Association Vahatra

Annual Report for 2021

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Gastrorchis pulchra – © Vahatra

Cinnyris sovimanga – © Vahatra

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A MESSAGE FROM THE PRESIDENT OF VAHATRA, ACHILLE P. RASELIMANANA, PROFESSEUR TITULAIRE

After two successive years of anguish in the shadow of the Covid-19 pandemic, living and working in greater serenity during the year 2021 was everyone's wish and with the hope of catching up with much that could not be done in 2020. Unfortunately, the situation has only worsened in 2021, despite the precautions taken at a previously non-imaginable scale to prevent the spread of the disease and the associated vaccination efforts. The impacts of Covid-19 are multiple not only in the domains of health and work, but also redirecting the life and dynamics of society in general, as well as local and international communities. With the worry of being contaminated, fear and panic reign everywhere and people are afraid of being in contact with their friends and even families. Superimposed on this is the many individuals that fell sick and worse those that succumbed to the virus. It is a total psychosis. Life has slowed down and hovers in limitless anxiety, without anyone being able to say how and when it will end. Here in Madagascar associated with the lack of clear dissemination of information, the situation is largely unknown concerning the prevalence of the disease in Malagasy society and the number of deaths; at the time of writing this message only about 3% of the population of Madagascar has being vaccinated.

However, we realize that this is not a time for the lighthearted, that is to say to give up hope. Learning to live with the prevailing situation is the best strategy to cross this difficult period. It is in this spirit of harmonizing the way of life, even given the existing conditions, that the Association Vahatra has been able to advance with some level of serenity through the year 2021. The members and students affiliated with the association have been 100% fully vaccinated, some already with boosters, and taking the needed precautions in social contexts to protect better one other and with the intent to complete what was planned to be accomplish in 2021.

Thus, despite the difficulties and uncertain conditions in which we had to work, the association was able to make numerous important achievements. (Please see different portions of this annual report for further details.) These include, for example, large-scale biological inventories, as part of the BIOCOM project in collaboration with UNESCO with funding from The Korea International Cooperation Agency (KOICA) that were carried out in the protected areas of Montagne des Français in March and in the Marojejy in October and November. In addition, this year we were able to launch an ambitious new project with funding from Save the Rainforest Sweden that aims to support the efforts to conserve the Ambohitantely protected area via three different axes: research on aquatic insects; ecological restoration, including a the large-scale installation of firebreaks surrounding the remaining forests; and the establishment of a multifunctional biological station. The Ambohitantely project illustrates the association's desire to have a broad approach to its interventions directly needed to the management and protection of biodiversity, in addition to what we have been doing for many years concerning research, dissemination of information on the island's biodiversity, and human capacity building. Taken together these different aspects help to advance the national perspective on the importance of science and train a whole range of young Malagasy scientists, which in the end is to protect the natural patrimony of the island.

In addition, the Madagascar Protected Areas portal is up and functioning (see https://protectedareas.mg/) and a revised version of the three volume titanic project *The Terrestrial Protected Areas of Madagascar: Their History, Description and Biota* published by Vahatra in 2018 is now in e-book form (see http://www.press.uchicago.edu/ucp/books/publisher/pu3431914_3431915.html). In addition, despite a range of Covid-19 restrictions, the staff and students associated with Vahatra presented an HDR memoir, two PhD thesis, and five Masters, as well as a large assortment of scientific articles being published or submitted. Admittedly, the current world health crisis is a nightmare for any institution whatever their field of intervention, but accepting to live with the current situation and finding other solutions to overcome the challenge is the only way forward. Let us hope that with the experiences already lived during this past fateful year, we will all be able to face 2022 with a new and positive perspective and with more hope for the future. Good luck to all because with a valiant heart nothing is impossible!

LONG-TERM GOALS

The long-term goals of Association Vahatra are to advance Malagasy scientists, in particular graduate students within the university system, as well as other members of the national conservation biology community, and make substantial advances in understanding the island's unique biota. Our sincere intent is to put in place an organization with a long-term future and broad vision. A critical aspect to mention is that we have created this vision largely based on the scientists and students working with the association, and, hence, distinctly Malagasy in prospective. This is in comparison, for example, to large international organizations that might not necessarily have the interests of Madagascar as their principal point of perspective. This aspect is fundamental for the long-term strength of the association, since members are engaged and committed by their own conviction concerning the study and conservation of their natural heritage.

The seed was planted for Association Vahatra over three decades ago in the context of a project organized by WWF-Madagascar, put in place by Olivier Langrand, Sheila O'Connor, and the late Martin Nicoll, and known as The Ecology Training Program (ETP). Steve Goodman and Achille

Raselimanana were the coordinators of the project for over a decade, during which several generations of graduate Malagasy students finished their higher degrees within the university system in animal and conservation biology. Many of these people are amongst the major actors in the current Malagasy conservation community within different sectors. Some of these individuals are now responsible for the advancement of new generations of national field biologists in at least three different manners: 1) lecturers and professors within the national university system, as well as private universities, 2) active scientific members of the Vahatra staff or eminent researchers, and 3) playing important roles and holding key positions in the non-governmental and governmental sectors. Association Vahatra places strong emphasis on capacity building and continues this tradition and the body of well-trained nationals continues to grow, as well as the dissemination of information to the scientific community and the Malagasy public in general.

VAHATRA – PERMANENT STAFF

1. Professor Achille P. Raselimanana (raselimananaachille@gmail.com) – President of Vahatra and Professor, Mention Zoologie et Biodiversité Animale, Université d'Antananarivo. Founding member. Achille was in the first generation of ETP graduates (see above text under long-term

goals) and did his DEA and Ph.D. in the context of this program. In 2011, he presented his "Habilitation à Diriger des Recherches" (HDR) at the Université de La Réunion, which is the highest scientific degree in the French university system. Achille is a herpetologist with considerable experience in aspects ranging from field studies, classical taxonomy to molecular systematics. Before the creation of Association Vahatra, he held for nearly a decade the position of Biodiversity Program Officer for WWF-Madagascar. In 2018, Achille was named "Professeur titulaire" by the Ministère de l'Enseignement Supérieur et de la Recherche Scientifique.

2. Dr. Marie Jeanne Raherilalao (jraherilalao@gmail.com) – Co-editor of the journal *Malagasy Nature* and books published by Vahatra and Professor, Mention Zoologie et Biodiversité Animale, Université d'Antananarivo. Founding member. Marie Jeanne did her Ph.D. associated with the ETP (see above text under long-term goals) and recently presented her HDR at the Université d'Antananarivo (see below under "Person in focus"). She works on bird ecology, biogeography, and systematics.
3. Dr. Voahangy Soarimalala (voahangysoarimalala@gmail.com) – Scientific Coordinator at Vahatra; Head Museum Curator, Mention Zoologie et Biodiversité Animale, Université d'Antananarivo; and Professor, Université de Fianarantsoa. Founding member. Voahangy did her DEA and Ph.D. in association with the ETP (see above text under long-term goals). Voahangy is a mammalogist with a particular interest in rodents and tenrecs. She was elected in 2018 as the College President, Université de Fianarantsoa.
4. Professor Steven M. Goodman (sgoodman@fieldmuseum.org) – Scientific Advisor and Vice President at Vahatra; co-editor of the journal *Malagasy Nature* and books produced by Vahatra; and Docteur Honoris Causa, Université d'Antananarivo. Founding member. Steve works on both mammals and birds. He holds the post of MacArthur Field Biologist, Field Museum of Natural History, Chicago, and is based in Madagascar most of the year.
5. Mrs. Sabrina Raharinirina (msraharinirina@gmail.com) – Financial & Administration Manager. Sabrina joined the association in October 2015.
6. Mr. Rachel Razafindravao called "Ledada" – logistic coordinator. Ledada started working with the ETP some 29 years ago and transferred to Vahatra in October 2007. He has helped organize logistics for hundreds of field missions to some of the remotest areas on Madagascar.
7. Mrs. Sandra Ratsirahaingotiana – domestic help. She has worked with Vahatra since May 2016.
8. Mr. Elisa Malaimbohitsy, Mr. Mara Avisoa, and Mr. François Tsitindria – guardians.

VAHATRA'S BOARD OF DIRECTORS

In order to provide needed guidance and counseling for the current and future Vahatra programs, a Board of Directors has been named, which includes the following individuals:

Malagasy nationals

1. Professor Daniel Rakotondravony – A retired Professor from the Mention Zoologie et Biodiversité Animale, Université d'Antananarivo.
2. Nanie Ratsifandrihamanana – Country Director, WWF-Madagascar.
3. General Guy Ratrimoarivony – A retired Général de Corps d'Armée, Director of Strategy Seminar, Center for Diplomatic and Strategic Studies.
4. Chantal Andrianarivo – Former Head of Research and Biodiversity, Madagascar National Parks and now Technical Advisor at Indian Ocean Commission (Mauritius).
5. Professor Joelisoa Ratsirarison – Département des Eaux et Forêts de l'Ecole Supérieure des Sciences Agronomiques, Université d'Antananarivo and ex-Vice President of The University of Antananarivo in Charge of International Relations.
6. Jean Chrysostome Rakotoary – Ex-General Director of the Office National pour l'Environnement (ONE).
7. Professor Raoelina Andriambololona – Retired General Director of the Institut National des Sciences et Techniques Nucléaires (INSTN), Université d'Antananarivo, and Member of the Malagasy Academy.

Foreign members

1. Professor Jörg U. Ganzhorn – Professor, Tierökologie und Naturschutz, University of Hamburg.
2. Paul Goodman – Principal, Kingfisher Group.
3. Olivier Langrand – Executive Director, Critical Ecosystem Partnership Fund (CEPF).
4. Michael Polsky – President, Invenergy.

STUDENTS

As capacity building for the next generations of national field and conservation biologists is at the core of Association Vahatra activities, we work directly with Malagasy students registered within the national university system and following different types of higher diplomas: License, Master's II or Ph.D. degrees. The association continues to support financially some students as Post-docs. In recent years, the Malagasy national university has shifted from the classical French scheme to that of an Anglophone License-Masters-Doctorate (LMD) system. Further, the scientific members of Vahatra are also in contact with many other Malagasy students as secondary advisors or members of thesis and other types of mentoring committees. We make a dedicated effort to work with graduate students in universities outside of the capital city of Antananarivo, including the former provincial capitals of Antsiranana, Toliara, Fianarantsoa, Toamasina, and Mahajanga, as well as regional universities. In addition, Vahatra scientists advise many other Malagasy students on aspects of their research, access to literature based on the fine library housed at our office, and other forms of mentorship. Furthermore, several Ph.D. candidates working with other institutions or NGOs frequently request Vahatra scientists to be members of their graduate study committees.

