunting for bush meat and unregulated tourism are currently taking place in the caves. Large species such as *Eonycteris spelaea* and *Rousettus amplexicaudatus* are killed almost every day for food and trade. Therefore, the high species richness, and the presence of endemic and threatened species coupled with the occurrence of anthropogenic disturbances in caves suggests the need for an urgent and effective conservation intervention involving the local government and public community.

Keywords: Bat conservation, cave-dwelling bats, caves, disturbance, hunting.



Rousettus amplexicaudatus
Geoffroy's Rousette

DOI: http://dx.doi.org/10.11609/jott.1757.7.15.8185-8194 | **ZooBank:** urn:lsid:zoobank.org:pub:7C202F9B-CF5F-499B-B787-8E8C6DCC1D01

Editor: Paul Racey, University of Exeter, Cornwall campus, UK. **Date of publication:** 26 December 2015 (online & print)

Manuscript details: Ms # o4288 | Received 10 January 2015 | Final received 03 October 2015 | Finally accepted 15 December 2015

Citation: Tanalgo, K.C. & J.A.G. Tabora (2015). Cave-dwelling bats (Mammalia: Chiroptera) and conservation concerns in South central Mindanao, Philippines. *Journal of Threatened Taxa* 7(15): 8185–8194; http://dx.doi.org/10.11609/jott.1757.7.15.8185-8194

Funding: Southeast Asian Bat Conservation and Research Unit (SEABCRU).

Conflict of Interest: The authors declare no competing interests.

Author Details, **Author Contribution** & **Filipino abstract** see end of this article.

Acknowledgement: The authors would like to thank the Southeast Asian Bat Conservation Research Unit (SEABCRU) and Texas Tech University, especially Dr. Tigga Kingston, for generously supporting portions of the project through the Southeast Asian Bat Conservation Research Unit (SEABCRU) Small Grant for Southeast Asian Students. The same appreciation is given to the Department of Biological Sciences of the College of Arts and Sciences, University of Southern Mindanao for hosting and providing facilities for the project, to the Region XII Protected Areas and Wildlife Bureau and Department of Environmental and Natural Resources, Kidapawan City Environmental Office and Kabacan Municipal Environmental Office for granting the researchers the gratis permit to conduct a bat cave survey in Pisan caves. A same appreciation is given to the student trainees, local people and government unit of the Barangay Pisan for their participation and coordination during the implementation of the study. Finally, grateful thanks are due to the three anonymous reviewers and the subject editor for their generous and constructive inputs to the improvement of this paper.

INTRODUCTION

Bats are important in providing essential ecosystem services that are important for maintaining species and ecosystem interactions (Jones et al. 2009; Kunz et al. 2011). They are responsible for the pollination and seed dispersal of many economically important plant species thus enhancing the regeneration of degraded habitats (Nassar et al. 1997; Corlett 1998; Momose et al. 1998; Hodgkison et al. 2003; Bumrungsri et al. 2013). Insectivorous bats consume some of the insect pests that devastate crops (Cleveland et al. 2006; William-Guillen et al. 2008) and bats thus play critical roles in maintaining ecosystem health (Medellin 2000).

Their habitats include forests, urban sites and caves. Caves are vital for the maintenance and survival of many bat species (Furey & Racey 2016). They roost in thousands, and sometimes millions in caves because of the size, permanency and stable microclimate of these habitats (Kingston 2010). The roost structure, external habitat, and the presence of anthropogenic activities in caves can affect the physiological condition and the roost selection of cave-dwelling bats (Nagy & Postawa 2010; Sedlock et al. 2014). Moreover, reproductive condition and predation may also influence roost selection of bats in caves (Ho & Lee 2003). Consequently, caves and other underground habitats are considered to be among the most important and critically imperiled habitats for bats in Southeast Asia (Kingston 2010).

In the Philippines, there are about 1500 surveyed caves in the country (PAWB-DENR 2008) and about 10% of the archipelago is covered with karst landscape characterized by an abundance of caves (Restificar et al. 2006). According to the recent report of the Philippine Cave Committee (2012), about 308 caves house bats but only a few are under government protection. Furthermore, over 30 bat species in the country are known to be cave dwellers and dependent on these roost sites for their survival and life history (Heaney et al. 2010; Ingle et al. 2011). However, many species are threatened by local extinction because many caves still lack effective management and protection as evidenced by intensive meat harvest for food and trade, guano collection and unregulated tourism (Ingle et al. 2011). Of the species thought to be present in the caves, *Megaerops wetmorei* is threatened (Rosell-Ambal et al. 2008) and although *Emballonura alecto* is not listed as threatened, its population is thought to be decreasing (Csorba et al. 2008).

