

Rufford Small Grant Final Report

BOLIVIAN BAT CONSERVATION AND COMMUNITY EDUCATION PROJECT

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BACKGROUND AND OBJECTIVES

Bolivia is one of the globe's mega-diversity countries that hold a large percentage of the world's biodiversity. To date little of the country's rich biodiversity has been fully documented, even within groups such as birds and large mammals. This is principally due to a lack of financial resources and creates a major problem for conservationists working in Bolivia. A profound lack of data concerning basic biological information such as species richness, distribution and ecological requirements and the present state of threats means that conservationists are unable to make accurate and informed decisions to direct the limited and finite resources my country has for justified conservation projects. This is especially true for the Bolivian bats.

Within Bolivia, bats (Chiroptera) represent one of the most specious mammalian groups with an estimated diversity of 111 species, accounting for a third of all Bolivian mammal species. Despite their high species richness and wide distribution, knowledge of basic biology, ecology and distribution of almost all Bolivian bats remains poor. Furthermore bats play an undervalued role in forest regeneration. Bats pollinate and disperse many plant species and are thus potentially important to local human populations, as these plants are a source for commercial timber, traditional housing material, foods and medicines. These important relationships are poorly understood and little appreciated with no active programs attempting to educate people in rural communities about the important role that bats play in the ecosystem.

Many habitats within Bolivia are facing destruction and degradation on a scale that will result in a huge reduction of habitat extent over the next few years, the consequence of a change in Bolivian population demographics and an acceleration of intensive agriculture practices. Many Bolivian bat species are experiencing a number of threats; with habitat loss and human persecution due to public misconceptions being potentially the most severe. Human persecution results from many rural communities destroying roost sites believing all bats to be vampire bats that attack their livestock. The effect of these threats on the survival of bat populations remains unclear and needs to be investigated and quantified urgently.

Developed from the above issues, the principal goals of this project were

- 1) To identify and document a strategic network of sites important for bat conservation in Bolivia, by carrying out bat species inventories at sites across the country
- 2) To increase the scientific knowledge regarding bats and the threats they face thus enhancing the capacity of Bolivia to carry out bat conservation projects
- 3) To work with local communities against public misconceptions about bats that lead to destruction of their roosts.

This was to be achieved through successful completion of the following objectives:

- Survey of bat diversity, abundance and ecology at different sites within six tropical forest habitats in Bolivia.
- Conduct community based educational sessions to work against public misconceptions, at the most important sites identified by the survey work.
- Disseminate the project's findings and recommendations through scientific journal articles and the project's website.
- Train a number of Bolivian students in both theoretical and practical elements of bat conservation through a training workshop and field experience.
- The project ends by hosting a Bolivian Bat Conservation Workshop where the project's findings will be presented and a series of conservation strategies discussed and proposed.

The survey methodologies have been used successfully in the Neotropics previously, while I personally have worked with Anabat (a computer system to identify recorded bat calls in the field) and mist net capture techniques in Bolivia. The project focused on the most crucial aspects of the situation at present, principally the paucity of information and persecution by rural communities, as well as conducting community based information projects whose success is essential if bat populations are going to exist in relative proximity to the ever increasing human population.

RESULTS

Objectives as stated in the original application and progress in attaining these objectives

Survey of bat diversity, abundance and ecology at different sites within six tropical forest habitats in Bolivia

The surveys were carried out along with the surveys of the Key Biodiversity Sites Project (Darwin Initiative and Glasgow University). The sites were also chosen by this project, except the trip to Oruro department. They provided food and transport from the nearest city to each site, and between sites. In each site, bats were surveyed using mist nets, recorded using an acoustic method: the Anabat system for non-phylostomid bats, and in some cases we looked for roosts. For each bat captured, conventional measures were taken (weight, total length, length of forearm, tail, hind foot and ear) and also reproductive data (sex, age, reproductive status). Whenever it was possible, several photos of each individual were taken (face, hair color and other important characteristics of the species). Finally, bats were marked in the wing using a punch-marking method, to avoid counting



Bats were captured using mist nets.

re-captures. To determine species, in some cases cranial measurements were needed, so an individual was sacrificed; but mostly this was not necessary.



