

Species richness and endemism of cave herpetofauna in Northern Mindanao, Philippines

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Abstract. The Philippines is a biodiversity-rich country with high percentage endemism of reptiles and amphibians. However, cave herpetofauna particularly in Mindanao, the country's second largest island, is poorly known. In this study, 19 caves in Mindanao were surveyed using the modified cruising method to document the herpetofaunal species present giving particular attention to endemic species. Nine species of herpetofauna (four amphibians and five reptiles) belonging to six families were recorded. The endemic *Hylarana grandocula* was the most abundant and widespread among the amphibian species while the endemic *Cyrtodactylus annulatus* was the most widely distributed reptile species. A 44 % endemism was recorded. Kitaotao cave 5, which has suitable microhabitats, had the most species of herpetofauna. More reptilian species were found in a coastal cave. Assessment of more caves in Mindanao could increase the total number of herpetofaunal species. The presence of endemic species in caves indicates the need to protect these particular caves where the endemic species are found.

Key Words: amphibians, biodiversity, endemic, *Hylarana grandocula*, reptiles.

Rezumat. Filipine reprezintă o țară bogată din punct de vedere al biodiversității, unde se manifestă un endemism ridicat la reptile și amfibieni. În orice caz, herpetofauna cavernicolă, în mod particular în Mindanao, a doua insulă din țară ca suprafață, este puțin cunoscută. În acest studiu, 19 peșteri din Mindanao au fost explorate folosind metoda deplasării modificate pentru a documenta speciile de herpetofauna prezente, cu o atenție specială pentru speciile endemice. Noua specie de herpetofaună (patru amfibieni și cinci reptile) aparținând la șase familii, au fost identificate. Endemitul *Hylarana grandocula* a fost cel mai abundent și răspândit dintre speciile de amfibieni în timp ce endemitul *Cyrtodactylus annulatus* a fost specia de reptile cea mai răspândită. A fost observată o endemism de 44 %. Peștera Kitaotao, care are microhabitate adecvate, adăpostește cele mai multe specii de herpetofaună. Cele mai multe specii au fost găsite într-o peșteră de pe coastă. Studiul mai multor peșteri din Mindanao poate crește numărul total de specii de herpetofaună. Prezența speciilor endemice în peșteri indică necesitatea de a proteja peșterile în care au fost găsite aceste specii endemice.
Cuvinte cheie: amfibieni, biodiversitate, specii endemice, *Hylarana grandocula*, reptile.

Introduction. The Philippine archipelago, which is composed of more than 7,100 distinct islands (Ambal et al 2012), holds a concentration of species diversity and endemism of global importance (Peterson et al 2000) and recognized as one of the most important centers of herpetofaunal diversity in Southeast Asia (Diesmos et al 2002). It consists of 102 amphibian species (Alcala et al 2006) of which 78 are endemic and 258 reptile species of which 170 species (66 %) are recognized to be endemic (Diesmos et al 2002). Biodiversity study on Mt. Malindang recorded 257 terrestrial vertebrate species of which 26 amphibians and 33 reptiles were identified (Nuñez et al 2006). In the study conducted by Beukema (2011) in Mt. Kitanglad Range, 22 herpetofaunal species were recorded of which 12 are reptiles and 10 are amphibians and 15 of these species

constitute new records for the area. Brown & Alcala (1994) described several species of Philippine frogs of the *Rhacophoridae* family from Mindanao. Relox et al (2010) in their study in Mt. Hamiguitan reported that of the 15 reptiles and nine amphibians recorded, endemicity reached 80 % for reptiles and 77.8 % for amphibians. However, published studies of cave herpetofauna in the caves of Mindanao, the second largest island in the archipelago, are limited although limestone habitats are abundant (DENR-PAWB 2008). Most of the surveys on limestone habitats were in the Visayas, notably by Alcala et al (2004), who surveyed limestone and non-limestone forest fragments to elucidate the effects of fragmentation and degradation of tropical rainforests on tropical herpetofauna. Siler et al (2009) also reported a new species of limestone-forest frog from Eastern Samar Island.

Cave is home for wildlife species (Biswas 2010) and characterized by total darkness, almost constant air and water temperature, relative humidity approaching saturation and a relatively poor supply of nutrients (Engel 2007). Its fauna constitutes one of the important components of biodiversity (Biswas 2009). However, cave herpetofauna in Mindanao is poorly known. In this study, 19 caves in selected areas in Mindanao were surveyed to document the herpetofaunal species present, giving particular attention to endemic, threatened, and socioeconomically important species.

