Precision Biodiversity: Use of technologies to improve nocturnal animal research and conservation in Sabah, Malaysia

**PROGRESS REPORT** 

## **Acknowledgements**

We thank The Rufford Foundation (grant number **37092-1** awarded to P.M) who funded this research. We also thank the Sabah Biodiversity Centre for granting the research permit to study nocturnal mammals in Sabah (JKM/MBS.1000-2/2 JLD. 14 (122)). We also would like to thanks Sabah Parks and Sabah Forestry Department for giving us permission to access protected areas and forest reserve. We would like to thank all volunteers who helped during this survey, Harry Donnelly.

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# **Photo credits**

The photos used in this manual are all credited to Priscillia Miard

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# 1 Introduction and activities conducted

The overall aim of this project is to investigate how light impacts research outputs in terms of behavioural data collection and detection rates for nocturnal animal population assessment.

The outcomes of which are a more accurate and precise description of the natural behaviour of animals and estimates of their abundance. This project will build upon the work that the main author of this proposal has conducted as part of her PhD research and the strategies of which are through the delivery of the following key objectives:

i) The first objective is to conduct transects for population assessment and compare if possible, those data with previous research that was already conducted on the same species in the area. The hypothesis is that thermal device enhances considerably research outcomes and that results would be similar to previously conducted research on Langkawi and Penang Island (Miard, 2020).

This objective has been achieved but we are aiming to add more field sites to collect more data. Here are the results of this objective in term of nocturnal mammal detection using different methods:

1) The results from previous work in Penang and Langkawi Island gave the following results:



Red light alone increases nocturnal mammal detection by 46% compared to the traditional use of white light. A thermal imaging coupled with a red light increased detection by 72% compared to white light. In this study a white light headtorch was used with a red filter, diming the light intensity.

2) Comparison of real detection of mammals with data from Peninsula Malaysia and the current study in Sabah (Red light vs thermal when both were used during the same transect).



During transects using both thermal device and a headtorch with a red filter, individual detection was made with the red light first at 61.5 %.

During transects in Sabah using both thermal device and a headtorch with pure red LED, individual detection was made with the red light first at 100 %. In this case, the use of a red LED does not dim the light thus allowing a better visibility.

Those results shows that nocturnal research survey as well as nocturnal tours should only be made using red light, to improve detection but also for the welfare of the animals. Research is needed on other taxa such as frogs and insects.

Trainings have started and the RDC will switch all their nocturnal activities to red light soon. We also have training HUTAN staff to conduct night research and collect data. One master student currently registering with UMS and working with the Sabah Forestry department will oversee a new project in Sepilok at the RDC.

# 2 Preliminary results of the study

Field work has been conducted in 5 protected areas (Figure 1). We surveyed a total of 14.1 km in 24 nights (Table 1). We sighted 15 species of mammals, 3 species of identified birds (other to be identified soon, Table 2).



Figure 1: Location of field work inside protected areas.

Table 1: details of site surveyed with number of night and distance in km.

Site	Length survey (nights)	Distance surveyed (km)
Crocker range	5	3.8
Crocker range inobong	5	2
Hutan Lipur Kawang	5	2
Kinabalu park	4	3.8
Klias forest reserve	5	2.5

#### Table 2: Species sighted during the survey with number of sightings

Order	Species	Latin name	Number sighted
Mammals	Bornean Striped Civet	<u>Arctogalidia stigmatica</u>	11
	Common Palm Civet	Paradoxurus hermaphroditus	5
	Jentink's Flying Squirrel	Hylopetes platyurus	2
	Leopard Cat	Prionailurus bengalensis	1
	Lesser mouse deer	Tragulus kancil	2
	Long-tailed porcupine	Trichys fasciculata	2
	Malay porcupine	Hystrix brachyura	2

