A PRELIMINARY ASSESSMENT OF GIRAFFE SKIN DISEASE IN RUAHA NATIONAL PARK

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EXECUTIVE SUMMARY

A skin disease suspected to be *Dermatophillus* was first reported in the giraffe population of Ruaha National Park in the year 2000. It is not known whether this is somehow related to the otitis infections observed in Mikumi N.P., whether or how quickly the disease is spreading in Ruaha, or whether the disease will affect the giraffe or other wildlife populations in Ruaha or surrounding areas.

To redress these deficiencies in our understanding of the disease and its significance, and in response to the TANAPA call for proposals regarding giraffe disease in Mikumi, the Wildlife Conservation Society has proposed the research program outlined in this proposal.

The objectives of the proposed research are:
1. To establish a badly-needed baseline of (suspected) *Dermatophillus* prevalence and spatial distribution among giraffe in Ruaha National Park
2. To identify the sub-populations and areas most significantly affected by the disease
3. To evaluate the ecological significance of the disease by determining whether the disease affects animals' feeding behavior and/or movement.
4. To assess seasonal variation in disease prevalence and severity
5. To verify that Ruaha giraffe infections are indeed distinctly different from other nearby populations.

These data will provide a first look at the nature of the disease in conjunction with critical information for decisions regarding whether and how to manage the disease.

The proposed research will be carried out in collaboration with the Ruaha National Park Ecologist, and the Southern Zonal Veterinarian. Follow up and development of next steps will take place with the TANAPA Veterinary Unit and the WCS Wildlife Health Center, both of which will also be solicited if and when additional expertise is necessary.

Giraffe Disease in Ruaha and Elsewhere

In the year 2000 a skin disease suspected to be *Dermatophillus* was observed in the giraffe of Ruaha National Park. The disease tends to affect the inside and rear portions of the front legs, surrounding the carpal joints. There is some speculation that the disease may make some animals lame or less willing to move, making them more vulnerable to predation and possibly reducing their ability to move to feed or stay with conspecifics. To date, numerous questions remain unanswered:

- What proportion of giraffe are affected?
- Which sub-populations have the disease?
- Where in the Park does the disease occur?
- Is the disease spreading?
- Are diseased individuals debilitated?
- Does the disease affect other wildlife?
- Are other giraffe populations affected?
- Is the pathogen related to the Mikumi otitis outbreak?

Answering these and other questions is a high priority for TANAPA and for WCS. The otitis outbreak in Mikumi has demonstrated the potential consequences of disease in giraffe populations. Ruaha has a dense population of giraffe and the potential exists for a disease to significantly affect both giraffe and other species densities and distribution, so baseline data are urgently needed to assess whether the disease is spreading and how it is affecting the giraffe population.

PROPOSED ACTIVITIES:

## Mapping spatial prevalence and population structure of diseased animals

Observations of giraffe will be conducted from vehicles moving through Ruaha National Park, where giraffe densities are highest. This preliminary assessment will take place from existing management and tourism roads, which provide sufficient spatial coverage for a preliminary assessment. Only if the preliminary mapping of disease highlights other roadless areas in need of sampling (for example if a number of severe cases are observed, or if the existence of a boundary between affected and healthy individuals appears to exist) will off road sampling be conducted.

Each time a group of giraffe is encountered the following data will be collected:
1. spatial location (UTM Coordinates)
2. age class (neonate, juvenile, subadult, adult)
3. sex (M/F)
4. whether skin lesions are observable (+/-)
5. severity of the lesions (if observed; (minor= small, dry scars evident; moderate = larger, open or fluid filled lesions obvious; severe = lesions evident and hampering movement or otherwise affecting behavior; *see figure 1, below*)
6. group size (number of individuals)
7. whether oxpeckers are present (+/-)
8. if so, whether they are near or in the lesions (+/-)

Observational recording of prevalence over this large area will provide two critical pieces of information: first, it will establish a badly-needed baseline of where the disease exists, so that its spread can be monitored; and second, by establishing data sets relating disease prevalence to giraffe density, vegetation community and exposure to possible vectors like livestock, we may begin to understand the factors driving the spread of the disease and which sub-populations are most affected (i.e. young vs. old, those in large groups vs. small or those living at high vs. lower giraffe densities; or those living in proximity to livestock).

