## **Final Evaluation Report**

Your Details	
Full Name	OKWUONU ELIJAH SUNDAY
Project Title	Parasites diversity and conservation of cave-dwelling bats in
	Enugu State, Nigeria
Application ID	38035-1
Date of this Report	26/11/2024

**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
Establish bat diversity			Fully	We established 17 (seventeen) bat species roosting in 35 caves
State			achieved	across Enugu State, Nigeria.
Investigate the			Fully	We have run models using
disturbance and			Achieved	(GLMMs) to indicate the
environmental factors				relationship between parasite
health (body				We also run models to show the
condition and parasite				association between species
load)				richness and parasite load.
Conduct evidence-			Fully	A total of 2,158 locals were
outreach to train tour-			achieved	outreach including pupils, youths,
guides and educate				tour-guides and hunters. Pens and
tourists				exercise books carrying
				conservation message were given
				guides, and hunters received t-
				shirts carrying conservation
				message.

#### 2. Describe the three most important outcomes of your project.

We have completed this research project. Our project's three most significant outcomes are as follows:

**a).** Bat species identification – Six hundred and ninety-seven (697) individuals and seventeen (17) bat species roosting in 35 caves across 12 communities in Enugu State, southeast Nigeria were identified.

**b).** Models - We have modelled parasite load against bats' body condition which showed significant negative relationship. This implies that high parasite load could lead to lower body condition thereby affecting the health of bats. Disturbance was the only ecological parameter among the random effect variables that was significant throughout the models. The implication is that bat migration is significantly impacted by human disturbances such as

hunting, fire, and tourism (Doherty *et al.*, 2021), which may also result in a decline in bats' species richness (Phelps *et al.*, 2016; Phelps and Kingston, 2018).

**c).** Conservation education - A total of 108 tour-guides were trained to educate tourists on the rules (such as crowd no entrance into the cave; noise-making no entrance into the cave, etc.) to follow while they visit the caves for tourism. Seventy-nine (79) hunters were educated to reduce bat bushmeat hunting for many Nigerian bat species are threatened according to IUCN Red List. They were informed that bats pollinate many plants e.gs. banana, castor oil plants, etc. and can transmit some pathogens. Six hundred and fifty-six (656) youths of the communities were equally educated. A total of 1315 pupils from primary 4 and 5 were educated on the ecological importance of bats and disease spillover. We use models to inform the future of the bat population, ecological importance and disease spillover. The communities were excited to know the outcome of this research. The community stakeholders such as community heads (igwes), president generals (PGs), chief security officers (CSO), youth leaders, tour-guides' group leaders and leaders of hunters' association as well headmasters and headmistresses were engaged on the best method of reducing disturbance to cave bats. State Ministry of Health were equally informed of our conservation outreach and they're willing to know the outcome.

## **3.** Explain any unforeseen difficulties that arose during the project and how these were tackled.

We do not have field vehicle so we resort to hiring vehicles for fieldwork and conservation outreaches. There is insecurity in this part of Nigeria, Southeast. For instance, there was compulsory Monday sit-at-order so we made sure we didn't travel on Mondays. Due to insecurity, we stayed in local hotels and didn't make use of tents. Some caves were inaccessible by the local assistants who took us there because of the misconception of snakes and dangerous animals in the caves but we were able to enter into those caves.

# 4. Describe the involvement of local communities and how they have benefitted from the project.

The local communities were engaged during the fieldwork and conservation outreaches. Many of them were excited to learn bat ecosystem services such as pollination, guano as manure, agricultural insect pest reduction and how they could contribute to reducing anthropogenic disturbances on cave bats. We engaged the services of the locals as porters and field assistants. This earned them income during this research project. During conservation education, hunters, tour-guides, and youths were given t-shirts carrying conservation message of which they were excited about it. Pupils were given exercise books and pens, and they were highly happy about this kind gesture. During the fieldwork, some of the locals learnt how to set ground mist nets and harp traps. As a result of their involvement, subsequent conservation projects will be easier in these communities.

#### 5. Are there any plans to continue this work?

Yes, we have plans to continue this research. We intend to research on parasites of bats found in the forests within Southeast Nigeria especially malaria parasites (*Plasmodium, Nycteria, Polychromophilus, Hepatocystis*), trypanosomes and ectoparasites and identify them using molecular techniques. This will help us to know if there is any relationship between human malaria parasite and trypanosomes and those likely to be found in bats using phylogenetic trees. It has been anticipated that certain ectoparasites of bats can spread infections to other bats and humans (Szentiványi *et al.*, 2024). Additionally, some of the students who served as volunteers are equally interested to delve into bat research; they'll be closely mentored. One of the student volunteers recently was employed by Small Mammal Conservation Organisation (SMACON), a major conservation NGO in Nigeria, as a field officer.

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

The results of our work will be published in a peer-reviewed journal, Biological Conservation, also we plan to present the work in conferences e.gs. International Congress for Conservation Biology (ICCB), 2025 and/or American Society of Mammalogists (ASM) Annual Meeting 2025. Abridged summary of the work will be made available to Enugu State Ministry of Health.

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

This study broadened our knowledge on the existence of bat species in the caves. About 10% of the surveyed caves are highly disturbed due to anthropogenic disturbance (hunting, fire and tourism). The important next step to take is to investigate other caves we did not survey. This will help to establish occurrence of bat species in these caves seeing that many Nigerian bat species are threatened according to IUCN Red List.

## 8. 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, The Rufford Foundation logo was used during conservation education outreaches when the locals were educated at their different designated places. The logo was placed on the tshirts and exercise books carrying conservation messages. The logo was also used during Bat Conservation International (BCI) cohort-to-cohort presentation of the research work showcasing that The Rufford Foundation was one of the supporters of this project.

### 9. Provide a full list of all the members of your team and their role in the project.

Professors Tigga Kingston and Ikem Chris Okoye are the supervisors of this research project. Elijah Sunday Okwuonu is the principal investigator who is also a PhD student. He oversees the day-to-day activities during the fieldwork and conservation outreaches. Samuel Ismaila Odugbo is a veterinarian, with a Doctor of Veterinary Medicine (DVM), from University of Nigeria, Nsukka (UNN). His role was to make sure we did not have any veterinary incidents. He also assisted in validating and streamlining our sampling pipeline. Mr. Christopher Oned is a field technician with extensive bat trapping skills. He helped set up mist-nets and harp traps, as well as retrieve bats that had been captured. Chinaza Blessing Ukwueze, Festus Chizoba Eze and Emmanuella Chigozirim Agbedo were students' volunteers who assisted in bats prepping and data recording of environmental variables.

### 10. Any other comments?

The 1st Rufford Small Grant was very helpful because it assisted us to achieve our objectives despite alarming security challenges in these localities. This is first time to study parasites diversity (ecto-, intestinal and haemoparasites) of cave bats in Nigeria, thanks to The Rufford Foundation, and second time of doing conservation education programme in this area. Without the funding it would have been very difficult to contribute to bat conservation science at the grassroot level.



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