

ACTION PLAN

Mantella cowani



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GENERAL PURPOSE

Remove or at least mitigate all of the threat concerns (collect in nature, habitat loss, fire, hybridization, fragmentation and climate change) of the species in order to restore the population and according the new data collected in nature to down listing the current status CR:

- 1 - Establishment of secure areas of the species at Fohisokina and protect the species in the new future Protected Area at Itremo (NAP Itremo);
- 2 - Ensure that the impact of the collect in nature, the appearance of fungal diseases, and climate change are assured by the ex-situ breeding;
- 3 - Applying a rational use of the species by eco-tourism visits (or scientific nature) at Soamasaka,
- 4 - Biological and ecological studies of the species used as base management tool for the conservation assurance,
- 5 - And investigate all potential sites of the species in the highland of Madagascar.

INTRODUCTION

Madagascar has the 4 % of the global amphibian diversity with almost 100% of the species found nowhere else. Unfortunately, habitat destruction, climate change, fire, pet-trade and the emergent fungal disease that caused destruction in America and other regions threaten this unique diversity. To remedy this, a workshop entitled “A Conservation Strategy for the Amphibians of Madagascar” or ACSAM was held at the Hotel Colbert Madagascar in September 2006. The issue of the workshop is the ACSAM initiative in order to prepare vision Sahonagasy and Sahonagasy Action plan for the following five years, to save all amphibians and their habitats. Among those threatened frogs of Madagascar, *Mantella cowani*, *M. auriantiaca* are outside the protect area and *Mantella cowani* is the most serious threatened, a particularly symbolic and aesthetic species. That probably helped that it has a certain sacred status locally (Soloniaina, pers. Com.) and took a great place in the international pet trade in quantity since the late 1980s.

Studies on *Mantella cowani* population were initiated in 1995 by BIODÉV International confirmed their restricted distribution of this frog and this case has led the Department of Forestry of Madagascar some years later to take full suspension of permits of trade of this frog after getting the opinion of the specialists.

Behra and Raxworthy have raised in 1988 the question of sustainable and valorization of this species and especially the limits of probable impacts of simple commercial banned (“Interest - danger, and future prospects”).

Nothing has been implemented to date and recent fieldwork conducted by teams of Conservation International, MATE, Mavoava and the University of Antananarivo in March 2008 confirmed that the species is decreased due to degradation of its habitat by bush fires and uncontrolled slash and burn, the overharvesting before 2003, and hybridization with *Mantella baroni*. The impact of chemical pollution were also collected by Soloniaina (student of Geography, University of Antananarivo) during a socio-economic survey on the species in the Antoetra region.

The current distribution of the species is Antoetra / Ivato and Itremo. But other potential sites are also reported, namely Antakasina / Ambatolampy, the eastern part of the Analamanga region and Betafo.

In addition, brochures showing the different activities, distribution and species identification, and stickers did and will used to support this program and increasing public awareness to all stakeholders, tourists, local people, students, politicians, governments, and travel agencies, national and international NGOs...

This year is also declared, “Year of amphibians by Zoos specialists (EAZA) and *M. cowani* was used as a flagship of this event for Madagascar.

However, the recent proposal proposed by these teams after this preliminary study of the species and the contacts with communities and local authorities show an opportunity of exceptional intervention in terms of coherence for a long-term action of conservation of the species in the local context.

2. General Information

2.1 Taxonomy

Family Mantellidae

Genre *Mantella*

Species *Mantella cowani* Boulenger, 1882

Common name: Sahona mena , Harlequin Mantella, Halloween Mantella or harlequin Mantella, Black Golden Frog, Cowan's Mantella, Cowan's Golden Frog.

Syntype: BM 1947.2.7.4-5 according Blommers-Schlösser and Blanc 1991; BM 1947.2.7.4 (primarily 82.3.16.38) designated by Vences, Glaw and Böhme, 1999 as lectotype. Locality type: "East Betsileo," Madagascar.

