seed madagascar
sustainable environment, education & development

SEED Madagascar's Conservation Research Programme

ANNUAL REPORT 2019

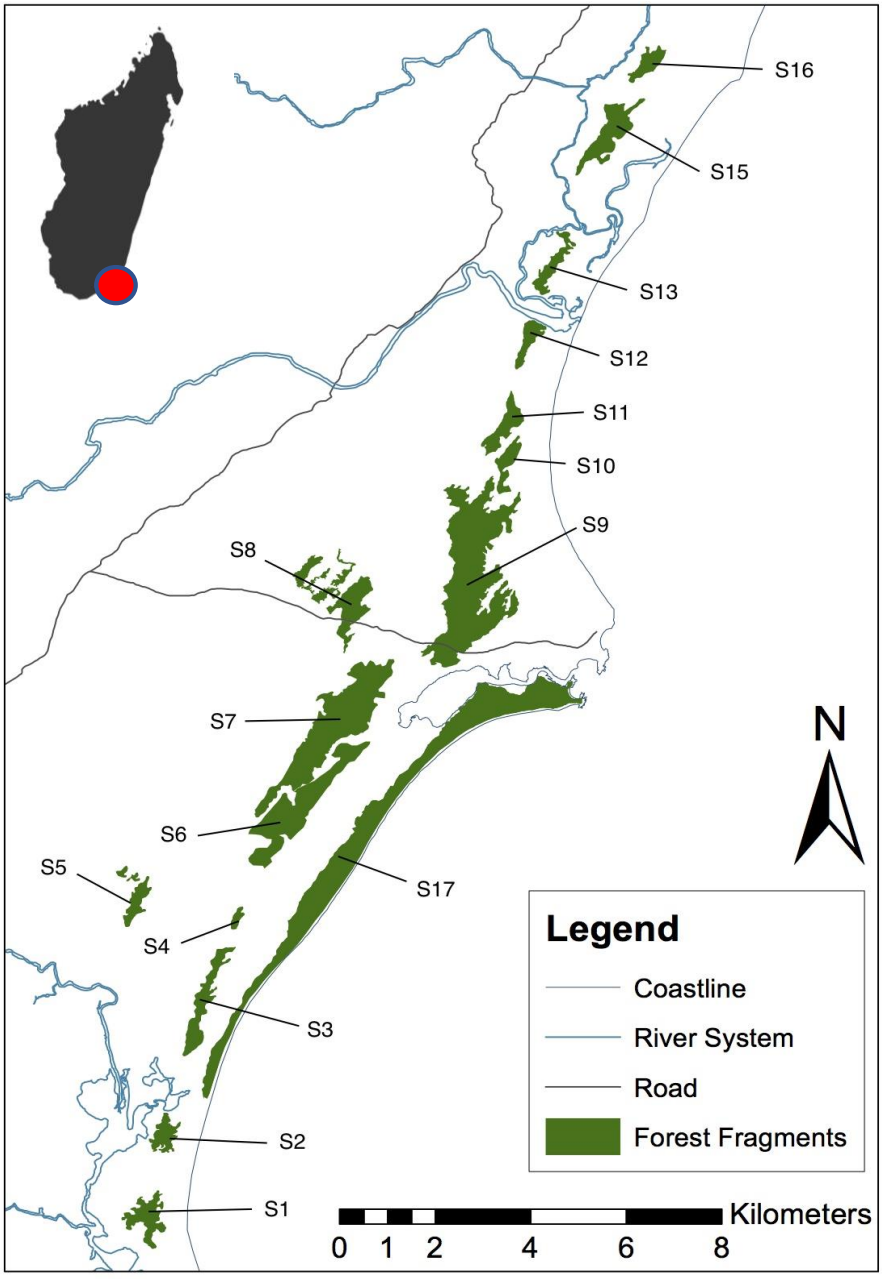
Conservation Research Coordinator: Kathryn Strang
Executive Conservation Coordinator: Sam Hyde Roberts

