



Global Re-introduction Perspectives: 2010

Additional case-studies from around the globe
Edited by Pritpal S. Soorae



IUCN/SSC Re-introduction Specialist Group (RSG)





The designation of geographical entities in this book, and the presentation of the material, do not imply the expression of any opinion whatsoever on the part of IUCN or any of the funding organizations concerning the legal status of any country, territory, or area, or of its authorities, or concerning the delimitation of its frontiers or boundaries.

The views expressed in this publication do not necessarily reflect those of IUCN.

Published by: IUCN/SSC Re-introduction Specialist Group & Environment Agency-ABU DHABI

Copyright: 2010 International Union for the Conservation of Nature and Natural Resources.

Citation: Soorae, P. S. (ed.) (2010) GLOBAL RE-INTRODUCTION PERSPECTIVES: Additional case-studies from around the globe. IUCN/SSC Re-introduction Specialist Group, Abu Dhabi, UAE, xii + 352 pp.

ISBN: 978-2-8317-1320-5

Cover photo: Clockwise starting from top-left:
i. Damselfly, UK © *PC Watts*
ii. Corn crane, UK © *Andy Hay (rspb-images.com)*
iii. Western prairie fringed orchid, USA © *Margaret From*
iv. Arabian oryx, Saudi Arabia © *M. Z. Islam*
v. Corroboree frog, Australia © *D. Hunter*

Cover design & layout by: Pritpal S. Soorae, IUCN/SSC Re-introduction Specialist Group

Produced by: IUCN/SSC Re-introduction Specialist Group & Environment Agency-ABU DHABI

Download document at: www.iucnsscscrg.org

Reclaiming the lost world: Kihansi spray toad re-introduction in Tanzania

Alfan A. Rija¹, Fadhila H. Khatibu² & Kuruthumu A. Mwamende³

¹ - Department of Wildlife Management, Sokoine University of Agriculture, P.O. Box 3073 Morogoro, Tanzania (alfanrija@yahoo.com)

² - National Environment Management Council, P. O. Box 63154, Dar es Salaam, Tanzania (fhemedali@yahoo.com)

³ - Department of Animal Science and Production, Sokoine University of Agriculture, P.O. Box 3004 Morogoro, Tanzania (ummykulthumu@yahoo.com)

Introduction

The Kihansi spray toad (*Nectophrynoides asperginis*) was first discovered in 1996 and listed in CITES App. I, and as critically endangered species endemic to the Kihansi river gorge in Tanzania. Its original population declined following diversion of water for hydropower production resulting in reduced flow of less than 2 m³/s from the initial 16 m³/s thereby causing the toad habitat to desiccate. Despite installing artificial sprinklers to generate sprays for the habitat, in late 2003 the population crashed to less than ten toads from more than 20,000 since its discovery (Lee *et al.*, 2006; Poynton *et al.*, 1999). Now, the species is extinct in the wild. The population and habitat viability assessment done in 2007 cited presence of chytridiomycosis, toxic pesticide chemicals released from dam flushing and pollution from agricultural activities as the probable causes of decline. Species conservation approach has included captive breeding in the USA since 2000 and due to commence shortly in Tanzania, ecological monitoring of the gorge habitat and Kihansi ecosystem restoration. The government of Tanzania has started plans to re-introduce the toad to Kihansi gorge using a captive population of approximately 4,000 toads presently available in the USA.

Goals

- Goal 1: A reasonable number of captive populations established at Bronx and Toledo zoos in the USA.
- Goal 2: Establish fully recovered toad habitat at all three spray wetland meadows in Kihansi gorge through management of the installed artificial spray system and the wetland vegetation.
- Goal 3: Cultivate healthy and substantial local captive population at Dar-es-Salaam and Kihansi to be used for re-introduction into the wild.
- Goal 4: Developing effective biological control for chytridiomycosis that will be used to eradicate the disease in Kihansi gorge and other infested areas.
- Goal 5: Viable and self-sustaining Kihansi toad population reinstated at the gorge and other prescribed suitable areas that are free from diseases and predators.
- Goal 6: Long-term monitoring of the re-introduced population carried out.

Success indicators

- Indicator 1: Control and treatment for chytrid fungus successfully developed.
- Indicator 2: Healthy captive population established and natural habitat restored in Tanzania.
- Indicator 3: Sustainable Kihansi spray toad population established at Kihansi gorge.