Since Vahatra open its doors in late 2007, something approaching 2516 different student and research visitors not directly part of the association's mentoring program have visited the office to use the library facilities or consult with the scientific staff. (These figures are based on a sign-in notebook for arriving library users.) In 2021, despite the problem of Covid-19, over 46 different students and researchers from different faculties (science, agronomy, veterinary medicine, etc.) of national and private universities visited our library and hundreds of documents (books, reprints, theses, etc.) were consulted. As the Vahatra office was closed for several months in 2021 associated with lockdown measures in Antananarivo, the number of people visiting the library was reduced, as well as a distinct tendency for many students and researchers to access online documents.

Malagasy students passing through the Vahatra program have considerable success finding permanent jobs within the national governmental and non-governmental sectors. In many cases, these posts are in domains related to biology and conservation, for example, university appointments, working within NGOs, associated with the Madagascar National Parks, etc. Some of the former students hold key posts, for example, in different managerial capacities, such as at UNESCO, mining companies, Ministry of Higher Education and Scientific Research, and Ministry of the Environment and Sustainable Development. Hence, one of the mandates of the association, to

advance science and conservation on Madagascar with focused mentorship of graduate students, is indeed meeting the intended expectations. A good example of this is that numerous Vahatra graduates have obtained university appointments, providing an even greater means to advance capacity building for Malagasy field and conservation biologists. Below is the list of 2021 graduate students working on Licence, Master's II, and Ph.D. degrees under the direction of Vahatra scientists, as well as those currently in preparation. After receiving their higher degrees from the university in collaboration with Association Vahatra scientists, these well-trained young researchers are for the most part dynamic and with long-term visions, capable of designing and implementing research projects, and obtaining associated funding.

Graduate diplomas presented in 2021 or in preparation

As can be seen from the following lists, the scientific members of Vahatra are actively involved in the advancement of Malagasy graduate students. We consider this one of the hallmarks of the organization. Further, we encourage students to publish the results of their scientific work (see below, "Scientific outputs of Vahatra during 2021") and take their rightful place in the international scientific community.

A) Licence, Master's, Ph.D., and HDR diplomas presented by student members of Association Vahatra or staff members of Vahatra and under the direction of Vahatra scientific members

1. Rafanomezanjanahary, J. M. 2021. Distribution écologique des chauves-souris aux environs du bas versant du Parc National de Marojejy. Mémoire pour l'Obtention du Diplôme de Master, Mention Zoologie et Biodiversité Animale, Université d'Antananarivo.
2. Raherilalao, M. J. 2021. Concilier la recherche, le renforcement de capacité et l'appui à la gestion et à la conservation de la biodiversité malgache : aperçu via l'évaluation éco-biologique des oiseaux malgaches. Mémoires d'Habilitation à Diriger des Recherches, Université d'Antananarivo.
3. Raolihanintrasina, S. E. 2021. Etude de la biologie et du régime alimentaire de l'oiseau invasif, *Passer domesticus* (PLOCEIDAE) dans la ville de Toamasina, Madagascar. Mémoire pour l'Obtention du Diplôme de Master, Mention Zoologie et Biodiversité Animale, Université d'Antananarivo.
4. Raobson Hanitrandrasana, E. 2021. Distribution et statut de la population des corbeaux familiers (*Corvus splendens*, Corvidae) dans les villes portuaires de Madagascar. Mémoire pour l'Obtention du Diplôme de Master, Mention Zoologie et Biodiversité Animale, Université d'Antananarivo.
5. Rasoanoro, M. 2021. Etude des parasites sanguins des petits mammifères de Madagascar. Thèse pour l'Obtention du Diplôme de doctorat, Mention Zoologie et Biodiversité Animale, Université d'Antananarivo.
6. Rasoarimanana, R. T. 2021. Structure et distribution écologique de la communauté herpétofaunique du Parc National de Marojejy, Nord-est de Madagascar. Master en Biologie de la Conservation Animale, Université d'Antananarivo.
7. Rasolonjatovo, S. M. 2021. Phylogéographie et génétique des populations de *Mantidactylus bellyi* Mocquard, 1895 au niveau de la Montagne d'Ambre, Nord de Madagascar. Thèse de Doctorat, Faculté des Sciences, Université d'Antananarivo.
8. Todilahy, L. J. 2021. Régime alimentaire et structure sociale de *Mops leucostigma* (Chiroptera : Molossidae), durant la saison humide au sein de la station forestière d'Ivoloina, région Atsinanana. Mémoire de Master, Mention Zoologie et Biodiversité Animale, Université d'Antananarivo.

B) License, Master, Ph.D., and HDR diplomas defended with implication of Vahatra scientists as a supervisor, lecture committee member or jury member

1. Ahmed Abdou, A. 2021. Diversité des écosystèmes terrestres de La Grande Comore et invasion par les plantes introduites : état des lieux, régénération sur coulées de lave et comparaison avec les îles du Sud-Ouest de l'océan Indien. Thèse de doctorat en Biologie des populations et écologie, Université de La Réunion.

2. Andriamihaja, F. C. 2021. Caractérisation des espèces aphylles du genre *Vanilla* endémiques de Madagascar en vue de leur conservation. Thèse de Doctorat, Cotutelle Ecole Doctorale Sciences, Technologie et Santé, Université de La Réunion et Ecole Doctorale Sciences de la Vie et de l'Environnement, Université d'Antananarivo.
3. Andriamihanta, L. 2021. Contribution à l'étude d'impact des feux de brousse sur la population de *Furcifer oustaleti* dans le Parc National d'Isalo. Mémoire de Licence, Institut des Sciences et Techniques de l'Environnement, Université de Fianarantsoa.
4. Rabarisoa, R. 2021. Evaluation de la population et identification des habitats préférentielles du Héron crabier blanc, *Ardeola idae* (Hartlaub, 1860) en vue de sa conservation à Madagascar. Thèse de doctorat, Faculté des Sciences, Université d'Antananarivo.
5. Rabearivony, J. 2021. Caméléons : indicateurs environnementaux, outils de la conservation. Mémoires d'Habilitation à Diriger des Recherches, Université d'Antsiranana.
6. Rabekoronana, S. V. 2021. Contribution à l'étude des impacts du feu sur la population de *Coua cristata* dans zone de protection Beraketa Malio, Parc National Isalo. Mémoire de Licence, Institut des Sciences et Techniques de l'Environnement, Université de Fianarantsoa.
7. Rafanomezantsoa, N. F. 2021. Contribution à la connaissance des impacts du feu de brousse sur *Lemur catta* dans le Parc National Isalo. Mémoire de Licence, Institut des Sciences et Techniques de l'Environnement, Université de Fianarantsoa.
8. Ranaivoson, H. C. 2021. Les microparasites du sang des chiroptères frugivores (Pteropodidae) de Madagascar et de leurs ectoparasites hématophages : identification moléculaire et caractérisations écologiques. Thèse de doctorat, Ecole Doctorale Sciences de la Vie et de l'Environnement, Zoologie et Anthropologie Biologique, Université d'Antananarivo.
9. Rasambahita, I. L. 2021. Contribution à l'étude du comportement et des habitats de *Propithecus verreauxi* en vue de la réintroduction dans le site Namaza, Parc National Isalo. Mémoire de Licence, Institut des Sciences et Techniques de l'Environnement, Université de Fianarantsoa.
10. Rasolonjatovo, S. M. 2021. Phylogéographie et génétique des populations de *Mantidactylus bellyi* Mocquard, 1895 au niveau de la Montagne d'Ambre, Nord de Madagascar. Thèse de Doctorat, Faculté des Sciences, Université d'Antananarivo.
11. Raveloson, L. 2021. Analyse des facteurs de croissance de la population de la Buse de Madagascar *Buteo brachypterus* (Hartlaub, 1860) dans l'aire protégée de Bemanevika, District de Bealanana, Région Sofia. Thèse de Doctorat, Ecole Doctorale Biodiversité et Environnements Tropicaux, Université de Toliara.
12. Ravelotafita, S. S. O. 2021. Rôle de l'écrevisse marbrée, *Procambarus virginalis* (Cambaridae), sur le contrôle de la bilharziose intestinale de l'homme. Master en Biologie de la Conservation Animale, Université d'Antananarivo.
13. Razafimanjato, G. 2021. Modèle type de gestion communautaire des zones humides: Cas du complexe Tsimembo Manambolomaty, ouest de Madagascar. Mémoire d'Habilitation à Diriger des Recherches de l'Ecole Doctorale Biodiversité et Environnements Tropicaux, Université de Toliara.
14. Razafindrazaka, D. F. A. 2021. Contribution à l'étude de la population et préférence en habitat de *Monticola sharpei* dans la forêt d'Andranonombilahy, Parc National Isalo. Mémoire de Licence, Institut des Sciences et Techniques de l'Environnement, Université de Fianarantsoa.
15. Réné De Roland, A. 2021. Analyse spatio-temporelle de la distribution et structure de la communauté des caméléons dans les aires protégées de Bemanevika et de Maimborondro, Hautes terres du nord de Madagascar. Thèse de Doctorat. Ecole Doctorale Biodiversité et Environnements Tropicaux, Université de Toliara.
16. Zaonarivelo, J. R. 2021. La génétique de la conservation comme un outil pour la préservation de la Biodiversité ; cas des lémuriens *Indri indri* (Gmelin, 1788) et *Propithecus perrieri* (Lavauden, 1931. Mémoires d'Habilitation à Diriger des Recherches, Université d'Antsiranana.

C) Licence, Master's, Ph.D., and HDR diplomas in preparation in direct collaboration with scientific members of the Associated Vahatra

1. Falimiarintsoa, D. In preparation. Distribution écologique des chauves-souris aux environs du Sud-ouest du Parc National de Marojejy, Antsiranana. Mémoire de Master, Gestion Biologique pour la Protection de l'Ecosystème, Faculté des Sciences, Université d'Antsiranana.
2. Manana, C. In preparation. Variation altitudinale du régime alimentaire des chauves-souris insectivores du Parc National de Marojejy. Mémoire de Master, Gestion Biologique pour la Protection de l'Ecosystème, Faculté des Sciences, Université d'Antsiranana.
3. Nomenjanahary, Z. B. In preparation. Paleobiologie, paléoécologie et paléoenvironnement d'*Alopochen sirabensis* (Aves : Anseriformes : Anatidae). Thèse de Doctorat, Faculté des Sciences, Université d'Antananarivo.
4. Radovimiandrinifarany, H. T. R. In preparation. Etude éco-biologique et lutte contre les rongeurs exotiques nuisibles dans la Commune Rurale d'Analavory Itasy, Madagascar. Thèse de Doctorat, Faculté des Sciences, Université d'Antananarivo.
5. Raherisoa, M. N. A. In preparation. Contribution à l'étude de la population et l'habitat de *Tachybaptus pelzelnii* à Andilana Atsimo, Lac Alaotra. Mémoire de Licence, Institut des Sciences et Techniques de l'Environnement, Université de Fianarantsoa.

