ZSL
LET'S WORK FOR WILDLIFE

EDGE

EVOLUTIONARILLY DISTINCT & GLOBALLY ENDANGERED

Survival Blueprint

Madagascar frog, Mantidactylus pauliani

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1. STATUS REVIEW

1.1 Taxonomy:

Class: AMPHIBIA
Order: ANURA
Family: Mantellidae
Genus: Mantidactylus (Guibe, 1974)
Subgenus: Brygoomantis (Dubois, 1992)
Common name: Madagascar frog, Paulian's stream frog, sahona
Taxonomic sources: Vences et al. 2002

M. pauliani is a small aquatic frog (male: 25-32mm, female: 24-34mm SVL) with a short snout and prominent eyes. The fingers and toes have rounded terminal disc and the feet are webbed. Dorsal colour is brown with large-dark brown spots, and there are dark-brown transversal band across the legs. The underside is pale white. Males have a very distinct femoral gland, which is also visible in females but is much smaller (see Blommers-Schlösser & Blanc, 1991).

1.2 Distribution and population status:

M. pauliani is an endemic species to Madagascar and micro-endemic to the Ankaratra Massif. It is only known from Manjakatompo Ankaratra Protected Area, situated within District Ambatolampy, Vankinakaratra region. Due to ongoing declines in the extent and quality of its natural habitat, the population is assumed to be decreasing (IUCN, 2019).

1.2.1 Global distribution:

Country	Population estimate (plus references)	Distribution	Population trend (plus references)	Notes
Madagascar	1025 Individuals (Andreone et al., 2014)	From 4 streams in Manjakatompo Ankaratra Protected Area	Unknown	Population census in 2011

1.2.2 Local distribution:

Country	Region / province	Site	Level of Protection	Population size	Reference(s)	Notes
Madagascar	Vakinankaratra province	Specimens were known from 7 sites above 2000m asl: Nosiarivo, Ambohimirandrana. Tavolotara, Maharavana, Tsimiaramianadahy, Analafohy and Ambitsika	The creation of Manjakatompo Ankaratra Protected Area was on 26th February 2015, classified as "Natural Resources Reserve", which is equivalent to the Category VI of IUCN.	Research conducted by Andreone et al. in 2011 from 4 sites: Ambohimirandrana 1 and 2, Tavolotara and Maharavana showed a total number of 404 captured individuals. The population estimate according to Schnabel method ranged from 16 (minimum) to 1025 (maximum). - Survey conducted by Rakotonoely in 2011 during dry season (June/August) and rainy season (November/December) showed a total of 898 individuals according to Schnabel method. They are from 4 localities (Tavolotara, Maharavana, Ambohimirandarana and Tsimiaramianadahy). *M. pauliani* was not detected in the control sites (Ambatomalama and Andraraty <2000m)	(Andreone et al. 2014) -(Rakotonoely, 2012)	Population size has been estimated with Schnabel method. However different researchers conducted these studies varying in season, years and different length of surveys.

				-Population estimate from surveys conducted in Ambohimirandrana, Tavolotara and Tsimiaramianadahy in 2011 ranged in total from 51 to 1021. -Population estimate between 2012 and 2013 from 5 localities (Ambohimirandrana, Tavolotara, Tsimiaramianadahy, Analafohy and Ambitsika) ranged in total from 3 to 217 and from 27 to 177 respectively.	-(VIF, 2013)	- Regular monitoring conducted by VIF team from 2011 to 2013 indicated an improvement of the population abundance (at highly degraded site: Ambitsika and Nosiarivo) due to the conservation effort after the massive degradation in 2010. Despite several surveys in Nosiarivo since 2009, *M. pauliani* had not been detected anymore until 2013 where only 7 tadpoles were found.