It is considered by Guibé, 1948 and Busse, 1981 as a synonym of *Mantella madagascariensis*, then identified by Blommers-Schlösser et Blanc as a valid species. In addition, Amphibia-Reptilia, 2: 29 noted confusion regarding the use of the name *Mantella cowani*. Glaw and Vences, 1992 noted a morphological resemblance between *Mantella cowani*, *Mantella baroni* and *Mantella madagascariensis*. Vences, Glaw, Peyrieras, Böhme and Busse, 1994, which noted that this specific name encompasses several morphospecies of geographical differentiation. Vences, Glaw and Böhme, 1999 identified a nomenclatural confusion in the group *Mantella cowani* around this specific name. Finally, Glaw and Vences, 2006. Staniszewski, 2001 presented the real *Mantella cowani*

2.2 Description

Mantella cowani is a small poison frog (22-29 mm) characterized by a black skin with red or orange bands on limbs (sometimes orange-yellow) and the underside black with dark blue spot giving its common name Harlequin Mantella.. By contrast with the other species of the *Mantella cowani* group, his color is uniform with almost circular spots red or yellow patches to orange in the insertion of arm and legs. Size and morphology are almost stable. In addition, a line on the dorsal part of the head, which is typical of *M. baroni* and *M. madagascariensis*, is lacking.

The front of the throat presents one or two spot (s) rounded off (s), contrary to the other mantelles (arranged in a horseshoe, case of *M. pulchra* and *M. madagascariensis*). Besides, the species assigned successively to *Mantella cowani* by Andreone (1992) and *M. pulchra* by Gavetti and Andreone (1993) is similar to *M. baroni*, it differs mainly by shape of coloring spots and ecology in general.



2.3 Distribution

The distribution of the species from different publications showed that it is known only in the highland of Madagascar. The type locality “East Betsileo” is on the other hand does not present a precise indication on the origin of the species and it is so large.

Currently, *M. cowani* is present in three Communes: Antakasina, Antoetra and Itremo (see map 1). Besides, the specimens from MNHN of Paris indicate its presence, at least (in the past) in the other localities like in Betafo and Ambatodradama (closed to Betafo), what requires a new investigation. Also, Andreone and Randrianirina 2003 confirms its presence in the region of Ankaratra-Tsinjoarivo.

But from bibliographical analysis and a preliminary surveys in March 2008 led by the Conservation International and his partners (University of Antananarivo or UADBA, NGOs such as Man and Environment or MATE, Madagasikara Voakajy or MAVOA, and Direction of Environment and Forest or DGEF), it was noticed that the location of the species presenting individuals evidence by the field since 2000 is presented in the table below. This require a new field to check and observe a new potential sites identified during this study, namely Betafo, Ambatondradama, the eastern part of Analamanga, Vakinankaratra and Imoron’i Mania, presented the same habitat of *Mantella cowani*.. If we look their area of occurrence, it is probable that other populations are present between Ambatolampy and Ambatofinandrahana through Betafo.

COMMUNE	SITE	GEOGRAPHIQUE POSITION	ALT.	OBSERVATION
ANTOETRA 20°46' 31,9''S/47°19' 0,6'' E	Fohisokina	20°42' 8,2''S/47°17'16,3''E	1600m	MRSN, Parc Tsimbazaza, CI, ASG MATE, UADBA, Departement Geographie
	Soamasaka	20°44' 52,9''S/47°17'41,1''E	1611 m	MRSN, Parc Tsimbazaza, CI, ASG MATE, UADBA, Geographie
	Bekaraka	20°44'56,6''S/47°19'1,9''E	1605m	CI, MATE, UADBA, ASG
	Ambodin'i Vatolampy	20°49'40''S/47°19'08''E	1540 m	UADBA, MRSN
	Farimazava	20°50'06''S/47°19'59''E	1380m	MRSN, Parc Tsimbazaza UADBA, BIODEV
	Ambinanitelo	20°43'23,8''S/47°18'02,9''E	1648m	MATE
ITREMO 20°35' 40''S/46°38' 10'' E	Antsirankambiaty	20°35,608'S/46°33,803'E	1534m	MAVOA, CI/MBG, ASG
	Antsirakambiaty	20°35,604'S/46°33,797'E	1498m	MAVOA, CI/MBG
	Andaobatofotsivava	20°39,08'S/46°35,58'E	1375m	CI/MBG
	Tsimabeomby	20°37' 33''S/46°34' 5,9''E	1674 m	CI/MBG
	Alan'i Volamena	20°28,53'S/46°32,15'E	1400 m	CI/MBG
ANTAKASINA-AMBATOLAMPY 19°30' 15,8''S/47°41' 2,6'' E	Mariana	19°30'15,9''S/47°48' 37,8''E	1628m	Parc Tsimbazaza, MRSN

