



Annual Report 2019

Message from the Chair

Ficus and Fable

For over five decades, I've lived and worked in a botanical garden founded in Naples, Florida by Dr. Henry Nehrling. The tiny ficus seeds he received via international mail in 1926 could have easily been blown away by a gentle breeze. But like Aesop's slow and steady tortoise that beat the hare in the race, their inexorable progress made them successful and they grew into the giant fig trees that have withstood nearly a century of hurricanes.

Beyond nurturing his garden, Nehrling planted ideas. In 1904 he urged, "It is high time to protect and preserve what is still left in Florida." I have taken pride that Naples Zoo's garden founder was an early conservationist and that the successive generations on this site have only expanded on this ethic. But in recent years, I've reflected how Nehrling would be grieved at how the state's prairies have turned to pavement. The tortoise strategy that served his trees has been insufficient to the global needs of conserving the land against the speed of development's hare. As Will Rogers once said, "Even if you're on the right track, you'll get run over if you just sit there." Or if you're not moving swiftly enough. Wonderfully, conservation has bright spots worth emulating and MFG has its share of them. But we all know they have simply not been enough to meet the worldwide challenge.

A Global Heart Attack

Like the proverbial CEO working 90 hours a week having a heart attack, humanity has been dropped in its tracks and utterly shaken with deadly force by COVID-19 while I write this. A terrible wake up call that has not left the MFG family unscathed. I am grateful that MFG's longstanding efforts to secure a financial hedge against crises has enabled us to fund our staff who lack the same social safety nets many of us have. But the hare's rest would be equally foolish now and the MFG must seek more diverse income streams as many of our members and supporters face their own pressures. All the while, the island's relentless never-to-be-forgotten challenges of cyclone seasons, deforestation, plague cycles, and daily poverty press on.

And so we have been given this awful gift of a pandemic. Will we wait for healing and resume the status quo and "us vs them" mindset? Or will we take this moment to strategize and forge the new tools, the deeper relationships, and the truly revolutionary methods we need to defend the precious wildlife and the natural world we have inherited? Of course, the devil is in the details. If it were easy, we would have done it by now. But it needs doing. Nearly 20 years



ago, I was stirred listening to the challenge posed by Peter H. Raven, President Emeritus of MFG Member Missouri Botanical Garden:

"...when all is said and done, conservation and sustainable development becomes a matter of morality, one of elevating our sights...We will eventually be judged by the condition of the world that we leave behind us. We will be judged by whether we acted in a way consistent with the privileges that we enjoy. Effective action can begin only with concern for one another...To accomplish this, cultivate the kind of moral concern that will be the basis for informed action; be as visionary and original as you possibly can...Our success will be the key to shaping the world of the future, and I know that we are equal to the challenge."

We've done much since he spoke those words. But we need to change the rules of the race as we're still losing. We must chart a future that unites the talents of the tortoise and hare for the truly common good. Empowered by a deep love of nature and humanity, we must act with reinvigorated passion to bridge heretofore impassable divides to create a race we all win. Together, we are equal to that challenge. We have to be. See you at the new starting blocks...


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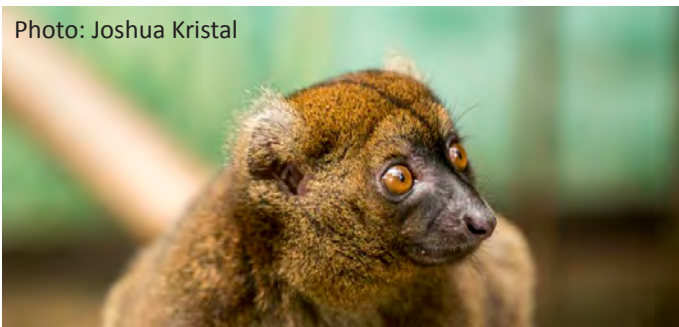
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COVER: Aerial image of the village of Rendriendry, the home base for our conservation agents on the edge of Betampona Strict Nature Reserve.

MNP & MFG

Madagascar National Parks (MNP), originally known as the Association National pour la Gestion des Aires Protégées (ANGAP), was formed in 1991 as an independent association with the legal mandate to manage Madagascar's parks and reserves, however it does not have enforcement power. MNP works under the direction of the Ministry of the Environment and Durable Development (MEDD) which encompasses multiple Departments and has the legal authority to address environmental crimes. MEDD has a Regional Directorate office in Toamasina (DREDD). The Ministry has a long history of collaborating with outside donors, national and international NGOs, and other partners to achieve its objectives.

The MFG's involvement with Betampona Natural Reserve began in 1990 when Charlie Welch and Andrea Katz initiated lemur surveys which led to the *Varecia variegata* restocking and research program which, in turn, led to an expansion of the research program under Karen Freeman's leadership.

MNP's management team includes its Director, Madam Emérentienne Mametsa (below with Fidy Rasambainarivo (Center) and Jean Noel), and four agents. The MFG has formally served as MNP's Technical Research Partner for over 20 years, a relationship that is detailed in a Memorandum of Understanding.



MNP is responsible for developing and implementing a management plan for Betampona that advance MEDD's goals.



MFG partnered with taxonomic experts to identify Betampona's reptile and amphibian species. The above chameleon is a new species yet to be named.

MFG provides essential information such as species' inventories, distribution and population trends, ecological and behavioral data on select species of interest or concern, and identifying threats.



For example, Fidy Rasambainarivo's research demonstrated the frequent occurrence of village dogs within Betampona poses a significant threat to many of its endemic species from disease, predation and harassment. MNP has responded by engaging community leaders to assist in communicating the message that owners must control their dogs from straying into Betampona.

In addition to MFG's role in providing technical expertise, MNP requests, when possible, that MFG joins them in activities and initiatives aimed at protecting and preserving Betampona, including community development, patrols, environmental



education, awareness-raising and reforestation. Of course, MFG has a history of working with communities through our Saturday School program, expanding our Green and Girls leadership camps to include children from rural schools, initiating a long-term reforestation program of Betampona's Zone of Protection (ZOP), and working with farmers to improve food production.



Betampona ZOP reforestation evaluations are done by a team of MNP and MFG agents.



MFG's Head of Capacity Building Christian Rambeloson's 2017 training to improve vanilla production is yielding positive results for farmer's like this.

Betampona is one of only two strict nature reserves in Madagascar where entry is restricted to researchers. To help defray the costs of managing the reserve, MFG also provides an annual donation to MNP. Information is shared on a quarterly basis through written reports and working meetings. In addition, MNP and MFG hold a meeting at the beginning of each year to review and coordinate our annual plans.



2019 Publications

Dubos N1, Morel L, Crottini A, Freeman K, Honoré J, Lava H, Noël J, Porton I, Rendriendry G, Rosa G M, Andreone F. 2020*. **High interannual variability of a climate-driven amphibian community in a seasonal rainforest.** *Biodiversity and Conservation* 29:893–912 (*Published online 28 November 2019)

Farris, AR, Misyak S, O’Keefe K, VanSicklin L, Porton I. 2019. **Understanding the Drivers of Food Choice and Barriers to Diet Diversity in Madagascar.** *Journal of Hunger & Environmental Nutrition*. DOI: 10.1080/19320248.2019.1566110

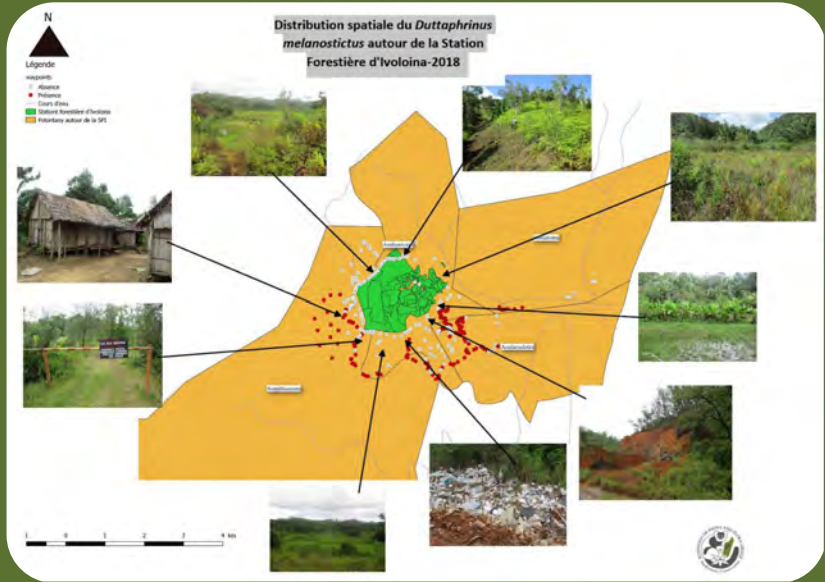
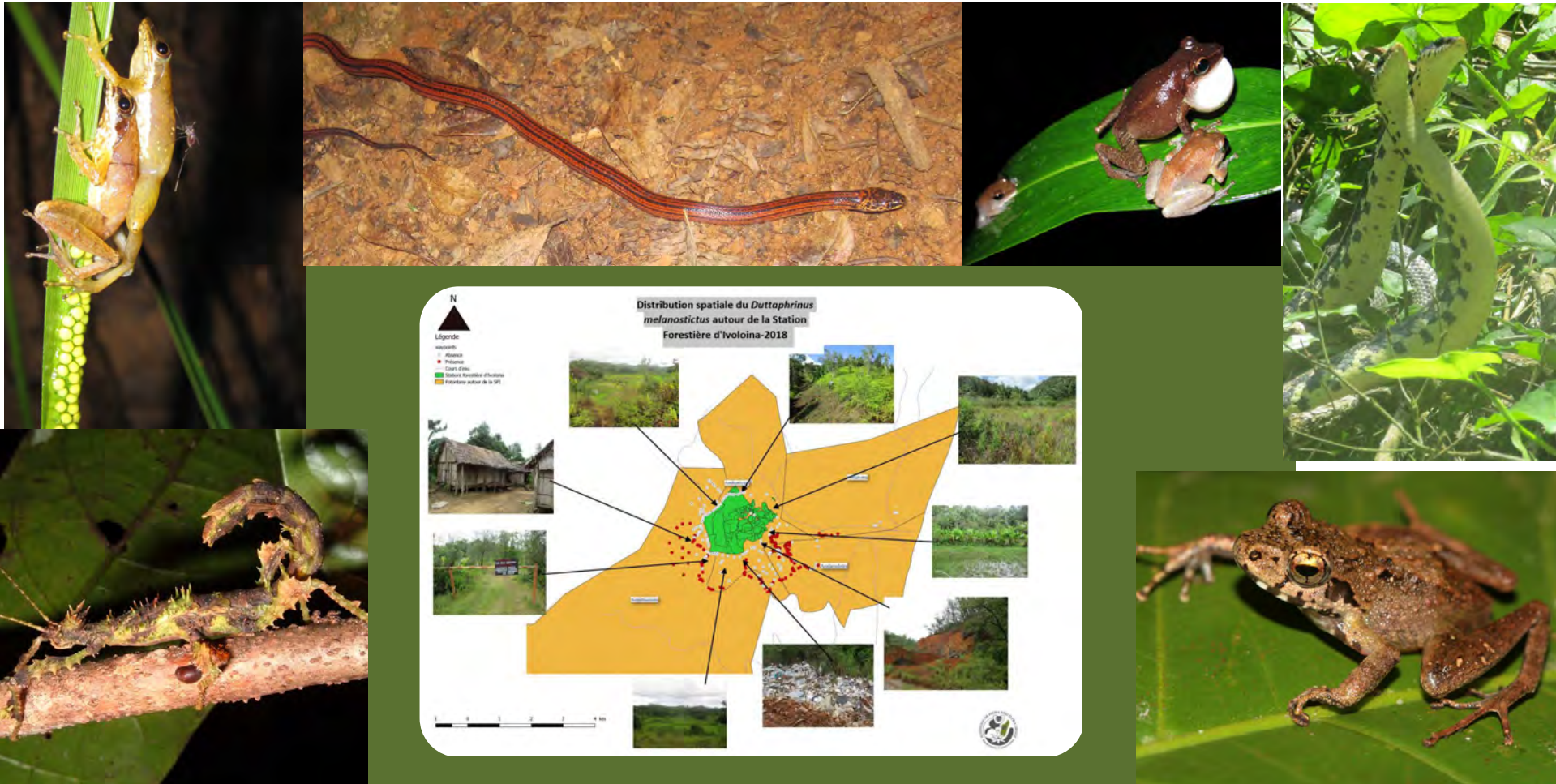
Licata F, Ficetola GF, Freeman K et al (2019) **Abundance, distribution and spread of the invasive Asian toad *Duttaphrynus melanostictus* in eastern Madagascar.** *Biol Invasions* 21:1615–1626. <https://doi.org/10.1007/s10530-019-01920-2>