1.3 Protection status:

Mantidactylus pauliani is one of the most threatened amphibians in Madagascar. It is listed as critically endangered by IUCN Red List because its extent of occurrence (EOO) is 12 km^2, it occupies an area of less than 10 km^2, all individuals are in a single threat-defined location, and there is an ongoing decline in the extent and quality of its remaining forest habitat (IUCN, 2019)

M. pauliani has received protection from the creation of Ankaratra Massif as New Protected Area. Not only Ankaratra Massif is home to two critically endangered species of amphibians (*Boophis williamsi* and *Mantidactylus pauliani*), it also harbours numerous other threatened species such as *Lygodactylus mirabilis*. Thus, this region is one of the high priorities for conservation, which lead to its classification into the Alliance of Zero Extinction (VIF, 2010).

A local NGO: Association Vondrona Ivon'ny Fampandrosoana (VIF) manages the reserve. VIF is collaborating with local associations/communities, Vondron'Olona Ifotony" (VOI), to create forest guard that will frequently patrol the reserve to help prevent illegal activities. VOI are also engaged in reforestation efforts aiming to improve habitat within the protected area.

A first workshop about "A Conservation Strategy for the Amphibians of Madagascar" in 2006 led to the production of the Sahonagasy Action Plan (SAP) in 2008, the first national conservation action plan for amphibians in Madagascar. SAP outlined the recommendations and activities required to secure the survival of Madagascar's amphibian fauna over a five year period. After the Second Conservation Strategy for the Amphibians of Madagascar workshop in November 2014, a new national action plan for the conservation of amphibians: the New Sahonagasy Action Plan 2016-2020 (NSAP) was developed and published in July 2016. This NSAP provided a framework for planning and delivering amphibian conservation and research at the National level. It has been proposed that one of the high priority actions to be carried out was the establishment of regular amphibian monitoring in order to assess present day distribution and abundances of some of the most threatened frog species of the country. However, *M. pauliani* and Ankaratra were not really specified.

1.4 Ecology, behaviour and habitat requirements:

Mantidactylus pauliani is a montane stream micro-endemic, lives and breeds in fast-flowing high-altitude streams in the Ankaratra Massif (Glaw &Vences, 2007). It is only known from cold-clear rocky streams above 2000 m of elevation. The streams are bordered by remnant of primary rainforest, pine plantation and savannah, though *M. pauliani* shows a preference toward forested streams (Rakotonoely, 2012).

M. pauliani is an aquatic species that spends long periods under water (Glaw & Vences, 2007), usually hides in water under rocks in streams or underwater cavities and refuges along the streams, where it also lays its eggs. The characteristic of its stream is either stagnant like a pond, fast or slow-moving but the species is often found in fast moving streams (pers. obs). It has a maximum longevity of eight years (Andreone et al. 2014).

Depending on individual habitats, *M. pauliani*'s coloring often matches the colour of local rock or bedrock ranging from dark-brown or reddish-brown to grey. The dorsal color of this frog is usually brown with large-dark brown spots that enhance its camouflage. However, some individuals (eg: from Tsiafajavona) have red/copper dorsal spots. This physical ability to mimic the colour of its substrate plus the ability to hide under submerged small rocks has made this species not easy to spot especially during rainy season where the level of water in the streams is very high (pers. Obs).

1.5 Threat analysis:

According to the IUCN Red List of Threatened Species, *Mantidactylus pauliani* is classified as critically endangered

Threat	**Description of how this threat impacts the species**	**Intensity of threat** *(low, medium, high, critical or unknown)*
Poverty	The main occupations of communities in Ankaratra are farming and keeping livestock. Products from these activities are intended for self-consumption and sometimes for sale at the local market (with only a small benefits). Rural people are living in extreme poverty and strictly rely on the use of ecosystem services for their livelihoods. This situation pushes them to overexploit forest as income sources to survive. Thus, habitat loss and degradation stem from poverty.	critical
Wildfire	This pressure has become a regular threat to the entire ecosystem of the massif. Wildfires are usually set by local farmers (for the renewal of pasture) or caused by inattention by herdsmen. In October 2010, 60% of exotic forest has been damaged by fire. All the crests and slopes were denuded and this resulted in soil erosion, sedimentation, siltation, pollution of streams and decreases in rainfall (VIF, 2013). The change in water quality affects the breeding condition of amphibian communities in Ankaratra.	Critical
Illegal logging for charcoal and woods for construction	Continuous deforestation has led to: - loss of forest cover: forest cover plays an important role in determining rainfall. In	High

