

STUDIES OF FRUIT BATS ON NEGROS ISLAND, PHILIPPINES

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ABSTRACT

The current status of population of fruit bats in some forests of Negros Island was assessed between March 1999 and March 2003. Bats were studied using mist nets and direct observations at their roost sites and in captivity at the A.Y. Reyes Zoological and Botanical Garden of Silliman University. A total of twelve species of fruit bats were recorded; namely, *Acerodon jubatus*, *Cynopterus brachyotis*, *Eonycteris spelaea*, *Haplonycteris fischeri*, *Harpyionycteris whiteheadi*, *Macroglossus minimus*, *Nyctimene rabori*, *Ptenochirus jagori*, *Pteropus hypomelanus*, *P. pumilus*, *P. vampyrus*, and *Rousettus amplexicaudatus*. A new island record of the Greater Bamboo Bat *Tylonycteris robustula* was first recorded in Canaway, Mantikil, Siaton, Negros Oriental. Species *A. jubatus*, *P. vampyrus*, and *P. hypomelanus* were observed roosting in thousands and in hundreds at Calinawan-Moratorium Area, Apo Island, Sta. Catalina, Vallehermoso, and San Jose in Negros Oriental and in Patag, Mambucal-Murcia, and Danjungan Island, in Negros Occidental.

The data gathered have been used to develop a community-based conservation education program aimed at increasing awareness of the importance of bats in the ecosystem. A local community and the Province of Negros Oriental have also initiated significant protective measures for the conservation of this species. On Negros Island, fruit bats are heavily hunted especially in their roosting and feeding sites.

Introduction

The Philippines is one of the world's major centers of biological diversity (WCSP, 1997; Kennedy *et al.*, 2000). Because of its high level of species endemism and the severity of threats to the survival of these species, the country is among the

top ten of the world's biodiversity "hotspots" (Mittermeier, 1988). One of the highly diverse vertebrate faunal groups in the country with high endemism are fruit bats (Heaney *et al.*, 1998). From the 25 total number of fruit bat species in the Philippines, 14 are found on Negros of which eight species are endemic. These include *Acerodon jubatus*, *Dobsonia chapmani*, *Eonycteris robusta*, *Haplonycteris fischeri*, *Harpyionycteris whiteheadi*, *Nyctimene rabori*, *Ptenochirus jagori*, and *Pteropus pumilus* (Heaney *et al.*, 1998; Ingle and Heaney, 1992).

In the Philippines and elsewhere, fruit bats play an important role in the pollination and seed dispersal of many tropical plants (Hutson *et al.*, 2001; Mickleburgh *et al.*, 1992; Fujita and Tuttle, 1991). However, bats face a number of threats that are pushing the natural populations to the brink of extinction (Utzurum, 1992). These include habitat destruction by human disturbance at roost sites (e.g. hunting, guano extraction, and visits by people) and unregulated local or commercial hunting and trade (Mickleburgh *et al.*, 1990; Heaney and Regalado, 1998; Mildenstein *et al.*, paper in prep.).

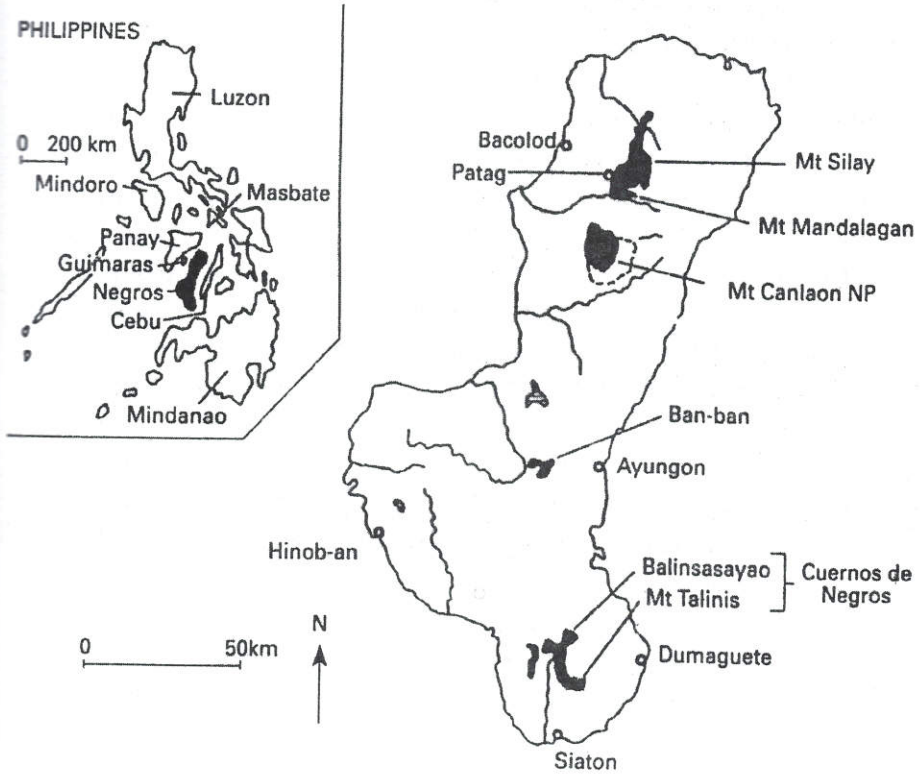
Thus, a concerted effort towards developing flexible and multidimensional programs to address problems of conservation for this species is imperative. This paper presents the current condition of the remaining population of fruit bats in the wild and the conservation activities being carried out through community-based initiatives.