Ranarilalantiana T, Bergsten J. (2019) **Discovery of specialist Copelatinae fauna on Madagascar: tropical forest floor depressions an overlooked terrestrial habitat for diving beetles (Coleoptera, Dytiscidae).** *ZooKeys* 871: 89–118. 10.3897/zookeys.871.36337

Randriamoria T, Rafilipo L, Fidy J . 2019. **Mise à jour de la distribution du crapaud commun d’Asie (*Duttaphrynus melanostictus*) dans le sud de Toamasina, Madagascar.** *Malagasy Nature*, 13: 162-168.



Two leaf-tailed geckos illustrate their nearly perfect camouflage on mottled tree bark.



Ivoloina Impact

The value of Parc Ivoloina’s forestry station in ex-situ conservation of threatened and endangered plant species is expanding (see page 16). In partnership with Missouri Botanical Garden, Parc Ivoloina’s improved infrastructure and human capacity to propagate endemic plant species have led to over 360 species growing in the forestry station. Together with MFG’s Ivoloina Forest Station Manager Jean Francois’ ongoing replacement of exotic with native tree species, seeds



from Parc Ivoloina’s plant populations can be a valuable resource for other reforestation efforts. Surveys of the forestry station’s vertebrates, and subsequent molecular research by MFG Advisor Angelica Crottini, have revealed that four of Parc Ivoloina’s 18 amphibian species are new to science. This discovery reinforces the important role the forestry station plays with respect to in-situ conservation of Madagascar’s endemic amphibians.

Regrettably, the forestry station is situated directly in the pathway of the Asian toad invasion, and based on Australia’s



experience with the cane toad, their arrival will likely have a decidedly detrimental impact on Madagascar's endemic predators. All bufonid toads produce toxins known as cardiac glycosides. By disrupting sodium regulation, this group of compounds can cause heart rate irregularities and death. However, species that have co-evolved with toads are resistant to the toxin. In 2015 researchers demonstrated the genetic mutation that confers resistance to toad toxins is the same in all species.

Armed with this knowledge, Marshall et al. (2018) examined 77 Malagasy species that prey on frogs, their eggs or tadpoles and found only one species, the white-tailed antsangy (a native rodent), was genetically likely to be resistant.



Developing Support

The 2014 discovery of the Asian toad in Toamasina and the alarm over its impact on Madagascar's endemic species was widely covered in national and international newspapers. Scientists and conservation NGOs expressed the urgent need for a rapid response. The Malagasy Government appointed a National Toad Advisory Committee to develop an eradication strategy, however, the level of organization, authority, and funding required to both agree upon and execute a large-scale, coordinated effort simply did not exist. Invasive species specialists were brought to Madagascar to evaluate the feasibility of an eradication. Their 2015 report concluded the possibility of eradication was low because 1) the toad likely arrived in 2010 and already covered an area of approximately 98 km², 2) would require immediate action, and 3) could cost between two and ten million dollars.



Above is a juvenile Asian toad

If eradication was not an option, the authors suggested the possibility of prioritizing the protection of high biodiversity sites. Regardless of what approach would be taken, basic research on the behavioral ecology of Asian toads in Madagascar would be needed to develop and evaluate management strategies. The MFG collaborated with its

partners to map the toads' dispersal, monitor its rate of advancement and population demographics, and assess its habitat preferences and feeding ecology. The MFG was actively engaged in awareness-raising programs and partnered with Association Vahatra and Island Conservation to implement an expanded public awareness campaign.



Can Asian Toads Be Stopped?

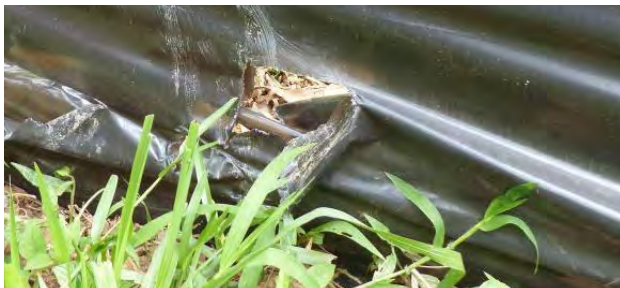
Surveys clearly showed the toads were steadily advancing towards Parc Ivoloïna. Would it be possible to construct a toad exclusion zone along Parc Ivoloïna's northern border? Karen Freeman sought extensive input from members of the Amphibian Specialist Group, Amphibian Survival Alliance, DREDD officials, and MFG staff on a proposal to test whether barrier fencing, in combination with pitfall traps, could exclude the toads from invading Parc Ivoloïna. The technique is successfully used to study populations of small vertebrates and to prevent individuals from expanding their range during ongoing eradication campaigns.

While everyone acknowledged challenges entailed in such a project would be significant, they also recognized the importance of evaluating whether an adaptive management approach (potentially

incorporating other control methods) could be successful in some situations.



Roderic Mahasoa, who led the awareness-raising campaign, was hired to coordinate and oversee the fencing project. The initial proposal called for installing a triple line of protective drift fencing and pitfall traps, however, it was impossible to install three fence lines in areas of steep, rocky outcroppings. Finding quality plastic sheeting in the dimensions required proved to be difficult, and even the higher quality plastic degraded from UV exposure more rapidly than expected. Unfortunately, there were incidences of vandalism despite multiple awareness-raising campaigns and good communication with local residents. An offer from Ambatovy (a private mining enterprise) to donate used rubber conveyor belting they discard awaits testing as the donation has been held up for over a year in the bureaucracy of Madagascar's Customs office.



Leaping Forward

Ever since the Asian toad's discovery, it has been a great struggle to raise sufficient funds that would enable substantial and definitive testing of methods to detect, capture and remove toads from specific areas of higher biodiversity. In 2019, a Memorandum of Understanding (MOU) was signed between MFG and Ambatovy for a two-year project to delimit, control and mitigate the impact of the toad on Madagascar's endemic species. The MOU with Ambatovy specifies that the company will provide substantial funds to allow, for the first time, the employment of a full-time team focusing specifically on Asian toad issues.



Dr. Muller with toad trap. Photo: Dr. Eric Nordberg

The funds will also cover office space, a project vehicle, and operating funds. We are lucky to have recruited Dr. Ben Muller (above) to lead this program. Ben received his Ph.D. from James Cook University, Australia, where his major professor Dr. Lin Schwarzkopf, was developing a trap for cane toads. Ben's research focused on identifying the acoustic characteristics of male advertisement calls

that lured the highest number of gravid females into a trap. He compared calls made by males of different ages, body conditions, and populations. He found females were most attracted to calls from large-bodied males with high energy reserves who lived within the females' range. Upon graduation, Ben moved to Florida, which also has a problem with the cane toad. He came supplied with the trap he helped Dr. Schwarzkopf develop, now commercialized as the "Toadanator," for use in Australia. Not unexpectedly, he has found the calls of male cane toads in Naples, Florida, differ from those in Australia. Ben will move to Madagascar in 2020.

Our luck continued when Dr. Noelikanto Ramamonjisoa (below) accepted the position of Deputy Coordinator. Noeli graduated from the University of Antananarivo's School of Agronomy with a BS and DEA. In 2013, he moved to Japan to further his graduate studies at Nagoya University.



His Master's research looked at factors that affect the life-history of amphibians; his Ph.D. research was a deep dive into niche partitioning and phenotypic plasticity exhibited by tadpoles in multi-species communities. His post-doctoral research includes the impact of an invasive crayfish on amphibians and of guava on Madagascar's endemic trees. The program



View of Parc Ivoloïna

will benefit from his expertise and experience. Roderic is the third member of the field team; his involvement with all of MFG's toad projects and masterful abilities to organize and motivate teams will be invaluable. We are hiring an accountant and office manager to maximize the amount of time the team can spend in the field. Additional field staff will be hired as needed.