Material and Methods

Sampling Sites. This study was conducted in the provinces of Bukidnon and Misamis Oriental and in the cities of Iligan and Valencia (Figure 1). Nineteen caves were sampled, of which four caves (Hindang Cave 1, Hindang Cave 2, Hindang Cave 3 and Dalipuga Cave) are in the city of Iligan, two caves (Gitagum Cave 1 and Gitagum Cave 2) are in Gitagum, Misamis Oriental, six caves (Minsalirac Cave 1, Minsalirac Cave 2, Minsalirac Cave 3, Minsalirac Cave 4, Blue Waters Cave and Kabyao Cave) are in Quezon, Bukidnon, five caves (Kitaotao Cave 1, Kitaotao Cave 2, Kitaotao Cave 3, Kitaotao Cave 4, Kitaotao Cave 5) are in Kitaotao, Bukidnon and two caves (Salawaw Cave and Kariis Cave) are in Valencia City. Table 1 shows the 19 caves sampled with corresponding description.

Sampling Methods. A modified cruising method was employed to document the herpetofauna in the caves. The caves were sampled for a total of 2521 man-hours from April to August 2010 at 700 hours-1500 hours and 1800 hours-2100 hours. Cave sites were described following Alcala et al (2007). Reference works such as Inger (1954), Brown & Alcala (1978, 1980), Alcala (1986), and Alcala & Brown (1998) were used for species identification. Distribution and conservation status of herpetofauna species was based on IUCN Red List of Threatened Species (2014) while a list of socioeconomically important species was based on key informant interviews. Paleontological Statistics Software Package by Hammer et al (2001) was used for cluster analysis.



Figure 1. Map of the world (A) (www.marloncabilan.wordpress.com 2012) and the Philippines (B) (www.google.com.ph/maps 2015) showing the location of 19 caves (red dots) (C) (www.car-navi.ph 2010).

Table 1

Description of the 19 caves sampled in Northern Mindanao, Philippines

Cave Sites	Coordinates	Elevation meters above sea level	Water Bodies/ Droplets	Diameter of cave entrance (m)	Height of the cave entrance (m)	Type of Substrate	Type of Disturbances	Presence of stalactites, stalagmites, crevices and boulders	Guano depth	Temperature °C			Relative Humidity %			
										E	T	I	E	T	I	
Iligan City											E	T	I	E	T	I
Hindang Cave 1	08°18'121" N 124°21'394" E	2522	Absent	8.3	5.44	muddy	-	Few Stalactites, Big boulders	20 cm depth	27.3	27.3	25.4	89	89	91	
Hindang Cave 2	08°18'122" N 124°21'389' East	531	Absent	2.8	3.30	muddy	markings and graffiti	Moderate stalactites Few Stalagmites, Cave crevices, Small boulder	absent	26.5	26.5	27	81	81	84	
Hindang Cave 3	08°18'104" N 124°21'373' E	525	absent	3.9	2.93	-	markings and graffiti	Moderate Stalactites, Few crevices, boulders	25 cm depth	26.5	26.5	27	87	87	89	
Dalipuga Cave	08°18'112" N 124°21'39" E	239	present	15	9.45	muddy	spelunking and treasure hunting	Moderate stalactites, wall crevices and boulders	absent	24	24	24	82	82	82	
Gitagum, Misamis Oriental																
Gitagum Cave 1	08°34'322" N 124°22'55" E	90	absent	4.14	2.24	dry	Cooking inside cave	Few stalactites	absent	26	26	27	73	73	74	

Gitagum Cave 2	08°34'272" N 124°22'510' ' E	77	absent	1.9	0.82	dry	Low human disturbance	Few stalactites, Moderate crevices		27	27	26	74	74	76
Quezon, Bukidnon															
Minsalirac Cave 1	07° 42'017" N 125°03'322' ' E	282	absent	7	6	dry	Low human disturbance	Moderate stalactites, Few stalagmites, wall crevices	Rare	24	24	23	85	85	86
Minsalirac Cave 2	07° 42'014" N 125°03'219' ' E	356	absent	3	5	dry	Low human disturbance	Moderate stalactites, Few stalagmites, Moderate wall crevices	Rare	28	28	26	83	83	87
Minsalirac Cave 3	07° 42'014" N 125° 03'219" E	356	absent	2.5	2	dry	Low human disturbance	Moderate stalactites, Few stalagmites, Moderate wall crevices	Rare	28	28	26	83	83	87
Minsalirac Cave 4	07° 42'006" N 125°03'209' ' E	341	absent	2	2	dry	-	Moderate stalactites, Few stalagmites, wall crevices	Rare	28	28	27	91	91	90
Blue Waters Cave	07° 42'062" N 125°03'249' ' E	241	present	4	5	dry	treasure hunting	Few Stalactites and stalagmites, Few wall crevices	Rare	27	27	27	79	79	84

