The Rufford Foundation
Final Report

Congratulations on the completion of your project that was supported by The Rufford Small Grants Foundation.

We ask all grant recipients to complete a Final Report Form that helps us to gauge the success of our grant giving. We understand that projects often do not follow the predicted course but knowledge of your experiences is valuable to us and others who may be undertaking similar work. Please be as honest as you can in answering the questions – remember that negative experiences are just as valuable as positive ones if they help others to learn from them.

Please complete the form in English and be as clear and concise as you can. We will ask for further information if required. If you have any other materials produced by the project, particularly a few relevant photographs, please send these to us separately.

Please submit your final report to jane@rufford.org.

Thank you for your help.

Josh Cole, Grants Director

Grant Recipient Details	
Your name	Anagaw Atickem Meshesha
Project title	Cryptic species of Ethiopia: Canids and Suidae in Ethiopia
RSG reference	17970-D
Reporting period	September 15, 2015 to September 14, 2016
Amount of grant	£9790
Your email address	anagawam@gmail.com
Date of this report	October 12, 2016

1. Please 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
To determine if the Eurasian golden jackal (*Canis aureus*) exists in Ethiopia using molecular techniques			X	Even if the initial plan was to work in Ethiopia, we got an opportunity to extend our work to the entire range of the golden jackal in Africa, and provide substantial information that showed the absence of the Eurasian golden jackal in the continent.
To further clarify the taxonomy of African wolf			X	In collaboration with experts in paleontology, we combined morphometric analysis and molecular genetics to further confirm the unique taxonomic status of African wolf.
To examine the phylogenetic relationship of African jackals (black backed and striped jackals) from molecular methods			X	Except the challenge we faced in getting samples representing all regions of Africa, we provided phylogenetic relationship for the African jackals that provided an important insight for deep genetic divergence in the African jackal populations.
To clarifying phylogenetic relationship of African Suidae family			X	This was the most successful part of this project in terms of novelty of the research outcomes. Collaborating with several researchers working on Central and Western Africa countries, we discovered a cryptic species of Suidae which possibly evolved through introgression.
Help conservation efforts of the African canids and African Suidae			X	Results of this project will be published and available for conservation managers and researchers.

family though providing useful information in prioritising conservation efforts.				

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

The most important challenge I faced in this project was getting samples for DNA sampling. African canids and species of Suidae family are widely distributed, and getting representative samples needed to adequately answer the research questions of the project was very difficult. In addition to costs associated with traveling and field work, getting research permits and sample export permits was a big problem. Even if I did not get all samples I was looking for, I got staggering number of samples across Africa by establishing collaborations with researchers working in the area. I also got samples from different museums in Europe.

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

1. We provide substantial evidence for the absence of the golden jackal not only in Ethiopia, but thoughout Africa. Large numbers of canid samples from Africa collected from field sites and museums were sequenced and no single Eurasian golden jackal type of haplotype was found. Hence, we suggested to IUCN that the former range of the golden jackal should be designated as the new African wolf species. Combining skull and teeth morphometric analysis with molecular techniques, we also further confirmed African wolf is a distinctive species. More information is provided in the detailed report of this project.
2. We provide evidence for the deep genetic divergence in the striped jackal populations in Africa where, the population in Guinea is the most distinctive population whereas the populations in Ethiopia, Kenya and Benin are closely related. Both black backed jackals and striped jackal populations in Africa are distantly related from genetics point of view when compared to other canids, wolf species and Eurasian golden jackals.
3. For the first time, we did a comprehensive study on the African Suidae family that reveals, the Ethiopian bush pig is in fact not a bush pig like that of the eastern Africa countries. It is cryptic species possibly evolved though the

introgression of the bushpig (*Potamochoerus larvatus*) and red river hog (*Potamochoerus porcus*) species. Please see the detail report for more information.

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

The local community were involved mainly in sample collection for canid and wild pig species in Ethiopia. This benefits the local community to get better awareness on conservation of wildlife and economically benefited even if this is at small scale.

5. Are there any plans to continue this work?

Substantial information is provided to confirm the former golden jackal in Africa is a wolf species closer to the grey family. However, there are still several open questions regarding the phylogeny and phylogeography of African jackals (side striped jackal, *Canis adustus* and black backed jackal *Canis mesomelas*). Our project clearly demonstrates that the "Ethiopian bushpig" across its rain forest from west to south and east part of the country is a cryptic species. Our study based on mitochondrial and nuclear DNA showed the species may be evolved with introgression between the bushpig and red river hog dating back many years. To our knowledge, no red river hog is found in Ethiopia, and it may be extinct though hybridization. The details of the evolutionary history of the cryptic Ethiopian bushpig have to be studied though genome wide sequencing. Our future project hence will focus on further studies of the African jackals and bush pig at genomic level.

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

Results from this project will be published in ISI journals and book chapters available for researchers and conservation managers. The first paper is under revision at *African Journal of Ecology* resubmitted for minor revision and the second manuscript is submitted to *BMC Zoology* both from canids study. We are in process of submitting the third manuscript from the study of Suidae family.

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

The project was implemented as planed within a year period.

8. Budget: Please 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.

Item	Budgeted Amount	Actual Amount	Difference	Comments
Per diem for PIs	720	540	180	
Per diem for three field assistance and two camp attendants	6400	6300	100	
Transport	950	1800	-850	
DNA extraction kit, Enzyme for PCR, sequencing, Laboratory Supplies	1440	8800	-7360	With this project, over 300 samples were exacted for DNA and about 800 sequences were generated for 5 mitochondrial and 6 nuclear DNA markers.
Postal service	280	300	-20	
TOTAL	9790	17740	-7950	

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

Since the unique species status of African wolf is confirmed and substantial information is provided for its distribution pattern, it may be safe to start assessment of African wolf conservation status by IUCN. African wolf is not yet listed by IUCN. Further studies on its population size and ecology also needed to be studied to increase our knowledge on the species ecology and conservation threats. African jackals (side striped jackal and black backed jackal) are considered as widely distributed canids. African jackals receive little attention for conservation effort and are subject to persecution by humans. The African jackals however have several genetically distinctive populations that need different conservation assessments. We clearly showed the bushpig in Ethiopia is rather cryptic species that possibly evolved though genetic introgression. However, the extent of hybridisation and many other questions cannot be answered from this study. Hence, further research at genomic level is urgently needed to better understand the evolutionary history and taxonomy of the cryptic Ethiopian bush pig.

10. Did you use the RSGF logo in any materials produced in relation to this project? Did the RSGF receive any publicity during the course of your work?

So far, it was mainly on research and writing up manuscripts, and I acknowledge RSGF in the two submitted manuscripts so far and will continue in doing so in papers and presentations I will held in the coming years.

11. Any other comments?

IUCN provide conservation status for wide range of mammals which has an important implication for prioritizing conservation efforts to endangered species. Cryptic species and uncertainty in taxonomic positions of many species however challenged the current conservation strategy. Cryptic species that remains undetected confused with some of the widely distributed species potentially can vanish without a significant effort of conservation. Hence much effort is needed to clarify the taxonomic status of many mammal species. Regardless of this however, molecular based taxonomy research are not favourite choices of many small grant programs for funding, at least to my experience. I very much appreciate RSGF support of this project which otherwise may not be successfully accomplished.