Ecological Monitoring Surveys

Once a year, MFG Betampona Head Agent Jean Noel and two or three Betampona agents spend a week surveying Parc Ivoloïna's terrestrial vertebrates. Their surveys are the foundation of our species' lists and will be used to monitor species populations over time. To set up more quantitative long-term surveys, MFG Research Coordinator Juliana Rasoma worked with students from the University of Toamasina's Higher Institute for Sciences, the Environment and Sustainable Development (ISSEDD) to establish four transects, two inside and two outside parcels established for ISSEDD. Additional transects are required to account for the Parc's diverse habitats and to evaluate the impact of the Asian toad.

The first survey of the transects outside ISSEDD's parcel took place in late May by a team that included Danni Rae, a keeper from Wellington Zoo, Jean Honore Velo, Betampona agent (left in photo at bottom left), and translator Charly Nirina Hoby. The transects were walked twice a day, from 6-9 am and 4-7 pm for six days. In total, 50 species were identified; no Asian toads were detected.

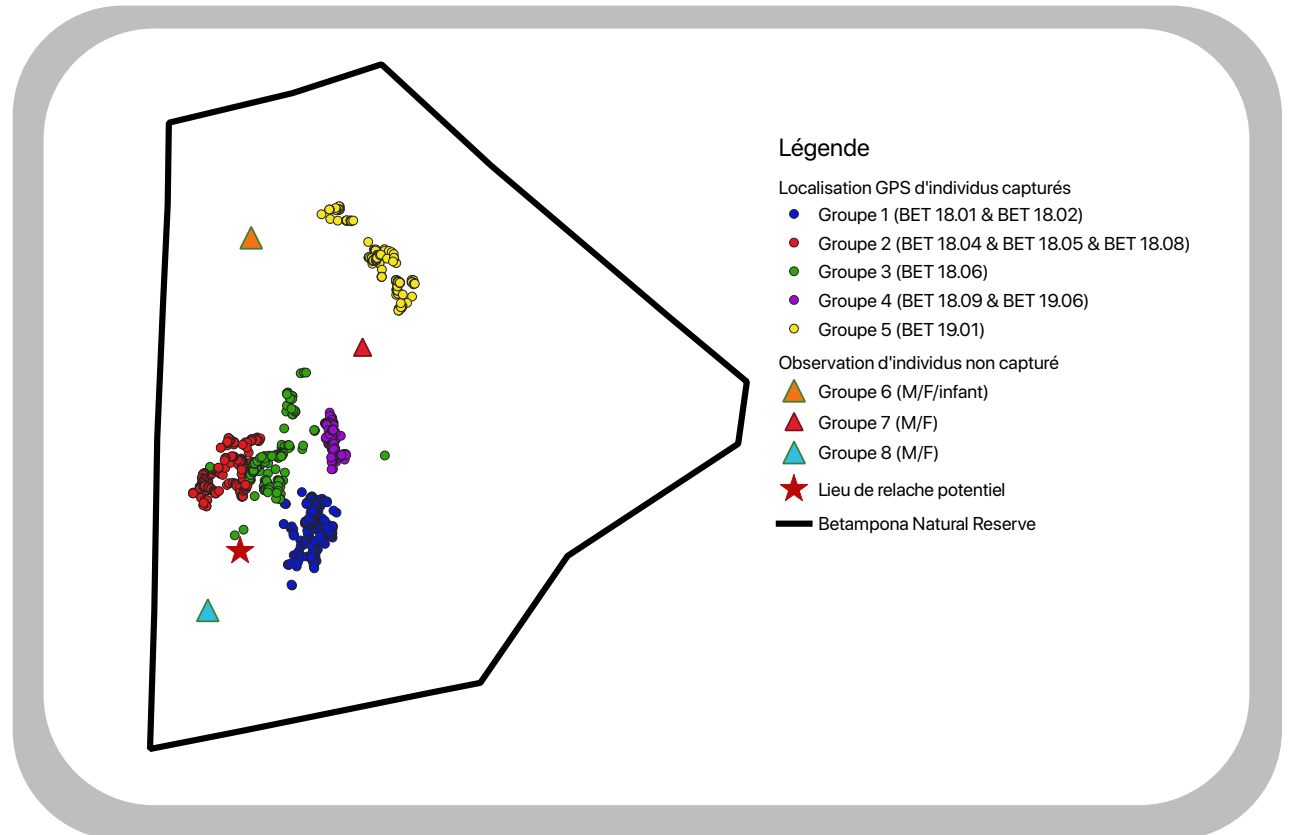


Betampona's Diademed Sifaka - The Demographics Do Not Look Good

Despite previous attempts using standardized distance-sampling surveys in 1991, 2004, and 2016, we have never been able to obtain a good estimate of Betampona's diademed sifaka (*Propithecus diadema*) population size - until now. The very nature of this project, which requires radio collaring the sifaka, allows us to apply the "total count" census method. This method is appropriate when the entire area can be searched, the population is small and individuals can be identified.

At the end of 2018, seven individuals representing four groups had been collared. In 2019, two collaring missions were focused on the northern part of the reserve where the Betampona agents had observed a single male and a pair. In May, the team was successful in capturing the male (19.1); in December, the female from Group 4 was collared.

Master's student, Stephan Andrianarivo, began tracking the radio-collared sifaka in February; collecting GPS data to map their home ranges. After adding male 19.1 to his schedule, Stephan spent time in the northern part of the reserve which led to an exciting discovery - a second pair with an infant. Betampona agents were aware of an eighth group in the southwest corner of the reserve; they set about to search for the pair and were able to confirm their continued presence. Additional capture missions for the three uncollared groups are scheduled for 2020.



After Stephan completed his six months of field work, Juliana Rasoma identified a second Master's student, Savien Ianjara, to continue the mapping work. The map on page 10 is based on Stephan's home range data for groups 1-5; the location of the three non-collared groups 6 to 8 is also shown. What we see is a population that is demographically unsustainable. Although *P. diadema* groups are known to range in size from 2-10 adults, five of Betampona's groups are composed: a pair; a pair with an infant; two "groups" are solitary males; and one group (#2) is a pair with a subadult female. The current population of 16 individuals includes seven females, eight males, and one unknown (the infant).



Ruth's Story

When we captured female BET 18.8 in December 2018, a microchip revealed her identity. Ruth had been captured and radio-collared for two research projects, first in November 2007 and again in May 2009. She gave birth in June 2008 to an infant who was alive when the researcher left in July 2008. When the second study was initiated, Ruth's infant was gone. She was found living with a different adult male and an adult female. That female (Claire) gave birth in June, and Ruth gave birth in September.

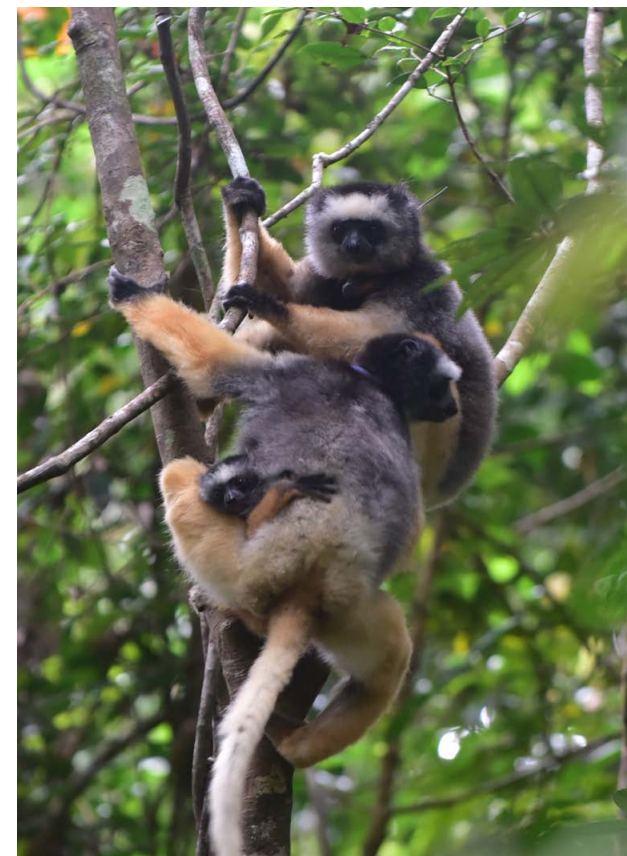


Claire's infant disappeared shortly before the study ended in late September; the fate of Ruth's infant is unknown.

Fast forward to December 2018. Ruth is living with yet another male and a subadult female, who is likely her daughter. Fidy's physical exam reveals Ruth is lactating, indicating the recent loss of an infant. In October, Stephan discovered Ruth

carrying a healthy infant. On December 24, Savien writes in his notebook that Ruth's infant was playful and active. When he returns to observe the group on the 26th, the infant was nowhere to be found.

Such high infant mortality is not unusual in sifaka. Morelli et al. (2009) monitored the outcome of 56 *P. edwardsi* births and found 52% of the infants died within a year, and 75% died before reaching sexual maturity. Sifaka can live well into their 20s, and females remain fertile throughout their life. This ongoing research gives critical data to guide effective planning and to know that Ruth's potential to growing Betampona's population is not over.



A Drop of Immunity



Newcastle's disease (NCD) is a highly contagious viral disease of birds that is endemic in Madagascar. Families who raise chickens are familiar with NCD outbreaks that can sweep through a village and kill over 50% of their chickens. Because families living near Betampona prefer chicken over bushmeat, increasing chicken production could be a conservation strategy that benefits both people and Malagasy wildlife. However, the initial challenge is that some people are wary of vaccinations, while others may be hesitant to spend what little money they have on vaccinations. The IUCN awarded the MFG a Save Our Species – Lemurs grant to show families that NCD vaccinations can increase chicken production and thereby pay for themselves. We targeted 12 villages, training one person in each village to vaccinate chickens, and collect the survey data required to evaluate outcomes.