Kabyao Cave	07° 42'062" N 125°03'249' E	278	absent	6	7	dry	spelunking and treasure hunting	Numerous Stalactites and stalagmites, wall crevices	4 cm depth	24	24	24	85	85	89
Kitaotao, Bukidnon															
Kitaotao Cave 1	07° 42'062" N 125°03'249' E	316	absent	8	10	muddy	Low human disturbance	Few stalactites and stalagmites	absent	26	26	26	88	88	88
Kitaotao Cave 2	07° 42'062" N 125°03'249' E	328	Absent	4	5	dry	Low human disturbance	Stalactites and stalagmites	Few	27.5	27	26	87	87	89
Kitaotao Cave 3	07° 42'062" N 125°03'249' E	372	Absent	2.5	5	Dry	vandalism was noted on the walls	Moderate stalactites and stalagmites	Few	25	25	25	74	74	74
Kitaotao Cave 4	07° 42'062" N 125°03'249' E	333	Present	7	7.5	-	Low human disturbance	Moderate stalactites and stalagmites	absent	25	25.5	25.5	89	89	89
Kitaotao Cave 5	07° 42'062" N 125°03'249' E	360	Absent	3.5	4	-	Low human disturbance	Moderate stalactites and stalagmites	Rare	26	26	25	89	89	89
Valencia City, Bukidnon															
Salawaw Cave	07° 42'062" N 125°03'249' E	728	Present	3	6	muddy	Low human disturbance	Numerous Stalactites, stalagmites, and columns	Moderate	23.5	22.5	23.5	75.5	95.5	91
Kariis Cave	07° 42.062" N 125°03.249" E	437	present	20	25	muddy	Low human disturbance	Numerous Stalactites, stalagmites, and columns	Abundant	25.5	27	24	-	-	-

Legend: E- entrance zone, T-twilight zone, I- inner zone

Results and Discussion. Nine herpetofaunal species (four amphibians and five reptiles) belonging to six families were recorded in the caves surveyed (Table 2). This result was lower than the recorded number of species in forest habitats of Mt. Sambilikan (Nuñez et al 2012) but higher than the recorded number of herpetofauna species in Fiji PABITRA (Morrison & Naikatini 2008).

According to Jones et al (2003) species diversity within caves is affected by food or resource availability. Stevens & O'Connor (2006) also reported that habitat area, temperature, humidity, rainfall, latitude and altitude also affect species diversity. Kitaotao cave 5 was the most species-rich probably because it has low human disturbance.

Table 2

Species richness of herpetofauna in 19 caves in Northern Mindanao

Sampling Site	Amphibians	Reptiles	Total
Iligan City			
Hindang Cave 1	1	2	3
Hindang Cave 2	1	2	3
Hindang Cave 3	0	0	0
Dalipuga Cave	0	1	1
Gitagum, Misamis Oriental			
Gitagum Cave 1	2	1	3
Gitagum Cave 2	1	1	2
Quezon, Bukidnon			
Minsalirac Cave 1	0	1	1
Minsalirac Cave 2	0	1	1
Minsalirac Cave 3	1	0	1
Minsalirac Cave 4	1	0	1
Blue Waters Cave	1	0	1
Kabyao cave	0	1	1
Kitaotao, Bukidnon			
Kitaotao Cave 1	0	1	1
Kitaotao Cave 2	1	0	1
Kitaotao Cave 3	1	0	1
Kitaotao Cave 4	1	0	1
Kitaotao Cave 5	4	0	4
Valencia, Bukidnon			
Salawaw Cave	1	1	2
Kariis Cave	1	0	1
Total Number of Species	4(2)	5(3)	9(5)

Legend: (endemic species)