	Masked Palm Civet	Paguma larvata	2
	Moonrat	Echinosorex gymnura	1
	Pen-tailed tree shrew	Ptilocercus lowii	2
	Red Giant Flying Squirrel	Petaurista petaurista	1
	Slow Loris	Nycticebus menagensis	5
	Spotted Giant Flying Suirrel	Petaurista elegans	1
	Sunda Colugo	Galeopterus variegatus	2
	Temminck's Flying squirrel	Petinomys setosus	1
Birds	Bird/ Owl sp.		12
	Brown boobook	Ninox scutulata	5
	Kingfisher		1
	Large-tailed Nightjar	Caprimulgus Macrurus	6
	Oriental bay owl	Phodilus badius	2

Some of the species in the photos are not recorded in the list as they were seen in the new long term site when we did a recce.



Buffy fishing owl in red light



Buffy fishing owl



Common palm civet





Black flying squirrel



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Temminck's flying squirrel

## **3** Publications

Publications for this project could not be achieved during data collection but we are planning three publications in 2023-2024 from this project.

- i) Abundance of the large-tailed night jar in the west coast of Sabah
- ii) Red light as a tool for nocturnal research (Review paper)
- iii) Nocturnal mammals distribution in the west coast of Sabah
- iv) Workshops as a tool to enhance nocturnal mammals knowledge and sustainability in tourism

Item	Description	Progress	Date	Remarks
Publication	Precision Biodiversity: Use of technologies to improve nocturnal animal research and conservation in Sabah, Malaysia, through ecotourism activities.	60%	February 2024	First draft on the way
	Abundance of the large- tailed night jar in the west coast of Sabah	40%	December 2023	Data analysis almost complete
	Red light as a tool for nocturnal research (Review paper)	20%	March 2023	Litterature review started
	Workshops as a tool to enhance nocturnal mammals knowledge and sustainability in tourism	30%	December	Data being analysed from 2 workshops conducted in Langkawi Island and in Sabah.

# 4 Budget

Information relating to the budget spent and remaining budget is detailed in Error! Reference source not found.

Item	Description		Obtained		Amount used	Amount left
		Item Cost	from other	Rufford Amount		
			sources		(Rufford)	(Rufford)
Equipment	FLIR Scout 3 model 640	2 090	2 0 9 0	0		
	(Thermal imaging device)	3,080	3,080	0		
	Garmin GPSMAP 64S	240	240	0		
	Bushnell Binocular trophy XLT	80	80	0		
	Nikon D750 camera	1,100	1,100	0		
	70-300 Lens	700	150	550	550	
	Rechargeable battery for	50	0	50	50	
	equipment	50	0	50		
	Head torch with red and white	190	190			
	LED x2 (Wolfeyes)	150	150			
Utilities for	Accommodation (£100 for 20				300	100
volunteers	nights per month for 4 months:		0	400		
and assistants	£5 x 20 x 4)					
	Transportation (£6 per night for		0	190	350	130
	4 months: £6 x 20 x4)		0	400		
	Food (£50 per month per		0	400	300	100
	person: £50 x 4 x 2 people)		0	400		
Workshop	Workshop and ecotourism	9000	5 800	2 200	2000	1,200
	activities planning with tourism	9000	5,600	3,200		

stakeholder (5 days workshop for 100 people). Cost per person: £ 90: including meal food (5£/day/5 days), venue (45£/5 days), transportation (20£)					
Print materials for the participants (activity materials and booklets with info about nocturnal wildlife of Sabah and best practice) for 100 participants (4£/person)		400	400	200	200
Snacks and refreshments for 100 participants (£3 per person) during field trip		200	300	0	300
Contingency	200	0	100 5880	0 3750	100 2130

# **5** Workshops

We have conducted two training workshops, one at the Rainforest Discovery Centre in Sepilok (March 22-23) and one in Coimbatore, India during the ATBC conference (July 2). Both have been attended by around 30 and 19 participants.



Future workshops and activities are planned with Sabah Park, Sabah Forestry Department and MOTAC (tour guide training) for 2023- 2024.

