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THE BAT SPECIES IN CAMOTES ISLANDS, CEBU, PHILIPPINES

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ABSTRACT

The study was conducted to assess the bats species in Camotes group of Islands, Cebu, Philippines. It specifically aimed to identify species composition and relative abundance of bats in the study sites. The assessment was undertaken from 16-20 May 2005 in the two sampling sites, Montealegre, San Francisco and Pagsa, Poro respectively. Thirty five mm mesh monofilament mist nets 4m x 6m in dimension were used to capture the bats and mounted at different elevational gradient (upper slope, middle slope and lower slope), along flyways, across ridges, ravines and near fruiting trees. Ingle and Heaney's Key to the Bat of the Philippine Island (1992) was used in bat identification.

A total of 101 bats representing three different species of fruit bats (Megachiroptera:Pteropodidae) were netted. Seventy nine individuals were captured in Pagsa and Twenty two in Montealegre respectively. Of which fifty five species of the common Short-nosed Fruit Bat (*Cynopteros bracyotis)*, 32 were the Common Rousette (*Rousettus amplixicaudatus)* and 14 were the Dagger-toothed Flower Bat (*Macroglossus minimus).*

Results also showed that the abundant fruit bat species in the area was the *Cynopteros bracyotis* followed by th *Rousettus. amplexicaudatus* and the lowest was *Macroglossus. minimus*. There were no insect bats captured, this could be attributed to the fact that insect bats has the ability to echolocate and enable to evade the nets (Sedlock, 2001).

The presence of these bats indicate that the forest habitat in Camotes group of islands is already disturbed and degraded therefore, conservation efforts of the island is imperative. Information, education and communication must be fully intensified to upgrade the awareness and attention of the populace with regard to the importance of biodiversity conservation and protection particularly on bats.

INTRODUCTION

The exceptionally rich and biological diversity of the Philippines is evident from its highly variable distribution and composition of endemic terrestrial vertebrates on each island or island group. This can be largely based on the formation of these islands into distinct faunal regions namely: Greater Luzon, Greater Mindanao, Greater Negros-Panay, Greater Mindoro, Greater Sulu and Greater Palawan.

The most threatened or critically important faunal region is definitely the Greater Negros Panay or Western Visayas faunal region, comprised of the Masbate, Ticao, Panay, Guimaras, Siquijor, Negros and Cebu islands. This region is now recognized as one of the world's ten highest priority conservation areas, because more than 93% of its natural vegetation were already gone and many species are listed in the Red List of Threatened Species (Hilton-taylor, 2002). Thus, it makes Philippines as one of the two countries in the world, Madagasgar, being the other, which are both megadiversity country and biodiversity hotspot.

In spite of the biodiversity crisis, the archipelago is still a home to one of the greatest concentrations of mammalian diversity (Tabaranza, et al., 1997). It ranked fifth on the world's list of endemic mammals (Mittermeier, R., 1997).

Habitat loss is the main threat to biodiversity in the Philippines. Logging and shifting cultivation (*kaingin making*) are regarded as the primary forces of habitat conversion (Davis *et al.*, 1995). Disturbance of cave roosts by guano mining and hunting of bats for meat have also contributed to the decline of this species.

The island of Cebu is one of the most degraded areas in the country. Thus, it is considered a conservation priority in terms of both numbers of endemic species and degrees of threat. Furthermore, it was also the hottest of the global hotspots for biodiversity conservation based on recent data on forest cover of the islands shown through satellite maps conducted in 1987, wherein less than 1% of Cebu island's original forests remain.

It is also in Cebu where the supposed extinct Philippine Bare-backed Fruit Bat was rediscovered first (Paguntalan *et al*., 2001). A number of threatened bat species are also found, including: the endangered Golden-crowned Flying Fox, Large Flying Fox, Little Golden-mantled Flying Fox, and the critically endangered Philippine Tube-nosed Fruit Bat. Notably, all these threatened wildlife are distributed in forest fragments that are widely separated from each other, and are under enormous pressure of disappearing.

Camotes group of islands is located between the islands of Cebu and the Leyte group of islands. However, Camotes islands was never connected to Cebu or to the greater Pleistocene islands more than ten thousand years ago. Hence, Camotes is considered an oceanic island. A very limited information on the volant mammals of this island creates gap in knowledge, therefore, there is a possibility that species occurrence on the said islands might be different as that of the mainland. Thus, this endeavor.

