Kihansi Spray Toad Re-introduction Guidelines

CONSERVATION BREEDING SPECIALIST GROUP

TAWIRI Tanzania Wildlife Research Institute

RSG

WILDLIFE CONSERVATION SOCIETY

TOLEDO ZOO

GLOBAL WILDLIFE CONSERVATION

ASG IUCN/SSC Amphibian Specialist Group

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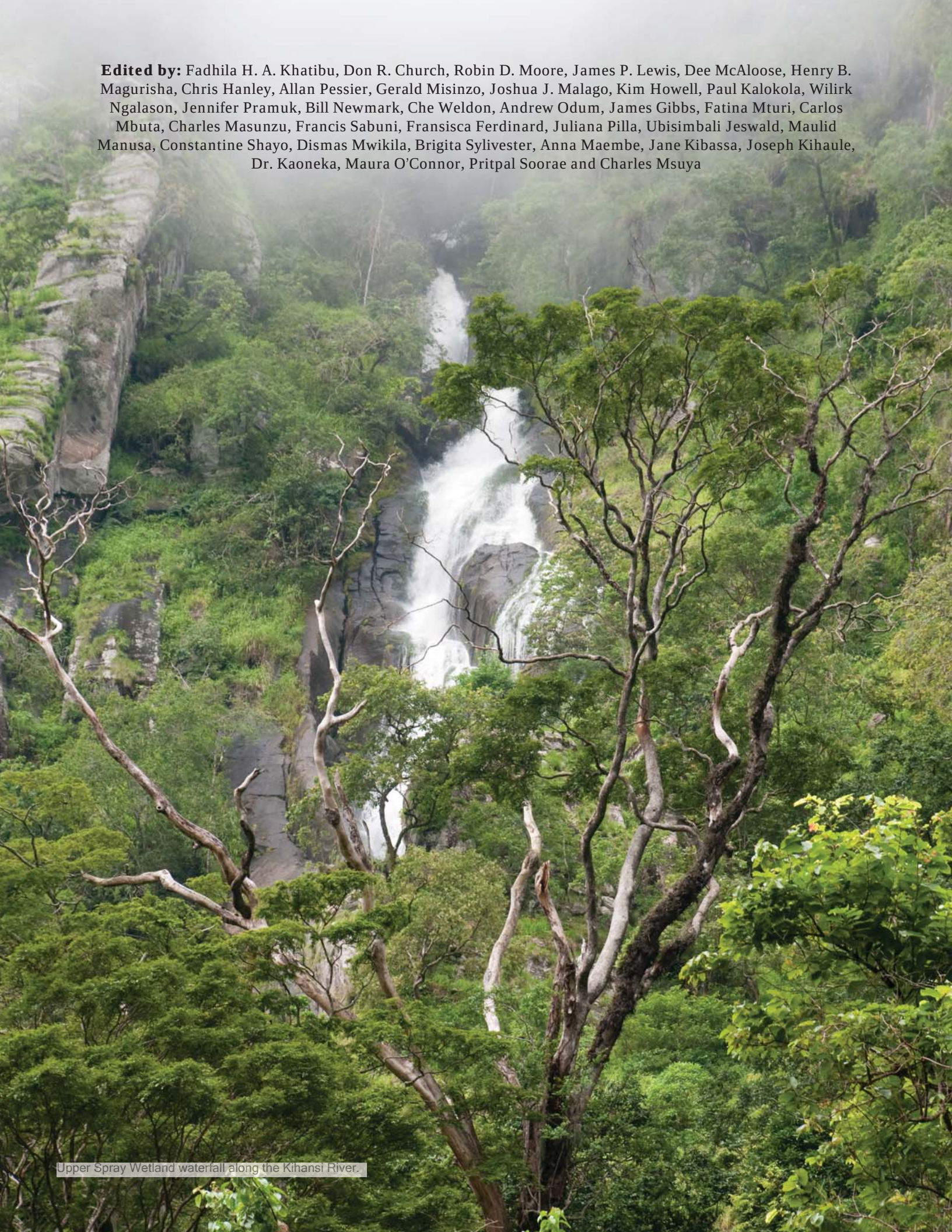

Upper Spray Wetland waterfall along the Kihansi River.

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BACKGROUND

The Kihansi Spray Toad (KST), *Nectophrynoides asperginis*, is endemic to 2.0 hectares of spray zone in the Kihansi Gorge of south-central Tanzania. The toad was believed to be extirpated from the area in 2003 and was declared Extinct in the Wild by the IUCN in October 2009. The species' rapid decline followed dam construction from 1996–2000 and coincided with the emergence of the amphibian chytrid fungus in the population and the flushing of sediments into the gorge in June 2003.

Lower Spray Wetland, spray irrigation system, and the Mhalala bridge over the Kihansi River. (credit: William Newmark)

In November 2000, at the invitation of the Tanzanian Government, 499 toads were collected and transferred to the Bronx Zoo to initiate a captive breeding program. The captive population has experienced periodic husbandry and health challenges, but currently over 6,000 toads are housed by Bronx and Toledo Zoos.

A Population and Habitat Viability Assessment (PHVA) workshop held in Bagamoyo Tanzania from 14–17 May 2007 brought together a diverse range of stakeholders and experts to produce guidance on how KST management challenges could be handled by way of developing a KST recovery plan. This PHVA remains highly relevant and forms the backbone of this re-introduction plan. One of the primary challenges addressed during the 2007 PHVA meeting was increasing the size of the captive population, which has suffered several crashes and was, at the time, the same size as when it was founded. Since this meeting, the captive population has grown, providing a large enough stock maintained in biosecure facilities to return approximately 4,000 animals to Tanzania annually.

This document is designed to guide the re-introduction of KST to the Kihansi Gorge. The guidelines provided herein are a product of the Kihansi Spray Toad Re-introduction Workshop that was held in Dar es Salaam during three days in February 2010. The workshop was facilitated by Cuthbert Nahonyo from the University of Dar es Salaam and attended by over 76 people. Several Tanzanian governmental and nongovernmental entities were represented including the Lower Kihansi Environment Management Project (LKEMP) and other programs within the National Environment Management Council (NEMC), Tanzania Wildlife Research Institute (TAWIRI), Division of Wildlife, TANESCO, University of Dar es Salaam, and Sokoine University. International participants included representatives from WCS-Bronx Zoo, Toledo Zoo, San Diego Zoo, Amphibian Ark, Museo Tridentino di Scienze Naturali, North-West University, IUCN/SSC Re-introduction Specialist Group, IUCN/SSC Amphibian Specialist Group, State University of New York, USGS Patuxent Wildlife Research Center, and the World Bank (see Appendix 1 for a complete list of participants).

The first day of the re-introduction workshop focused on presentations that summarized research findings and status of conservation work since the PHVA meeting in 2007. Topics covered included vegetation changes in the gorge, status of captive populations, contaminant levels in the gorge, probiotic research underway in Tanzania, histopathology research in

Tanzania, review of global amphibian disease research, hydrology of the gorge, invertebrates in the gorge, and risk mitigation for the shipment of toads to Dar breeding facility. The deliberations of the first day of the workshop are presented in Volume I of the proceedings.

On the second day, participants split into working groups to discuss what work is needed in the areas of captive population management in Tanzania, pathology screening of KST to minimize risks of introducing harmful pathogens into the gorge, experimental re-introductions (aka soft releases) and the longer term initiative to reestablish a population in the gorge, ecological monitoring of the gorge habitat, and the coordinated administration within and among relevant agencies of the Tanzanian government (particularly NEMC), and social dimensions of the project (national and international press communications, and local education and engagement with the Kihansi area community).

