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sustainable environment, education & development

An update on

Project Rufus: *In situ* conservation of the *Pteropus rufus* fruit bat in the Sainte Luce littoral forest, southeast Madagascar



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1. Introduction

Madagascar has been identified as one of the world's highest conservation priorities (Myers et al., 2000); it supports 5% of global biodiversity (Bikalemesa, 2014) and boasts levels of endemism reaching 83% (Temple et al., 2012). It is also one of the most impoverished and least developed countries in the world, ranking 154/188 in the UNDP 2015 Human Development Index (UNDP, 2015).

The Anosy Region is renowned for its littoral forests, however only 10% of original forest persists across Madagascar, making it one of the most threatened habitats in the country (Krishnam et al., 2012). The Sainte Luce Littoral Forest (SLLF) covers just 1,143 ha (SEED, 2016), existing in isolated diminishing fragments, yet boasts a wealth of biodiversity and endemism; 98% of the 189 plant species are endemic to Madagascar (Rabevohitra, et al., 1996). The SLLF faces multiple external threats, including illegal logging and proposed mining by QIT Madagascar Minerals (QMM) (Temple et al., 2012). It also supports a highly impoverished community of approximately 2,000 people, most of whom are dependent on its natural resources for subsistence and livelihoods.

Pteropus rufus (*P. rufus*) are primarily distributed around the coasts of Madagascar, situated in lowland areas within 100km of coastline (Roberts et al., 2016). The species typically inhabits small, vulnerable forest remnants outside protected areas (Jenkins et al., 2007, Racey et al., 2010). The population has been experiencing severe declines of up to 30% across Madagascar over the last 20 years (Andriafidison et al., 2008). This fall has been attributed to a combination of loss of suitable roosting sites and increased human pressure (Roberts et al., 2016).

Project Rufus is working to ensure the protection and conservation of the *P. rufus* colony occupying the S6 fragment of the SLLF. This is one of the few colonies roosting within a forest, not open degraded land, meaning it plays a crucial role in preserving the SLLF through seed dispersal and pollination. As S6 is an unprotected forest fragment, the roost site is at risk of destruction from logging or land clearance. High levels of human disturbance also cause distress to *P. rufus* which, if severe, can lead to desertion of the roost. With the remaining SLLF fragments unlikely to provide adequate alternative roosting sites, loss of this species from Sainte Luce would have a significant impact on future reforestation and the preservation of the SLLF.

Project Rufus has supported species conservation through establishing an Exclusion Zone around the roost sites and engaging communities and stakeholders in appropriate action. This report covers activities undertaken in the second six months of the project, from July to December 2016 (inclusive). A key success achieved of the reporting period was formal stakeholder ratification and mapping of an Exclusion Zone 10 times larger than originally envisaged, providing protection to a larger area of vulnerable littoral forest. The zone is now actively patrolled by two Forestry Police recruited from the local community. Successful regional stakeholder and community meetings led to the development of a management strategy for the Exclusion Zone and the surrounding forest fragment. The viewing platform has been constructed and is now in use.

The *in situ* research activities have faced setbacks due to unsuccessful bat trapping attempts. With *P. rufus* entering birthing season, trapping activities have been postponed until the offspring are no longer dependent on their mothers, expected to be in April 2017. Population census has also been postponed to coincide with the other research activities.

2. Project activities

2.1 Community meetings and surveys conducted in Sainte Luce, Mahatalaky and Tsiharoa (communities using the S6 forest fragment)

Four community meetings were held in Sainte Luce, Mahatalaky, Tsiharoa North, and Tsiharoa South in early November 2016 (see figure 1.). The meetings were attended by community representatives, the respective community COBA (local forest management bodies), Chef Fokontany (Community Chief), representatives from QMM (a locally active mining consortium) and Manafiafy Beach and Rainforest Lodge.



