Final Evaluation Report

Your Details	
Full Name	Alexandra Hofner
Project Title	Understanding Purple-faced Langur (*Semnopithecus vetulus philbricki*) Persistence in Fragmented Habitats with Social and Ecological Research in Sri Lanka.
Application ID	36803-1
Date of this Report	May 30, 2023

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

The purpose of this grant was to examine the value of forest fragments for an endangered primate endemic to Sri Lanka, the northern purple-faced langur (*Semnopithesus vetulus philbricki*). Although these animals are sensitive to the loss of forest cover, their biology (i.e., a leafy diet) may allow them to sustain populations in small, degraded forests to some degree. At the same time, studies show that human-wildlife interactions are prevalent in fragmented landscapes and if people do not accept these monkeys in certain forests, that may limit the conservation value of these areas. Therefore, this grant supported activities that facilitated data collection to better understand how and why people interact with monkeys across the dry zone landscape, their tolerance of monkeys, and the distribution/ habitat use of purple-faced langurs across their range. Below I outline the activities covered in this grant period.

Objective	Not achieved	Partially achieved	Fully achieved	Comments
Field Assistant Training			✓	During my grant period, I trained all incoming assistants including those funded by The Rufford Foundation (Upali, Dilki, and Wasana), and other assistants funded by other sources supporting the Kaludiyapokuna Primate Conservation and Research Center including, Asanka, Charith, Dilan, Rashini, Paani, Martin, Erick (see descriptions below). My training activities included all day monkey follows to introduce all assistants to primatology techniques including faecal collection, systematic behavioural data collection using Animal Observer, GPS tracking, acoustic survey techniques for primates, and camera trapping. I also carried out numerous in camp training activities covering abstract writing, social survey methods, writing ethograms for behavioural research, mapping using GPS data using QGIS, and interpreting scientific literature in a monthly paper club. To assure the students with varied proficiency in English had the necessary tools to learn data protocols, I wrote a field manual and translated it to Sinhala. I continue to create step by step learning

				materials upon the request of the research assistants to support their growth and development as researchers. These activities are ongoing.
Primate Survey				Due to the petrol crisis throughout the dry season, we were only able to survey Minneriya, Sigiriya, Mihintale forests. Each forest was surveyed using acoustic monitors (15 total points) and data were collected on langur encounters including the distance at which they fled from observers (FID- flight initiation distance) and number of groups encountered. Because national parks are only reachable by vehicle due to elephant activity, groups were sometimes counted from vehicles, but an observer would get down from the vehicle and walk calmly toward the group to record flight distances. From September 2022 to May 2023, I conducted an acoustic survey in Kaludiyapokuna near our basecamp by setting up five grids of nine acoustic monitors placed 450 m apart. This distance represents a generous size of a purple-faced langur group home range and will help us to better determine the influence of variables such as slope, distance to forest edge, and vegetation composition on a smaller scale. I aim to use this survey to complement the coarser scale survey across the dry zone region (to take place beginning in June 2023) to examine the influence of environmental co-variates at a local and regional scale. This survey resulted in 43 points repeated twice across Kaludiyapokuna forest, a 13 km^2 fragment that represents relatively healthy forest in Sri Lanka. The design of this localised survey may also allow us to estimate the number of purple-faced langur groups in this fragment. This is because our team simultaneously carried out all day group follows of groups while acoustic monitors were set on a transect through their known home range. Research assistants tracked the GPS location of the group, and noted the exact GPS location of calling males during

				follows. We therefore have a total of 15 calls from purple-faced langur males and recorded distances from recorders in the forest. Using this information, I will calculate a detection distance and estimate the number of groups picked up by each acoustic monitor during the survey. By also recording GPS distances, we will estimate the home range size of these groups to better define our model parameters.
Questionnaire Survey				We carried out a total adult surveys 450 questionnaires with adults in areas within 1 km of the Kaludiyapokuna Forest Reserve, Minneriya National Park, Mihintale Sanctuary, and temples frequented by grey langurs in Anuradhapura. Questionnaires included questions on demographics, economic wellbeing, interactions with monkeys (purple-faced langurs, grey langurs, and macaques), people's reactions when they see monkeys, and their feelings and tolerance toward each species. In addition to these surveys, we wanted to know if children learn about monkeys through experience of social learning. We therefore also conducted 80 surveys with children in households that parents were also surveyed to compare results. Surveys with children are comparable to those of adults, but we used VR headsets to show videos of monkeys in different circumstances to guide questionnaires.
Regional Interviews				Our questionnaire surveys included short answer questions and therefore interviews were not as necessary. All questionnaires were recorded, and the open-ended interview questions are being translated to English.