In South central Mindanao, although some information is available on the bats of the region, to the best of our knowledge none was ever published on cave bats. This may explain the lack of bat conservation initiatives in the region. The primary goal of this study is to document species of cave bats species present in caves of Pisan, Kabacan, northern Cotabato, in South central Mindanao, Philippines so that this information can be utilized in future conservation management.

MATERIALS AND METHODS

The Study Site

The village of Pisan is located in the southeast of the municipality of Kabacan in the province of North Cotabato, South central Mindanao region (Fig.1). It is the only mountainous part of the municipality, covered with secondary disturbed forest and agro-forest with a maximum elevation of 300–400 m. The area is known as one of the main sources of food for the municipality including rice, corn, banana, and sweet potato. Pisan is known throughout the province for its caves and underground habitats which are visited by many for tourism and caving activities. It is also the location of the Kulaman watershed, the only one in the municipality.

Locals recounted that there were numerous caves in the area. However, only five caves are open to the public due to unstable security conditions and further exploration of other cave sites is prohibited (MENRO 2013). Accessible caves were surveyed in the village of Pisan (located between 7.19958519^{0}N & 124.89060285^{0}E). The caves are karstic with a diverse structure, some with narrow or wide mouth openings, numerous openings and obstacles; others have alluvial floors composed of guano and soil. The caves are situated in an agro-forest ecosystem. Throughout the year the area experiences a wet season (November–February) and a dry season (March–October).

Caves that were surveyed for cave bats include Lope, Cathedral, Shortcut, Avenue, and Usok caves. Lope (7.20137422^{0}N, 124.8720195^{0}E) cave is located around 500 m from the nearest local settlement. The atrium of the cave is about 30m wide and 15m high with a wide opening. The cave floor is covered by river water that flows through the cave, which is about 1m deep. Bat roosting marks can be found on the cave ceiling. The cave is long and it may take several days for a surveyor to reach its end.

Cathedral Cave (7.20020612^{0}N & 124.8720195^{0}E) is about 45 mins trek from Lope cave. It is located under a hill and is the widest (around 40–50 m in diameter) and the highest cave (around 30m) cave surveyed.