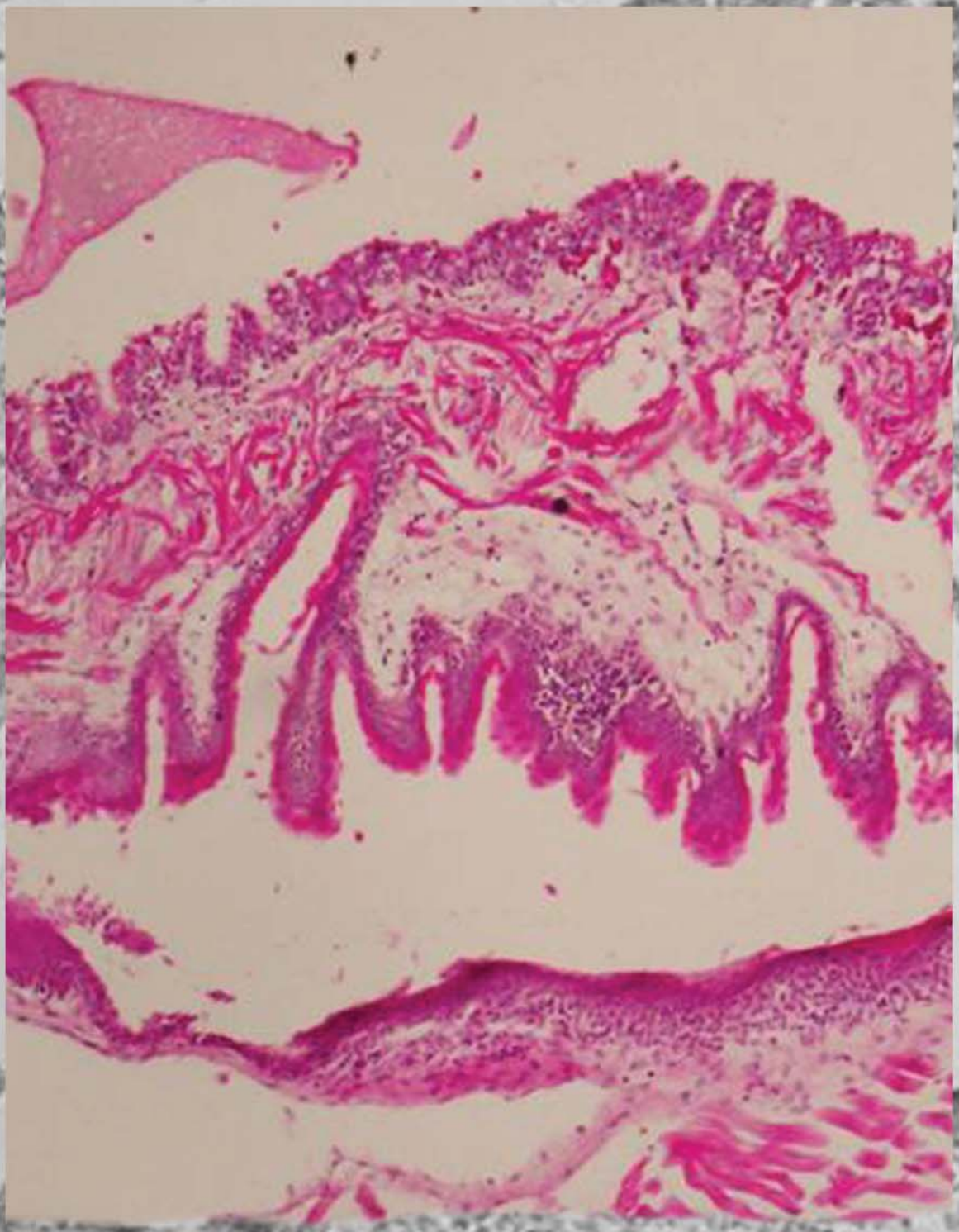
Working groups presented summaries of the key needs and actions within their areas on the third day of the workshop, and opened each topic up for broader review and discussion by all participants. Finally, a timeline was presented that organized the initiation dates for major actions that were determined over the course of the workshop.

KIHANSI SPRAY TOAD RE-INTRODUCTION GUIDELINES

The goals of the KST re-introduction program are to establish a viable, free-ranging population of the KST within the Kihansi Gorge, together with protection and restoration of habitat components critical to the survival of KST populations in the gorge.

The re-introduction requires a multidisciplinary approach involving a team of persons drawn from a variety of backgrounds with appropriate expertise. Team leaders are responsible for coordination between the various bodies and provision has been made for publicity and public education about the project. Above all, it is recommended that the re-introduction be adaptively managed, thereby learning from successes and failures as the release program proceeds.

Thematic Area 1
Diseases and Pathology



KST tongue with squamous metaplasia. Credit: Joshua Malago

DISEASES AND PATHOLOGY

Working Group participants: D. McAloose (chair), Henry B. Magurisha, Chris Hanley, Allan Pessier, Gerald Misinzo and Joshua J. Malago.

Three main categories of activities for disease and pathology research and screening were focused on, including captive assurance population, re-introduction, and re-establishment. Specific topics: diseases to screen for, existing diagnostic capabilities/capacity, needs for diagnostic capabilities/capacity, time frame, and budget. Establish captive assurance population at University Dar es Salaam: pre-shipment health/disease screening; quarantine and post-shipment health/disease screening (incoming and ongoing).

Health and Disease Screening: Captive Assurance Colonies and Pre-Re-Introduction Activities

Challenge: To return KST to Tanzania without introducing novel pathogens from the United States.

Activity 1

Complete retrospective assessment of necropsy and histopathology data from captive US KST population.

Output: Review to be completed by DM. Summary of results of 867 necropsy submissions in which 556 animals were suitable for histologic review is listed below.

Chytrid: Single outbreak noted in Bronx collection in 2007. No subsequent outbreaks, individual cases, or PCR positive animals since that time.

Ranavirus: No histologic findings suggestive of ranaviral disease in captive population.

Enteric Parasites: Sporadic presence of enteric nematodes (strongyloides-like) in both wild and captive populations.

Respiratory Parasites: Animals came into the US with Rhabdias (lungworm) present. No recent necropsy evidence of parasite (since March 2002).

Intravascular Ciliates: Intermittent presence of intravascular ciliates in TolZ collection. Presence appears to correlate with population density.

Other infectious diseases: Other diseases, such as rickettsia and mycobacteriosis, have been present in only a few cases and likely not significant.

Time frame: Completed.

Organization structure and information management: Results discussed between veterinary advisors of KST program at workshop: D. McAloose, Henry B. Magurisha, Chris Hanley, Allan Pessier, Gerald Misinzo and Joshua J. Malago.

Activity 2

Complete screen of captive US population for pathogens of specific concern for permit process.

Output: Screening to be completed by AP, DM, and CH. Summary of results to date and plans for additional testing below.

Chytrid: Extensive screening by taqman PCR negative (Boyle technique) and no cases documented on histology other than single outbreak (see Activity One). Based on these findings, the captive US population is considered to be free of the Chytrid fungus.

Ranavirus: Does occur sporadically in US zoos, but neither Bronx nor TolZ have had cases in their amphibian collections, let alone in the KSTs. But with exposure to rest of collection, it is THEORETICALLY possible the KSTs were exposed at some point or even came from TZ with it.

Screening to date: No suspicious lesions have been noted in any of over 556 full necropsies (see Activity One). Targeted surveillance of organs collected at necropsy by PCR have revealed a small number of tests that were questionably positive on initial tests (2/11 animals at Bronx without DNA sequencing) but were negative on subsequent testing in a different laboratory. Twenty-five animals from TolZ (healthy animals culled for disease surveillance) were recently tested and all negative by Taqman PCR (San Diego Zoo lab).

Additional testing planned: Run Taqman PCR on banked (frozen) 40 to 70 randomly selected samples from Bronx and possibly some from TolZ. Run Taqman PCR on another diagnostic cull from TolZ.

Enteric parasites: A strongyloides-like nematode is present in the captive collection, that may have been acquired in captivity or been present in the wild population.

Additional work planned: DM to review historical parasitology results from Cornell University at the time KST came into captivity. This will help to determine origin of the parasite (captive vs wild). Collect appropriate samples from TolZ diagnostic cull (same as above) to aid in specific identification of the enteric nematode currently present in the captive population.

Intravascular ciliates: This appears to be a free-living organism that can cause opportunistic disease. It was first identified in October 2003 and has been sporadically diagnosed via histology in captive KSTs (49 necropsy cases) since that time. Appears to be a density-dependent problem and has only been seen in a small number of KST in the TolZ population.

Additional work planned: CH to review cases in order to assess if organism limited to some tanks or is widespread in collection. Toads may come back to TZ with the intravascular ciliates present. However, the persistence in KST and the potential significance of this organism in other species are unknown. Will continue to monitor the organism, especially during the challenge experiments.

Additional discussion points:

JM – Discussion about keeping low levels of parasites to avoid loss of immunity.

AP – May be helpful to maintain a low level of parasites endemic to the site of release.

DM – Only about 30/500 cases show enteritis (reactions to parasitism).

Discussion about likelihood of parasitism (nematodiasis) being animal density dependent. Nematodiasis, coccidiosis (seen very rarely in captive animals), and other parasites may be less of a concern in the wild due to more space and ability to move.

Time frame: Complete disease screening process for permit by April 30th.

Organization structure and information management: Results to date discussed between veterinary advisors of KST program at workshop. D. McAloose, Henry B. Magurisha, Chris Hanley, Allan Pessier, Gerald Misinzo, Joshua J. Malago.

Future results to be summarized for permit.

Activity 3

Review and revise existing protocols for identification and treatment of chytrid, enteric parasites, and intravascular ciliates and necropsy protocol for use in the Tanzanian KST program. Protocols will be based on existing protocols used in the US KST program (McAloose, Hanley), protocols outlined in the amphibian disease control manual (Pessier AP & Mendelson JR. 2010. A manual for control of infectious diseases in amphibian survival assurance colonies and reintroduction programs.

Version 1.0 Captive Breeding Specialist Group) and research protocols developed by Sokoine University of Agriculture (Misinzo G & Malago J 2009. A survey of infectious amphibian diseases affecting free-ranging amphibians inhabiting Kihansi gorge and University of Dar es Salaam compound). Additionally, create protocol for sample transfer to SUA.

Output: KST veterinary advisory group to assign tasks within group.

Time frame: Protocols in place by June 30th.

Organization structure and information management: Protocols to be distributed to facilities housing captive assurance populations of KST and those doing diagnostic work.

Activity 4

Cross training of Pathology and Microbiology/Molecular diagnostics experts prior to and in preparation for return of KSTs to Tanzania.

Output: Discussion among veterinary advisors to KST workshop. Discussed travel of JM to US (WCS and San Diego Zoo) and GM to US (San Diego Zoo) and South Africa (Northwest University). Discussed purpose of cross training, length of stay, and what to study.