MBG : Missouri Botanical Guarden, **MRSN** : Museo Regionali di Torino, **CI** : Conservation International

However, there are other distribution sites according to commercial collectors and that needs confirmation by rapid assessments

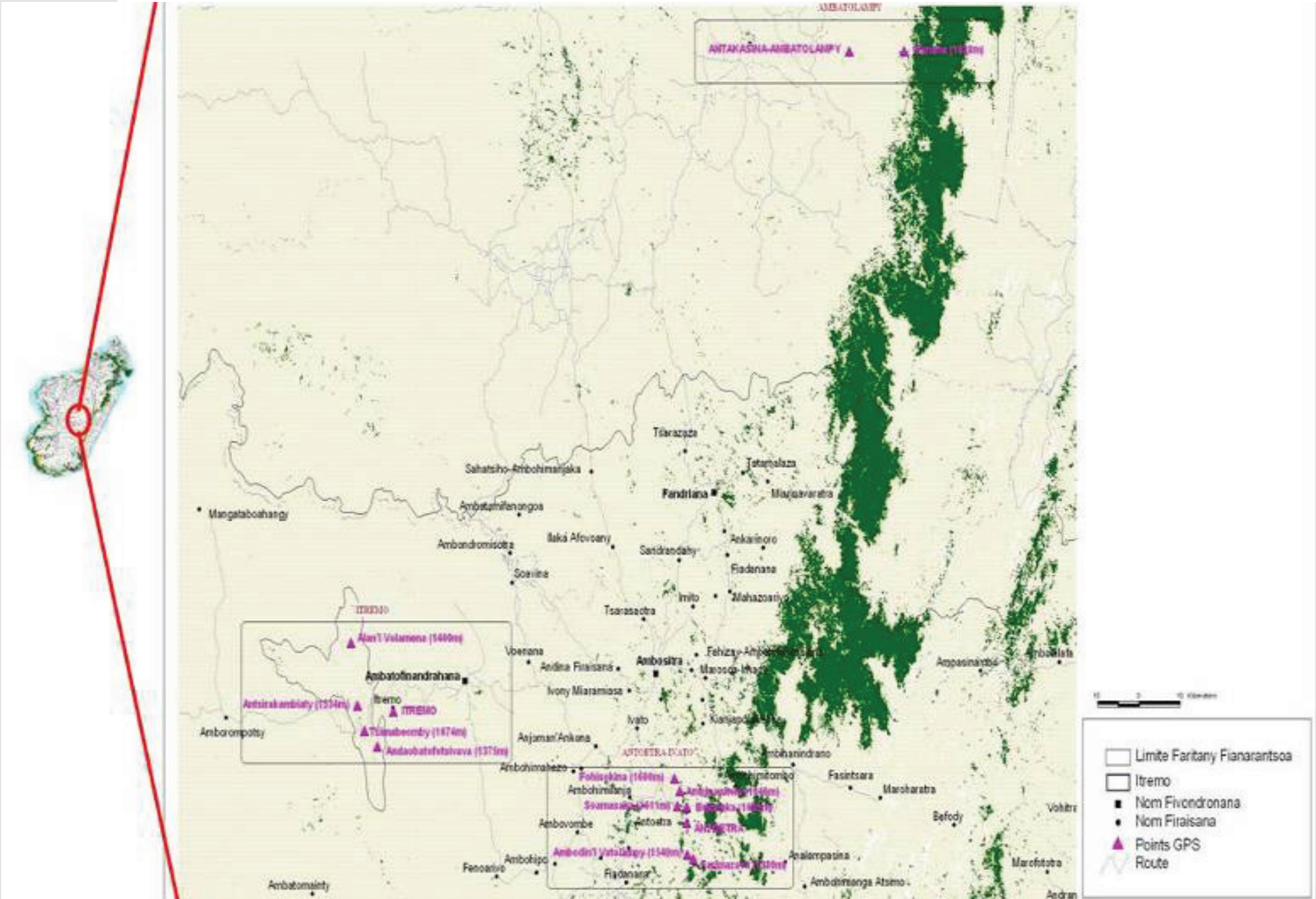


Figure 1. Map of distribution

2.4 Habitat condition

Mantella cowani is a terrestrial species, in forest edge (Bekaraka, Amparihimazava, Alan'i Volamena, Antsirakambiaty and Antakasina) or non-forest (Amparihimazava, Soamasaka, Ambodin'i Vatolampy, Fohisokina, Ambinanitelo et Tsimabeomby) and closed a running water or wetlands rocky. It moves in the savannas of neighboring mountains and the ground during a heavy rain. It is fossorial and housed under rocks during the dry season. Like all of *Mantella* spp., eggs could be deposited on land and then carried by water during the heavy rain into small streams.

It is quite active early morning and late afternoon to avoid the strong sunshine.



The habitat of the species observed from these sites is of three types:

- **Savannah rock Population:** constituted by the walls made of wet rocks, rich foam, presenting cracks or domes and mounds of land, with floral essences surrounded by montane savannah (typical habitat, Fohisokina).



- **High altitude border forest Population:** constituted by ripicolous forests and rocks (typical habitat, Antsirakambiaty).



- **High savannah and humid grassland population** (typical habitat, Tsimabeomby).



In general, from observations made since 1996 by the team of BIODÉV it can be assumed that the natural habitat of the species is Antsirakambiaty i.e. consisting of primary forest edge and high altitude. Then when its natural habitat is lost, it adapts to new condition such as open or degraded area (tavy or fields of culture like Amparihimazava, BIODÉV, unpublished) or under grass, tree trunks, interstices of rocks or crevices and in eucalyptus forests... but always closed of a wetland.