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

a). Field Assistant Training: I was responsible for training all employees of the Kaludiyapokuna Primate Conservation and Research Center. I have experience training mentees and field assistants and I was able to bring this knowledge to the field. However, as is the case in all new places, my approaches had to be adjusted to facilitate capacity building. In terms of primatology training, the students have broad interests which meant that I incorporated training on methods related to my

project with those related to the research goals of the larger project. This included training on acoustic methods in wildlife surveys, GPS tracking animals, vegetation sampling, and social science methods such as questionnaire design. Training relevant to the larger project included behavioural data collection in primatology, the collection of biological samples (tissues and faecal), and data management. I found that hands-on training on methods in the field were effective, but assistants grasped the information better when I also led a group discussion on scientific literature that uses each method. Likewise, because English is a second language for the assistants and instruction was largely in English, I wrote bilingual manuals, including a bilingual ethogram (list of langur behaviours), describing methods and protocols, data cleaning instruction, and data management. To ensure that assistants were grasping the material, I conducted periodic quizzes using Quizlet (an app-based testing tool) and broke trainees into groups to work through sets of questions about the data protocols, methods, and animal behaviour. This was a low stakes group activity with discussions about the questions and answers directly after trainees completed quizzes. To compliment this, I rotated my time in the forest with all assistants to give them one on one time with me to ask questions in the field.

To grasp if our training was relevant to the career goals of assistants, I designed a questionnaire to administer to each assistant, and future assistants of the project. This survey included questions such as emergency contact information, but also career goals, research interests, and desired skill building. I found that while assistants were interested in the project methodology, they also wished to gain skills in map making, camera trapping, and scientific writing. Because of this, I incorporated this training into my itinerary. I wrote a step-by-step map making exercise using GPS points that the assistants took in the forest using opensource QGIS. I also placed camera traps at each of my acoustic points and allowed assistants to rotate on survey trips to gain exposure in the equipment and examine camera trap data after reading several papers with me on the subject. Placing camera traps added little effort to my trips and showed some terrestrial behaviour of purple-faced langurs! Finally, I ran an abstract writing workshop and am preparing some materials for academic writing for when I return to Sri Lanka. We also discussed several published papers including the elements and process of writing. The camera trap data serve as an opportunity for assistants to co-publish with me if they chose.

b). Survey design and predicted outcomes: Although the langur survey became more localised on this field trip, the outcomes are already indicating trends in abundance and habitat use. For example, while grey langurs appear to use all types of forest and human areas even when relatively intact forest is available, purple-faced langurs have so far only been in closed forest areas during the survey Kaludiyapokuna. In Mihintale, however, where very little forest remains, ecological surveys and questionnaires indicate that purple-face are often seen in gardens and more human dominated areas. Additionally, purple-faced langurs were not encountered as much as grey langurs in Kaludiyapokuna, although these data need to be analysed. Finally, purple-faced langurs appear to be confined to areas with high elevation forest. These findings indicate that purple-faced langurs can occupy small, secondary forest, but that they do not choose these areas if more intact forest is available, and that elevation may be a critical covariate predicting occupancy.