MATERIALS AND METHODS

I. Study Site

The study was conducted in the Camotes group of islands on May 16 to 20, 2005. Camotes Islands is situated in Central Visayas in the Philippines with coordinates of 10^{o} 40' N 124^{o} 24' E. It is a part of the province of Cebu in Region VII. Camotes Islands is located east of Cebu and west of Leyte. It is made up of three main sub-islands and divided into four municipalities. This four capital towns are Pilar, Poro, San Francisco and Tudela. Camotes Island's topography is hilly. The highest point of the island is 386 meters above sea level. It's climate is characterized by distinct dry season. The island is approximately 562 kilometers south east of Manila, 62 kilometers north east of Cebu and 25 kilometers west of Ormoc. It has a total size of 20,964 hectares.

The Camotes are low-lying islands. There is only one hill on Pacijan and another hill on Poro. Pacijan has a fresh-water lake around two kilometers in length. Palm trees are the dominant plant on the islands. There are also numerous native varieties of fruit trees and other plants.

The dominant timber species were mostly pioneer species (108 species) and 6 species were associated to old-growth forests and found to be commercially important these include: Molave (Vitex parviflora), Dao (Dracontomelon dao), Malugai (Pometia pinnata), Bogo (Garuga floribunda), and Langil (Albizia lebbeck). Most timber species found were not commercially important. Apparently, the big trees of prime timber species are already removed by extraction. Trails frequently used by locals in going from one farm to the other have been observed.

Data collection was concentrated in two study sites. These study sites were in Montealegre, San Francisco which is located in Pacijan island and Pagsa, Poro which is situated in Poro island respectively. These two islands are actually joined together by a paved road.

II. Site Characterization

Preferential sampling was used in characterizing the vegetation of the mist-netting sites. Quadrats measuring 20 m x 20 m were established where mist net was located to determine the forest structure. The gathering of data for trees included common name, scientific name, total height, and diameter at breast height (DBH). The trees were identified using the revised Lexicon of Philippine Trees (Rojo, 1999).

The forest structure was determined in terms of percent crown cover and its quantification was based in modification of Braun-Blanquet criteria, namely closed if the vegetative cover is 76%- 100%, moderately closed if the cover is 51-75%, and fairly closed if the cover is 50% or less.

III. Instrumentation

The study utilized a variety of research instruments to effectively gather relevant data that would address the objectives in the study.

An improved data sheet was made for easy recording and measurements of captured bats. The age, sex, body length, forearm length, and other data needed (following Ingle and Heaney 1992) were arranged in column in the data sheet. Caliper with dial was used to measure the biometrics of bats and spring balance was used for the recording of weight. The " Key to the Bats of the Philippines" by Ingle and Heaney (1992) was used in the identification of bats.

Basic information on site characterization was gathered and made on sites where mist nets were located. A data sheet was then devised to record data on the vegetation components of the characterization which include among others the identification of species in terms of common name, family name, scientific name and measurements in terms total height, and diameter at breast height (DBH) . It also provided space for recording the ground coordinates and elevation. For forest structure data, the first five big trees were recorded. Notes on the number of fruiting trees and their identification were also recorded.

The instruments which were commonly used on the site characterization were the following: Global Positioning System (GPS), diameter tape, steel tape, ruler, and the like. The GPS was used to determine the coordinates and elevation of the mist-netting sites. The same instrument was used to determine the distance of the nets location from rivers and other bodies of water.

IV. Sampling methods/Mist netting procedure

To capture the bats, 35 mm mesh monofilament mist nets 4m x 6m in dimension were set-up in areas that are believed to maximize capture success, either near or adjacent to fruiting trees or in expected flight routes/flyways, in clearings, ridges, ravines, across caves, or by water (Heany *et a*l., 1989), in a variety of combinations, such as 'Z' and 'T' formations (Kunz *et al*., 1996).

Using tree climbers and/or sling shots, ropes were hung over tree branches, between 3-10 meters from the ground. These ropes were used to raise the mist nets up to the desired height. Nets were usually open from 6:00 PM to 6:00 AM (considered as one net- night) but were closed during periods of rain and checked from 7:00 PM to 12 MN and 3:00 AM to 5:30 AM (with 3 hours interval). As soon as bats were captured, mist nets were immediately lowered and bats were removed to prevent injury. Captured bats were placed in bags made of cotton to avoid stress and harm in them.

For the first study site at Montealegre, San Francisco, sampling lasted for two days using 15 nets totalling 30 net nights. The site was sampled covering the period from 16-17 May 2005.

