Final Project Evaluation Report

Your Details	
Full Name	Ashwini Venkatanarayana Mohan
Project Title	Diversity of geckos in the Andaman and Nicobar Islands: identifying islands and species of conservation importance
Application ID	20448
Grant Amount	4992 pounds
Email Address	ashwinivm30@gmail.com
Date of this Report	19/10/2018

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
Field work sampling A&N Islands for Gekkonidae			■	In all the islands included in the permit letter issued by the A&N Forest Department.
Species list			■	Revised species, new species to science added, please see attached report for further details.
Species distribution in different islands of A&N Islands			■	In addition to other publications listing species distributions, we have added several new distribution records and surveyed previously unsurvey islands.
Evolutionary origins of species through phylogeny			■	Complete using five different genetic markers from representative individuals from different islands.
Intraspecific phylogeography within the A&N Islands		■		Lack of funds to amplify mitochondrial markers from all the samples (approximately 450).
Conservation status of species		■		Based on their distribution and preliminary results from the intraspecific phylogeography.
List of islands and species important for conservation		■		Due to lack of extensive intraspecific data, an island's conservation importance is based on species distribution and preliminary phylogeographic structures only.
Educational material with species names and distributions	■			This could not be achieved at this time as additional work is required to sort systematics of the currently known and newly discovered species. Will be done once this completed.

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

We had to limit the generation of genetic data to representative individuals per species per island, instead of the proposed sample w ide phylogeography. This was due to lack of funds for the molecular laboratory work. Since this part of the work is in progress, we were unable design and print education material from this project. As all the components of the budget were calculated in INR and then converted to GBP, reduced GBP value affected the fund which was granted post announcement of Brexit.

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

1. Recognising true species diversity in Gekkonidae of the Andaman and Nicobar Islands: In addition to previously recognized widespread human commensal species and endemic species, this study has identified up to seven independently evolving lineages of geckos on A&N islands, all of which are potentially new species to science. The new species identified in this study are not restricted to one genus, they are widespread among the endemic lineages and one apparent human commensal lineage, *Gehyra sp.* from the Nicobar Islands is also confirmed as an endemic lineage.

2. The effect of geological past of the A&N Islands on contemporary genetic structure, especially a comparison between the Andaman and Nicobar Islands. The Andaman Islands have a narrow sea between them, whose depth is also more or less the same between islands. The Nicobar Islands, on the other hand, are widely separated and can be divided into northern, central and southern group of islands. The genetic distances between different gecko species on these different islands are concordant with the geological history. Historically, during the late Pleistocene, islands with narrow sea between them remained connected longer than islands with deep sea between them. The Gekkonidae on the Andaman Islands are structured phylogeographically, but are still a single species with putative population differentiation. However, the Gekkonidae on the Nicobar Islands show clear differences in species distributions between the northern, central and the southern group. They are also genetically distant, following independent evolutionary paths leading to the formation of new species on these island groups. Even within the central group of islands, inter island genetic distances are high despite low geographical distances and this is concordant with the time of their last land connections.

3. In addition to identifying and confirming that the larger islands are home to a greater number of species, through building phylogenetic trees, we now have information on the colonising history of these islands. Previous hypothesis and support from other taxa distribution data showed that the Andaman Islands are biogeographically Indo-china and the Nicobar Islands are Indo-Sumatran in their species assemblages. However, phylogenetic relationships between gecko species on these islands reveal that the species on these islands are almost

always sister lineages and hence, one of the island groups (Andaman or Nicobar) have functioned as a stepping stone for the colonisation of the other. However, previous prediction painted a different picture of colonisation that is of Indo-Burma to the Andaman Islands and Sumatra to the Nicobar Islands. These results will have biogeographical implications and might change our views of known evolutionary relationships of taxa inhabiting these islands. Addition of genetic data from species distributed in parts of South-east Asia and the Indian sub-continent could influence these results to a certain degree.

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

As the Andaman and Nicobar Islands have the common house gecko (*Hemidactylus frenatus*), common four clawed gecko (*Gehyra mutilata*), flat tailed house gecko (*Hemidactylus platyurus*) and geckos which are morphologically very similar to these above-mentioned human commensal species, we sampled in human inhabited areas. We interacted extensively with the village and town people to grant access to their stores, houses or parking areas to collect these gecko samples. In the process, we explained them the objectives of our project, and introduced them to the concept of endemicity and provided examples of endemic and non-endemic geckos in colloquial languages. My field assistant could communicate in two languages, and is related to communities of Burmese origin. I can speak five languages, including English of which four were regularly used on the Andaman and Nicobar Islands. As the modern human population of the Andaman and Nicobar Islands is a complete mixture of settlers from different parts of mainland India, immigrants from Sri Lanka and Bangladesh, mixed native tribal people and government officials from mainland India posted on duty, being able to communicate in these different languages was a huge bonus. Due to these regular interactions, my field assistant and I learnt names of different species of geckos used by different settler communities and gained insights into the perception of different communities towards geckos. These interactions also highlighted the differences in the level of knowledge on this subject among different communities of settlers. The staff at the Andaman and Nicobar Environmental Team (ANET) were also enthusiastic about the project and its goals, and several of them helped with sample collection on different islands.