This observation concurs with the study of Heinen (1992) that species richness and diversity of herpetofauna are higher in less disturbed sites. Moreover, anuran diversity and species richness are lower in disturbed areas (Suazo-Ortuno et al 2008). This indicates that less disturbed sites could harbor many species. The Kitaotao cave 5 was an easy walk through because it has only one opening and one chamber. The presence of a body of water makes it a good microhabitat for breeding amphibians. According to the Natural Resources Conservation Service (2006), amphibians usually dwell in areas with water and cool areas where the air is humid enough to keep their body moist. Alcalá et al (2006) reported that 85 % of the Philippine amphibians are highly dependent on and sensitive to moisture. This factor could also explain the richness of Kitatotao cave 5. However, in the Blue Waters cave only one species was recorded, while in Hindang cave 3 no single species was documented. Blue Waters cave is a tourist destination because of its clear water. Residents and tourists use the cave as picnic grounds leaving trash behind. In Hindang cave 3, human disturbance as seen from markings and graffiti was

moderate in the entrance zone and none in the inner zone. Amphibians and reptiles are particularly sensitive to habitat disturbance (Natural Resources Conservation Service 2006) and thus disturbed areas have significantly lower herpetofauna diversity than in the undisturbed area (Surasinghe 2007), however there are also few species that can tolerate disturbance (Heinen 1992) like some frog and toad species which could tolerate or even increase after disturbances (Moorman et al 2011). Human activities can have adverse effects on animal distribution and abundance (Ruddock & Whitfield 2007). Moreover, human disturbance is increasingly becoming a concern to conservationists because, as human populations continue to expand, ecotourism is increasing as a potential revenue source, and wildlife in diminishing areas of refuges are exposed to greater human recreational and other anthropogenic activities (Wight 2002; Christ et al 2003). In Hindang Cave 1, Hindang Cave 2, and Gitagum Cave 1 three herpetofauna species were documented in each cave. Hindang Cave 1 is the biggest cave among Hindang caves. It was also least disturbed, being located far from human settlements and the landowner prohibited people from exploring the cave. Hindang cave 1 is located near a forest which makes this cave a good site for reptiles and amphibians. Many crickets were observed that might serve as food for reptiles and amphibians. The same observation was obtained by Browne (2009) that amphibians prefer elongated prey such as crickets or insect larvae. Hindang Cave 2 has three interconnecting chambers. There was a small extraneous debris found in the three cave zones in addition to fallen rocks and boulders that created holes suitable for reptiles, which also provide quick escape from predators. Gitagum Cave 2 is a small three-chambered cave with open canopy cover. Just like Hindang Cave 1 and Hindang Cave 2, Gitagum Cave 2 consists of abundant holes and crevices. Spiders, ants, cockroaches, bugs and crickets were observed in the caves, which are available for reptiles and amphibians as food. Macro-invertebrates serve as the primary food base of many amphibians and reptiles (Poulton 2004). Moreover, human disturbances in this site were low.

Table 3 shows the species of amphibians and reptiles found in the caves surveyed. The Philippine endemic, *Hylarana grandocula* was found in eight sites and was the most abundant species. This species was found mostly in cave entrance and mid inner zone. According to Gunn (2004), amphibians are commonly encountered at the entrance of the cave with high air humidity and buffered temperature changes. *Hylarana grandocula* is an inhabitant of undisturbed and disturbed streams and rivers in lowland forests (Diesmos et al 2004a). The presence of *Hylarana grandocula*, which feeds mainly on invertebrates (Alcala & Brown 1998), indicates the presence of food source in the cave. This species was also recorded in the study of Alcala et al (2012a) in caves and limestone habitat. *Kalophrynus pleurostigma* was found only in Kitaotao Cave 5 where two individuals were found. According to Diesmos et al (2004b), *Kalophrynus pleurostigma* is found occasionally in disturbed forests and breeds in small pools of water. This could be the reason for the existence of *Kalophrynus pleurostigma* in Kitaotao Cave 5 which is a less disturbed habitat with presence of bodies of water. *Limnonectes magnus* was found in three sites (Gitagum cave 1, Kabyao cave and Kitaotao cave 5) while *Platymantis* sp. was found in five sites (Kitaotao cave 2, Kitaotao cave 3, Kitaotao cave 4, Kitaotao cave 5 and Salawaw cave) and both were usually seen at the cave entrance up to five meters inwards for *L. magnus* and up to 10 meters for *Platymantis* sp. Alcala et al (2012b) reported that frogs are generally found in moist and cooler portions of the caves, particularly near the entrance and in moist rock crevices which are also the location of amphibian species found in this study. Calls of *Platymantis* sp. were heard in the four caves in Kitaotao (caves 1-4). This species made its call inside rock crevices and holes where it cannot be seen. It was observed to be very sensitive to noise that it automatically stopped calling with just one small noise. It took 1-3 hours before it made another call. Calls of *Limnonectes magnus*, *Hylarana grandocula*, and *Kalophrynus pleurostigma* were also heard in Kitaotao cave 4. The calls emanated from the accumulated debris at the entrance of the cave which was observed to be the microhabitat of these anurans. Of the reptiles, *Cyrtodactylus annulatus* was found to be widespread being found in eight sites, which is expected since this species is known to occur in limestone caves.