Bat calls of non-phylostomid species were recorded using the Anabat system.

The survey was carried out in 20 sites located in five (out of nine) departments of Bolivia, all of these within nine habitats (Table 1) that have been poorly surveyed in the past. In total, using mist nets I captured 278 bats of 38 species from three families (Phyllostomidae, Molossidae and Vespertilionidae) and using Anabat I recorded 4134 files of 32 species from four families (Emballonuridae, Molossidae, Noctilionidae and Vespertilionidae), although four species could not be identified yet. The acoustic information contributed with ten additional species, having in total the record of 48 species in all sites surveyed. There is the new departmental record of two species from Tarija and six species from Pando. In some

sites, there were very few captures and recordings; this is due to the habitat type that was in some cases not ideal to hold a large bat diversity and abundance. This was the case in all the sites in the Puna Ecoregion and in Tucumanian forest. Most of these sites have not been surveyed previously because of this low diversity. In some cases, it is necessary another evaluation in a more favorable season (especially in the department of Oruro).

Table 1. Sites surveyed in the Bolivian bat conservation and community education project.

	Site	Ecoregion	Habitat	Department	Dates	Coordinates
1	Estancia Marrimia	Cerrado and Dry Chiquitano Forest	Chiquitano cerrado and Chiquitano forest	Santa Cruz	Feb 25 - Mar 4, 2004	16°44'28.6" S, 60°21'52.9" W
2	5 sites: Catavi, Cala Cala, Cerro San Pedro, Itos and Chusaqueri	Northern and Southern Puna	Semi humid Puna and Dry Puna	Oruro	Mar 12 - 17, 2004	17°57'S - 18°24'S, 66°34' - 67°09' W
3	Cerro Imbochi (Serranía Taremekua)	Chaco Montane	Chaco Montane forests	Santa Cruz	Apr 5 - 12, 2004	20°15'15.7"S, 63°11'49.7"W
4	Estancia Urubigua	Chaco Montane	Chaco Montane forests	Santa Cruz	Apr 13 - 19, 2004	20°14'11.4"S, 63°13'51.9"W
5	Cerro Cobre	Northern Puna	Humid Puna (Polylepis Forest)	Tarija	May 7 - 11, 2004	21°41'22.8"S, 65°09'04.9"W
6	Piedra Grande, Rio Calderillas	Northern Puna	Humid Puna (Polylepis Forest)	Tarija	May 12 - 17, 2004	21°44'01.1"S, 64°55'47.7"W
7	Infiernillo, Cuenca A	Northern Puna	Humid Puna (Polylepis Forest)	Cochabamba	Jun 24 - Jul 2, 2004; Nov 30 - Dec 3, 2004	17°26'38.7"S, 65°32'33.1"W
8	Cajon, Rio Churuma	Tucumanian-Bolivian Forest	Tucumanian-Bolivian Forest	Tarija	Aug 8 - 23, 2004	20°16'10.7"S, 64°10'39"W
9	Camp Alarache	Tucumanian-Bolivian Forest	Tucumanian-Bolivian Forest	Tarija	Aug 28 - Sep 1, 2004	22°11'54.5"S, 64°37'52.8"W

10	Camp Castañero Santa Rosa	Amazonian Forest	Amazonian forest of Pando	Pando	Oct 20 - 26, 2004	12°00'00.3"S, 68°12'31.7"W
11	Camp Malecón	Amazonian Forest	Amazonian forest of Pando	Pando	Oct 27 - 31, 2004	11°57'12.5"S, 68°48'35.8" W
12	Camp Negro	Amazonian Forest	Amazonian forest of Pando	Pando	Nov 2 - 8, 2004	12°18'47.4"S, 68°40'07.9"W
13	Campos de Pinos	Tucumani-Bolivian Forest	Tucumani-Bolivian Forest	Tarija	Jan 16 - 22, 2005	21°54'47.4"S, 64°31'49.0"W
14	Quebrada Lorayo	Tucumani-Bolivian Forest	Polylepis and Podocarpus forest	Tarija	Jan 23 - 29, 2005	21°54'00.5"S, 64°35'08.5"W
15	Curqui	Prepuna	Cactus Forest	Tarija	Jan 31 - Feb 4, 2005	21°29'34.4"S, 65°04'12.0"W
16	Yuquerity (during the workshop)	Chaco Montane	Chaco Montane forests	Santa Cruz	Apr 18 - 20, 2005	
Total	16	8	10	5		



One of the most abundant species captured: the frugivore Sturnira lilium.