Executive Summary

This report summarises the activities of the SEED Conservation Research Programme (SCRP) during 2019. Since being established in 2010, SCRP has worked together with the SEED Environmental and Livelihoods Department, the Sainte Luce community, international institutions, and local authorities to understand the importance and use of the littoral forest and surrounding habitats; expand scientific knowledge of the ecology and population trends of the native fauna and flora; and highlight the importance of biodiversity, conservation, and protection in the area. The wide-ranging data collected has led to description of new species, numerous publications, and, most importantly, key data for practice conservation efforts on a local and regional level. Data have continued to be collected for long-term research projects that SCRP has set in place, as well as starting several new projects in the area. SCRP continues to be a unique platform for involvement in cutting edge conservation from the experienced biologist to more casual enthusiast.

Study Site

SCRP's work is focused in the littoral forests of Sainte Luce. At almost 2,000 hectares, these littoral forests are considered to be amongst the largest and most intact examples of this threatened habitat type remaining in Madagascar. Recent work suggests a key importance of this habitat within the larger and more comprehensive complex of remaining forests in the region. The forests are believed to be naturally fragmented; however, today they are under immense pressure from the local community and loggers for natural resources, and now the area consists of 17 disconnected forest fragments. Two fragments have already been severely deforested and extirpated for firewood and timber use, and the land is now used for agriculture. The entire area encompassing the Sainte Luce littoral forest is managed by QMM (QIT Madagascar Minerals), a mining company that has partnered with Rio Tinto and the Malagasy Government, to extract ilmenite from the sandy substrate, with operations set to begin in the near future. To mitigate some of the damage from the proposed mining plans, QMM has created conservation zones in which it is illegal to remove anything from the forest fragment, such as animals or plants. The S8, S9, and S17 fragments all have this protection status. The S6 and S7 fragments have been designated as community usage zones and provide community resources such as the firewood and timber needed for everyday use. SCRP works in all five of these fragments, with transects established in S7, S8, S9, and S17. Although SCRP does not have transects in the S6 fragment, SCRP regularly visits S6 due to its ongoing research on the Madagascar flying fox (*Pteropus rufus*) colony.



The fragments of the Sainte Luce littoral forest.

Ongoing Research Projects

Lemurs

The studies carried out on lemurs over the past nine years have covered several different research areas. SCRP has continued to measure the abundance and density of lemurs, with plans to continue to collect this data until December 2020, marking the end of a 10-year period of continuous data collection. Research is focused on the three nocturnal species found in the Sainte Luce littoral forest: the Anosy mouse lemur (*Microcebus tanosi*), Thomas's dwarf lemur (*Cheirogaleus thomasi*), and the Southern woolly lemur (*Avahi meridionalis*). In the past, SCRP also conducted research on the only diurnal lemur species in the area, the red-collared brown lemur (*Eulemur collaris*), and although there is no current ongoing work with this species, there are plans to start population assessments within the next year.

Two of the lemur species inhabiting the Sainte Luce littoral forest. Left: Thomas's dwarf lemur (Cheirogaleus thomasi). *Right: Anosy mouse lemur* (Microcebus tanosi).

