

Final Project Evaluation Report

Your Details	
Full Name	Marisol Martinez Bautista
Project Title	Feeding ecology and conservation of roosting and foraging sites of long-nosed bats (<i>Leptonycteris</i>) in Mexico and effects of human activities.
Application ID	22104-1
Grant Amount	£4982
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Date of this Report	14-09-2018

1. Indicate the level of achievement of the project's original objectives and include any relevant comments on factors affecting this.

Objective	Not achieved	Partially achieved	Fully achieved	Comments
To determine diet, roosting and foraging sites for <i>Leptonycteris nivalis</i> and <i>L. yerbabuenae</i> in areas where their distribution overlaps.				I found a total of 52 different plant species in the diet of both <i>Leptonycteris</i> (16 in autumn-winter and 37 in spring-summer) (Figure 1). Of these, more than half were consumed by both species.
To determine the potential mechanisms that allow two species as similar as <i>L. nivalis</i> and <i>L. yerbabuenae</i> co-exist in areas of distribution overlap.				The high resources availability in both study areas (Rio Balsas Basin and Metztitlan Canyon Biosphere Reserve) (Figure 2) is the reason for what these bats can coexist in the same areas. The resources are enough for both species, so there is no need of competition.
To re-visit sites reported as historical roost for <i>Leptonycteris</i> and record if the species are still present.				In total I visited eight different places reported as historical roosting sites for <i>Leptonycteris</i> . I found the genus in two of them. One is the Salitre cave, located in Ticumán, Morelos. Here was supposed that both species shared the refuge, but just <i>L. yerbabuenae</i> was found. The other are the Tziranda caves, located in Ciudad Hidalgo, Michoacán. Here was found a very important group of <i>L. nivalis</i> since represent a mating colony for the species, which is a great contribution in its conservation.
To define important foraging and roosting sites for <i>Leptonycteris</i> in the Rio Balsas Basin and Metztitlan Canyon Biosphere Reserve.				In both areas I found several foraging sites that are key in the feeding of <i>Leptonycteris</i> . In both cases I had to increment the size of the buffer area because inside of the 30 km I did not found enough foraging sites. In Rio Balsas Basin the buffer was of 50 km and in Metztitlan Canyon Biosphere Reserve the buffer was of 100 km (Figure 3).

<p>To detect key factors that are affecting both species and that cannot be detected in separate studies.</p>			<p>The factors that most affect to <i>L. nivalis</i> and <i>L. yerbabuena</i> are the change in land use, the disturbance of their roosting sites and mainly the disinformation that exists in the inhabitants of the surrounding communities, who often attack the bats because they are considered a danger. Also, the lack of protection or knowledge of the roosting and foraging sites of <i>Leptonycteris</i> by the Mexican authorities puts the conservation of these species at risk.</p>
<p>To identify the anthropogenic threats in each study site.</p>			<p>I could identify the threats in all the sites I visited. The most common anthropogenic threats were the accelerated land use changes for the construction and the introduction of livestock or crops, as well as unregulated entry of people to the different caves.</p>

2. Please explain any unforeseen difficulties that arose during the project and how these were tackled.

For security and inaccessibility reasons was no possible to visit some zones inside of 30 km buffer areas proposed initially. Therefore I could not identify enough foraging sites to *Leptonycteris*. However I solved it increasing the size of the buffer areas and in these way I found more foraging sites, which are key in the conservation of *L. nivalis* and *L. yerbabuena*.

A similar situation occurred one the historical roosting site, San Lorenzo cave, since the place where is located is unsafe so we could not do night sampling. I decided to ask local people that someone would come with us to the cave to register if *Leptonycteris* was there or not, at least during the day. Thus, I checked that cave no longer serves as a refuge for *Leptonycteris* at least during the season when I visited the site (Figure 4).