	addition, absence of forest cover along the streams exposes this latter directly to the sun. Therefore, the decrease in rainfall and the increase of heat exposure would provoke a prolonged period of low/no water during dry season and the communities of amphibians are at risk of desiccation and death. -Forest fragmentation: the movement and dispersion between subpopulations is reduced or impossible due to the presence of unfavourable environments (such as mountains, deserts, dry-open area) between fragmented habitats. Dry conditions between suitable habitats prevent organisms with high water demands from dispersing across them. The isolation of subpopulations influences gene flow.	
Cattle ranching/overgrazing	Cattle ranching is a driver of deforestation in Ankaratra Protected Area. Cattle keepers have used a considerable proportion of forested land for livestock pasture resulting in the reduction of the natural regeneration capacity of the natural forest. They also burn the savannah to promote fresh grass that is grazed by livestock. All these practices have huge impacts on the stream conditions (pollution, siltation…)	Medium
Infectious disease: "Chytrid fungus"	Several specimens of *M. pauliani* were infected with chytrid fungus (Bletz et al., 2015), known as *Batrachochytrium dendrobatidis* (hereafter Bd) which is responsible for mass mortalities, populations declines and species extinctions throughout the world. But malagasy amphibians have been spared because so far no Bd-associated population declines have been reported (Bletz et al. 2017). However, the risk of declines is high if a lethal Bd genotype infects critically endangered and micro-endemic frogs like *Mantidactylus pauliani.* Continuous research is needed to understand the effect of Bd on the EDGE species in Ankaratra to allow for a rapid intervention.	Unknown

1.6 Stakeholder analysis:

Country	**Stakeholder**	**Stakeholder's interest in the species' conservation**	**Current activities**	**Impact** *(positive, negative or both)*	**Intensity of impact** *(low, medium, high or critical)*
Madagascar	Eight Local-based communities: "Vondron'Olona Ifotony" (VOI).	The local associations "VOI" were created in 2011 in order to restore and maintain the fire-ravaged areas in 2010. Each VOI is responsible for the protection and control of its respective areas. They manage the protected area in collaboration with VIF and they are engaged in all conservation activities in this region. Thus, they are interested in the conservation of *M. pauliani,* because this frog is an umbrella species and its conservation helps to protect many other species in Ankaratra.	VOI regularly patrol the reserve to prevent illegal activities. The patrol team's mission is to destroy all centres of charcoal found, seize illegal products (timber, charcoal…) and prosecute offenders. They are also engaged in forest maintenance (establishment of firewalls, forestry cleaning, delimitation of the reserve) and reforestation efforts intended to improve habitat within the protected area.	Positive	High
Madagascar	The local NGO: Vondron'Ivon'ny Fampandrosoana (VIF team)	VIF ensures the sustainable conservation of the biodiversity of Manjakatompo Ankaratra Protected Area under the category VI of IUCN. VIF manages the reserve in cooperation with local communities. They look for funds as well as coordinate and financially support	-Public awareness dealing with the conservation of the area, and both CR amphibians -Workshops and meetings: held regularly, involving all stakeholders -Capacity building of the eight VOI groups -Amphibian	Positive	High