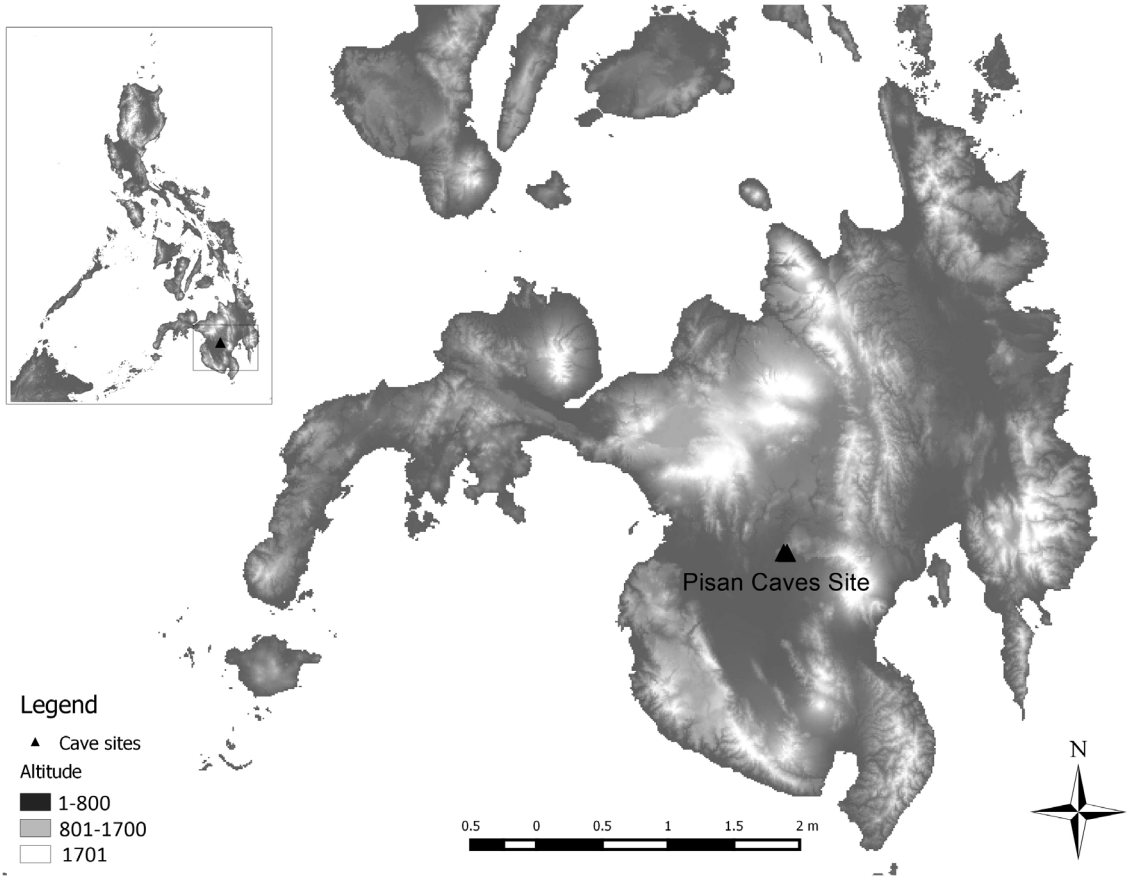


Figure 1. Location of the Pisan caves, in South central Mindanao, Philippines (Quantum GIS 2.2.0 version). All caves are found in different area but in a single locality.

The interior is dome-shaped with two fenestrae in the ceiling.

Shortcut Cave (7.199722222^{0}N & 124.8917778^{0}E) is located 300m from Cathedral Cave. It is only around 50m long with a narrow opening passable by a single person, although it widens a little in the central part.

Avenue Cave (7.19917858^{0}N & 124.8902161^{0}E) is located on the side of a 35^0 slope. It is surrounded by the endemic natural plants of Pisan in contrast to the introduced *Gmelina arboria* trees around some other caves. The cave starts with a very low entrance of about 1–2 m wide. The ceiling rises to 20m. The Avenue Cave is wide in its main chamber and can accommodate 15 people walking side-by-side.

Usok Cave (7.199722222^{0}N & 124.8917778^{0}E) derives its name from the Ilocano (a local language) word which means 'pass-through'. In this cave, a river passes through the cave and there are no solid surfaces on which to step. A person exploring the site has to swim to get to the other side of the cave and the ceiling is about 60m high.

Survey Method and Data Analysis

The study received a gratis permit from the Department of Environment and Natural Resources allowing the collection of bats from Pisan caves (GP # RXII 2013-04). The survey was conducted from July to August 2013. Bats were captured using mono-filament mist nets of various dimensions (12x6 m, 10x6 m, 5x12 m) depending on the geophysical characteristic of the sampling site. Nets were set on suitable flight paths such as cave openings, cliffs, and crevices. Nets were checked at least every 2–3 hours from 18:00–24:00 hr. Captured bats were carefully removed from the nets and placed in a clean moisture-free cloth bag and immediately processed at the camp site.

Captured bats were identified using the keys of Ingle & Heaney (1992), Kingston et al. (2006) and the photographic guide for the cave bats of the Philippines by Sedlock & Ingle (2010) by examining basic morphological structures including the lengths of the total body, snout-vent, forearm, tail, ear and hind foot, measured using plastic vernier calipers and a ruler. Notable features

including the presence of a tail, markings, tragus/antitragus, noseleaves and interfemoral membrane were recorded.

The relative abundance of bat species (%) was calculated using the equation *N*/*n* (where: *N* is the total number of captured individuals of a species and *n* is the total number of all species). Relative abundance of species and relative abundance of all species was calculated for each cave. The species diversity of the bats at each cave site was compared using the reciprocal form of Simpson's index (*1/D*), $1/D = Spi^2$ (where *1/D* =reciprocal of Simpson's *D*, Spi^2= abundance of common genera) and calculated using Biodiversity Pro 2.0 software (McAleece et al. 1997).