Figure 1. Community meetings taking place in Sainte Luce (left) and Tsiharoa North (right)

The meetings provided a platform to reinforce local knowledge on *P. rufus*, including its critical role in maintaining the health of the forest, and the importance of conserving the colony occupying the S6 fragment. Information was also provided on project activities, notably the Exclusion Zone which enforces a ‘no logging and bat hunting’ policy throughout the year. The Exclusion Zone was discussed in depth to ensure all community members understood its exact location and the rules in operation.

Project staff also used the meetings as an opportunity to review, discuss and address community questions and concerns related to the management of the Exclusion Zone and S6 forest fragment. This included responsibility for two Forestry Police patrolling the zone and coordination of ecotourism opportunities arising from the colony and viewing platform. Information gathered from each community meeting informed discussions at a regional stakeholder meeting in December 2016 (see sub-section 2.2) and facilitated the development of a COBA management strategy for the Exclusion Zone and S6 forest fragment.

A key issue discussed during community meetings was the management of the S6 fragment by the four community COBAs, with project staff facilitating discussions on possible management plans. It was proposed that the two Tsiharoa COBAs would co-manage the Exclusion Zone; however the Sainte Luce community feared they would lose access to part of the S6 forest fragment and not benefit from ecotourism opportunities. Co-management by all four COBAs was resolved at the regional stakeholder meeting (see sub-section 2.2)

A second issue debated at community meetings was recruitment of the two Forestry Police following the stakeholder meeting in June 2016. Each community had wanted recruitment from their respective localities and representatives enquired as to whether it was possible to hire an additional Forestry Police to increase the distribution of socioeconomic benefits. Three patrols was deemed more than required, therefore agreement was reached to keep the two patrols recruited following the stakeholder meeting (*see section 2.2*).

Finally, meeting attendees discussed the fines associated with infractions of the Exclusion Zone. It was proposed that the fine for killing a bat should remain as outlined in the *dina* (local customary law), whilst the fine for logging within the Exclusion Zone should be slightly less. All community opinions remained confidential and were not discussed with the other communities. Information and learning from the meetings were discussed with the stakeholders at a stakeholder meeting in early December 2016 before final agreements were made (*see section 2.2*).

2.2 200m exclusion zone around *P. rufus* roosting site

At the regional stakeholder meeting in June 2016, the Exclusion Zone was agreed around the main roost site. When project staff visited the forest in August 2016 with COBA and FIMPIA representatives to map the Exclusion Zone with GPS, an area 10 times the size of originally planned was agreed. The Exclusion Zone now provides protection to approximately 30 ha of forest. The perimeter of the Exclusion Zone is marked with flagging tape and a sign has been erected on the main path, stating the rules and area of the Exclusion Zone (*see figure 2.*).



Figure 2. Original Exclusion Zone area (left), Exclusion Zone sign and SCP staff (centre), finalised Exclusion Zone area and location (right)

Two Forestry Police were selected from Tsiharoa North, due to the community's proximity to the roost site, and have been patrolling the Exclusion Zone since October 2016. Alongside enforcing the Exclusion Zone rules, the Forestry Police are recording data on: instances of hunting, logging and forest use; viewing platform activity (*see sub-section 2.3*) and colony population census. In December 2016, one Forestry Police terminated his contract, leading the COBA's and FIMPIA President to select a replacement.

Following community meetings in November 2016, a regional stakeholder meeting was held on 12th December 2016 in the larger village of Mahatalaky. This was attended by the Director of the Regional Directorate for Environment and Forest (DREF), the President and Vice President of FIMPIA, COBA representatives, local community representatives, and opinion leaders. The aim was to discuss and agree a suitable COBA management strategy for the S6 forest fragment.

It was agreed through a democratic vote that all four COBA would co-manage the S6 forest fragment, enabling the benefits of the Exclusion Zone to be shared equally among the four communities. With regards to income from ecotourism and use of the viewing platform, it was agreed that four community-elected representatives would collect the money each month and distribute it fairly between their respective COBAs. Upon project completion, this money will be used to sustain the Forestry Police positions, with any surplus shared between the four COBAs.