		activities of VOI in Ankaratra. In general, VIF put the two critically endangered species: *Boophis williamsi* and *Mantidactylus pauliani* as umbrella species for the conservation of the whole Ankaratra Protected Area.	monitoring: to see the impact of rehabilitation of the habitat in Ankaratra on population trend of *Boophis williamsi* and *Mantidactylus pauliani* -Site restoration: creation of plant nurseries and reforestation.		
Madagascar	Ministère de l'Environnement et du Développement Durable	-They aim to protect Madagascar's unique biodiversity for current and future generations through stakeholder commitments (ministries, national and international NGOs, donors, local governments). -They honour their engagement to protect all living species in their managed area according to the biodiversity convention. Thus, they have a large interest in species conservation.	-There are two forest agents from this organisation based in Ankaratra. Their roles are (1) to accompany researchers to accomplish their project, (2) help VOI in their activities, (3) patrol the area and report any issues and (4) to enforce the law -Any activities (research, visit…) conducted in the protected area must be controlled and authorised by the Ministry	Positive	High
International	Amphibian Specialist Group/Researchers/ Conservationists/ Students working in amphibian conservation in Madagascar	Amphibian researchers are very interested in conservation of the most threatened amphibians in Madagascar, including *M. pauliani*. Its conservation is a priority in the ACAP.	-Develop research and conservation plan -Continue the monitoring, conservation research of frogs around Madagascar	Positive	Medium
UK	Funder: EDGE/ZSL	Interested in conservation of all	Supporting the project by financially	Positive	High

		EDGE species worldwide	funding all activities and also by enhancing skills of the EDGE Fellow to become successful in achieving the goal of the project.		
Madagascar	Illegal operators	They have no interest in species 'conservation. They might not aware of the presence of the species in Ankaratra and the impact of their activities on the survival of the species.	They are carrying out illegal activities such as logging and charcoal. These resources are mainly used to feed the aluminium pottery industries in Ambatolampy (nearby town), but also for sale. These perpetrators are from different area (outside of Ankaratra area, or from the local people)	Negative	Critical
Madagascar	farmers and livestock keepers	Some have little interest in species 'conservation but some do not have. They are convinced that keeping their cattle inside the protected area does more good than harm to the ecosystem.	They keep their livestock inside the protected area	Negative	Medium

1.7 Context and background information that will affect the success of any conservation action for this species:

	Description	Threats	Opportunities
Socio-cultural effects and cultural attitudes	There are some places in Ankaratra Massif venerated by the surrounding population or descendant of Ankaratra from other regions. These sacred places are called “Doany” (stones, hills, source of water), located in Anosiarivo, the hills of Ambohimirandrana and the summit of Tsiafajavona; and protected from all kind of exploitation. The places are used to honour and worship ancestors, where offerings, rituals and ceremonies are practiced to ask for help or blessings. The ritual cleaning is held at the waterfall in Ankaratra and the water source from the “Doany” is collected in bottles and believed to cure illness and bring luck.	This cultural attitude does not constitute a threat to the biodiversity. But people are influenced and forced to break laws due to the lack of financial resources to meet their daily needs. Poverty in Ankaratra push people to use forest product for their survival.	Promote ancestral culture approach: The local association "Ankaratra tsy rava fenitra”: was founded to conserve cultural values and traditional natural resource management system. The development of this traditional conservation, culture and belief might constitute an opportunity to protect the forest.

Economic implications	-The species has direct monetary value: Research projects conducted on the species provide some direct employment for local field guide, assistant, porters and cook. -Income generating activities (such as fish breeding) for economic development in this area were very insufficient to improve the living condition of a large number of people affected by the creation of Ankaratra massif as Protected Area and were abandoned/failed.	Successful conservation of the species leads to the restriction or absence of activities (charcoal production, logging) which constitutes an income sources for surrounding population that will impoverish them. This provokes negative economic impacts for stakeholders and incites them to practice illegal activities. -Charcoal production and selective logging which constitute the main source of income for many villagers will be banned. -The aluminum pottery factories, baby-foot and cart' manufacturers in town (main source of economic development in Ambatolampy) which rely on a big demand for charcoals and timbers will be negatively affected. - Herdsmen will not have access to keep their cattle inside the Protected Area.	-If income-generating activities (fish farming, beekeeping and potato farming) are developed along with the conservation of the species, then successful conservation of this species will have positive economic impacts. -Income-generating activities and ecotourism would bring positive economic impact, if developed but this needs financial support. The use of ecosystem services such as water sources, dead wood and exotic forests has an economic implication: -Water sources in Ankaratra are an important draining basin of potable water for the surrounding villages, Ambatolampy town and for lots of factories (STAR, JIRAMA, NBM) -Streams are used by the local communities for fish farming and to irrigate their fields. - People are allowed to collect dead wood for fire-wood and cooking, and exotic wood to produce brooms. This latter is sold in Ambatolampy town or during the market day in Ankaratra.