Finally, the habituation of each species does appear to vary across the region. In areas with forest cover, purple-faced langurs may be quicker to habituate than grey langurs due to smaller group size and limited home ranges, whereas grey langurs tend to avoid people until there is a human resource they incorporate into their diet. Because I am currently recording the behaviours toward observers across the landscape as well as landcover and human reactions to them, I will be able to define these findings further by the end of data collection. In human areas thus far, it does appear that people are more tolerant of purple-faced langurs on their property given that they do not often see them, they are less terrestrial, do not feed on many crops, and people believe they are beautiful.

c). **Questionnaire outcomes:** Because women are present in the home most often, we confined our questionnaires to them. All interviewers are also women, and therefore this was the most culturally appropriate work for them because it avoided female assistants being alone with men. So far, our questionnaires show that purple-faced langurs cause little damage to people's property and most people are tolerant of their presence. Grey langurs cause much more damage, but people are relatively tolerant, partially because toque macaques cause relatively more damage. One interesting result so far is that people often offer food to monkeys on holidays which likely exacerbates the human monkey overlap with macaques and grey langurs in some areas. However, only a few of our adult respondents recommended lethal measures to manage the monkeys and most suggested relocation. Likewise, children mirrored their parent's responses, but most adults and children reported that they learned about monkeys from personal experience. The results of emotional responses have yet to be analysed, but they may help to indicate how similar or different adults and their children feel about monkeys and their experiences with them. In general adults do seem to be tolerant and have the most positive emotions surrounding purple-faced langurs, likely because of their rarity. The influence of Buddhism appears to be a strong indicator of this, but we are finding, at least slight, influences of rurality, occupation, and economic wellbeing.

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

Beginning in June 2022, Sri Lanka faced the worst economic crisis in the country's history, which led to a depletion of foreign reserves and acute fuel shortages nationwide. Because of this, traveling to survey sites was impossible during the dry zone's dry season (June-September) given that all vehicle owners were subject to petrol rations and petrol availability was unreliable. As a result, I altered my research protocol by focusing more survey effort in Kaludiyapokuna, a forest reserve adjacent to our base camp. This and other slight methodological changes were necessary to ensure that project goals were met and to plan for the next field season aimed at a regional acoustic survey. Each is described below with each planned grant activity in my accepted proposal. This grant period (June 1, 2022- May 31, 2023) allowed me to carry out acoustic surveys of langurs in Kaludiyapokuna Forest Reserve, begin regional surveys, complete questionnaires in four regions, and train field assistants to build capacity for the Kaludiyapokuna Primate Conservation and Research Center.

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

Throughout my grant period, I employed Sri Lankan students and worked closely with several residents native to the Dambulla area where the bulk of this research takes place. My work with students is ongoing and is so far a success given their progress in the research process and their growth as research assistants that have learned to work independently and contribute to research ideas. When I initially wrote my proposal for my PhD work, I intended on having a long-term research career in Sri Lanka and I believe that I have made valuable connections during my grant period to make this possible. I will maintain a connection with the students that I work with as a mentor and co-author. I am extremely proud of the individuals who continue to work on this project and am dedicated to being a positive role model for them and a source of support where needed.

Unfortunately, the more grounded participatory aspects of my work that I intended when I began my PhD were not possible due to my lack of preliminary work and pilot research given COVID-19 travel restrictions. However, the connections I have made with families across my study region provide a promising platform for future research that engages communities more fully in research design and implementation. As part of questionnaire, we asked participants if they would like to be contacted to receive updates about the project and participate in future work. As such, I have a running list of families that have interest in such endeavours and updates. I would like to see future work engage these communities in further research on the management of primate species in Sri Lanka, especially given current proposed legislation that may remove primate in Sri Lanka from endangered species lists and arm farmers with firearms to control populations.

I strive to make my work beneficial for those involved, but this will take longer-term engagement with people in this region. My field assistants have benefitted by gaining knowledge relevant to their chosen career paths and earning a salary, and I will continue to work with them as much as I can in the future. A benefit to them is that the Kaludiyapokuna project will not end with my field work, and the efforts that I put into managing it and creating a system for work to continue without me there allows for long-term employment. This project is a wonderful effort in this region and is particularly timely given the lack of resources for students and young professionals to gain paid employment and educational experience. This long-term project is one of the only programs of its kind in the country and has great potential to support Sri Lankan researchers by offering training, paid experience, research opportunities, and mentoring by international scientists.

5. Are there any plans to continue this work?

The Kaludiyapokuna Primate Conservation and Research Center is a long-term project with ongoing research goals focused on the behaviour and physiology of grey and purple-faced langurs and their ecology and conservation generally. Therefore, the research assistants working with me will continue to work for the site. My role at the site has been as a PhD candidate and stand in manager, but I would like to continue my work beyond my PhD if the centre has an opportunity for

collaboration. I have worked very hard to learn how to carry out passive acoustic surveys in this region and have gained experience in working with people in as a socio-cultural anthropologist. Continuing this work as ongoing goals of the overall research project will be invaluable to langur conservation given the role of human-monkey conflicts in the lives of both people and other primates in Sri Lanka.