This reciprocal form of Simpson's index ($1/D = Spi^2$), which is considered to be the most accurate measure of diversity (Rex et al. 2008) was used to compute the data sets from the study. The computation was based only on captured individuals. The value of this index starts with one as the lowest possible figure. The higher the value the greater the diversity of the species in the area.

RESULTS

A total of 14 species representing five chiropteran families Pteropodidae, Emballonuridae, Hipposideridae, Rhinolophidae, and Vespertilionidae were recorded (Table 1). *Cynopterus brachyotis* accounted for the highest relative abundance among all species in cave sites with 26.3% of total captures, although it was absent from Shortcut cave. It was followed by *Rousettus amplexicaudatus* (Image 1) and *Hipposideros diadema* with 22.4% and 18.7% relative abundance respectively. Moreover, *H. diadema* and two other species *Myotis horsfieldii* and *Rhinolophus arcuatus* were common at all cave sites.

The frugivorous *C. brachyotis* was observed around

Table 1. Taxonomic list of cave-dwelling bat species identified from Pisan caves, Kabacan, northern Cotabato, in South central Mindanao.

Species	Lope	Avenue	Usok	Cathedral	Shortcut	Total	Species Relative Abundance (%)
Pteropodidae							
Cynopterus brachyotis	41	80	26	2	0	149	26.28
Eonycteris spelaea	0	12	17	1	0	30	5.29
Megaerops wetmorei# *	1	0	2	0	0	3	0.52
Ptenochirus jagori *	4	0	10	0	0	14	2.47
Rousettus amplexicaudatus	17	32	44	34	0	127	22.40
Hipposideridae							
Hipposideros ater	2	0	0	0	0	2	0.35
Hipposideros diadema	41	12	15	29	9	106	18.69
Hipposideros pygmaeus *	0	4	2	0	2	8	1.41
Rhinolophidae							
Rhinolophus arcuatus	7	6	5	6	12	36	6.35
Emballunuridae							
Emballonura alecto	0	17	16	0	7	40	7.05
Vespertilionidae							
Miniopterus australis	0	7	7	0	1	15	2.65
Miniopterus tristis	0	0	7	1	3	11	1.94
Myotis horsfieldii	5	4	6	1	4	20	3.53
Pipistrellus javanicus	0	6	0	0	0	6	1.06
Total # of individuals	118	180	157	74	38	567	100
Relative abundance of cave bats per cave	20.8112875	31.746	27.6896	13.051146	6.70194	100	
Species richness	8	10	12	7	7		
Simpson's Reciprocal Index	3.805	4.041	7.014	2.748	5.286		
Eveness	0.475625	0.4041	0.5845	0.3435	0.755143		

Legend: # - Vulnerable; * - Endemic to the Philippines

Image 1. ***Rousettus amplexicaudatus***

cave openings especially in Avenue and Lope near fruiting tree such as *Ficus* spp. *Rousettus amplexicaudatus* and *Eonycteris spelaea* were observed roosting in caves with large openings. Other fruit bat species recorded were the endemic *Megaerops wetmorei* and *Ptenochirus jagori*. Among all fruit bats, *R. amplexicaudatus* was the most dominant in all cave sites and has highest population count in Cathedral Cave. Visual observations estimated the population size to range from hundreds to thousands of individuals roosting in walls and ceilings inside the cave.

In addition to fruit bats (Pteropodidae), 64% (n=5) of the species are represented by insectivorous bat species from families Emballonuridae, Hipposideridae, Rhinolopidae and Vespertilionidae. *Hipposideros diadema* was the most abundant comprising 18.7% of the total number of captures and occupying all cave sites. Both *Hipposideros ater* and *Pipistrellus javanicus* were the least common species among cave sites with 0.35% and 1.05% relative abundance, respectively. *Hipposideros ater* was netted only from Lope cave and *P. javanicus* was present only in Avenue Cave.

Among cave sites, 31.8% of all individual bats were captured in Avenue cave followed by Usok and Lope with 27.7% and 20.8% respectively. The lowest number of individuals captured was at Shortcut caves (6.7%). The highest species richness was recorded in Usok (n=12), followed by the adjacent site, Avenue cave (n=10), then Lope cave (n=8) and finally Cathedral and Shortcut caves with seven species each.