For the second study site at Pagsa, Poro, the netting efforts lasted for three days which constitute a total of 45 net nights using 15 nets. Between 18-20 May 2005, sampling was conducted in this particular site.

VI. Bat Identification

Bat Examination/Measurement

Captured bats species were identified following the "Key to the Bats of the Philippine Islands" by Ingle and Heaney (1992). Biometric measurements were done using a dial caliper wherein the length of their forearm (measured to the nearest 0.1 or 0.5), hindfoot, tail, body, ear and the total length were noted. Bats weight were also determined to the nearest 0.1 or 0.5 g with a 50- 0r 300- g spring balance. No cranial measurements of bats being undertaken.

Determination of Maturity and Sex

After measuring and examining the external structures of bats. Bats were classified into age classes based on the presence or absence of cartilaginous metacarpal and phalangeal epiphyseal plates, determined by transilluminating the metacarpal-phalangeal joints with a flashlight (Anthony, 1988). Juveniles were defined as those bats with both phalangeal and metacarpal plates visible, subadults as bats with only one plate visible, and adults as bats with no plates visible.

As to sex determination, examination of the genitalia was done. Males have a conspicuous penis (except sub-adult male *Rousettus* in which the penis is retracted into the abdomen). Both sexes possess axillary nipples on the upper chest, usually near the armpit (axilla). However, the nipples of adult females are more prominent than those of males.

Most bats captured were released immediately after processing. Before release, each bat was marked so that it could be identified if recaptured.

Relative abundance of species was also calculated by the number of individuals per species collected over the total number of individuals caught (Brower et al, 1990).

RESULTS AND DISCUSSION

A total of 101 bats representing three different species of fruit bats of the 70 species recorded in the Philippine archipelago (Heaney et al., 1987; Ingle and Heany, 1992; Koopman, 1989) all belong to the sub-order megachiroptera and family Pteropodidae were netted. The fruit bats species include the common short-nosed fruit bat (*Cynopterus brachyotis)*, common Rousette *Rousettus amplexicaudatus,* and dagger-toothed flower bat *(Macroglossus minimus)*. Seventy nine individuals were captured in Pagsa, Poro and Twenty two in Montealegre, San Francisco respectively. Table 1 provides a summary for all fruit bats species captured. Fifty five species of which were *Cynopterus bracyotis*, there were thirty two *Rousettus amplexicaudatus* and fourteen were *Macroglossus minimus*. It was indicated in the results that more individuals caught in Pagsa than in Montealegre perhaps this is attributed to the condition of the vegetative cover of the former wherein it had still a plant cover of 50 % and 55% canopy cover and also the forest habitat is not so disturbed and degraded as compared to the later which is not only disturbed but also degraded only about 10% of the total area of the sampling area. Depite most of these species of fruit bats captured were associated with disturbed, degraded, lowland cultivated areas and in agricultural areas where they occur abundantly (Heaney *et al*., 1989; Utzurrum, unpubl. Data).

Table 1. Summary of Fruit Bats Species (Megachiropteran: Pteropodidae) captured during the survey in Camotes Islands, Cebu on 16-20 May 2005

Fruit Bat Specie	**Sampling Sites**		**Total**
	Motealegre,San Francisco	Pagsa, Poro	
Common Short-nosed Fruit Bat ***Cynopteros brachyotis***	13 (1)12 , M-10 F-3	42 (2)38,1* M-16 F-24	**55**
Common Rousette ***Rousettus amplexicaudatus***	5 (0)5, M-4 F-1	27 (2)18, 2* M-10 F-16	**32**

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Dagger-toothed Flower Bat ***Macroglossus minimus***	4 (0)3,1*, M-3 F-1	10 (0)10 M-6 F-4	**14**
Total	**22 (1)18, 1* M-17 F-2**	**79(4)66, 3* M-32 F-44**	**101**
Total no. of net-nights	**30**	**45**	**75**

Note: Figures inside parenthesis denotes juveniles while outside denotes adults and with asterisk denotes sub-adult as for age classes. Whereas M refers to male and F represents female bats.

As observed in Table 2, all three species were present in two sampling sites. This was attributed to the fact that the three fruit bat species mentioned here were included in species with populations known to be stable or increasing, and are geographically widespread both within and outside the Philippines and resistant to habitat disturbances and forest degradation. All species are associated with disturbed, agricultural areas where they are usually abundant (Heany *et., al*., 1989; Heideman and Heany, 1989; Ricart *et al*., in prep.; Utzurrum, unpubl. Data).compared to the other species of fruit bats which are not caught they are not only widely distributed but also endemic to some islands of the Philippines.