For JM, training will be intensive and focused to enhance existing histopathology knowledge and develop specialized expertise in amphibian histopathology with an emphasis on normal histology and amphibian diseases and gross necropsy of the KST and other amphibians. One month of training will be split into two-week blocks with two weeks each at the WCS and ZSSD. Initial training in basic normal amphibian histology and diseases will occur at SDZ to be followed by KST focused and additional amphibian disease training at WCS. Training will include accessing existing digital catalog of images/baseline and acquiring amphibian pathology related references.

Dr. Chris Hanley, Toledo zoo veterinarian, instructing University of Dar es Salaam captive breeding technicians.

For GM, intensive training will focus on enhancing existing knowledge in chytrid culture and polymerase chain reaction (PCR). 1 week of training at the North-West University in South Africa with Che Weldon in both activities (chytrid culture and conventional PCR) will be the priority; an additional 1 week of training at SDZ (real time-PCR) is also recommended. Training will include discussion and provision of positive controls and quality control protocols to supplement existing SUA protocols for chytrid culture and PCR

The veterinary advisory group strongly recommends that all cross-training be prioritized and occur prior to KST return to TZ.

Time frame: Initial cross training to be completed by May 30, 2010. Diagnostic support and collaboration between US and TZ experts to be ongoing through 7 month and 5 year time frames.

Organization structure and information management: Travel arrangements for initial cross training to be completed between essential participants for each cross training trip (DM and AP with JM; CW and AP with GM).

Activity 5

Provision of ante and post-mortem health assessment and disease

Output: Diagnostics and therapeutics in captive assurance colonies.

Time frame: Diagnostic support is ongoing indefinitely.

Organization structure and information management: Sokoine University of Agriculture with technical back-stopping from US zoos will provide disease diagnostics and therapeutics for the captive assurance colonies in Tanzania and U.S. zoos will be responsible for the captive assurance colonies that they hold.

University of Dar es Salaam and Toledo Zoo technicians censusing the captive Kihansi Spray Toad population at the Toledo zoo.

Activity 6

Develop and perform experiments that expose amphibian species currently present in the Kihansi Gorge to captive-reared KST and/or substrates that have been exposed to captive-reared KST.

The KST population has previously been exposed to the cosmopolitan amphibian collections at the US institutions. This increases the risk that the captive KST may introduce a novel pathogen into the Kihansi Gorge. Therefore, before reintroduction ("into the wild") can occur, disease transmission experiments MUST be undertaken. This should be done early in the process to avoid holding up reintroduction process if a problem was identified.

Because of the need in performing these experiments in a narrow time frame, they may need to be carried out at the biosecure facility at the University of Dar es Salaam. Regardless of location, these experiments should be started when the captive TZ KST population is stable.

Logistics of experiments: husbandry and care of other gorge species, space requirements, ability to house multiple species together, and numbers needed and that can be acquired

Output: A general outline of the suggested experiments is provided below. The final experimental design will be determined once additional information has been gathered.

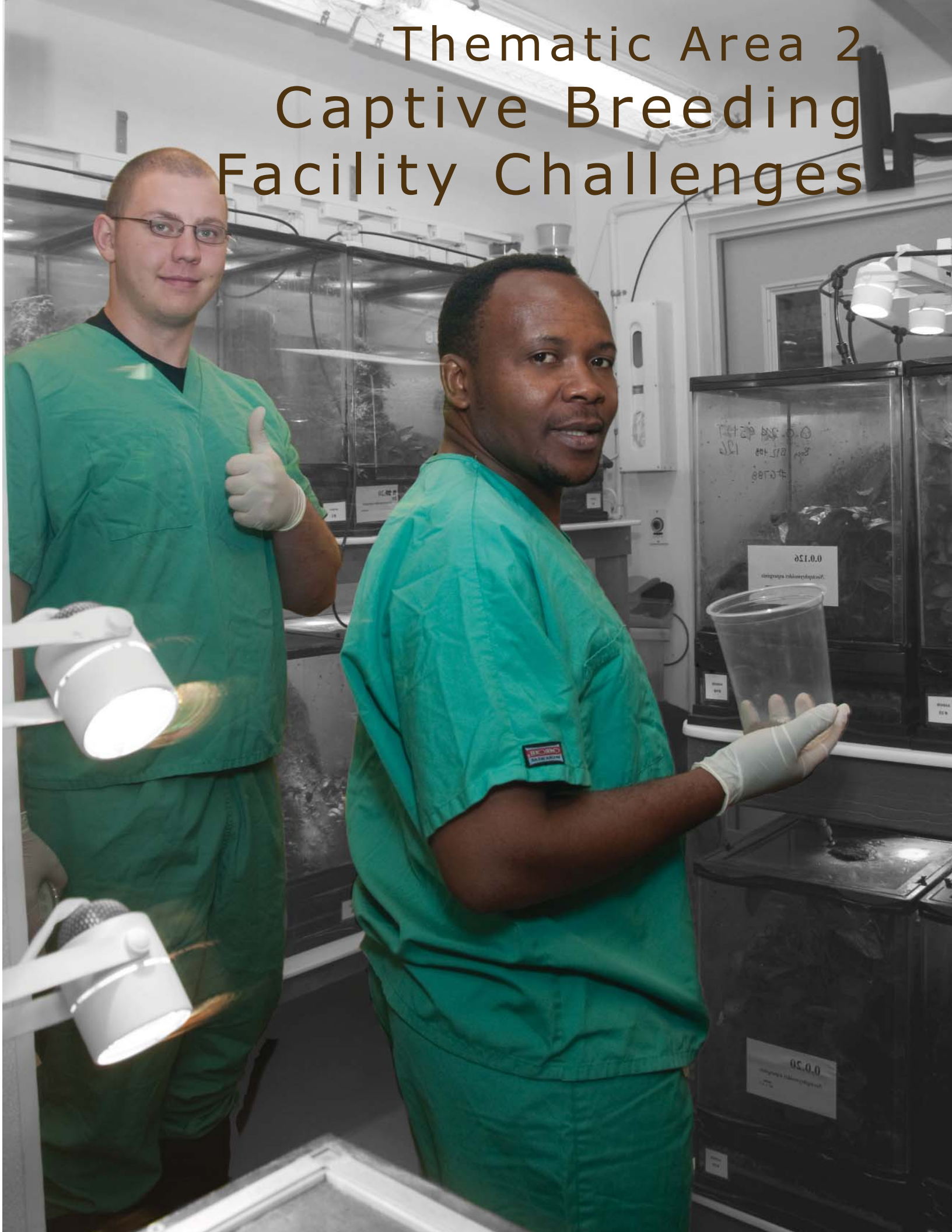
- Experiments should be carried out using multiple different amphibian species from the Kihansi Gorge if possible. This is because different species may vary in susceptibility to different potential pathogens.
- It needs to be determined if exposure of Gorge amphibians will occur by direct housing with captive-reared KST (direct exposure) or if Gorge amphibians will be exposed to substrates previously used in KST enclosures (indirect exposure). Other Gorge amphibians do not usually inhabit spray zones and therefore may not tolerate husbandry conditions used to maintain KST. A final decision will be made in consultation with amphibian husbandry experts.
- Experiments will require appropriate controls. At a minimum, suggested enclosure arrangements include: 1) Enclosure with Gorge amphibians not exposed to captive-reared KST or substrates exposed to captive KST; 2) Enclosure with Gorge amphibians exposed to captive-reared KST or substrates exposed to captive KST. As noted in # 1, multiple concurrent experiments may be performed using different amphibian species from the Kihansi Gorge. The number of animals used in the exposure experiments will be determined by availability of gorge amphibian species, facility space and by consultation with an epidemiologist.
- If substrate experiments are performed: Enclosure(s) of current gorge amphibians and enclosure(s) of KST are established and maintained for 3-4 weeks. At the end of this time period substrates from the KST enclosure are moved to enclosures containing gorge amphibians. Substrates from the gorge amphibians could also be introduced to the KST enclosures to evaluate any potential for pathogens present in gorge amphibians to affect reintroduced KST.
- Both direct and indirect (substrate exposure) experiments should be conducted for a minimum of 60-90 days or until all animals have died. Animals still living after the end of the experimental period will be euthanized.
- Necropsies will be performed on all animals from both exposed and control groups that die during the course of the experiment or that are euthanized at the end of the experimental period. Necropsies will include histopathology and collection of tissues for use in ancillary diagnostic tests (e.g. PCR or virus isolation). Comparisons of mortality, histologic findings and ancillary diagnostic findings between control and exposed groups of animals will be performed to assess risk of introducing a novel pathogen to the Kihansi gorge.
- Consideration may be given to performing experiments that place gorge amphibians under "stress" (e.g. overcrowding; suboptimal temperature) in order to maximize the possibility that infectious diseases will be expressed.

Consider experiment repeated at Kihansi facility using gorge water and native substrate (or transfer native substates from Kihansi Gorge to the Dar facility) to assess ability of KST to survive after release.

Timeframe: Ideally, experiment can be started within 2-3 months after assurance population stabilizes IF experiments are done at Dar facility. If timeline for reintroduction changes, then may have to run before population stabilizes, as these experiments MUST be done before reintroductions.