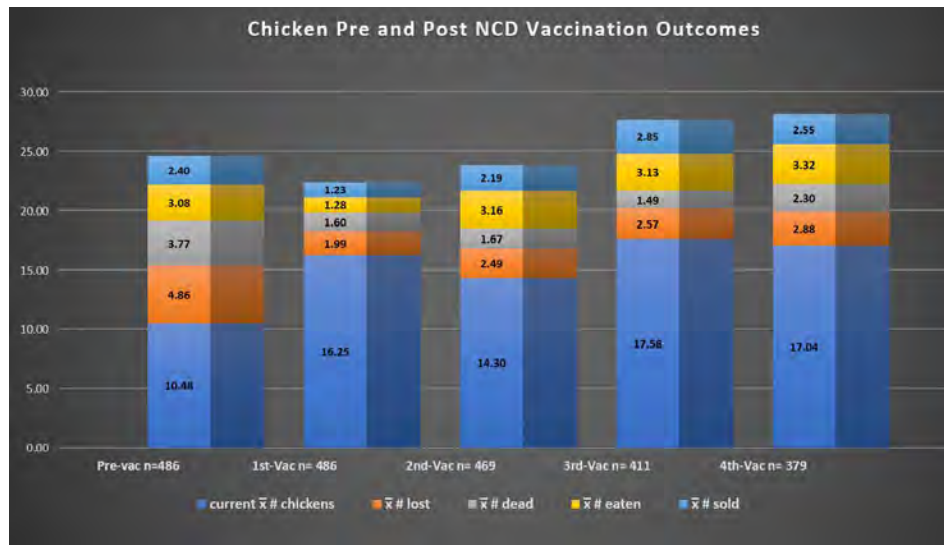
The thermo-tolerant vaccine, produced at the Malagasy Institute of Veterinary Vaccines (IMVAVET), must be given every four months. To date, we have completed five vaccination campaigns; two in 2018 and three in 2019.



The procedure adopted by the vaccinators is to complete the detailed census survey when they collect orders. The survey includes the number of chickens by age and sex the family currently owns plus the number of chickens purchased, sold, eaten, died, and lost since the last survey. When the chickens are vaccinated, data collection is limited to the age and sex of the chickens. MFG's Christian Rambeloson meets with the vaccinators to deliver the vaccine, and after each vaccination campaign to review outcomes and resolve problems as a group. For example, the number of vaccinated chickens was markedly reduced in November 2018 because several families spread their conviction that NCD vaccines killed their chickens. To prevent this rumor's perpetuation, the vaccinators agreed to remind skeptics within their community that the vaccine does not prevent other poultry diseases. A veterinarian from IMVAVET met directly with the families to explain their chickens most likely died from avian pox.



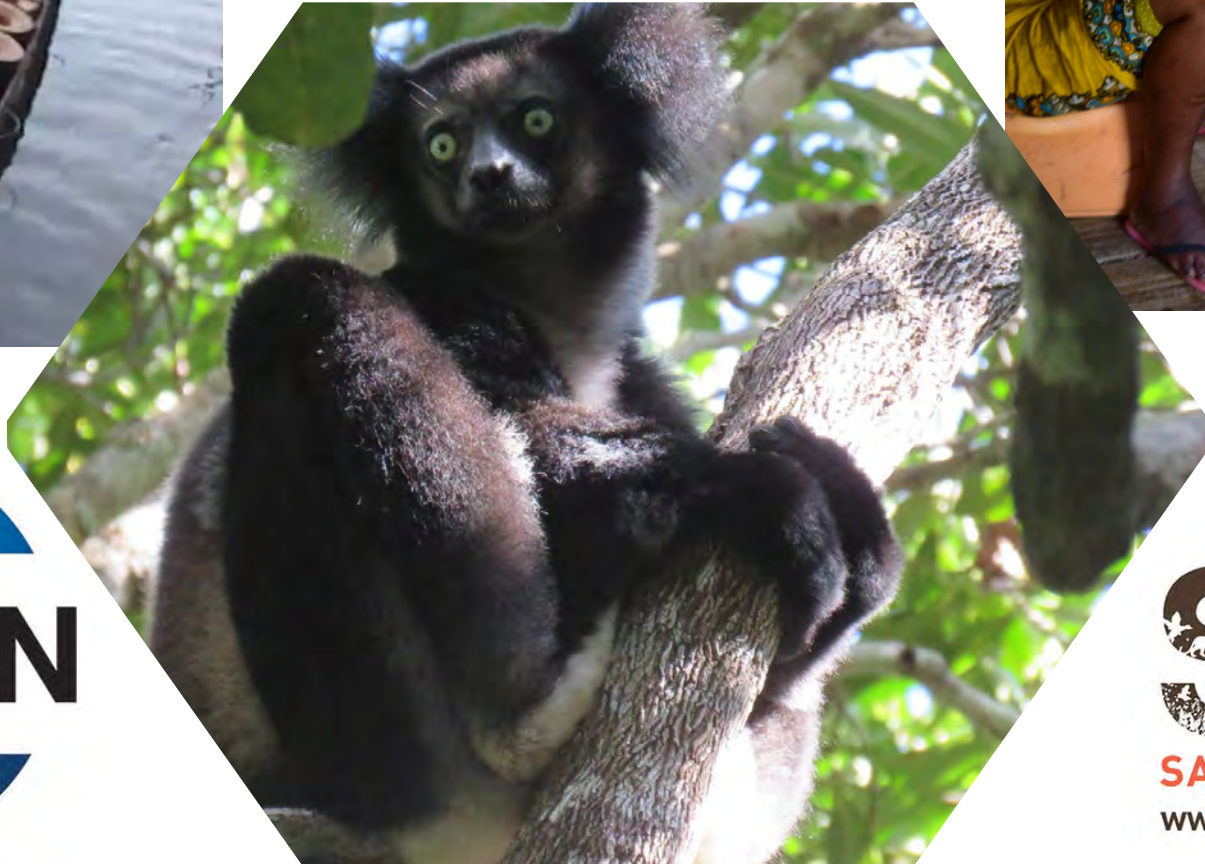
Not all households (HH) in the 12 villages participated in the vaccination campaigns when first initiated in May 2018. Some joined later, some missed a vaccination campaign, or did not complete the detailed order survey. The graph represents HHs that consistently participated in each subsequent census and vaccination campaign, regardless of when they joined. The graph reveals several positive outcomes: 1) there has been a 22% increase in the number of consistently participating HH, 2) the average number of dead or lost chickens decreased by 40-58% following vaccinations, 3) there have not been any NCD



outbreaks in the 12 targeted villages, 4) the high number of pre-vaccination chickens eaten is likely due, in part, to the habit of eating sick chickens before they die; note the lost/dead category was high and “lost” chickens may include chickens who died, 5) flock size has increased by 14% in four-vaccination HHs, and 6) a reduction in the number of lost/dead chickens has enabled HHs to consume and sell more chickens.



We will do a more in-depth analysis of the data when the project ends in September 2020, at which time we will have completed seven rounds of vaccinations. We will also assess whether improved chicken production affected bushmeat hunting through a survey of HHs in the 12 participating versus nonparticipating villages.



IUCN SOS Grant - Fuel Efficient Stoves

Another aspect of the grant is to distribute fuel-efficient stoves to reduce deforestation. Stoves are shipped by truck to Toamasina where they are unloaded and stored at the Ivoloina Conservation Training Center (ICTC). Christian organizes a rental truck that takes the stoves to the first broken bridge. Thereafter, pirogues, cars, and porters bring the stoves to their designated village. It took several weeks to deliver the 700 stoves.

Christian meets with the women animators who will oversee the distribution of the stoves in their community. Each stove recipient is required to sign a contract agreeing not to sell the stove or use charcoal in place of firewood.



They are asked to estimate how much firewood they currently use in a week. The animators show the recipients how to use and clean the stove, and check-in with them three to four times within the first month to ensure there are no problems or questions. In March, one of the animators reported that 17 stoves had been converted to use charcoal instead of firewood. Although there are ADES stoves designed for charcoal, we intentionally ordered wood-burning



Bags of charcoal line the road awaiting passersby to purchase.

stoves because producing charcoal consumes and wastes more wood. Whole trees are cut to produce charcoal, whereas firewood is typically comprised of scattered deadwood or a cut branch.

The 700 fuel-efficient stoves were distributed to qualified families, based on 1) they participate in the chicken vaccination program, 2) they participate in the Betampona Zone of Protection Reforestation program, and 3) they did not receive a stove in the first round.

In September, part of the MFG's radio program, Bitsiky ny ala Atsinanana, was used to promote the health, time-saving and environmental benefits of the ADES fuel-efficient stoves and the efficacy of the Newcastle disease vaccine.

Another 700 stoves will be delivered in 2020.



Building on Success: Rescuing Even More Plant Species



In last year's Annual Report, we described the substantial achievements of the 3-year project funded by the Darwin Initiative to conserve native plant diversity. Through ex-situ conservation at Parc Ivoloïna, seeds were collected from unprotected and thus doomed forest fragments within the Ivoloïna and Ifontsy River Valleys. While the Darwin Initiative funding finished in March 2019, we are pleased to report that ex-situ plant conservation work at Parc Ivoloïna continued, albeit more modestly, through 2019 and is expected to continue for at least another 2 years.

During 2019, three main ex-situ plant conservation activities were implemented by a team including Head nurseryman Alex, his two assistants - Platini and Philemond, and the MBG field botanist - Patrice.

In the first activity, the team nurtured seedlings propagated during the Darwin Initiative project that had been too small to plant during the 3-year project window. Now at proper size, they were planted into the Parc. In total, since the end of this grant, 3,007 individually-tagged and databased seedlings of 138 different shrub and tree species have been planted in the Parc. This team also monitored and provided some post-plantation care for the 14,129 seedlings that had been previously planted in the Parc during the Darwin Initiative project. This survey revealed an average seedling mortality rate of 31%. This is higher than we had hoped, but is not unexpected given the challenges of the planting zone.



The cost of this work was kindly covered by gifts from the friends of Missouri Botanical Garden (MBG).



Second, two field trips were organized with the aim of propagating a species of *Melanophylla* (in the family *Toricelliaceae*) discovered during Darwin Initiative fieldwork and new to science, but not yet propagated. In 2019, Pete Lowry, et.al., from MBG published an article describing this species for the first time, and giving the tree the name *Melanophylla dianeae*.