Courses and workshops	Title	Location	Date	Participants
Trainings to be conducted in 2023.	MOTAC collaboration for tour guide training (Proposal for compulsory course for tour guide training)	Kota Kinabalu	To Be Confirmed Awaiting final collaboration approval from MOTAC	To Be Confirmed
	Nocturnal Tourism Training & Workshop Providing Safe Educational Tours: Animal Welfare and Safety Practical Nocturnal Training	Sabah Parks	To Be Confirmed Awaiting discussion for dates	To Be Confirmed

#### Workshop 1:

## Nocturnal Tourism Training & Workshop Providing Safe Educational Tours Animal Welfare and Safety Practical Nocturnal Training

#### Summary:

The training was conducted at the Rainforest Discovery Centre, on 22 -23<sup>rd</sup> March 2023. It was attended by 30 participants and included lectures, practical activities, and group exercise.

The website <u>www.mentimeter.com</u> was used to make the presentations more interactive and also collect knowledge from the participants. The participants learn about different concepts on night tourism but also created their own packages.

#### Aim of the training

- Develop nature guides knowledge on nocturnal species.
- Develop nature guides spotting abilities of nocturnal animals using red light
- Develop activities following the highest standards for animal safety and guest experiences.

The training also involved proper planning in term of area to use for the activities to ensure the areas don't become overcrowded at night resulting in animal welfare issues and poor standard of tour activities.

#### **Training poster**



#### Training outline

The training was conducted at the Rainforest Discovery Centre, on 22 -23<sup>rd</sup> March 2023.

Day 1		
Time	Description	
9:30 - 10:00 am	Registration and coffee	
10:00 – 11:30 am	Introduction to nocturnal animals of Sabah and what can be seen at	
	night.	
	This introductory session will test the participants knowledge about	
	Sabah wildlife and present what is found on the state. It will cover a	
	wide range of taxa from mammals, insects, snakes, birds	
11:30 – 11:50 am	Coffee break	
11:50 am –	The different methods to spot animals at night and why they matter?	
1:00 pm	Working at night can be challenging but a wide range of technology	
	exists. We will cover from the most common techniques to more	
	advance ones and how they influence animal detection.	
1:00 – 2:00 pm Lunch break		
2:00 – 3:00 pm	Animal welfare importance and guidelines for night tours activity	
	This session will be a discussion about what is animal welfare and why	
	it is important when looking for animal at night more than during the	
	day. We will also present why tour guiding activities need to follow	
	some standards to ensure long term activities.	
3:00 – 4:00 pm	Why good equipment matters and how to improve from experience	
	In this session we will present the different tools available to spot	
	animals at night and the participants can have a closer look at them.	
	But experience is also important, and we will discuss how each	
	participant can bring in his own interest and experiences to night	
	activities.	
4:00 – 9:00 pm	Break time for rest and dinner	
9:00 – 11:00 pm	Practical training at night in groups: what can you spot and how?	
	During this session we will provide the participants with tools to	
	explore the night world and experience the differences. We will also	
	demonstrate what is important for a guest experience and this will also	
	include tips on night photography.	

## Day 2

Time	Description
10:30 - 11:00 am	Arrivals and coffee
11:00 am – 1:00	Night tour locations planning
pm	Morning session in groups to develop ideas for night tour locations on
	the island fitting everyone interests and need. This will be a discussion
	with some activities. This will ensure that there is no overcrowding in
	certain areas of the island and encourage everyone to collaborate to
	ensure all the island potential is utilised.
1:00 – 2:00 pm	Lunch break
2:00 –4:30 pm	Tourist package creation
	The afternoon session will focus on packages development for tourists.
	This discussion part will ensure that we bring tourists satisfaction with
	animal welfare in mind as well as fair guide remuneration.
4:30 – 5:00 pm	Closing session

# Workshop photos



Venue and participants



# Presentations using online tools





Night walk practical in small groups

The 5 Senses of TAWAY HILLS PARK TINHE C HERT SPOTTINO C & SUMAINS AND CORRECCE (22)3 FRAE GARONS AN VEN WART HE ROW MIGH TROPS STAN PLETT 200 RM/re aRG92ING AN CRO XDERIENCE THE



Participants tour package creation example.