Existing conservation measures	-Ankaratra massif is included in the Protected Area network in Madagascar because of the presence of two critically endangered and micro-endemic amphibian species *Boophis williamsi* and *Mantidactylus pauliani.* -These two species have become umbrella species for conservationists, researchers and manager of the Ankaratra reserve. Their presence makes this area one of the high priorities for conservation and lead to its classification into the Alliance of Zero Extinction. - Since 2010, "VIF" has managed the reserve in cooperation with local associations "VOI" who patrol the reserve and involved in conservation actions. -Other existing conservation actions that address the drivers of immediate threats include: law enforcement, sensitization and education. These measures were developed by the government and VIF respectively.	-Ankaratra Massif is a vast area and two forest agents or a few members of VOI cannot ensure permanent control of the whole area. -Illegal operators work mostly at night and transport the products, making the intervention of patrol teams difficult. -Illegal operators are very aggressive (they throw stones and threat to death forest patroller), bring dogs and knives.	-Threats are reduced during the implementation of donor-funded projects but begin to intensify again when the funding is finished because the funding for forest guards runs out. -Increase the number of forest guards and the budget for control. -"Dina" (a fine or a penalty imposed for the non-performance of a contract or for neglect of a public order) must be established and implemented. -Support from military/gendarme is also crucial to conduct night patrols.

Administrative/political set-up	-Political event (eg: political crisis in 2009) meant that effective conservation could not be guaranteed. It caused the suspension of projects and international funding. -Political instability makes it difficult for Madagascar to implement its National Strategy for Sustainable Management of Biodiversity (NSSMB) and to respect other international conventions related to biodiversity they had approved.	-Political crisis and economic changes in the country could threaten current conservation actions. -Lack of staff to monitor activities in the field, lack of material resources (eg: means of transport ...)	-Raising the profile of *M. pauliani* to attract government's interest and support to favour its conservation. -Strengthen collaborations with existing projects (establishing partnership agreement). -Stability politic: the authority can follow the convention and enforce environmental laws.
Local expertise and interest	There are many local experts who have experience with the species and are interested in conserving it. These experts are students from the University of Antananarivo and Mahajanga who have conducted master' thesis on the species before, or researchers, or conservationists (VIF) or the field assistants from local communities/associations in Ankaratra Conservation is effective only if it includes working with local communities.		In Ankaratra there are people who have expertise and interest in the species. Some of them are community leaders. Working with these people is beneficial especially during the awareness campaign because they were born, grew up and live in close proximity of the protected area. Therefore, they are closer to their communities and have more influence in changing people's perception.

Resources	-The main source of funding to conserve this species usually comes from donors outside Madagascar: Mac Arthur foundation, Conservation international, Rainforest trust, Global Wildlife Conservation, CEPF. -There are already two ongoing project conducted by VIF team and the EDGE Fellow. -VIF has funding from CEPF for the next 2 years to conserve the species. Their conservation activities are already mentioned in the stakeholder analyses. There is also the EDGE Fellowship intended to conserve this EDGE species and the grant from the Rufford Foundation to conserve *Boophis williamsi*. -Currently, two people are working on this species: A student supported by VIF to conduct regular species monitoring and me (EDGE Fellow)	**Skills, capacity or equipment most urgently needed are**: -Development of income generating activities -More land and seeds for agriculture -Equipment to maintain plant nursery and reforestation works. -Capacity building of VOIs about habitat restoration and conservation, valorisation of biodiversity, plant nursery management. In general, the training time is too short compared to the level of understanding of members of the VOI. Some VOI do not apply the new knowledge acquired. Some members also resign from the association after receiving training and the VOI concerned is obliged to replace them. - Increase the number of patrol teams and budget, find support from gendarmes to conduct night patrols.	**Key resources already in place are:** - Presence of income generating activities which are not well developed and insufficient. -VIF financially supports all conservation actions in Ankaratra and manages the reserve. -VOI conducts regular forest patrols and forest maintenance. -Forest agents from the ministry of forest and environment implement the law. - funding for 2 years from CEPF - Infrastructure: house (meeting, education) and office - Three permanent staff from VIF based in Ankaratra