6. Ranaivoson, T. N. In preparation. Diversité, écologie et ectoparasites chez les petits mammifères de la forêt humide sempervirente, des écotones et des milieux anthropiques de la Région de Mandena – Marojejy, Madagascar. Thèse de Doctorat, Faculté des Sciences, Université d'Antananarivo.
7. Rasolobera, F. In preparation. Etude bio-écologique des Tenrecidae, diversité et distribution altitudinale des petits mammifères terrestres dans le Parc National de Marojejy, Nord-Est de Madagascar. Thèse de Doctorat, Faculté des Sciences, Université d'Antananarivo.
8. Rasolonjatovo, H. A. M. In preparation. Histoire, taphonomie, et paléoécologie des oiseaux subfossiles du Parc National de Tsimanampesotse, Sud-ouest de Madagascar. Thèse de Doctorat, Faculté des Sciences, Université d'Antananarivo.
9. Razafimanantsoa, S. T. M. I. In preparation. Effet de versant sur les communautés d'oiseaux des parties est et ouest des trois massifs forestiers : Marojejy, Anjanaharibe-Sud et Andringitra, Madagascar. Mémoire de Master, Mention Zoologie et Biodiversité Animale, Université d'Antananarivo.
10. Razafimandimby, J. L. In preparation. Structure de la communauté de petits mammifères du Parc National de Marojejy. Mémoire de Master, Mention Zoologie et Biodiversité Animale, Université d'Antananarivo.

VAHATRA MEMBERS AS REVIEWERS OF PAPERS SUBMITTED TO SCIENTIFIC JOURNALS

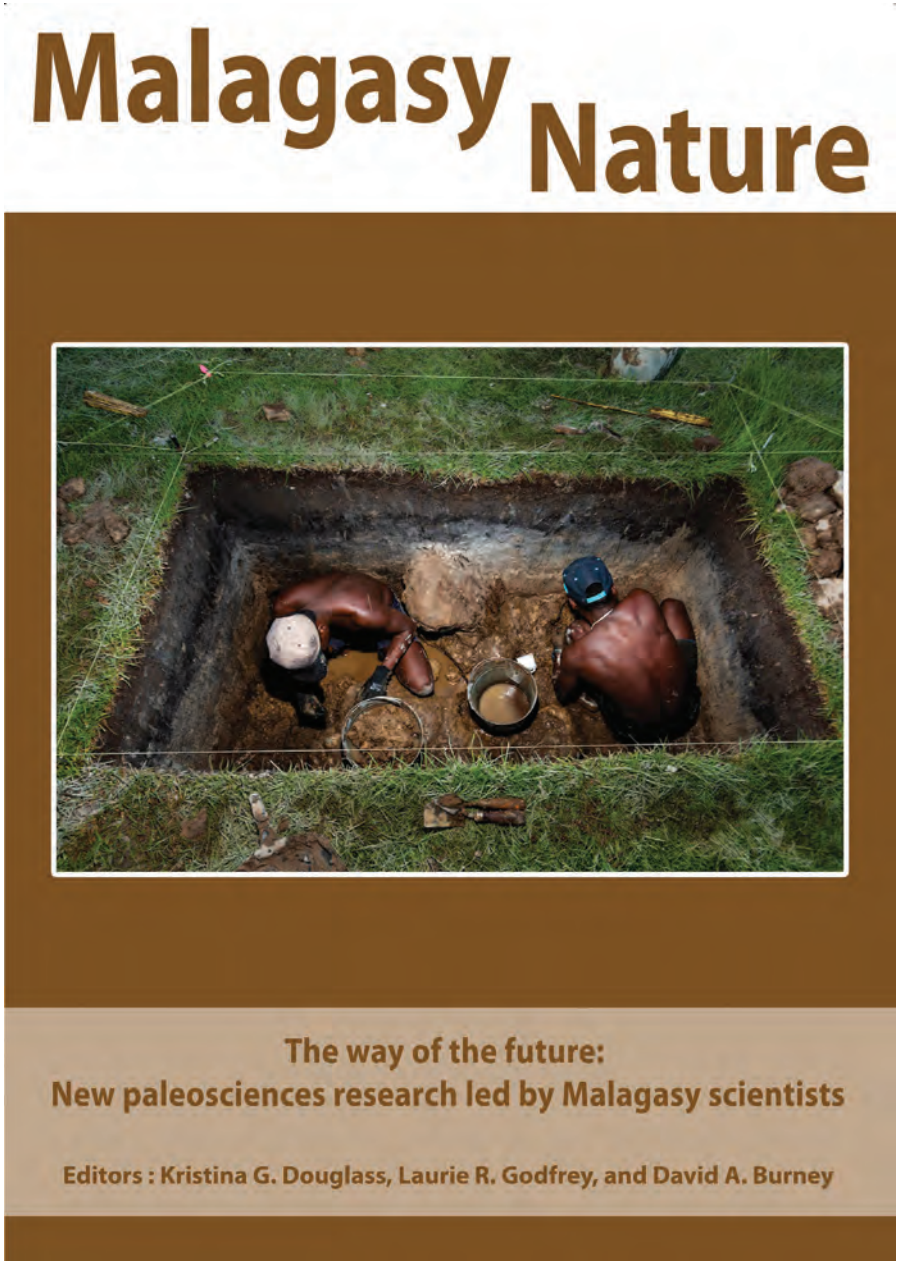
As an indication of the role of Association Vahatra scientists play in the realm of published scientific papers, they served in 2021 as reviewers for papers submitted to the following international journals:

- *Acta Chiropterologica*
- *Agroforestry Systems*
- *Biological Conservation*
- *Biology Letters*
- *Ecohealth*
- *Ecosphere*
- *Environmental Conservation*
- *Forests*
- *Frontiers in Conservation*
- *Frontiers in Ecology*
- *Journal of Mammalogy*
- *Malagasy Nature*
- *Mammalia*
- *Parasite Epidemiology and Control*
- *Tropical Zoology*

MALAGASY NATURE

Our intention with the scientific journal *Malagasy Nature*, published by Association Vahatra and online with free download, is to advance peer-reviewed papers at high scientific and technical standards. As the review has an International Standard Serial Number (ISSN) number, it is an international scientific journal. Manuscripts in French or English are passed through an editorial team, including a review process of international norms. We work closely with Malagasy authors, particularly graduate students and young researchers, to help them understand the process of composing, writing, and editing scientific articles. In many cases, the first publication of a researcher poses considerable hurdles and the editorial staff of *Malagasy Nature* provides the means for these less experienced scientists to negotiate such problems. Based on this approach, this outlet plays an important role in regional capacity building, which in turn separates it from other international journals, for which the editors and associated editorial committee are not readily available to help at the same levels with manuscript submission and revisions. Further, the journal allows Malagasy scientists to return information to the worldwide scientific world. All of these aspects together, provide professional advancement for the Malagasy scientific community, specifically a certain sense of responsibility and for national authors to understand the importance of invested efforts when producing scientific articles. As a further point of explication, several researchers preparing their theses or professors working on their HDR diplomas submit articles to *Malagasy Nature* as they understand that when needed or appropriate they will get assistance from the editorial team to improve their manuscripts. The on-line publication of the journal also guarantees the local availability of research results in the fields of ecology and biology conducted on Madagascar and neighboring islands, as compared to foreign scientific journals with copies or electronic files not readily downloadable or repatriated to Madagascar. All numbers of the journal are available online and with free access (http://www.vahatra.mg/malagasynaturefr.html).

Marie Jeanne Raherilalao and Steven M. Goodman are the co-editors of *Malagasy Nature* and several associated editors assist in different aspects with submitted manuscripts. At least one volume of the journal is published each year. The editorial board of *Malagasy Nature* is composed of both national and international scientists, from the Anglophone and Francophone worlds, made up of the following individuals:



A special issue of the journal, Volume 15, dedicated to advances in the field of paleosciences by Malagasy researchers and students, was published in late 2021 and all pdf versions are downloadable for free at http://www.vahatra.mg/volume15.html. Different articles have appeared in the overseas press about this special issue (see https://www.umass.edu/news/article/anthropologys-laurie-godfrey-co-edits-all-indigenous-researcher-edition-malagasy and https://www.psu.edu/news/impact/story/bringing-disciplinary-diversity-western-dominated-research/). The 2021 volume includes the following papers:

Volume 15 (2021)

- **Foreword** — Jonah Ratsimbazafy
- **Introduction: The way of the future — new paleosciences research led by Malagasy scientists** — Kristina Douglass, Laurie R. Godfrey & David A. Burney
- **Applying human niche construction theory to study settlement choice in southwest Madagascar, 16th-19th centuries CE** — Tanambelo Rasolondrainy
- **Nontrivial responses of vegetation to compound disturbances: A case study of Malagasy grasslands** — Tanjona Ramiadantsoa & Cédrique L. Solofondranohatra
- **Adaptation of subsistence strategies of the southwestern Malagasy in the face of climate change** — Estelle Razanatsoa, Malika Virah-Sawmy, Stephan Woodborne, Caitlyn Callanan & Lindsey Gillson
- **The Malagasy monsoon over the Holocene: A review from speleothem $\delta^{18}O_c$ records** — Ny Riavo G. Voarintsoa
- **Paleoecological evidence for late Holocene aridification from the Taolambiby subfossil site of southwestern Madagascar** — Francine Mirya Ramarolahy, David A. Burney & Laurie R. Godfrey
- **Description of the subfossil crocodylians from a new Late Pleistocene subfossil site (Tsaramody, Sambaina Basin) in central Madagascar** — Ravoniaina Rakotozandry, Lovasoa Ranivoharimanana, Voajanahary Ranaivosoa, Nadia Rasolofomanana, Evon Hekkala & Karen E. Samonds
- **Comparing the paleoclimates of northwestern and southwestern Madagascar during the late Holocene: Implications for the role of climate in megafaunal extinction** — Peterson Faina, Stephen J. Burns, Laurie R. Godfrey, Brooke E. Crowley, Nick Scroxton, David McGee, Michael R. Sutherland & Lovasoa Ranivoharimanana
- **Subfossil birds from a submerged cave in southwestern Madagascar** — Harimanjaka A. M. Rasolonjatovo, Kathleen M. Muldoon, Lovasoa Ranivoharimanana, Mamy Rakotoarijaona & Steven M. Goodman
- **The growth and development of *Pachylemur*, a large-bodied Lemuridae** — Noromamy J. Rahantaharivao, Laurie R. Godfrey, Gary T. Schwartz, Stephen King & Lovasoa Ranivoharimanana
- **The stories people tell, and how they can contribute to our understanding of megafaunal decline and extinction in Madagascar** — Eva Stela Nomenjanahary, Benjamin Z. Freed, Luke J. Dollar, Jeannot Randrianasy & Laurie R. Godfrey

The next issue of *Malagasy Nature* to be published in 2022 will be a general volume with an assortment of unrelated scientific papers.