Whilst the Exclusion Zone rules are now in operation, the fine system for infractions requires further approval. Writing the Exclusion Zone rules into the *dina* was also raised at the stakeholder meeting, with attendees agreeing this needs to be discussed with the communities to ensure that all community members are aware of the rules.

2.3 Community managed elevated P. rufus viewing platform

To promote ecotourism opportunities and provide ongoing funding for local conservation activities, an elevated viewing platform has been constructed by the SEED construction team within the Exclusion Zone (see figure 3). The platform is approximately 10m high, is situated 30m away from the roost tree and has two levels providing alternative views of the roost site (see figure 3).

Manafiafy Beach and Rainforest Lodge has begun conducting guided tours to the viewing platform. Visitors pay a fee to use the S6 forest fragment, which is then distributed between the four COBAs. In December 2016, Manafiafy Beach and Rainforest Lodge paid in total 110,000 MGA (27 GBP) to the four COBAs. The viewing platform also provides community members with an opportunity to benefit from conducting guided tours. SCP staff and volunteers are also using the viewing platform to support research activities (see sub-section 2.5).



Figure 3. The bat viewing platform (centre) and the view from the bat viewing platform (left and right)

2.4 Tree-planting site for fig and guava trees

Fig and guava are important elements of the *P. rufus* diet as a source of calcium, required particularly when nurturing young. Guava seeds were planted by SCP in February, April and June 2016 and by the end of June, 133 guava seedlings had been established in the SCP nursery. Of the 133 guava seedlings, 109 remain and are successfully developing. Furthermore, 29 seedlings reached sufficient development to be transferred from the nursery beds to pots for continued growth.

Fig cuttings and seeds were planted in February and June 2016 and by the end of June, a single fig cutting had been established. The 1,000 fig seeds planted in June germinated at the end of July 2016, and at present there are 133 fig seedlings developing in the SCP nursery.

Extensive, ongoing maintenance of the nursery is carried out by SCP staff and conservation volunteers to ensure optimal growing conditions. In addition, a recently established composting site in the SCP camp now provides compost that is used in the nursery. Ongoing care of the seedlings will continue to be carried out by SCP staff, including the local experienced botanist, and international volunteers.



Figure 4. Tree nursery, established in the SCP camp

2.5 In-situ research

Due to delays in obtaining the necessary research permits, the bat specialist's visit was postponed until September 2016, taking place from the 21st - 29th September. The primary aim of the visit was to trap and fit three *P. rufus* individuals with GPS collars, whilst also building the capacity of local guides and the SCP research team in dietary analysis and other research activities.

Upon arrival, the bat specialist assessed the local flora and environment to determine the most effective location for trapping of the bats. Trapping was conducted at the *P. rufus* food source, away from the roost tree, to limit disturbance of the colony. Two plant species, *Agave sisalana* and a *Eucalyptus* sp., were selected as the trapping sites. Mist nets were constructed and erected next to the flowering section of the plants (*see figure 5.*). Trapping attempts were conducted over five nights (22nd - 27th September), from 8:30 p.m. – 00:00 a.m., and 01:00 a.m. – 03:30 p.m.



Figure 5. Mist nets on the *Agave sisalana* (left) and the *Eucalyptus sp.* (right)

Although night trapping was conducted for five consecutive nights, no bats were caught in the mist net. Whilst bats were present in the area, and on occasion flew close to the nets, the numbers were relatively low. A high wind and a bright moon also led the bat specialist to believe that the mist nets may have been visible for *P. rufus*, particularly given its dependency on eyesight for feeding. Bat movements at the two trapping sites were recorded by the bat specialist and are presented in a table below.