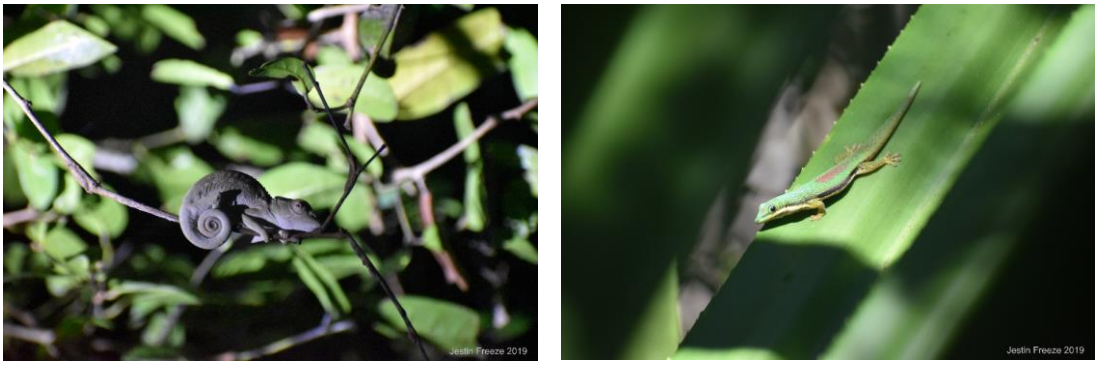
SCRP uses distance sampling to estimate population density of the lemur species. This method is robust, can be used to monitor several species at the same time, and can be used long-term. In January 2011, transects were set up in three different forest fragments; two in conservation zones (S8 and S9), and one in the community take zone (S7). Transects are walked at night, with torchlight used to spot eye shine from the lemurs. Ecological information is recorded about the lemurs that are spotted, such as distance from the transect, the height of the tree that they are inhabiting, the species of tree, and how many individuals there are. The data collected from this long-term monitoring will be used to infer spatial-temporal changes in density and habitat use in the Sainte Luce littoral forest over the 10-year data collection period. This information can then be used to inform conservation actions for these species to ensure their long-term persistence in the area.

During 2019, with the help from short-term volunteers, the SCRP team had 164 lemur observations over the 75 transects that were conducted, equating to 36.7 km of transects surveyed. Interestingly, the SCRP team spotted a woolly lemur in S7 - the first woolly lemur spotted in S7 for six years. Unfortunately, it is predicted that the woolly lemur population in S7 is unlikely to persist in the future due to the very low numbers seen in the forest fragment.

Data collected from 2011-2018 were analysed and the results were presented at the joint European Federation of Primatology & Primate Society of Great Britain conference in September of 2019. Preliminary analysis of the dataset shows that there are many species-specific and location-specific trends. The population of woolly lemurs appears to have halved since the data collected during the 2011-12 period, and their highest populations are found in the S9 fragment. The dwarf lemur populations have remained stable, though there has been a population increase in the last data collection period of 2017-18. The highest population of dwarf lemurs is found in the S9 and S7 fragments, with the S7 population remaining stable from 2011-18. The mouse lemur population trends are more varied compared to the other two nocturnal species, but population estimates appear very low. *Microcebus tanosi* is likely a rainforest species, and its limited abundance in the littoral forests may indicate that the littoral forests are a sub-optimal habitat for this species. Overall, the mouse lemur population has remained relatively stable; however, the lowest density of mouse lemurs was estimated for the 2017-18 period. The rest of the data collected are currently being analysed and the information written up for a manuscript to be submitted in 2021.

Herpetology

SEED's herpetological studies have been on-going since 2010, with the objective of monitoring species abundance and distribution. Over this period a multitude of survey techniques and methodologies have been employed, including the implementation of a long-term distance sampling protocol, genetic barcoding work, and specimen collection and analysis. This varied approach means that the SCRP team now possesses a comprehensive understanding of the herpetological community. We can confidently confirm that 21 distinct species of amphibian and 54 species of reptile occupy the littoral habitats of Sainte Luce.



Two reptile species found in Sainte Luce. Left: Furcifer verrucosus*. Right:* Phelsuma lineata*.*

The genetic barcoding assessment undertaken between 2015-2017 in collaboration with CIBIO in Portugal has been instrumental in identifying a number of candidate new species and correcting numerous previously published misidentifications. These results revealed 17 new amphibian and reptile species that required formal description or some taxonomic reassessment. One of these species, a tiny Microhylid frog (*Mini mum*) has been formally described this year in the journal PLOS One (Scherz et al., 2019), and samples and ecological information collected by SCRP contributed to its classification and the description of a new genus of frog.