Organization structure and information management: North-West University (C. Weldon), University of Dar es Salaam (C. Msuya) and Sokoine University of Agriculture (G. Misinzo, J. Malago) will collaborate in conducting this experiment.

Thematic Area 2
Captive Breeding Facility Challenges



Captive Breeding Facility Challenges

Working Group participants:Kim Howell (Chair), Paul Kalokola, Wilirk Ngalason, Jennifer Pramuk.

Challenges Identified

- *Staffing and administration*
- *Fully equipped and functional KST facility*
- *Regular supply of food insects*
- *Development of protocols*
- *Funding*
- *Employee retention*
- *Surplus captive KST in U.S.*
- *Surplus captive KST in Tanzania*

1. Staffing and Administration

Goals:

- Three dedicated KST technicians per facility.
- Two interns/volunteers to assist KST technicians and train future recruits.
- Facility Administrator for staff to report to, manage major finances, assist with major operations.
- AZA training through Amphibian course in Toledo for all technicians
- Identify and develop scholarship opportunities.

Outputs: Trained staff and a well-managed facility with no gaps in operation

Timeframe: Staff in place before arrival of KST

Responsible Parties: UDSM, Wildlife Division, NEMC

2. Fully equipped and functional KST facility

Equipment/Action Needed:

- Connect and test backup generator
- Power loss alarm
- Visible temp readout in windows
- HACH Water quality testing equipment
- Computer with internet access and a digital camera for sending photos of problem animals, etc. for remote diagnosis if necessary.
- Infrared temperature guns
- HOBO data loggers
- Dissecting scope (and equipment for fecal analysis).
- Shade awning for front window
- KST photo and informational graphics
- English and Swahili
- Fire extinguisher
- Servicing and maintenance of equipment
- Consistent supply of consumables such as gloves and scrubs, insect food, vitamins, disinfectants, etc. for Dar facility.
- Refrigerator to slow activity of fruit flies prior to feeding out

Outputs: Facility ready to successfully house KST

Timeframe: In place before KST arrival

Responsible Parties: UDSM, NEMC

3. Regular supply of food insects

Primary Goals:

- Increase cricket and Collembola production
- Improve cricket nutrition
  - Chick feed
  - Leafy greens
  - Carrots and sweet potatoes
- Secondary (backup) insect cultures in a separate relatively biosecure space.

Secondary Goals:

- Flightless Drosophila
- Taxonomic identification of feeder insect species

Outputs: Thriving KST in Tanzania

Timeframe: Primary goals ASAP and secondary goals 1 to 6 months

Responsible Parties: UDSM, NEMC, Ezekiel Goboro and other KST technicians

4. Development of Protocols

Goal:

Develop and implement protocols for:

- Biosecurity
- Daily Operations
- Daily Report for documenting/communicating
- Emergencies
- Fire, Theft, Loss of Water/Electricity, A/C failure, Disease outbreak, etc.
- Is insurance available?
- Sample daily report on subsequent page:
- Outputs: Hard and digital copies of all protocols in place at facility and available for dissemination (updated as needed)

Timeframe:

Biosecurity: rough draft completed before end of workshop

Emergencies: 1–3 months

Daily operations manual and daily report form developed as facility comes online

Responsible Parties: UDSM Department of Zoology in collaboration with workshop participants

5. Funding

Goal:

Identify funding sources for:

- Facility support after World Bank funding ends
- Consumable/Disposable supplies
- Accessible cash (petty cash?) for minor and immediate facility expenditures

Outputs: Discussion at workshop about funding to support facility operations and salaries

Timeframe: Preliminary discussions before end of workshop and ongoing

Responsible Parties: UDSM Department of Zoology in collaboration with workshop participants

Outputs: Discussion

Timeframe: decisions and actions required ASAP/Urgent

6. Employee Retention

Goals:

- Professional Development Workshops
- Training
- Travel
- Raises
- Other incentives?

Outputs: Content employees, limited staff turnover resulting in stable operations and affordable training costs

Timeframe: Ongoing

Responsible Parties: UDSM, Wildlife Division, NEMC

7. Surplus US KST

Surplus KST in U.S. are a major, immediate, and ongoing problem

Options:

- Additional U.S. facilities
- Experimental testing (pesticides, Bd, etc.)
- Euthanasia
- Transfer to Tanzanian Facilities
- Hard/Soft Release

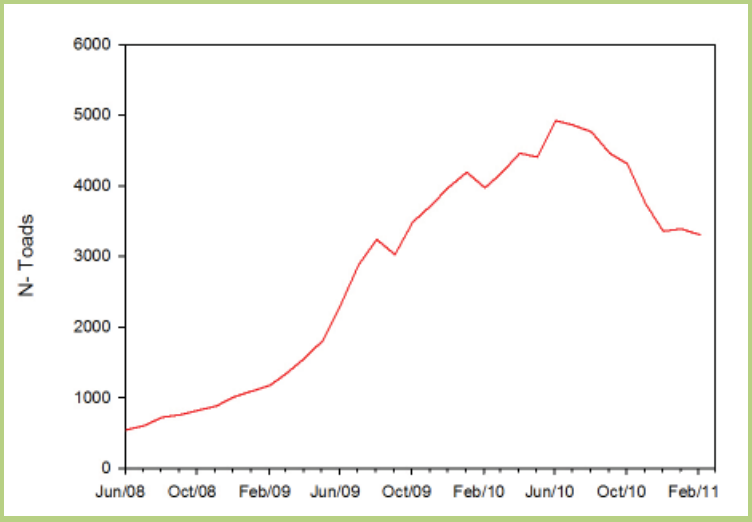
Success at UDSM facility will eventually produce a surplus of KST.

What will be done with surplus prior to release?

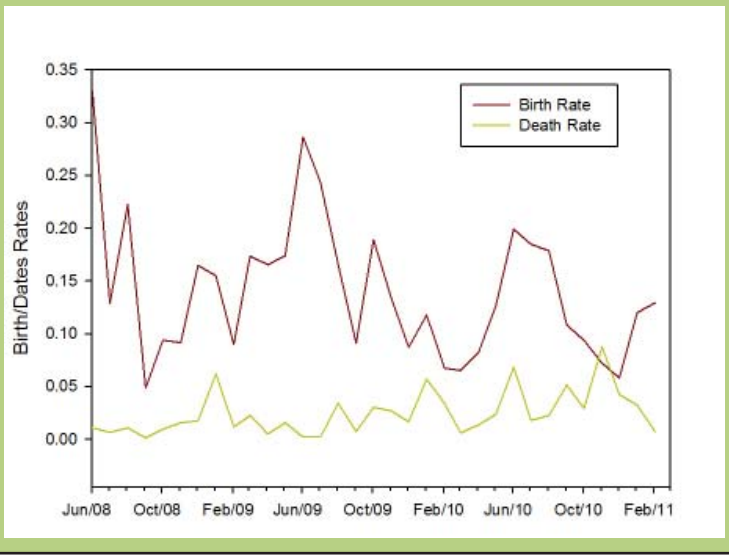
Following release, what will be done if carrying capacity is reached?

Responsible Parties: Wildlife Division as owners of KST, U.S. Zoos to carry out actions

Toledo KST Census Data



Nectophrynoides Birth/Death Rate



Thematic Area 3
Re-introduction Experiments

Mhalala Spray Wetland is the proposed site for the hard release. (credit: William Newmark)

Re-introduction Experiments

Working Group: Don Church (Chair), Bill Newmark, Che Weldon, Andrew Odum, Robin Moore, James Gibbs, Fatina Mturi, Carlos Mbuta and Pritpal Soorae.

Preliminary comments

- Different position today (February 2010) than 3 years ago (2007 PHVA).
- Largest captive population of an 'Extinct in the Wild' amphibian species in the World.
- Capacity to think boldly, and to try things that other recovery programmes cannot.
- Fast-tracking the reintroduction will make the project more sellable in Tanzania and relieve issues of overcrowding in zoos.

Preliminary Actions for Re-introduction
Ensure husbandry needs are met

- Bring other species from the gorge into captivity immediately for challenge experiments (see Disease and Pathology section).
- Also important to provide valuable husbandry experience.
- Allow for habituation (at least one month) prior to next steps, to minimize chance of stress responses complicating results of challenge experiments.
- Challenges: meeting husbandry needs of different genera of amphibians.

