

BAT COUNT 2003



Working to promote the long term, sustainable conservation of globally threatened flying foxes in the Philippines, by developing baseline population information, increasing public awareness, and training students and protected area managers in field monitoring techniques.

A Terminal Report Submitted by



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EXECUTIVE SUMMARY

Large flying foxes in insular Southeast Asia are the most threatened of the Old World fruit bats due to deforestation, unregulated hunting, and little conservation commitment from local governments. Despite the fact they are globally endangered and play essential ecological roles in forest regeneration as seed dispersers and pollinators, there have been only a few studies on these bats that provide information useful to their conservation management.

Our project aims to promote the conservation of large flying foxes in the Philippines by providing protected area managers with the training and the baseline information necessary to design and implement a long-term management plan for flying foxes. We focused our efforts on the globally endangered Philippine endemics, *Acerodon jubatus* and *Acerodon leucotis*, and the bats that commonly roost with them, *Pteropus hypomelanus*, *P. vampyrus lanensis*, and *P. pumilus* which are thought to be declining in the Philippines.

Local participation is an integral part of our project. We conducted the first national training workshop on flying fox population counts and conservation at the Subic Bay area. All of our fieldworks were also conducted with the help of local students, bat hunters, environmental non-government organizations, and protected area managers. Our team is made up of students at all academic levels. There is at least one student from each major geographical region in the country, so each region has a local bat expert after the project. Our project team represented two local government units, six environmental non-government organizations, six universities, and all of the team members plan to pursue flying fox research and conservation for their academic research.

We surveyed over twenty large flying fox roosts in the country and established baseline information on population sizes and species proportions. At each roost site, we promoted public education and awareness of flying foxes, and built the capacity of local protected area managers by training them in the simple and inexpensive field techniques for flying fox monitoring. The project has virtually shed light on the conservation status of the endangered, Philippine endemic bats across their range that led to the development of the first nationally coordinated conservation management plan for endangered flying foxes and first bat documentary in collaboration with the national TV program I-Witness of GMA7 that was featured nationally. The documentary was also distributed to all our partners and shown in most of their environmental education outreach and awareness programs.

As a result of these initial efforts, we received and gained the support of the national and local environmental institutions and agencies. Our methodology has been proven to be effective, and there have already been benefits to the bats' conservation. With funding from British Petroleum's Conservation Programme, we have built on the pilot project's success and expanded our roost surveys, student and manager trainings, and public awareness efforts across the country. By investing time and energy in Filipino managers and students, we empowered them with the knowledge, skills, and experience they need to ensure the sustainable conservation of the globally threatened flying foxes and their threatened natural forest habitats.

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AIMS & OBJECTIVES

Aims: Our project aimed at promoting the long term, sustainable conservation of globally threatened Philippine endemic flying foxes (*Acerodon jubatus*, *Acerodon leucotis* and *Pteropus pumilus*), the threatened non-endemic flying foxes they roost with (*Pteropus vampyrus* and *Pteropus hypomelanus*), and their threatened natural forest habitat in the Philippines by developing baseline population information, increasing public awareness, and training students and protected area managers in field monitoring techniques.

Objectives: The Project have: 1) conducted surveys of at least twenty flying fox roost sites throughout the country and estimated population sizes, species composition, and established conservation status of these threatened species on a national scale; 2) coordinated training workshops and transferred simple and effective flying fox monitoring techniques to local protected area managers; 3) created a network of students, biologists, and managers across the islands working together on bat conservation under a coordinated management plan, sharing ideas, and data management accessed by all managers; 4) compared habitat types at roost sites and associated foraging areas, determined how habitat types correlated with the bat population sizes and species composition; and 5) involved university students working in environmental conservation fields, and pursued further study of flying foxes on their graduate study requirements.

INTRODUCTION

The Philippines as a “hotspot” for conservation focus

Recent conservation attention has been focused on the Philippines because, coupled with a high degree of environmental degradation, the country harbors an uncommonly rich endemic fauna (ICBP, 1992; Dinerstein & Wikramanayake, 1993; Wildlife Conservation Society of the Philippines, 1997). Since the Philippine archipelago has remained fairly isolated (Heaney, 1986) and is comprised of over 7000 islands, it follows that it harbors very high rates of biodiversity and endemism. In fact, it exhibits one of the world’s highest species richness on a per unit area basis (Heaney, 1997), which is often attributed to the fact that it lies right on “Wallace’s line”, bridging two major biogeographical regions (Oliver & Heaney, 1997). Philippine mammalian fauna, for example, currently sums to 180 species with 115 of these (67%) endemic to the archipelago. These numbers, although already among the world’s highest, represent minimum counts, as the rate of discovery of new species is higher in the Philippines than anywhere else in the world (Heaney, 1997).

Originally, the Philippines was nearly completely covered with forest, but now less than 10% of that original old growth forest is left (Revilla, 1987; World Bank, 1989; Kummer, 1991). The environmental degradation in the Philippines has had obvious negative impacts on native flora and fauna. Nearly one third of the 180 described Philippine mammals was threatened and endangered (Heaney 1997; WCSP, 1997). The most commonly cited cause is habitat loss and, in cases of larger fauna, hunting. Most major international conservation organizations recognize the Philippines as one of the highest priorities for world conservation concern (Oliver & Heaney, 1997).

Large flying foxes endemic to insular Southeast Asia are a global conservation priority

Although flying foxes (Old World fruit bats, Pteropodidae) have experienced nearly two decades of international conservation attention, populations are still declining (Mickleburgh *et al.*, 1992; Kunz & Pierson, 1994; Tidemann *et al.*, 1999). Large flying foxes (genera with max. forearm length > 110mm) in particular are of concern, because they tend to forage over wide ranges, roost conspicuously in colonies, and are heavily hunted (Pierson & Rainey, 1992; Mickleburgh *et al.*, 1992; Kunz & Pierson, 1994). Most large flying fox research has taken place in Australia (e.g. Tidemann *et al.*, 1999). In Southeast Asia, where half (83/166) the world's flying fox species are found, flying foxes remain virtually unstudied (Mildenstein, 2002; compiled from Mickleburgh *et al.*, 1992). This is a region with widespread fruit bat hunting (Mickleburgh *et al.* 1992), the world's highest amount of natural habitat loss (Whitmore, 1997), and where there is, effectively, no formal bat conservation commitment from governments (Mickleburgh *et al.*, 1992). A daunting three quarters (20/27) of Southeast Asia's endemic large flying foxes are threatened and endangered (Mildenstein, 2002; compiled from Mickleburgh *et al.* 1992, WCSP, 1997; and IUCN, 2000).

In addition to being globally threatened, flying foxes deserve heightened conservation attention for a number of reasons. 1) They are important ecologically, as pollinators and seed dispersers, and play a key role in the regeneration of natural forest (Cox *et al.*, 1991; Rainey *et al.*, 1995). 2) Their maintenance of the forest has indirect economic importance to buffer zone communities, which are dependent on natural forest for water, timber, countless non-timber forest products, and protection from extreme weather events (e.g. flooding). 3) In many countries, flying foxes are culturally important to indigenous people. 4) Large flying foxes tend to be charismatic, and therefore, make good flagships for environmental education and awareness. 5) Finally, flying foxes are good conservation umbrella species, because they have such wide foraging ranges (i.e. protection of their large tracks of habitat would result in the protection of many other species).

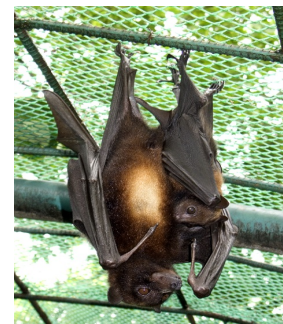
We are focusing our research efforts on the four largest species of Philippine flying foxes. *Acerodon jubatus* and *Acerodon leucotis* are Philippine endemics, which are formally listed as endangered (WCSP, 1997; IUCN, 2000). *Pteropus vampyrus* and *Pteropus hypomelanus* are Southeast Asian species that are thought to be declining in the Philippines; the Philippine subspecies of the former is considered vulnerable (Mickleburgh *et al.*, 1992; Wildlife Conservation Society of the Philippines 1997). However, we included *P. pumilus* in the study since the species was also found to co-roost with the other *Pteropus* species. These species typically roost together in the Philippines in large colonies, which were once found throughout the Philippine islands. Recent evidence suggests, however, that the number of roosts remaining is quite small, and the population sizes at these roosts are now only a fraction of their historically documented sizes (Mickleburgh *et al.*, 1992). While it is clear



Acerodon jubatus



Pteropus vampyrus



Pteropus hypomelanus

that today the original number and sizes of *Pteropus* sp. and *Acerodon* sp. roosts have been reduced, no surveys have been done to assess the status of what populations remain. What little we know about the roosts comes from species inventories, at best, and often, from no more than anecdotal evidence and hunters' stories. Without clear information on the status of their roosts and populations, and without local participation in the effort to acquire this information, sustainable conservation efforts cannot begin.

