

Final Project Evaluation Report

Your Details	
Full Name	Ashni Kumar Dhawale
Project Title	Ecological and Behavioural Adaptations of the Endangered Lion-Tailed Macaque to a Rainforest–Anthropogenic Habitat Matrix in India: Implications for Management
Application ID	25067-1
Grant Amount	£4992
Email Address	ashnidhawale@gmail.com
Date of this Report	31 st March 2019

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
<p>1.Documenting the status of a unique lion-tailed macaque (LTM) subpopulation of the Puthuthottam rainforest fragment on the Valparai plateau by recording its demographic parameters, including the number of troops, troop size and the age/sex composition of these troops, and by estimating birth-, and mortality rates of adults and infants in select troops</p>				<p>Total troop counts were conducted on all five troops of lion-tailed macaques at 6-monthly intervals. The first troop count was conducted in August 2018, and the second in January 2019. Between counts, we noted two deaths; both were 2-3 year old juveniles, two births, and one emigration by an adult male. Immediately after the second count however, two more deaths, multiple births and a few more emigrations were noted. To understand the birth and death rates of this subpopulation, repeated counts must be conducted over multiple years to represent the highly fluctuating nature of deaths and emigration. Further, LTMs exhibit two birthing peaks, in October and in February- only one of these seasons was represented in the present study. Repeated troop counts will be continued over 2019-22 to better represent the patterns of demography for this sub-population. Based on the present data, however, it is already clear that a few age groups are more susceptible to fatal accidents, although further inquiry is required.</p>
<p>2.Examining the habitat use and competition for resources across multiple lion-tailed macaque troops residing in the Puthuthottam forest fragment through a close monitoring of their ranging, movement and foraging behaviour</p>				<p>We quantified each habitat type in terms of its vegetation structure (tree density, canopy cover, tree species composition, etc.) and a pre-defined 'Human presence index'. Using GPS data, collected from the centre of each troop at 15-minute intervals between November 2018 and March 2019, we mapped LTM troop movements over months to understand their differing use of</p>

Objective	Not achieved	Partially achieved	Fully achieved	Comments
				habitats, specifically in terms of rates of visitation to human habitation. As expected, we found that visitation rates to human habitation varied across troops. We also found that certain prime habitat locations with higher resource availability (although not formally quantified) were used largely by the two largest troops in the subpopulation. The largest troop is also known to initiate inter-troop aggression more frequently than other troops (ad libitum data), indicating that there may be a dominance hierarchy maintained across troops in this subpopulation, which may, at least in part, determine habitat use by troops. Continued monitoring of all troops in 2019-22 would provide a better understanding of temporal variation in home range size and habitat use. Additionally, simultaneous following of all five troops would give us a better understanding of competition for resources in this forest fragment.
Gaining insights into the adaptability of select lion-tailed macaque troops that frequent human habitations by investigating the behavioural variation in foraging and social interactions across habitat types				All adult members of one selected troop were individually identified and followed as they moved through three pre-identified human-modified habitats: 'Forest Edge', 'Open Forest Patch' and 'Human Settlement'. Behaviour was recorded through focal animal sampling (8.80 h/individual) and instantaneous group scans (217); data was analysed using non-parametric tests and matrix statistics. Foraging frequencies varied significantly across different habitats (Mann-Whitney U-Test, $U=113$, $p < 0.001$) seemingly due to the availability of provisioned food in human-dominated habitats. Aggression increased significantly in

Objective	Not achieved	Partially achieved	Fully achieved	Comments
				anthropogenic habitats ($U=8.5$, $p < 0.05$) but individuals adopted allogrooming as a novel behavioural strategy to effect reconciliation, leading to altered social dynamics in the Human Settlement (Mantel Test, correlation coefficient = 0.24).
Conducting an ethnographic, non-participant study on the direct interactions between select lion-tailed macaque troops and humans as well as with their different artefacts				We could not conduct the ethnographic study with the local community members, as private tea estates in the field site employ them, and permissions were not obtained in time. The permissions have since been granted and a new attempt at this specific study will be made during 2019-22.

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

The most noticeable difficulty involved factors that significantly reduced the amount of data finally obtained from the study. These factors included the presence of elephants on the field site making it impossible to safely follow and observe monkeys, and abrupt seasonal variation and intensive rainfall which obstructed visibility to conduct uninterrupted observations on the study subjects. These factors could not be avoided, but all data has been tested to ensure adequate sample size. Additionally, although permissions to enter the forest fragment were granted by the tea estate that owns the land, permissions to watch and observe human subjects were initially denied due to the company policy. After extended discussions with managers of the tea estate, however, permissions are now being drafted for the latter, and the ethnographic study will be conducted between 2019 and 2022.

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

A study on lion-tailed macaques from Puthuthottam, published in 2001, found that lion-tails visited human habitation at a rate of 0.43 per day. At the time, there were only two troops present in Puthuthottam. The present study noted the presence of five troops, and an average rate (across all troops) of 0.57 per day, indicating that the macaques have begun to visit human habitation more frequently in the last decade, perhaps suggesting increased preference for human-use foods (there has been no change of underlying vegetation structure of the forest fragment since 2001).

Our study also found that troops significantly reduced time spent in foraging in the modified habitat. This observation is consistent with many studies on other primate species facing a similar predicament of habitat modification, and is thought to be a direct result of ingesting 'high quality' human-use foods. The resultant reduction in foraging is known to be associated with increased time spent in resting, as corroborated by the present study, and with decreased social interactions such as grooming, which may affect overall troop social cohesion, an important aspect for the survival of this social species.