3. Briefly describe the three most important outcomes of your project.

a). To determine the diet and food availability for *Leptonycteris*. Knowing the different plant species of which *L. nivalis* and *L. yerbabuena* feed on, helped me to identify which of them are more important in the diet of these bats. I found that the genus *Ipomoea* and *Agave* are key in the feeding of both species. The results showed that these bats share more than half of the plant species in their diets, therefore is important protect all the plants of which they feed on.

b). To locate important foraging sites for *Leptonycteris*. In the Rio Balsas Basin *Ipomoea* was available in the whole autumn-winter. I also found *Agave horrida*, *Agave* sp., *Ceiba* sp. and *Pachycereus* sp. in this area. In the Metztitlan Canyon Biosphere Reserve *Agave* was always available and almost completely dominated the foraging sites, with the exception of some elements of the family *Cactaceae*. All the families, genera and species identified in the foraging sites were also found in the diet of both *Leptonycteris* species, which makes the foraging sites identified in this study key in the feeding and therefore protection of these bats.

c). To find a new breeding colony for *L. nivalis*. In the Tziranda caves, Ciudad Hidalgo, Michoacan I found a large number of individuals of *L. nivalis*. Of them approximately 50% were females and 50% males. Also many of the males were sexually active. These data agree with the data founded in the only mating colony known for *L. nivalis*, and indicate that this site is also a mating roost, becoming in the second mating colony of the species and therefore in a key site on its conservation.

4. Briefly describe the involvement of local communities and how they have benefitted from the project.

The participation of the communities was key in the realisation and success of this project. Since the beginning I looked for their participation, so each time that we arrived to a community, before starting the fieldwork, my team and I informed them about the work we would be doing on the area. We also gave small informal talks about our work and the importance of the bats in the ecosystem, looking for they knew the great importance of protect each of the sampling sites. On several occasions they showed great interest, and they by their self-participated in the sampling activities (Figure 5).

Once the community knew us and knew about our work, we gave them more formal talks, seeking to gather most of the members from the different towns. In each of the talks there was an intrusive part about what the bats are and their benefits, and then the project was explained as well as its importance (Figure 6). After the talk, activities with the children of the community were carried out, so that in a didactic way they could understand the benefits of protecting the bats (Figure 7). In the particular case of the Aguacatitla Canyon, one of my sampling sites, these talks were given to the guides, to whom we gave information about the bats that will help them in the future with the tourists in their tours. It is important say that the owners of this site protect the bats enormously.

5. Are there any plans to continue this work?

Yes, I have to finish the remaining month of sampling to complete my project. After this, there are no plans to continue with the field work in these areas, but in the near future it is possible that I seek further studies of diet and identification of foraging sites for *Leptonycteris* in other areas of its distribution in the north Mexico. Currently, I am in contact with the residents of the Aguacatitla Canyon and it is possible that we will carry out more environmental education activities in the zone.

6. How do you plan to share the results of your work with others?

This year I am going to participate in the North American Society for Bat Research (NASBR) Congress in Puerto Vallarta, Mexico, where I will present the results of this research. Additionally I plan to participate in other international congresses as the III Latin America Congress of Bat Research, Latin America Network for Bat Conservation (RELCOM) in the Mérida, Yucatán, Mexico 2020.

I will continue collaborating with the Mexican Program for Bat Conservation (PCMM) and Bioconciencia A.C. with environmental education. And the information obtained from this project can serve to create more material and activities.

Finally, as I mentioned in the proposal, this is my thesis project, therefore the whole work will be available on line in TesiUNAM. Also I will publish the results in journals available to the international community.

7. Timescale: Over what period was the grant used? How does this compare to the anticipated or actual length of the project?

The RSG was used to cover one sampling year, from October 2017 to October 2018, as I specified in the project proposal.

8. Budget: Provide a breakdown of budgeted versus actual expenditure and the reasons for any differences. All figures should be in £ sterling, indicating the local exchange rate used. It is important that you retain the management accounts and all paid invoices relating to the project for at least 2 years as these may be required for inspection at our discretion.

Item	Budgeted Amount	Actual Amount	Difference	Comments
3 Mist nest (3 m)	132	126	6	The 3 m mist nets that I planned originally buy were sold out, so I had to look for others, which were cheaper, but also very useful.
3 Mist nets (6 m)	177	187	-10	The prices of the 6 and 12 m mist nets increased a little, so there was a minimal difference on the prices when I bought them.
3 Mist nets (9 m)	147	166	-19	The 9 m mist nets that I planned originally buy were sold out, so I had to look for others, but in these case were more expensive.
2 Mist nets (12 m)	177	181	-4	
3 Aluminium mist nets	589	394	195	I bought just 2 Aluminium mist nets