In 2017, the herpetological methodology was changed to align with the lemur protocol, adhering to a more robust methodology and standardising data collection across both surveys. Distance sampling is now used to assess population density of different herpetofauna. Monitoring is carried out both during the day and at night to ensure that all species are being detected. SCRP aims to collect five years of data in this manner, which will then be used to assess habitat requirements of different amphibian and reptilian species, with this information used to inform population trends in the area.

During 2019, SCRP and short-term volunteers had 2,974 herpetofauna observations over the 135 transects that were conducted, equating to 65.4 km of transects surveyed. An exciting observation this year was that a *Lycodryas gaimardi* was found during an S7T3 night transect. This species has been observed infrequently in Sainte Luce.

Work by the team in 2017 has recently been published (Neaves et al., 2019). The SCRP team made several opportunistic observations of the diet of *Madagascarophis meridionalis.* An individual was seen consuming another snake species, *Liophidium rhodogaster*. This behaviour, classed as ophiophagy (or, simply, the consumption of snakes), has not been described before for *M. meridionalis*. Three other foraging events were also observed, two of which were on the introduced ship rat (*Rattus rattus*) and the other on the endemic Webb's tufted-tailed rat (*Eliurus webbi*).

The SCRP team is also collecting morphological and basic ecological data on the pygmy leaf chameleon (*Palleon* cf. *nasus*), one of the species identified as requiring further clarification by our earlier genetic study. Data will be combined with the genetic analysis for the species description. The collection of this data is being done opportunistically, where individuals spotted during the herpetological transects are being measured. SCRP aims to collect measurements on individuals found within the S7, S8, S9, and S17 forest fragments.

Lobsters

Project Oratsimba has worked with fishers in Sainte Luce since 2013 and has recently expanded the project to other lobster fishing communities. The aim of the project is to protect lobsters from overfishing (an important source of income for most people living in Sainte Luce), while also providing a sustainable livelihood and income.

Spiny lobster (Panulirus longipes) *being measured for Project Oratsimba.*

Project Oratsimba measures the catch effort, catch composition, the number of berried females (those with eggs), and those that are smaller than the national take size (20cm). The project has established a no-take zone off the coast of Manafiafy as a way to protect lobster stocks and is looking at how this no-take zone affects the local fishers. SCRP works with Oratsimba every Saturday morning, helping them to collect data as the lobster fisher pirogues come ashore. SCRP also helped the Oratsimba team to conduct their annual survey with the local communities, assessing how the actions of the project affect the lives of the people they work with.

In June of this year, SEED Madagascar partnered with Roehampton University to hold a festival celebrating marine cultural heritage and sustainable fishing in the Manafiafy community in Sainte Luce. The Festival of the Sea was used as a platform by Project Oratsimba to share information about lobster fishery management by local communities. The festival was run over four days and reached approximately 2,000 people. Authorities from the Ministry of Agriculture, Animal Husbandry and Fishing, the Ministry of Culture and Communications, and the Lobster Research Unit attended the festival. SCRP was involved with running the children education and activity sessions that celebrated marine life, with 200 children attending this from all three hamlets.

New Projects

Ala

Project Ala re-connects isolated remnants of the protected littoral forest fragment S8 through the planting of forest corridors. These remnants have historically been connected to the northern part of the S8 forest fragment but have been separated by land clearance for crops and zebu (cattle) grazing. The main purpose of planting the forest corridors is to connect the isolated populations of the three nocturnal lemur species found in the S8 remnants. These lemur species are reluctant to cross open ground and disperse into new habitats, meaning that these populations are currently isolated from each other. Reconnecting these populations through corridors will enable the populations to interbreed and will ultimately increase the amount of habitat available to individuals.