PROJECT BACKGROUND

Bat Count 2003 is the result of a pilot study conducted in 2002 to gather information on some of the remaining roosts containing the endangered and endemic species, *Acerodon jubatus*. After three years of working on our Master's research at one of the larger and more protected roosts at Subic Bay, two of the Bat Count 2003 team members (Tammy Mildenstein and Sam Stier) had noticed that the endangered and endemic *Acerodon jubatus* species made up only a small part of the total population of the roost. We began inquiring about other large bat roosts that may have *Acerodon jubatus* individuals, and from what we could piece together, it became clear that there was little information available on where these bats still existed in the Philippines and no information on how many might be left.



After a four-month information gathering period (November – February 2001), we developed a list of over thirty potential large bat roosts in the Philippines speculated to have *Acerodon jubatus*. We visited a few of these sites in the field with a team of students and protected area workers. Our population estimates at these sites showed that roost population sizes were smaller than previously estimated by other biologists in their rapid field observations, and much, much smaller than what protected area workers and hunters had predicted (in pilot study final report by Mildenstein, Stier, & Cariño, 2002). Until this pilot study, roosts thought to contain both *Acerodon jubatus* and *Pteropus vampyrus* were generally treated as a population of roughly half and half of each species. We found, however, that many of the roosts thought to contain the endangered and endemic *Acerodon jubatus* did not have any individuals of this species at all. Of the roosts that did contain both species, *Acerodon jubatus* individuals made up less than a quarter of the populations (usually less than 10%) (Mildenstein *et al.*, 2002).

We also compared the sizes of these roosts to the amount of natural forest remaining within the foraging range of the roost. While it is based on few data points, we found a clear relationship between the total population size of the roosting colony and the amount of natural forest available to them for foraging (see Fig. 1 in Appendix, copied from Mildenstein *et al.*, 2002). This suggests that natural forest may be a limiting resource for the large flying foxes. Since Philippine natural forest cover has been reduced to less than 10% its original size, and that 10% is fragmented all across the country, it is likely that the total Philippine flying fox population is correspondingly small. It would be very informative to compare more roost populations to natural forest cover, and if the relationship between population sizes and natural forest cover is consistent, this may be a strong addition to the argument for protecting the threatened natural forests of the Philippines.

Due to limited time and resources, our pilot project covered just a few of the largest, easily accessed, and/or best-known roost sites in the Philippines. From what we have learned

so far, there is reason to be concerned about the persistence of the endangered and endemic *Acerodon jubatus*, and it seems clear that a strategically coordinated conservation effort will need to begin soon if we are going to keep these bats around into the future.

Our pilot study marks the first time the population status of large fruit bats has been investigated in the Philippines. In terms of actual on-the-ground conservation, the pilot study gained so much more than just those data on the remaining *Acerodon jubatus* bat roosts. Local communities and especially protected area managers showed unexpected enthusiasm in promoting the conservation of the large fruit bats in their areas. Due to the large amount of interest, we ended up training over twice the protected area managers and local students than we had planned to train in field monitoring techniques for the fruit bats. We also had the unexpected support of many local hunters, who seemed to recognize the benefits of hunting regulation for maintaining a stable population of fruit bats. Since our departure, many of the protected area conservation groups we worked with have contacted us and urged us to continue our surveys in the rest of the country. The Filipino wildlife students, who were involved in the project, have continued to identify new bat roosts and survey them for *Acerodon jubatus* individuals. It is exciting that the pilot project generated a growing interest in fruit bat conservation, and with a little encouragement, the current momentum could lead to an important tipping point for fruit bat conservation in the Philippines. It is important that we built these successes and expanded our survey and training efforts to the entire country.

METHODOLOGY

While the preparation and equipment gathering began in 2003, we did our fieldwork between January and June 2004 and during sunny days of year 2004 to 2006. This is a relatively dry season which provided us with weather suitable for traveling, hiking to, and surveying at the bat roosts. It should also be noted that during the months of March to June is roughly the time of year when the bats give birth and begin rearing their pups. This means the newborn pups will not yet be flying and therefore not complicate the exit counts of the bats.

Study Areas

Through our preparation for the pilot study and investigations made by some of the Filipino team members, we have already generated a list of over thirty bat colonies that are thought to contain either of the two Philippine endemic species of large flying fox. Most roosts are found in areas identified to be bird conservation priorities by Mallari *et al.* (2001) and some are in forested areas not

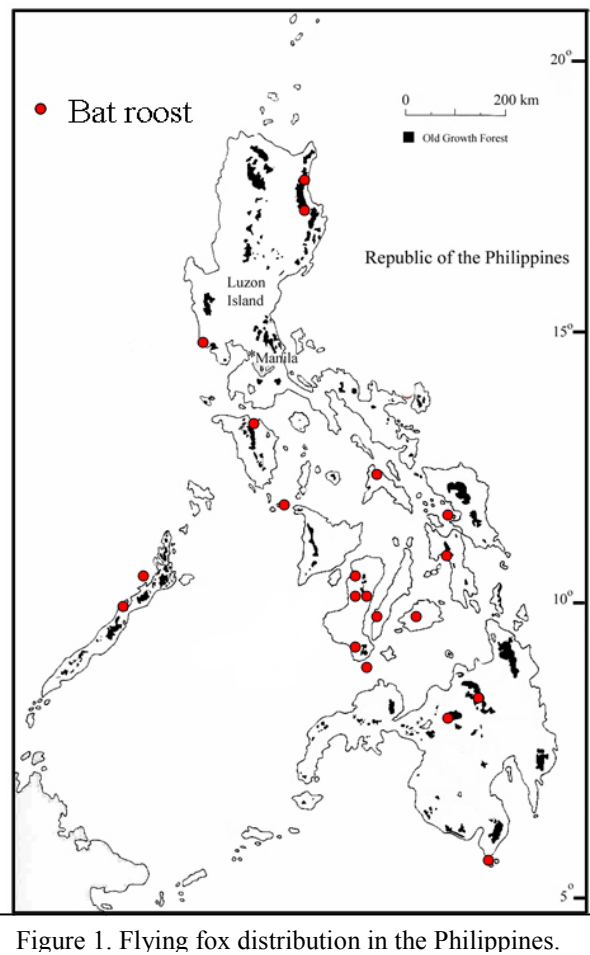


Figure 1. Flying fox distribution in the Philippines.

formally protected. The locations include Sierra Madre Natural Park/Luzon Island; Polillo Islands; Bicol; Maripipi Island; Leyte State University Forest Reserve/Leyte Island; Samar Island; Masbate Island; Bat Island, Honda Bay, Palawan; St. Paul Underground River National Park/Palawan; Mindanao Island; Mindoro Oriental; Mindoro Occidental; Masinloc and Santa Cruz Island, Zambales. See also Figure 1 for the distribution of bats' roosting sites on these Islands.

Population Estimation

Roost population estimates served as an index to actual population size, and these can be compared over time to identify trends in population growth. We estimated the number of individuals in the bat roosts using two methods: roost exit counts and direct roost counts (both described in Kunz *et al.*, 1996; Eby *et al.*, 1999; Garnett *et al.*, 1999; and Worthington *et al.*, 2001).

Exit Counts

We spent one to two nights observing the flight patterns of the bats and located good vantage points for observing bats exiting the roost. On two subsequent nights, we stationed observers in vantage points surrounding the roost prior to the bats' departure, which is typically sometime after 18:00 hours depending on the time of year and the longitudinal location of the roost (roost sites further East departed earlier and those further West departed later according to the time of sunset). Using handheld counters, observers counted the number of bats flying through their observation area, counting in multiples of ten, twenty, or occasionally fifty when exit streams are very large (see Appendix A for the sample colony size data sheet). When multiple observers counted in the same area, we take the average of these observers' counts. We added together the bat numbers counted for each observation area to reach an estimate of the total number of bats that departed the roost during our observation. These estimates were considered minimum population sizes, since, in past surveys, we have often observed and heard bats flying from the roost after it was too dark to count them (around 19:30), and in most cases some bats stayed behind at the roost.

Direct Counts

For each bat colony we surveyed, we located the roost by day and estimated the roost size by directly counting the bats at the roost. We used vantage points (e.g. opposite hillsides, river bottom, etc.) from which we obtained a clear view of the roost. Then, looking through binoculars and/or a spotting scope and using a handheld counter to record, we counted the number of bats in each tree and sum all of the tree counts for a total estimated roost count (see Appendix B for the sample roost count data sheet).