Table 1. Bat activity during capture sessions

Capture sessions	Sites	08:30 p.m. – 00:00 a.m.	01:00 a.m. – 03:30 p.m.
First night	<i>Eucalyptus sp.</i>	0	3
	<i>Agave sisalana</i>	1	0
Second night	<i>Eucalyptus sp.</i>	0	4
	<i>Agave sisalana</i>	2	0
Third night	<i>Eucalyptus sp.</i>	2	0
	<i>Agave sisalana</i>	0	1
Fourth night	<i>Eucalyptus sp.</i>	0	2
	<i>Agave sisalana</i>	0	0
Fifth night	<i>Eucalyptus sp.</i>	0	0
	<i>Agave sisalana</i>	0	0

Following the unsuccessful trapping attempts in September, SEED employed two local bat trappers in late October, who employed the same methodology. Mist nets were substantially increased in size and placed adjacent to fruiting trees. The trappers attempted activities over 14 nights, making multiple trips to test varying levels of brightness in the moon, but were unfortunately not successful.

The *P. rufus* bats have since entered birthing season with pups clearly visible from the viewing platform (see figure 6). As the pups cling to the mothers for the first few months of infancy, there is the risk that a mother with a pup may be caught causing injury to, or the loss of, the pup. It is thought that the pups will be weaned by April 2017 and trapping attempts will resume following this. SCP staff will closely monitor the colony to determine when it is feasible to resume trapping.



Figure 6. Two suckling *P. rufus* pups

The bat specialist supported SCP in establishing dietary analysis research, with the team erecting tarpaulin below the roost tree to collect faeces. The tarpaulin was left in place for three weeks and faeces samples were collected on a weekly basis. Seed content and diversity were recorded, however with each sample containing over 500 various seeds, it was not feasible to record exact seed numbers. After three weeks, the tarpaulin was removed as local guides identified that it was causing disturbance to the colony.

Based on this learning, a new dietary analysis study has been developed. Every two weeks, SCP staff collect 10 samples from underneath the roost tree and plant these in individual trays in the SCP nursery (see figure 7). Once the seeds have germinated, pictures will be taken of the trays and seedlings will be identified and tagged. Photos and tagging will allow SCP to identify species that do not grow to adulthood. Controls were established by SCP using five empty trays and five *Eucalyptus sp.* seed trays. The empty trays will identify whether wind dispersed seeds not in the faecal sample, whilst the *Eucalyptus sp.* seeds will show whether soil and water conditions allow germination to take place. The methodology will not provide analysis of the larger fruits in *P. rufus*' diet, such as lychees, as the seeds are too large to be swallowed by the bats. The study will be ongoing alongside trapping and GPS data collection.

Population census data has been postponed to align with the trapping and tracking of *P. rufus*. Data collection will be carried out in January and will run until 31st December 2017.



Figure 7. Germination trails for dietary analysis

2.6 Training and capacity building of local guides in monitoring and habitat analysis of P. rufus

Whilst in Sainte Luce, the bat specialist worked with local guides, building their capacity to effectively monitor *P. rufus* populations and disseminate knowledge of the species in the wider community. The training developed skills and knowledge in the ethical trapping, handling, and collaring of *P. rufus*, in particular through the use of mist nets.

Training was also provided on the use of equipment to track collared bats and download data, including Yagi antenna, and the UHF Pinger receiver and base-station. Finally, the bat specialist demonstrated data collection techniques for the dietary analysis and population census which minimised distress to the bats. Accurately recording population census data and increasing understanding the diet of *P. rufus* will allow local guides to minimise human-bat conflict and protect the bats food source.

2.7 Educating the community about P. rufus and the importance of conserving its habitat

Community education has continued through SCP's free conservation club in Sainte Luce, Club Atsatsaky, reaching over 200 young people. A key lesson on *P. rufus* in August 2016 covered pollination. The lesson described what pollinators are, what they eat, and their role in maintaining the health of the forest. It concluded with a game involving the transfer of sand from one cup to the next by the children, simulating the transfer of pollen between flowers.

