

**A Conservation Strategy for  
the Amphibians of Madagascar**  
**Une Stratégie de Conservation  
pour les Amphibiens de Madagascar**

**WORKSHOP**



**ATELIER**

**ACSAM**

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**BOOK OF ABSTRACTS**

## **THE AMPHIBIAN CRISIS AND MADAGASCAR**

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Very little is known generally about the decline of amphibians in mainland Africa and Madagascar, due to the lack of quantitative data. A workshop on the Global Amphibian Assessment held at the IUCN headquarters in Gland evaluated the status of the endemic species of amphibians of Madagascar. This led, among other things, to the publication of a paper, where the main problems affecting all the Malagasy species were highlighted (*Conserv. Biol.* 19 (6): 1790-1802). As a conclusion, it was evident that many species are at a critical conservation point, due to the increasing deforestation and habitat degradation. Furthermore, some species (e.g., *Mantella* spp., *Scaphiophryne* spp., *Dyscophus* spp.) are the object of a significant commercial trade for the terrarium market: due to their biological peculiarities and remarkable colouration, thousands of individuals of some of these frogs are exported for the pet trade each year. As an introductory talk, I will present the major threats that affect the amphibians of Madagascar, introducing the topics touched by the different conveners and during the sessions of the workshop. Moreover, I will discuss which should be the different points to be treated during an overall conservation project for the amphibians of Madagascar. Among these: (1) the continuation and the increase of a fieldwork, together with long-term studies, (2) the realisation of a national herpetological collection, (3) the attention to the education activities, (4) the updating of the Global Amphibian Assessment and the identification of hotspots for the conservation of amphibians, with special attention to species that are not present within protected areas, (5) the development of biomolecular techniques to identify sibling species and to regularly update the list of amphibian species, (6) the increase of a regular screening for the emerging pathologies, (7) the application of captive breeding programs and a regular monitoring on the pet-trade.

## **LES AIRES PROTEGEES DU RESEAU ANGAP ET LA CONSERVATION DES AMPHIBIENS**

*Chantal Andrianarivo, Association National Gestion Aires protégées*

Abstract not provided

## **FACING THE CHALLENGE OF INNOVATIVE SOLUTIONS FOR POPULATIONS FOLLOW UP**

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The work to be done on reptiles and amphibians of Madagascar has been out of this world and is still huge. Populations follow up have therefore come far after the priorities of describing species and trying to find out about their distribution. At the beginning most of the work was conducted by foreign specialists, staying in Madagascar only for quite short periods. Malagasy biologist started

to be trained by specialist (C.J. Raxworthy being the beginner, but almost all the specialists followed the same path of passing their knowledge to motivated young Malagasy), but their priorities were to work on the same aspects treated by their holder fellows. Habitat changes in a country like Madagascar, with species having very narrow distribution ranges can have unexpected impact. The efficiency in term of biodiversity of the forest regeneration programs might also be highly improved by the understanding of habitat change impact on herp populations. Some work to try to asses populations started in the early nineteen nineties under the leadership of O. Behra, C. Raxworthy, A Raselimanana and J.B. Ramanamanjato for IUCN, but failed to generate interest - and for funding - of a permanent improvement of the work. A system of follow up for CITES listed populations was designed a bit later, with the aim of finding solutions to ensure objective non detrimental finding, and good progress where made on population follow up techniques (e.g., F. Andreone and J.E. Randrianirina). The program however failed to be seriously continued, although there is now a system of permanent funding of the scientific authority. The NGO "Man And The Environment" then experienced a system of welcoming foreign biology students, which showed to be economically viable over the long term. They were put in front of the challenge of setting up a follow up of the amphibian populations of Vohimana, where D. Vallan carried out some studies on the diversity of amphibian populations after major habitat changes. Methodology should be reviewed by specialists but if such a system could be linked to the funding of the scientific authority to ensure long term follow up of the Universities of Madagascar it could be a proper system to ensure populations survey over years on many sites.

## **MALAGASY AMPHIBIAN TRADE LEVELS & NETWORKS: COULD THERE BE A SUSTAINABLE POVERTY ALLEVIATION OUTCOME FROM THEIR TRADE?**

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The trade in wildlife has historically engendered much debate, with trade often undertaken without any consideration for biological surveys to provide robust data that guide harvest levels. The lack of any such population data and information on harvested species, results in the sustainability of harvesting often being sacrificed for maximum profits. UNEP/WCMC CITES trade data (collected in June 2006), were used to investigate trends and dynamics in trade levels and species composition for CITES listed species. The first data recorded were in 1994, with eighteen known CITES listed species having been traded from Madagascar, totalling nearly 162,000 individuals traded between 1994 and 2006. *Mantella aurantiaca* was the single most traded species in time (10 years) and number (38% of the total numbered traded). Four genera, of CITES listed species, were traded, with 99% of the traded total being accounted for by just *Mantella*. *Mantella madagascariensis*, *M. pulchra*, *M. viridis* and *M. aurantiaca* occupied four of the top five most traded species, with *Mantella* spp occupying the fifth position. Species composition consisted of just *M. aurantiaca* in 1994-6, but increased rapidly after 1997, with 15 species the highest number of CITES listed species traded in a single year. The temporal structure of the trade recorded a rapid increase post 1994 until 1998, with a peak in 2001 and troughs in 1999 and 2002. These UNEP/WCMC CITES trade data were compared to trade data for 2001 collected from the

ministries of Eaux et Forêt and l'Élevage. These Madagascar sourced data recorded six genera and 22 species in the trade. Nearly 40,000 individuals were recorded for trade, with orders by individual traders requesting 880 *M. aurantiaca* and 440 *M. madagascariensis* in a single consignment. Trade networks investigations recorded 27 traders with 18 exporting amphibians to 68 importers. Village incomes were investigated and a model developed to explore shifting revenue sources towards more holistically sustainable practices.