The highest computed Simpson's Reciprocal Index was recorded from Usok cave with *1/D*=7 value suggesting high species diversity at this cave site. This was followed by shortcut cave (*1/D*=5.3), Avenue cave (*1/D*=4.0, Lope cave (*1/D*=3.8) and Cathedral cave (*1/D*=2.8). Remarkably, a threatened species with a decreasing population, *M. wetmorei* was recorded at two sites - Lope and Usok caves. A second species with a decreasing population, *Emballonura alecto,* was recorded in Avenue, Usok and shortcut cave.

DISCUSSION

This study is the first to provide details of cave bat biodiversity in the South central Mindanao region. The exploration of five accessible caves in Pisan, Kabacan, North Cotabato, in South central Mindanao identified a total of 14 bat species with three endemics: *H. pygmaeus*, *P. jagori* and *M. wetmorei,* which are listed as threatened with a decreasing population (Rosell-Ambal et al 2008; Heaney et al. 2010).

Among these 14 species, five were fruit bats, comprising 36% of all bat species recorded from Pisan caves during the current survey. They were observed roosting in caves near fruiting trees and in caves with large openings. Species such as *C. brachyotis* were netted in caves near areas where fruit trees grows, while other fruit bats such as *E. spelaea* and *R. amplexicaudatus* roosted in caves such as Usok and Cathedral with large openings and near water. According to Funakoshi & Zubaid (1997), fruit bats such as *Cynopterus* sp. are common plant-visiting bats that feed on fruits, flowers, and foliage. They commonly roost in areas with high vegetation because they are attracted to fruiting and flowering plants as it complements their dietary requirements (Mohd-Azlan et al. 2010). In Thailand, Bumrungsri et al. (2013) found that *E. spelaea*, which commonly roosts in caves, is a vital pollinator of many economically important plant species. In Panay Island, large maternity colonies of fruit bats, particularly *R. amplexicaudatus,* roosted in caves, which were therefore important for the conservation of their local populations (Mould 2012).

The role of caves as roosts for bats has recently been reviewed by Furey & Racey (2016). Fruit bats are important for seed dispersal, leading to the regeneration of forests. They also play a vital role as pollinators in lowland Malaysian rainforest (Hodgkinson et al. 2003). According to Tuttle (2011), approximately 70% of fruits from trees or shrubs sold in tropical food markets depend on bats for pollination. Furthermore, the presence of fruit bats in disturbed areas such as those around Pisan caves may promote forest regeneration and pollination of many crops in the area (Fujita & Tuttle 1991).

Two-thirds of the bat community in Pisan is

comprised of insectivorous species. *Hipposideros diadema* was the most abundant and common bat in all cave sites in Pisan. It was also one of most abundant insectivorous bat species recorded in other caves in Mindanao in Iligan, Bukidnon, and Valencia in northern Mindanao region, Davao Oriental in northeastern region (Nuneza et al. 2010; Galorio & Nuneza 2014) and Samal Island (Quibod et al. 2013). According to Heaney et al. (1991), *H. diadema* is widespread and common in the Philippines particularly in primary forest and disturbed lowland forest from sea level to 900m and is also known to roost in low trees. In the present study *H. ater* and *P. javanicus* were the least recorded species occurring only in a single cave, in Lope and Avenue cave respectively. *Hipposideros ater* is found in many habitats. It is known to roost in caves, primary and secondary forest and agricultural areas (Heaney et al. 1998) and a few individuals were also recorded from mining areas in Mindanao Island (Tanalgo et al. in-review). In the Philippines, this species may have declined as a result of destruction of lowland forest and disturbance of caves (Heaney et al. 1998; Heaney et al. 2010). While *P. javanicus* is common in urban and agricultural areas, and in secondary and primary lowland and montane forest, it is uncommon in mossy forest, from sea level to 1750m (Heaney et al. 1998). The presence of many insectivorous bats in Pisan caves suggest they may play a vital role in the area as major predators of nocturnal insects and have the potential to act as biological pest control agents in farmlands, where they can consume insects up to 30–100 % of their body weight each night (Leelapaibul et al. 2005). The consumption of pest insects by bats contributes to the reduction of insecticides used in farm crops (Cleveland et al. 2006). Furthermore, the guano from the bats is also good source of nutrient for improving plant crops when used as a fertilizer (Furey & Racey 2016).