Other species that are commonly recorded are *Molossus molossus*, *Nictinomops laticaudatus*, *Promops nasutus* (Fam. Molossidae) and *Myotis nigricans* (Fam. Vespertilionidae). In most bat studies carried out in Bolivia in the past, only mist nets were used, and all these species and families that I found to be common are greatly underrepresented. There is also an attempt to establish the conservation status of such species, but this not possible yet due to the profound lack of information regarding all the non-phyllostomid bats. This is why there is an urgent need to continue the acoustic survey in all habitats in Bolivia; not only to determine the acoustic signatures of many species that to date can't be fully identified, but also to determine the distribution range and in the long term, the real conservation status of non-phyllostomid bats.

The abundance for most species was low, in most cases there was only one individual per species. The most abundant species captured were the frugivores *Sturnira lilium*, *S. erythromos*, *Carollia brevicauda* and *Artibeus jamaicensis* (Fam. Phyllostomidae). These species are usually readily captured with mist nets in paths and water bodies. Using Anabat is not possible to estimate relative abundance since we can't determine if the recorded files belong to one or more individuals. But it is possible to establish which species are common and which are rare. The rarest species are those of the Emballonuridae family (four species) and *Noctilio albiventris* (Fam. Noctilionidae), which were recorded only in one habitat, the Amazonian forest. The most common species recorded in

the lowlands was *Eptesicus furinalis* (Fam. Vespertilionidae) and in the highlands was *Tadarida brasiliensis* (Fam. Molossidae).



New departmental record for Tarija: the carnivore Chrotopterus auritus.

Table 2. Number of captures, recordings and species for all sites and habitats surveyed. The last column shows the new departmental records for Tarija and Pando.

	Site	Habitat	# mist net captures	# mist net species	# Anabat files	# Anabat species	Total species	New departmental records
1	Estancia Marrimia	Chiquitano cerrado and Chiquitano forest	24	4	9	3	7	
2	5 sites: Catavi, Cala Cala, Cerro San Pedro, Itos and Chusaqueri	Semi humid Puna and Dry Puna	0	0	0	0	0	
3	Cerro Imbochi (Serranía Taremekua)	Chaco Montane forests	15	6	21	3	12	
4	Estancia Urubigua	Chaco Montane forests	13	7	319	7		
5	Cerro Cobre	Humid Puna (Polylepis Forest)	0	0	-	-	1	
6	Piedra Grande, Rio Calderillas	Humid Puna (Polylepis Forest)	1	1	3	1		
7	Infiernillo, Cuenca A	Humid Puna (Polylepis Forest)	0	0	139	3	3	
8	Cajon, Rio Churuma	Tucumanean-Bolivian Forest	51	4	-	-		1
9	Camp Alarache	Tucumanean-Bolivian Forest	11	5	501	5		1
10	Camp Castañero Santa Rosa	Amazonian forest of Pando	44	12	-	-	38	6
11	Camp Malecón	Amazonian forest of Pando	41	17	2414	15		
12	Camp Negro	Amazonian forest of Pando	30	10	83	4		
13	Campo de Pinos	Tucumanean-Bolivian Forest	40	2	558	7	9	
14	Quebrada Lorayo	Polylepis and Podocarpus forest	-	-	22	0	0	
15	Curqui	Cactus Forest	0	0	22	1	1	
16	Yuquerity (during the workshop)	Chaco Serrano	8	6	43	3	7	
			278	38	4134	32	48	8

Conduct community based educational sessions to work against public misconceptions, at the most important sites identified by the survey work.