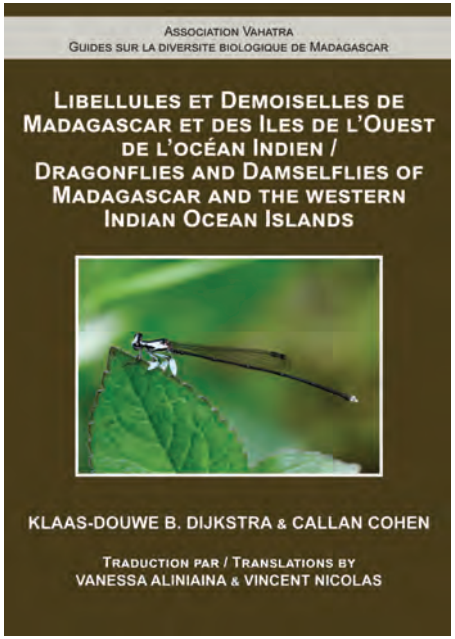
THE PUBLISHING HOUSE OF ASSOCIATION VAHATRA

The year 2011 marked an important advancement for Association Vahatra with the creation of its own publishing house, focusing on a series entitled "Guides sur la diversité biologique de Madagascar" [Guides to the biological diversity of Madagascar]. For individuals that grew up over the past 40 years in, for example, North America, portions of Latin America or western Europe, information on regional plants and animals are readily available in field guide format. These types of books, generally presented by taxonomic group (e.g. ferns, reptiles, birds, etc.) and region, revolutionized making information on biodiversity available and penetrable for members of different age and social groups in different regions of the world. Such guides provide the means for individuals to become familiar with different plants and animals found in areas where they live or travel, and, most critically, integrating this familiarity into how they perceive the importance of the natural world. It is not an exaggeration to state that these types of guides have led to the "greening" of different sectors of society in numerous countries. For Madagascar, which is so rich in biological diversity and being one of the world's principal tropical conservation priorities, the largely previous lack of such books created a considerable void, which Association Vahatra strongly believes needed to be filled.

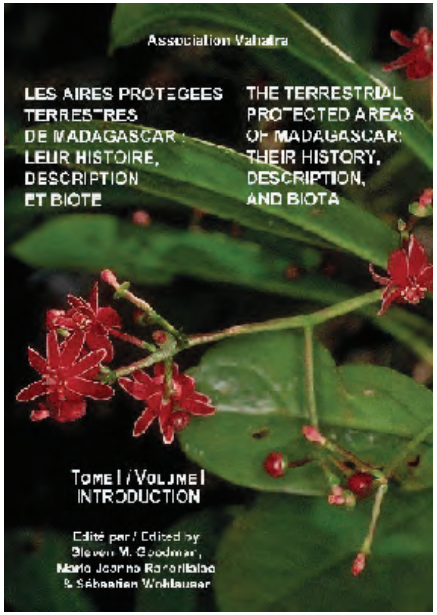
Since 2011, nine books have been published in the series, which is edited by Marie Jeanne Raherilalao and Steven M. Goodman and designed and typeset by Madame Malalarisoa Razafimpahanana:

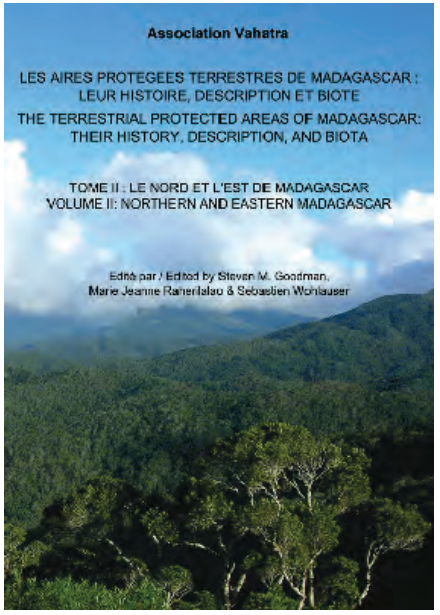
1. *Les chauves-souris de Madagascar* [The bats of Madagascar] by Steven M. Goodman, 2011, 129 pp.
2. *Les petits mammifères de Madagascar* [The small mammals of Madagascar] by Voahangy Soarimalala & Steven M. Goodman, 2011, 176 pp.
3. *Histoire naturelle des familles et sous-familles endémiques d'oiseaux de Madagascar* [The natural history of the families and subfamilies of endemic Malagasy birds] by Marie Jeanne Raherilalao & Steven M. Goodman, 2011, 146 pp.
4. *Les Carnivora de Madagascar* [The Carnivora of Madagascar] by Steven M. Goodman, 2012, 158 pp.

5. *Les animaux et écosystèmes de l'Holocène disparus de Madagascar* [The extinct Holocene animals and ecosystems of Madagascar] by Steven M. Goodman & William L. Jungers, 2013, 249 pp.
6. *Les amphibiens des zones arides de l'Ouest et du Sud de Madagascar* [The dry forest amphibians of western and southwestern of Madagascar] by Franco Andreone, Gonçalo M. Rosa & Achille P. Raselimanana, 2014, 180 pp.
7. *Les amphibiens du Nord de Madagascar* [*The amphibians of northern Madagascar*] by Franco Andreone, Angelica Crottini, Gonçalo M. Rosa, Andolalao Rakotoarison, Mark D. Scherz & Achille P. Raselimanana, 2018, 355 pp.
8. *Fourmis de Madagascar : Un guide pour les 62 genres* / *Ants of Madagascar: A guide to the 62 genera* (a bilingual French-English book) by Brian Fisher & Christian Peeters, 2019, 253 pp.
9. *Libellules et demoiselles de Madagascar et des Iles de l'Océan Indien occidentale* / *Dragonflies and damselflies of Madagascar and the western Indian Ocean Islands* (a bilingual French-English book) by K. D. Dijkstra & Callen Cohen, 2021, 194 pp.



The production of the first three books in the series was financed by a grant from the Critical Ecosystem Partnership Fund (CEPF). Subsequently, a generous gift from the Ellis Goodman Family Foundation and Paul Goodman (not at all related with Steve Goodman) allowed additional guides in the series to be published. To date, other than free or at production costs diffusion of Vahatra Press books to Malagasy students and scientists, numerous copies have been sold to people coming to the Vahatra office, at different fairs in Antananarivo, and through overseas booksellers. We are pleased with the interest these books have generated, which includes seeing young Malagasy students and naturalists, as well as tourists, carrying and consulting the books on field trips to different forested areas. Further, these books are important resources for national students and researchers, as well as reference works for different university courses. The University of Chicago Press is responsible for the distribution of Vahatra books (see http://www.press.uchicago.edu/ucp/books/publisher/pu3431914_3431915.html) in the New World and Europe, which also include the *Atlas of selected vertebrates of Madagascar* published in late 2013, as well as *Les aires protégées terrestres de Madagascar : leur histoire, description et biote* / *The terrestrial protected areas of Madagascar: Their history, description, and biota* released in March 2018.





A new ecotourism guide series to be published by Association Vahatra in collaboration with Madagascar National Parks

The extraordinary levels of animal and plant species diversity on Madagascar, including high levels of endemism, are well known worldwide, as is the heavy burden of anthropogenic pressures, making the island one of the world's most important "hotspots". Association Vahatra is of the view that one important way to ameliorate the current situation is through education and dissemination of information, with two different axes:

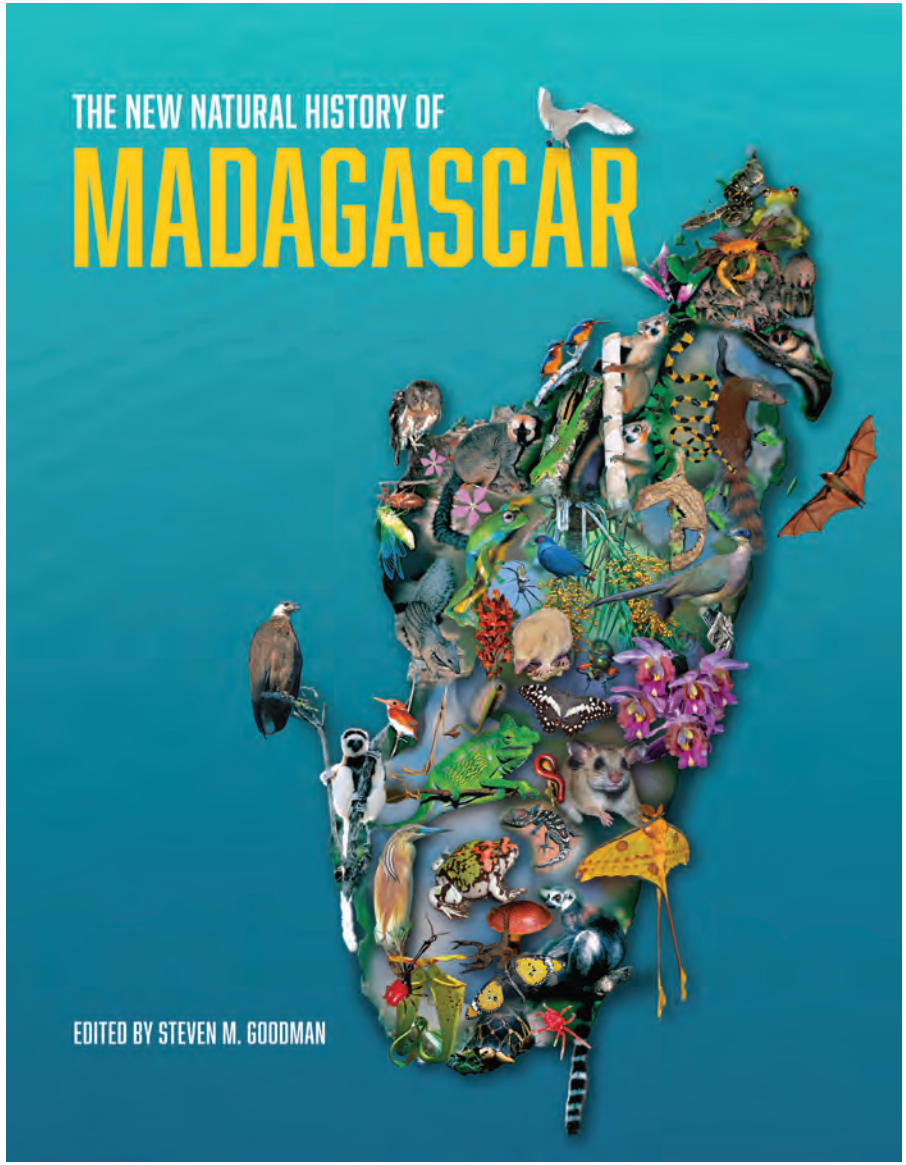
1. To bring to the general public, particularly Malagasy nationals, a series of thematic guides (e.g. bats, birds, small mammals, etc.) that cover in a comprehensive but simple manner different groups of organisms. A book series described above and known as "Guides sur la diversité biologique de Madagascar" [Guides to the biological diversity of Madagascar], has advanced well and nine books have been published. These books are sold to Malagasy students, scientists, guides, and naturalists at production costs (less than $3 USD) and in numerous cases given away for free to these individuals, as well as sold to foreign scientists, students, and naturalists. As mentioned in the previous section, this series has played an important role in raising the awareness of the island's unique biodiversity to the non-scientific community and hence, put in another manner, the greening of Madagascar.
2. As about 30% of the incoming foreign currency to Madagascar, at least before the COVID-crisis, is related to tourism, a critical step is to create a new book series that we propose to call "Guides d'écotourisme sur les aires protégées" [Ecotourism guides to protected areas] and to be published by Vahatra in collaboration with Madagascar National Parks. By augmenting the amount of information available to both foreign and national tourists visiting protected areas in a series of simple guidebooks, this will increase interest in these sites, which in turn will augment the number of visitors and advance the local economy around the protected areas, as well as national economy. Thanks to the generous donations of several private donors, we now have the funding for this project.
3. At the start of stage of this new project, we propose to produce four bilingual (French-English) books before mid-2023, each covering well-visited protected areas that are part of standard tourist circuits, in close vicinity to national roads, and with advanced local infrastructure (guides, hotels, and restaurants).