2. ACTION PROGRAMME

Vision (30-50 years)	
Effective long-term conservation of habitats and populations of *Mantidactylus pauliani* within Manjakatompo Ankaratra Protected Area	
Goal(s) (5-10 years)	
Promote population recovery of *Mantidactylus pauliani* by empowering local communities to effectively conduct conservations actions and by supporting them through the development of alternative livelihoods.	
Objectives	**Prioritisation** *(low, medium, high or critical)*
Develop capacity of local associations/communities to enhance their skills in forest restoration and plant nursery management	High
Promote population recovery of *Mantidactylus pauliani* from conservation efforts (improvement of habitat quality)	Critical
Promote income generating activities for poverty reduction (beekeeping, fish-farming and potato farming)	High

Activities	Country / region	Priority *(low, medium, high or critical)*	Associated Cost	Time scale	Responsible stakeholders	Indicators	Risks	Activity type
***Objective 1*: Develop capacity of local associations/communities to enhance their skills in forest restoration and plant nursery management**								
Capacity building of local communities (VOI, GALO, head of villages) to enhance their skills in forest restoration and management and plant nursery management	Madagascar/ Vankinankaratra	High	£1090 (attendees 'incentive for 2 days, learning materials, conception and printing of posters, 2 days of car rental and fuel, salary of cook for 4 days, employment of the experts delivering the training for 4 days)	2 days	Forest manager: VIF team, Ministry of Forest and Environment in Ambatolampy and EDGE Fellow	-Holding 2 days of workshop and approximately 80 people will be trained about conservation plan for the priority habitat/population for conservation, then about forest restoration and management.	-The level of understanding of attendees is slow and they are unable to apply the new knowledge acquired. Some member also resign from the association after receiving training. -They will not apply what they learnt	Education and Awareness (Training)

Activities	**Country / region**	**Priority** *(low, medium, high or critical)*	**Associated Cost**	**Time scale**	**Responsible stakeholders**	**Indicators**	**Risks**	**Activity type**
***Objective 2*: Promote population recovery of *Mantidactylus pauliani* from conservation efforts (improvement of habitat quality)**								
Regular monitoring of the species to see population trends following conservation effort	Madagascar/Vakinankaratra	High	£ 2261/year (-2 days of car rental and fuel per trip and 4 times a year, -Employment of 2 field assistants and 1 cook from local people for 14 days in the field and per 4 fieldwork - Employment of porters for 4 fieldwork -Per diem of the student doing the amphibian monitoring -Materials needed to conduct the research survey and for camping)	3 years	University students	-Conduct 4 field works per year for population abundance survey. -Each field work will last 2 weeks -6 month report about the evolution of population abundance	N/A	--Improving knowledge

Activities	**Country / region**	**Priority** *(low, medium, high or critical)*	**Associated Cost**	**Time scale**	**Responsible stakeholders**	**Indicators**	**Risks**	**Activity type**
Study for the establishment technique for reforestation plan	Madagascar/Vakinankaratra	High	£ 1294 (Employment of the 2 researchers, one local assistant and one cook for 2 weeks, porters, car rental and fuel for 2 days)	2 weeks	An expert from VIF (Dr Falitiana Rabemanajara) and another assistant will conduct 2 weeks of study in Ankaratra to establish the reforestation plan at the priority habitat but also for the whole area managed by the 8 VOI	-Field work conducted - A report about the reforestation plan	N/A	Land/water management