During the survey work, I asked the local people what they know about bats, with this information it was possible to determine the threats that bats face in each site. In most sites, this was not possible because there were not villages or houses surrounding our survey site. In some cases I had to ask the people that were hired to work with us (villagers or park rangers). Using this information, I determined two areas that were ideal to conduct the educational workshops: Pando and Chaco Serrano.



Park rangers of Manuripi Reserve (Pando) during the educational workshop.

Pando was chosen because it was the site with the highest bat diversity, and because the Amazonian forest is in constant risk of habitat lost due to timber. Another threat is the disturbance made during the season of chestnut extraction (from November to March). In this period many villagers go in the forest to work, but they also hunt and cut trees for firewood. I did not identify a specific threat to bats in the forest, but people have a bad image of them in the city of Cobija, and it is possible that this also occurs in the villages. Since the

people live in a very scattered manner (there very few well established villages), it was thought to better work with the park rangers of the Manuripi Reserve, and let them disseminate the information in their own villages and in the sites they patrol inside the Reserve. This way, the contact with the Reserve's administration was made, and they gathered all the park rangers for a one-day educational workshop in the city of Cobija. The workshop was carried out by Victor García (a student trained by this project) in April 9 of 2005, and it had the participation of all park rangers (13), the supervisor and the director. The workshop had three main activities: 1) A power point dissertation of the theoretical aspects of bats that included bat diversity, echolocation, reproduction, roosts, feeding habits, benefits and vampire bats. For this, we used the digital photos I took during all the survey work and we emphasized on the diversity found in Pando. 2) Identification practice in the local museum with bat specimens to recognize feeding groups, specially vampire bats, and 3) Capture of live bats using mist nets, to give them an idea of the capture method and so they can see and recognize a live bat. During the workshop, a very important part was to know the "student's" point of view regarding bats, and as it was foreseen they had a general bad of image of bats. Among the things they commented were: bats are bad, there are only three species, they are monkeys because they live in palm trees, harmful because of the smell they leave in the houses, they are not beneficial, dangerous because they transmit diseases and one person said that bats are good but did not know why. During the workshop these aspects were treated and the students realized that they were misinformed.

The other area considered important to carry out educational sessions was the Guaraní communities of Chaco Serrano. The bat diversity found in this area was not significantly high, but the bat assemblage was a very interesting mix of bats from different habitats. This is because Chaco Serrano's vegetation is a mix of Yungas and Tucumanian forest, dry valley and chaco. Like many other chaco areas in Bolivia, there is a habitat loss threat due to oil extraction that will take place in the future. But for now, this area is relatively well preserved and the villagers contribute enormously to this situation.



Community education in the guaraní region (Yuquerity).



Guaraní villagers deployed mist nets for bat capture. Live bats were shown to them, they were later released.

vampires to domestic animals, that leads to villagers to kill any bat they see, and in some cases to burn tree roosts. A very good aspect of this area is that the villagers are very organized in well-established communities, and all these communities organized in Municipios that conform a big organization called "Capitanía Parapetiguasu". These aspect, along with the fact that Guaraní people are very open and connected to their environment, as we realized when several villagers worked with us during the biodiversity survey; made an ideal place to carry out an educational workshop. This way, the contact with the Capitanía was made with the help of a person from the German cooperation (F. Dupret, GTZ), and they gathered representatives of all communities from the Municipio Boyuibe. The workshop was carried out by myself with the help of a educator (Paola Selaya) and a biologist (Arturo Muñoz) in April 18 to 20 of 2005 in the community Yuquerity, and it had the participation of nine villagers from five communities. Additionally, we gave a short dissertation to the children and the teacher in the community school. The design of the workshop was carefully planed with the help of other two professionals (an educator and a biologist) with experience on community education and taking into account all these previous experiences and the characteristics of the participants (villagers and facilitators). The result was an educational workshop ideal for guaraní communities, that was horizontal, with equal participation and experimental. The information transferred to the villagers was the same that in the Pando workshop, but using a totally different methodology: using the digital photos that were enlarged and printed and showing it to them in a very casual way (like showing family photos) and letting them make any comments and questions. We also showed to them all the capture material (mist nets and Anabat) and photos of us working. We did not show any specimens because it is very contradictory to tell them that they should not kill bats and then show them dead bats. Instead, we captured and recorded bats with them at night and it was a great experience for them to see live bats and learn to recognize them. We also gave them posters with the information of the bats I found in the survey and all their benefits. This was very positive and the villagers were very happy to have this information. The main result was the fact that the participants understood the importance of the conservation of bats and its commitment of