Methodology

Description of Study Sites

Field surveys were conducted in selected forests of Negros Island, especially in Banban (Mabato-Candanaay Forests of Ayungon), Campuestohan (Mt. Mandalagan), Canaway and Landay (Mantikil, Siaton), Danjungan Island, Nasuji and Guinsayawan (Mt. Talinis Range), Twin Lakes and Calinawan (Sibulan), Maladjas-Talalak (Sta. Catalina), and caves in Candugay, Siaton and Guihulngan.

Figure 1. Map showing the island of Negros and the study sites (adapted from Brooks *et al.*, 1992).



Banban-Ayungon Forests

Between 26 March and 10 April 1999, a survey was conducted in the forests of Tihol-tiholan (9° 48' 68" N, 123° 0' 38" E), Katungaw-tungawan (9° 51' 23" N, 123° 0' 29" E), and Manlawaan (9° 50' 35" N, 123° 0' 36" E) in Barangays Banban, Mabato, Candanaay, Maaslum, and Jandalamanon of Ayungon, Negros Oriental from elevations 750 to 896 m asl. These five barangays harbor a mature secondary lowland dipterocarp forest dominated by red and white laua-an and tangile trees (*Shorea negrosensis*, *Pentacme contorta*, and *S. polysperma*) with dbh that range from 20-260 cm and 8-30 m in height. Although the canopy was observed to have at least 40-70 percent opening in most parts of the forests, the undergrowth is dominated by saplings of dipterocarp species, shrubs, some herbs, ground orchids (*Spathoglottis* sp.), climbing pandan, and rattan (*Calamus* sp.). Orchids (*Vanda* sp.) and lipstick vines (*Aeschynanthus* sp.) were observed growing from the ground climbing to tree trunks that reached upper branches. Clinging to some of the branches in larger trees are epiphytes, such as hanging fern (*Platyrium coronarium*), bird's nest fern (*Asplenium nidus*), and many varieties of orchids including species of *Gramatophyllum* and *Medinilla* spp. the latter, oftentimes seen growing on grounds in most parts of the forests. The forest ground is covered with humus and thick layer of decaying leaves (see detailed description of the site in CenTrop, 1998 unpubl. report, Brooks *et al.*, 1992 and Paguntalan *et al.*, 2001).

Campuestohan, Mt. Mandalagan Area

Mist-netting was conducted between 7 and 10 and 25 of May 1999 in a lightly disturbed old-growth forest, secondary forest, and abandoned clearings near Sitio Campuestohan, Mandalagan of the North Negros Forest Reserve 10° 39' N, 123° 08' E (see also Turner *et al.*, 2001 for the detailed description of the site).

Canaway, Mantikil, Siaton

From 28 to 31 March 2000, mist-netting was conducted along the Canaway River headwaters, ridge tops, and agricultural portions of the area (9° 12' 59" N, 123° 04' 12" E). The lowland forest (750-850 m asl) is a dipterocarp forest dominated by *Shorea* spp. and some species of *Lithorcarpus* and *Ficus* spp. clinging on boulders and rocks. Between 750 m asl to more than 1300 m asl, tree species *Agathis* and *Podocarpus* interspersed with "bolo" plants (*Schizostachium* sp.), oftentimes in dense population along steep ravines and between ridges, dominated the area. Epiphytes observed were composed of several species of orchids (*Vanda lamellata*), ferns (*Lycopodium* spp.), climbing vines, hoyas, lianas, bromeliads, *Medinilla* spp. and lipstick vines (*Aeschynanthus* sp.). In most of the forest clearings, agricultural crops were planted (*Cocos nucifera*, carrots, *Zea mays*, green onions, *Manihot esculenta*, *Coffea Arabica*, and *Ipomoea batatas*).