Pole Set				Pole Sets because I got borrowed the other set from the Ecology and Conservation of Terrestrial Vertebrates Laboratory, UNAM (Laboratorio de Ecolgia y Conservación de Vertebrados Terrestres, LECVT).
Measuring Tape	51	51	0	
2 Dial Plastic calliper 150 mm	74	44	30	I found cheaper Dial plastic callipers that were also useful.
2 Pesola Spring Scale 100 gr	63	74	-11	The price of the Pesola Spring Scale increased a little, so there was a difference on the price when I bought them.
100 Cotton bags	100	99	1	
14 Microscope slides and Slide cover Box	103	110	-7	The microscope slides and slide cover that I planned originally buy were sold out, so I had to look for others, which were cheaper.
4 Eppendorf tube boxes	67	67	0	
White label box	18	18	0	
10 Scotch tape piece	5	6	-1	
NaOH bottle (1 kg)	7	13	-6	The price of the NaOH bottle increased a little, so there was a difference on the price when I bought the bottles.
10 Alcohol bottle (1 l)	25	18	7	I found cheaper Alcohol bottles.
10 Glycerine bottle (1 l)	10	19	-9	The price of the glycerine bottle increased a little, so there was a difference on the price when I bought the bottles.
Lodging	1117	1214	-97	The lodging expenses increased due to some of the my sampling sites are very tourist places, so the cheapest lodging places were quickly saturated, therefore I had to pay for lodging sites a little more expensive.
Vehicle maintenance and gas	1120	1338	-218	Due to the constant increase in the price of gas in Mexico, and the fact that my sampling sites are very far from each other, gas expenses increased considerably. At the same time, some of the trips had to be made by bus, and sometimes we had to take more than one bus to reach to the sampling sites,

				which increased the costs even more.
Food	1000	928	72	Occasionally, to save money, I bought ingredients to prepare our own food in the supermarket, which was cheaper than eating in restaurants. This helped to reduce expenses on food.
Total	4982	5053	-71	1 GBP = 24.6568 MXN pesos 1 MXN = 0.04007 GBP

9. Looking ahead, what do you feel are the important next steps?

In the case of the sampling of diet and foraging sites, the next step is to carry out this kind of work in other distribution areas of *Leptonycteris*, mainly in northern Mexico, and seek their protection to preserve the habitat of the long-nosed bats throughout its whole distribution. The same action have to be carried out in the search of historical roosting sites, since in the north of Mexico there are countless reports of *Leptonycteris* in different caves that, after these reports, were forgotten. Resuming this search is essential in the conservation of both species of chiroptera. A very important point to address in both cases is to stop the degradation of the distribution areas of these bats and to end with the idea that these are dangerous. Therefore, the implementation of environmental education talks in each of the towns from these places is very important.

10. Did you use The Rufford Foundation logo in any materials produced in relation to this project? Did the Foundation receive any publicity during the course of your work?

Yes, I used the Rufford Foundation (RF) logo in each environmental education talk that I gave and I thanked to the foundation for financing my project. Also in talks with colleagues of the LECVT I used the logo and mentioned the great support from the RF to my project (Figure 7).

This year in the NASBR Congress, and in other subsequent conferences, I will use the logo and I will mention the support of RF. In addition in the written work of my thesis as well as in the publications produced from this project I will mention the Rufford Foundation again.

11. Please provide a full list of all the members of your team and briefly what was their role in the project.

Dr. Rodrigo Medellín and **Dr. Ana Cecilia Ibarra**. They gave their guidance and experience, increasing the success of all the steps of this project.

M. Sc. D. Leonor Quiroz and **M. Sc. Salvador Acosta** from the National Polytechnic Institute (IPN). They have always given me their unconditional support and without them this project would not have been possible. Passionate of the palynology that

have deposited all their effort and knowledge in helping me to the identification of the diet of *Leptonycteris*.

Dr. Alberto Rojas-Martínez from the Autonomous University of Hidalgo State. He gave me his enormous support in the sampling carried out at the Metztitlan Canyon Biosphere Reserve.