## **SUSTAINABLE NATURAL RESOURCE MANAGEMENT BY LOCAL POPULATIONS - THE CASE OF THE ANALAMAZAOTRA FOREST STATION, ANDASIBE, MADAGASCAR**

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The Analamazaotra Forest Station is a 700 ha forest close to Andasibe-Mantadia National Park in eastern Madagascar. Having previously faced enormous problems with poachers, loggers, and charcoal-burners, environmental degradation has virtually stopped after the management of Analamazaotra has been transferred to the local association "Mitsinjo". Natural resource management based on ecotourism is now one of the most important sources of income. Money from ecotourism is used for raising environmental awareness, promoting sustainable forms of agriculture and offering environmentally sound alternatives for the population surrounding the forest. Being one of the amphibian hotspots of Madagascar, Analamazaotra's frogs naturally play an important role in the management of this forest. Besides their significance in research, their economic value in arts and crafts and possible ranching schemes are discussed.

## **THE GLOBAL AMPHIBIAN ASSESSMENT AND ITS UPDATE FOR MADAGASCAR**

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The Global Amphibian Assessment (GAA) (<http://www.globalamphibians.org/>), managed by IUCN, Conservation International, and NatureServe is a major initiative to produce a comprehensive assessment of the current conservation status for the world's ~6,000 amphibian species. The current conservation status of amphibians in Madagascar, as shown in the results of the Global Amphibian Assessment (GAA), will be presented. The GAA results identify the main threats to each species, and reveal a worldwide crisis in amphibian conservation. The GAA process has identified many seriously threatened species that were previously overlooked in conservation programs. The results also provide a basis for developing a strategy and action plan to combat amphibian declines at local, regional and global levels. This presentation forms a basis for discussion on the future development of the GAA towards assisting amphibian conservation in Madagascar.

## **DISEASES OF AMPHIBIANS: SHOULD WE BE CONCERNED ABOUT MADAGASCAR?**

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Like other vertebrate classes amphibians too are plagued by a variety of pathogens. These include bacterial infections, viral infections, fungal infections, and parasitic infections including a wide variety of protozoans, trypanosomes, monogenetic flukes, digenetic flukes, tapeworms, acanthocephalans, nematodes and pathogenic arthropods such as dipteran larvae and mites. Amphibians do have a well developed and effective immune defence system and the majority of pathogens will not cause serious illnesses. The clawed frog *Xenopus laevis* for example serves as host for no less than 25 different parasite genera representative of all major parasite groups except the acanthocephalans and they appear to cope very well with these multiple infections. Amphibians however do get infected by two extremely lethal pathogens namely a group of closely related viruses grouped in the genus *Ranavirus* and the amphibian chytrid fungus *Batrachochytrium dendrobatidis*. Both these are classified as emerging infectious diseases and were placed on the Wildlife Diseases List by the OIE (Office International des Epizooties), the World Organisation for Animal Health. We have seen in recent years how chytrid infections swept through large geographical areas killing off frogs in thousands. Frogs on several continents have suffered sudden high mortality rates, resulting in various species becoming extinct and many others undergoing massive population reductions. The global decline in populations of amphibians is one of the most vexing conservation issues of recent times. A recent report from the IUCN's Global Amphibian Assessment suggests that as many as a third of amphibian species have undergone severe declines or extinction with over seven percent listed as critically endangered and many species on the brink of extinction. A question that comes to mind is but what about Madagascar? With its unique and diverse anuran diversity an outbreak of either amphibian chytrid or *Ranavirus* could undoubtedly have catastrophic consequences. The time to investigate and take action is now!

## **MADAGASCAR AMPHIBIAN CONSERVATION IN ZOO ZÜRICH, SWITZERLAND**

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The Masoala exhibit in Zoo Zürich was opened in 2003. It is a walk-through 11'000m<sup>2</sup> exhibit displaying the fauna and flora of Masoala. The system contains more than 400 plant and 40 vertebrate species. This conservation project is strongly linked to the Masoala National Park. Through this project, Zoo Zurich is able to support the conservation work in Masoala significantly (by financing, with marketing and by promoting eco-tourism). Many endangered species are kept in the exhibit; most of them breed within international breeding programs. Zoo Zürich can offer space within the Masoala exhibit for amphibians, both 'free-ranging' or within terrariums, according to the specific needs. At the moment we keep (and breed) *Mantella aurantiaca*\*, *M.*

*laevigata*\*, *Dyscophus guineti* and *Scaphiophryne marmorata*. In 2006 Zoo Zürich has opened a separate amphibian exhibit and has started to support amphibian in-situ conservation work in Madagascar and Colombia (capacity building, research).