Analysis and Error Measurement

When it is possible to obtain population estimates at a roost using both exit and direct counting methods, we compared the estimates to each other to determine which provided the best estimate. If we were able to obtain a good view of the roost, the direct counting method provided the larger population estimate and also the one which is most accurate. It is often difficult to get near the roost, access all of the roost, and/or counted all the bats before they fly, in which case, counting during their exit flights yielded a larger and more accurate estimate. Each bat roost is different, and managers learned which method is most the efficient at their site and use this method year after year to look at trends in their population estimates.

When we had multiple observers independently counting the same bats, we looked at the variance in observer counts in order to assess measurement error in our population estimation method. This process familiarized managers with the amount of variance they may experience when repeating counts for monitoring in the future with different observers. This helped stress the value of using the same observers year after year and spending time training new observers in systematic bat counting techniques prior to surveys.

Species Identification and Composition at the Roost



Using several vantage points near the roost (e.g. opposite hillsides, river valley bottoms, tree tops etc.) we identified the species of as many individuals as possible at the bat roost. Our goal is to view the roost from around its entire parameter and to identify the species of at least 10% of the individuals at a roost to serve as a sample, from which we could infer the species composition of the entire roost. The four target species of the research were easily identified in the field by pelage characteristics based on our own experiences, by Ingle and Heaney's Key to the Bats of the Philippines (1991), and a pictorial guide of the flying fox species in the Philippines prepared by the Project (see attached sample of the pictorial field guide).

Roost Site Characteristics

Flying fox roosting habitat is important background information for managers. We described patterns in flying fox roosting site selection across all of the sites we visited. At each site we recorded the exact geographic location (latitude, longitude) of the bat roost, the general forest type in which the roost is located, the number of trees used by the bats in the roost, and the amount of human disturbance present (based on trails, proximity to human residential areas, and anecdotal information about hunting pressure). Geographical and vegetative patterns in roost sites across the country gave managers some insights to the roosting bat colonies' site selection, and certainly were very useful in formulating bat roost site selection hypotheses for future research (see Appendix C for the sample roost site data sheet).

RESULTS AND DISCUSSION

Training Workshop for protected area managers and students

We conducted a training workshop for flying fox managers in January 2004. This workshop was held in Subic Bay, Philippines, which is an ideal venue for flying fox counting and identification training. The Subic Bay Protected Area has a very large roost of flying foxes. Since no hunting is allowed at the roost site, the bats were easy to accessed and approached and therefore conducive to training managers to identify species and count individuals. The Subic Bay flying fox roost also became a popular eco-tourist site, which could stimulate ideas for protection at different flying fox roosts.



We offered this training opportunity to all conservation advocates, biologists, and managers from all of the protected areas with flying foxes. The workshop focused on practicing *in situ* the field techniques necessary for monitoring flying fox roosts and on developing relationships between all the flying fox managers so they can work as a team for the conservation management of Philippine flying foxes on a national scale. Activities included field training in monitoring techniques, calculating and

interpreting results, reporting/publishing findings, funding and grant writing strategies, community and hunter education, and any other skills managers may need to be able to actively conserve the fruit bats in their protected areas. Together with all participants we devised an action plan for coordinating bat conservation efforts across the Philippines.

Training in the field (on site) for local protected area managers, hunters, and students

We trained protected area managers, local students, hunters, and other conservation workers in our flying fox roost survey techniques by bringing them into the field with us to the bat roost site and including them in all of our survey efforts at the roost. They had their own data sheets and take observational notes and population count data alongside our team. At camp after our data gathering, we talked about flying fox ecology, explain the survey techniques and showed them how to use the data to come up with an estimate of population size and species composition of the roost.

Comparison of roost population size to forest cover

The two most commonly cited causes for the global declines in flying fox populations were hunting and habitat loss. While it is clear that both hunting and habitat loss were likely threats that most flying foxes face, there has never been a correlation of these pressures to flying fox population growth/decline. Since we obtained population estimates of flying fox

roosts, we managed to work farther in the applicability of our results to basic conservation questions and compare roost population size and species composition to forest cover surrounding the roost (See Table 1 for the Roost Summary Distribution of Flying Foxes in the Philippines).

Up to date forest cover information is not yet available for the Philippines (Kummer personal communication 2003). For a preliminary comparison of the population size of roosts to the amount of forest available to them, we used the most current vegetative cover information available, most often from the National Mapping and Resource Information Authority (NAMRIA). Given the large amount of forest degradation that has occurred throughout the country in the last fifty years (see Kummer 1991), the vegetation information on the maps is most likely to be an overestimate of what is left.

We defined the foraging range of the bats as 15 km from the roost based on observations by Taylor (1934) for both species and by Lim (1966) and Gumal (pers. comm.) for *Pteropus vampyrus*. This distance represented a typical value that compares to observations of other flying fox species' foraging range (Roberts 1977; Marshall 1983; Mickleburgh 1992; Pierson and Rainey 1992). For each bat colony, we used graph paper and estimated the amount of forest within 15km from the roosting site. In the cases where vegetation information is very old, we adjusted the amount of forest based on the advice given to us by our counterparts at the site of our observations while visiting the roost on foot, and other biologists and managers who are familiar with the area.

We understand that it is vital to the success of any conservation project that there is local participation at many different levels. We have structured our project to include the key local players in flying fox conservation (hunters, protected area managers, local government and non-government biologists, and students) at each site such that all these groups came together for the same cause. From our pilot study we found that a synergism arose from joining different parts of the community together in our efforts to survey the bat roosts, and these new relationships were definitely the foundation to the long-term sustainability of conservation management efforts for the flying foxes. We continued this type of team building in Bat Count 2003. Below are some examples of the relationships that our project helped to develop and the benefit to the long-term conservation of the flying foxes.

1) Hunters and Managers Work Together for Conservation

While it is clear that hunting is one of the biggest threats to large flying foxes, it is very difficult for outside biologists (foreign or Filipino), unknown to local communities, to assert that hunting must be stopped. In our pilot study fieldwork, we found it very effective



Patag hunters turned forest wardens

to do the counting of the fruit bats side-by-side with managers and hunters. The resulting

population estimate, though shockingly small to them, was never questioned. In fact, the managers and hunters seemed to take pride in the population estimate that we derived as a team, and we heard them repeating the number to various friends and family members when we returned to the town. This sort of ownership is crucial to the eventual conservation management decisions that needs to be made if, and when, it becomes evident that the fruit bat populations are declining.

The hunters who accompanied us during our fieldwork were often adamant previous to the roost counts that their local bat roosts contained millions of fruit bats. After we counted the roosts, however, they realized their bat roost was a much more limited resource than they had expected. Managers as well as some hunters became strong proponents of hunting regulation to maintain a stable population of bats. With the hunters now in agreement with, or at least aware of, the need to conserve the fruit bats, managers will have a much easier time implementing management decisions regarding hunting.

2) Managers Experience of the Fruit Bat Roost in the Field

Bringing the protected area managers into the field to locate the bat roost plays a few important roles in encouraging the conservation of the fruit bats. Managers not only learn where exactly the roost is located and which guides to use to find it, but they also experienced the bat roost first hand, and therefore became aware of the general needs of the bats when roosting (i.e. trees near a hilltop or ridge crest, near to a river, limited access for people). Managers also became aware of disturbance issues at the roost. They have seen signs of hunting, manmade trails to the bat roost, local human developments, and slash and burn agriculture, all of which disturb the bats. This has been an important segue that discussed necessary changes to be made to management routines for the protection of the bat roost.

3) Training Workshops Lead to Long-term Monitoring



We conducted training in the field at each bat roost for interested protected area staff members, people's organizations (PO), students, and non-government environmental workers in the fairly simple field methods necessary to monitor their populations of large flying foxes. Long term monitoring is imperative for the conservation of large fruit bats, and in our pilot study, each group of protected area workers trained showed an enthusiastic commitment to repeating the population estimation annually.

After the field part of our work, they began actively pursuing better fruit bat management techniques and expressed interest in contacting the protected area managers at other sites with large flying foxes to compare results and share ideas for fruit bat conservation management. Since there was a growing interest in the conservation management of large fruit bats, thus

the organization of a countrywide workshop and planning meeting for all protected area managers in the Philippines was made.

4) Awareness and Capacity Building of Local Students

In all our roost survey activities, we involved local university students. This gave them an opportunity to develop new skills in wildlife monitoring techniques and more experience in fieldwork. As we have been gathering information about roosts, many local wildlife biology graduate students have expressed interest in gaining skills in field methodologies of population estimation and the assessment of species composition within the roost, as well as the importance of promoting fruit bat population monitoring at a local level.