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

My team and I plan to have one outreach day at a local temple during my next stay in Sri Lanka. I have created videos of purple-faced langurs that people can watch in VR headsets and am working with our team to run short research talks about the work being done at the centre and why it is important. Beyond this, I will work with an artist in Colombo to create a short storybook about primatology in Sri Lanka and the work that I have done with all the assistants during my PhD. Furthermore, I will send technical reports to the authority of each protected area that we survey. Although I will not be in Sri Lanka, reports can be shared through Rajarata University and the current assistants working at the Kaludiyapokuna forest.

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

Beginning June 1, 2023, I will return to Sri Lanka to continue the regional primate survey using additional funding from the University of Georgia and shared funding with the Primate Conservation and Research Center from Conservation Food and Health. This will take 4 months to place acoustic monitors in random forest areas across the dry zone. Following this, I will return to Atlanta, Georgia and prepare data for publication. These data will be used to create maps of human-langur interactions and langur habitat use and to model langur reactions to people across their range.

In the short term, these will be published in relevant journals and shared with relevant departments in Sri Lanka. In the longer term, these data will be used to tailor a second survey in areas where purple-faced langurs may be present that were not surveyed previously and to resurvey areas that may support a low density of langurs that were not detected in the first survey. It is my hope that I can repeat my chosen methods to continue to monitor these animals in collaboration with the Kaludiyapokuna Primate Conservation and Research Center. Because this will be the first project that incorporates data on the presence and absence of langurs in forests throughout the dry zone, these data will be invaluable for informing future studies aimed at identifying stronghold areas for the purple-faced langur, examining the connectivity of important areas, and thoroughly examine areas that may be inhabited by this species but have previously not been surveyed.

Likewise, the efforts of my team and I have created research connections with communities throughout our questionnaire study area that will be very useful for future studies on people's tolerance for and interactions with langurs. Our data show that people in Sri Lanka show considerable tolerance for langurs, but that interactions between people and both species of langurs are becoming more frequent. Given the economic instability of Sri Lanka, close attention to the impacts of wildlife on the livelihoods of farming communities should be closely monitored. This is particularly important given recent suggestions that farmers should be allowed to

kill monkeys with encroach onto their land. If I can continue my work in Sri Lanka, I will pay attention to people's acceptance of governmental mitigation strategies and interview political offices and local leaders to better understand possible solutions for ongoing human-wildlife conflict in Sri Lanka.

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?

During my grant period, I was also a Fulbright grantee and carried out two presentations to Fulbright affiliates. On both occasions, I used the Rufford Logo. Likewise, I used the Rufford logo on all talks given at our base camp. In the future, the logo will also be used in conference talks, posters, and social media posts.

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

Rufford Supported

Dilki (1750 USD): Dilki Abeysinghe is from Sri Lanka and has a B.A. Honors from the University of Sri Jayewardenepura, for which she studied traditional and modern tactics to control primate crop damages. Dilki's interest in working for my project because she wished to gain research experience relevant to a career in teaching and Anthropological research. During her time funded by the Rufford Foundation, she completed training in Kobotoolbox, questionnaire techniques, semi-structured interviews, consent processes in social research, and abstract writing. Her work consisted of carrying out questionnaires and interviews, transcribing recordings, and managing the social research schedule with me. Today, she is a lecturer in Anthropology at the University of Sri Jayewardenepura and is working with me to publish the results of this research, including a publication she will first author on macaque-human interactions in Sri Lanka.

Wasana (1750 USD): Wasana Rajapaksha is a graduate from the University of Peradeniya Interested in pursuing a career in ecology. She is the Secretary of Zoologists' Association at University of Peradeniya, a member of Botanical society, Chemical society, Astronomical society, and Music society on campus and is currently working with the Kaludiyapokuna Primate Conservation and Research Center as a research assistant focused on all day follows of monkey groups and acoustics research. She has carried out training with me in GIS techniques, acoustic primate surveys, behavioral data collection of primates using Animal Observer, and Scientific Writing. She is interested in staying on with the project and working with me to publish ecological aspects of my proposed project.