Project Ala started in early 2019 with the expansion of the nursery at the Sainte Luce camp site. Acacia (*Acacia mangium*) seeds were sown in the nursery in March and April, to be planted in the corridors once the land was obtained and cleared. Acacia is a non-native tree but is often used as a colonising plant because they can survive in a variety of conditions, is a nitrogen-fixing plant, and is fast-growing. The acacia, planted with a 3m spacing, will provide coverage in the bare land that is the corridor and will help native seedlings to grow. SCRP helped to collect the acacia seeds that were sown in the nursery, with over 2,000 seeds collected. SCRP has also been collaborating with the Project Ala team to collect the native pioneer trees that will be planted in the corridors in early 2020. To date, SCRP has collected 8,500 seeds from 17 different tree species.

The first of the four corridor sites was planted in July 2019. SCRP helped to clear the corridor and plant the seedlings with the help of short-term volunteers. Corridor 4 was planted in August and Corridor 3 was planted in November. The use of the land for Corridor 2 is still being negotiated, and there are plans to plant this last corridor in early 2020. Once cleared and planted, SCRP carries out all of the baseline and monitoring surveys for the project.

Baseline surveys on lemur abundance and herpetological abundance is conducted in the corridors. This is to determine whether there are any species using the corridors, and how this might change as the trees establish and grow over the years. These surveys are conducted in a similar manner to the rest of SCRP's herpetological and lemur work. Survival and growth monitoring of the planted trees are also carried out. The planted seedlings are measured, and their condition is assessed just after they have been planted, one month after planting, and then every three months afterward. Mortality rates of the planted acacia have been much lower than was estimated; a 50% mortality rate was estimated, but mortality rates of less than 20% have been measured for Corridors 1 & 4. After one month of planting, any dead acacia were replanted. Botanical surveys are also being conducted. SCRP set up two 10m by 10m quadrats, with one in the middle of the corridor and one in the southern end. All plant species within the quadrats and their coverage are recorded. This survey will be used to determine how the floral community changes over time as the corridor establishes. Invertebrate sampling is being conducted in the planted corridors, with 15-minute searches being conducted in three quadrats (set up in each corridor). Invertebrates are caught and identified (except for flying invertebrates) and are recorded. SCRP also conducts these surveys in the forest on either end of the corridor with the same method. This will be continued every month in each corridor to determine how species composition changes with the changing corridor habitat; from being bare/newly planted, to an established forest. This sampling will contribute to the overall biodiversity monitoring of this project.

SCRP have also set up transects in the four S8 remnants and have been conducting lemur and herpetofauna surveys over the past six months. The aim of these surveys is to determine the species that are present in the remnants so that it is known which populations will be potentially connected through the corridors.

Left: Babaly (local guide and land owner) planting acacia seedlings with Ala Forest Specialist, Sam. Right: Newly planted acacia seedling in Corridor 1.

Flying Foxes

Project Rufus focuses on the *in-situ* conservation of *Pteropus rufus* (the Madagascan flying fox) through community engagement and scientific research. *P. rufus* populations have been declining throughout the country due to hunting and deforestation. To mitigate these effects, in 2017, a 48ha exclusion zone was established in S6 as part of Project Rufus Phase I, protecting the only *P. rufus* colony in Sainte Luce. The exclusion zone is an area agreed upon by the community where logging and hunting are prohibited. The Sainte Luce colony was estimated to contain 130 individuals in 2016, a decline from an estimated 300-350 individuals in 2000.

SCRP have been collecting guano from the Sainte Luce *P. rufus* population to determine their role in seed dispersal of both native and non-native species. Guano is analysed and seeds collected for identification of the species that the flying foxes are consuming. Seeds from the forest are also collected from a number of different species to create a reference sample to aid identification. SCRP has identified that the fruit of Fihamy (*Ficus polita*), a native fig tree, makes up a large part of the *P. rufus* diet when the trees are fruiting.