Students and trainees conducting a workshop

CONSERVATION INITIATIVES

Environmental Awareness

Mt. Talinis – Twin Lakes Biodiversity Conservation Symposium

The symposium was held on July 9, 2004 at Bethel Guest house and was attended by different students leaders, LGUs, Line Agencies, POs, members of the two Federations, DENR officials as speakers, the Governor, Vice-governor, NGOs and the media. Biodiversity conservation was the main highlight of the symposium. A recommendation declaring the Calinawan Community-based bat sanctuary to be declared as a provincial ordinance was presented by the community leaders during this time. The Governor and Vice-governor shared support by proposing a draft ordinance to the council for deliberation. This was a very significant event that led to the formulation and endorsement of the Vice Governor for a Provincial Ordinance declaring the Community-based Bat Sanctuary as a Provincial Wildlife Sanctuary. Not only protecting the bats but also protecting their roosting habitat (the lowland forest) and other associated wildlife in the area.

Overnight Critters' Camp January 15 - 16 and February 10 - 11, 2005

Overnight Critters' Camp for a group of 14 children from the upland farming community of Caidiocan, Valencia was held at the A.Y. Reyes Zoological and Botanical Garden on 15-16 January 2005 and 10-11 February 2005. Overnight Critters' Camps were focused on nocturnal animals – particularly endangered ones (focusing on flying foxes) – and their adaptation for survival in the wild; the camps were made possible with coordination from the Social Welfare and Development Office of Dumaguete City and the FFI – Philippines Biodiversity Conservation Project – Mobile Education Unit.

Earth Day Workshop Camp

A day camp (5 April 2005) featuring endangered wildlife and feeding them in captivity was held at the A.Y. Reyes Zoological and Botanical Garden. At least 35 kids participated in this workshop from the Little Children of the Philippines (a Non-Government Organization). At least 15 of the participants enjoyed feeding the flying foxes in captivity. They were amazed to see the baby *Acerodon jubatus* who was just delivered a few weeks ago. They soon realized that this species really belongs to the mammal group of animals.

4th and 5th Annual Mt. Talinis-Twin Lakes Youth Environmental Camp



The 4th and 5th Annual Mt. Talinis-Twin Lakes (MTTL) Youth Environmental Camp (YEC) held from April 14-18 for 2004 and May 4-6 for 2005 in Camp Look-Out, Valencia. The YEC provided fun, hands-on training and learning process for underprivileged youth belonging to farming communities in the MTTL areas. The 4th Annual YEC included 20 participants from the children of Peoples Organization members of Mt. Talinis and Twin Lakes among 16

Barangays and for the 5th YEC at least 19 participants came from the barangays of Caidiocan and Ticala, Valencia, as well as special participation from six underprivileged youth from Dumaguete City (Casa Miani – an orphanage home). The variation in the participants' backgrounds provided a unique look into their perceptions on the environment. The first day was devoted to understanding wildlife conservation (threatened birds) and the ecology of flying foxes by showing an orphaned *Pteropus vampyrus*. The YEC provided hands-on experiential education program to all of the participants. This was organized by the Silliman University Center for Tropical Conservation Studies (SUCENTROP) in cooperation with the USPeace Corps volunteers and some members of the Mt. Talinis – Twin Lakes Federation of People's Organizations.

13th Annual Philippine Terrestrial Biodiversity Symposium (WCSP)

One of the principal investigators (Poli) participated the symposium last April 20-23, 2004 at Antipolo City, Philippines. Poli represented Bat Count 2003 in drafting conservation status of Philippine Mammalian Fauna and its conservation. The outputs were submitted to the DENR for the making of the Implementing rules and regulations (IRR) of the Republic Act No. 9147 known as Wildlife Act. We evaluated the status of all flying foxes in the Philippines that will serve as basis for providing penalties on violations made for the species. Dr. Lawrence Heaney chaired the evaluation and Poli facilitated the entire process. Outputs of the workshop were submitted to the DENR-PAWB for further evaluation.

14th Annual Philippine Biodiversity Symposium (WCSP)

Pol presented a poster and an oral paper presentation on Bat Count Philippines held at Crown Lodge, Tuguegarao City on 6 to 8, April 2005. He also joined environmental education group committee of the WCSP for future working plans of the society on wildlife

conservation education programs. His travel was supported by the Threatened species project of the Haribon Foundation for the Conservation of Nature.

Field Course in Conservation Ecology Research

This field course was held on Danjugan Island, Punta Bulata, Cauayan, Negros Occidental on October 13-23, 2004. This was organized by Haribon Foundation to provide skills and knowledge of young conservationist of some 30 selected students and young conservationists in the Philippines to conduct research and studies on threatened species in the country. Poli was the resource person for bats and trained the participants to do bat counting on the island and taught them some basic field methodologies in studying bats. Each participant was given with copies of the bat documentary produced by GMA I-Witness and some materials on bat conservation. Possible research topics on bats were also presented and discussed during the training.



Symposium on Water Conservation

On March 6, 2005, a symposium for college students of Silliman University was held at the Audio Visual theatre promoting water conservation and putting emphasis on how flying foxes play an important role in dispersing seeds for its natural regeneration (aided by bats). At least 67 college students of various fields attended the symposium. Principal Investigator A.B. Cariño also interacted with the students in the importance of bat conservation in relation to water conservation.

National Biodiversity Monitoring Workshop

This workshop was held at Forest Hills, Village Resort, Olongapo City on 2 to 3 of June 2005. The workshop aims to come up with a consolidated and standardized methodologies in wildlife monitoring. Pol presented methodologies in monitoring flying foxes and was recognized as one of the resource persons in bat assessment particularly on flying foxes. This lead to the incorporation of the Bat Count Project's methodology adopted in the national monitoring protocol in flying fox monitoring.

Bat Monitoring and Assessment at Calinawan Community-based Wildlife Sanctuary

A 5-day monitoring and assessment was held in the lowland forests of Calinawan, Enrique Villanueva, Sibulan, Negros Oriental last 16-20 June, 2005. This was participated in by 25 Deputized Environment and Natural Resources Officers of the Calinawan United Farmer's Association and trained at least 10 army forest wardens. The bat roost at that time

was monitored and apprehended at least 4 hunters confiscating their airguns and catch (dead bats).

World Environment Day Celebration

On June 5, 2005 the celebration for the World Environment Day was held at the Rizal Boulevard in partnership with the Department of Environment and Natural Resources, the City Government of Dumaguete thru the City Tourism Council and the local government of Oriental Negros. Eight participating non-government organizations (NGO's) and youth groups held booth exhibits to showcase the activities that they did for the environment. A day long program was held, highlighted by the visit of Protected Areas and Wildlife Bureau (PAWB) OIC Director Dr. Theresa Mundita Sison-Lim, who gave the keynote address and commended CenTrop and many other environmental organizations for their efforts. She also expressed her appreciation and esteem for the local government of Oriental Negros for its active role in environmental protection and preservation. She expressed support for the plan for the establishment of a Bat Sanctuary in Calinawan and urged the Province of Oriental Negros to come up with a Provincial Ordinance pertaining to its protection and conservation. The activity was participated in by more than 500 spectators and environmentalist groups in the Province.



With DENR-PAWB Personnel and Pinol LGU

Pinol, Maitum, Sarangani Province, Mindanao Island Bat survey

On 27 – 30 June 2005 a bat assessment was requested by the Local Government Unit of the Municipality of Maitum in Barangay Pinol (refer to attachment for the report). A focus group discussion among the members of the local government unit of Barangay Pinol along with the DENR-PAWB staff, Bat Count Philippines

and the officials of the Municipality of Maitum and DENR staff of Region X was held in the Barangay Hall of Pinol. Discussions pertaining to the problems caused by bats due to disturbance in their crop yield (coconuts being used as roosting sites) were discussed during the FGD.

Information and Education Campaign at Pinol Elementary School

On July 1, 2005 an education campaign thru video showing and question and answers were held in a classroom of Pinol Elementary School. At least 200 kids attended the campaign that filled-in the entire



Bat documentary showing at Pinol Elem. School

school building. Some IEC materials were also shared to the faculty and the Pinol Elementary School.



Central Mindanao University IEC

Pol presented a bat ecology and conservation from over 150 college students of the University (Biology, Veterinary Medicine, Forestry, Chemistry, BSEducation, MS Bio students, college deans, department heads and staff). This was the first of a series of symposia held in the University for this school year. Project outputs of Bat Count 2003 were also presented during the lecture.