Grooming is arguably one of the most important aspects of macaque sociality. Grooming helps lion-tails to keep their coat clean of ectoparasites, but it is also a strategy to maintain social bonds within troop units. Grooming involves the act of *initiating* a grooming session, usually between a long-term 'friend', family or cohort member, and the *duration* of time spent in grooming. Given the pair-wise nature of grooming behaviour, individuals usually maintain a system of reciprocity (LTM A grooms LTM B, and vice versa). In the present study, however, we found that reciprocal grooming broke down in two of the modified habitats. To understand the nature of breakdown in modified habitats, we looked at whether both grooming initiation and grooming duration ceased between pairs, but found that while initiation increased (especially by subordinate individuals towards dominant individuals), duration decreased. This suggests that certain subordinate troop members may have employed the grooming initiation behaviour as a strategy for reconciling with dominant individuals (who maintain privileged access to food), potentially in response to increased competition over 'high quality' human-use foods.

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

Prior to the start of the study, members of the local community were informed about the objectives of the study and its importance for the conservation of the lion-tailed macaques. During the study, as part of an initiative started by the NGO, NCF, a field and classroom session was conducted with ~60 students from three local high schools, on the ecological significance of lion-tails, scientific research and conservation. When the project is concluded, interaction sessions will be held with members of the local community to disseminate the results and discuss the larger goal of conservation management for lion-tails.

5. Are there any plans to continue this work?

The present study will be continued through 2019- 22. During the next 3 years, repeated troop counts will be conducted on the Puthuthottam subpopulation, on which behavioural observations will also be continued. We aim to closely follow and observe three of the five troops now present in Puthuthottam to achieve better representation of the subpopulation. The proposed ethnographic study with members of the local community to ascertain their responses to interactions with lion-tails will also be conducted during the period 2019- 2022.

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

Results from this study will be shared with all relevant stakeholders either through technical reports or interaction meetings. A scientific report will be submitted to the Tamil Nadu State Forest Department, along with a report on recommendations for conservation management of the Puthuthottam lion-tails. Technical reports will be submitted to all managers of relevant estates where lion-tails are present. Interaction meetings will be held with members of the local community to explain the results and their implications for conservation management. The results from this study will also be shared with the larger science conservation community through presentations at international conferences such as SCCS, Bengaluru and the International Primatological Society Congress. Scientific papers will also be submitted to international- peer reviewed journals such as *Biological Conservation* and *PlosOne*.

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

The grant was used for a period of 12 months, as anticipated.

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
Contingency grant: Medical expenses and other emergencies for the primary investigator and field assistants	220	50	-170	This amount was used partly to pay first- aid medical bills for the primary investigator and field assistants during the study, and part of the amount was used to compensate for an additional field assistant's salary
Communication: Postage and telephone bills Communication: Postage and telephone bills	115	115		This amount covered all telephone bills for two field assistants and the primary investigator, and postage for multiple permission applications
Consumables: Batteries and stationery	47	100	+53	This amount was used to purchase batteries for GPS units and stationary for data

Item	Budgeted Amount	Actual Amount	Difference	Comments
				collection.
GPS: Garmin Etrex 20 * 3 Units	660	660		This amount was used to purchase 3 GPS units @ 220 per unit
Dictaphone: Philips Voice Tracer DVT2710, with Speech Recognition Software	70		-70	This device was not purchased as the method of data collection had to be altered to suit on- field variables. This amount was used to compensate for the additional field assistant's salary
Field station charges, £55/month*12 months	659	659		This amount was used for field station charges for 12 months
Field expenses, INR 5,000/month*10 months	550	550		This amount was used for expenses incurred at the field station
Field assistant wages, £120.9/month*10 months	1209	1689	+480	In the last four months of the study, an additional assistant was hired to help track another troop of LTMs simultaneously with the primary troop.
Fuel charges for field vehicle, INR £146.2/month*10 months	1462	1222	-240	Due to fluctuating fuel rates, the difference amount left over from the budgeted fuel amount was used to partly compensate for increased field assistant salary
Total	4992	5245	+53	All amounts exceeding the amount granted by Rufford were covered by other external grants

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

To better understand demography and behaviour of the lion-tails in response to a changing environment and increasing human pressures, it is crucial to continue the sampling protocols so as to truly represent the underlying patterns. Thus, we will continue this study from 2019 to 2022. Provided that sufficient funds are acquired, we also plan to incorporate some new objectives to the study, including genetic analysis from collected faecal samples to understand the dispersal ability of this arboreal primate, which is seemingly 'constrained' in a forest fragment, in the larger

landscape. We will also analyse part of the collected faecal samples to test for the hormonal stress levels, as a measure of physiological wellbeing, of lion-tails in the modified habitats. Further, we also aim to examine the effects of consuming human-use foods by examining the gut microbiota that inhabit the lion-tail sub-population in Puthuthottam.

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?

The Rufford Foundation logo was used to acknowledge the financial sponsor of this project while presenting the study at the International Primatological Society Congress, Nairobi, in 2018.

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

Primary Investigator- **Ashni Kumar Dhawale**

Project Supervisor- **Dr. Anindya Sinha**

Field Assistant 1 – **Ramesh R**

Field Assistant 2 – **Venkatesan M**

12. Any other comments?

Direct conservation output of the present study over the last year:

We had the opportunity to interact with ~60 students from three local high schools and teach them about the biology and ecological significance of the lion-tails, and the importance of scientific research in informing conservation strategies- a first time initiative started in Valparai, Tamil Nadu.

We also had the opportunity to interact with managers of the private tea estates and discuss the occurrence of lion-tails raiding the homes of the tea estate workers in search of food. Home raiding by monkeys is quite common and often increases intolerance and a negative perception of the monkeys by the people, potentially leading to conflict situations between the two species. This particular tea estate company has now started its own initiative of 'monkey proofing' particularly vulnerable houses in the field site so as to decrease occurrence of home-raiding by monkeys.