All of the sites to be covered are under the management of Madagascar National Parks, who is a direct collaborator in this project. The first four books will include the following site:

1. Northern set of protected areas (Lokobe, Ankarana, Montagne d'Ambre),
2. Southwestern set of protected areas (Zombitse-Vohibasia and Isalo),
3. Central east set of protected areas (Analamazaotra and Mantadia),
4. Southeastern set of protected areas (Ranomafana and Andringitra).

THE NEW NATURAL HISTORY OF MADAGASCAR

In 2003, Steve Goodman and Jonathan P. Benstead (University of Georgia) published a large volume (+1700 pages) entitled *The Natural History of Madagascar* (University of Chicago Press). Steve was first editor and principal contributor to the volume, which was widely praised—e.g., *Science* called it "a scientific milestone and by far the largest synthesis of tropical biology research ever." Now fast forward nearly two decades later and since the 2003 book appeared the amount of new information on the natural history of Madagascar has expanded at a rate beyond the most enthusiastic expectations. Advances made on research and conservation fronts concerning Madagascar during this period easily surpassed that of the 20 years preceding that volume's publication. With all of this in mind, Steve, as the principal editor, joined by 17 subject editors, including Achille Raselimanana, have completely reworked the 2003 book. It is important to underline that the new project is not a simple revision of the 2003 volume, but a completely new book, with no previous contribution being simply reprinted. Princeton University Press will publish the new volume in late 2022 or early 2023 under the title *The New Natural History of Madagascar*. At the time of this writing, late January 2022, most of the book is in first page proofs. The manuscript came in at just under 7,000 pages, including 553 figures and 243 tables, and has 279 contributions from 539 contributors, of which about one-third are Malagasy and the 2003 book less than one-quarter. The book will appear in two separate volumes of an estimated 1250 pages each. Princeton University Press has been highly collaborative in this project and several hundred copies of the book will be sent to Madagascar for distribution to different governmental and non-governmental collaborators and partners of Association Vahatra.

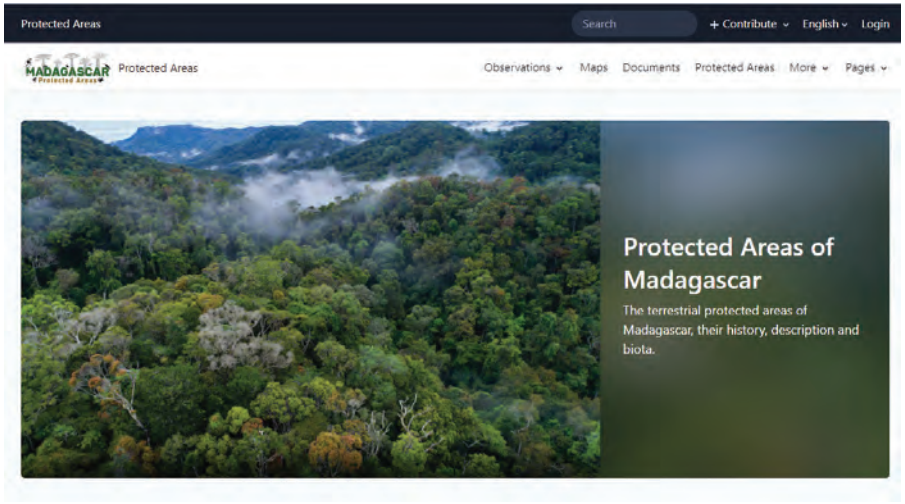


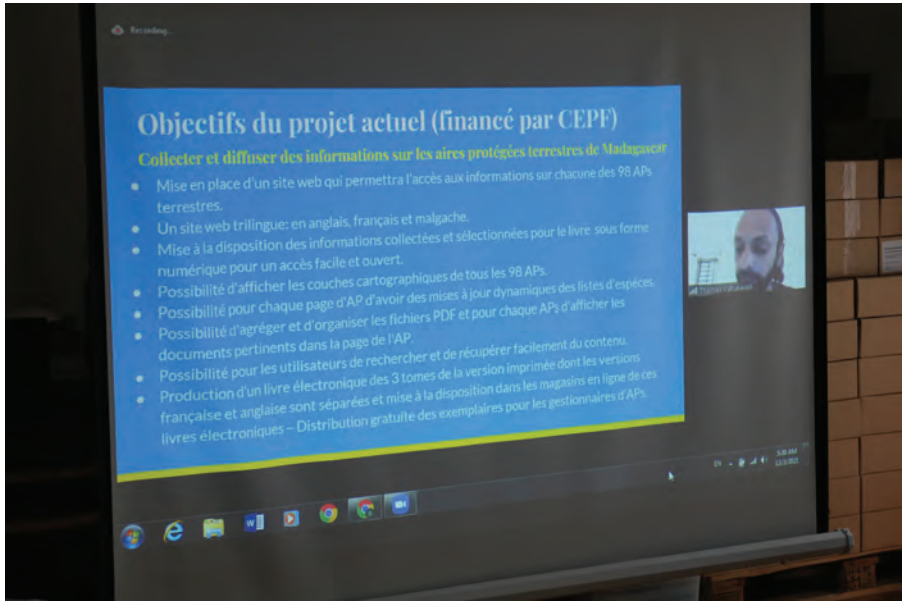
CURRENT VAHATRA PROJECTS AND GRANTS

Critical Ecosystem Partnership Fund (CEPF) – e-book on the protected areas of Madagascar and other user tools

In late 2015, Association Vahatra received a three-year grant from CEPF to conduct a large-scale review of the protected areas system of Madagascar. The bilingual French-English three volume book entitled *Les aires protégées terrestres de Madagascar : leur histoire, description et biote / Terrestrial protected areas of Madagascar: Their history, description and biota* was published by Association Vahatra in late 2018. Based on an additional grant from CEPF to Strand Life Science (Bangalore, India), with Association Vahatra as a partner, an e-book of a revised and corrected version of the protected area book has been produced, and is distributed by The University of Chicago Press (https://w.bibliovault.org/BV.titles.epl?pc=596&sort=title). The printed volumes of the protected area book are cumbersome to say the least, weighing close to 7 kg, and the e-book version greatly facilitates their utilization. Further, to simplify usage and be more user-friendly, separate e-books have been prepared for the French and English language versions.

Other aspects of this project included the creation of a website in Malagasy, French, and English containing lots of details on the 98 terrestrial protected areas of Madagascar covered in the book, including up-to-date species lists of vertebrates known from each site, as well as the means for citizen





scientists and naturalists to update the downloadable species lists based on new observations and published data. Based on a day-seminar presentation in Antananarivo by Thomas Vattakaven and Prabhakar Rajagopal of Strand Life Science and different members of Association Vahatra to potential users of the site, important input was received on aspects that facilitated the website organization. The timing of the seminar was just before the start of the COVID-19 epidemic and all subsequent work on the project has been via email and video conferences. Another important aspect of this project was uploading on to a cloud and providing free access to about 9000 pdf files used in writing the book, which include a range of different types of publications, unpublished reports, previously unavailable DEA and Master's memoires, Ph.D. theses, and other types of diploma documents from the Malagasy university system. The Madagascar Protected Areas portal site can be accessed at https://protectedareas.mg/. The portal is an important tool for researchers, students, and conservationists on Madagascar and overseas and we hope to amend the project to more advanced stages. In early December 2021, our colleagues at Strand Life Sciences in Bangalore via a video conference formally presented the portal in Madagascar to an assortment of

interested individuals physically present at Vahatra or connected via a video conference, which was followed by a reception. The event received press and television coverage. The final accepted report to CEPF was submitted in late 2021 and the first phase of the project has now been completed.

Critical Ecosystem Partnership Fund (CEPF) / Madagascar Fauna and Flora Group / Vahatra – Indian House Crow eradication and invasive species surveillance

In the context of this project, Madagascar Fauna and Flora Group (MFG) in collaboration with Association Vahatra and other partners received a grant to eradicate the recently introduced and highly invasive Indian House Crow (*Corvus splendens*) in the Toamasina area, central eastern coast of Madagascar, as well as other areas the species has turned up on the island. The grant also included advancing different types of research associated with problems imposed on Madagascar's ecosystems and the Malagasy people by invasive animal species. MFG was responsible for orchestrating the eradication of the Indian House Crow and Vahatra's interventions focused on scientific aspects associated with the biology, distribution, and zoonotic

diseases of the crow and House Sparrows (*Passer domesticus*) in and around Toamasina. More specifically, scientific research on invasive species included projects conducted by three Master's students from The University of Antananarivo and working with Vahatra scientists, all of which were presented in 2021. These studies included the presence and absence of Indian House Crows in all major ports on the island and population estimates (by Estelle Raobson Hanitrandrasana); the breeding biology and dietary regime of House Sparrows in the city of Toamasina (by Saholy Raolihanitrasina); and the diet of a quasi-invasive bat species living in human-built structures (by Lomeris Todilahy). As of late 2021, MFG and the project collaborators have removed all of the known House Crows on Madagascar, which is a major accomplishment.

Duke University / National Institute of Health (NIH) and the National Science Foundation (NSF) – land use in the SAVA Region and global health challenges

This project is based on a grant awarded to Duke University, with Dr. Charles Nunn as the Principal Investigator, in 2019 through the Ecology and Evolution of Infectious Diseases (EEID) program, a joint initiative between

the National Institute of Health and the National Science Foundation (NSF). This large-scale project aims to understand the linkages between diseases circulating in the foothills of the Marojejy Massif across a habitat mosaic of native forest, agricultural areas, and near villages for which endemic and introduced animals may act as reservoirs and the source of transmission. Association Vahatra is one of the collaborating organizations focused on field capture of bats, endemic and introduced small mammals, and collecting the needed samples for the zoonotic disease analyses. Toky Randriamoria, a post-doc in the context of the project, is responsible for the field sampling and seconded by Voahangy and Steve. A new assistant, Rianja Nantenaina Randriamifidisoa, has been engaged to reinforce the field team. Fifaliantsoa Rasolobera, the previous field assistant, is now incorporated in the project as a PhD student and working on small mammal ecology and distribution. Three different field camps at the foothills of the massif, each visited during three different seasons for sampling in a range of habitats, have solar panels to provide the needed energy to run a refrigerator to keep samples at the required low temperatures. In association with a considerable range of collaborators studying multiple facets of local circulating zoonotic diseases and parasites, this research project aims to study novel methods to predict disease spread, particularly different infectious diseases being important human health concerns on Madagascar.