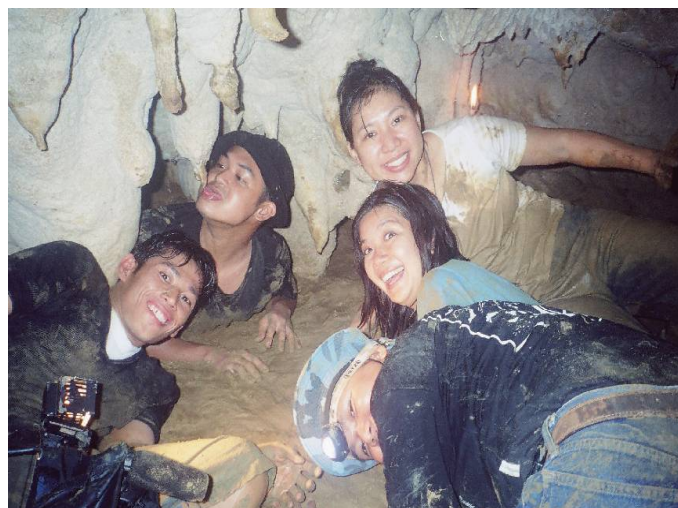
International School Students Youth Marine and Wildlife Camp

This marine camp was held on Danjugan Island from 18 – 21 July, 2005. The camp focused on 20 students from Metro Manila as future potential environmental collaborators for they are children of elite (highly influential) people in Makati and in the Philippines. They were taught on wildlife conservation both marine and the terrestrial ecosystems. Pol presented the ecology of bats and showed the documentary on the conservation of bats in the Philippines. They were amazed seeing their resource person in the documentary. He also showed them the bats' roosting in a cave in Danjugan and how to count bats flying during night time.

Media Advocacy

“Aswang sa Dilim” Vampires in the Dark Bat Documentary

GMA 7's I-Witness program together with one of the Principal Investigators (A.B. Cariño) made a documentary on bat conservation in the Philippines. The documentary was created from different places documenting bats, their habitat, ecology, conservation and threats. This was presented nationally on the 15th of November at 11 o'clock in the evening. Following that night due to public demand it was presented again once in a month by GMA I witness 'til summer of 2005. Another local



television network in the Province of Oriental Negros, the FilProducts Cable TV presented the documentary in their daily evening documentary presentations. This is still on-going until now. Furthermore, NGO partners all around the country were given with a copy of the documentary and used them on their environmental education advocacies. The Filipino

(National language) language was used in the interpretation so that a wider audience will understand the documentary.

International School Students Youth Marine Camp

This marine camp was held on Danjungan Island from 18 – 21 July, 2005. The camp focused on 20 students from Metro Manila as future potential environmental collaborators for they are children of elite (highly influential) people in Makati and in the Philippines. They were taught on wildlife conservation both marine and the terrestrial ecosystems. Pol presented the ecology of bats and showed the documentary on the conservation of bats in the Philippines. They were amazed seeing their resource person in the documentary. He also showed them the bats' roosting in a cave in Danjungan and how to count bats flying during night time.

YEC Post Camp Activity

The follow up camp to the Youth Environmental Camp (YEC) held in early May was concluded last July 30-31. The first day of the YEC Post-Camp was spent reinforcing modules on environment and biodiversity conservation which were introduced at the YEC. Nighttime activities involved introducing participants to our Overnight Critters' Camp program which focuses on nocturnal animals (e.g. bats) and their needs for survival at night. The second day of camp exposed participants – majority of which were from upland communities – to marine ecosystems through a field trip to Bais Bay, a popular dolphin watching site, and to the Manjuyod Sand Bar. The YEC Post-Camp was primarily held within the garden grounds and was participated in by 19 of the original 20 YEC participants. It was facilitated by People's Organisation federation officials of the upland project, the same facilitators and support crew as in May.

The 5th Overnight Critters' Camp

The camp was held from September 23-24 on CenTrop's grounds and was participated in by 15 boys (ages ranging from 6-14 years) from the new all-boys dormitory of Little Children of the Philippines (LCP), a non-government organization that works with underprivileged children, women and families. CenTrop has in the past worked with LCP through projects organized by CenTrop's US Peace Corps Volunteers. A half-day children's workshop was conducted on the afternoon of September 24th. Participation for this "Junior Zookeeper Workshop" was coordinated with the city Social Welfare and Development Office who sent 15 children (ages 7-15 years). The workshop introduced children to the concept of the proper care of animals and enabled them to interact with some of the residents in the garden when they personally offered enrichment materials to the bats and the deer. This workshop was conducted with the assistance of Dr. Emilia Lastica (our veterinarian) and volunteers from the Silliman University Biology Society.

Seminar and Learning Visit on Innovations in Holistic Approaches to Watershed Management

Pol presented a paper on the conservation of Mt. Talinis and Twin Lakes and lessons learned in the management of the area. The declaration of the Bat Sanctuary in Calinawan and the deliberation of its draft ordinance was presented as an example for ensuring water

management in the future by protecting bats who are agents of pollination and seed dispersers. This was held at Atlantis Beach Resort, Dauin, Negros Oriental on August 28 to 30, 2005 among 30 participants around the Visayas region.

Teacher's Marine and Wildlife Camp on Danjungan Island

At least 30 High School and College Teachers from Manila, Batangas, and Bacolod Cities went for a marine and wildlife camp on Danjungan Island, November 3-5, 2005. Most of the lectures and activities revolve around the conservation of wildlife and marine ecosystems. The presentation on bat conservation and the bat documentary were presented and shared to the participants.

Initial Steps for Institutionalization of Bat Count Philippines

Due to the sudden change and replacement of the PAWB Director and possibly affecting our Project, Pol decided to visit PAWB and made discussions pertaining to the problem. He stayed for 5 days in Manila to resolve the issues and gather information in order to cover up problems for the Project. Eventually, resolving the matter in five days. So far, Bat Count has submitted a letter of intent together with a local NGO partner here and PAWB to await us from its response to come up with a memorandum of agreement for the Project. This has been one of the major accomplishments of the Project to institutionalize further the long term and sustainability program on the conservation of flying foxes in the Philippines. This will initiate collaboration on many Local Government Units and cooperation of Regional Directors on the conservation of flying foxes regionally.



Most recent visit with the PAWB Director Lim

Upgrading the GuBAT Learning Center in Subic Bay, Philippines

The GuBAT (literally called as forests) was constructed and materialized in 2002 (per initial thoughts and efforts made by Sam Stier and Tammy Mildenstein while serving as USPeace Corp Volunteers in Subic Bay). The GuBAT Learning Center (GLC) was improved and further construction of the make over was supported by the Netherlands Embassy. This effort was made possible by the Haribon Foundation for the Conservation of Nature to come up with a world class Bat and Biodiversity Learning Center. Please visit their website at www.haribon.org for a complete update on the status of the GuBAT Learning Center.



The GuBAT Learning Center at night (photo taken from the Haribon website).

Cultural appreciation through Bat Presentations



For two years now, the Province of Negros Oriental celebrated its Buglasan Festival. This is a traditional cultural presentation of the various municipalities and cities of the Province depicting their histories, cultural practices, day-to-day lifestyle, and forms of thanksgiving for the gift of nature into their lives performed by the participating contingents. Two of the municipalities (Mabinay and Pamplona) showcased bats and flying foxes in their overall concept of their presentation for the festival showdown competition. During this competition, the Municipality of Mabinay won the best in Costume and Original storyline. They also won first runner-up in the booth display showcasing their ecotourism sites and conservation of cave habitats.

ACKNOWLEDGEMENTS

We thank the support of BP Conservation Programme and its partners; Birdlife International, Fauna and Flora International, Conservation International, and Wildlife Conservation Society, the Lube Bat Conservancy, Bat Conservation International, and Foundation for the Philippine Environment. We also thank the Department of Environment and Natural Resources and Protected Areas and Wildlife Bureau for providing us permits and assistance in the implementation of this Project. Special thanks are also shared to advisers; Carlo Custodio, Nina Ingle, Lawrence Heaney, Alysson Walsh, and Angelita Cadelina. We are also very grateful to all of the student volunteers, people's organizations, Non-Government Organizations, Government Agencies and partners at the local level for their continued support and undocumented contribution to the Project.

MEMBERS OF THE TEAM

Tammy L. Mildenstein, 34, American, M.S. Wildlife Biology. Principal Investigator/Head project coordinator and the one in charge of circulating project results. She worked on the pilot project and conducted master's research on the habitat use of large flying foxes at Subic Bay, Philippines. Currently, a full-time Ph.D. student at the University of Montana, USA. (Please see attached curriculum vitae)

Apolinario B. Cariño, 28, Filipino, M.S. candidate Biology. Principal Investigator and biologist in-charge of surveys and training in the central Philippine islands. He worked on the pilot project and has worked for five years in research and community education for flying fox conservation in the central Philippines. Full-time M.S. student at Silliman University and currently the Coordinator of two Federations of People's Organizations..