Activities	**Country / region**	**Priority** *(low, medium, high or critical)*	**Associated Cost**	**Time scale**	**Responsible stakeholders**	**Indicators**	**Risks**	**Activity type**
Tree nursery maintenance	Madagascar/Vakinankaratra	High	£ 2435/year (Employment of 2 members of each 8 VOI to control young tree planted after reforestation and conduct weeding work. The control will be made 5 times per month).	3 years	VOI	-Number of plant nursery managed -Amount of ha controlled and weeded -Amount of planted trees: dead or alive	-Lack of control and management will prevent the young tree to regenerate -Bad condition of the terrain will not allow the viability of the plants.	Land/water management

Activities	**Country / region**	**Priority** *(low, medium, high or critical)*	**Associated Cost**	**Time scale**	**Responsible stakeholders**	**Indicators**	**Risks**	**Activity type**
Conduct reforestation program (effort focused on the priority habitat) for habitat improvement	Madagascar/Vakinankaratra	Critical	£ 4087/year (twice a year) (Price of 500 natural young trees for reforestation, perdiem of 50 people involved in reforestation, equipment, employment of 4 leaders during 4 days, to supervise the work, organisation of the trees (command, transport), car rental and fuel)	3 years	-VIF team and EDGE Fellow. -VOI and other local communities interested in conservation action	-Conduct reforestation program involving at least 50 people from VOI and other associations. The activity is twice a year -Number of trees planted -Amount of hectares reforested -Photos, video	-We may not get a maximum number of local people to participate in reforestation -No control/supervision of the young trees planted.	Land/water management (Habitat & Natural Process Restoration: enhancing degraded or restoring missing habitats and ecosystem functions; dealing with pollution)

Activities	**Country / region**	**Priority** *(low, medium, high or critical)*	**Associated Cost**	**Time scale**	**Responsible stakeholders**	**Indicators**	**Risks**	**Activity type**
Awareness raising by promoting the association that preserves the cultural and traditional attitudes to change peoples perception toward conservation	Madagascar/Vakinankaratra	Medium	£ 3120/year (Conception of posters and other materials distributed during the sensitization, car rental and fuel for 2 days, employment of cook for 5 days, material needed for sensitisation, employment of 4 people during 3 days of the awareness campaign)	2 years	VIF team, Ankaratra tsy Rava Fenitra, EDGE Fellow.	-Number of places visited and sensitized -Photos, video -Number of materials and posters distributed The awareness campaign will be held twice a year. The campaign will last for 3 days and materials will be shared.	May not reach a maximum populations	- Education and awareness (Awareness & Communications)

Activities	Country / region	Priority *(low, medium, high or critical)*	Associated Cost	Time scale	Responsible stakeholders	Indicators	Risks	Activity type
Reinforcement of forest patrol for site securing	Madagascar/Vakinankaratra	Critical	£ 10540 s/year (Employment of 4 members of each 8 VOI to patrol their respective area, 4 times per month –Employment of 2 gendarmes or military force to assist VOI with forest patrol)	3 years	VIF team,8 VOI and the Ministry of Environment in Ambatolampy	-Effort spent in patrolling: Once a week, 4 people from each VOI will conduct forest patrol of their respective area. The gendarmes will be assisting them only twice per month – -Number of patrol conducted per week -Report from VOI - Amount of hectares patrolled per month	Gendarmes are not motivated to conduct night patrol	-Land/water protection -Livelihood, economic and other incentives
***Objective 3*: Promote income generating activities for poverty reduction (bee-keeping, fish-farming, ecotourism, potato-farming)**								