Three Vahatra students from The University of Antananarivo and one from The University of Antsiranana are taking part in this project: Tamby Ranaivoson (PhD student) and Fifaliantsoa Rasolobera (PhD student, mentioned above) working on small mammal ecology and reproduction; Daniel Falimiarintsoa (Masters student) working on bat ecology and habitat associations on the southwestern slopes of the Marojejy Massif; and Johanna Rafanomezanjanahary working on bat ecology and habitat associations on the southwestern slopes of the Marojejy Massif; Daniel will present in March 2022 and Johanna presented in March 2021. Fieldwork for this project continues until mid-2023.

KOICA / UNESCO / Madagascar National Parks / Association Vahatra – BIOCOM, Restauration Patrimoine mondial: Forêts humides de l'Atsinanana

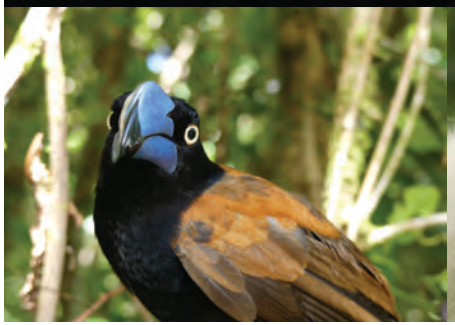
The moist evergreen moist evergreen forests of the eastern region of Madagascar are home to an exceptional diversity of plants and animals and these ecosystems play a fundamental role in maintaining biodiversity and ecological processes. Their integration some years back within UNESCO's network of World Heritage Sites, the series of protected areas known as "The Rainforest of the *Atsinanana*", was a crucial step in supporting efforts to preserve their Outstanding Universal Values. Unfortunately, these ecosystems for different economic and cultural reasons are often subject to anthropogenic pressures. The 2009 political crisis on Madagascar, a period of near total anarchy in certain areas of the island, allowed people to rush massively into protected areas for illegal exploitation of rosewoods, gold panning, charcoal production, and to acquire new agricultural lands via deforestation. The integrity of the biological diversity of The Rainforest of the *Atsinanana* and their Outstanding Universal Values have been seriously threatened. The magnitude of the situation was such that UNESCO's World Heritage Committee decided in 2010 to classify The Rainforest of the *Atsinanana* in the World Heritage list of sites "In Danger". The purpose of this current project financed at the level of several million US dollars by the Korea International Cooperation Agency (KOICA) is to rectify the situation through several different approaches: economic development, public education, and studies of the regional biota.

The role of Association Vahatra in the project is to examine patterns of biotic diversity at the focal sites through biological inventories, with a focus on change through time. Vahatra scientists and students surveyed several of these sites some 20-25 years ago and comparisons of possible change at the scale of several decades can be made, and if such changes have taken place, to determine the probable causal reasons. Finally, with biodiversity data across nearly 20+ years, it will be possible to strengthen protection of the sites and better understanding different pressures. Another aspect is to install a system of ecological monitoring sites and automated meteorological stations to provide measures of climate change in the future.

In early 2021, in the context of this BIOCOM project, a Vahatra field team, together with nine students from The University of Antsiranana and another individual working for the protected area manager took part in a field school and conducted an eco-biological evaluation of the dry forests of Montagne de Français in the far north.

The results of this field project have been accepted for publication in *Malagasy Nature* and will appear in 2023. Further, over the course of nearly eight weeks in October and November 2021, a large field team conducted an elevational transect of Marojejy, one of The Rainforest of the *Atsinanana* sites. The survey repeated in fine detail the transect of 1996 and across different groups of organisms. This was a large-scale logistic exercise, with five camps

between the lowland forest and summital zone of the massif, and with displacements of over 40 porters at a time to carry gear, supplies, and food. The material included solar panels, a large battery, and a small refrigerator to maintain collected samples from forest-dwelling mammals on the massif and tie-in to the Duke University (NIH and NSF) zoonotic disease research project mentioned above. Vahatra and colleagues are in the process of analyzing data to understand patterns of possible change through time and the scientific results will be available in the near future. In late 2022 the Vahatra team will redo another elevational transect in the Andohahela protected area in the same fashion as Marojejy and part of the The Rainforest of the *Atsinanana*.



FEDER / University of La Reunion / PIMIT / Vahatra – Diversity and transmission dynamics of infectious agents in Malagasy bats

The scientific objectives of this project are to characterize the diversity of infectious agents circulating in bat populations of northern Madagascar and to study the temporal dynamics of transmission, particularly within breeding and day-roosting colonies. Funding is based on a grant from the Fonds Européen de Développement Régional (FEDER). The study in collaboration with Dr. Camille Lebarbenchon from the Processus Infectieux en Milieu Insulaire Tropical (PIMIT) laboratory and associated with The University of La Reunion, and with a Malagasy post-doc, Riana Ramanantsalama, who did his PhD with Vahatra, employs samples of captured/marked/released bats for laboratory analysis. For each bat, samples include oral and rectal swabs, as well as ectoparasites.

In the original plan for fieldwork, it was proposed that each study colony, including caves in Ankarana and synanthropic roost sites in buildings in the nearby town of Ambilobe, to be visited every 3-4 months to study seasonal shifts in the temporal dynamics of infection at the population level. Individuals of the fruit bat *Rousettus madagascariensis* (family Pteropodidae) living in the caves of Ankarana are marked with uniquely numbered rings

in order to study infection dynamics at the level of individuals. With the lockdown of 2020, only two visits were conducted to the study sites in that year and we were only able to restart the fieldwork in late 2021. Because of all of the COVID-19 related delays, an extension of the project has been requested from the granting agency. We are still awaiting that decision.

Save the Rainforest Sweden (Rädda Regnskog) project at Ambohitantely

The Réserve Spéciale d'Ambohitantely is one of the last remnant Central Highland montane forests on the island and it is of high priority to conserve, even though already notably fragmented. This fragile and vulnerable relict forest is home to rich and unique biodiversity from the invertebrate to the vertebrate fauna as well as for the flora. Since 2007, the Association Vahatra has organized in this protected area a series of regular research missions, field schools or forms of ecological and biological training for students, as well as for conservation agents and managers.

Over the past decades, between the anthropogenic pressures of wild grassland fires, some being set as acts of anarchy, which enter into the remaining natural forest, the number of forest parcels and their surface areas have been dramatically reduced or disappeared forever. In a collaborative project between Association Vahatra and Madagascar National Parks, the organization responsible for the management of the protected area, and

with funding from Save the Rainforest Sweden, and in collaboration with Johannes Bergsten, Swedish Museum of Natural History in Stockholm, we have taken steps to try to conserve Ambohitantely and in association with local villagers. The first critical step to conserve the forest was the completion of a firebreak around the largest remnant parcel, a massive activity and done 100% by hand. Between April and June 2021, just before the bush fire season, about 19 km of firebreaks were completed and these were installed in a manner to stop open country fire progression into the forest.

Since 2015, scientific members of Association Vahatra with different colleagues were solicited to conceive and design a simple and practical guide for ecological restoration of three protected areas (Marojejy, Masoala, and Ranomafana). To restore the ecological integrity of Ambohitantely, a significant portion of which has been destroyed or heavily degraded by bush fires, and several blocks will soon not be viable without intervention, the same methods and technics have been applied as for the sites mentioned above. An expert Malagasy Botanist in collaboration with Achille is in

charge of the implementation of this challenging project. For now, we adopt active and assisted passive restoration strategy. A plant nursery has been established and the restoration site, that will link in a corridor fashion the main forest and a nearby forest fragment, is already prepared with a matrix of dug planting holes filled with compost and ready for transplantation in early 2022.

Previous studies carried out at Ambohitantely mainly concern vertebrates and plants, but the site includes different aquatic habitats for insects. To advance studies on the diversity and ecology of aquatic insects, Vahatra has engaged a post-doc student from the Entomology Department at The University of Antananarivo to carry out biological inventories of aquatic insects within and around the protected area. He is also in charge of the training and mentoring of Master students working on insects at his home institution. Two of these students are now finalizing the preparation of their memoirs.

In Ambohitantely, there is no functional infrastructure other than rugged camping sites for researchers, students or for other visitors. To promote research activities and to increase the frequency of visitors, in the context of this project, we are in the process of constructing a humble biological station of 14 x 5 m with three rooms (kitchen, lab, and large room/dormitory for 8 persons). Construction is now well underway and 40 000 fires clay bricks, cement, iron, etc. have been delivered to the site. The building is at the edge of the Madagascar National Parks village complex and a short distance from the main forest.

Developing effective rodent control strategies to reduce disease risk in ecologically and culturally diverse rural landscapes financed by Global Challenges Research Fund (GCRF), United Kingdom Research and Innovation (UKRI)

The project, named REDROZ (Reduce Rodent Zoonosis), aims at reducing the risk from rodent-borne infections in Africa, including Madagascar, by

increasing knowledge and expertise needed to develop holistic rodent management applicable for local conditions and at the community level. Research is designed to answer whether sustainable community-based rodent management can reduce risks of disease transmission and improve overall human health and wellbeing. Multidisciplinary activities conducted in Tanzania and Madagascar, focus on three rodent-borne infections (leptospirosis, plague, and rickettsiosis) and proceed in two stages. First, we fill knowledge gaps, and deepening our existing collaborations with communities and stakeholders, allowing us to co-develop rodent control that are holistically evaluated in the second stage. We are developing a spatially realistic modelling tool to explore likely responses of rodent populations and rodent-borne infections to localized rodent control. Analyses of rich archived datasets and new experimental trials are being used to parameterize models and test output. In Madagascar, the study is carried-out in collaboration with Institut Pasteur de Madagascar. In the first stage, we work in 12 villages within Analavory/Miarinarivo commune (Central Highlands to the west of Antananarivo), where villages act as replicates, experimentally determining how rodent movements and the prevalence of rodent-borne infections are impacted by control. We use a range of qualitative and quantitative social science to produce a deeper understanding of community practices, behavior, and understanding around relevant issues of health, hygiene and pest management, and work with stakeholders from health, agriculture, and environment spheres to understand their perceptions, policies, and support services. In the second stage, we conduct a comparative trial in 12 intervention - non-intervention village pairs (n=24), co-developing and trialing rodent management strategies over one year, and monitoring changes to human practices and attitudes, rodent damage, disease within the rodent population (i.e. leptospirosis, plague, and rickettsiosis), human health indicators and time/financial inputs. Collaborative workshops are designed to facilitate cross-country comparisons and high-level training to early career researchers. A PhD student from The University of Antananarivo, Todisoa Radovimiandrinifarany, is integrated in this project in the context of his PhD thesis, and two students from The University of Fianarantsoa was taking part in the fieldwork in the context of capacity building.