2.5 Role of the species in the ecosystem

Like other species of *Mantella*, it is predator of small insects of litter and / or dead leaves. The role of the integument of lively tint against the predators are not known, but studies are at present in progress, made by the team of Martha Andriatsarafara (University of Antananarivo). The tadpoles can be eaten by fish, crayfish, insect larvae or aquatic insects.

2.6 Population: natural history, trend, abundance and threat

Andreone and Randrianirina during the 2003 DAPTF noted that the species is quite active very early morning hours between 5.00-7.30. Then the animal ceases its activity or calls in the interstices of rocks. On the other hand, team of Biodev in 1996 noted that *M. cowani* begins again moved towards the end of the afternoon when the temperature falls. In general, populations are seen very shy and difficult to detect, and generally it slip between the grass even when weather conditions are optimal and warm temperatures. Probably, these activities outside of strong sunshine are caused by the strong influence of UV radiation on animals and avoid direct exposure to the sun because she lives in open areas.

Currently, the abundance of the species seems to be very limited :

-During the last field managed by CI and stakeholders in March 2008, only one site (Fohisokina) present 12 individuals with a 8 pers/hour research effort of and this site has presented 40 individuals during favorable month (January 2008). However, before 2003, it is easy to find several individuals during an hour work (BIODEV 1995, unpublished).

- In five years' interval, the Itremo population remains stable, 4 and 5 (2 at Antsirakambiaty and 2 at Andaobatofotsivava near the river Imasoandro in December 2003, observed by the team of MBG; 5 identified by the Mavoia team in January 2008).