(<https://novon.mobot.org/index.php/novon/article/view/490/459>)

In 2018, cuttings taken from one of the five known remaining trees of this species failed to root and, in 2019, this set-back was followed by two more failed propagation attempts: none of a sample of seeds collected from one of the trees and sown at the Parc germinated and several air layers that have given robust roots nevertheless failed to grow when severed from the parent tree and potted-up in the nursery.

Now, a second attempt is underway to propagate the tree using the air-layering approach, albeit modified to that applied previously. This Critically Endangered tree is a hair's breadth away from extinction and its successful propagation and ex-situ conservation in 2020 is of the highest priority. This work was also funded by gifts from friends of MBG.



The third ex-situ plant conservation activity conducted in 2019 was to seek seeds from diverse sub-populations of the spectacular, Critically Endangered, monocaulous (singled-stemmed and unbranched) tree *Dracaena umbraculifera*.



A scene featuring *Dracaena umbraculifera* within an unprotected forest fragment in Ivoloïna river valley

Until recently this plant was thought to be extinct in the wild and known only from botanical gardens. These institutions had obtained their plants from a specimen in the glasshouses of the Schönbrunn Palace in Vienna which had apparently originated from the Pamplemousse Botanical Garden in Mauritius towards the end of the 18th Century.

Then, in 2014, much to everyone's surprise, this species was found on Ile Se Marie (an island off the east coast of Madagascar) followed by a succession of further discoveries on the mainland including within doomed forest fragments in the Ivoloïna river valley. To secure some of the genetic diversity from these later sub-populations, Patrice led field trips to seek and collect seed samples from each that were then propagated at Parc Ivoloïna. Through



these actions, at the end of 2019, we had successfully propagated 83 young plants originating from three unprotected forests in the Ivoloïna river valley (*Ampasina*, *Mahatalajona*, and *Fodiarika*), and of these, 33 had been planted out into the Parc (*below photo*) while the rest remained in the nursery. This work was completed with the support of the Mohamed bin Zayed Species Conservation Fund and the Association of Zoological Horticulture.



Residual funds from gifts made by friends of MBG will enable all the work described above to continue in 2020. In addition, a new grant secured from the Association of Zoological Horticulture will be used to support work to propagate six trees species thought to be new to science that were discovered in unprotected forests fragments during Darwin Initiative fieldwork but which have not yet been brought into cultivation. These species include

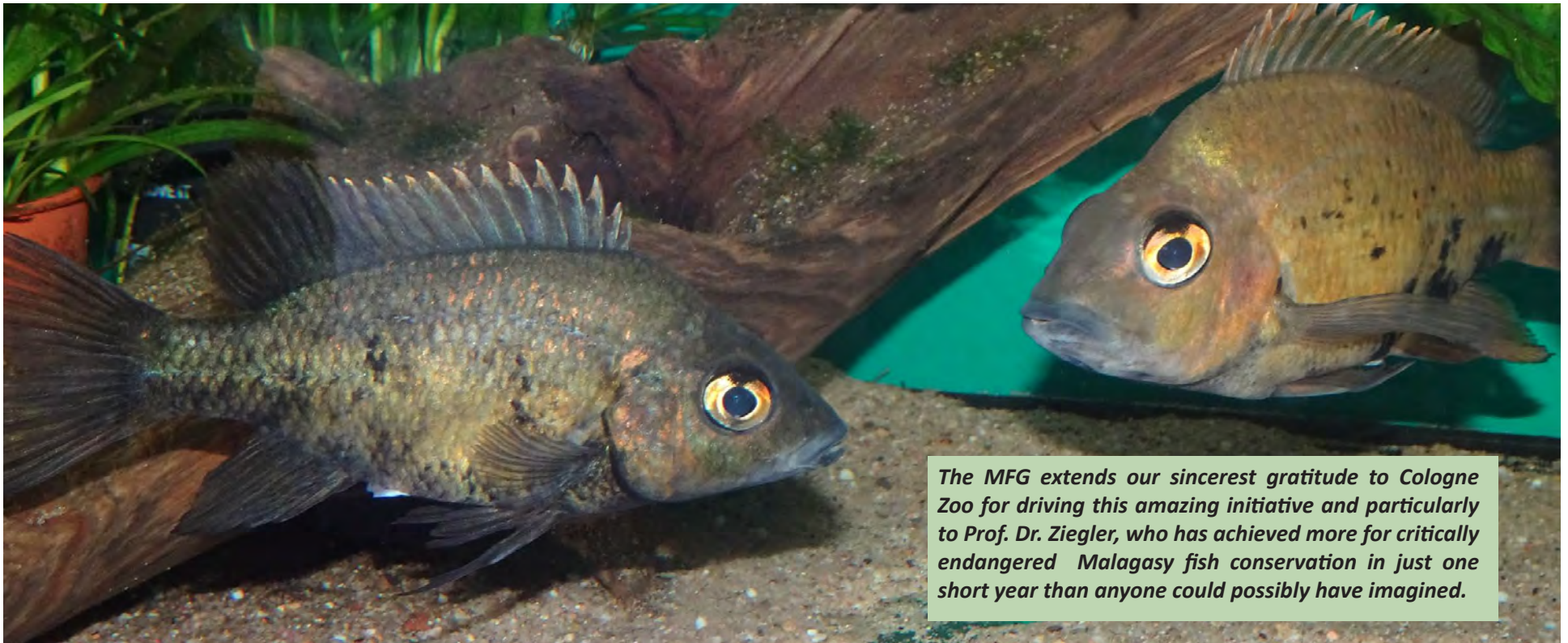
the problematic *Melanophylla dianeeae*, as well as two species of *Polyscias* (*Araliaceae*), a species of *Astrocassine* (*Celastraceae*), a species of *Vitex* (*Lamiaceae*) and a species of *Rhopalocarpus* (*Sphaerosepalaceae*).

We hope, that in next year's Annual Report, we will be able to share with you the good news that these plants have all been successfully propagated and thereby snatched from the very jaws of oblivion.

Cologne Leads Collaboration of Firsts

Cologne Zoo hosted the MFG's annual meeting in May 2019. On that occasion, Zoo Director and MFG Board Member Prof. Theo Pagel had also invited his curators to participate, among them the head of Cologne Zoo's Aquarium, Prof. Dr. Thomas Ziegler (right). In past years, Ziegler had built up a focus on research and conservation including the many threatened freshwater fish species including three notables from Madagascar: *Bedotia madagascariensis*, *Pachypanchax sakaramyi* and *Paretroplus menarambo*.

Because of Cologne Zoo's focus on research and conservation in concert with close cooperation with molecular biologist and Madagascar expert Prof. Dr. Miguel Vences from the Zoological Institute of the Technische Universität Braunschweig, Thomas was assigned the job to improve the international distribution of threatened Malagasy freshwater fish in zoos. After the meeting, Ziegler was connected with renowned ichthyologist and MFG Advisor Paul Loiselle from the Wildlife Conservation Society's New York Aquarium, who recommended the first measure of sending offspring of rare Malagasy fish from overseas to Europe.



The MFG extends our sincerest gratitude to Cologne Zoo for driving this amazing initiative and particularly to Prof. Dr. Ziegler, who has achieved more for critically endangered Malagasy fish conservation in just one short year than anyone could possibly have imagined.

A breeding pair of Loiselle's cichlid at the Cologne Zoo

Acting rapidly, Cologne Zoo received rare and threatened fish surplus from the Toronto Zoo in Canada just a few months later in October 2019. Among them were the endangered Loiselle's cichlid (*Ptychochromis loisellei*), and Crystal Rheocles (*Rheocles vatosoa*), as well as the Mangarahara cichlid (*Ptychochromis insolitus*), which is classified as Critically Endangered on the IUCN Red List. Based on official zoo databases, these species are not kept in any zoo in Germany.

The Mangarahara cichlid was found in only four zoos in Europe, which kept the species in very low individual numbers. This species is one of the rarest fish species known on Earth and almost went extinct before a rescue mission in recent years. Crystal Rheocles was only found at London Zoo and Loiselle's cichlid has never before been kept in any European zoo. It was thus Cologne Zoo's goal to establish the husbandry of these three species in Germany, to breed, and subsequently to provide offspring to other zoos in Germany and Europe. By doing so, a network could be established for *ex situ* conservation of these species.

For this purpose, Cologne Zoo has built a special aquarium system behind the scenes of the Aquarium house and Crystal Rheocles is already displayed in a show tank in the public area. In addition, a 20,000 liter tank, where fish from Lake Tanganyika were previously shown, now features endangered fish species from Madagascar to educate the public and create additional spaces for the endangered freshwater fish species that need our help.

Only two months after the arrival of the Mangarahara cichlids in Germany, they successfully reproduced. Several hundreds of them in different sizes are currently being reared. Around 200 were already sent to some zoos in Germany (e.g., Berlin,



Cologne Zoo's conservation messages have been expanded through both print and television media. Shown here is the filming of the backstage view of the large 20,000 liter tank.

Stuttgart) and Europe (e.g., Vienna, Austria). More zoos in Europe are already interested in participating in the conservation breeding network as well. Thomas has also initiated a Citizen Conservation Program beginning with the Mangarahara cichlid. This integrates passionate hobbyists as well and extends the conservation breeding network as the Cologne Aquarium has sufficient offspring available at this time.

Thomas also sought to establish connections with private breeders worldwide and with the German Cichlid Society (DCG). This can bring back the Endangered Lamena (*Paretroplus nourissati*) to the zoo community, as there are presently no current holdings according to official zoo databases.

Giving a preview of 2020, the Crystal Rheocles successfully bred and the first breeding of Loiselle's cichlid succeeded at Cologne Zoo's Aquarium in

March 2020, which represents the first breeding of the latter species in a European Zoo. Offspring of these fish can be forwarded to other institutions soon. In the meantime the collection of Malagasy freshwater fishes kept at Cologne Zoo has also further increased: Currently nine species are kept in Cologne Zoo's Aquarium, with eight of them being threatened and five already successfully reproducing.