MEETINGS AND CONFERENCES IN 2021 ATTENDED BY ASSOCIATION VAHATRA

We encourage students and young researchers to attend international meetings, to help their individual development in an international sense, to meet with fellow scientists, and mentorship. Unfortunately, during 2021 associated with COVID-19 restrictions and international air travel in and out of Madagascar being curtailed for a long period, no students were able to attend in person overseas scientific meetings, although virtual meetings did take place. Voahangy and Steve gave a virtual presentation about the scientific collections in the Mention Zoologie et Biodiversité Animale, University of Antananarivo, in the context of the American Institute for Conservation/Society for the Preservation of Natural History Collections (AIC/SPNHC) 2021 annual meeting.

PERSON IN FOCUS: MARIE JEANNE RAHERILALAO

After finishing her PhD at The University of Antananarivo in 2006 and in the context of the Ecology Training Program of WWF-Madagascar, which was the precursor to the creation of Association Vahatra, on the distribution and biogeography of birds in the Madagascar Central Highlands and neighboring areas, Marie Jeanne was engaged in a range of different ornithological field studies and different conservation-related projects. She is one of the founding members of Association Vahatra and has played a major role as co-editor of *Malagasy Nature* and the Guides to the biological diversity of Madagascar series, including co-authoring a book on the natural history of Malagasy endemic birds. She also co-edited the Madagascar terrestrial protected areas book. In 2008, she was recruited as lecturer in the Zoology and Animal Biodiversity Department at The University of Antananarivo, where she gives courses on a wide diversity of subjects and is responsible for the mentorship of a considerable number of Malagasy graduate students.

In June 2021, Marie Jeanne presented her “Habilitation à Diriger des Recherches” (HDR) memoir at The University of Antananarivo, which is the highest scientific diploma in the European and Malagasy academic system. The title of her memoir, “Reconciling research and capacity building for the conservation of biodiversity in Madagascar”, clearly shows her visionary view of research on Madagascar and using associated data for advancing

conservation on the island. We wish here to highlight her contribution to Malagasy Zoology and future generations of Malagasy researchers and send our congratulations for presenting her HDR.

WITH A SPECIAL THANKS

We would like to give a special thanks to a number of individuals that have financially supported different Vahatra activities in 2021, including the advancement of Malagasy graduate students and a range of other activities, such as the publication of *The new natural history of Madagascar* and the new "Ecotourism guides to protected areas" series. The list is ordered alphabetically by family name:

- Joyce Chelberg
- Ellis Goodman Family Foundation
- Paul Goodman
- Mary Ann and Owen Griffiths
- Bob and Gail Loveman
- Michael and Tanya Polsky
- Bob and Charlene Shaw
- Jai Shekhawat
- Adele Simmons

ACTIVITIES OF VAHATRA PERMANENT MEMBERS DURING 2020

Members of the Vahatra scientific staff were involved in a variety of activities, which are summarized below.

January

Jeanne was occupied with exams at The University of Antananarivo, as well as the preliminary report concerning a biological inventory in the Parc National de Marojejy carried out in the context of BIOCOM project of the UNESCO. She worked also on the translation of French texts into Malagasy for the Madagascar Protected Area Portal. Voahangy and Achille took an active role in the supervision of a project on climate resilience through the preservation of biodiversity, known by the acronym PRCPB/BAD. Voahangy worked with a student from Fianarantsoa on a memoir and towards the half of the month, took part in the initial meetings and preparation on the Global Challenges Research Fund project. Achille was busy this month with teaching activities and exams session at the university. He advised two PhD students from The University of Toliara associated with research design and thesis content. For Steve, most of the month was devoted to finalizing and submitting the book manuscript to Princeton University Press for *The new natural history of Madagas*car.

February

Jeanne and Steve worked on the last versions of two Masters memoirs on exotic bird species to be presented at The University of Antananarivo, and Jeanne continued working on the report concerning the biological inventory carried out at Marojejy. Voahangy continued to contribute to the PRCPB/BAD project and she prepared different aspects for the Montagne des Français fieldwork associated with the KOICA funded project. During the first half of the month, Achille taught at The University of Antsirabe, as well as at The University of Antananarivo. He also worked on an article concerning the population diversification of an endemic frog species.

Towards the middle of the month, Achille, Steve, Voahangy, and Jeanne went to the protected area of Montagne des Français in the far north of the island for fieldwork and student training associated with the UNESCO/ BIOCOM project. Nine students from The University of Antsiranana and an individual working for the site protected area manager took part in this field training. The team returned to Antananarivo in early March.

March

One student from Vahatra presented her Masters at The University of Antananarivo and Steve, Achille and Jeanne were among the jury members. Jeanne and Steve made the last edits on a book manuscript to be published by Vahatra on the damselflies and dragonflies of Madagascar by K. D. Dijkstra & Callen Cohen before sending the needed elements to Malalarisoa Razafimpahanana for the design and typesetting. After returning to Antananarivo from Montagne des Français, the four Vahatra scientists for much of the balance of the month worked on data analysis and writing up results from that field inventory. Achille was also a jury member for three different Masters presentations affiliated with Vahatra.

April

Jeanne and Steve worked on the page proofs of the damselflies and dragonflies book, and edited the Montagne des Français biological inventory report. During this month, Voahangy was occupied with coursework at The University of Fianarantsoa. Achille spent considerable time working on the report for the biological inventory of Montagne des Français and an associated manuscript. He also prepared his reports related to two HDRs and a PhD for the Ecole Doctorale at The University of Antananarivo. Steve started editing a special issue of *Malagasy Nature* dedicated to scientific advances in the paleosciences by Malagasy researchers and students. The first chapters for *The new natural history of Madagascar* in copy-edited form started to be sent to Steve from Princeton University Press for corrections.

May

Jeanne spent most of May working on the Montagne des Français report for UNESCO and preparing her HDR presentation. Voahangy spent portions of the month on different activities associated with her duties at The University of Fianarantsoa and the virtual presentation for a meeting on scientific collections in conjunction with the American Institute for Conservation (AIC). She also developed the terms of reference and financial documents for the KOICA/BIOCOM project at Marojejy planned for the last portion of the year. Apart from his usual teaching activities at The University of Antananarivo, Achille (together with Steve) acted as a jury member for an HDR presentation, as well as a PhD. Steve corrected the first page proofs and more copy-edited text for the new natural history book.

June

Jeanne continued to work on her HDR memoir, which was defended on 25 June, with Steve and Achille being among the jury members. Voahangy spent time attending meetings and field preparation for the Reduce Rodent Zoonosis/Global Challenges Research Fund (REDROZ/GCRF) project, as well as assisted putting together a grant for Geopark Madagascar, being developed as part of a UNESCO Global Geopark project for Madagascar. Voahangy and Steve gave a virtual presentation about the scientific collection in the Mention Zoologie et Biodiversité Animale in the context of the American Institute for Conservation/Society for the Preservation of Natural History Collections (AIC/SPNHC) virtual 2021 annual meeting. She also continued with different activities and responsibilities at The University of Fianarantsoa. Achille was also a jury member for one PhD and one Master, the later also with Steve. During this period, Achille prepared and presented courses at The University of Antananarivo. Steve corrected the page proofs and more copy-edited text for several chapters in the new book.

July

With Steve, Jeanne edited articles for a special issue of *Malagasy Nature* (volume 15) about paleoscience studies of Malagasy researchers and students; see also continued with her teaching duties at The University of Antananarivo. Voahangy continued to take a role in the supervision of the PRCPB project and she also was occupied in developing Master's program on health and environment for the Institut des Sciences et Techniques de l'Environnement, The University of Fianarantsoa. Achille and Steve went to Ambohitantely Special Reserve with the new and former directors of the protected area to discuss in detail the activities that Vahatra hopes to realize at the site in the context of a new project financed by Save the Rainforest Sweden. During the first week of this month, Achille went to Morondava

were he was invited by The University of Toliara to sit on the jury for one HDR and two PhDs and towards mid-July he participated virtually as a committee member of a PhD jointly supervised between The University of La Réunion and The University of Antananarivo. In the first week of the month, Steve traveled to Chicago to work at The Field Museum of Natural History and continued to receive page proofs and more copy-edited text for chapters in the new book.

August

Jeanne continued her regular activities of teaching, exam sessions, and editing volume 15 of *Malagasy Nature*. Voahangy conducted fieldwork in Analavory/Miarinarivo in the context of REDROZ/GCRF project. Achille carried out a reconnaissance mission in the Andohahela National Park, southeastern Madagascar, to assess the state of the trail along the altitudinal gradient used during the biological inventory of the site in 1995 and planned to be revisited in late 2022 in the context of the BIOCOM project of UNESCO. He also spent some time teaching at the university, as well as working on the blue print and cost assessment for the construction of the biological station in the Ambohitantely Special Reserve financed by Save the Rainforest Sweden. Steve continued to work at The Field Museum of Natural History, principally on reading page proofs and verifying copy-edited text for chapters in the new book.

September

Jeanne worked with one of her Masters students on the final version of the associated memoir, as well as the Montagne des Français report before being sent off for typesetting. She was also invited as a jury member for a PhD thesis presented at The University of Antananarivo. In the first portion of the month, Voahangy was responsible for fieldwork in the Analavory/Miarinarivo area in the framework of REDROZ/GCRF project; conducted a scouting mission in the context of the Duke University NIH/NSF project on the southeastern slopes of Marojejy; and was busy organizing the logistic and

administrative aspects for fieldwork at Marojejy for the BIOCOM project in collaboration with UNESCO. Steve returned to Madagascar during the first week of the month and the balance was principally devoted to page proofs and copy-edited texts for *The new natural history of Madagascar*. At the end of the month, Achille, Steve, Voahangy, and Jeanne, together with different team members, left Antananarivo to conduct an eight-week biological inventory of the Marojejy National Park. Two students from The University of Antananarivo, one from The University of Antsiranana, and one from Arizona State University accompanied the group.

October

All Vahatra scientific members are involved in the biological inventory carried-out along the altitudinal gradient of the Marojejy National Park. During this field expedition, they ensured also the supervision of the fieldwork and data collection of one Master student and a PhD candidate. This large-scale biological investigation is part of the BIOCOM project in collaboration with UNESCO with funding from The Korea International Cooperation Agency (KOICA).

November

During the three first weeks of the month, the team continued the biological inventory of the Marojejy Massif. A restitution on the results of the nearly eight week inventory, including threats and pressures to the park's biodiversity, as well as suggestions from the team members, was made in Andapa for the protected area manager and the local representative of UNESCO. Towards the end of the month, the team returned to Antananarivo and started working on data analysis and specimen identification from the Marojejy survey, as well as preparing the preliminary report to UNESCO. After the survey, Voahangy visited a site on the eastern slopes of Marojejy associated with the Duke University NIH/NSF project, where a Vahatra post-doc and one Ph.D. student were conducting fieldwork. Towards the end of the month, Achille worked closely with a Masters student for which Marie Jeanne and he were jury members for the presentation, as well as with a PhD student planning to present in early December. Steve picked up again on work for the new natural history, principally on reading page proofs and verifying copy-edited text.