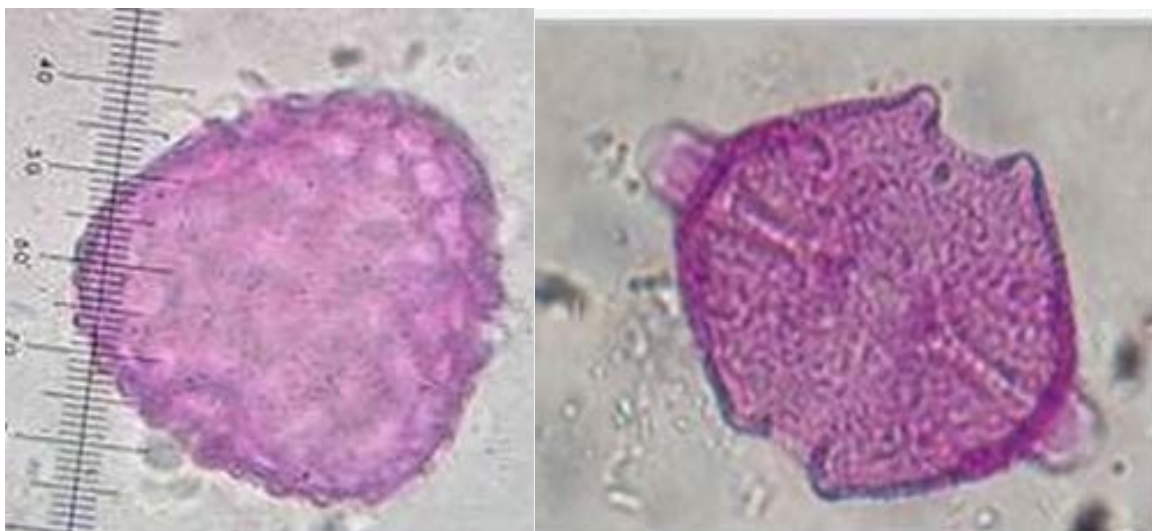
Dr. Laura Navarro coordinator of the PCMM and member of Bioconciencia A. C. Key piece in the environmental education works carried out during this project. With her extensive knowledge and experience contributed to the success of each of the talks and activities.

Marco Antonio Reyes. Indispensable constant assistant, who always accompanied me to the field trips, putting all his effort into each of the sites and whose work made the success of this project possible.

12. Any other comments?

The data about diet, foraging and roosting sites that this work provide will contribute to the revision and update of the *L. nivalis* Recovery Plan (USFWS, 1994) and will address important points in the global protection of *L. yerbabuenae* and mainly in the recovery of *L. nivalis*. This work is the first to determine from the observation the location of foraging sites for *Leptonycteris*. Therefore, it is important to continue with this kind of efforts to answer the same question in other distribution areas of the long-nosed bats.

I would also like to thank to the Rufford Foundation for financing this project and contribute enormously to the research, conservation and protection of the long-nosed bats and their ecosystem in Mexico.