A second lesson covered the life cycle of *P. rufus*, informing children that it is a slow reproducing animal which only gives birth once a year, mostly to a single offspring. Staff also outlined that during the breeding season the population is most at danger of exploitation. A final lesson was conducted on the negatives of *tavy* (traditional slash and burn agriculture), including the threats it poses to the forest and alternative, sustainable agricultural methods to *tavy* such as alley cropping.

In addition to the Club Atsatsaky sessions, environmental education posters on the subject of *P. rufus*, its conservation, and the Exclusion Zone have been created and distributed to five schools across the Mahatalakay Commune.

2.7.1 World Environment Day

World Environment Day took place on Saturday 5th June 2016, with activities detailed in SEED's six-month progress report.

2.8 Stakeholder coordination

SEED works in close collaboration with local communities and stakeholders, utilising stakeholder engagement platforms to facilitate capacity building. This creates mutually beneficial links between the community, government and private sector to improve the environmental protection of Sainte Luce. Stakeholders were actively engaged in community meetings and regional stakeholder meetings (see sub-section 2.1 and 2.2).

Liaison with private sector stakeholders has been particularly important to coordinate use of the viewing platform. Project staff have held two meetings with Manafiafy Beach and Rainforest Lodge, in November and December 2016, to review the average number of guests visiting the viewing platform, and discuss ways to ensure guests are considerate and do not cause disturbance whilst

visiting the roost site. Several new stakeholders have been identified and will be approached by SEED in the coming months. This includes the Sainte Luce Reserve, which is looking to use the viewing platform for its guests, providing another source of income for the communities that co-manage the forest.

3. Conclusion & Future Action

Project Rufus has made significant progress over the last six months, notably in the mapping of the Exclusion Zone and establishment of a management strategy, the recruitment and operation of two Forestry Police and the construction of the elevated viewing platform.

Since the establishment of the Exclusion Zone and operation of Forestry Police, *P. rufus* population numbers have notably increased. In September 2016, prior to community endorsement of the Exclusion Zone, staff counted approximately 60¹ flying bats and no roosting bats. Low numbers were likely due to recent human and logging disturbance. A population census in January 2017 recorded 284 bats, with the majority roosting and not disturbed (*see figure 8.*). Including the nonvisible, surrounding trees, the total population is believed to be closer to approximately 350 bats.

Over the next two months, SEED will work with stakeholders and community members to formally write the rules of the Exclusion Zone into the *dina*, and determine the fines applicable for infraction of Exclusion Zone rules. The aim will be to reach formal agreement on these issues during a community meetings in February 2017. To strengthen the camouflage of the viewing platform, construction staff will secure Ravinala leaves to the front, whilst wood preservation oil will be applied to protect against rain damage. The guava and fig trees will be removed from the nursery after sufficient growth and replanted.

Bat trapping and tagging will resume when *P. rufus* offspring gain independence from the mother, anticipated to be in April 2017. Whilst the offspring are still dependent, project staff will conduct extensive research to explore supplementary or alternative techniques to trap the bats. Dietary analysis and population census data collection will be ongoing for the next 12 months.