We examined existing and recent reports of cave bat diversity in the region with which to compare our findings. In Visayas Island, Sedlock et al. (2014) surveyed Bohol Island and a total of 29 species were identified, 19 of which are known to be cave dwellers. In Siquijor Island, Sedlock et al. (2012) assessed a total of 20 large caves and captured a total of 19 species, including 13 cave dwellers with only four caves containing relatively large colonies and only five containing fruit bats. Mould (2012) recorded large colonies of *R. amplexicaudatus* in Panay Island.

In Luzon - the largest Island in the Philippines, Galvan (2012) surveyed cave bats in Polilio Island and recorded 10 cave bat species. Macasaet et al. (2011) reported bat species in 14 cave sites in Marinduque Island with 13 species recorded including a single frugivorous species *R. amplexicaudatus*. Moreover, Vinarao & Cabauatan (2011) surveyed selected caves in the northern Sierra Madre Natural Park, Luzon, Philippines and recorded 24 species. From previous and recent findings on cave bats, we found that caves in Pisan in south Central Mindanao has a relatively higher bat diversity and species richness then other sites in the Archipelago.

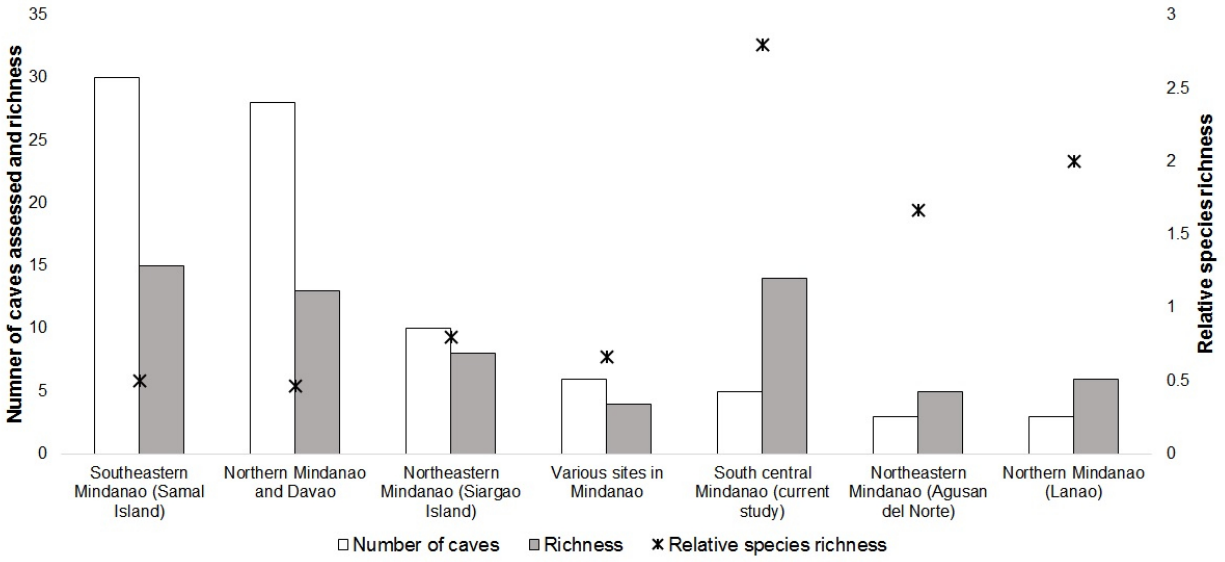


Figure 2. Relative species richness in selected cave sites on Mindanao Island, Philippines, calculated by dividing the total number of species recorded (r) by the total number of caves assessed (Nuñeza et al. 2010; Quibod et al. 2013; Requiroso et al. 2013; Warguez et al. 2013; Macaalang et al. 2014; Nuñeza et al. 2014).