Samuel C. Stier, 34, American, M.S. candidate Natural Resource Conservation. Principal Investigator and trainer. He worked on the pilot project and conducted master's research on the dietary choices of large flying foxes at Subic Bay, Philippines. Currently, a full-time Ph.D. student at the University of Montana, USA.

Sherry P. Ramayla, 25, Filipina, M.S. candidate Wildlife Biology. Biologist in charge of surveys and training in the Mindanao area. She has begun her M.S. research on the diet of large flying foxes in Mindanao, Philippines. Full-time M.S. student at Mindanao State University.

Edwin Breganza, 29, Filipino, M.S. candidate in Environmental Conservation. Biologist in charge of some surveys and training in Luzon Island and the coordination of the training workshop to be held in Subic Bay. He worked on the pilot project and has been working for the protected area management office in Subic Bay. Part-time M.S. student at University of the Philippines, Los Baños.

Mylanar Saulog, 26, Filipina, M.S. candidate in Biology. Biologist in charge of some of the surveys and training on Luzon Island. She worked on the pilot project and many other conservation biology projects. Full-time M.S. student at University of the Philippines, Los Baños.

Jessie Guerrero, 25, Filipino, B.S. Forestry. Biologist in charge of surveys and training in the Sierra Madre area. He worked on the pilot project and has been working with Plan International for 2 years in the Sierra Madre National Park conducting research on endangered wildlife species. Intends to begin his master's work at Isabella State University on large flying foxes.

Bernard Tarun, 25, Filipino, B.S. Forestry. Biologist in charge of surveys and training in the Sierra Madre area. He worked on the pilot project and has been working with Plan International for 2.5 years in the Sierra Madre National Park conducting research on endangered wildlife species. Intends to begin his master's work at Isabella State University and hopes to study flying foxes.

C.E. Nuevo-Diego, 25, Filipina, B.S. Wildlife Biology. Biologist in charge of making and delivering presentations on the results and training on Luzon Island. She was involved in first two investigators' masters' research projects on bats and co-authored two papers on the results of those projects. She intends to begin in the master's program at the University of the Philippines, Los Baños, and is hoping to study flying foxes.

Nina R. Ingle, 33, Filipina, Ph.D. in Biology. She will serve as a professional advisor on the project. Her Master's and Doctoral research included flying fox species in Mindanao, and she is currently working to support conservation biology in Mindanao through Haribon Foundation.



Partners:

- 1) University of Montana (USA)
- 2) Silliman University (Philippines)
- 3) University of the Philippines, Los Baños
- 4) Isabela State University (Philippines)
- 5) Mindanao State University (Philippines)
- 6) Leyte State University (Philippines)
- 7) The Haribon Foundation for the Conservation of Nature (Haribon)
- 8) Center for Tropical Conservation Studies (CENTROP),
- 9) Plan International-Philippines (NSMNP-CP),
- 10) Philippine Endangered Species Conservation Project (PESCP),
- 11) Cebu Biodiversity Conservation Foundation, Inc. (CBCF)
- 12) Soil and Water Conservation Foundation-Bohol (SWCF),
- 13) Calinawan United Farmer's Association, Inc. (CUFAI)
- 14) Patag Bantay Gubat Brigade
- 15) Cienda San Vicente Farmers' Association, Inc. (CSVFAI)
- 16) The Philippines Protected Areas and Wildlife Bureau (PAWB) of the Department of Environmental and Natural Resources (DENR) and their local offices at the field sites where surveys will take place.
- 17) Ecology Center of the Subic Bay Metropolitan Authority (SBMA)

Budget

Pre-project expenses:

Administration	
Communications	175
Insurance (health)	500
(equipment)	200
Visas and permits	325
Freight	175
Flights	1700
Reconnaissance	900
Equipment	
Field rations	100
Medical	75
Scientific	2100
Photographic	150
Communications	700
Maps	150
Satellite imagery	650
Digital camera	300

Field expenses:

Living costs	
(Manila for PIs coordinating/project)	2000
4 people x 25.00/day x 20 days	
(Subic Bay for training)	
30 people x 6 days x 20/person/day	3600
(Field)	
22 sites x 6 people x 6 days x 4.0/day	3168
Local guides	125
Travel allowance (incl. vehicle use and fuel cost)	3000
Miscellaneous	

Post-project expense:

Administration (mailing expenses for final reports)	85
Report production	20
Photography	20
Travel to conferences	
International (2 investigators)	
Airfare	500 x 2 people
	1000
Conference registration fee	100
Per diem	4 days x 2 people x 50/day
	400
Local (Wildlife Conservation Society of the Philippines) for 6 people	
Travel (ferry/airfare)	75 x 6
	300
Conference registration fee	10 x 6
	60
Per diem	4 days x 6 people x 20
	480

Contingency: 10% of total project expenses 2256

TOTAL BUDGET **24,973**

Other funding for 2003 project:

Bat Conservation International	1606
Wildlife Conservation Society	6427
National Science Foundation Fellowship (PI stipend, not itemized above)	11,247
Remainder of funding from pilot project used for any of the above itemized expenses (from Wildlife Conservation Society)	1800

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Table 1. Roost Summary Distribution of Flying Foxes in the Philippines.

Site	# of local PA workers involved	Total number of bats	Species breakdown/ proportion of roost identified	Roost site (veg. & geogr.) characteristics	Stresses on bats at site	Comments/data quality/lacking info. etc.
Calinawan, Negros Oriental	20	9,041.3	No data	A mixed old and 2 nd growth forest. Along municipal boundaries of Sta. Catalina, Sibulan and Valencia in Oriental Negros. Two rivers interspersed the roost.	Heavy hunting both recreational and for subsistence. A minimum of at least 3 to 4 hunters hunt every week.	No species proportion were made since the roost is so disturbed that you can't even get nearer at least for about 200 meters to the roost. We only used binoculars for observations. Weather conditions didn't allow us to do species proportion counts.
Vallehermoso, Negros Oriental	3	152	P. hypo = 152	A lowland agricultural area with very few stumps of <i>Ficus</i> trees along steep slopes and ravines of a privately owned sugarcane plantation.	Formerly frequented with hunters. But recently locally protected by the land lord of the sugarcane plantation.	Bats were observed and counted on their roosting trees. This is a 100% roost count!
San Jose, Negros Oriental	3	65	P. hypo = 65	A lowland agricultural area along ridges of a cornfield plantation. Bats were roosting along <i>Ficus</i> trees.	Frequented by hunters. Bats keep on moving as hunters disturbance occur. Original roost is nearby is visited by hunters that keep them from transferring.	This is a temporary roosting site though the original roost is at the opposite ridge nearby.
Mambukal, Negros	4	2,421.83	P.vam. = 692.64	A lowland secondary forest within an	Visiting people/tourists that uses the trail under	Bats were observed one by one on their roosting trees. This is a 100%

Occidental			P. hypo = 1668.64 A.j. = 58.12	upland resort.	the bats' roost and the canopy walk. Sometimes they disturb the bats so that they can take photos of the bats flying. Although vehicles passing by near their roosts doesn't disturb the bats.	roost count! Although, during the current visit bats transferred to the inner part of the forest and only a portion of the population can be observed along the bridge (vantage point for observation).
Sagay, Negros Occidental	7	< 1000	P. hypo = <1000	A mangrove forest and a marine reserve dominated by <i>Rhizophora</i> spp.	Sometimes hunters visit the site for hunting. But lately no longer visited due to the difficulty in accessing the site during lowtides. Mudflats prevent people from getting inside the reserve and bantay dagat brigades take turns in protecting the site.	You can actually visit the roost even observing them under their roosts. However, bats sometimes are agitated when noise is produced. Observation is recommended during high tides where you can ride into small non-motorized boats.
Dalaguete, Cebu Province	10	716.6	P. vam. = 142.60 P. hypo = 573.28 P. pu = ? A. ju = ?	A lowland secondary forest on ravines along an agricultural area.	Bats roost together with other Ajs and <i>P.pumilus</i> (not accounted) for observation difficulty with Pvs and Phypos along a <i>Ficus</i> tree. They are roosting together in one single tree.	Roost count is made however, species proportion is very difficult to count since there are tendencies to do overlap counts. Figures shown may be not sufficient. Needs more verification and counts. A spotting scope is recommended for observation.
Malagos, Davao, Mindanao	10	895	P. va = 860.99 A. ju = 34.01	A lowland dipterocarp old growth protected forest. A watershed	Bats were hunted by farmers using hook and line to evade their fruiting lanzones and	Most of the counts were made under their roosts or sometimes just a little distance (20 meters from the tree). Bats are not so stressed. There's a

				by the City of Davao.	rambutan plantations. But were recently stopped by authorities and hunting gear were confiscated by security guards of the reserve.	need for more monitoring and exit counts using a good vantage point.
Bongo Island, Maguindanao, Mindanao	5	642	P. va = 642	A beach forest type found along two islets adjacent the island.	Bats were only disturbed during strong winds (northeast and southwest monsoons) so they transfer to take hide on the two islets from time to time.	This count is made from one of their exits. Roost count is so difficult especially when counting along a non-motorized boat. The Muslim community living nearby doesn't eat bats. So is facilitating in their conservation.
Pinol, Maitum, Sarangani Province, Mindanao	8	22,288.8	P. va = 22,288.8	A private owned swampy beach forest dominated by <i>Terminalia catappa</i> and <i>Nypa fruticans</i> .	No disturbance was observed on this site except for indirect disturbance like clearing of some of the roosting trees. As reported bats grew in number thus invading some of the coconut plantation nearby their roosts.	The Muslim community protected the site by passing an ordinance declaring it a Bat Sanctuary.