## **EX SITU CAPTIVE BREEDING AS TOOL FOR AMPHIBIAN PRESERVATION: LESSONS LEARNED AND FUTURE APPLICATIONS**

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The science of captive breeding of amphibians and other herpetofauna is not new, nor is its application to the field of conservation. While significant attention and resources need to be directed to the abatement of threats such as habitat loss, climatic factors, and disease, there are instances where captive breeding colonies may be the last hope for maintaining and safeguarding the global resources of a critically endangered species. Careful consideration of the short or long term resources needed, husbandry obstacles or future plans for species is very important. As demonstrated by existing projects in Panama, Ecuador, and Costa Rica, *in country* projects can be successful and can also be done in combination with programs outside of range countries to further expand the safety net for critically threatened species. Sharing the technical knowledge and expertise in a timely and practical fashion will allow more rapid response to critical situations in Madagascar and ultimately more direct, in-country action will take place to preserve native species in this very diverse country.

## **A REVIEW OF MALAGASY AMPHIBIANS KEPT IN CAPTIVITY: ANALYSIS OF ZOOS AND PRIVATE SECTOR**

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The Amphibian Conservation Action Plan has proposed captive breeding as a potential tool to address amphibian declines. As a consequence of the serious threats facing Malagasy amphibians it is important to determine if there is expertise in breeding these species in captivity. An analysis of the world zoos using ISIS and ARKS databases, a questionnaire to European Zoos and interviews with private breeders holding specimens of Malagasy amphibians were used to determine their level of knowledge and expertise over the last ten years. Of the 226 species of Malagasy amphibians, 21 species are currently kept in zoos. Only three species are held by more than 4 institutions; *M. laevigata* (4), *Dyscophus antongilii* (7) and *Mantella aurantiaca* (20). *M. aurantiaca* is the only species to have a coordinated captive breeding programmes in zoos and private collections. Of the zoos holding Malagasy amphibians, 81% of zoos hold only one or two species. Forty-nine zoos hold only a single specimen of a species. An average 32% of all specimens of all species are wild-bred, 47% captive-bred and 21% of unknown origin. An analysis of the intercommunication between different zoos with captive colonies *Scaphiophryne gottlebei* was analysed as an example. Only a few institutions have historical records of breeding for several generations or keeping large number of Malagasy frogs. Private breeders are keeping

approximately the same number of species. Communication between them is based on the internet and regular trade meetings. There is a need for drawing up husbandry protocols for captive breeding populations, effective record-keeping for a complete understanding of the success of the captive programme, further collaborations between private breeders and zoos, and evaluations of the potential for reintroductions for certain species.

## **MALAGASY AMPHIBIAN MANAGEMENT AND CONSERVATION AT ACQUARIO DI GENOVA**

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The Acquario di Genova is one of the first oceanic aquariums in Europe and the first being deeply involved, from the very beginning, into several *in-situ* and *ex-situ* conservation projects in Madagascar, developed in collaboration with several other institutions from different countries. This program, among other goals, achieved good results in terms of captive breeding of amphibians and reptiles, in order to efficaciously reduce the trade of wild caught animals and also increase public awareness on the problems that are afflicting these species. The presentation will mainly show how an aquarium can participate, at different levels of involvement, to international conservation programs providing proper environmental conditions to manage and reproduce different species of amphibians. It will also enhance the need for a global understanding and a central coordination for the management of endangered amphibians, not only in terms of number of animals and species, but also in terms of space, know-how and financial possibilities.

## **ASSISTANCE IN DEVELOPING A NATIONAL HERPETOLOGICAL COLLECTION**

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The herpetological collections in the Département de Biologie Animale, Université d'Antananarivo and in the Parc Botanique et Zoologique de Tsimbazaza are among the most important collections in the world with regards to the amphibians and reptiles of Madagascar. These collections are of great value to document the distribution and diversity of the Malagasy species that are still very poorly known for the large majority of the taxa. To develop a national herpetological collection, a number of aspects should be discussed at the workshop, including the following: The curation of scientific collections is a long-term task that requires continuous long-term funding. Even in developed countries sufficient financial support can be difficult to obtain. Since modern funding is usually project-based and limited to a few years, the possibilities to warrant sufficient long-term funding might be a major issue. The continuous costs for scientific collections include storage rooms with basic infrastructure (e. g. water, electricity, computer and internet access, shelves), consumables (e. g. jars, labels, alcohol, formalin, office) and personal staff including curators and technicians. Since it appears unlikely to warrant long-term funding for two collections, the possibility of a fusion of the two existing collections should be considered.

Many species of frogs and reptiles are very difficult to determine without voucher specimens. However, due to the enormous species diversity (more than 300 species of frogs and 400 species of reptiles have been identified so far from Madagascar) and the difficulties for their correct identification, the simple conservation of vouchers will not be sufficient for the future requirements. Therefore future vouchers should be accompanied by as much data as possible, including photographs, call recordings, and tissue samples. All these data sets should be linked in an electronic database that could be stored in the national collection. Additional aspects that should be discussed might include the access to the collection and their data, the protection of data of each research team, and possibilities for international loan.