Petudez + et to Kn the Sepic \* Numt time campy walk \* Guldes sprest meditaban + 1 hair star gazing Constallabion identification Deninty. NIGHT SIME book Star gozing tour at the Rainforce Discovery Centre, Sealer Penday, Wednesday, Friday X 7 pm - 9pm weather dependence



Participants tour package creation example.



Participants presenting their work.



Participants winner of the tour package creation with their gifts.



Participants group photo with their certificate of completion of the workshop

## Workshop 2:

# Working at night with mammals: what is never considered and how to improve research output, animal welfare and conservation.

#### Summary:

The training was conducted at the Kurumaguru college of technology in Coimbatore, India on the 2<sup>nd</sup> July 2023.

It was attended by 19 participants and included lectures, practical activities, and group exercise.

#### **Description:**

Working at night is a challenge that technology has improved over the past decades allowing us to gain a better insight into the ecology and behaviour of nocturnal mammals. However, our understanding of the night is always growing, and basic rules are often ignored by many in research from methodological approaches and result bias. This introductory workshop will show you how you can improve your nocturnal mammal detection (including bats) and follows as well as improving animal welfare standard during night surveys. This knowledge does not only apply to research but also to practical conservation efforts. Ecotourism promoting night activities such as night walk, car spotting or even animal watching are harmful for wildlife.

During this workshop you will be provided with a theoretical and practical overview of recent advances to study nocturnal mammals from five years of research in Malaysia but also based on ten years of nocturnal mammal research worldwide. Firstly, we will provide a hands-on introduction to nocturnal mammal biology and why it is important to consider it when doing research. We will then discuss how current research planning and methods impacts animal welfare and how we can mitigate this. We will look how study design can also affect the results of your research and how certain bias can make your entire research results incorrect. This knowledge will then be applied to improving conservation effort by promoting guidelines for nocturnal mammal watching and nocturnal mammal activities in general.

Different technologies exist to study nocturnal mammals such as red light, thermal imaging, camera trapping and sound recorder. We will give an overview of each of them and details about their usefulness, project cost savings, streamlined survey planning, increased survey capacity (*without* extra surveyors!) and improved health & safety conditions.

This will be followed by a practical night training to test the different equipment and experience its effects on wildlife.

At the end of the workshop, participants will know: (i) How to properly identify challenges to their study subject; (ii) How to adapt their research method to reduce bias; (iii) What technology is more suited to their goals; and (iv) How promoting improved guidelines for nocturnal mammal watching activities increase conservation outputs.





Venue of the workshop



## 5 Plan for permit renewal

We would like to include all birds species sighted on top of all mammals for our work. During our study we have sighted a huge number of birds, both diurnal and nocturnal and this information can prove valuable for experts. We are planning to publish a paper on night jar occupancy and population numbers in site surveyed. The thermal imaging has also proved valuable to spot birds at night, and we would like to also write a short publication on this.

The first phase of the project to identify hotspot for night ecotourism on the west coast of Sabah is almost finished and talks with key stakeholders already initiated (Sabah Forestry, Sabah Parks, Sabah Wildlife Department and Sabah tourism Board).

The current project has been extended and divided into two subprojects as follow:

- Nocturnal mammal and bird population assessment and identification of ecotourism hotspot (Almost complete).
- Long term population assessment of nocturnal mammals and birds at Pangi forest reserve.

Project	Name	Description	Remarks
2	HUTAN (NGO)	Collaboration	Letter as proof
		for research	

**Field sites to finish in pink:** We plan to first survey the following areas for a population assessment (2 weeks per areas/2,5 months; Figure 2):



#### Figure 2: Map of the proposed area of research for transects



An additional field site for nocturnal mammal transects and population assessment will be surveyed in collaboration with HUTAN: Hutan Simpan Pangi.