Danjugan Island

Occasional mist-netting was carried out on the Island from 25 to 28 April 2000. Danjugan Island is a small (approximately 43 ha), coral-fringed island covered with tropical limestone forest, 3 km west of Cauayan, Negros Occidental and 3 km off the coast of Barangay Bulata in the Sulu Sea (King *et al.*, 2002). In February 2000, the Island was designated as the Danjugan Island Marine Reserve and Sanctuaries (DIMRS) by the Municipal government of Cauayan and the provincial government of Negros Occidental (see King *et al.*, 2002; Harborne *et al.*, 1996; Turner *et al.*, 2002 for detailed description of the Island).

Landay, Mantikil, Siaton

Between 6 and 9 June 2000, mist-netting was conducted along a mature secondary forest and a mossy forest dominated by dipterocarp species (*Hopea*, *Pentacme*, and *Shorea* spp.), along river banks, and from 756 m asl up to 950 m asl on ridge

tops in Landay, Mantikil, Siaton, Negros Oriental (9° 59' 39" N, 123° 00' 14" E) dominated by *Agathis* spp., *Podocarpus* spp., and many varieties of *Ficus* spp. Canopy is oftentimes closed and sometimes with 30 percent light penetration. Fallen logs were observed as fairly common and shrubs and tree ferns (*Cyathea* spp.) dominate most of the ridges and slopes. Species of pandans, Araceae, ground ferns, and *Calamus* spp. constitute ground cover. Climbing lianas, hoyas, drynarias, and lycopodiums were observed on tree trunks of most emergent trees in the area. Moss cover is common even on dead logs and along rocks and riverbanks, and tree buttresses. Common epiphytes observed were orchids, bromeliads, and lipstick vines (*Aeschynanthus* sp.), and *Medinilla* spp. (also observed on understorey and riverbanks).

Nasuji, Valencia

Mist-netting activities were conducted between 21-24 May 2001 in Nasuji, Puhagan, Valencia, Negros Oriental. The forest of Nasuji is part of the PNOC-EDC Project and is just a few kilometers away from the Palinpinon Geothermal Power Plant. The area is described as a mid-montane forest type dominated by almaciga (*Agathis* sp.; average dbh of 300-535 cm) and white and red laua-an trees (*P. contorta*) and (*S. negrosensis*) with average dbh of 35 and 50 cm. respectively). A few individuals of ulayan trees (*Lithocarpus* sp.), *Ficus* spp., and apitong (*Dipterocarpus grandiflorus*) were also observed in the area. Many tree ferns (*Cyathea contaminans*), epiphytic plants (*Rhododendron* spp.), *Medinilla* spp., vines (*Aeschynanthus* sp.), and orchids were observed on river banks as well as on trunks and branches of taller trees, and these constitute the understorey of the forest. Several abaca plantations (*Musa textiles*) were observed on elevations 600 to 800 m asl.

Twin Lakes Balinsasayao and Danao

A survey was conducted on 27 - 28 June and 16 - 19 October 2001 in the Twin Lakes Balinsasayao area (9° 21' 10"N,

123° 10' 30" E). Steep slopes characterize Twin Lakes and their immediate surroundings. Some portions have low elevation and rolling terrain dominated by dipterocarp forest with some 181 tree species (RSA, 1994). Illegal cutting of trees and *kaingin* practice have mainly cleared the forest of many indigenous species. Years of advocacy finally resulted in the proclamation of the Twin Lakes on November 2000 as a natural park by virtue of Presidential Proclamation No. 414 and covers 8,016.5 ha (FPE-CenTrop, 2004; see also Antone, 1983; Utzurrum, 1995; Heaney *et al.*, 1989; Heideman and Heaney, 1989 for detailed description of the area).

Calinawan Community-based Sanctuary

Between 30 and 31 August and 22 - 26 October 2000 and 4 - 8 December 2001, a survey was conducted in the Calinawan community-based wildlife sanctuary of Enrique Villanueva, Sibulan, and Barangay Talalak of Sta. Catalina, Negros Oriental. The sanctuary is an old-growth dipterocarp forest of about 400 ha, with coordinates at 9° 20' 00" N and 123° 02' 00" E with an elevation of 500 to 1000 m asl, and characterized by low-lying hills with gentle slopes. The site contains old trees, with dbh of one to two meters, belonging to such premium species as *A. dammara*, *P. contorta*, *S. negrosensis*, and *S. polysperma* (also refer to Tiempo *et al.*, 2002; Cariño, 2002; CenTrop, 1998 unpubl. report).