Table 3

Species list of herpetofauna in 19 caves in Northern Mindanao

SPECIES	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	Total
AMPHIBIANS																				
Family																				
Dicroglossidae																				
<i>Limnonectes</i>																				
<i>magnus</i> ⁺																				
(Large Swamp Frog)	0	0	0	0	3	0	0	0	0	0	0	2	0	0	0	0	5	0	0	10
Family																				
Microhylidae																				
<i>Kalophrynus</i>																				
<i>Pleurostigma</i>																				
(Black-spotted Narrow-mouthed frog)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2
Family																				
Ranidae																				
<i>Platymantis</i> sp.																				
<i>Hylarana</i>	0	0	0	0	0	0	0	0	0	0	0	0	0	3	5	2	2	1	0	13
<i>grandocula</i> [*]	2	1	0	0	2	1	0	0	0	1	2	0	0	0	0	0	3	0	2	14
(Big-eyed Frog)																				
REPTILES																				
Family Elapidae																				
<i>Ophiophagus</i>																				
<i>hannah</i> [^]	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
(King Cobra)																				
Family																				
Gekkonidae																				
<i>Cyrtodactylus</i>																				
<i>annulatus</i> [*]	0	1	0	1	0	1	1	1	1	0	0	0	1	0	0	0	0	0	1	8
(Small Bent-toed Gecko)																				
Family Scincidae																				
<i>Sphenomorphus</i>																				
<i>fasciatus</i> [*]	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
(Banded Sphenomorphus)																				
<i>Sphenomorphus</i>																				
<i>jagori</i> [*]	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
(Jagor's Sphenomorphus)																				
<i>Sphenomorphus</i>																				
<i>variegatus</i>	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
(Blacked -spotted Sphenomorphus)																				
Total Number of Individuals	4	3	0	1	6	2	1	1	1	1	2	2	1	3	5	2	12	1	3	51
Total Number of Species	3	3	0	1	3	2	1	1	1	1	1	1	1	1	1	1	4	1	2	9

Legend: (A) Hindang Cave 1, (B) Hindang Cave 2, (C) Hindang Cave 3, (D) Dalipuga Cave, (E) Gitagum cave 1, (F) Gitagum Cave 2, (G) Minsalirac Cave 1, (H) Minsalirac Cave 2, (I) Minsalirac Cave 3, (J) Minsalirac Cave 4, (K) Blue Waters Cave, (L) Kabyao Cave, (M) Kitaotao Cave 1, (N) Kitaotao cave 2, (O) Kitaotao Cave 3, (P) Kitaotao Cave 4, (Q) Kitaotao Cave 5, (R) Salawaw Cave, (S) Kariis Cave; *endemic, + near threatened, ^vulnerable

These species is also found in a wide variety of microhabitats, including among detritus on the forest floor, under rotting logs in forests and it also congregates in suitable habitat close to rivers and streams (Brown & Rico 2009). The endemic *Sphenomorphus jagori* was only found in Hindang cave 1 with only one individual, although this species has wide distribution, presumed large population and has tolerance to habitat modification (Brown et al 2009).