- In 2003, Randrianirina and Andreone team found no tadpole, and this reality is very critical for the survival of the species.

1. During the breeding season (December), the BIODÉV team 1996 counted 598 specimens per hectare in different ecological niches. At the end of the breeding season, at the same site, the number is decreased of 48 per hectare after a strong collection. The local collector said it is easy to collect up to 2 000 specimens in a single day, compared to 100-150 specimens collected nowadays, it appears that the population of Antoetra is unstable.

The sex ratio of the 39 individuals at Fohisokina (study in 2007 by the Franco Andreone team) is 1: 2 (26 females for 13 males).

M. cowani call is very similar to *M. baroni*. It consists of series of brief click. The frequency is between 4 and 5 kHz. Concerning eggs and tadpoles, observation in captivity shows that it can produce an average of 40 white eggs (diameter 2.2 mm and with gelatinous gangue can reach 7 mm).

The conservation status of *M. cowani* population is very critical nowadays. Four main types of threat are hanging over it :

- **Habitat loss**: it is essentially the practice of Tavy (eg Amparihimazava), bushfires (Tsimabeomby), grazing, and drainage of habitat.
- **Overharvesting** to supply the international pet trade (Antoetra): Generally, the Malagasy people are not interested in animals and wild plants that have no economic interest, but this is not the case of *Mantella cowani* a species that is very attractive in international pet trade. Before 2003, the capture is very intense at Antoetra, children and young people spent their day to catch this species, and one person can collect up to 2000 individuals a day and the price varies between 800-1000 Ariary per individual. However, currently during our last field in March 2008, we could not observe a dozen individuals at all at Antoetra. Moreover, even if the time of observation is made through the end of the breeding season, we could not observe a juvenile individual.

We can notice also that there is mixture deliberately or misunderstanding of the group of *Mantella cowani* (*M. baroni*, *M. madagascariensis*, *M. "loppei"*, *M. pulchra*, *M. nigricans* and hybrids) in pet trade, which leads an inability to have a reliable data of *M. cowani*. So far the origin of animal collected was Antoetra and Itremo.

- **Hybridization**: In addition, *M. cowani* lives in sympatry with *M. baroni* at Amparihimazava (Antoetra) in an open area (Tavy near a forest or in a culture) or along the forest edges.



Mantella cowani



Hybride



Mantella baroni

The team of Franco Andreone has observed some hybrids, around 10 individuals for 5 days of research in 2003. In addition, during the last field made by the team of Conservation International in March 2008, we captured one individual similar to hybrid at Fohisokina. This result shows that the two species are very similar genetically and are separate and distinct from an ecological and ethological point of view.

- **Fragmentation on the distribution and habitat**: The population of *M. cowani* at Antoetra and other regions (Itremo) is currently very fragmented. Thus,

the presence of the corridor (habitat or rivers) between different sites can play an important role in terms of conservation. First, it allows the survival of metapopulation and on the other hand, the exchanges can take place between populations. If no corridor exists between sites, population is condemned to collapse, due to genetic poverty and therefore more vulnerable (environment change, parasitic disease ...).

2.7 Status IUCN

Category: Critical endangered (CR)

Criteria: A2acd + B2ab (iii)

Argument: Registered as a CR following:

- Its area of occupation (AOO) that is probably less than 10 km²,
- Its distribution is very fragmented,
- Its forest habitat decline following the extent of Bismarksberg;
- And also because of the drastic declination of the population is estimated at more than 80% during the last three generations (estimated at 15 years), this is deducted from the decrease in the observed distribution, the decline in the number of mature individuals and information on habitat destruction;
- And the levels of exploitation deducted by the numbers of animals entering in international pet trade.

2.8 CITES status

M. cowanii is currently in Appendix II of CITES which is subject to regulation of exploitation. Indeed, due the high price among collectors, it is collected in large numbers and stored pending the arrival of intermediaries causing high mortality of animals. This behavior has a negative impact on the wild population that is in furthermore facing in habitat loss. Thus, since 2004 the trade of the species is prohibited because it was found that the declination of the population is due to a combination of habitat loss and overharvesting in nature.