SCRP have been conducting roost counts of the Sainte Luce population every two weeks for the past six months. The team splits into two at the colony to visit the two different sites and groups of roosting trees that the colony uses. Both flying and roosting bats are counted. Accurate estimates are difficult because some bats are concealed by trees, and sometimes the whole colony is in flight if there has been disturbance in the area that morning. However, initial results indicate that the population has rebounded from 2016, with roost counts suggesting the colony has reached approximately 300 bats again.

Left: A Pteropus rufus *roosting. Right: A group of* P. rufus *bats in flight.*

Mahampy

The *Lepironia articulate* (Mahampy) species is a herbaceous wetland plant that is utilised by local communities for weaving baskets, hats, and mats. Part of project Mahampy monitors the spatial distribution of the Mahampy wetland using remote sensing techniques to determine if the harvesting of Mahampy can be sustained under current practices.

SCRP has been using GPS units to gather coordinates for the Mahampy wetland areas. This information has been used to identify and 'ground-truth' the habitat types with remote sensing software. A map is currently being created that will show the extent of the wetlands.


Left: A Mahampy wetland in Sainte Luce. Right: Two women harvesting Mahampy for weaving.

Dragonflies

Work carried out in 2016 and 2017 by the SCRP team concerning the rediscovery of a dragonfly species has recently been published (Hyde Roberts et al., 2019). Five male individuals were caught around the Sainte Luce area and were positively identified as *Libellulosoma minutum*, a species that had not been seen since 1907. The female of this species has never been described.

Continuing this work, SCRP has been assessing dragonfly diversity in Sainte Luce. Past work was focused on capturing dragonflies within and around the forest fragments. This year, dragonflies are being sampled around Mahampy wetlands and the forest to determine whether there are any habitat preferences by different dragonfly species, and any differences in species composition. Habitats sampled have included degraded Mahampy wetlands that have a high harvesting rate, mixed Mahampy wetlands that have a low harvesting rate, and the degraded and protected forest fragments.


Left: Short term volunteers learning to identify dragonflies from Senior Research Assistant, Kashmir. Right: Libellulosoma minutum *male.*

Palms

At the end of 2018 and early 2019, SCRP reassessed the populations of two endangered palms: *Dypsis saintelucei* and *Becarriophoenix madagascariensis.* These two palm species have been used heavily in the past for constructing lobster pots. In 2011-12 the adult, sub-adult, and juvenile populations of *D. saintelucei* and *B. madagascariensis* were mapped by SEED Madagascar. These marked individuals were revisited recently to determine their survival, and potential causes of mortality. This information will be used to determine the potential persistence of the population, and the conservation actions that might need to be implemented to save these species. These data are currently being analysed and the manuscript is being written, with the aim to submit this work for publication in 2020.


The dypsis palm (Dypsis saintelucei).

Club Atsatsaky and Community Education

Club Atsatsaky, or Club A, is SCRP's conservation club for the children of Sainte Luce. Lessons are conducted twice a week, with one conducted in Ambandrika, and the other in Manafiafy. Both of these lessons are taught out of school time. The aim of this conservation club is to educate the children on the forest and everything that inhabits it. Lessons are taught about different projects, fauna, and flora. Attendance fluctuates between lessons, with class sizes ranging between 40-150.


Left: Short term volunteer Maria teaching the children songs. Right: Short term volunteers pretending to be insects as the Club A children form different parts of the tree and stop the insects from getting in.

During 2019, Club A covered a variety of different topics, with some of these having a project-based theme. Lessons were presented on Project Oratsimba, covering topics such as a lobster's lifecycle, and where sharks and rays live and why they are important for the ecosystem. Lessons were also given on Project Ala, explaining how deforestation negatively impacts wildlife, why corridors are important, and actions to mitigate climate change. Other topics also included the structure of trees, dung beetles, and the different patterns of butterflies. All lessons have a similar structure to try to engage the children as much as possible, with the lesson broken up with videos, activities, and games that are related to the topic.