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The photos taken during the project were used to make an informative poster for the guaraní villagers.

transmitting all that they learned to their families and communities. Having as prove the transmission of this information to the community of Yuquerity in a meeting carried out when the workshop concluded, becoming the villagers in facilitators and explaining the topics in Guaraní language.

Disseminate the project's findings and recommendations through scientific journal articles and the project's website

The projects findings were exposed in the "First Mastozoology Congress in Bolivia" carried out the first days of June 2005. Two oral presentations were presented: "Some proposals for the bat conservation in Bolivia" and "Educational workshop on bats in Guaraní communities" disserted by the educator Paola Selaya. This was a very important scientific event, with around 200 participants from all Bolivia and from foreign countries, and the dissemination of the project's findings was an important first step. After the Congress I will start working on the manuscripts of these two presentations, and also on a third manuscript in which I will emphasize the acoustic work with Anabat. I intend to write these manuscripts in Spanish, this way the information will be more accessible to other young biologists in my country.

The "Key Biodiversity Sites in Bolivia" project is going to begin their web site soon (www.boliviaacb.com, www.boliviakba.co.uk). It will probably start running when the project ends in July of 2005. The results of this project will be presented in this web site, along with some of the digital photos taken during the work.

Train a number of Bolivian students in both theoretical and practical elements of bat conservation through a training workshop and field experience.

Thanks to the initiative of the Key Biodiversity Sites in Bolivia Project (KBS) and the Program for the Conservation of Bats of Bolivia (PCMB) I organized the training course "Techniques for evaluating and monitoring bats" that was financed by Conservation International and Darwin Initiative. The course was carried out in the town of Villa Tunari from 27 to 30 January of 2004,

with a duration of 4 days and 3 nights and a total of 38 hours of theoretical training and practice. It had the participation of following people: Luis F. Aguirre, Ph.D. (instructor), Lic. Lizette Siles (instructor and organizer), Lic. Arturo Muñoz (Representative of KBS Project) and eight students from three cities of Bolivia. The following topics were developed: 1) Introduction to the biology, ecology and conservation of bats of Latin America and Bolivia, 2) Capture and manipulation techniques for bats 3) Identification of species 4) Acoustic techniques (Anabat and Petterson), recording and analysis and 5) Data analysis. We read and discussed articles of the following topics: acoustics



Training workshop for Bolivian students "Techniques for evaluating and monitoring bats".

and the Anabat method, bat communities, bats in caves and behavior of a cave-roosting bat. We also captured bats in the forest and visited the Repechón Caves, which hold a large bat population. The course had very positive results, the students that didn't know anything about bats, not only learned the basic methodology but also their importance in Neotropical ecosystems. For the students that already had some experience, the course helped them to clarify the part of data analysis and the importance of systematizing the sampling. For all the students the course helped them to see possible topics that they can be developed in areas so varied as ecology, conservation, behavior and acoustics. The only weakness of the course was not presenting in a pedagogic way the taxonomic part, this obviously will be taken into account for future courses.

Through fieldwork experience, I trained three people, two of them are villagers from Chaco Serrano and one is a student from Pando that also gave the educational workshop to the park rangers.

The project ends by hosting a Bolivian Bat Conservation Workshop where the project's findings will be presented and a series of conservation strategies discussed and proposed

The Bolivian Bat Conservation workshop was proposed in the "First Mastozoology Congress in Bolivia" and its accomplishment will depend on the will and interest of all the bat biologists in Bolivia. The Program for the conservation of Bolivian bats (PCMB) is planning to host a meeting in October; this will probably be an ideal moment to discuss the research and conservation strategies for bats in Bolivia.