We narrowed down our examination by comparing our results to recent cave bat studies in other regions in Mindanao. Relative species richness over the number of caves assessed was used as a reference for comparison (Fig. 2). Nuñeza et al. (2010) conducted a Mindanao Island-wide survey of cave vertebrates. A total of 28 caves were surveyed which resulted in the record of 13 bat species. Nuñeza & Galoria (2014) surveyed 10 caves with eight species in northeastern region in Siargao Island. Quibod et al. (2013) surveyed cave bats from Samal Island, Davao Oriental and identified 15 species, several of which were recorded in the current study. Requiroso et al. (2013) studied a total of six caves in Mindanao with four species, from Zamboanga, Bacolod, Lanao, and Misamis Oriental. In northeastern Mindanao, Warguez et al. (2013) assessed the roosting preference of three species of insectivorous bats and two species of fruit bats, noting that *E. spelaea* and *R. amplexicaudatus* prefer to cling on walls on areas with partial illumination. Maca-alang et al. (2014) identified six species from caves in Lanao del Sur - *E. spelaea*, *R. amplexicaudatus*, *Miniopterus schreibersii*, *M. australis*, *H. diadema* and *Rhinolophus arcuatus.* Based on a comparison of the number of caves assessed over the number of species identified from throughout the Island of Mindanao, Pisan caves in South central Mindanao contains a relatively higher bat diversity. Such a comparison must be viewed with caution because each survey may have employed different methods for detection and different sampling efforts.

Furthermore, noteworthy in the present survey is the presence of the endemic species *H. pygmaeus*, *M. wetmorei* and *P. jagori* in three caves in Pisan (Lope, Avenue and Usok). *Hipposideros pygmaeus* is a poorly known species known from caves and secondary forests and thought to be widespread. However this species is negatively impacted by degradation of cave habitats (Heaney et al. 1998). In contrast, although *M. wetmorei* is not endemic to the Philippines it is known to occur only in the Mindanao faunal region, and only from primary and lightly disturbed lowland forest from 800–1200 m and is probably absent from montane forest beyond 1500m (Heaney et al. 2006). *Ptenochirus jagori* is widespread in various habitats in the Philippines with a large and stable population, and tolerant of heavily disturbed habitats (Heaney et al. 1998). The presence of endemic and threatened species could pave the way for implementing conservation and protection measures at cave sites that are also tourism hotspots in Pisan, as it shows that Pisan caves are suitable roosting habitats for many bat species.

However, current cave destruction occurring in many areas imperils this rich bat biodiversity in South central Mindanao. There are an estimated 38 to 41 caves in Pisan but from information provided by the local government unit (LGU), it appears that cave sites claimed by locals are part of some villages including Barangay Banawag, Pentag, New Abra and Bangilan. Some caves are located near the boundaries of the municipalities of Kabacan, Carmen and Matalam.

Hunting for food and trade were commonly observed and identified by locals as threat for cave bats. Local authorities reported that hunters came from different sites and neighboring villages and towns. They usually enter caves with larger mouth openings such as Cathedral and Lope. To harvest bats roosting inside the caves, a loud noise is made using pistols and disturbed bats are captured using fishing nets placed in front of cave openings. Hunters prefers large species such as *R. amplexicaudatus*, *Eonycteris* spp. and *H. diadema* for these species are abundant and common to all sites especially caves with large openings and multiple entry points. Local reports revealed that hunted cave bats were beheaded and skinned alive, brought down to local markets or sold in houses at 2.00 to 3.00 (US $ .06) pesos per piece, a very cheap price compared to reported price in some area which is 100 pesos (US $ 2.00) for three pieces (Bat Conservation International 2010), some locals consume bats as part of an exotic menu such as 'Adobo', a kind of casserole. This report is supported by observations at cave sites. We found remains of dead bats in cave openings and the darkening of the walls and ceiling in Cathedral Cave, indicating that bats formerly inhabited the cave but may have been removed or the bats may have moved to another cave site. According to Cardiff et al. (2009) hunting of pteropodids in Madagascar occurs in highly accessible caves. In Panay Island, Mould (2012) mentioned harvesting for food, cultural use and treasure hunting in caves, and land developments as threats to bats.

Unregulated tourism is also among the threats recorded in the area. There are inadequate protocols for cave tourism in Pisan caves as exhibited by the absence of local regulation of the number of visitors allowed to enter the cave sites, uncontrolled deposits of waste during visits, unregulated local guidance and entrance fees. Heavy vandalism, use of bright lights, and coconut torches inside the caves is further evidence that tourism at the sites is unregulated. Quibod et al. (2013) noted that guano collection and cave visitation were among current threats in Samal Island. Furey et al. (2011) noted harvesting for consumption and tourism developments

in Vietnam were among the threats to the high bat diversity in the country.