Activities	**Country / region**	**Priority** *(low, medium, high or critical)*	**Associated Cost**	**Time scale**	**Responsible stakeholders**	**Indicators**	**Risks**	**Activity type**
-Capacity building of people interested in practicing these activities	Madagascar/Vakinankaratra	High	£2500 Employment of the organisation that provides the training, the hire of a venue for classes to take place, and the teaching materials.	1 week	DREF Vakinankaratra, Forest manager VIF, Ministry of Environment in Ambatolampy, local expert in farming and fisheries (eg: Association LALONA)	-Number of people engaged and benefits from these activities	NA	-Capacity building

Activities	Country / region	Priority *(low, medium, high or critical)*	Associated Cost	Time scale	Responsible stakeholders	Indicators	Risks	Activity type
- Promotion of bee-keeping, fish-farming, ecotourism, potato-farming with those people.	Madagascar/Vakinankaratra	High	N/A All the materials needed to develop the income generating activities and employment of 2 persons to become responsible or in charge of the control and development of this project.	3 years	Association LALONA	Development of bee-keeping, fish-farming, ecotourism, potato-farming	Insufficient to cover a large number of people affected by the creation of Ankaratra protected area. -Fail if not well managed. For example the plantation of potato may be affected by a crop disease	-Livelihood, economic and other incentives

3. LITERATURE CITED

Andreone et al., 2014. Age structure, population estimate and *Bd*-status of two Critically Endangered frogs from the Ankaratra Massif (Madagascar), *Boophis willliamsi* and *Mantidactylus pauliani* (Amphibia: Mantellidae), Scripta Herpetologica. Studies on Amphibians and Reptiles in honour of Benedetto Lanza: 17-29pp**.**

Bletz, M. C., Myers, J., Woodhams, D. C., Rabemananjara, F. C., Rakotonirina, A., Weldon, C., Edmonds, D., Vences, M. & Harris, R. N., 2017. Estimating herd immunity to amphibian chytridiomycosis in Madagascar based on the defensive function of amphibian skin bacteria. Frontiers in Microbiology, 8, 1751.

Bletz, M. C., Rosa, G. M., Andreone, F., Courtois, E. A., Schmeller, D. S., Rabibisoa, N. H. C., Rabemananjara, F. C. E., Raharivololoniaina, L., Vences, M., Weldon, C., Edmonds, D., Raxworthy, C. J., Harris, R. N., Fisher, M. C. and Crottini, A., 2015. Widespread presence of the pathogenic fungus *Batrachochytrium dendrobatidis* in wild amphibian communities in Madagascar. Scientific Reports. 5: Article No. 8633. [PMC free article] [PubMed]. doi: 10.1038/srep08633

Blommers-Schlösser, R.M.A. & Blanc, C.P., 1991. Amphibien (première partie). Faune de Madagascar, 75 : 1-340.

Glaw, F., & Vences, M., 2007. Field Guide to the Amphibians and Reptiles of Madagascar. *Third Edition*. Vences and Glaw Verlag, Köln

Rakotonoely, S.A.X., 2012. Biologie et écologie de deux espèces d'amphibiens *Boophis williamsi* (Guibé, 1974) et *Mantidactylus pauliani* (Guibé, 1974) critiquement en danger du Massif de l'Ankaratra. Unpublished thesis of Diplôme d'Etudes Approfondis (DEA), University d'Antananarivo, Antananarivo.

Vences, M., Andreone, F., Glaw, F., Raminosoa, N., Randrianirina, J. E. & Vieites, D. R., 2002. Amphibians and reptiles of the Ankaratra Massif: reproductive diversity, biogeography and conservation of a montane fauna in Madagascar. Italian Journal of Zoology, 69(3), pp. 263–284. doi: 10.1080/11250000209356469

VIF, 2010. Gestion durable des ressources naturelles des zones forestières de l'Ankaratra: élaboration du schéma global d'aménagement. Rapport final N°56 544. Conservation International Madagascar, Antananarivo. 103 p.

VIF, 2013. Step for establishment of new protected area Manjakatompo Ankaratra. Final project report, Conservation International Madagascar, Antananarivo. 78p.