Maladjas, Talalak, Sta. Catalina

The survey was conducted from 19 - 23 January 2002 in Maladjas, Talalak, Sta. Catalina, Negros Oriental (9° 19' 41.4" N, 123° 02' 19.4" E) from elevations 650 to 750 m asl, which is the highest part (in terms of elevation) of the sanctuary. Vegetation cover is very similar to the Calinawan Forest. It is part of the community-based sanctuary located in the Municipality of Sibulan.

Mt. Guinsayawan

Between 30 January and 4 February 2002, mist-netting activities were conducted from 650 to 800 m asl of Mt. Guinsayawan, Malaunay, Valencia, Negros Oriental, which is also part of the PNOG-EDC Project. Dominant tree species found are hindang (*Myrica javanica*), bakan (*Litsea philippinensis*), malatambis (*Syzygium hutchinsonii*), almaciga (*A. philippinensis*), and bunlas (*Tectona philippinensis*) with an average dbh of 45-141 cm and an average height of about 15-34 m. The area has been described by Heaney *et al.* (1989) and Heideman *et al.* (1987). The mountain has been heavily logged and cleared since their observations in 1987 and was observed to be in relatively similar condition during this survey. Many agricultural crops are now planted (cayote, *Collocasia esculenta*, *I. batatas*, *Musa* hybrids, and *M. textilis*) from elevations 500 to 700 m asl in valleys and ridges. Rattan (*Calamus* sp.), orchids (*Dendrobium*, *Vanda*), ferns (lycopodiums and tree ferns) were reported to be heavily harvested for human consumption and sold in local markets.

Siaton Candugay and Guihulngan Caves

Occasional visits to the Candugay Cave (9° 07' 04" N, 123° 02' 48" E) in Siaton on 11 March 2003 from an elevation of 145 m asl and to one of Guihulngan caves (10° 12' 29" N, 123° 16' 54" E) from 767 m asl were also made. The two limestone caves are both situated in agricultural areas planted with crops. Brush vegetations were observed around and near the caves' mouth.

Field Research

The field research was conducted between March 26, 1999 and March 15, 2003, with assistance provided by members of the People's Organizations surrounding the Twin Lakes area organized by CenTrop.

Bat capture by mist nets was carried out from 26 March 1999 to 15 March 2003. The mist nets were 6 m high, 6-12 m long when set, and with 36 mm mesh size. When possible, nets were placed end to end in a straight line, while other nets were separated by gaps ranging from 8-10 meters. The bottom edge of the lowest net panel was at least one meter above the ground. High nets were set following the methods used by Ingle (1993). Instead of using a pulley, the ropes were secured to a branch and made to hang on the canopy. An average of 25-30 nets per site were set up following methodologies described by Heideman and Heaney (1989) and Rickart *et. al.* (1993). Bats in caves were captured using scoop net and sometimes by flicking a 6m long mist net hand held by two assistants on both ends and blocking flight route of bats. Captured animals were released after these were sexed, weighed, photographed, and identified. Some threatened species, such as *Nyctimene rabori*, *Haplonycteris fischeri*, *Harpyionycteris whiteheadi*, *P. pumilus*, and *A. jubatus* were tagged with numbered necklace bands. Identification of bats was done using the *Key to the Bats of the Philippine Islands* by Ingle and Heaney (1992). In order to make a thorough study of the fruit bats in their natural roosts, direct observations were done at their roost sites using binoculars.

Results and Discussion

Field Research

In this study, six Philippine endemic species of fruit bats were recorded. About 50% of the total species recorded were endemic (Table 1). One out of 2 Negros-Panay Faunal Region endemic species was recorded in this survey on Ban-ban-Ayungon, Campuestohan-Mandalagan, Mantikil-Siaton, Twin Lakes, Calinawan-Sibulan, Talalak-Santa Catalina, Apo and Danjungan Islands, and Mt. Guinsayawan. The Greater Bamboo Bat *Tylonycteris robustula* was recorded for the first time in

Canaway, Mantikil, Siaton, Negros Oriental indicating that this species is a new record for the Island of Negros.