Phase 1 of Re-introduction: Challenge Experiments (see Disease and Pathology for design details)

- Following one-month habituation of KST's in Dar, test the potential for diseases transmittable from the KST to other gorge species.
- This is a "threshold" activity: other steps cannot proceed until we are satisfied that the risk of transmission to native species is minimal
- Timeframe: 6 weeks
- Substrate experiments suggested. Experimental design to be developed by pathologists and scientists.
- Challenges: adequate space, and time.
- Proceed to phase 2 only if no transmittable disease is identified
- If a transmittable disease is found, mitigate and repeat phase 1 experiments

Phase 2 of Re-introduction: Soft Release Experiments

- Objective: determine whether KST will persist in the gorge
- Start as soon as confidence that KST's will not transmit anything to native species
- Parallel approach with conservative and bold science
- Design experiments so we can "learn" a good management strategy
- Determine optimal time of year when animals are likely to be in best condition and food supply is most abundant (probably known based on previous field observations)
- Pre-experiments to be conducted in captivity include design of open topped KST proof enclosure and "sampling posts" to increase detection probability when surveying for toads in enclosures
- Locate pens logically within vegetation plots so that influence of vegetation structure on toad survival can be learned
- Release toads into 1 m^2 pens at 4 different densities: 5 , 10 , 15 and 20 toads / m^2
- Swab toads immediately prior to release and weekly thereafter. Use qPCR to relate incidence of Batrachochytrium dendrobatidis (Bd) to mortality.
- Monitor pens at consistent times, 3 times daily if possible (challenge: foot traffic.)
- Wear mud boots that are kept in gorge.
- On a weekly basis, search vegetation to locate toads within 0.25 m^2 ring.
- Search for dead specimens, collect bacterial cultures and preserve on the spot.
- After 30 days, capture all toads, measure body condition index and assess success of experiment.
- If toads survive (high survival), proceed to Phase 4.
- If toads do not survive, proceed to Phase 3.

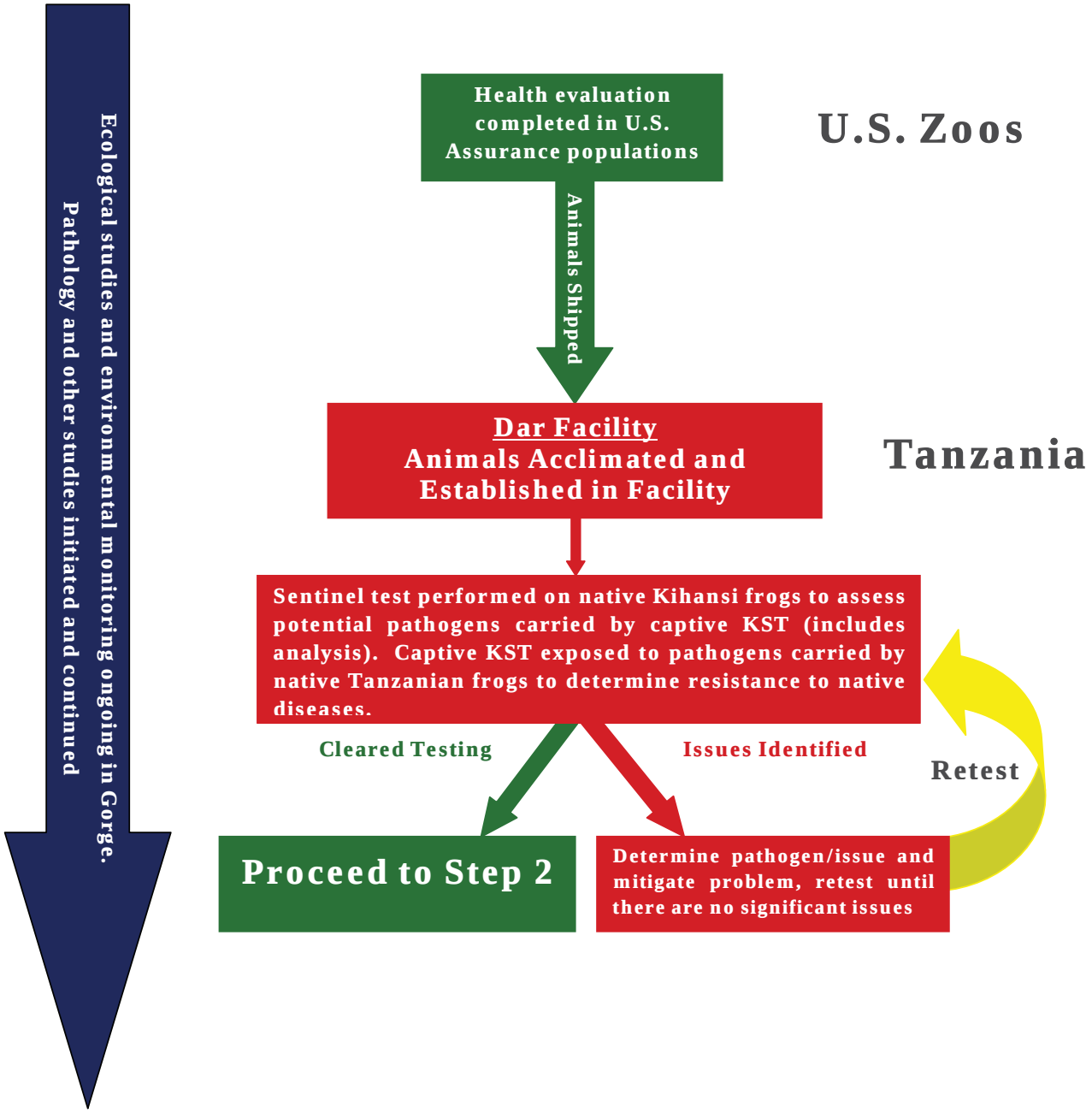
Phase 3 of Re-introduction: Exploring Chytridiomycosis Mortality Hypothesis

- Put more toads into a pen at high density, and collect live animals weekly for full histopathology.
- Determines TIMELINE of mortality and HOW they died.
- Additionally swab for qPCR to quantify the load and intensity of disease.
- Conduct experiments to try and mitigate disease in situ, with a simplified cage design that allows animals to be collected and treated with fungicide. Compare with control.
- If toads survive with treatment, explore in situ disease mitigation options (eg, probiotics, long-term and large-scale release program to "select" for resistance). If they die; explore potential stressors such as contaminants.

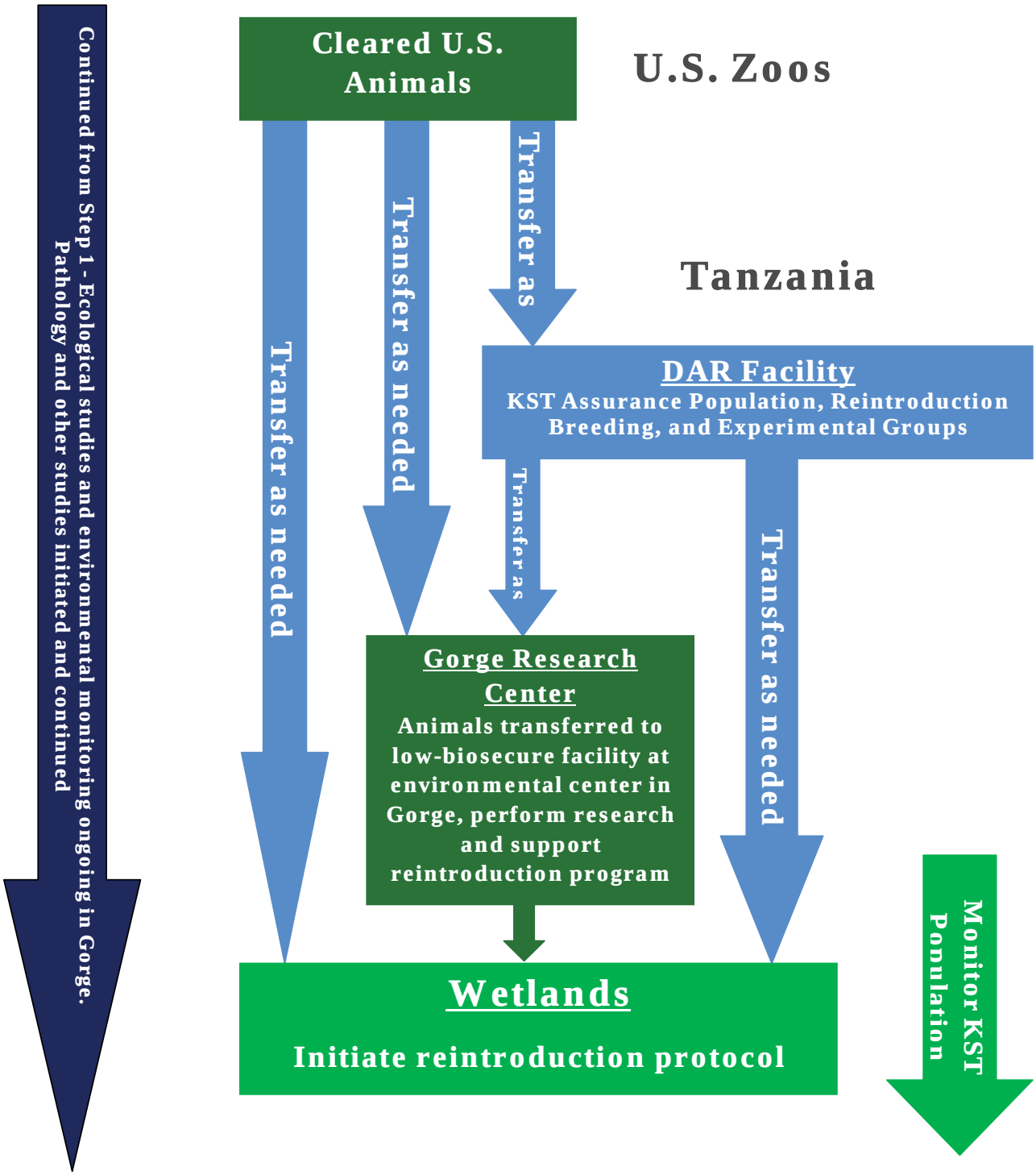
Phase 4 of Re-introduction: Hard Release

- HARD release in Mhalala falls. Small, manageable area
- Follow with release in macro pen in upper spray wetland. Estimate Allee effect.
- Incorporate genetics into optimal release strategy: how many individuals, in how many pulses?
- In parallel, conduct demographic experiments in pens to address those factors likely to limit the success of the reintroductions and to facilitate management.