Cluster analysis (Figure 2) shows that the first group consists of cave sites situated in Bukidnon area (caves N, P, O, R). These N, P, O, R caves are less disturbed and serve as good habitats for herpetofauna because of the high number of insects found at the time of study. *Platymantis*, which is known to be karst habitat-specialised as reported by Siler et al (2010), was commonly found or shared in N, P, O, R cave sites. Furthermore, the most similar sites in this group are caves N and P, which are less disturbed, with presence of water droplets or bodies of water and high availability of food such as insects. The other group of sites, J to L, had low to moderate disturbance with sparse vegetation. The Caves E, Q, L formed a branch at <40% similarity because of the presence of human disturbance in this group affecting the presence of the near threatened species *Limnonectes magnus*. According to Diesmos et al (2004c) *Limnonectes magnus* inhabits undisturbed and disturbed streams and rivers in lowland forests and is threatened by habitat loss due to logging and harvesting for human subsistence. Moreover, the presence of *Limnonectes magnus* in caves E, Q and L could be due to the abundant availability of spiders and crickets which serve as food. The similarity of Caves E and Q at >50% was observed to be due to the occurrence of anthropogenic activities in both caves where there were occasions that farmers cooked and took meal inside the cave affecting the presence of *Limnonectes magnus* and the endemic *Hylarana grandocula*. Another group branches out at <30 similarity forming the group of caves J, B, F, K, S, A. Caves J, B, F are then further clustered to caves B and F possibly due to sharing of two endemic species found in the sites, namely *Hylarana grandocula* and *Cyrtodactylus annulatus*. Caves K, S, A had >60% similarity but further clustered to caves K and S at >75% because of the presence of similar species in these sites. On the other hand, caves M, D, G, H, I, which clustered together, are characterized by low human disturbance and almost the same ambient temperature values. Moreover, the reptile species, *Cyrtodactylus annulatus* was the only species present and shared by these cave sites.