Species *Pteropus vampyrus* and *P. hypomelanus* were observed roosting individually or sometimes together on a tree in Mambukal, Minoyan, Murcia, Negros Occidental. *P. hypomelanus* individuals were also noted in 3 different roosting sites in Vallehermoso, one in Janay-janay, San Jose, and another in Apo Island, Negros Oriental and in Danjungan Island, Cauayan, Negros Occidental. *P. vampyrus* species were also recorded in Buenavista, Sta. Catalina, Negros Oriental.

Among the species of considerable conservation importance recorded in this survey are: the Philippine Tube-nosed Fruit Bat (*Nyctimene rabori*); the Golden-crowned Flying Fox (*Acerodon jubatus*); Harpy Fruit Bat (*Harpyionycteris whiteheadi*); Little Golden-mantled Flying Fox (*Pteropus pumilus*); and the Philippine Pygmy Fruit Bat (*Haplonycteris fischeri*). Most notably, the capture of the Greater Bamboo Bat (*Tylonycteris robustula*) in Canaway Forest of Mantikil, Siaton shows it to be a new record for Negros along with six other species of insect bats from the Families Megadermatidae, Rhinolophidae, and Vespertilionidae (Table 1), including the two Philippine endemics *Hipposideros pygmaeus* and *Rhinolophus virgo* species.

These species are fully accounted below in terms of their distribution, population size, behavior, and breeding activities.

Species Accounts

Acerodon jubatus (Eschscholtz, 1831)

Many observations of roosts and one capture were made of the Golden-crowned Flying Fox *Acerodon jubatus* (see Table 1), which is endemic to the Philippines and is classified as endangered by IUCN and CITES: Appendix II (Heaney *et al.*, 1998). On Negros, this flying fox was recorded by Cariño, 1998 (unpublished report) in Calinawan, Enrique Villanueva, Sibulan, Negros Oriental in an estimated 10,000 ha of lowland dipterocarp forest that also contains other species of wildlife. A single individual

Table 1. Bats netted in selected forests of Negros Island, Philippines between March 1999 and March 2003.

Species	Site	Site	Site	Site	Site	Site	Site	Site	Site	Site	Site	Site
	1	2	3	4	5	6	7	8	9	10	11	12
Family Pteropodidae												
<i>Acerodon jubatus</i> *								1				
<i>Cynopterus brachyotis</i>	32	72	25	33	36	21	18	45	45	1		
<i>Eonycteris spelaea</i>	2		8	50	2	6	1	82	8			1
<i>Haplonycteris fischeri</i> *	35	2	1		3	20	16	4	4	15		
<i>Harpyionycteris whiteheadi</i> *	1	1	1		4	8	1	4		1		
<i>Macroglossus minimus</i>	37	9	21		9	49	11	17	19	2		
<i>Nyctimene rabori</i> **	9	3	2					1	4	2	2	
<i>Ptenochirus jagori</i> *	44	16	85		146	34	86	57	42	34		
<i>Pteropus hypomelanus</i>				2								
<i>P. pumilus</i>	4		1	2	1			3	1			
<i>P. vampyrus</i>								1				
<i>Rousettus amplexicaudatus</i>	121				1		10	9	9			
Family Megadermatidae												
<i>Megaderma spasma</i>								1				
Family Rhinolophidae												
<i>Hipposideros diadema</i>			1									
<i>Hipposideros pygmaeus</i> *	1		3								1	1
<i>Rhinolophus virgo</i> *							1					
Family Vespertilionidae												
<i>Miniopterus australis</i>						1		1				
<i>Scotophilus kuhlii</i>								1				
<i>Tylonycteris robustula</i>			1									
Total Net nights	151	26	51	8	94	57	55	67	66	38	1	1

Legend:

Site 1: Banban-Ayungon Forest (26 March to 10 April 1999); Site 2: Campuestohan, Mt. Mandalagan (7-10 May & 25 May 1999); Site 3: Canaway, Mantikil, Siaton (28-31 Mar 2000); Site 4: Danjuran Island (25-28 Apr 2000); Site 5: Landay, Mantikil, Siaton (6-9 Jun 2000); Site 6: Nasuji, Valencia (21-24 May 2001); Site 7: Twin Lakes Balinsayao & Danao (27-28 Jun & 16-19 Oct 2001); Site 8: Calinawan Community-based Sanctuary (30-31 Aug and 22-26 Oct 2000 & 4-8 Dec 2001); Site 9: Maladjas, Talalak (19-23 Jan 2002); Site 10: Mt. Guinsayawan (30 Jan to 4 Feb 2002); Site 11: Siaton Candugay Cave (11 Mar 2003); and Site 12: Guihulungan Cave (15 Mar 2003)

* Philippine Endemic, ** Negros-Panay Endemic

Table 2. Breeding Records of some fruit bats in captivity at A. Y. Reyes Zoological Botanical Garden.