Legend:

AJ – *Acerodon jubatus*

PV – *Pteropus vampyrus*

PH – *Pteropus hypomelanus*

PP – *Pteropus pumilu*

ANNEX A

STUDIES OF FRUIT BATS ON NEGROS ISLAND, PHILIPPINES

Apolinario B. Cariño

**Center for Tropical Conservation Studies, Silliman University
6200 Dumaguete City**

ABSTRACT

The current status of population of fruit bats in some forests of Negros Island was assessed between March 1999 to 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 number 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. The data gathered were used to develop a community-based conservation education program to increase awareness on their importance in the ecosystem. Significant protective measures for the conservation of these species were also initiated by a local community and the Province of 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 Danjugan Island, in Negros Occidental. 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) and because of its high level of species endemism and the severity of threats to their survival, the country is among the top ten of the world's biodiversity "hotspots" (Mittermeier, 1988). One of these highly diverse vertebrate faunal groups in the country with high of 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, these bats faced a number of threats where natural populations have been pushed to the brink of extinction (Utzurum, 1992). These include; habitat destruction by human disturbance at roost sites (e.g. hunting, guano extraction and visits) 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 done through community-based initiatives.

METHODOLOGY

Description of Study Sites

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

Banban-Ayungon Forests

Between 26 March to 10 April 1999, a survey was conducted in the forests of Tiholiholan (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, 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 pandans, and rattans (*Calamus* sp.). Orchids (*Vanda* sp.) and lipstick vines (*Aeschynanthus* sp.) were observed growing from the ground climbing to tree trunks that reached upper branches. Found clinging to some of the branches in larger trees are epiphytes like hanging fern *Platyterium 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 to 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 forests (750-850 m asl) is a dipterocarp forest dominated by *Shorea* spp. and some species of *Lithorcarpus* and *Ficus* spp. clinging on boulders of rocks. Between 750 m asl to more than 1300 m asl, tree species *Agathis* and *Podocarpus* interspersed with "bolo"

plants (an unidentified bamboo variety) 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 in the Island between 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). The Island was also designated as the Danjugan Island Marine Reserve and Sanctuaries (DIMRS) by the Municipal government of Cauayan and provincial government of Negros Occidental in February 2000 (King *et al.*, 2002 and see also Harborne *et al.*, 1996 and Turner *et al.*, 2002 for the detailed description of the Island).

Landay, Mantikil, Siaton

Between 6 to 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 often times closed and sometimes with 30 percent light penetration. Fallen logs were observed as fairly common and most of the ridges and its slopes are dominated by shrubs and tree ferns (*Cyathea* spp.). Ground cover constitutes species of pandans, Araceae, ground ferns, and *Calamus* spp. 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 river banks and tree buttresses. Common epiphytes observed were orchids, bromeliads and lipstick vines *Aeschynanthus* sp. and *Medinilla* spp. (also observed on understory and river banks).

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 or *Agathis* sp. (average dbh of 300-535 cm) with white and red laua-a trees *P. contorta* and *S. negrosensis* (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 trunks and branches of taller trees or river banks and which constitute the understory of the forest. A huge number of abaca plantation, *Musa textilis* on elevations 600 to 800 m asl.

Twin Lakes Balinsasayao and Danao

A survey was conducted on 27 to 28 June and 16 to 19 October 2001 in the Twin Lakes Balinsasayao area (9° 21' 10"N, 123° 10' 30" E). The TwinLakes and its immediate surrounding are characterized by steep slopes but with portions which are low elevation and some rolling terrain dominated by dipterocarp forest with some 181 tree species (RSA, 1994). The forest is riddled with clearings caused by kaingin practice and illegal tree cutting. Through years of advocacy, Twin Lakes was finally proclaimed on November 200 as natural park by virtue of Presidential Proclamation No. 414 which covers 8,016.5 ha (FPE-CenTrop, 2004; see also Antone, 1983; Utzurum, 1995; Heaney *et al.*, 1989; Heideman and Heaney, 1989 for detailed description of the area).

Calinawan Community-based Sanctuary

Between 30 to 31 August and 22 to 26 October 2000 and 4 to 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, the area is characterized by low-lying hills with gentle slopes. The site contains old trees with one to two meters (dbh) that belong 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 between 19 to 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. Vegetation cover is very similar to the Calinawan Forest. It is part of the community-based sanctuary that is located in the Municipality of Sibulan that constitutes the highest part (in terms of elevation) of the Sanctuary.

Mt. Guinsayawan

Between 30 January to 4 February 2002, mist-netting activities were conducted from 650 to 800 m asl of Mt. Guinsayawan, Malaunay, Valencia, Negros Oriental and is also part of the PNOC-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 had been heavily logged and cleared since their observations in 1987 and still observed in relatively similar condition in 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. Rattans *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 were done 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 in one of Guihulngan caves (10° 12' 29" N, 123° 16' 54" E) from 767 m asl. The two limestone caves were both situated in

agricultural area planted with crops. Brush vegetations were observed around and near the caves' mouth.

Field Research

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

Bat capture by mist nets occurred 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 ground. High nets were set following the methods used by Ingle (1993). Instead of using a pulley the ropes are laid to a branch then hanged at 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). Scoop nets were also used to capture bats in caves and sometimes by flicking 6 m long mist net hand held by two assistants on both ends and blocking flight route of bats. Captured animals were sexed, weighed, photographed, identified and released. Some threatened species e.g., *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, Campuestuhan-Mandalagan, Mantikil-Siaton, Twin Lakes, Calinawan-Sibulan, Talalak-Sta. Catalina, Apo and Danjugan 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 of 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* were also noted in 3 different roosting sites in Vallehermoso, one in Janayanay, San Jose, and another in Apo Island of Negros Oriental and in Danjugan Island, Cauayan, Negros Occidental. *P. vampyrus* species were also recorded in Buenavista, Sta. Catalina, Negros Oriental.

Among the species recorded in this survey which have considerable conservation importance 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 island record of 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, notes on their behavioral and breeding activities.

Species Accounts

***Acerodon jubatus* (Eschscholtz, 1831)**

Many observations of roosts and one capture was 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 with an estimated 10,000 ha of lowland dipterocarp forest that also contains other species of wildlife. A single individual 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. The roosting site was first reported by members of our People's Organization (PO), the Calinawan United Farmer's Association Inc. (CUFAI) 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 (coordinates) area due to hunting pressures and habitat destructions.

During the April-May 1998 survey in Calinawan (unpublished report), a single adult female was observed carrying a young while on flight as their roosting site was disturbed by hunters. 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 after four years of continuous hunting activities in the area, their population (both *A. jubatus* and *P. vampyrus*) drastically went down to an estimated 5,000 individuals. Other records for this species on the island was documented by Mildenstein *et al.*, (paper in prep.) in Mt. Patag and Mambukal, Minoyan, Murcia, Negros Occidental.

Breeding records in captivity revealed that mating occurs in months of November to December 2000. Birth of *A. jubatus* was recorded on 4 June 2001 and weaning observations were noted starting on 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, and is rare in secondary forest and absent in agricultural areas (Heaney *et al.*, 1998). Yet this species, can still be found in some cleared forests replaced with agriculture

such as; the Twin Lakes (that has 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) from the ground and the other one was observed roosting on a branch of an “amalau” tree (sapling) with 2-3 m tall. From this study, 4 pregnant females were observed on May 21-24, 2001 in Nasuji, Puhagan, Valencia and was the 6th most captured individuals of the species (Table 1).