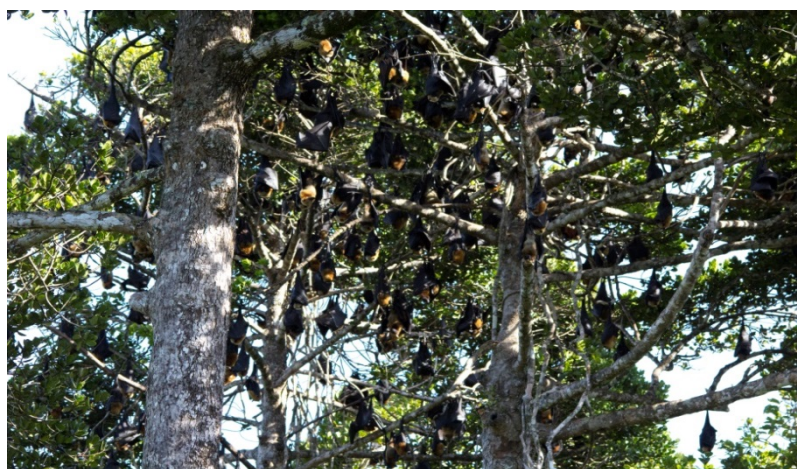


Figure 9. *P. rufus* in the roost tree

¹ An accurate population census could not be completed due to the movement of the bats.

1. Andriafidison, D, Cardiff, S.G., Goodman, S.M., Hutson, A.M., Jenkins, R.K.B., Kofoky, A.F., Rabearivelo, A., Racey, P.A., Ranivo, J., Ratrimomanarivo, F.H. & Razafimanahaka, H.J. (2008). *Pteropus rufus*. The IUCN Red List of Threatened Species (2008) Available at: <http://www.iucnredlist.org/details/18756/0>, Accessed: 14/09/2015
2. Bikalemesa, J. (2014). *Natural resources of Madagascar*. [online] Fortune of Africa Madagascar. Available at: <http://fortuneofafrica.com/madagascar/2014/01/27/natural-resources-of-madagascar/> [Accessed 20 Sep. 2016].
3. Jenkins, R.K., Racey, P.A., Andriafidison, D., Razafindrakoto, N., Razafimahatratra, E., Rabearivelo, A., Ratsimandresy, Z., Andrianandrasana, R.H. and Razafimanahaka, H.J., 2007. Not rare, but threatened: the endemic Madagascar flying fox *Pteropus rufus* in a fragmented landscape. *Oryx*, 41(02), pp.263-271.
4. Myers, N., Mittermeier, R., Mittermeier, C., Fonseca, G. and Kent, J. (2000) Biodiversity hotspots for conservation priorities. *Nature* 403(6772), p.853-858.
5. Rabevohitra, R., Lowry II, P., H. Randrianjafy, H., Schatz, G. and Razafindrianilana, N. (1996) Assessment of plant diversity and conservation importance of East Coast Low Elevation Malagasy Rain forests. Report on the project: National center of Research applied to the Farming development, Madagascar. Department of forest and piscicoles research, Madagascar. Biodiversity support program. Missouri Botanica Garden. St Louis.
6. Racey, P.A., Goodman, S.M. and Jenkins, R.K., 2010. The ecology and conservation of Malagasy bats. *Islands Bats: Evolution, Ecology, and Conservation. TH Fleming and PA Racey (eds.)*, pp.369-404.
7. Razafimizanilala, Andrée Anne Marie. (1996) *Introduction a l'etude ecologique des forets sublittorales de Sainte-Luce (Tolagnaro)*.
8. Roberts, S.H., Jacobs, M.D., Clark, R.M., Daly, C.M., Tsimijaly, L.H., Rossizela, R.J. and Prettyman, S.T., (2016). A review of the *Pteropus rufus* (É. Geoffroy, 1803) colonies within the Tolagnaro region of southeast Madagascar—an assessment of neoteric threats and conservation condition. *Madagascar Conservation & Development*, 11(1).
9. Temple, H., Anstee, S., Ekstrom, J., Pilgrim, J., Rabenantoandro, J., Ramanamanjato, B., Randriatafika, F. and Vincelette, M. (2012) Forecasting the path towards a Net Positive Impact on biodiversity for Rio Tinto QMM. IUCN, Gland, Switzerland. Available at: <https://portals.iucn.org/library/efiles/documents/2012-049.pdf>, Accessed: 10/07/2016
10. United Nations Development Programme (2015) *Human Development Report* [online] Available at: http://hdr.undp.org/sites/default/files/2015_human_development_report.pdf, Accessed: 11/04/2016