Species	Observations on Mating	Date of Births	Last Observed Suckling
<i>Pteropus leucopterus</i>	Oct - Nov, 1999	3 Apr 2000	24 August 2000
	Oct - Nov, 1999	5 Apr 2000	24 August 2000
	Oct - Nov, 2001	24 Apr 2002	6 September 2002
<i>Pteropus hypomelanus</i>	Aug - Sep, 1999	12 Jan 2000	April 2000
	May - Jun, 2000	10 Oct 2000	11 February 2001
<i>Acerodon jubatus</i>	Nov. - Dec. 2000	4 Jun 2001	7 October 2001
	Nov. 2002	21 Apr 2003	August 2003
<i>Pteropus leucopterus</i>	Dec. 2000 - Jan. 2001	10 Mar 2001	July 2001
	Dec. 2000 - Jan. 2001	26 Mar 2001	July 2001
<i>Pteropus pumilus</i>	Dec. 2001	28 Mar 2002	July 2002
	Dec. 2001	30 Mar 2002	July 2002

was captured using a high net placed above the canopy hoisted with a pole on both ends of the net on two white laua-an (*Shorea contorta*) trees in the area. Members of the People's Organization (PO), the Calinawan United Farmer's Association Inc. (CUFAI), first reported the roosting site in 1996. In Hinotongan area near Upper Tampa of Calinawan (09° 19' 32" N; 123° 09' 35" E, 1028 m ASL), the roosting site was moved to Anahawan, Enrique Villanueva (9° 20' N and 123° 02' E) area due to hunting pressures and habitat destructions.

During the April-May 1998 survey in Calinawan (unpublished report), a single adult female whose roosting site was disturbed by hunters, was observed carrying a young while on flight. Almost every week (especially during summer) hunters visit and shoot bats for fun and trade (sold for 20-30 PhP per individual) in this roosting site. Aside from *A. jubatus*, *P. vampyrus* species was also observed roosting in thousands. Although no counting was made to determine the species ratio of bats roosting in the area, an estimated 15,000 total number of individuals were counted visually in 1998 while bats were doing their exit flying at around 6:25 in the evening. However, Mildenstein *et al.* in 2002 (paper in prep.) recorded at least 10,576 total individuals of flying foxes in the same site of which 27% were *A. jubatus*. This shows that the four years of continuous hunting activities in the area has drastically reduced the population of both *A. jubatus* and *P. vampyrus* by an estimated 5,000 individuals. Other records for this species on the island were documented by Mildenstein *et al.* (paper in prep.) in Mt. Patag and Mambukal, Minoyan, Murcia, Negros Occidental.

Breeding records in captivity revealed that mating occurred from November to December 2000. Birth of *A. jubatus* was recorded on 4 June 2001 and weaning observations were noted starting 7 October 2001 (Table 2).

***Haplonycteris fischeri* (Lawrence, 1939)**

A total of 100 individuals of *Haplonycteris fischeri* were captured in these sites on Negros (Table 1). This endemic Philippine pygmy fruit bat is reported to be common in primary forest, rare in secondary forest, and absent in agricultural areas (Heaney *et al.*, 1998). Yet this species can still be found in some cleared forests that have been converted to agriculture, such as the Twin Lakes (with cleared areas planted to food crops), Calinawan, Enrique Villanueva, Sibulan (with corn and other vegetable plantation), Canaway, Mantikil, Siaton (planted to corn and other crops), and in Banban, Ayungon (agricultural areas within the forest). In Ayungon, two individuals were observed roosting on different plant types. One was found roosting under a *Rhododendron* leaf (Ericaceae) on the trunk of a large laua-an tree (approximately 3-4 m height) while the other one was observed roosting on a branch of a 2-3 m tall amalau tree (sapling). During this study, 4 pregnant females were observed on May 21-24, 2001 in Nasuji, Puhagan, Valencia. Records show that this species is the 6th most captured (Table 1) in terms of number of individuals.