minor   moderate   severe
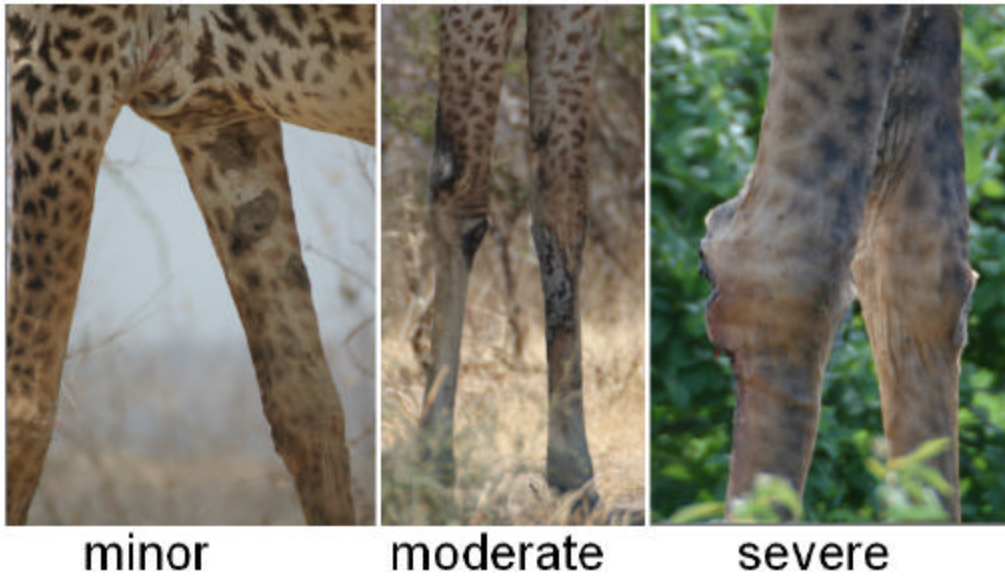
Fig. 1 showing the three severity classes of skin lesions. Note that the "severe" class requires that the behavior of the individual is also affected.

It has been suggested that a possible vector for the disease is oxpeckers. If this is the case, the possibility exists that other species will also be affected. Therefore, we will examine whether there are more oxpeckers on giraffe in areas most heavily affected by the disease, whether affected individuals are more likely to have oxpeckers on them, and whether the oxpeckers are focusing on the lesions themselves. Observational data of this nature will only provide evidence of an association between the birds and the disease, because it is possible that birds will be drawn to the affected individuals but not necessarily spread the disease. Therefore, if this association is observed, it will warrant further investigation into whether oxpeckers transport the disease on their bills, and how their behavior affects disease transmission (e.g. whether individual birds specialize on one species or many, whether they keep lesions open and/or move between affected an unaffected individuals, etc.).

Fig. 2 Oxpeckers' association with the disease will be investigated to shed light on whether further research into their role in the spread and/or maintenance of the disease is warranted.

Behavioral observations of affected individuals

Two samples of 40 giraffe with and without moderate lesions will be observed for 3 minutes to assess whether the behavior of affected individuals differs from that of unaffected animals. During the 3-minute focal observation, stepping rate and bite rate will be quantified. Time of day and sex of the animal will be recorded to test (and if necessary control for) for diurnal and sexual effects. All observations will be made on adult animals to minimize variance associated with age or parental dependence. Observations will be made from a sufficient distance and after the focal animal stops observing the vehicle so that the presence of the observer does not affect the behavior of the focal animal.

The behavioural data will shed light on the ecological implications of the disease. If the behavior of affected and unaffected individuals does not differ, then the disease may not be having severe effects on the giraffe population. However, if affected animals are feeding less or less willing to move, then the disease may be affecting nutritional ecology or vulnerability to predation. Knowledge of these factors is of obvious importance in developing management responses to the disease

Longitudinal observation of affected individuals

Another important consideration is the progression of the disease. To assess the effects of the disease through time, a subset of 10 individually recognizable animals will be selected. These individuals will be found near Msembe, so that they can be re-sighted and observed at regular intervals. (Msembe animals are also more likely to be habituated to people, again minimizing observer effects). Similar 3 minute focal observations will be made at 3 month intervals and the behavior of each animals will be compared to that animal's behavior in previous and subsequent seasons. The severity of the individuals lesions will be assessed visually and photographed to allow comparison with previous and subsequent seasons. Seasonal changes in behavior will be analysed by comparing the changes with the changes observed by the sample of behavioural observations from unaffected animals elsewhere in the park. This will effectively separate the seasonal effects of the disease from the seasonal effects of food availability.

As with the comparative behavioural observations, these data will shed light on, a) whether diseased individuals are more severely affected during certain seasons, and b) how the disease progresses through time (whether indivudals are affected temporarily and then heal, or whether they are progressively more seriously hobbled, etc.).