## **AMPHIBIAN CONSERVATION IN MENABE, WESTERN MADAGASCAR**

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The natural habitats of Madagascar are being lost at a very high rate, especially the deciduous dry forest in the west of the island which by 1990 was thought to have been reduced to only 3% of its original extent. Menabe Central is one of the largest remaining blocks of dry forest in Madagascar and with several local endemic vertebrates restricted to the area it therefore represents an important site for biodiversity conservation. Durrell Wildlife Conservation Trust has been working with local partners to arrest rates of deforestation in this region and to develop a protected area. The amphibian fauna of Menabe consists of 15 species, many of them local endemics with specific adaptations to the dry forest habitat. At present, Durrell is conducting a field study to provide data on the distribution and relative abundance of herp species in Menabe Central and the relationship between habitat characteristics and herp diversity. This study therefore will be of extrinsic value by investigating the effects of forest disturbance and fragmentation on amphibian diversity as well as furthering the understanding of the biogeography of key species. Furthermore, incidental data will be collected to investigate the basic breeding biology and activity patterns of key species, which will help improve the design of future monitoring programmes. The study will also be vital to the development of a potential monitoring programme that could be used to quantify the long term changes in trends in abundance and/or distribution to help quantify the effects of conservation management on amphibians. At the ACSAM workshop, we will put the design of this study up for discussion and present preliminary results. Furthermore, we will present a conservation oriented habitat use model of one endangered frog species, *Aglyptodactylus laticeps*, and discuss the suitability of this frog as one key species in a species-based conservation strategy in Menabe.

## **MANTELLA BREEDING: DIFFICULT, BUT NOT IMPOSSIBLE**

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Tropical frogs have attracted the interest of the developed countries hobbyists, and professional breeders for more than 30 years. Amongst tropical species, Mantella is still the most difficult frog

to breed in artificial environment, and a very few breeders were successful. This presentation will explain the key elements of a successful mantella breeding over a 30 years period, and their potential application for Mantella conservation.

## **MADAGASCAR'S AMPHIBIAN BIODIVERSITY - INFERRING PRECEDENCE AND PROSPECTIVE DIVERSITY FROM PATTERNS OF FAUNAL SUBSTRUCTURE**

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Amphibian declines and extinctions, resulting from land use, commercial exploitation, exotic species competition, and emerging disease, are a global priority. With nearly one-third of the world's amphibian species classified as threatened with extinction, and as much as 50% of the amphibian fauna undescribed, a rapid assessment leading to a collaborative, definitive, and proactive result are needed to define biodiversity worldwide. Due to its unique species biodiversity and to the continued pressure from human encroachment, Madagascar has been placed at the top of conservation priority lists, or hotspots. Given the rapid decline of amphibian populations to environmental factors and disease, there is a pressing need to understand the taxonomy and phylogeny of amphibians so that a scientifically rational approach to their conservation and management can be developed and implemented. Additionally, the taxonomic revision of species and distributions warrants the need to consistently re-evaluate the conservation protection status of amphibians as new information becomes available. By correlating the geographic distributions of the prosimian, leaf-tail gecko, tortoise, and boid taxa using the most current available molecular data, a consistent pattern of substructure is presented. Driven by the isolating effects of river barriers, a congruent pattern for biodiversity can be inferred, suggesting that Madagascar's amphibian biodiversity is considerably underestimated.

## **AMPHIBIAN CONSERVATION IN MADAGASCAR: AN OPPORTUNITY FOR SUCCESS?**

*Joseph R. Mendelson III, Zoo Atlanta, 800 Cherokee Ave SE, Atlanta, Georgia, USA, and IUCN-Amphibian Specialist Group, Washington, DC, USA; email jmendelson@zoatlanta.org [Non-present at the workshop]*

Since the 1980's herpetologists have been watching helplessly as amphibians disappeared all around the world. Very recently, several landmark research and conservation programs have informed new perspectives on the issue of global amphibian extinctions. Quite important, also, is the remarkable consensus achieved by diverse stakeholders in forming the Amphibian Conservation Action Plan (ACAP) and the formation of the IUCN-Amphibian Specialist Group. Despite numerous challenges to its native amphibians, Madagascar still represents an important opportunity to apply lessons-learned in other parts of the world and to develop the first truly proactive amphibian conservation program.

## **AMPHIBIAN CONSERVATION AT THE WORLD LEVEL**

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Amphibian populations continue to decline and go extinct throughout the world at an alarming rate. Traditional approaches to conservation are failing to stem the crisis; it is therefore time to do something fundamentally different, and at a larger scale than ever before. The Global Amphibian Summit held in Washington, DC in September 2005 brought together over 60 delegates from around the world to produce a Declaration and a more comprehensive Amphibian Conservation Action Plan (ACAP). The summit found consensus amongst stakeholders that the scope of the problem is large and global, and familiar and novel threats are to blame. It was also concluded that science-as-usual and conservation-as-usual are both insufficient. While the Declining Amphibians Population Task Force (DAPTF) has achieved amazing successes in helping to advance our knowledge of the extent and causes of amphibian declines, the current crisis is beyond the scope of a Task Force. The IUCN/SSC Amphibian Specialist Group (ASG) has therefore formed to develop and coordinate a global network of expertise to support amphibian research and conservation and catalyze action at a scale beyond that at which it is currently operating. The ASG network will be composed of global conservation/research professionals organized around geographic nodes to ensure a “bottom up” body of influence to guide the implementation of the ACAP. The complex pieces of the amphibian crisis cannot be addressed by the IUCN/SSC model alone, however, and the ASG will also act as the umbrella organization for the Amphibian Survival Alliance; a cross-disciplinary coalition of a diverse set of stakeholders and partners. The ASA will provide a forum for action to enable new partners and initiatives within ACAP. Together, ASG and ASA will support conservation, research, assessment, communications, policymaking, and fundraising. Madagascar represents a priority for amphibian conservation and consistently falls in the top 20 countries in the world in terms of total number of amphibian species, number of endemic amphibian species, and number of threatened amphibian species. The ASG and ASA aim to build partnerships and mobilize resources to advance amphibian conservation in Madagascar; workshops such as this will be critical for developing strategies to implement the ACAP on the ground.