Upali (1750 USD): Upali Weerasinghe is a farmer from the Kaludiyapokunda forest area who was employed by my Rufford Grant to place acoustic monitors in the Kaludiyapokuna forest and support Dilki in her interviews and questionnaires. Upali has a deep knowledge of the forest, including elephant behavior and local politics, and was a valuable aspect of our team. He continues to work with me on these tasks until the completion of my project.

Paramee (402 USD): Paramee Sumanasekara is an enthusiastic and passionate recent graduate of University of Sri Jayewardenepura with BA (Hons) in Anthropology. Paramee is currently a remote research assistant working with me to translate and transcribe documents, including interviews, questionnaires, and other documents related to this research. She will continue working with me until the completion of these tasks.

Dilani (402 USD): Dilani Palihakkara is a graduate of the Anthropology program at the University of Sri Jayewardenpura interested in pursuing a career in Primatology. She is currently my remote field assistant working on translating questionnaire data and will start as my primary field assistant in the regional acoustics survey beginning in June 2023. I am excited to have her as a research assistant given her wonderful work over the last several months.

Other Team Members

Dr. Roberta Salmi is my academic advisor from the University of Georgia. She is a biological anthropologist that specializes in primate behavioural ecology with 18 years of field experience with wild primates and worked extensively on the conservation of western gorillas. She has extensive experience in wildlife censuses, primate behaviour, nutrition, cognition, and wildlife bioacoustics. Over the last 6 years, she has mentored me through this project, introduced me to Sri Lanka, and has overseen my field work.

Dr. Rajnish Vandercone is a senior lecturer in the Department of Biological Sciences at Rajarata University with extensive experience in ecology and conservation of colobine monkeys and other mammals. He has conducted primate research on the target species since 2006 and was an awardee of Conservation, Food, and Health Foundation research Grant in 2007. Dr. Vandercone serves on my committee and mentors me in Sri Lanka. His help has been invaluable to my success in Sri Lanka.

Charith Madushan is a research assistant & organizational manager at the Kaludiyapokuna project. He has a BSc. in Natural Science the Open University, Sri Lanka and continues to work at the site.

Dilan Dilan Thisaru Hewamanna is a research assistant & professional wildlife photographer with a B.A. (Honours) in Anthropology from the University of Sri Jayewardenepura, Sri Lanka. He continues to work closely with me on the acoustics aspect of my project and has overseen my research with me.

Rashini Rashini Lakshani is my newest research assistant with a B.Sc. Honours in Environmental Science from the University of Peradeniya, Sri Lanka. She is now working with me on GPS tracking the monkeys for home range analysis.

Vajirapaani Chandrasena is a Research Assistant with a B.Sc. Honors in Environmental Science form the University of Peradeniya, Sri Lanka. She has worked with me over the last 6 months carrying out questionnaires and interviews as well as all day follows in langur groups.

Asanka Tharindu is a research assistant & web developer with a BICT (Honors) in Information & Communication Technology from the University of Ruhuna, Sri Lanka, He developed the project website and worked as a research assistant during my time in Sri Lanka.

Thuan Cao is a former research assistant that worked as an expat volunteer during my time in Sri Lanka. He carried out all day follows on monkeys and aided me in training endeavours.

Amitha Tharindu is our camp organizer. She cleans, cooks, and looks out for all of us.

Tikiri Banda Weerasinghe is our full time cook and camp uncle. He helps us organize food to keep the research going and cares for the research assistants like they are family.

10. Any other comments?

Please reach out to me (hofnera8@gmail.com) if you would like more photos of this grant period for the website of other promotions.

Lily, a female grey langur

Cosmo, A male purple faced langur.

Wildlife Acoustic recorders being tested.

Dilan (front), Upali and Alli at Kaludiyapokuna placing acoustic monitors.

Paani, Wasana, and Dilki (left to right) learning how to carry out questionnaires.

Me (Alli), Paani, Wasana and Dilki (left to right) on a survey trip to Mihintale.