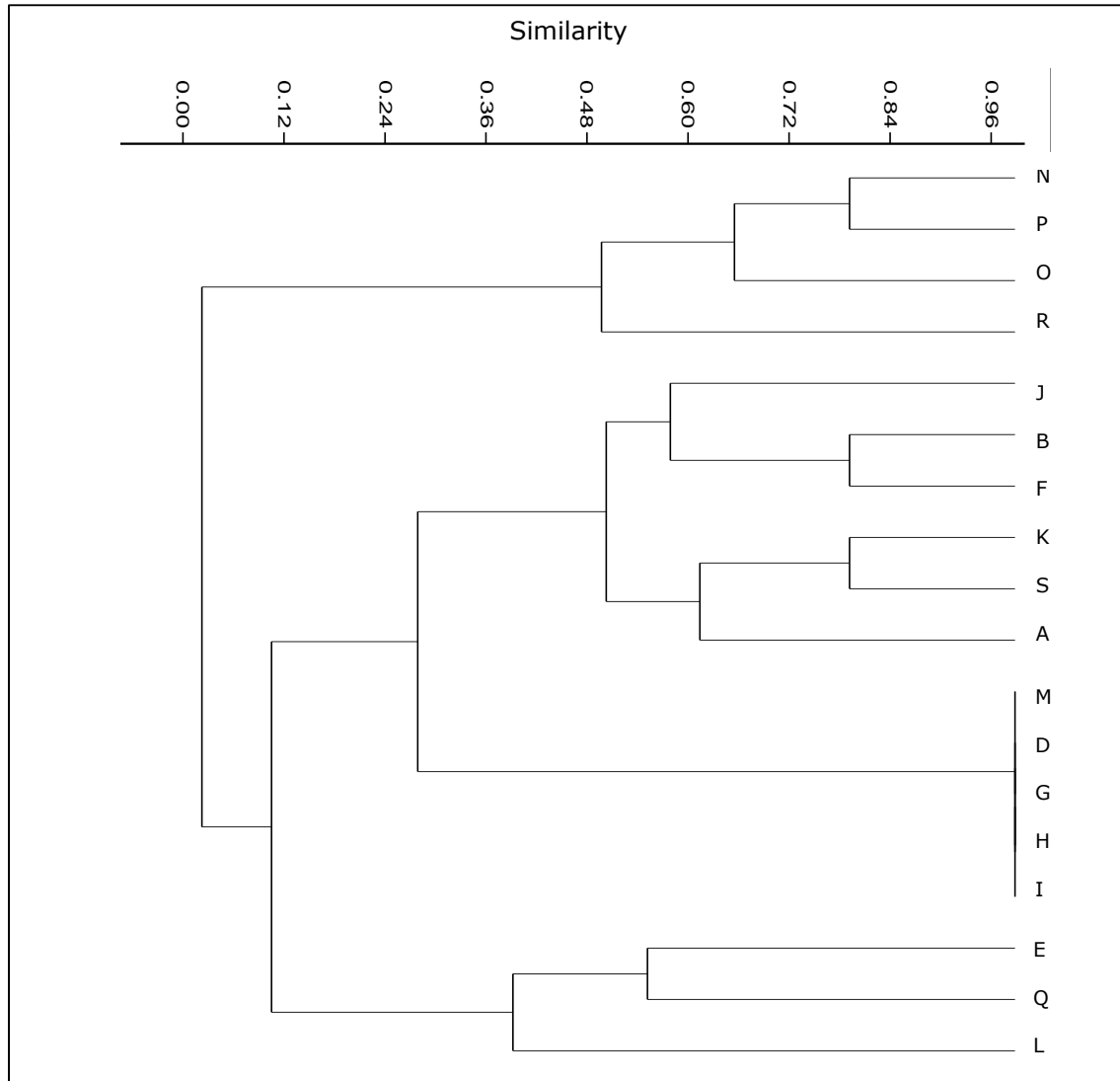


Figure 2. Similarity of cave sites in Northern Mindanao using cluster analysis (Bray-curtis). (A) Hindang Cave 1, (B) Hindang Cave 2, (C) Hindang Cave 3, (D) Dalipuga Cave, (E) Gitagum cave 1, (F) Gitagum Cave 2, (G) Minsalirac Cave 1, (H) Minsalirac Cave 2, (I) Minsalirac Cave 3, (J) Minsalirac Cave 4, (K) Blue Waters Cave, (L) Kabyao Cave, (M) Kitaotao Cave 1, (N) Kitaotao cave 2, (O) Kitaotao Cave 3, (P) Kitaotao Cave 4, (Q) Kitaotao Cave 5, (R) Salawaw Cave, (S) Kariis Cave; *endemic, + near threatened, ^vulnerable.

Four species (44%) were recorded to be endemic with one species documented to be under Near Threatened (*Limnonectes magnus*) and Vulnerable (*Ophiophagus hannah*) category of IUCN (2014) (Table 4). General threats observed to the cave biodiversity were guano harvesting and treasure hunting which greatly disturb the cave fauna. According to DENR (2014) guano harvesting also leads to the loss of biodiversity, specifically of the guano-dependent animals. McFarlane (1986) and Mithra (2012) observed that caves with excessive disturbance associated with guano harvesting and tourism lead to the decrease of species. The endemic species were observed to have wide distribution in the caves, for instance, *Hylarana grandocula* was found in eight sites which have bodies of water or have moist environment. Likewise, *Limnonectes magnus* was found in three sites, also with bodies of water, and *C. annulatus* in eight sites. *C. annulatus* has wide distribution, presumed large population and inhabits wide variety of microhabitats (Brown & Rico 2009) while *Hylarana grandocula* is adaptable with a

presumed large population and is also at times common in disturbed habitats (Diesmos et al 2004a). These endemic species appear to thrive in the cave habitats in this study.

Table 4

Conservation status and distribution range of herpetofauna recorded in selected Caves in Northern Mindanao, Philippines

Species	Common Name	Distribution Status (IUCN, 2014)	Conservation Status (IUCN, 2014)
AMPHIBIANS			
Family Dicroglossidae			
<i>Limnonectes magnus</i>	Giant Philippine Frog		Near Threatened
Family Microhylidae			
<i>Kalophrynus pleurostigma</i>	Black-spotted Narrow-mouthed Frog		Least Concern
Family Ranidae			
<i>Platymantis</i> sp.			
<i>Hylarana grandocula</i>	Big-eyed Frog	Philippine Endemic	Least Concern
REPTILES			
Family Elapidae			
<i>Ophiophagus hannah</i> (King Cobra)	King Cobra		Vulnerable
Family Gekkonidae			
<i>Cyrtodactylus annulatus</i>	Small Bent-toed Gecko	Philippine Endemic	Least Concern
Family Scincidae			
<i>Sphenomorphus fasciatus</i>	Banded Sphenomorphus	Philippine Endemic	Least Concern
<i>Sphenomorphus jagori</i>	Jagor's Sphenomorphus	Philippine Endemic	Least Concern
<i>Sphenomorphus variegatus</i>	Black-spotted Sphenomorphus		Least Concern
Total Number of Endemic Species		4	

Conclusion. Caves in Northern Mindanao support a considerable number of herpetofauna. Kitaotao cave 5 is the only cave site which had the presence of all documented amphibians in the study. The presence of endemic and threatened species in caves indicates the need for protection of the caves. Other caves in Mindanao need to be assessed in order to come up with a complete database of the cave herpetofauna in Mindanao.

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