Thomas is also currently supervising a student working on her Master's thesis at Cologne University dealing with *ex situ* zoo husbandry of threatened Malagasy freshwater fish species on a world wide scale to gather the necessary data in order to guide the next steps in their conservation.

If you're interested in participating in this exciting endeavor in the US or other regions, please contact the MFG.



Advancing Lemur Welfare and Conservation Breeding Programs in Madagascar

In late 2018, the Duke Lemur Center (DLC) was awarded a grant by AZA's Conservation Grants Fund/Disney Conservation Fund, to expand efforts for *ex situ* lemur conservation in Madagascar. In partnership with the Ministry of the Environment and Sustainable Development (MEDD), the project's main goals are to: 1) contribute to advances in lemur husbandry, welfare, and collection management in the 14 licensed Malagasy zoos and parks which together hold over 600 lemurs; 2) establish the foundation for cooperation and animal exchanges among zoos for national breeding programs; 3) encourage creation of a Madagascar zoo association and a zoo code of ethics; and 4) promote guidelines for management of confiscated lemurs. While lasting progress towards these goals will require sustained support for Malagasy zoos, in 2019 there were significant accomplishments.

Project Director Andrea Katz obtained an AZA CGF/DCF grant to fund the manual and workshop.

A 75-page Lemur Care and Management Manual was written in French and compiled by Andrea with important contributions from DLC staff and Malagasy collaborators including Eric Robsomanitransana of MEDD, Dr. Fidisoa Rasambainarivo of Mahaliana Labs, and others. Manual chapters include taxonomy and conservation status, welfare principles, collection planning, animal records, housing, nutrition, enrichment and training, reproduction, social management, veterinary care, animal



transport, conservation education, national wildlife laws, and zoo ethics. This Manual was endorsed by MEDD, the first of its kind in Madagascar. With great assistance from the MFG staff in Toamasina and at Parc Ivoloina, a training workshop based on the Lemur Manual and the records template was held at Ivoloina in June 2019. A total of 19 institutions represented by 34 Malagasy zoo staff, veterinarians, government officials, and representatives from local conservation and research NGOs participated. Input from the participants has been incorporated into the final version of the Manual.

During the workshop, the training team saw the evolution of an exciting synergy and interest in the creation of a Madagascar zoo association. Such an association would provide structure for peer-to-peer zoo visits to improve animal care, would facilitate communication for studbook creation and maintenance, and for cooperative breeding programs. The association could serve

as a professional network to support MEDD's responsibilities for captive wildlife. Additionally, if legally created as an association in Madagascar, the group could initiate its own fundraising and serve as a coordinating body for future training and support provided by outside organizations such as the DLC and other MFG member organizations.



Dr. Sarah Zehr of DLC developed a new animal records template specifically for lemurs in Madagascar's zoos, and she provided training in data needs and entry during the workshop. Afterwards, most of the Malagasy zoos sent biographical data on the individual lemurs in their collections. Data (of varying quality) was received and tabulated for 473 lemurs of 24 taxa. This extraordinary response represents over two-thirds of the most recently reported *ex situ* lemur holdings in the licensed zoos. Some of the zoos found the records template challenging, and communication and support continues so that maximal lemur data can be accurately compiled and given to MEDD.

With this animal data, the first version of a Madagascar studbook for Coquerel's sifaka (*Propithecus coquereli*) has been drafted by the SSP Coordinator and Studbook Keeper, Britt Keith. There are numerous data gaps to fill, but it is a tremendous start - the first regional studbook ever for lemurs in Madagascar!



Britt Keith, DLC Assistant Curator, demonstrating lemur capture and restraint techniques (above & right).

The one project goal that has not been achieved is the development of guidelines for the large number of illegally, privately-held lemurs in Madagascar and housing options for confiscated lemurs. The lack of adequate holding facilities for these lemurs on any significant scale is a huge challenge. Were the government to insist that the zoos accept more confiscated lemurs, the care and welfare of their current collections would be jeopardized. The IUCN guidelines on confiscated wildlife were reviewed during the June workshop; however no real plan of action was proposed by the government wildlife authorities or the participants.

The next steps are to officially launch and distribute the Manual in a ceremony with MEDD, zoo representatives, and collaborators. In addition, the PDF version of the Manual will be made broadly available to Malagasy veterinarians and students, to associated NGOs and local wildlife authorities. A follow-up workshop will also be held to lay the groundwork and develop the goals and activities for a new zoo association.



To further advance lemur care and welfare, Duke Lemur Center sent its most experienced lemur technician, Ms. Bevan Clark, to Madagascar in September 2019.

During Bevin's 10-month stay at Parc Ivoloina, she is working alongside Zoo Manager Bernard lambana and the team of zookeepers. Her focus is to evaluate and propose improvements to daily husbandry practices, animal observations, birth and breeding management, health protocols, sanitation procedures and record-keeping.

Prevention - Early Detection - Mitigation

This is the mantra of invasive species specialists, and for good reason. The optimal solution to the invasive species problem is to prevent their accidental introduction in the first place. Although optimal, it is an enormous challenge that requires a significant commitment and close collaboration within and among public and private sectors. Should an invasive alien species slip through border inspections, a coordinated system to report and remove the species before its population expands is essential. The Asian toad is the archetype of what happens when a species' population grows beyond our current capacity to remove it. Thereafter it is a matter of damage control.

Madagascar's *National Biodiversity Strategy and Action Plan 2015-2025* identifies invasive aliens as threats to Madagascar's ecosystems and biodiversity. Toamasina has always been the country's largest and busiest seaport city; approximately 75% of domestic and 90% of international cargo comes through Toamasina. The common mynah, an infamous member of the top 100 list of worst invasive species,



entered through Toamasina. Since it arrived in the 1850s, the mynah has become entrenched throughout the island. In the mid-1970s, the house sparrow entered Madagascar through Toamasina's port; its 1978 population of 20 individuals has grown to over seven and a half million.

A population of the Asian toad and a small population of another highly invasive bird, the house crow, were discovered in 2014; their arrival in Toamasina was most likely ship-assisted. The discovery of two highly invasive species within a few years of each other, one that has grown exponentially and is beyond extirpation, has generated renewed urgency to address invasive species and biosecurity issues.

Karen Freeman was already well-versed on the conservation threats posed by invasive species when she arrived in Madagascar 16 years ago. Over that time, she has initiated and overseen research that informs invasive species management strategies.

Under Karen's leadership, the MFG was awarded a grant from the Critical Ecosystem Partnership Fund (CEPF) to: 1) work with local and national authorities and community leaders to remove the still small house crow population from Madagascar, and 2) develop an invasive species community reporting system.



In 2014 the house crow population numbered around 15 individuals, by 2019 it had more than doubled. Immediate removal was required to succeed and minimize the number of house crows impacted. The grant enabled us to engage invasive species specialists, InGrip Consulting, who began their work in October. MFG staff and ISSEDD students accompanied them, and Association Vahatra trained students to carry out a parallel disease-screening program. At year's end, approximately a third of the population was removed. The work was authorized and overseen by the Ministry of the Environment and Sustainable Development (MEDD) and their regional branch (DREDD-Atsinanana).

The grant called for several workshops to obtain input from community leaders and government authorities. The first workshop was held in May and included representatives from the National and Regional Departments of the Environment and Sustainable Development, including the newly created department of invasive species, MNP, the Port Authority, the Maritime and River Port Agency, Ambatovy, Island Endemics Foundation, and MFG Staff. Workshop participants (left) broke into groups to discuss what it would take to develop a community invasive species surveillance network.

Among the identified needs were increased public awareness, technical training for authorities, identification of additional stakeholders, clear lines of communication, and funding. The ideas and momentum from the workshop led to the submission of an IUCN Motion. Motions are “the mechanism by which IUCN Members influence third parties and guide the policy and program of IUCN”.



IUCN MOTION: Building Madagascar's Capacity to Counter the Threat from Invasive Species Requires:

Establishing a cross-sectoral national invasive species committee incorporating key government agencies and civil society from the environmental, agricultural, trade, transport and human health sectors to develop a formal framework for communication and action regarding invasive alien species (IAS). Enabling rapid and effective reactions to new IAS threats supports the Malagasy National Biodiversity Action Plan to “promote mechanisms for regulation, management and governance for invasive species to protect natural ecosystems”.

Developing a rapid-response capability to remove IAS as soon as they are detected.

Urging companies importing goods into Madagascar to ensure they are not introducing an alien species, to immediately notify government authorities if one is discovered and provide assistance in its removal.

Requesting Malagasy experts and the IUCN Species Survival Commission support the implementation of a country-wide program to counter IAS by providing key decision makers with critical data and advice.

The motion was submitted by IUCN Member Synchronicity Earth and supported by Madagasikara Voakajy, Madagascar Institute for the Conservation of Tropical Environments, Island Endemics, Saint Louis Zoo, Leipzig Zoo, Cologne Zoo, and the Florida Association of Zoos and Aquariums. (Florida has more non-native reptiles and amphibians than any other location in the world.)



Creating Opportunities to Advance Science Education

Ivoloina Conservation Training Center's Manager Véronique Ravololonarivo's message to all her students is that *Science is Fun and Science is for Everyone*. She has developed an array of training modules for primary to university students, often

in collaboration with teachers and professors. For many primary and secondary students, it is the first time they have looked through a microscope – and they find it thrilling. A Pew survey asked career scientists what sparked their interest in science;

just under half responded that it was a teacher or parent or an opportunity to do hands-on science that hooked them. Vero's objective is to hook as many as she can.