***Harpyionycteris whiteheadi* (Thomas, 1896)**

During this study, the Harpy Fruit Bat was a rare capture. The only site having the most captures is in Nasuji with a total of eight (Table 1). This is probably because the Nasuji forest was still a moderately disturbed forest at the time of the survey. This species ranks number eight in the over all total number of captures in the study and is quite rare in the lowland areas of Ayungon, Canaway, and Twin Lakes. The species was observed feeding on the fruit of yagumyum (*Melastoma malabathricum*) which is abundant in thickets at medium-to-high altitudes in the areas surveyed. At least 1 female was recorded pregnant on 7 Jun 2000 in Landay, Mantikil, Siaton while two pregnant females were recorded on 21-24 May 2001 in Nasuji, Puhagan, Valencia, Negros Oriental.

***Nyctimene rabori* (Heaney and Peterson, 1984)**

In this study, the most number of individuals of *N. rabori* was recorded in Ban-ban, Ayungon with a total capture of nine individuals. A total capture of three individuals was noted in Campuestohan, Mandalagan and Calinawan, Enrique Villanueva, Sibulan. Considered critically endangered (IUCN) and endemic, individuals of this species were twice captured (one individual each time) in Canaway-Mantikil, Siaton; Maladjas-Talalak, Sta. Catalina; Mt. Guinsayawan and only once captured at the Twin Lakes area. It is interesting to note that this species was also captured in secondary forests which are sometimes cleared for agriculture. As in the case of Banban-Ayungon, two individuals were captured in an agricultural area on a ridge top planted to cassava (*Manihot esculenta*), gabi (*Colocassia esculenta*), and camote (*I. batatas*), with forests on its slopes and ravine areas. In Campuestohan, the two individuals were netted on the ground at an abandoned *kaingin* (slash and burn) area where ferns were already growing. Another two individuals were captured on a moderately disturbed forest of Canaway, Mantikil (at the time of the survey) along the Canaway River. A single individual was netted in the Twin Lakes on October 17, 2001. This was recorded along a forest ridge on the slopes of Mt. Balinsasayao. In a semi disturbed primary lowland forest of Maladjas, Talalak, Sta. Catalina, only two individuals were recorded with one pregnant female observed on January 20, 2002. Two individuals were also recorded from a moderately disturbed primary forest of Mt. Guinsayawan. In Ayungon, two individuals were observed feeding on the fruits of *Medinilla magnifica* and were also identified through the fecal droppings inside the cloth bags.

***Pteropus pumilus* (Miller, 1910)**

A total of 12 individuals of the Little Golden-mantled Flying Fox were captured in this study. This species is rare in degraded and cultivated areas exceeding 1 km from tracts of forest

(Utzurum, 1992). This observation paralleled with the results recorded in Ayungon. Only four individuals were captured during the entire duration of the study. One was caught along a ground net set on a ridge top planted to agricultural crops such as cassava (*Manihot esculenta*), gabi (*Colocassia esculenta*), and camote (*I. batatas*). The other individuals were caught inside the secondary forests of Banban-Ayungon. The other captures were recorded singly in Canaway-Mantikil, Landay-Mantikil, Maladjas-Talalak. Two captures were made in Calinawan-Sibulan and on plantations of *Rhizophora* species in Danjugan Island.

Breeding of this species in captivity is well noted by Seyjagat (1999). In captivity, couples were observed mating in dorsoventral position. Copulation lasts up to one minute and 15 seconds then resumes two or three times with an interval of five to six minutes in between in a day. The process includes following and flicking of wings by an interested male (or the dominant male) at a female. These activities are accompanied with great vocalization. The male displays grooming attempts at the female while positioning himself at her dorsal part. He will then clasp her with his wings and thumbs and grasp the thickened nape of her neck. Eventually, the male copulates with the female for about two minutes.

Similar actions have also been observed among species of *Pteropus hypomelanus* and *P. leucopterus* although *P. leucopterus* species mating lasts more or less two minutes a day. On the other hand, *A. jubatus* species are the noisiest breeders, their activity lasting also at least two minutes a day. Mating only occurs with dominant males in the colony or in a harem. Table 2 also shows breeding records of fruit bats in captivity at the A.Y. Reyes Zoological and Botanical Garden. At the Camp Look Out facility (now abandoned), three harems of *P. pumilus* species have been observed. During the observation, each harem was composed of five to eight adult females (most of them lactating and nursing pups), and at least

three to five sub-adult males, three to four sub-adult females, and three to five adult males. Other adult males roosted singly or with a nursing adult female and juvenile offspring on the side.