## **IMPORTANCE OF THE NORTHERN REGION OF MADAGASCAR FOR THE CONSERVATION AND BIOGEOGRAPHY OF THE MANTIDACTYLUS SUBGENUS *OCTHOMANTIS***

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A three-year survey of Northern Madagascar completed between 2001-2003, directed by Raxworthy, American Museum of Natural History (AMNH) and the University of Antananarivo Department of Animal Biology, has revealed the biogeographic and conservation importance of this region for the sub-genus *Octhomantis*. Despite a surface area that is less than other biogeographic regions, 10 species have been identified for this group: 3 species currently described,

6 new species, and 1 requiring resurrection from synonymy. The described species are: *M. femoralis*, *M. ambreensis*, and *M. mocquardi*, the resurrected species is *M. poissoni* Angel 1937; and the new and as yet unnamed species: *M. sp A-F*. A Parsimony Analysis of Endemism (PAE) establishes that Northern Madagascar is the center of endemism for the sub-genus *Octhomantis* (similar to chameleons, Raxworthy and Nussbaum, 1995) and that the mountain chain extending from Anjananaharibe-Sud to Tsaratanana to Manongarivo represents a major zone of endemism and a possible center for dispersion. To conserve the amphibian species diversity of the sub-genus *Octhomantis* it is vital that the following humid habitats are included within the Durban Vision protected area expansion program: 1) forest corridors associated with the star-like radiating ridge system of the Tsaratanana Massif; 2) unprotected additional forests in the Manongarivo region, and 3) unprotected forests in the Vohémar region.

## **ACTIVITES DE RECHERCHE EFFECTUEES ET ETAT DES LIEUX SUR LA GESTION DES AMPHIBIENS MALGACHES**

*Daniel Rakotondravony, University of Antananarivo, BP 906, Antananarivo 101, Madagascar; email drakotondravony@simicro.mg*

Les recherches effectuées sur les Amphibiens de Madagascar sont nombreuses et datent de très longtemps. En 1993, Glaw et Vinces repertorient déjà 598 références sur l'herpetofaune de Madagascar, incluant Amphibiens et Reptiles. Depuis cette date, plusieurs autres travaux ont eu lieu. Une revue des recherches menées sur les Amphibiens depuis dans les quinze dernières années et un état des lieux sur les efforts relatifs à la gestion des espèces, en particulier sur le commerce et international, constituent l'objet de la présente communication.

## **AMPHIBIAN DIVERSITY AND NEW PROTECTED AREAS**

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The lowland rain forest of Anosy Region in south eastern of Madagascar, hold amazing biodiversity and endemism levels, and unique vegetation types. 145 of the 170 species of reptiles and amphibians found in Anosy region occur in low land rain forest habitat. 11 amphibians are endemic or chiefly restricted to the forests of the Anosy Region. Of these five are endangered and two are vulnerable to extinction (IUCN, 2006; Conservation International, and Natureserve 2006). This richness makes the Anosy region one of the second richest region of Madagascar after Sambirano. In spite of their present-day healthy appearance, their biota is seriously threatened of habitat loss by human pressure, because of the projected warming for the end of this century. Available data are still insufficient for a definite assessment, but preliminary estimations based on representative endemic herps species show that roughly more than 50% of them are outside of the existing protected area and would loss their habitat during the next ten years. Given the underlying endemism, the eventual loss of biodiversity will be of global nature. Other mountain ranges around the Madagascar with similar characteristics, namely topographical isolation, high endemism because of the lower altitude, would be under similar unexpected risk, and should be urgently considered

for conservation (SAPM) purposes. Using amphibian's species as tool, QMM SA, within his environmental programme, contribute to identify and to set up 5 sites of the 14 proposed new protected areas (Durban vision). We are using amphibians and reptiles species distribution as indicator of the efficiency of the choice of core zone of new protected area. Distribution of 145 species is analysed and