Figure 3: Pangi Forest reserve map from HUTAN.

Two different methods will be used to assess the use of technology and its impact on animal behaviour.

• Population assessment

Assessing populations density of certain species can prove difficult but one way to do it is with transect walks. However, those are proving time consuming and detection rates are low (Bernard et al., 2016). The use of thermal technology significantly improved detection rates when using a thermal camera (Flir scout III model 640) coupled with red light for most species compared to the use of white light (Miard 2020, PhD thesis). The species of focus for this study are non-volant nocturnal mammals.

We will survey 8 areas both in villages and protected forested areas for one week each. During this survey any animal sighted or heard will be recorded. This survey will be done for three months 5 days a week for a minimum of 3h every night starting after sunset and finishing

before midnight. We will survey 5 transects repeat 3 times in each site to allow us to detect the maximum of species and will walk at a maximum speed of 1.5 km/h to enhance detection rate (Nekaris et al.2008). Transects will be surveyed by two observers between 1900h and 0200h of each survey night mostly during clear nights without heavy rain to achieve similar probabilities for detecting animals and for the safety of the observers. We will use Open Street Map and QGIS to identify suitable survey sites at the desktop ensuring that a minimum of seven distinct 500m-long transect paths and 50 m wide will be available per site (Buckland et al., 2015; Buckland et al., 2004; Marshall et al., 2008). Transects will be surveyed using a combination of line transect and point sampling method by detecting animals by their eyeshine using a headtorch with a red-light filter (Wolfeye dingo) between and at observation points located at fixed intervals of 100 m. At these points, we will stop for 5 minutes to conduct more intensive surveys using a thermal imaging device (FLIR Scout III model 640 monocular).

Transects will be separated by a distance of 100 m, as we studied small to medium mammals that have a limited home range size (Buckland et al. 2015). This method will ensure that individuals will not be detected more than once (Buckland et al. 2015). We will choose transects along pre-existing trails to minimise forest impacts but also due to the nature of the surveys at night to minimise animal disturbance related to noise (Hiby & Krishna 2001; Nekaris et al. 2008; de Winter *et al.* 2018). We will use curved line transects defined as a path along which one counts and records occurrences of the species of interest (Hiby & Krishna, 2001). Whenever an animal will be spotted along the transect, a picture will be taken with a camera (Nikon model D750; 70-300mm lens) to confirm the species (identified following Francis, 2019).

A current study in Sabah is conducting a new population assessment for the proboscis monkey and a study showed that using thermal cameras enhanced population count (Jumail et al. 2021). Although a diurnal species, it will be included in the assessment as thermal cameras in the tropics works better when the temperature is not too high so transects will be walked either at night or sunset/sunrise to count the number of animals in any proboscis monkey group detected and compared with other techniques already in use such as human vision. During this survey other diurnal animals can be recorded too, and potentially also assessed for their population. This study will help to boost ecotourism site with updated presence of nocturnal animals in different sites.

## • Long term monitoring for population abundance

Population abundances of nocturnal species are widely lacking due to the difficulty of studying them. Long term monitoring is required to acquire baseline data on population trend assess number of individuals in one area.

In collaboration with HUTAN, PANGI Forest Reserve is the appropriate site to start this longterm research, as a total of 24 staff is available on site 24/7. The local staff is monitoring caves for bird nest and thus are constantly monitoring the area. Training will be conducted to get the interested staff used to research method and data collection. Animals recorded will include mammals but also bird.

The data collection will be as followed: The survey time will be between 6:30 pm and midnight with a survey shift occurring for 3h with a rotation. Three transects are available on site and will be surveyed each once per week. The survey will be conducted for a full year, and repeated every year. This will allow us to get different species population abundances but also analyse variation in time.

## Statistical analysis

R Studio (version 1.0.153, R Studio Team, 2017) will be used to analyse the results of the three different surveys as well as QGIS for mapping.