Particular challenges faced and solutions adopted

The most difficult challenge was the recording of bats in the field using Anabat. At first I was using an equipment that needed a laptop computer to make recordings, but it was very difficult to charge in the field. In one case, we were able to get a motor to charge the computer, but this was only for one trip. After the sixth trip, Wildlife Conservation Society (WCS - Bolivia) asked me to participate in an advanced Anabat course, where I was able to learn to work with another Anabat unit that did not need laptop computer (called CF-Zcaim). WCS lend me this unit for the rest of the trips, and from then on the recordings were made without any problems.

At first, it was planed to buy a complete Anabat equipment, but since WCS insisted on lending the equipment for this project, the money was invested in a digital camera and accessories. This was a great investment, since the photos from the project were used for training and educational workshops with success, and also will be used in the future for Museum posters and other publications.

Another challenge faced was related to the educational workshops in communities. There is no previous work in Bolivia that uses appropriate methodologies to carry out this type of workshops in rural communities. When this project was planned, it was thought that I would use the educational workshop that the Program for the Conservation of Bolivian bats (PCMB) has; but this workshop is not appropriate because it uses slides and therefore it needs electricity. Most rural communities in Bolivia don't have electricity, so the whole workshop had to be re-thought. With the help of other biologists and an educator, we gathered our experiences and were able to design a successful workshop, using the information and photos from the survey work.

Changes to your project arising during the year / 18 months

There were a lot of changes in the timetable, the project started in January 2004 with the training workshop and the field trips started in February 2004. The trips were not continuous, and for three months there was not any trip (adjustment to KBS project's timetable and the WCS advanced Anabat course). The project was originally planned to last 9 months, including 6 months of fieldwork; but it lasted from January 2004 to April 2005, with 12 months of work (including 10 months of fieldwork). This was possible because in most of the sites it was not necessary to have a field assistant, due to the low diversity, so I worked alone and the money that remained was used for extra trips.

Expenditure vs. Budget

Budget costs have been worked out in US dollars (exchange rates £1=\$1.5). The Rufford Grant was for a total of 8408,5 US dollars, and the total spend is a total of \$ 8400,1 (9038,7 – 638,6 of the Bat training workshop).

Item	Budget		Expenditure	
	£sterling	\$us	£sterling	\$us
Equipment				
- bat recording and detection equipment	1300	1950	1529,5	2294,3
- general fieldwork equipment	700	1050	104,12	156,2
Transport and supplies for fieldwork †	2000	3000†	315,14	472,7
Bat training workshop ‡	450	675	425,71	638,6
Community education	700	1050	278,7	418,0
Museum work	50	75	50	75
Printing and office	150	225	142,58	213,9
Subsistence Payments	2400	3600	3180	4770
Total	7750	11625	6025,8	9038,7
Total spend Rufford Grant			9038,7 – 638,6 = 8400,1	

† This item was 90% covered by KBS project, the figure shown here is the expense made with the Rufford grant for transport between major cities.

‡ This item was 100% covered by Conservation International through KBS project

Where next?

In the short term, I will participate in a Glasgow Expedition to Beni, the same methods will be applied, and the data obtained will contribute to the data base that was started with this project. In the long term, I will try to find more funds to continue fieldwork in other sites that have not been previously studied. There is also going to be intensive work with acoustics to add more bat signatures of Bolivian species to the database that already has a lot new files thanks to this project. Hopefully, this work will be able to tell us the distribution range, the rarity and the conservation status of most non-phylostomid species in Bolivia.

How will this take you forward?

The results from this project let me focus on the investigation areas I want to work with in the future. Now, I feel capable of start and manage other projects, and also to look for monetary resources. I also have the support of important institutions, such as the Museum of Natural History of Cochabamba Alcide d'Orbigny and WCS-Bolivia. It is really difficult to think about future conservation work in my country, due to the serious social and political problems that Bolivia is going through, but I really want to continue working here. I think the opportunity to study for a Master's or Doctorate's degree outside Bolivia has increased thanks to this grant. If I achieve this goal, I will certainly return to Bolivia to continue working for the biodiversity conservation of this great mega-diverse country.