Project Summary

The diversion of Kihansi river for hydropower production left approximately 1.5-2 m³/s water as bypass flow through the gorge. The water was insufficient to generate natural mists to maintain a healthy gorge ecosystem, consequently resulted in significant change of the gorge wetland hydrological regime. Gorge ecosystem alteration was evidenced by desiccation and rapid change in composition of the wetland vegetation and lower slope moist forests, from overgrowth of the toad's habitat herbaceous species to invasion of the wetlands by weeds, forest chameleons, lowland anurans and occasionally by safari ants (*Dorylus* sp.) (Lee *et al.*, 2006). This was followed by the toad population decline at Mhalala, Upper Spray Wetland, Lower Spray Wetland and Mid-gorge Wetland habitats. In response to these serious ecological and environmental changes in the gorge, artificial sprinklers were installed at all wetland meadows but Mhalala, to mimic the natural mists originally produced by the rapid falls. To ensure long-term perseverance of the species, about 500 toads were collected from various sites along the gorge and captive breeding was initiated at Bronx and Toledo Zoos in the USA. Captive breeding started in December 2000 by the United Republic of Tanzania (URT) and the Wildlife Conservation society (WCS) with support through the U.S. Fish and Wildlife Service, CITES and TRAFFIC. Initially, the breeding process presented unsurpassed challenges overwhelmed by sudden die-offs due to health and management issues and the population of the globally surviving Kihansi toad was soon reduced to only 37 individuals (Lee *et al.*, 2006). However, improved husbandry practices resulted in an increased population and recent reports from the Lower Kihansi Environmental Management Project (LKEMP), Tanzania which has been overseeing toad conservation show the population has reached 4,000 toads.

Other conservation measures toward sustaining the remaining wild population included, launching various field studies such as assessing diet spectrum of insects fed on by the spray toad, amphibian inventory studies, gorge microclimate



Mating Kihansi spray toads

Amphibians



Installed artificial sprinklers at one of the three spray wetlands toad habitat at Kihansi

© **Alfan A. Rija**

and vegetation, working with policy makers to realize the kind of environmental flows required for the Kihansi gorge (now 2 m³/s water) as prior to 2002, it was not legally recognized in Tanzania, toad screening for chytridiomycosis, construction of bridges and walkways within the toad habitat to reduce trampling damage and long-term ecological monitoring of the gorge by LKEMP. These measures provided invaluable data for the long-term conservation of the species, albeit were not able to sustain the Kihansi spray toad in the wild. In

2006, LKEMP launched a communication strategy to reach a wider Tanzania community to support the Kihansi toad recovery program. To gain more support for conservation by the local communities living around Kihansi catchment, LKEMP has been providing financial support for income generating projects in 21 surrounding community villages within the catchment. The projects could serve as alternative sources of cash income, thus help minimize serious negative environmental impacts emanating from human economic activities such as, valley and stream-side cultivation and use of pesticides such as endosulfan which is toxic to amphibians.

With the recovering habitat at Kihansi and the recent increase in captive population, the government of Tanzania is planning to re-introduce the toad back to the gorge. Essentially, the re-introduction program consists of four tentative stages; Pre-reintroduction phase. Main activities include, establishing possible causes of Kihansi toad crash, identifying strains and pathogenicity of chytrid fungus in Kihansi gorge, developing biological control measures for the fungus, investigating whether pesticide residues from the Kihansi dam caused population decline and determining the abundance of the toad's food habits at Kihansi. Other activities include designing pre and post release monitoring protocols as per the IUCN guidelines and selecting a task force to guide and monitor the re-introduction. Establishment of the local breeding colonies in Tanzania. Two captive breeding houses one at University of Dar-es-Salaam (already constructed) and Kihansi (not yet) will be furnished to further breed translocated Kihansi toads from the USA zoos. Capacity has been built for university technicians on husbandry practices for the toads, their feeding habits and habitat structure. Technicians have begun identifying and culturing feeder insects at the established breeding facility. Ongoing studies include, screening various amphibian species to determine chytrid fungus and other pathogens including

rana viruses, survey of toad and frogs species at University of Dar-es-Salaam for histopathology studies against pathogens and testing for vegetation and diet requirements of the Kihansi spray toad.

Pre-release activities: Encompass construction of breeding house at Kihansi, translocating toads from Dar-es-Salaam to Kihansi facility for further breeding, developing monitoring indicators for soft release, site selection for soft release and final release to the wild. Long-term monitoring of the released population and the habitat. On a tentative schedule it is expected that soft releases will be done by December 2010.