3. Program of Action

It is clear that this species has remained outside the current network of Protected Areas. Thus global conservation action and durable (habitat protection) adapted to the local context is the priority actions to do more with operating moratorium that was implemented since 2004.

The program is based on the dynamics and synergy of skills of those Malagasy actors and international researchers by considering firstly the need to imply communities and local authorities. This involvement appears to be quickly supported by agro forestry but also through the promotion of eco-tourism visits.

Understanding the dynamics of populations remains very fragmented, the program is designed with a quick securing two areas of habitat and development

activities of management in agreement with local population, and which will be made while increasing the knowledge of the species and their habitats. The studies of populations in situ and ex situ that must allow to refine and to make more relevant as well the programs of reassurance of environment to purposes of conservation as the modalities of management of the populations and habitats.

Finally, it appears as an opportunity to promote human resources development and natural to develop a program management and effective conservation that can serve as an example and possibly to be duplicated in some similar context.

Accordingly, the action program will focus on six main points:

- 1- Habitat protection: establishment of the first conservation area to Fohisokina with involvement and support of local communities in the management of conservation areas,
- 2- Continuation of the ban of trade in order to restore the natural population,
- 3 - Establishment of the captive breeding program ex-situ (hosting site to be determined following recommendation of the AARK) and in nature (Soamasaka)
- 4 - Establishment of eco-tourism site and applied research center on the study ethological and impacts of collect at Soamasaka,
- 5 - Continuation of basic biological research, socio-economic background on the species and population monitoring at Antoetra.
- 6 - Study on distribution and ecological needs of the population in the different potential sites in the high plateaus with evaluation of potential extensions on favorable habitats.

3.1 Formalize conservation area at Fohisokina and develop a management plan based on Fohisokina in agreement with the authorities and local communities

This part of program is corresponded of the Sahonagasy Action Plan, Chapter 6, which consist of the management of focal area of amphibians (priority sites for conservation of amphibians).



The NGO, Man and the Environment (MATE), formalize the management contract in the manner that appear the most appropriate following the negotiations which will do on the field with local actors and administration, the key principle unchangeable as maintaining the purpose of conservation with local actors approval for policy choices.

Depending on the results of field surveys conducted by ASG and Conservation International in March 2008, it is desirable to make the total montane of Fohisokina (300 hectares) as protection site and the rivers in valley is considering as natural limit and taking into account as buffer zone the surrounding slopes to preserve the water quality.

Actions of reforestation in plant with fast growths will be probably made as soon as possible and as much as possible to the benefit of the local communities; the objective is to prevent against the fire and to protect the quality of the rivers in valley bottom.

The small local population and the potential to see researchers and tourists to come and spend several days on site should allow to involve these local populations to built a construction for these visitors and so to get benefit from incomes related to the presence of this species.

3.2 Develop an eco-tourism plan and applied research basis at Soamasaka in agreement with the authorities and local communities

The development plan of Soamasaka will be conceived according to the same principles as that of Fohisokina but mainly designated to eco-tourism (besides *Mantella*, the landscape is rich in orchid, *Pachypodium* and also a particularly attractive landscape as a small cascades and a natural swimming pool) and being in priori more important because of the proximity of the road, this action will be implemented with the participation of local population.

In the same way as for Fohisokina, THE NGO The Man and the Environment will formalize the contract of management following the modalities which will seem the most appropriate on the field with the local actors and the administration, by considering having said that, besides the objective of conservation, a vocation of study of the species on this site which could request for manipulations of animals in situ breeding and a vocation of development of tourism activity for the profit of the local population.

3.3 Scientific research and socio-economic sector

All scientific and socio-economic activity are under the supervision of Franco Andreone, Chair of the ASG Madagascar. The research activities are consisting:

- To continue the study of the dynamics of populations both at Soamasaka and Fohisokina
- Continuation of studies on population biology, reproductive behavior, threats and density (Fohisokina; Soamasaka and Bekaraka...).
- Research on the behavior and ecology of the species at Soamasaka and Bekaraka.
- Continuation on the socio economic study and safeguard plan to local population (environmental degradation and impact of the collect on the species and human well-being) by a student in geography.
- Study on captive breeding in the wild (Soamasaka).