Mahaliana Lab Celebrates First Anniversary On February 5th, 2020, Mahaliana Labs, a unique research and training center built by co-founders Fidy Rasambainarivo, DVM, Ph.D., and Liz Toomey, will celebrate its one-year anniversary. Their vision for this new enterprise is to offer university students the opportunity to learn molecular techniques that have become essential to advancing conservation science. They recognized that molecular tools such as Polymerase Chain Reaction (PCR) remain mysterious, inaccessible tools for many Malagasy graduate students. In its first year, Mahaliana hosted introductory training sessions in advanced molecular techniques that enabled 46 students to expand their ability to answer questions of conservation importance. Of course, advancing conservation requires both hard and



Listening and Learning

Christof den Biggelaar, MFG's Ecoagriculture Advisor, spent part of his nine weeks in Madagascar reviewing the MFG's ecoagriculture activities with Christian. Christof was particularly interested in hearing what the farmers identified as problems and learning more about the rice varieties they planted. Juliana identified two ISSEDD students, Silver Tsilavina and Florian Zafiroa, who could work with Christof to do a rapid rice survey of farmers in five fokontany (villages) around Betampona. In October, as Christian and Christof visited MFG's tree nurseries and spoke with farmers engaged in innovative practices, Silver and Florian carried out their rice survey. In the late afternoon, they all met with



groups of farmers to discuss farm problems, the objective of the rice study, and introduce/discuss the farmer field school/study circle approach, i.e. farmers can improve crop yields through sharing positive and negative experiences. While hiking between villages and visiting with farmers, Christof and Christian identified several cases of



farmers experimenting with, for example, terraced and irrigated rice paddies on hillsides, dams, and stream diversions for fish and rice production, and agroforestry. If willing to share what they have learned, these innovative farmers could host a farmer field school.

soft skills, which is why, whenever possible, Fidy invites students to accompany him to research sites. In addition to gaining experience collecting and processing samples under field conditions, and developing problem-solving skills when, for example, equipment fails, they are also exposed to a range of stakeholders who have different skills, perspectives, and objectives that have to be recognized. Listening carefully and communicating clearly is a learned and essential life skill. When Fidy brought six veterinary students to Rendriendry to collect blood samples from chickens, they had an opportunity to sit in on a meeting with Christian and the vaccinators. Listening to the vaccinators identify challenges they have experienced expands the students' perspective on the non-medical aspects of implementing a vaccination program.



Girls' Leadership and Science Camp

This is the sixth year of the Girls' Leadership and Science Camp, organized and led by Véronique Ravololonarivo. Twenty-five girls from Tamatave, in their first or second year of high school, attended the two-day Camp in March. The second camp in December was for girls in their fourth year of secondary school. A total of 28 girls, evenly divided among schools in Sahambala, Ambodiriana, and Sahandahatra (communities near Betampona), and Tamatave, and their teachers participated in the camp.

Vero always invites women leaders to be part of a discussion with the girls after they first give a short presentation on their career path. This year Juliana Rasoma, Ph.D., MFG's Research Coordinator and instructor at ISSEDD, Michella Nantenaina, MFG's Manager of Human Resources, and two ISSEDD Ph.D. students participated in the camp. The December camp included a representative from the Regional Directorate of Population and Women's Promotion, women leaders in education, and female Ph.D. students.



The two goals of Girls' Camp are always the same: 1) girls need to know their rights, including the right to delay marriage, avoid unwanted pregnancies, have goals beyond marriage and family, and stay in school, and 2) inspire girls to learn about science. Girls are selected for camp based on their answers to two questions: 1) what goal do you want to accomplish before age 25, and 2) what personal characteristics got you through a difficult situation in your life? The first day of the camp is devoted to issues of girls' and women's rights. Vero begins each Girls'



Camp with the history of International Women's Day, an official holiday in Madagascar, but only for women. She explains the role gender has played in societies throughout the world, as well as in Madagascar. Although Madagascar's constitution gives women equal rights to an education and jobs, the reality, especially in rural areas, is much different. Madagascar remains a largely male-dominated society, and violence against women remains a significant problem. Many families with limited income will preferentially send their sons to school; girls are told only a husband can lift them out of poverty. According to UNICEF, Madagascar has one



of the highest rates of marriage in girls under the age of 18. Ms. Delphine Razafindrafara's message to the girls was blunt: *"Early marriage is not a solution to get out of poverty, it is violence against girls!"*

The UN's 2019 Human Development Index Report states: Gender inequality has long been associated with persistent discriminatory social norms prescribing social roles and power relations between men and women in society.





The second day of camp is focused on science and includes a science-related activity. This year the high school students participated in planting native trees as part of Parc Ivoloïna's reforestation program. The secondary school students were introduced to geology, the lab's collection of rocks, and how to use a microscope. At the end of the day, the girls are asked to apply their leadership skills and share what they have discovered through their camp experience with their classmates, teachers, and even their parents.



Gender awareness-raising conference at local high school led by Veronique Ravololonarivo.

Breaking Norms

Girls who have attended Vero's Girls Leadership and Science Camp are encouraged to practice and share what they have learned with their fellow students. It appears they are indeed spreading the word. This year several high school girls approached Vero with a special request. Could she come to their high school and lead a gender awareness-raising conference, opening it up to boys as well as girls. After conferring with school administrators who approved the girls' initiative, Vero scheduled two conferences (below left photo). The first was held on May 26, the second, at a different high school, on June 16. Attendance was high at 73 and 60 students; mostly girls, but some boys did show up. In addition to inviting a few inspirational women who held leadership positions, Vero also invited two girls who had attended camp the previous year. Both girls had told her how much camp had changed their perspective. Their stories were important, and perhaps because they had the same story, their impact would be even greater.

The girls told Vero that Camp had led them to reconsider their future, to realize they had the power to change their life's trajectory. Each girl returned home, excited to share all they had learned with their moms. When expressing their determination to complete high school, each girl's mother explained the family couldn't afford their continued education. If they wanted to continue their schooling, the only realistic path open to them was to get married immediately. Their mothers' advice did not deter the girls; quite the opposite, both felt empowered to explain that education, not marriage, was their path out of poverty. They would find a way to pay for their school registration and supplies. Through their tears, both mothers signaled their approval and pride. True to their word, the girls found part-time jobs, are back in school, with a story that may inspire other girls to follow in their footsteps.

Women Scientists

Dr. Juliana Rasoma was invited to speak at a workshop hosted by Ikala STEM, an NGO formed in 2016 by two young Malagasy scientists. Both women wanted to inspire Malagasy girls to become the next generation of women scientists. Ikala is a Malagasy word for a young girl or group of young girls. The three-day workshop, *Take Charge of Your Career*, was organized around three themes: 1) *Lemur Science*, 2) *Conservation and Sustainable Development*, and 3) *Entrepreneurship & Building Your Skill Set*. Young women had the opportunity to learn about different careers, and what it took for the speakers to

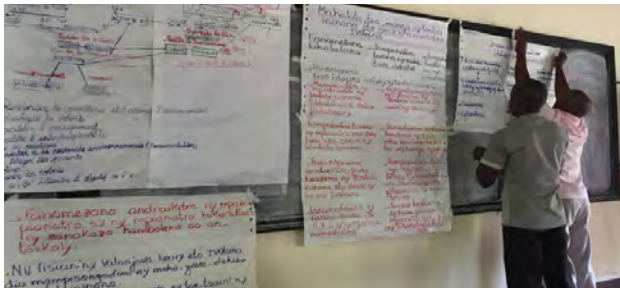


Juliana Rasoma, Claire Raisin, Karen Freeman

become the professional women they are. Juliana's presentation described MFG's work in conservation and development. Later all the speakers were available to meet with students in smaller groups to answer their questions and provide advice. The young women were especially interested in learning about the MFG's internships and job opportunities.

Saturday School 2018/2019

In early January, the CEE team along with teachers from each of our four Saturday School sites, three Chef ZAPs (*Zones Administrative et Pédagogique* - the equivalent of School Superintendents) and the Administrative Assistant of CISCO (*Circonscription Scolaire* - School District Administrative Assistant) came to Ivoloina for three days to review, discuss and organize this year's curriculum



Parents Club

The MFG initiated the Saturday School Parents' Club as a way of encouraging parents to be more engaged in their children's schooling. Our education team uses every opportunity to talk with parents about, for example, the importance of good attendance. It is still the case that some parents pull children out of school when they need



Parent participating in Saturday School SRI (rice planting)

help in the rice fields, or with household chores. Our instructors will point out that attendance is essential to a child's success in mastering a topic. Once children fall behind, it is difficult for them to catch up, which isn't fair to the child. The objective is to reorient the perspective of parents who have not fully recognized the significant role they play in their child's educational achievement. Is the Club making a difference? CEE Manager, Tsiry Harison, tells us, after taking into account unavoidable absences during a measles epidemic in February, and flooding events that blocked children from getting to school, he is seeing some improvement in attendance. But for him, the more telling indicator of parents' increased engagement, is when they make sure to contact instructors in order to explain why their child was missing from class.



Raising Scores - Opening Doors

A 2012 workshop that brought together School Superintendents, the rural Saturday School teachers, and the CEE team to assess the Saturday School program changed how students were selected. Beginning in 2013, the focus shifted from selecting high achieving students to selecting lower achieving students who demonstrated an interest in learning. As shown in the below Table, the percent of Saturday School (SS) and CISCO students who passed the CEPE exam is close. The result is a testament to the substantial progress the SS students made, and represents a significant achievement in and of itself. This because of a sad truth that fewer than three of five Malagasy children obtain their CEPF Certificate (INSTAT et UNICEF, 2019).

At the end of every school year, the CEE holds a ceremony attended by the SS children, parents, school officials, and local leaders. The top students, one from each of the 22 primary schools who attended one of the four Saturday Schools, are awarded a school kit and a commitment to pay their secondary school entrance fee of 35,000 ariary.

# Students Participated	437
# Students Selected	285
# Students Passed CEPE	174
% Curricula Completed	88%
% Environmental Test	90%
CEPE Success: Ivoloina	70%
CEPE Success: Ambodiriana	65%
CEPE Success: Analamangahazo	44%
CEPE Success: Sahambala	50%
Average CEPE Success: CISCO	60%
Average SS Students Success:	57%

Green Ambassadors

MFG’s Camp program focuses on developing students’ problem solving and collaborative skills to tackle environmental challenges within their community and beyond. Because the objective is to mentor youth who exhibit the potential to become leaders, teachers select high achieving, motivated students to participate in the Camp program. In total, ten fourth-year secondary school students from Ambodiriana, Sahandahatra, Antetazambaro, Sahambala, and 30 second-year high school students from Toamasina II were selected. The 70 students were evenly divided by gender with 35 boys and 35 girls.



The five-day camp includes a quick review of Madagascar’s diverse ecosystems, fauna and flora, and the government’s national environmental priorities. Within this context, students are invited to select environmental issues, brainstorm potential solutions, and analyze the pros and cons of each.