December

The first week of this month was marked by the launching of the Madagascar Protected Areas Portal at the Vahatra office, which included a video

presentation made by the collaborators at Strand Life Sciences in India, as well as a reception after the presentation. Jeanne and Steve were involved in checking the final version of the special issue of *Malagasy Nature* (volume 15) before its publication towards the end of the month. She also worked on the Masters memoir of one of her students. Voahangy continued fieldwork in the Analavory/Miarinarivo area in the context the GCRF project. Achille participated as the jury president for a Masters and as director for a PhD presentation, for which Steve also participated as a jury member. Towards the end of the month, Achille went to the Ambohitantely Special Reserve to supervise activities associated with the Save the Rainforest Sweden project at the site. For 10 days in the middle of the month Steve and a Malagasy post-doc based on La Réunion Island in the PIMIT lab, in the context of the FEDER project, conducted fieldwork on bats of Ankarana and Ambilobe in the northern portion of the island. Before the close of the year, Steve was a jury member for an HDR presented at The University of Antsiranana.

VAHATRA SCIENTISTS PART IN THE GOVERNING OF SCIENTIFIC RESEARCH ON MADAGASCAR

A special committee has been reestablished by the Malagasy Government that evaluates research permit requests based on proposals submitted by national and international researchers for work on Malagasy biodiversity. This committee known as Commission ad'hoc Faune et Flore/Comité d'Orientation de la Recherche Environnementale (or CAFF/CORE) holds monthly meetings to evaluate incoming research proposals. Achille and Voahangy take an active role in the committee's evaluation of proposals.

The Malagasy Government has obtained a loan from the African Development Bank to advance a funding mechanism for the valorization of natural capital and the reinforcement of resilience to disaster risks. The allocated sum is being used to conduct a feasibility study of climate resilience through the preservation of biodiversity. In the context of the project, Madagascar National Park is the executing agency and a supervisory committee was established, and Vahatra was chosen as a member on biodiversity aspects. Voahangy and Achille take an active role in the project supervision.

SCIENTIFIC OUTPUTS OF VAHATRA DURING 2021

Publications from 2021, including those manuscripts in press and submitted, are presented in this section. Names in **bold** are those of Vahatra scientific members, as well as research associates, and those in *italics* are current or past Malagasy student members. This does not include the more than 60 contributions that will appear in *The new natural history of Madagascar* co-authored by Vahatra scientists, students, and post-docs.

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Ostrich 2021, 92(4): 316–318
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OSTRICH
ISSN 0030-6525 EISSN 1727-947X
https://doi.org/10.2989/00306525.2021.2003883

Short Note

The diet of the Olive Bee-eater, *Merops superciliosus*, in the Central Highlands of Madagascar

Balsama Rajemison[1], Hesham T Goodman[2] and Steven M Goodman[2,3]*

[1] *Parc Botanique et Zoologique de Tsimbazaza, Antananarivo, Madagascar*
[2] *Association Vahatra, Antananarivo, Madagascar*
[3] *Field Museum of Natural History, Chicago, Illinois, United States*
**Correspondence: sgoodman@fieldmuseum.org*

Regurgitated pellets from the Olive Bee-eater, *Merops superciliosus*, were collected below a hunting perch in Antananarivo, Madagascar, and used to examine this species' food habits. The diet of this species was largely composed of bees (Apidae, genus *Apis*) and the next most common group was wasps (Vespidae). Remains of soft-bodied ticks (Argasidae) were also identified, presumably associated with the consumption of ectoparasites during preening.

Le régime alimentaire du Guêpier de Madagascar *Merops superciliosus* dans les Hauts Terre Centrales de Madagascar

Des pellets régurgités du Guêpier de Madagascar *Merops superciliosus* a été collectée sous un perchoir de chasse à Antananarivo, Madagascar, et utilisé pour examiner les habitudes alimentaires de cette espèce. Le régime alimentaire de cette espèce était en grande partie composé d'abeilles (Apidae, genre *Apis*) et le groupe suivant le plus commun était les guêpes (Vespidae). Des restes de tiques à corps mou (Argasidae) ont également été identifiés, vraisemblablement associés à la consommation d'ectoparasites pendant le lissage.

Keywords: Antananarivo, dietary regime, quantified data, urban area

The Olive Bee-eater *Merops superciliosus* is restricted to the Malagasy Region (Madagascar and near-shore islands and the Comoros Archipelago) and portions of Africa (Safford 2013). In general, it is a species of open habitats, open canopy forest, and on Madagascar is widely distributed across the island, including the Central Highlands. It is relatively common in urban and peri-urban areas.

Although some information is available on the diet of this species across its non-Madagascar range (e.g. Benson 1960; Fry 1981; Cheke and Diamond 1986; Marnicheet al. 2007), as well as for the Malagasy population (Rand 1936; Benson et al. 1976; Goodman and Parrillo 1997; Koenig 2006), few quantified data are available from the island. The purpose of this note is to provide details on the diet of this species in the Central Highlands of Madagascar.

During May and June 2020, regurgitated pellets of Olive Bee-eaters were obtained in a neighbourhood of Antananarivo known as Ambohidempona (Tsiadana), and located at 18°55'14" S, 47°33'03" E and at 1 380 m asl. The pellets were collected on a clean brick and cement surface, below a small grove of *Eucalyptus* trees, the tallest of which reached approximately 15 m off the ground. The site was in a peri-urban area within a housing complex with widely dispersed buildings separated by areas of mostly introduced vegetation. At any one time during the day, between five and 15 Olive Bee-eaters, the only locally occurring insectivorous bird regurgitating small pellets, were perched in and actively hunting from the upper branch of the *Eucalyptus* trees, which were in flower during the period the pellets were gathered. Altogether 67 separate collections were made during daylight hours, each including one to four pellets that were found in close proximity or physically touching one another, and within a few hours of being regurgitated. The pellets were conserved in 70% ethanol and in individually numbered tubes. Each collection represented the regurgitated food remains from a single Olive Bee-eater, but it was not possible to discern how many different individual birds were involved in the pellet deposition.

The pellet remains of the 67 samples were identified by the first author at the laboratory of the Madagascar Biodiversity Center in Tsimbazaza, Antananarivo. After soaking a given sample in a petri dish with 95% ethanol and then gently crushing the pellets, identifications were made using a binocular scope (Leica MS5) at 10× to 40× magnification. Taxonomic determinations were based

Ostrich is co-published by NISC (Pty) Ltd and Informa UK Limited (trading as Taylor & Francis Group)

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Bulletin de la Société Zoologique de France
2021, volume 146 (4), pages 167 à 173
ISSN : 0037-962X
http://societe-zoologique.fr/

Régime alimentaire de *Microgale brevicaudata* (Tenrecidae), Nord-Est de Madagascar

Fifaliantsoa RASOLOBERA[1,2], Balsama RAJEMISON[3], Toky M. RANDRIAMORIA[1,2], Voahangy SOARIMALALA[1] et Steven M. GOODMAN[1,4]

1. Association Vahatra, BP 3972, Antananarivo 101, Madagascar. E-mail tsikyrasolo@gmail.com, tokilaci@yahoo.fr, voahangysoarimalala@gmail.com.

2. Mention Zoologie et Biodiversité Animale, Domaine Sciences et Technologie, Université d'Antananarivo, BP 906, Antananarivo 101, Madagascar.

3. Parc Botanique et Zoologique de Tsimbazaza, BP 4096, Antananarivo 101, Madagascar. E-mail balsama38@hotmail.com.

4. Field Museum of Natural History, 1400 South Lake Shore Drive, Chicago, Illinois 60605, USA.

Auteur correspondant : Fifaliantsoa Rasolobera, Mention Zoologie et Biodiversité Animale, Domaine Sciences et Technologie, Université d'Antananarivo. E-mail < tsikyrasolo@gmail.com>.

Manuscrit reçu le 22/06/2021, accepté le 27/11/2021, mis en ligne le 20/12/2021

Résumé

Dans le but d'apporter des compléments d'informations sur le régime alimentaire de *Microgale brevicaudata* (G. Grandidier, 1899) dans la forêt dense humide sempervirente de basse altitude du Parc National de Marojejy et les zones anthropiques situés à proximité de cette aire protégée, la présente étude vise à déterminer les arthropodes consommés par cette espèce et d'examiner la possibilité de variation du régime alimentaire en fonction de la saison, de l'habitat, du sexe et de l'âge des individus. L'analyse des contenus stomacaux montre que la base alimentaire de cette espèce est principalement constituée par des Coleoptera suivie des Hemiptera, des Hymenoptera et des Araneae. La comparaison de pourcentage des proies consommées présentes dans les contenus stomacaux montre qu'il n'y a pas de variation suivant l'âge, le sexe et la saison mais une différence est observée selon l'habitat.

Mots-clés Petit mammifères, arthropodes, régime alimentaire, Marojejy, Madagascar.

Diet of *Microgale brevicaudata* (Tenrecidae) in northeast Madagascar

Abstract

Herein we provide a dietary analysis using stomach contents of *Microgale brevicaudata* (G. Grandidier, 1899), a poorly known species of shrew tenrec, in the dense lowland moist evergreen forest of the Marojejy National Park and human modified habitats in the peripheral zones. We specifically examine the arthropods consumed by this species and variation related to season, habitat type, sex and age of individuals. Analysis of stomach contents shows that the principal prey types of this species in order of importance are Coleoptera and followed by Hemiptera, Hymenoptera, and Araneae. No differences in prey consumed were found between age and sex classes, nor season, but the percentage of the different arthropod groups varies with the type of habitat.

Keywords Small mammals, arthropods, diet, Marojejy, Madagascar.

Introduction

Madagascar est connue mondialement comme l'un des centres de biodiversité parmi les plus riches et qui est menacée par les activités humaines, ce qui la fait considérer comme un « hotspot » ou point chaud de la biodiversité (MITTERMEIER *et al.*, 1999 ; MYERS *et al.*, 2000). Cette exceptionnelle originalité de la faune et de la flore est due aux différents évènements de colonisation associés aux radiations adaptatives du fait que Madagascar est totalement isolé dans l'Océan Indien depuis longtemps à l'échelle des ères géologiques. La biodiversité faunique de la Grande Ile présente un niveau d'endémisme très élevé touchant différents groupes taxonomiques (GOODMAN, sous presse). Par exemple, les mammifères terrestres indigènes non volants présentent un taux d'endémisme de 100 % pour les plus de 170 espèces reconnues sur l'île. Parmi ces

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Association Vahatra - BP 3972, Antananarivo 101, Madagascar - 261 20 22 277 55 - associatvahatra@moov.mg