In 2020, Club A will target slightly older students to build their capacity and knowledge and SCRP will conduct regular community information meetings to disseminate data about SCRP and project-related work, and any issues that may need to be raised by authorities, such as an increase in hunting. As hunting appears to be on the increase, SCRP is working with the local authorities and the forestry management units to discuss incidences and a wider community meeting has already been held where SCRP ran a session on the importance of birds and lemurs for the ecosystem and creating new forests for community use. The team and the local authorities found this meeting productive and SCRP will continue to work with the authorities in 2020 and bring more sessions to the community with a focus on young adults.

World Environment Day

In June, SCRP worked with the Project Ala team to engage 150 children for World Environment Day. Although the global theme for this year was "Air Pollution", as air pollution is not a large issue in Sainte Luce, children were taught about the importance of trees and the children's roles as guardians of the forest. The day began with a video on air pollution and why trees and forests are important. The children were split into two groups based on age, with 50 of the oldest children heading into the S9 forest fragment with SCRP and the local guides. The children drew different parts of trees and wrote down why they were an important part of the tree. The younger children stayed at the school and added their handprints to a pre-drawn tree trunk symbolising how the children are all part of the forest.

Left: Children adding their handprints to the tree to form the leaves. Right: The children that attended World Environment Day.

Other Biodiversity Studies

SCRP recently started conducting bird point counts to add to the data that were collected between 2014 - 2017. This will be used to confirm and add to the species list for the Sainte Luce area, and to look at potential guild diversity differences between the forest fragments.

SCRP has also started a new project looking at fungal diversity between different forest fragments. Although it is very difficult to identify fungi to species level, they can be identified to family level. SCRP is collecting data to identify the diversity of fungi within Sainte Luce, between different fragments, and to create an inventory of the different families present in the area.

Left: An interesting blue fungus found in the Sainte Luce littoral forest. Right: Short term volunteer, Tessa, searching for birds.

Future Directions

2020 will be another big year for SCRP. Project continuation of the lemur and herpetological transects will remain a primary activity of SCRP, with the last of the 10-year lemur dataset to be collected in December 2020. SCRP will continue working with the Project Ala team to collect information on the corridors and their effects on biodiversity, as well as helping to plant the final corridor, Corridor 2. SCRP will continue to visit the *Pteropus rufus* colony and conduct roost counts and guano collection. With the rainy season fast approaching, SCRP will continue surveying dragonflies in January and February of 2020. SCRP is also planning to bring in several new small projects to continue learning about the biodiversity in Sainte Luce.

Concluding Remarks

SCRP has carried out a variety of work in 2019, with many new projects starting. All the data collected for the palms project are now currently being analysed and produced into a manuscript. Project Ala officially started, and the research side of Project Rufus has recommenced in preparation for the project starting officially in 2020. There have been many small biodiversity projects introduced by the SCRP team, such as bird point counts, invertebrate sampling in the Ala corridors, creating a fungi inventory, and dragonfly diversity surveying. The team has also expanded on herpetofauna and lemur transect surveys to include the S8 remnants and corridors. SCRP is looking forward to 2020 and continuing to expand our work and research.

Citations for 2019 Publications – SCRP's Work

- Hyde Roberts, S., Barker, L., Chmurova, L., Klaas-Douwe, B., Dijkstra., Schütte, K. (2019). Rediscovery of *Libellulosoma minutum* in the littoral forests of southeast Madagascar (Odonata: Corduliidae). *Notulae odonatologicae 9*(4): 125-133.
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- Scherz, M.D., Hutter, C.R., Rakotoarison, A., Riemann, J.C., Rödel, M-O, Ndriantsoa, S.H., Glos, J., Hyde Roberts, S., Crottini, A., Vences, M., Glaw, F. (2019). Morphological and ecological convergence at the lower size limit for vertebrates highlighted by five new miniaturised microhylid frog species from three different Madagascan genera. *PLoS ONE 14*(3): e0213314.