Through this process, students gain a greater appreciation for the complexities of both environmental threats and solutions. The next step is for students to experience the logistics of leading a project from its inception to fruition. The CEE team asks students to identify a project that 1) is based at their school and 2) fulfills an unmet need.

To optimize a successful outcome, CEE Manager Tsiry Harison adopted a triangulation approach in which the CEE, teachers, and parents assume a share of the responsibility in helping students complete their project. The CEE funds the supplies, while teachers and parents help students learn new skills, address

administrative issues, or resolve conflicts. A two-day workshop with teachers and parents was held in May to reinforce the approach, address questions, and clarify responsibilities and procedures. This year’s projects included building a study chalet, installing a vegetable garden, and building a water pump.



A quiet, shaded place to study was the mini-project that students from Antetazambaro (left) and Ambodiriana (right) selected.

Communicating Through Print and Radio

The 22nd and 23rd editions of Bitsik’Ivoloina were produced this year. The theme for the 22nd edition was selected to reinforce the United Nations’ World Environment Day theme on “air pollution”. Articles identified local pollution-related problems and solutions. The 23rd edition’s focus on forests was based on the many out-of-control forest fires throughout the world. The issue explains that “the lungs of the world are weakening” and millions of animals are dying.

It appears that Bitsiky ny ala Atsinanana, the MFG’s bimonthly broadcasts, were not always reaching communities around Betampona. Therefore, beginning 2020, the MFG will use the same station, RCM (Catholic Radio Masova), that produces DREDD’s environmental broadcasts. This move will enable MFG to coordinate messaging themes with DREDD and better reach Betampona’s rural communities.





World Environment Day 5 June 2019



The United Nation's 2019 World Environment Day (WED) theme was "Beat Air Pollution," which the organizers of Toamasina's celebration expanded to include recycling. In Toamasina, the celebration began in the morning as a crowd gathered in front of Toamasina's Town Hall where officials from the Regional Office of the Environment and Sustainable Development welcomed the group and encouraged everyone to do their part to keep Madagascar's environment clean and healthy. Thereafter, DREDD officials, MFG Director Dr. Virginia Pongo Rodriguez, and others led the crowd to the beach where large bags full of trash were collected. An exhibition on recycling and air pollution was held at the Alliance Française de Toamasina from the 5th-7th. The celebration moved to Parc Ivoloina on the 8th, where Saturday School students and other children could play recycling-themed games, make crafts, and win prizes awarded by Miss Madagascar 2019.



World Lemur Festival

The World Lemur Festival was held in Toamasina from October 31 to November 2. The event was organized by the CEE staff with help from ISSEDD volunteers. Tables were set up with information about lemurs, art supplies to draw pictures of lemurs, face-painting, and two games. One game is a maze through which the lemur must travel to find food representing one day in the life of a lemur. The lemur begins her day at one end of the maze. As she moves through the forest, there are obstacles that represent threats, such as pots (bushmeat), a cage (the pet trade), etc. She must avoid all of these to reach the end of the maze. The second game challenges children to categorize objects pictured on a card as a product they can use, throw away or recycle.



Amphibian Festival

The Amphibian Festival was part of a larger CEPF grant, “Building a Future for the Amphibians of Madagascar.” The grant was aimed at advancing objectives laid out by the Amphibian Specialist Group (ASG) in the New Sahonagasy Action Plan 2016-2020. The festival’s organizers selected Parc Ivoloïna because the site is a well-known and popular attraction that has a strong environmental education component, the MFG’s active role in amphibian conservation, and close working relationship with the University of Toamasina.

Juliana Rasoma, who led the MFG’s preparations for the two-day event, was ably helped by the on-

site Managers. Members of the Varecia Association provided additional assistance. ASG members, Tsanta Rakotonanahary, Serge Ndriantsoa, and Andolalao Rakotoarison, came in advance of the weekend to help with the final arrangements.

The first day of the festival was devoted to a symposium held at the University of Toamasina and attended by students, MFG staff, ASG members, and representatives from DREDD and MNP. Discussions were centered on the progress, or lack thereof, towards achieving the 2016-2020 Action Plan’s objectives.



Held at Parc Ivoloïna, the second day of the festival was a public celebration of Madagascar’s amphibians. Much like World Lemur Day, all the activities had an amphibian theme. Songs, games, drawing competitions, and face paintings aimed to raise awareness of and celebrate Madagascar’s glorious frogs!





THANK YOU, PLANET FOUNDATION

The unwavering support you've provided over the last 11 years for the MFG's Capacity Building programs has elevated the lives of so many local students, farmers, and scientists to benefit Madagascar.



THANK YOU, GUHL FOUNDATION

Your unfailing funding for the Saturday School Program for 13 years is lifting up future generations of Malagasy to live better lives and to understand the importance of valuing the land and its animals.



THANK YOU, NAPLES ZOO

In addition to supporting Tim Tetzlaff's work, first as MFG's Public Awareness Advisor, and now as MFG's Chair, Naples Zoo has, for many years, donated well above and beyond their Managing Membership dues.



THANK YOU, WELLINGTON ZOO

It was wonderful having Danni Rae assist at Parc Ivoloina (pg.11). She did confess that "the opportunity to attend the Saturday School and engage with the children was an absolute highlight of my trip!"



THANK YOU, CHESTER ZOO

We were delighted to have your team visit MFG's projects at Parc Ivoloina and Betampona and are very grateful for your much needed donation supporting the Ivoloina Asian toad exclusion project.



THANK YOU, AZH

It is especially meaningful for our Malagasy horticulturalists to be awarded two grants from their counterparts in the Association of Zoological Horticulture supporting their work to propagate and conserve newly discovered plant species.



THANK YOU, SAINT LOUIS ZOO

For supporting the work of Fidy Rasambainarivo, DVM, Ph.D., whose leadership role is essential to MFG's P. diadema and V. variegata conservation initiative. We are also grateful for WildCare's foundational support of MFG's research and capacity building programs that have advanced our research objectives and helped build a strong partnership with ISSEDD.



THANK YOU, AAZK Chapters

Keepers hustle to care for animals near and far. Thank you for supporting MFG's in-situ and ex-situ conservation of Madagascar's biodiversity!

- DETROIT ZOO AAZK
- KANSAS CITY ZOO AAZK
- LITTLE ROCK ZOO AAZK
- MILWAUKEE COUNTY ZOO AAZK



MFG Statement of Revenue, Expenditure, and Assets

31 December 2019

in US Dollars

Revenue 2019

Membership Dues	186,140.47
Donations	22,643.74
Madagascar In-Country Income	45,445.53
Grants	407,082.68
Total Revenue	661,312.42

Expenditure 2019

Personnel	293,810.33
Operations	365,928.74
Total Expenditure	659,739.07

Net Surplus/Deficit for the Year:

1,573.35

Assets 2019

Bank Accounts (Madagascar)	121,728.83
Bank Account (Switzerland)	90,350.55
Bank Accounts (USA)	298,930.03
Cash on Hand (Madagascar)	11,275.64
Total Assets	522,285.05

Restricted Funds

Restricted Funds (Grants)	131,305.53
Total Restricted Funds	131,305.53

Our Members: The Foundation of MFG

All our efforts are truly only possible because of our Members' ongoing support. If you'd like to join our collaboration of zoos, botanical gardens, aquariums, and universities, see the benefits of each membership level at www.madagascarfaunaflora.org.

Managing Members



Africam Safari | Duke Lemur Center | Kölner Zoo | | Missouri Botanical Garden | Naples Zoo
Perth Zoo | Saint Louis Zoo | Taipei Zoo | Tennessee Aquarium | Zoo Zürich

Sponsoring Members

Cleveland Metroparks Zoo | Greenville Zoo
Isle of Wight Zoo | Leipzig Zoo | Lemur Conservation Foundation
San Diego Zoo | San Francisco Zoo

Contributing Members

Akron Zoo | Chester Zoo | Dickerson Park Zoo | Jacksonville Zoo and Gardens
The Living Rainforest | Mundomar Benidorm | Seneca Park Zoo | Ueno Zoo
Wellington Zoo | Woodland Park Zoo | Zoological Park Organization Thailand

Friends of the MFG

Lee Richardson Zoo | Maryland Zoo in Baltimore | Milwaukee County Zoo
St Augustine Alligator Farm | Trevor Zoo at Millbrook School



Remembering Jonah Noel

March 15, 1986 is a landmark date in the history of this organization that few people know. For days prior to that fateful Saturday, Cyclone Honorinina had ravaged 800 km of coastline as far inland as 100 km, but on that date she made landfall just north of Tamatave. Cyclone force winds as high as 200 km/h battered the region for 30 hours. Damage was widespread to homes and commercial infrastructure totaling an estimated \$350 million USD in today's dollars. Within days, the Malagasy government reached out to the international community to help rebuild.

Knowing of Duke University's prosimian expertise, they were among those sought out as the cages for confiscated lemurs at the government-run Parc Ivoloïna and its other infrastructure were largely destroyed. The Malagasy government requested their assistance to rebuild something greater. Duke selected Andrea Katz and Charlie Welch to carry out the work and the first steps to creating the MFG were taken.

But no new day dawns without the ones before it. When Andrea and Charlie first arrived at Ivoloïna in 1987, they were greeted by Jonah Noel, the parc's lone keeper. Jonah Noel was employed by what was then Madagascar's Department of Water and Forests to care for the lemurs. Noel welcomed the *vazaha* (strangers) and was eager to learn from their extensive experience and to help with zoo improvements. A pattern he maintained over the years.

Later, as the Ivoloïna zoo team grew, they relied on Noel to train new keepers in animal care and to teach them how to identify each individual animal. He took care to know every lemur and its history and loved his job of caring for them.

And just as he was for Andrea and Charlie, Noel was there to welcome subsequent MFG Program Managers over the decades. He served as a keeper for nearly 35 years. And so, we are deeply saddened to share that Jonah Noel fell ill with a serious condition and died while in hospital on 11 September 2019.

Noel is truly missed for his experience and commitment to the zoo and animal care. The MFG, and especially Andrea and Charlie who shared their memories of Noel for this memorial, offer our most sincere condolences to his family and to all in the MFG who worked closely with him over his many years of service to the lemurs he loved.



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Photo: Joshua Kristal