Table 2. Species of fruit bats observed in each study site

Fruit Bat Species	Study Sites	
	Motealegre,San Francisco	**Pagsa, Poro**
Common Short-nosed Fruit Bat		
Cynopteros brachyotis	**x**	**x**
Common Rousette		
Rousettus amplexicaudatus	**x**	**x**
Dagger-toothed Flower Bat		
Macroglossus minimus	**x**	**x**

Results also showed that among the fruit bat species captured *Cynopterus bracyotis* had the highest number of individuals netted with relative abundance of 54.45% (55 individuals) since this particular species has a wide range in terms of geographical distribution they occur abundantly in lowland cultivated areas and ranges up to montane forest habitats and widespread in Southeast Asia and throughout the Philippines (Heany *et a*l., 1987). In forests, it appears to rely mostly on wild figs for food (Utzurrum, !984, unpubl. Data). In disturbed and cultivated habitats, it is regularly netted in large numbers around orchards and patches of bananas (Musa spp.). This result was also indicated in the studies of Tamblyn *et al*., 2003 and Paguntalan *et al*., 2001

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Rousettus amplexicaudatus was the second commonly captured bat species accounting for about 31.68% (27 individuals). This species is geographically widespread from Thailand to the Solomon Islands and occurs throughout the Philippines (Heany et al., 1987). It is most common in disturbed and agricultural areas the same condition existing in the two sampling sites. The least number of individuals caught was the *Macroglossus minimus* having a relative abundance of 13.86% as with the other two species previously mentioned this is also included in the list of species with populations known to be stable or increasing, and geographically widespread. The species is abundant in agricultural areas, but also occurs uncommonly in secondary and primary forests over a broad elevational range (Heany et al., 1989; Utzurrum, unpubl.data). This species is often associated with patches of *Musa spp*.but may not be as strictly nectavorous (Heany *et al*., 1987).

The total number of male and female fruit bats species captured were almost equal in number with 47 males and 44 females. In terms of age classes, there were 88 adults, 10 sub-adults and 3 juveniles that have been captured. Bats captured were mostly adults, this is interesting to note that just like any other mammalian species the adult member will always be the one responsible in finding food and rearing their youngs.

There were only few species of fruit bats netted during the sampling compared to what was recorded in the study of Paguntalan *et al.*, 2001 there were five species being identified and reported. The capture of these bat species with their association with disturbances in agricultural areas indicate that the forest habitat in Camotes group of Islands is degraded and disturbed since they are regarded as indicators of such degraded habitats (Utzurrum, 1992).

There were no insect bats (microchiropteran) captured during the conduct of the study this could be attributed to the fact that insect bats has the ability to echolocate and enable to evade the nets (Sedlock, 2001). It is acknowledge that the bat species captured were few or limited with reference to the previous study conducted by Paguntalan *et al.*, 2001 where they were able to capture five different species, therefore, it is suggested that netting efforts should be intensified in order attain more capture success in the future.

CONCLUSIONS

Based on the findings the following conclusions were drawn:

1. A total of 101 individuals representing three species of fruit bats were netted. The most commonly captured and the most abundant species were the common short-nosed fruit bat *Cynopteros brachyotis* followed by common rousette *Rousettus amplexicaudatus* and the least number of individuals captured hence the lowest in terms of abundance was the dagger-toothed flower bat *Macroglossus minimus.*

2. The capture of these bat species indicate that the forest habitats in the Camotes group of Islands were already in degraded condition since these species are indicators of a disturbed and degraded habitats.

RECOMMENDATIONS

1. In order to obtain a complete list of the bats species of the island, intensive field efforts, and methods of capturing bats aside from netting, will be explored.

2. Though the bat species encountered during the survey are not in the “Red List of Threatened and Endangered Species” (Hilton-Taylor, 2002) yet they are still vulnerable to extinction if present threats will continue, so conservation efforts is a paramount concern and should be intensified more importantly at the local level.

3. Information, education and communication campaign must be thoroughly implemented in order uplift the awareness and awaken the attention of the populace in the area essentially on the importance biodiversity conservation and protection particularly on bats.

4. Though bats have a vital role in the ecology of the Philippine forests, particularly as pollinators and seed dispersers, very limited information about their distribution and ecology. Hence, further studies along this line are greatly needed.

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