Major difficulties faced

- Establishing solid re-introduction baseline data: Although there is substantial information on the habitat, food habits, and the biology of the spray toad than of any other amphibian species in Africa (D.W. Newmark, pers. comm. September 2009), important information pertinent to re-introduction is still lacking. Data are required on the suitability of potential release sites in relation to environmental variables, levels at which threats have been eliminated, nutrient dynamics in relation to habitat invasion by weeds, microclimate (temperature and relative humidity) effects on the emergence and severity of chytrid fungus, and on the best time and optimal temperature conditions to release the toads at the gorge. Such information if available would be useful for increasing chances of re-introduction success.
- Inadequate accounts of the causes of initial population decline and collapse: To date only chytrid fungus has been confirmed as the cause of population collapse. However, what caused the emergence of this disease has not been established. Ongoing studies include molecular characterization of the fungus species to determine its origin.
- Dam flushing: The impounded river dam gets flushed as part of routine maintenance work for the dam. While still investigated, this is a potential serious source of toxic substance that needs serious attention during the species re-introduction. Water and sediment samples that were collected during dam flushing in March 2009 indicated low levels of endosulfan present at the gorge. Further studies will be carried out to determine the lethal levels for amphibians, paying particular attention to the Kihansi spray toad.
- Anthropogenic issues: Despite the LKEMP investing in community development initiatives and environmental awareness, little has been appreciated by the locals. There have been serious environmental threats going on such as relentless wild fires, poaching, deforestation, stream-side and valley cultivation and use of toxic pesticides by the local communities, thereby increasing risks of damage to the gorge habitat. Although efforts have been increased to address the threats, they remain potentially critical to the survival of the re-introduced toad population.
- Healthy captive population in Tanzania: Final release of the toad to the gorge will probably depend on successfully bred colonies in Dar-es-Salaam and Kihansi. While managers are aware of the difficulty of establishing healthy colonies in Tanzania, there are also issues of longevity in captivity which may reduce species fitness to survive in the wild (McPhee, 2003). Research

(Kraaijeveld-Smith *et al.*, 2006) shows that long life in captivity up to eight generations may not reduce fitness traits. However, the recently bred colony of the Kihansi toad counts to eighth generation in captivity with perhaps more generations in Tanzania. Research is needed to test the ability of the spray toad on self defense against predators, on foraging ability and to changes in environmental conditions such as temperature and light to ascertain whether important traits are still retained by the toads in zoos.

- Harmonizing with the socio and political atmosphere to support the toad recovery program: Since commissioning of the Kihansi spray toad captive breeding in the USA, the toad conservation program has been ill-perceived with increasing comments from the press, some government officials, and the public being persistently negative largely due to its financial implications to a poor Tanzania nation (LKEMP, 2004). However, increased awareness raising by LKEMP to the public will probably help strengthen support for conservation of the spray toad.
- Inadequate funding for re-introduction program: Since its onset, toad conservation has been possible through financial support from the World Bank as part of the mitigation measures for negative environmental impacts emanating from the hydropower generation. Funding support will cease by December 2010 and all matters will be locally financed by the Tanzania government. In a poor country, the availability of internal funds is still a potential setback and a defining factor for successful implementation of the recovery program. There have been strategies to mainstream toad conservation activities into various government sectors in order to ease fund contributions from the sectors. However, the effectiveness of the mainstreaming strategy remains equivocal.

Major lessons learned

- Cultivating healthy captive colonies is a daunting undertaking that requires competent expertise as well as managerial and financial commitments. Experience acquired at Bronx and Toledo zoos will be useful for enhancing captive breeding in Tanzania.
- All threats caused initial population decline have not be completely and fully detected and addressed. Research is still required to effectively address and eliminate these threats.
- More socio-economic and political awareness at local and national level is still needed to gain support for successful recovery of the Kihansi spray toad.
- More data pertinent to re-introduction process are still needed to guide the recovery program. In the event of chytridiomycosis perseverance at the gorge, other options such as benign introduction will be explored as appropriately needed.
- A multidisciplinary team of both local and international experts is required for the Kihansi spray toad recovery program.

Success of project

Highly Successful	Successful	Partially Successful	Failure
		√	

Reason(s) for success/failure:

- The Kihansi spray toad population in captivity (Bronx and Toledo zoos, USA) has increased significantly reaching 4,000 toads recently.
- The natural habitats at Upper, Lower and Mid-gorge spray wetlands at Kihansi are recovering due to the artificial spray generated by the installed artificial sprinklers.
- Discovering of chytridiomycosis as the cause for population collapse has led to the ongoing research to develop its control treatment.
- Recovery program still at its infant stage with more research data still needed to guide the whole re-introduction process.

References

Kraaijeveld-Smith, F. J. L., Griffiths, R. A. & Moore, R. D. 2006. Captive breeding and the fitness of reintroduced species: a test of the responses to predators in a threatened amphibian. *Journal of Applied Ecology*, 43: 360-365.

Lee, S., Zippel, K., Ramos, L. & Searle, J. 2006. Captive-breeding program of the Kihansi spray toad (*Nectophrynoides asperginis*) at the Wildlife Conservation Society, Bronx, New York. *Int. Zoo Yb*, 40, 241-253.

LKEMP. 2004. Lower Kihansi Hydropower project: immediate rescue and emergency measures. Final Specialist report: amphibian studies: report produced for Tanzania Electric Supply Company Ltd (TANESCO), Dar-es-Salaam, Tanzania.

McPhee, M. E. 2003. Generations in captivity increases behavioral variance: considerations for captive breeding and reintroduction programs. *Biological Conservation*, 115, 71-77.

Poynton, J. C., Howell, K. M., Clarke, B. T. & Lovett, J. C. 1999. A critically endangered new species of *Nectophrynoides* (Anura:Bufonidae) from the Kihansi Gorge, Udzungwa Mountains, Tanzania. *African Journal of Herpetology*, 47, 59-67.