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

In this study, the harpy fruit bat is rarely captured and that the only site having the most captures is in Nasuji with, a total of eight (Table 1). This is probably because the Nasuji forest is 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 quiet 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 and 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 three individual total capture 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 was captured only once 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 from its slopes and ravine areas. In Campuestuhan, the two individuals were netted on the ground at an abandoned “kaingin” (slash and burn) area where ferns are already growing. Another two individuals were captured on a moderately disturbed forest of Canaway, Mantikil (at the time of the survey) and was captured 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 and were captured twice in Calinawan-Sibulan and on plantations of *Rhizophora* species in Danjungan Island.

Breeding in captivity of this species 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. Grooming attempts are presented to the female while positioning himself at her dorsal part. He will then clasp her with his wings and thumbs, and grasp her thickened nape of her neck. Eventually, the male copulates with the female for about two minutes. Similar action were also observed among species of *Pteropus hypomelanus* and *P. leucopterus* although, *P. leucopterus* species mating lasts more or less two minutes a day while *A. jubatus* species are the noisiest breeders, the activity lasting also to 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 were observed. Each harem is 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 roost singly or with a nursing adult female and juvenile offspring on the side.

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

On Negros, this 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 fore arm = 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 a mossy one 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 roost together inside one node of "bolo" a smaller variety of bamboo that was found in most of the ravines and upper slopes of the ridges in the area (850-1000 m asl). This species enters 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 Calauit 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 unknown (Heaney *et al.*, 1998).

CONSERVATION MONITORING ACTIVITIES

Continuous monitoring of the known fruit bat colonies on Negros is also recommended for both bats that roost in caves (insect and fruit bats) and on trees (flying foxes). Recommendations for the declaration of these sites as protected areas (locally or nationally) should be initiated for the protection of these species. More ecological studies are recommended for bat species of ecological importance to areas like: 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 areas.

Many caves in Negros especially in Guihulngan, Mabinay, Basay and Siaton are exploited by too many visitors (spelunkers), and people extracting guano, hunting, and mining of stalactites and stalagmites. Hence, a program for cave management and protection for the caves in these municipalities should be initiated. Moreover, the discovery of the greater bamboo bat in Canaway, Mantikil, Siaton indicates that the microchiropteran community in this area is diverse and but poorly known. Thus, more studies are recommended since it seems apparent that microchiropterans are also sensitive to environmental threats as bamboos are highly prized as construction materials. Conservation efforts for this group of small bats are worthwhile.

Community Education Programs for Fruit Bat Conservation

The community education program has virtually done its share to increase the people's environmental awareness especially on the conservation of fruit bats not only for the people living around the Mt. Talinis-Twin Lakes Area but also for the entire province of Negros Oriental. Participants of the summer theater workshop and the youth camps benefited from their learning experiences from speakers, facilitators and trainers. The theatrical workshop affected their lives so much in that it helped them develop their self-esteem and self-confidence from their performances before the local community, their parents and a local resort center. More theatrical workshops are recommended 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 Areas so that a good number of young participants will be given the chance to perform in environmentally oriented presentation during fiesta celebrations in all target municipalities. Since Filipinos are keen on watching plays in public rather than listening to semi-formal lectures, environmental protection message can be more effectively put across. The involvement of members of Sangguniang Kabataan will eventually strengthen and help sustain the program since each local government unit has funding intended for this group.

Legislative and Public Support

Furthermore, based on the results of the wildlife conservation education caravan held since November 2002 (to present) and participated in by nine municipalities, many legislators in these municipalities will support the program and ensure the protection of this species by formulating resolutions and declaring municipal protected areas. We highly recommend that to continue this effort, reproduction of posters as educational materials, television and radio programs can be supported by interested donors. This would greatly increase 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. More education campaign is recommended for this province as a good captive breeding facility is initiating this endeavor; in collaboration with interested non-government organizations. Besides the ecosystem services provided by these fruit bats, they are also hunted massively for food as evidenced by the number of hunting incidents in various localities of Negros.

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

Species	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8	Site 9	Site 10	Site 11	Site 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 Mar to 10 Apr 1999); Site 2: Campuestohan, Mt. Mandalagan (7-10 May & 25 May 1999); Site 3: Canaway, Mantikil, Siaton (28-31 Mar 2000); Site 4: Danjungan 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: Guihulngan 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 of Mating	Date of Births	Last Observed Suckling
<i>Pteropus leucopterus</i>	Oct - Nov, 1999	3 Apr 2000	24, Aug 2000
	Oct - Nov, 1999	5 Apr 2000	24 Aug 2000
	Oct - Nov, 2001	24 Apr 2002	6 Sep 2002
<i>Pteropus hypomelanus</i>	Aug - Sep, 1999	12 Jan 2000	Apr, 2000
	May - Jun, 2000	10 Oct 2000	11 Feb 2001
<i>Acerodon jubatus</i>	Nov - Dec, 2000	4 Jun 2001	7 Oct 2001
	Nov, 2002	21 Apr 2003	Aug, 2003
<i>Pteropus leucopterus</i>	Dec, 2000 - Jan. 2001	10 Mar 2001	Jul, 2001
	Dec, 2000 - Jan. 2001	26 Mar 2001	Jul, 2001
<i>Pteropus pumilus</i>	Dec, 2001	28 Mar 2002	Jul, 2002
	Dec, 2001	30 Mar 2002	Jul, 2002

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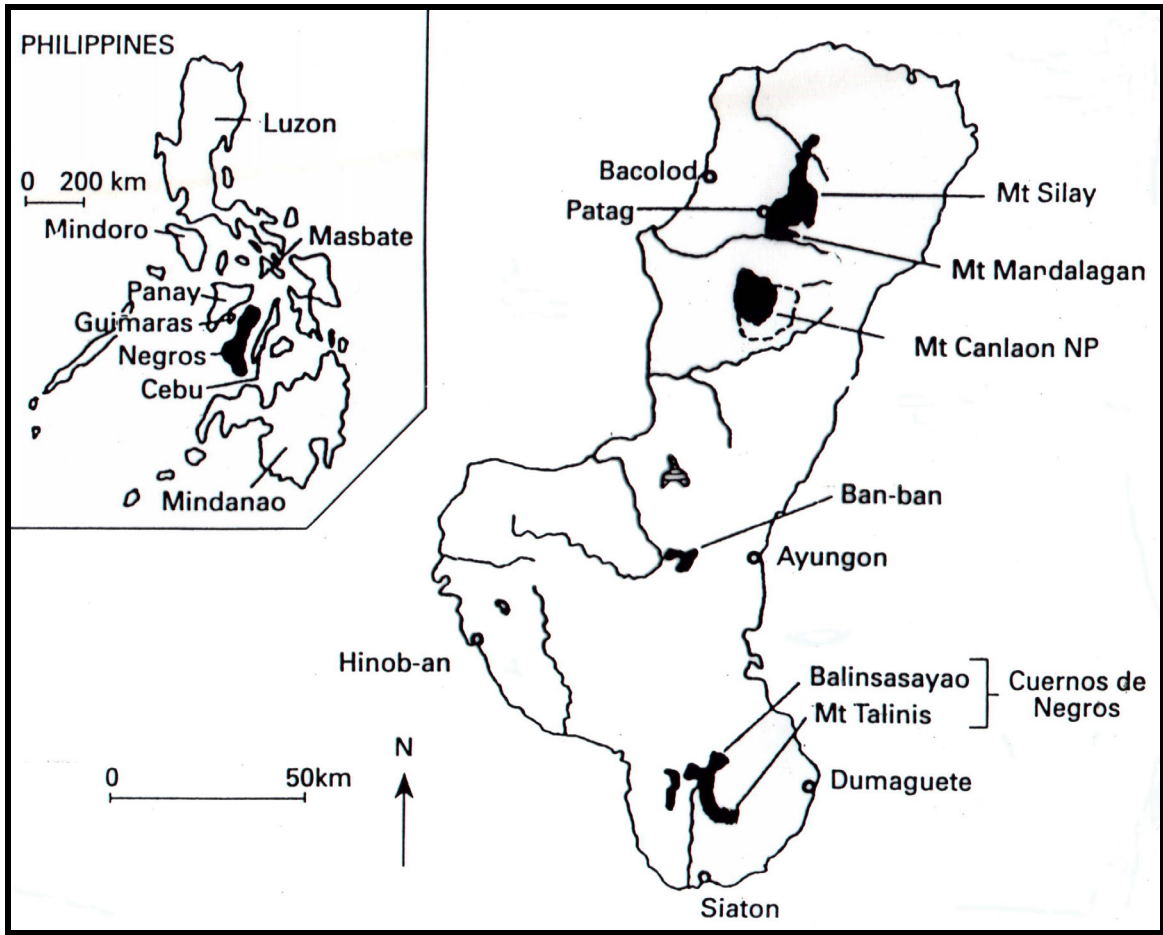


Figure 1. Map showing the map of Negros and its study sites (adapted from Brooks, *et al.*, 1992).

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