Additionally, locals perceived bats as pests causing damage to their fruiting crops such as Durian *Durio*, Rambutan *Nephelium lappaceum* and Lanzones *Lansium domesticum*. Some locals believe in the 'Aswang' (a local mythical creature) and that bats are associated with evil and witchcraft though there is no major extermination of bat colonies for these beliefs. Other local threats that were noted outside the caves include the removal of vegetation, deforestation and charcoal production, which is also one of the major source of community livelihood and income in Pisan.

Conservation concerns noted from Pisan caves were also noted in other regions. In recent years, reductions in the numbers of cave bat populations have increasingly concerned conservation biologists (Furey & Racey 2016). One of the major problems that places bat populations at risk is their low reproductive rates which means they are unable to recover quickly from population declines (Mickleburgh et al. 2002). Human disturbance at caves is a persistent problem internationally and has been documented as a major cause of decline of cave-dependent bats (Barbour & Davis 1969). Threats to cave species occur both on the outside and inside of the caves (Stone & Howarth 2007). Tourism and absence of regulations are major threats to cave and karst sites (Pulido-Bosch et al. 1997). Mickelburgh et al. (2002) added that many of the threats to bats can be directly related to increasing human population causing extra demands for land, food and other resources that ultimately results in the degradation or destruction of habitat for bats and other organisms. This pressure is especially acute in tropical countries where a large proportion of the population may live in rural areas and have relatively low income. The willingness of the local government and communities to cooperate remains an important element in the conservation of caves and bats in South central Mindanao.

CONCLUSION

This study has provided the first survey of bats in selected caves sites in South central Mindanao. A total of 14 bat species with three endemics and two vulnerable populations were identified. Field surveys revealed the following: (1) accessible caves in Pisan contains bat populations belonging to several different species, (2) caves were exploited mainly for tourism and other recreational purposes, (3) hunting for meat and trade, and unregulated entry to caves sites were the most persistent threats to bats, (4) Large species (*Rousettus amplexicaudatus, Eonycteris spelaea* and *Hipposideros diadema)* are preferred game species because of their size and abundance.

The results of the present survey and the presence of unexplored cave sites in South central Mindanao suggests further sampling and comprehensive cave exploration is necessary to fully understand the biodiversity of cave-dwelling bats in the region and to establish their effective conservation.

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Filipino abstract: Ang pirmihang mikroklima sa mga kweba ay nagbibigay ng isang katamtaman and maayos na tahanan para sa maraming uri ng paniki sa Pilipinas, ngunit patuloy na sinisira ng mga tao ang maraming kweba at maraming uri ng paniking kweba ang nanganganib mawala. Sa gitnang-timog ng Mindanao, ang pag-aaral sa ibat-ibang uri at ang estadong konserbasyon ng mga paniking kweba ay hindi pa nadokumento at nasaliksik. Sa pamamagitan ng *Mist-nets,* ang mga paniki ay hinuli mula sa limang kweba sa bayan ng Kabacan, Hilagang Cotabato, Pilipinas. Sa isang kabuuan, 14 na uri ng paniki ang nakilala, kabilang na dito ang *Hipposideros pygmaeus* at *Ptenochirus jagori* na sa Pilipinas lamang matatagpuan, at ang nanganganib ng maubos na *Megaerops wetmorei*. Gayunpaman, ang patuloy na pagbaba ng estadong konserbasyon ng mga paniki, kasama ang mga banta at aktibidad na maaring magpababa sa populasyon ng mga paniki tulad pangangaso para sa karne at hindi makontrol na turismo ay kasalukuyang nangyayari sa mga kweba. Ang mga malalaking uri tulad ng *Eonycteris spelaea* at *Rousettus amplexicaudatus* ay araw-araw na kinakatay para gawing pagkain at sa kalakalan. Samakatuwid, ang mataas na bilang ng uri ng paniki sa mga kweba, at ang presensya ng endemic at mga nanganganib na uri ay isang pagpapahiwatig ng pangangailangan ng isang kagyat at epektibong interbensyong konserbasyon kasama ang mga lokal na pamahalaan at mga komunidad.

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Author Contribution: All authors of the paper contributed equally in data gathering and writing of the final manuscript. All authors read and approved the final manuscript.