***Tylonycteris robustula* (Thomas, 1915)**

On Negros, this species was first recorded in Canaway, Mantikil on March 30, 2000. A single adult male was captured weighing 3.5 g, total length = 70 mm, tail vent = 26 mm, hind foot = 5 mm, ear = 9 mm, and forearm = 26.5 mm. This was caught on a ridge top at about 890 m asl. The site is characterized as a mature secondary type of forest and mossy at higher elevations (Hapon-haponon and Landay peaks) with clearings (slash and burn) on lower elevations near the Canaway River and steep slopes with elevations 800 – 885 m asl at the time of the survey. Reports from farmers revealed that 20 – 30 individuals roosted together inside one node of “bolo” (*Schizostachium* sp.), a smaller variety of bamboo found mostly in the ravines and upper slopes of the ridges in the area (850-1000 m asl). This species entered through a very small slit, crack, or crevice of the bamboo.

In the Philippines, it was first reported by Heaney and Alcala (1986) and has also been recorded in Luzon (in Rizal and Zambales provinces), in Calautit and Palawan (Heaney *et al.*, 1998). According to Heaney and Alcala (1986), this species is found in disturbed lowland areas with bamboo stands. Although widespread, its status in the Philippines is still unknown (Heaney *et al.*, 1998).

Conservation Monitoring Activities

As this study has shown, there is an urgent need to continuously monitor not only the known fruit bat colonies on Negros but also the bats that roost in caves (insect and fruit bats) and on trees (flying foxes). To protect these species, no less than the declaration of these sites as protected areas (locally or nationally) will be necessary and actions to this effect should be initiated as early as possible. Likewise, more ecological studies are

recommended for bat species of ecological importance to areas such as Mantikil-Landay, Siaton; Talalak, Sta. Catalina; Calinawan, Sibulan; Banban, Ayungon; Mt. Kanlaon; Mt. Patag; Mt. Mandalagan and Mt. Talinis/Twin Lakes; and areas in the southern most part of Negros, Basay to Hinobaan, Sipalay, and Cauayan. Meanwhile, the discovery of the Greater Bamboo Bat in Canaway, Mantikil, Siaton indicates that although the microchiropteran community in this area is diverse, little is known of the species. Since microchiropterans are also sensitive to environmental threats such as the clearing of bamboo stands (mainly for building construction purposes), measures should be taken to protect this population. Consequently, conservation efforts for this group of small bats should be carried out as soon as possible.

Many caves on Negros, especially in Guihulngan, Mabinay, Basay, and Siaton are either constantly disturbed by spelunkers or ravaged by those who want to extract guano, hunt, and mine stalactites and stalagmites. Hence, a program for cave management and protection for the caves in these municipalities should also be initiated.

Community Education Programs for Fruit Bat Conservation

The community education program has been quite successful in increasing awareness for the environment, especially on the importance of conserving fruit bats, not only among the people living around the Mt. Talinis-Twin Lakes Area but also in the entire province of Negros Oriental. One of the program's activities, the summer theater workshop, has been particularly effective in attracting participation among the youth who benefited from enhanced learning experiences provided by speakers, facilitators, and trainers. Participants reported that the community theater affected their lives by instilling self-esteem and self-confidence through their performances before the local community, their parents, and a local resort center. Training provided by the workshop has enabled a good number of young participants to produce environmentally oriented presentations and perform them

during fiesta celebrations in all target municipalities. This positive outcome has led to the planning of more theater workshops for out-of-school youth and members of the Sangguniang Kabataan (SK) of the Municipalities of Valencia, Dauin, Sibulan, and San Jose, and those living in the immediate vicinity of Mt. Talinis and Twin Lakes area. Among Filipinos given to watching plays in public rather than to listening to semi-formal lectures, community theater is proving to be an effective medium for disseminating environmental protection message to the public. It is hoped that the involvement of members of Sangguniang Kabataan, with funding from each local government unit, will further strengthen and help sustain the program.

Legislative and Public Support

Results of the wildlife conservation education caravan held since November 2002 (to the present) and participated in by nine municipalities reveal that many legislators in these municipalities support the program by formulating resolutions and declaring municipal protected areas to ensure the protection of this species. However, there is still an urgent need to attract more donors to support this effort, particularly in the production of educational materials such as posters, television, as well as radio programs aimed at increasing the awareness of the public not only in the municipalities of Valencia and Sibulan but the entire Province as well. The Province of Negros Occidental is another site of concern for wildlife conservation. A good captive breeding facility is initiating more education campaign for this province in collaboration with interested non-government organizations.

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