For each descent in the field, studies on diseases will be made (and parasitic fungi).

3.4 Study distribution

A rapid assessment program during the hot and rainy season in the potential sites in the eastern part of the Analamanga region, and Vakinankaratra and Amoron'Imania (between November and February) is needed to check the exact distribution of *Mantella cowani*. (to inspect all potential habitats identified in a site). ASG and CI and its partners lead this work.

3.5 Captive breeding

Launching a program of evaluation of the capacities of reproduction in captivity or semi captivity (by ASG and EAZA).

The choice of the site of hosting will owe in agreement with the action plan Sahonagasy (chapter 8), that is the institutions must be chosen on the basis of their experience, existing installations, and the desire to work on the Malagasy amphibians and also membership in a zoo or an aquarium, namely EAZA. However, currently in Madagascar no private institutions and / or public have necessary expertise or resources to maintain amphibians especially in the Biosafety. Thus, formation and training will be needed first and should be involve all aspects of farming, biosafety and field technical.

Requirements and stakeholders

Strategies	Activities	Responsible	Targets	Budget/an 1\$ = 1600 Ar
Develop a program involving local communities	Planting in buffer zones	MATE and local association	Local population	375 \$
	Planting species of immediate economic interest: plantations of fruit trees for local communities in buffer zone at Fohisokina	MATE with local NGOs Aingonala and SAFF/ FJKM	Local population	375 \$
	A program of accommodation for researchers and visitors to benefit the local population: 1 - Meeting and evaluation 2 - Case Constructions	MATE	Local population	3 750 \$
Securing the site of Fohisokina	A management plan based at Fohisokina	MATE		
	A management contract with all stakeholders : - Workshop, PV, letter of commitment - Administrative formalization letter (land tenure)	MATE	Region, Mayor, Administrative base, local population, Environment and Forest institution	10 000 \$

A management plan based on Soamasaka (eco-tourism and scientific sites at Soamasaka)	A management plan based at Soamasaka : A management-oriented to conservation in situ and scientific study and eco-tourism activity at Soamasaka - Workshop, PV, letter of commitment - Administrative formalization letter (land tenure)	MATE	Region, Mayor, Administrative base, local population, Environment and Forest institution	10 000 \$
	A proposal for a program to scientific and ecotourism visits (Soamasaka) : strategy developed with consideration by MATE on the case of Vohimana-Vohibola	Eco-tourism Team at CI, MATE, ASG	éco touristes, chercheur, grand public, éco volontaires	4 687.5 \$
Awareness and marketing (media communication)	- Media, booklets, Posters to promote conservation program - Design + Print	ASG	All stakeholders, malagasy population	1 562.5 \$
Study on population of <i>Mantella cowani</i> to refine conservation programs	Research and monitoring on population (biological, ethologic, ecological, dynamic and threats)	Université d'Antananarivo, MRSN, ASG, Parc Tsimbazaza	<i>Mantella cowani</i>	9 375 \$
An understanding of the possibilities of artificial and in situ breeding program of the species	In situ and ex situ studies : Strengthening the wild population	ASG, ARK, EAZA	<i>Mantella cowani</i>	11 250 \$

An understanding of social constraints and opportunities for economic and commercial management programs and conservation	Field study at Antoetra	Franco Andreone + Geography student	<i>Mantella cowani</i> and local population	2 250 \$
Search for potential sites	Rapid survey on potential sites (according to Museum specimen, modeling and habitat type)	CI, Mavoa, Langaha, Parc Tsimbazaza, Université d'Antananarivo and others	Highland region (East of Antananarivo, Betafo/Ambositra/ Ambatofinandrahana Triangle)	5 000 \$
TOTAL AMOUNT				58 625 \$

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