## **ROLE DU MUSEUM DU DEPARTEMENT DE BIOLOGIE ANIMALE DANS LA CONSERVATION DE LA BIODIVERSITE MALAGASY**

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Le Muséum du Département de Biologie Animale est un musée consacré à l'histoire naturelle des espèces faunistiques malagasy. Ses missions principales sont la recherche, la formation à la recherche et la conservation de collections scientifiques. Les collections du Muséum sont employées à des fins de recherche scientifique et pédagogiques dans le domaine de la science de la vie. Elles sont utilisées également par les chercheurs comme support d'études scientifique ou comme témoins de la biodiversité dans le cadre d'études biologiques, écologiques et/ou environnementales. L'activité de recherche consiste à inventorier, à ordonner et à comprendre la diversité biologique et écologique, son origine, son rôle et sa dynamique, afin de contribuer à une gestion durable de cette diversité. Les espèces conservées au Muséum servent de base essentielle aux expertises dans le secteur du patrimoine naturel. Cette expertise s'appuie sur tous les secteurs d'activités notamment les activités de recherche. Organisme scientifique et indépendant, le Muséum apparaît comme une véritable référence dans ce domaine particulièrement sensible. La gestion, l'entretien et la conservation des collections tiennent une place centrale dans les activités statutaires du Muséum. Les collections disponibles au Muséum proviennent des chercheurs nationaux et internationaux ou des institutions comme les grands organismes de recherche, des universités ou des établissements d'enseignement ou des autres muséums. Son enrichissement se poursuit actuellement dans le cadre des conventions entre les instituts de recherche publics ou privés, des universités ou lors d'expéditions scientifiques effectuées par les chercheurs nationaux ou internationaux et le Département de Biologie Animale de l'Université d'Antananarivo. Le Muséum s'adresse à des étudiants et doctorants du 3<sup>ème</sup> cycle par l'intermédiaire de l'école doctorale. Plusieurs espèces de chaque groupe faunistique malagasy sont conservées au Muséum du Département, entre autres l'Embranchement des arthropodes jusqu'à l'Embranchement des Vertébrés. Ce dernier comprend les 5 classes les plus importantes et les mieux étudiées du Règne Animal à savoir les Poissons, les Amphibiens, les Reptiles, les Oiseaux et les Mammifères. Actuellement, le Muséum abrite quelques holotypes et paratypes qui servent de spécimens de références des espèces nouvellement décrites au niveau mondial. Les spécimens conservés au muséum sont aussi utilisés dans l'identification des espèces récemment collectées. Les espèces menacées d'extinction y sont représentées, entre autres la collection en herpétologie est fortement fournie. Malgré la vétusté des locaux, beaucoup d'efforts sont déployés par les responsables locaux et ces partenaires afin que ce musée puisse suivre le norme requis.

## **THE GENUS *MANTELLA*, ENDEMIC TO MADAGASCAR, AND THE INTERNATIONAL PET TRADE**

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Among Madagascar's biodiversity, the amphibian family Mantellidae includes the genus *Mantella* with currently 15 species, classified in the subfamily Mantellinae. Since 2004, the 15 species of the genus are included in Appendix II of the CITES convention. They are considered to be threatened by extinction due to the international pet trade and therefore maximum yearly export quotas are fixed by the Scientific Authority of the Malagasy CITES, represented by the Département de Biologie Animale de la Faculté des Sciences (Antananarivo). In this framework, studies have been carried out to obtain sufficient data on the biology and ecology of species of *Mantella*, in order to allow for the measures necessary to manage both their exploitation and conservation. Of the 15 species, and excluding *Mantella manery*, only the 5 most threatened species will be dealt with in this presentation: *M. aurantiaca*, *M. cowani*, *M. bernhardi*, *M. expectata* et *M. haraldmeieri*. Their distribution is in general limited to small ranges. The populations studied choose different habitats for their life cycle that includes hiding deep under leaf litter or among tree roots far from water bodies during the hibernation. They gather in the stream valleys or around swamps before reproduction, and gather in the most humid areas during the post-reproductive period. The principal threat noted is habitat destruction through slash-and-burn practices ("tavy"), and forest fires. *Mantella cowani* and *M. bernhardi* appear to have suffered important population declines due to their continued exploitation at restricted sites. Not considering the biological cycle of the species provides further problems through massive collecting activity disturbing their breeding period. Habitat fragmentation provides further threats. Each of the species is currently only found at small sites, isolated from one another. The impact of this fragmentation requires further study to ensure an effective conservation. In the case of species that occur only outside of protected areas, these merit to be priority in terms of monitoring and control, especially at sites, which are principal, collecting areas for the pet trade.

## **KEY BIODIVERSITY AREAS AS A TOOL FOR IDENTIFYING PRIORITY CONSERVATION SITES IN MADAGASCAR: THE CASE FOR AMPHIBIAN BIODIVERSITY**

*Harison Randrianasolo\* and David Knox#, \* Conservation International - Madagascar. 6, rue Razafindrindra. Ambohidahy- Antananarivo (101). Madagascar; #IUCN/SSC CI/CABS Biodiversity Assessment Initiative c/o Center for Applied Biodiversity Science, Conservation International, 1919 M Street NW, Suite 600, Washington DC 20036, USA; emails h.randrianasolo@conservation.org and d.knox@conservation.org*

To ensure the protection of Malagasy biodiversity, Key Biodiversity Areas (KBAs) are being identified as a tool to support the identification of the new protected areas system, as well as for

supporting the management of the existing protected areas. KBAs are identified based on the presence of globally threatened species according to the IUCN Red List, restricted range species and congregatory species. To date, 164 KBAs have been identified covering 8 taxa in Madagascar. The highest priority subset of KBAs are Alliance for Zero Extinction (AZE) sites, which hold the last remaining population of a Critically Endangered (CR) or an Endangered (EN) species. There are currently nine AZE sites covering twelve amphibians in Madagascar. Five of these sites are already protected, an additional two sites will receive protection under the new protected area system (SAPM), while two sites will not be protected from the expansion of the protected area network.