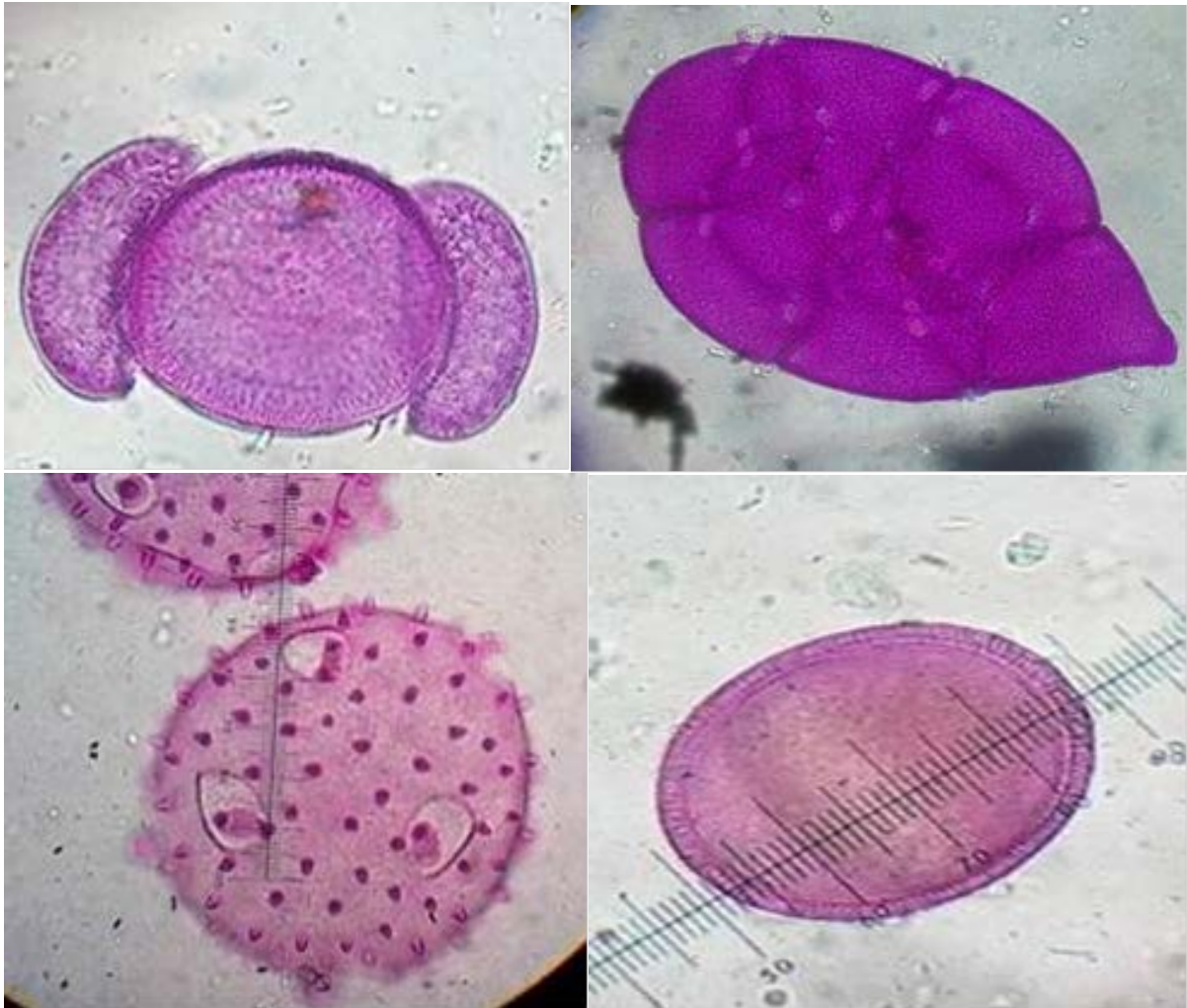
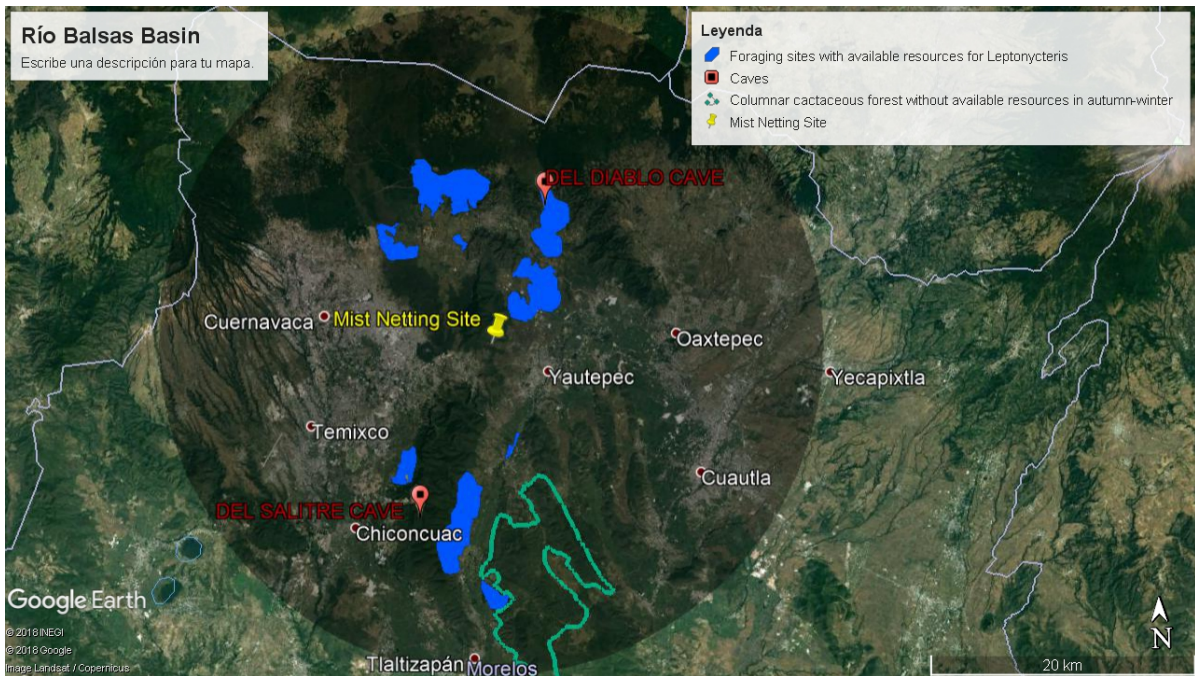