4. Are there any plans to continue this work?

Although the field component of this project is now complete, there is a lot of ongoing work in the laboratory. I am now pursuing a PhD in evolution of the genus *Phelsuma* on Madagascar, other West Indian Ocean islands and the Andaman Islands. I am currently amplifying microsatellite and mitochondrial markers for all the 150 samples of the Andaman day gecko (*Phelsuma andamanensis*) collected as part of this project and results from this study will provide detailed insights into the contemporary population structure of this species and connectivity between different Andaman Islands. By adding more genetic data from other species inhabiting these islands, we will compare different species of geckos, recognise common barriers to dispersal and factors governing spatial distribution of genetic diversity. This is essential to obtain detailed insights into connectivity of populations of

geckos on the A&N Islands. By discerning the phylogeographic structure, we can prioritize islands important for conservation with greater confidence.

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

The important contributions to science would be in the form of published research papers in internationally recognized journals. In addition, I am working on popular science articles to popularise geckos of the A&N Islands, the newly discovered lineages and the need to conserve such species with small distribution ranges. In a few years' time, after sorting the taxonomy and systematics of these species through scientific publications, I intend to produce a small booklet on the reptiles of the Andaman and Nicobar Islands in Hindi, Tamil and English. This booklet will be produced mainly for the island inhabitants and government officials on the Islands. As a sketch artist, I hope to work on a few illustrations on the ecology of these geckos on the Andaman Islands.

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

This grant was used from November 2016 to November 2017. The actual length of the project, including publication time would be much longer, and that was anticipated in advance. However, in this year, the field work and preliminary laboratory work has built the foundation and the data base to work on for the next few years. I intend to formally publish all the research from this project by mid-2021 as it requires much more intense work, e.g. morphological data collection from specimens of related species from several museums, amplification of genetic data from all individuals collected etc. We also need to find additional funds and researchers to carry out the molecular laboratory work.

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
Transportation	460	950	+490	Inter-island transportation was more expensive than expected, for local transportation within large islands, Petrol expenses for two- wheeler transportation was more than expected.

Accommodation	1000	487	-513	We saved money for accommodation as we obtained support from the Department of Environment and Forests, Andaman and Nicobar Islands through availability of their guesthouses for 'researcher' rates. We also saved money due to collaboration with Dakshin Foundation which reduced our food and accommodation charges at Andaman and Nicobar Environmental Team (ANET)
Food	932	374	-558	In most islands, we ate at local restaurants, food was not as expensive as expected.
Field assistant salary	776	1277	+501	Due to additional field assistance required on different islands of the Nicobar Islands, also on smaller Andaman Islands, I had to hire a 'local' islander, in addition to the project field assistant. In addition, I took support from a lab assistant during the lab work phase of this project.
Researcher Salary	1241	1151	-90	No comments
Poster design	120			The poster could not be designed at this stage as our work on identifying species and distributions is not complete. In addition, there was a funding shortfall due to changes in the exchange rate.
Poster printing	225			As above. However, in the next years, I plan to collaborate with ANET, Dakshin Foundation and the Forest Department in the A&N Islands to design and print education materials on reptiles of the A&N Islands. This will also provide additional time require to publish all the research outputs from this project.

Budget overhead	238	409	+171	This is the fee charged by the institution for processing funds, managing accounts, keeping all the bills and providing vouchers.
Field equipment for tissue collection		344	+344	Although this was not initially budgeted, buying equipment for data collection (tissue vials, laboratory grade alcohol), batteries for field work, paper printing, report printing for the department and additional stationary required for field work were crucial for the project and hence I had to use these funds.

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

The next important steps for this project would be to complete molecular laboratory work for all the collected samples to obtain information on the genetic diversity within the sampled species across different islands. This would complete the objective of identifying important islands for conservation. Appropriate outreach material can also be designed and produced at that stage.

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?

No, I have not used the logo yet as I have not begun to publish any of the work. I have recommended the Rufford Foundation to several co-researchers and acknowledged their support in the completion report of the project to another funding agency. In addition, I have acknowledged the foundation in all the presentations I have made regarding this project: A&N Forest Department, Technical University of Braunschweig.

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

Ashw ini V. Mohan
Designed the study, carried out field work, obtained funds for the field work, molecular laboratory work, analysis

Saw Sathaw
Field assistant during the field component of the project (November 2016 to May 2017)

Saw Issaac
Additional field assistant for the island Little Andaman, Baratang and Middle Andaman

Gayathri Selvaraj
Laboratory research assistant to help with DNA extractions, PCR and some preliminary data analyses

Kartik Shanker
Project supervisor, financial support for the laboratory component of this project.