## **INVENTORY, STUDY, AND CONSERVATION OF HERPETOLOGICAL REFERENCE COLLECTIONS**

*Jasmin Emile Randrianirina, Parc Botanique et Zoologique de Tsimbazaza, BP 4096, Antananarivo 101, Madagascar*

The Parc Botanique et Zoologique de Tsimbazaza, by its Division of Herpetology, provides continued efforts to promote the research and conservation activities related to the Malagasy amphibians. One goal is to better understand the natural history of the Malagasy batrachofauna, which is characterized by a proportion of endemic species of 99%. The inventories and bio-ecological studies on the endemic species are priority, and the obtained herpetological collections of scientific reference are prepared and curated for the needs of students, researchers, or other interested persons both at the national and international level. The knowledge acquired through these studies in the natural forests of reserves, national parks, and other sites of interest, can provide clues to the captive breeding of some threatened amphibians (genera *Mantella* and *Dyscophus*) at the “batrachiorum” of the Tsimbazaza Park. These results can also provide scientific support for the scientific faunal authorities, for the management of Madagascar’s wild animals (through the Ministère de l’Environnement et des Eaux et Forêts/Direction Générale des Eaux et Forêts), and for the management of parks, reserves and other sites. Other activities comprise the dissemination of knowledge on the conservation of these species and their ecosystems through training of researchers, nature conservation agents, guides, as well as through contacts with visitors (school pupils, students, national and international tourists) of Madagascar’s reserves, and especially of Tsimbazaza Park which is the only large parc and green area at the heart of Madagascar’s capital Antananarivo.

## **SHOULD THE “RADAKA” (*MANTIDACTYLUS GRANDIDIERI*) DESERVE A SPECIAL ATTENTION FOR CONSERVATION?**

*Jasmin Emile Randrianirina, Parc Botanique et Zoologique de Tsimbazaza, BP 4096, Antananarivo 101, Madagascar*

A survey of socio-economic data collecting for the giant *Mantidactylus* (*redaka* or *radaka* in Malagasy) has been recently carried out in the forest corridor between the Ranomafana and Andringitra forest blocks, at Vinanitelo (21°44’06 S; 47°15 48 E; 1125 m a.s.l., Fianarantsoa

Faritany). The investigations have been done on three categories of local people (outside the forest, at the periphery and within the forest). The study in the field has been done at Sahalava which is part of the great corridor forest, crossing the path connecting Vinanitelo and Ikongo). Apparently the species seems to be threatened by the local collecting and trade for food purposes, and for the habitat loss due to "tavy" practise. Further data are needed to understand which is the current degree of collecting and which is the impact for species conservation.

## **CONSERVATION THREATS TO MONTANE AMPHIBIANS IN MADAGASCAR**

*Christopher J. Raxworthy, American Museum of Natural History, Central Park West at 79th Street, New York, NY 10024-5192 USA. email rax@amnh.org*

Montane endemism is a common feature seen in amphibian communities in Madagascar, with species usually: 1) restricted to a small surface area of suitable habitat, 2) rarely seen or collected, and 3) lacking baseline distributional data for long-term monitoring. Populations have been historically threatened by anthropogenic habitat loss from agriculture, human set fires, and for some species, commercial collecting for the pet trade. In addition, future climate change and pathogens now also represent new concerns for montane species. However, to detect future distribution and population changes, we require baseline field data that is currently lacking for most species. A solution to this problem would be to establish montane transects which could be monitored over the long-term, coupled with new surveys of poorly studied massifs and species. These new surveys should 1) precisely record individual collecting localities (including elevation) by GPS, 2) collect genetic and morphological voucher specimens to document species, and 3) emphasize dense sampling along transects that will facilitate repeated monitoring.

## **BASE DE DONNEES SUR LES AMPHIBIENS AU SERVICE DU SAPM**

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La probabilité de distribution des espèces menacées d'Amphibiens a servi de base pour la priorisation des zones à conserver dans le cadre de la mise en oeuvre de la Vision Durban. Ces probabilités de distribution des espèces menacées ont été utilisées -- avec les autres groupes taxonomiques tels les mammifères, les oiseaux, les reptiles et les poissons -- comme outils pour la délimitation des zones prioritaires de conservation au niveau de la commission SAPM.

## **SMALL FOREST REMNANTS: HIGH DIVERSITY, LOW PROTECTION. WHAT ABOUT THEIR FUTURE?**

*Denis Vallan, Museum of Natural History Lucerne, Kasernenplatz 6, 6003 Lucerne, Switzerland, email denis.vallan@lu.ch*

Beside habitat loss for many amphibians and other animal species the fragmentation of their habitat is one of the biggest threat. In Madagascar there are many cases in which the remaining forest fragments either exhibit a high amphibian diversity or they harbour amphibian species which are highly endangered. Several of those small-sized habitats do not benefit from a special legal protection regulation. What are the strategies we could apply to allow the concerned species a long-term survival in situ? The range of strategies is broad, each implying a set of different consequences. In present study the problematic of Vohimana, better known as An'Ala, will be discussed. This forest is among the sites with the highest amphibian diversity in Madagascar. It lies between the "résérve spéciale" of Analazaotra, the Mantadia National Park and the "forêt classée" of Vohidrazana. Surrounded by little protected forests, An'Ala with a size of 600 ha lacks of any special protection. The future of this remnant depends on whether it can be connected to the adjacent forests and be valorised or protected respectively. Which path should be treaded to reach the goal to conserve amphibian and other species?