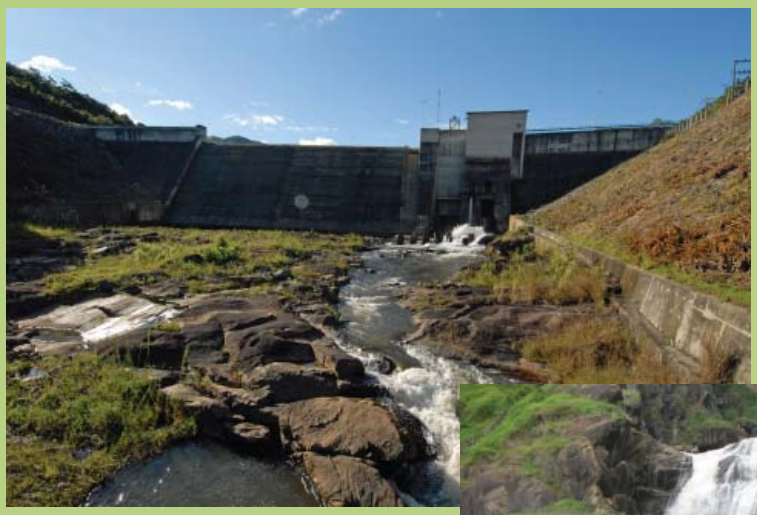
KST Project Reintroduction Process
February 2010
Step 1



KST Project Reintroduction Process
February 2010
Step 2



Environmental Mitigation Activities



Kihansi Dam and Spray Zone Mitigation

Kihansi Dam and the environmental bypass flow in the Kihansi River immediately below the hydroelectric dam. Spray irrigation and jet spray systems that have been installed in the Upper Spray Wetland to maintain the spray wetland vegetation. (Credit: William Newmark).

Thematic Area 4
Population Viability Analysis and Monitoring

Population Viability Analysis and Monitoring

Working Group: James Gibbs (Chair).

This thematic area focuses on KST population viability, how KST will respond to various variables, monitoring environmental aspects of the gorge, population models, etc. The Group identified eight areas/aspects that are crucial for KST and therefore need monitoring. The components are:

- Microclimate of the gorge
- Water quality
- Vegetation (wetland and woody vegetation)
- Invertebrates (in the wetlands)
- Amphibians
- Diseases
- Predators
- Soil
- Fires

The group assumes the current monitoring of the various components in the gorge will continue using the protocols and timeframe as detailed in Gibbs' report.

1

Challenges Hydrology of the Mhalala and Jabali not understood

Priority Critical

Activities Monitor discharge (quantity) of Mhalala and Jabali

Output Report on the discharge of the two streams produced

Timeframe Three times in a year to coincide with high, medium and low flow

Organization College of Engineering and Technology responsible and reports to the LKEMP

2

Challenges Magnitude of Microclimate change of the gorge not understood

Priority Critical

Activities Monitor temperature, humidity, precipitation, evaporation, solar radiation, wind

Output Data on various microclimate parameters produced

Timeframe Temperature and humidity to be recorded on six hourly basis using data loggers

Organization RAMPO responsible for data collection and report writing and reports to LKEMP

3a

Challenges Water quality in the sprinkler system – no information is available for sediment deposition, which will lead to growth of bacteria and fungus

Priority Critical

Activities - Monitor: pH, electrical conductivity, Nitrates, Ammonia, total nitrogen, Total suspended solids, IN Jabali, Handaki and KR intakes. Analysis of bacteria and fungal growth in sprinkler pipes.

Output Report on water quality variables produced

Timeframe pH and electrical conductivity to be measured twice per month, other parameters to be assessed twice in a year to coincide with the dry and wet season

Organization Department of Aquatic Sciences and Fisheries, University of Dar es Salaam and RAMPO

3b **Challenges** Flush release characteristics not known

Priority Useful

Activities Assess: total suspended solids, pH, electro-conductivity, Iron, Sulphides and pesticides in the sediments

Output A report on characteristics of flush release and sediments is available

Timeframe Pre-and post-flushing

Organization Department of Aquatic Sciences and Fisheries, University of Dar es Salaam and TPRI (for pesticides). Report to be submitted to LKEMP

4a **Challenges** Wetland Vegetation change monitoring

Priority Critical

Activities Continue with assessment of the 8 permanent plots in USW-sample other wetlands

Output Change in vegetation of the wetlands documented.

Timeframe Once per year (but to include other wetlands). In the 5 years timeline, assessment will be at quadrat level

Organization Department of Botany, University of Dar es Salaam. Report to LKEMP

4b **Challenges** Assessment of Woody vegetation

Priority Useful

Activities Monitor size, mortality and recruitment of woody species from the 28 permanent sample plots (PSP)

Output Report on DBH change, mortality and recruitment

Timeframe Once per year

Organization Department of Botany, University of Dar es Salaam. Report to LKEMP

5 **Challenges** Monitor endemic species in the plots established in 2005

Priority Useful

Output Report on status of endemic species

Timeframe Once every 3 years 5.

Organization RAMPO

6 **Challenges** Monitoring of Invertebrates status

Priority Critical

Activities Count the number of *Afrosteles distans* and *Ortheziola* sp. In Upper Spray Wetland. Assessment to be extended in all wetlands where KST are to be introduced.

Output Report on the number of *Afrosteles distans* and *Ortheziola* sp.

Timeframe Produced twice a year to coincide with dry and wet season

Organization Department of Aquatic Sciences and Fisheries, University of Dar es Salaam. Report to LKEMP

7 **Challenges** The status of Amphibians in the gorge not well understood

Priority Critical

Activities Assessment of KST and other amphibians in the gorge (including

Arthroleptides yakusini). Inside and outside wetlands using Audio, observation transects and pitfall lines.

Output Data on KST and other amphibians found in the gorge before and after reintroduction,

Timeframe KST will be monitored 5 times a year. For other amphibians once in a year (to coincide with short rains October to December)

Organization Department of Zoology and Wildlife Conservation, University of Dar es Salaam. Report to LKEMP

8 **Challenges** Diseases

Priority Critical

Output Assess the status of Chytrid fungus, ranaviruses and worms in amphibians resident in the gorge.

Activities Report the status of disease in the gorge.

Timeframe Twice a year Faculty of Veterinary Medicine, SUA.

Organization Sokoine University

9 **Challenges** Status of predators in the gorge is unknown

Priority Critical

Output Assess the status of Safari ants, crabs, snakes, crustaceans, ordonata lava etc using direct and indirect observation methods.

Activities Report on status of predators in the gorge produced.

Timeframe Pre and immediately after soft release Then twice in a year to coincide with the dry and wet season

Organization Department of Zoology and Wildlife Conservation. Report to LKEMP

10 **Challenges** Status of Soil (both physical and chemical) characteristics of the gorge is not known

Priority Useful

Activities Assess texture, porosity, structure, organic matter, contaminants (including pesticides), nutrients (Nitrogen and Phosphorus) and heavy metals in soil samples from wetlands.

Output Report on soil characteristics produced

Timeframe Sampling will be done once in a year

Organization Department of Botany, University of Dar es Salaam. Report to LKEMP

11 **Challenges** Fires and their status in Kihansi gorge

Priority Useful

Activities Two aspects to be considered: frequency of occurrence and extend of damage. GPS tracking of fire front and GIS mapping. Sampling along transects. Interviews with local people and gorge attendants