Figure 1. Different species of pollen found in the diet of both *Leptonycteris* species. Above left: *Ceiba pentandra*. Above right: *Ceiba aesculifolia*. Middle left: *Pinus* sp. Middle right: *Calliandra tergemina*. Bellow left: *Cayaponia racemosa*. Bellow right: *Operculina pinnatifida*.





Figure 2. Resources availability. Above: *Ipomoea* sp. Below: *Pachycereus* sp.



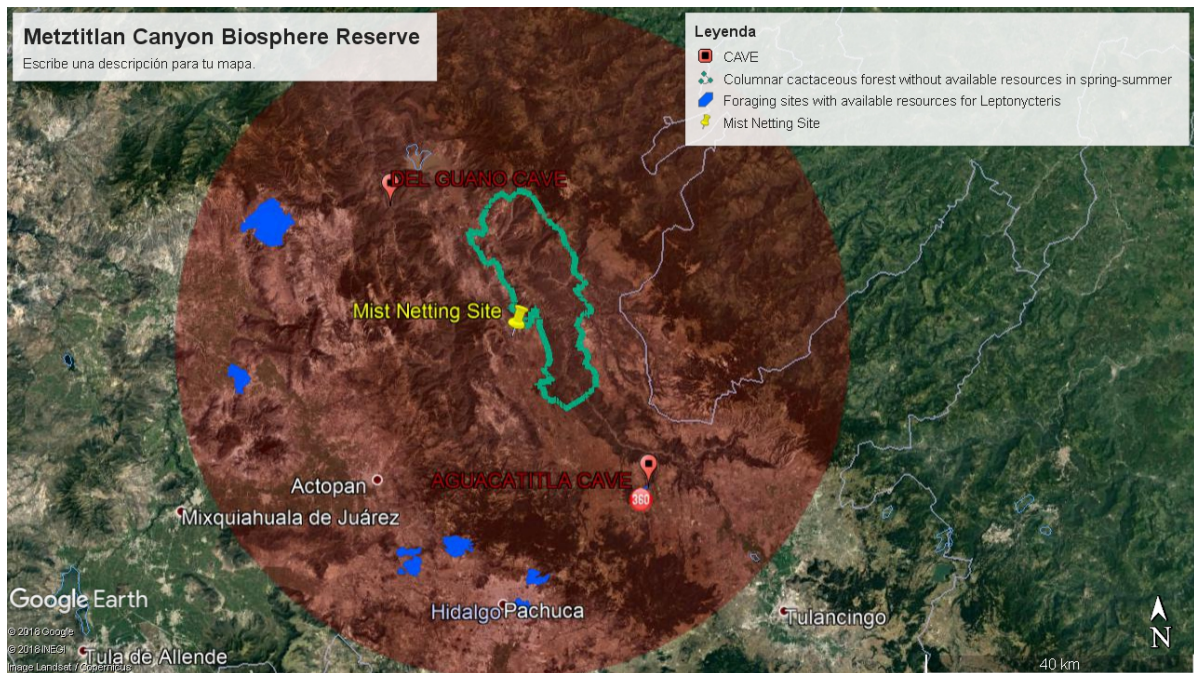


Figure 3. Foraging sites found in this project.



Figure 4. San Lorenzo cave. Left: Sign placed at the entrance of the site with the warning not to go up due to the risk of being assaulted. Right: Alejandro, member of the community that accompanied us inside the cave.



Figure 5. Girl member of Santo Domingo Ocotitlán, town where one of my sampling sites is located. She offered to accompany us inside of the cave due to the impact and emotion that the bats caused on her.





Figure 6. Formal talks given to the members from different communities nearby to my study sites.



Figure 7. Mention of the Rufford Foundation in different talks and environmental education activities with children.