## **WILL TOO MANY COOKS SPOIL THE RICE? A HISTORICAL OVERVIEW OF AMPHIBIAN RESEARCH IN MADAGASCAR, AND A PLEA FOR BETTER COORDINATION**

*Miguel Vences, Zoological Institute, Technical University of Braunschweig, Spielmannstr. 8, 38106 Braunschweig, Germany, email m.vences@tu-bs.de*

Historically, amphibian research in Madagascar has mainly been carried out by single researchers, but in the past 20 decades collaborative research has become more and more important. Until 1990, most works were published by single authors, while from 1990-2000 teams of two authors prevailed. Since 2000, multi-authored papers have become common, with sometimes up to 11 authors on single papers. This trend proves the efficiency of close collaborations, but also implies the need for a better coordination if amphibian conservation and research is to be approached at a larger scale. If amphibian surveys are to be successful and the limited financial resources efficiently allocated, it will be necessary for all research groups to agree upon common standards for data collection, and to develop a memorandum of understanding about free access to original survey data and related copyright issues. There are a number of issues that require a closer cooperation among as many researchers as possible, and a relevant resource allocation to the local coordination in Madagascar: (I) identification of sites for setting up a standardized monitoring system, and implementation of the methods; (II) regular maintenance of automated devices and central collection of data (e.g., from data loggers or bioacoustic recorders); (III) development of a database to store bioacoustic records with appropriate accompanying information; (IV) development of a standardized database where locality records are entered together with precise collection dates, voucher and tissue numbers, and validation information. Ideally this database will be directly integrated in the ReBioMa database project ([www.rebioma.org](http://www.rebioma.org)), with collectors being

given the opportunity to publish their data first; (V) development of a centralized tissue collection and streamlining of the process of large-scale sequencing for identification purposes in interested labs abroad and as soon as possible in Madagascar; (VI) development of specialized amphibian courses at Antananarivo university to be integrated in the zoology curriculum, and of other courses specifically designed for local stakeholders in reserves etc.

## **DEVELOPING PROTOCOLS FOR STANDARDIZED MONITORING AND INVENTORIES OF MALAGASY AMPHIBIANS: INTEGRATION OF CLASSICAL METHODS WITH BIOACOUSTICS, DNA BARCODING AND TADPOLE SURVEYS**

*Miguel Vences, Zoological Institute, Technical University of Braunschweig, Spielmannstr. 8, 38106 Braunschweig, Germany, email m.vences@tu-bs.de*

Amphibian survey work in Madagascar has so far mainly relied on opportunistic diurnal and nocturnal searches for adult as well as subadult specimens, and their subsequent identification through morphological analysis. Active search for calling males played an important role in localizing especially tree frogs in many surveys, but bioacoustic recordings have rarely been used to assert presence or absence of particular frog species. In contrast, projects like the South African Frog Atlas employed call records obtained by volunteers as main source of information. Also, so far, it has not been tested in Madagascar to which extent surveys of tadpoles may bear the potential to detect rare species that may not be present at the breeding waters at the time of survey. In general, larval stages as well as subadult metamorphosed frogs are especially difficult to identify in cryptic species where even the adults may be morphologically indistinguishable. For this reason, molecular species identification through DNA barcoding is likely to play a major role in future standardized monitoring and survey protocols. The potential contribution of bioacoustics, tadpole surveys, DNA barcoding and classical searches to these protocols is being currently assessed in a preliminary way, but more intensive research is needed to develop a robust methodology.

## **TOWARDS IDENTIFYING PRIORITY AREAS FOR AMPHIBIAN CONSERVATION IN MADAGASCAR: CHANCES AND CHALLENGES.**

*David R. Vieites, Museum of Vertebrate Zoology and University of California, Department of Integrative Biology, Berkeley, 94720-3160, California, USA; email vieites@berkeley.edu* [Non-present at the workshop]

Although Madagascar harbors a rich endemic amphibian fauna, very little is known about the biology, distribution and conservation status of most of the species. Moreover, the high rate of discovery of new species during the last years, even in well studied areas, together with the fact that many areas are still poorly or not explored, challenges our understanding of the distribution pattern of amphibian diversity across the island. In order to investigate this, we are trying to develop robust predictions of species ranges using available data on their observed distributions, their habitat preferences, and the occurrence of their habitat. Our preliminary analyses will allow us to define and prioritize areas which need further exploration, and for data deficient species,

areas where species may occur but were never recorded which may be critical for discovering new populations of endangered species. New surveys, in which georeferenced point locality data associated with reliable identified voucher museum specimens will be collected, are needed to improve our knowledge of amphibian distribution patterns and to define priority areas for conservation.

## **CHYTRID FUNGUS ASSESSMENT OF MADAGASCAR FROGS**

*Ché Weldon, Louis, H. du Preez, North-West University, South Africa*

The highly diverse and endemic amphibians of Madagascar are considered a national treasure by local and international authorities. However, many taxa are threatened with extinction because of a small distribution area, habitat destruction, and overcollecting. Amphibians furthermore are affected by dramatic global declines through the amphibian chytrid fungus. The presence of infectious chytrid fungus in Madagascar was assessed for the first time during a survey in January 2005. These samples were processed using conventional histological techniques and examined for the presence of the amphibian chytrid. Chytridiomycosis was not detected in any of the animals from this initial survey. A second, more extensive survey was conducted in East Madagascar in February 2006. The survey included 507 specimens representing at least 63 species. These specimens are currently being processed. Depending on whether chytridiomycosis is present or not, a potential risk may be the likelihood that chytrid fungus may cause disease in amphibians acquired via Malagasy frog exports in the importing countries, or the likelihood that chytrid fungus may cause disease in Malagasy frogs if introduced through animate or inanimate vectors. The outcome of the amphibian chytrid survey and risk assessment will be integrated to develop recommendations to protect Madagascar's amphibian diversity, which will be made available to Malagasy conservation authorities.

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