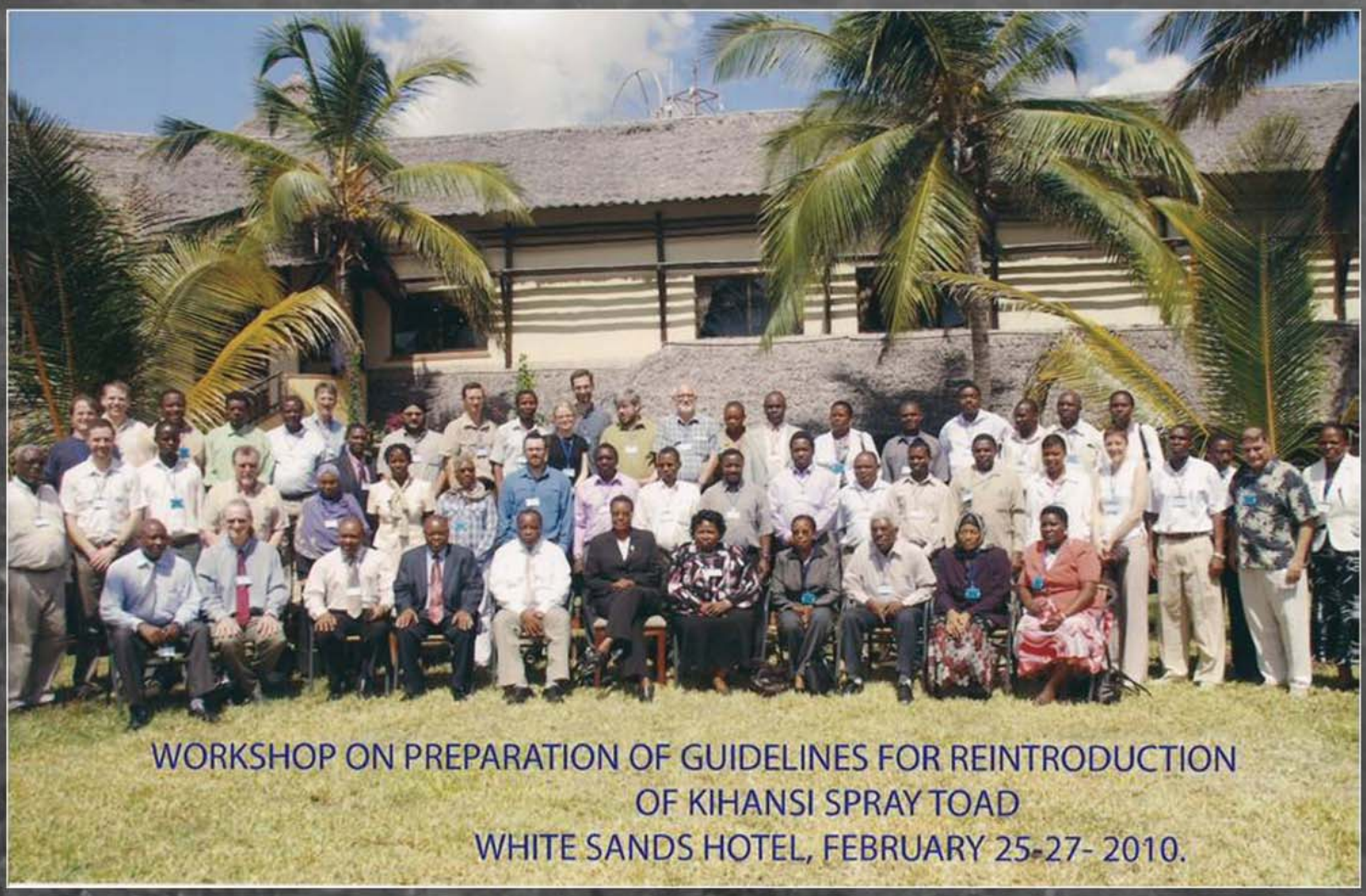
Output The status of fires in the gorge understood

Timeframe Sampling will be carried out once in a year

Organization Department of Zoology and Wildlife Conservation. Report to LKEMP

12 **Challenges** Procurement of equipment is a lengthy process and might delay field activites

Thematic Area 5
Stakeholders Involvement



Stakeholders Involvement

Working Group: Charles Masunzu (Chair), Francis Sabuni, Fransisca Ferdinard, Juliana Pilla, Ubisimbali Jeswald, Maulid Manusa, Constantine Shayo, Dismas Mwikila, Brigita Sylivester.

Government Stakeholders

- (VPO/NEMC+DOE)
- PMO/RALG- Wetland Unit (RAS (Iringa + Morogoro), DED Kilolo, DED
- Mufindi + DED Kilombero)
- MNRT - (FBD + WD +TANAPA)
- Ministry of Water and irrigation (directorate of water resources/Rufiji Basin
- Water Office)
- Energy and Mineral resources (TANESCO) Unit of Research and Environment
- Ministry of Agriculture, food, security and cooperatives (Tanzania Tropical
- Research Institute (TPRI)
- Ministry of livestock and fisheries
- Ministry of land, housing and human settlement Development. (Land Use
- Planning Commission)

Institutions

- UDSM
- SUA
- TANESCO
- Financial institutions (World Bank)

International NGOs

- International Union for Conservation of Nature (IUCN)
- Wildlife Conservation Society (WCS) USA
- WWF

National NGO

- Wildlife Conservation Society of Tanzania (WCST)
- Easter Arc Mountain Endowment Fund (EAMCEF)
- Tanzania Forest Conservation Group (TFCG)

Private Sectors

- Green resource (investor on Carbon trading)
- Community based organizations/villages groups
- Water user associations / Water user groups

Challenges/Activities/Outputs/Timeline/ Responsible/

1 **Challenges** Inadequate awareness about the project activities

Activities Create awareness to local communities, public, and decision makers. Develop and implement an effective communication strategy. Media, print materials, meetings etc. Awareness meetings and seminars conducted.

Outputs Enhanced media coverage on KST. Issues of KST become an agenda in political meeting. CS document in place and implemented.

Timeline To start from March-December

Organization NEMC, Ministry of water (RUFIJI Basin Water office), MNRT (WD, FBD), LGAs, Media, National NGOs, NEMC

2 **Challenges** Uncoordinated project activities among implementers

Activities To conduct Stakeholders coordination meetings. Allocated persons for the coordination identified (DEDs).

Outputs Coordination of all conservation activation. All activities will be known harmonized.

Timeline March – April

Organization NEMC, PMO/RALG

3 **Challenges** Unsustainable human practices (agriculture, illegal hunting, deforestation, settlements, fisheries etc. Alternative income generating activities, e.g. sustainable irrigations schemes, organic farming, proper use of agrochemicals

Optional Activities Stopping use of fire on hunting, honey collection etc. Promote afforestation as income generating activity. Land use plans + family planning. Addressing issues of sustainable fisheries. Entrepreneurship education.

Outputs Enforcement of Law and By-Laws. Reduced encroachment and water pollution. Improved livelihood. Biodiversity conserved proper land use

Timeline Starting May 2010.

Organization LGA - DED (Kilolo, Mufindi, Kilombero)

4 **Challenges** MNRT Inadequate financial resources

Activities Identify potential donors e.g. government, EAMCEF

Fundraising programme.

Outputs Sufficient funds available for various activities

Timeline Starting January 2011 – Dec 2015

Organization NEMC, MNRT, LGAs, NGOs

5 **Challenges** Inadequate Human resources (both qualified and skilled.TNA for staff involved on the KST, other implementers (LGAs, communities, Extension staff).

Activities To conduct Training programmes

Outputs Trained personnel and community in place.

Timeline Starting January 2011 – Dec 2015

Organization LGAs, NEMC, NGOs, Donors

Thematic Area 6
Administration and Communication

HabariLEO
Gwiji La Habari Tanzania

Maskani | Habari za Kitaifa | Tahariri | Makala | Wazo Langu | Michezo na Burudani

Jumatatu Juni 27, 2011

Habari za Kitaifa

Vyura 1000 wa Kihansi kurudishwa nchini

Imeandikwa na Mwandishi Wetu; Tarehe: 1st March 2010 @ 07:39 Imesomwa na watu: 378; Jumla ya maoni: 0

SERIKALI inatarajia kuwarudisha vyura 1,000 wa Kihansi kati ya 5,248 waliopo nchini Marekani hivi sasa katika miezi minne ijayo.

Vyura 499 walipelekwa na serikali nchini humo mwaka 2000 baada ya kubainika kufa kwa wingi kwa ugonjwa wa kuvu.

Idadi hiyo ni awamu ya kwanza ya majaribio endapo wataweza kuishi katika mazingira ya nchini, na kwa kuwa mradi wa vyura hao unaofadhiliwa na Benki ya Dunia (WB) kumalizika Desemba mwaka huu, serikali itaendeleza mradi huo.

Gharama zilizokuwa zikitumika katika mradi huo kupitia WB kwa mwaka ni Sh milioni 353.6 sawa na dola za Marekani 260,000.

Wanasayansi na wataalamu wa viumbe kutoka ndani na nje ya nchi, waliridhia hatua hiyo ya urejeshwaji wa vyura hao wanaozaa badala ya kutaga, Juni na Julai mwaka huu katika mkutano wao wa siku tatu, uliomalizika juzi jioni, jijini Dar es Salaam. Mkutano huo uliandaliwa na Baraza la Taifa la Mazingira (NEMC).

Dr. Charles Msuya and technicians at the Kihansi Captive Breeding facility (Credit: William Newmark)

Administration and Communication

Working Group: Anna Maembe (Chair), Jane Kibassa, Joseph Kihaule, Dr. Kaoneka and Maura O'Connor.

A: ADMINSTRATION

CHALLENGES /ACTIVITIES /OUTPUT

Who is in-charge?

- Ministry of Natural Resources and Tourism to be new key implementer through Wildlife Division and TAWIRI. To be handed over the Research Station and Information Center at Kihansi.
- Management of the habitat and species conservation both *in situ* and *ex situ* will be under MNRT Wildlife Division.
- TAWIRI will coordinate scientific research on reintroduction of KST. Other players will be UDSM, SUA and others.
- Steering Committee to include the Ministry of Agriculture Food and Cooperatives.
- Chairmanship of SC remains with the VPOs Office.
- Continued Chairmanship of the SC within the VPOs Office.
- Facilities and activities handed over to MNRT.
- Staff doing actual management work to be transferred to the WD.
- TANESCO to do maintenance of the sprinklers and other infrastructure.
- Administration of reintroduction fund to be managed by TAWIRI who is the chair to the re-introduction task force.

Timeline

- December 2010 – VPO to hand over.
- Handing over to be done immediately using the present captive Breeding agreement March 2010.
- Maintenance reports at regular intervals.
- Source of funds and staff from March to Dec 2010 to be covered by LKEMP.
- Jan – Dec 2011 funds to come from MNRT, NEMC, MoWI and TANESCO to be ring fenced for re-introduction (about 500m Tsh.).
- Proposals for 5 year extension completed by June 2010 and submitted for funding.
- Transfers to the task force to be done **immediately** which in turn will disburse directly to institutions day to day scientific and operational re introduction work.
- New funds sources for LKEMP by Dec 2010.
- Put in place MoU **as soon as possible.**
- Contract between MNRT and institutions that run day-to-day activities to be prepared **as soon as possible.**
- MoUs specifically for facilities and re introduction activities

B: COMMUCATION STRATEGY

CHALLENGES/ACTIVITIES/OUTPUT

Crisis Communication plan on reintroduction

- Prepare crisis communication plan
- Appoint key spokesperson to include scientists and project management by end of March 2010
- Post names and contacts of key spokes persons on websites, media, etc. For easy access
- Organize and conduct press conferences prior to the arrival of the KST on reintroduction.
- Continually update the public on the progress of the re- introduction exercise
- Introduce the issues to Parliamentary Committee of Natural Resources and Environment with few selected scientific members of the House
- Present LKEMP in the upcoming CBD COP10 meeting in Nagoya Japan

Communication crisis plan document in place by March 31st 2010 (By LKEMP)

Meeting and media reports

Reintroduction Task Force from March to June 2010

NB: LKEMP Communication Strategy is in Place

Appendix

Workshop Participants

NO	NAME OF PARTICIPANT	ORGANIZATION	CONTACTS/ADDRESS/E-MAIL
1	Brigita Sylvester	TANESCO	P.O. Box 9024, Dar es Salaam, 0713 275270 Brigita.sylvester@tanesco.co.tz
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69	Abdallah Kaniki	ITV Cameraman	0713 952352
70	Sam Mahela	Radio One ITV	0715 358535
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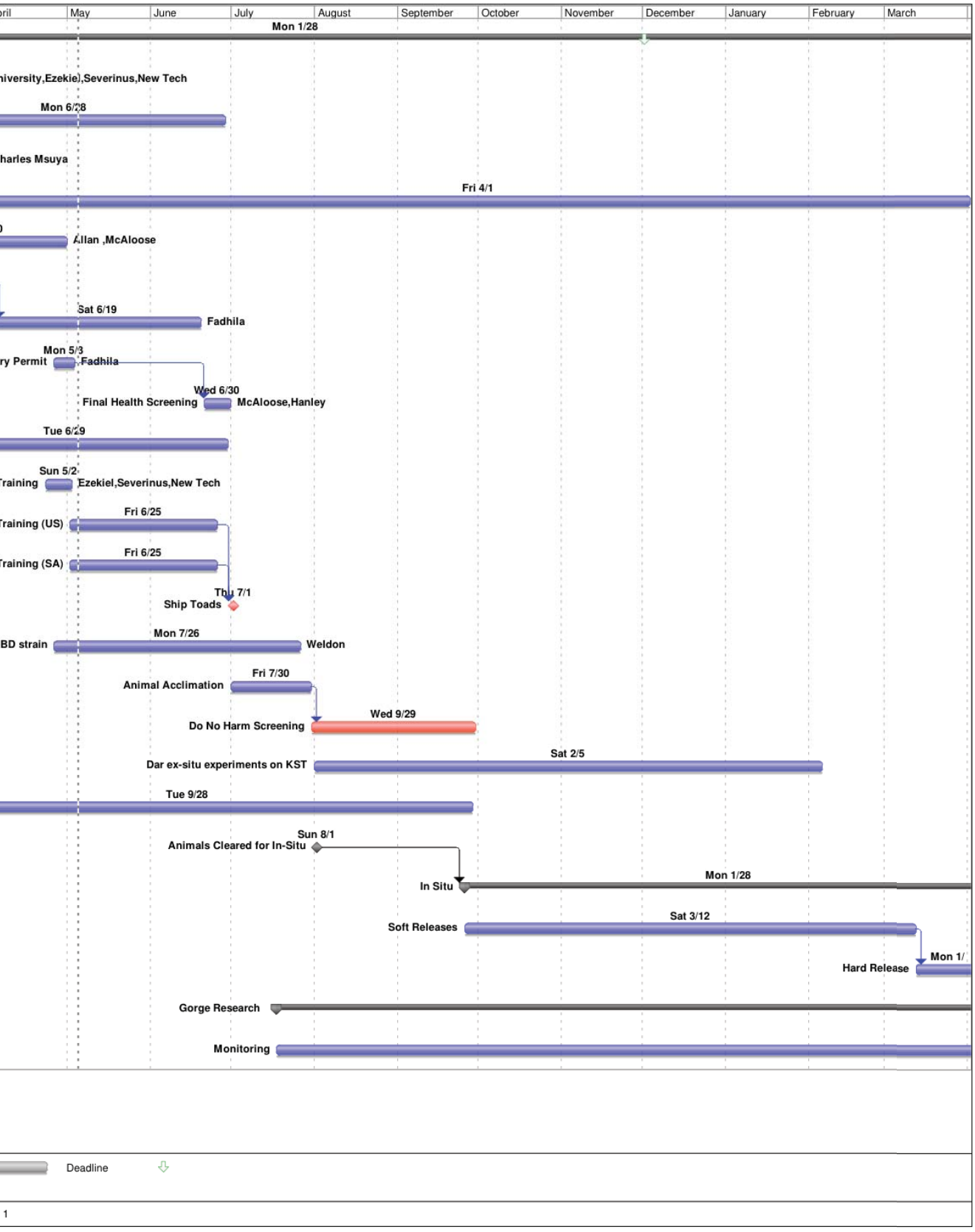
75	Nicodems Odhiambo Marcus	World Bank	Cell: 255 784 600004 Email: nmarcus@worldbank.org
76	Nice M. Mshana	NEMC	P.O. Box 63154 Dar es Salaam

ID	Task Name	Duration	Start	Finish
1	**Ex Situ**	**1178 days**	**Sun 11/8/09**	**Mon 1/28/13**
2	Dar Facility Final Tweaking	30 days	Mon 3/1/10	Tue 3/30/10
3	Increase insect cultures	120 days	Mon 3/1/10	Mon 6/28/10
4	Collect Native Amphibians	45 days	Sun 11/8/09	Wed 3/31/10
5	Native Colonies maintenance	366 days	Thu 4/1/10	Fri 4/1/11
6	Rana Virus Tests	45 days	Mon 3/1/10	Fri 4/30/10
7	US CITES PERMIT	37 days	Fri 2/26/10	Sat 4/3/10
8	TANZANIA CITES PERMIT	77 days	Sun 4/4/10	Sat 6/19/10
9	Sanetary Permit	6 days	Mon 4/26/10	Mon 5/3/10
10	Final Health Screening	10 days	Mon 6/21/10	Wed 6/30/10
11	Crisis Management Plan	121 days	Mon 3/1/10	Tue 6/29/10
12	Technician Training	10 days	Fri 4/23/10	Sun 5/2/10
13	Pathology Training (US)	55 days	Sun 5/2/10	Fri 6/25/10
14	Pathology Training (SA)	55 days	Sun 5/2/10	Fri 6/25/10
15	Ship Toads	1 day	Thu 7/1/10	Thu 7/1/10
16	Isolate BD strain	66 days	Mon 4/26/10	Mon 7/26/10
17	Animal Acclimation	30 days	Thu 7/1/10	Fri 7/30/10
18	Do No Harm Screening	61 days	Sat 7/31/10	Wed 9/29/10
19	Dar ex-situ experiments on KST	189 days	Sun 8/1/10	Sat 2/5/11
20	Preparations for soft release	212 days	Mon 3/1/10	Tue 9/28/10
21	Animals Cleared for In-Situ	1 day	Sun 8/1/10	Sun 8/1/10
22	**In Situ**	**856 days**	**Sun 9/26/10**	**Mon 1/28/13**
23	Soft Releases	168 days	Sun 9/26/10	Sat 3/12/11
24	Hard Release	688 days	Sun 3/13/11	Mon 1/28/13
25	**Gorge Research**	**616 days**	**Sun 7/18/10**	**Sat 3/24/12**
26	Monitoring	616 days	Sun 7/18/10	Sat 3/24/12


May
June
July
August
September
October
November
December
January
February
March
Mon 1/28
Mon 6/28
Fri 4/1
Allan ,McAloose
Sat 6/19
Fadhila
Mon 5/3
Fadhila
Wed 6/30
Final Health Screening
McAloose,Hanley
Tue 6/29
Sun 5/2
Ezekiel,Severinus,New Tech
Fri 6/25
Training (US)
Fri 6/25
Training (SA)
Thu 7/1
Ship Toads
Mon 7/26
Weldon
Fri 7/30
Animal Acclimation
Wed 9/29
Do No Harm Screening
Sat 2/5
Dar ex-situ experiments on KST
Tue 9/28
Sun 8/1
Animals Cleared for In-Situ
In Situ
Mon 1/28
Sat 3/12
Soft Releases
Hard Release
Gorge Research
Monitoring
Deadline