Opportunistic sampling

Finally, we will opportunistically collect skin samples from affected and unaffected giraffe to compare the disease load present in the two sub-populations. "Opportunistic" sampling means that samples will be collected only when a dead animal is discovered (e.g. lion kills or an animal that has died from other causes). To improve the chances of finding animals, we will request that tour operators, National Park and WMA Rangers, Livestock Officers and other people frequenting wildlife areas report giraffe carcasses to be sampled. We will ask tour operators and Park staff to report any giraffe carcasses to the Park Ecologist or WCS representative, so that samples can be taken as quickly as possible[1]. Data from Ruaha National Park will be combined

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[1] Please note that a salvage permit for opportunistic sampling *outside* Ruaha N.P. has already been issued by the Iringa District Natural Resource Office, so village Livestock Officers will also report carcasses, maximizing the number of samples that will be collected.

with data collected outside the Park to provide a comprehensive picture of the disease and its spread in the area.

Samples will be taken from affected giraffe by removing a section of affected skin and sub-dermal flesh spanning the lesion itself. Samples will be sectioned longitudinally across lesions in affected animals, and from a similar size and location in unaffected animals. It has also been reported that the bones of affected individuals show rough scarring under the lesions. Therefore, front leg bones will also be collected to evaluate whether disease status can be identified in older, decomposed carcasses.

Comparison with Other Populations

Finally, we will collect small samples (n ~ 50) of prevalence from other giraffe populations. This will provide a reference point verification that Ruaha giraffe are indeed affected differently than other populations. It will also provide limited baselines in other parks, making subsequent disease assessments possible. These observations will take place in Mikumi and Katavi N.Ps. These two parks are geographically the nearest to Ruaha, and therefore the most likely to also be affected should the disease spread. They are also ecologically similar, thereby minimizing environmental effects.

Analysis and Sample Storage

Reference samples will be deposited with the TANAPA Veterinary Department and with the Wildlife Conservation Society's Wildlife Health Center in New York, USA. WCS personnel will work with TANAPA to choose the appropriate laboratory for analysis, so that the results from this study will be consistent with previous data collected and with subsequent efforts.

PERSONNEL AND CAPACITY BUILDING

WCS Policy is to support host country institutions and develop their capacity to conduct research and management on their own. Toward that end, the proposed work will take place with the Ruaha National Park Ecologist, and with the Southern Zonal Veterinarian, and the TANAPA head Veterinarian when possible[2]. Where possible, WCS will directly support the research through partner organizations, whether financially, logistically or via technical support. WCS will commit to financially supporting the proposed activities and incidental costs incurred by partner organizations[3]. This includes provision of logistical support for fieldwork by providing access to vehicles, field equipment and WCS personnel. WCS will also help the Park Ecologist and Veterinary Unit as necessary to report on the findings of this research through publications, internal reports, presentation(s) at the TAWIRI Conference or through other channels

WCS will also work with the partner organizations to identify long-term sources of sustainable financing to support ongoing activities initiated in this proposal. Study design, data collection and analysis, and report writing and dissemination will all take place in collaboration with the aforementioned TANAPA personnel.

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2 Obviously, workplan development and time allocation depend on the availability of the aforementioned personnel, which is to be determined by TANAPA . WCS will ensure that the proposed work is completed in a timely manner, regardless of the amount of time TANAPA staff are able to allocate to the proposed research.

3 Please note that WCS supports *direct costs* incurred through fieldwork and/or workshops but is not permitted to support sitting fees or night-out allowances. If necessary, these costs must be paid by external or partner funds.

Dr. Peter Coppolillo is the principle investigator for the proposed work and Project Director of the Rungwa-Ruaha Landscape Conservation Program. WCS also anticipates adding two new staff members to help conduct this research. A search will be underway by the time of submission and both positions filled by the time research is initiated. These positions will be preferentially staffed by Tanzanian researchers and field assistants.

As part of the ongoing effort to build capacity within the partner organizations, WCS will also provide access to our existing literature and loan relevant papers, books and other literature to be copied for the RUNAPA EMD resource centre. We will also make ourselves available on an *ad hoc* basis for consultations on outside literature, research priorities, liaisons with other research or conservation organizations, or any other technical support for conservation-related research activities within the Rungwa-Ruaha landscape.

WCS in Tanzania

For nearly fifty years, the Wildlife Conservation Society has invested in Tanzanian conservation. Starting in 1957, WCS (then known as the New York Zoological Society) provided its first support for Parks in Tanganyika. To date, WCS investments total over $US 5 million for establishment of Parks, training wardens, ecologists and park rangers, radios, cars and even airplanes for law enforcement, and of course, technical and financial support for ecological studies to improve the practice of conservation. Below is a partial timeline highlighting some significant areas of support:

Table 1: WCS Investments in Tanzania	
Year	Support
1957	Support for parks in Tanganyika
1960	Contribution towards purchase of airplane to control poachers in the Serengeti
1961	Ecological study of plains wildlife of Serengeti-Mara region of East Africa
1962	Contribution towards Momela Estates, addition to Ngurodoto Crater N. P.
1963	Training course of two African trainee wardens at Mweka Training School
1963	Contribution towards purchase & maintenance of Super Piper Cub
1964	Purchase of Cessna airplane for poaching control in parks
1964	Preservation of the red colobus monkey in Zanzibar
1966	Purchase of truck for anti-poaching in Serengeti National Park
1967	Purchase of generator for use by wardens
1968	Survey of potential sites for marine parks
1970	Serengeti radio tracking research project
1972	Crocodile survey in East Africa
1974	Ruaha Park seminar training wardens
1975	Behavioural ecology of elephants in Ruaha N.P.
1978	Ecological study of high-pastoralist and wildlife interaction in Masailand
1980	Survey of forest distribution, Uzungwa Mountains
1989	Inventory of Forest Birds in the Udzungwa Mountains
1990	Oribi Ecology, Serengeti NP
1991	Environmental Monitoring and training in National Parks
1996	Biodiversity Inventory, Research and Monitoring in Tanzanian National Parks
1997	Vegetation mapping and Herbarium development in National Parks
1999- Present	Support of Park Ecological Monitoring Departments and Strategic Planning for N.P.s
1999- Present	Annual support for TAWIRI Scientific Conference

WCS History in the Rungwa-Ruaha Landscape

WCS's support for Ruaha National Park began with the Park's inception from 1964 through 1966, by helping to purchase the land for the Park and establish its basic infrastructure. In the 1970s, WCS helped train wardens and conduct research on Ruaha's elephant population. Then in the late '80s and early '90s WCS worked with TANAPA's director David Babu to establish a monitoring program in Ruaha. And most recently, WCS, with support from the MacArthur Foundation, has helped facilitate the development of Ruaha's current Annual Operations Plan (AOP) for the Ecological Monitoring Department (EMD). Finally, WCS is supporting ongoing management needs through ecological research, monitoring and law enforcement.

WCS is pleased to continue with this support and will significantly increase its investment in Ruaha. The appendix following this proposal lists selected objectives from Ruaha N.P.'s current Annual Operations Plan that will be addressed through WCS's proposed activities (submitted to TAWIRI for approval). Those activities that are relevant to this proposal are highlighted in yellow.

Note: The TANAPA Annual Operations Plan calls for strategic partnerships with external and local institutions. Trough the proposed research WCS is acting in this capacity. WCS will also work with TANAPA, Wildlife Division and the MBOMIPA Association to identify other institutions where necessary. The table below is provided to relate the proposed research to the related TANAPA activities.

APPENDIX 1: RUAHA NATIONAL PARK ECOLOGICAL MONITORING DEPARTMENT ANNUAL OPERATIONS PLAN ACTIVITIES AND INDICATORS RELATED TO THE PROPOSED RESEARCH

	ACTIVITY		INDICATOR
1.2.1	Document and map the extent of fire outbreaks.	1.2.1	Monthly report with map of fire outbreaks submitted.
1.2.2	Identify areas prone to fire outbreaks and establish the causes of fires.	1.2.2	Fire prone areas mapped and a report on the causes of those fires produced.
1.2.3	Effect of bush fires on park vegetation quantified and monitored.	1.2.3	Suitable protocol for monitoring the effect of fires on vegetation developed and implemented.
1.4.1	Inventories of large and small mammals carried out.	1.4.1	Preliminary Ruaha mammal list prepared by end 2003.
1.5.1	Establish and maintain literature database and library.	1.5.1	Library and database of relevant references and papers established by end 2003.
1.6.2	Monitor diseases outbreaks of the fauna and flora.	1.6.2	Reported outbreaks of disease monitored and documented in monthly / summary reports.
1.7.1	Collect data on the abundance and distribution of Wild Dogs, Cheetah, Grant's Gazelle, Lesser Kudu, Roan and Sable.	1.7.1	Data on numbers, distribution and movements of 3 rare and endangered species included in monthly reports by end 2003.
1.7.2	Determine if the Black Rhino persists in the park.	1.7.2	Report on the presence / absence of Black Rhino submitted by end year 2003.
1.7.3	Numbers and distribution of elephants in the park monitored (in collaboration with partners - WCS, TAWIRI, CIC).	1.7.3	Elephant monitoring programme designed and implemented together with partner institution by July 2003.

1.8.2	Effect of drying up on aquatic, amphibious and terrestrial vertebrates monitored.	1.8.2	Data on changes in animal populations contained in monthly / summary reports.
3.2.2	Monitor / Evaluate the effectiveness of early burning and firebreaks on wildfire prevention / suppression.	3.2.3	Report outlining all relevant fire data and advice submitted to PWC by end 2004.
3.2.3	External collaborator identified to do research on fire ecology leading to a Fire Management Plan.	3.2.3	Partner identified and active contribution to prep aration of FMP documented in monthly reports.
3.3.3	Identify and monitor the impact of human activities on park habitats, animals and the environment.	3.3.3	Report on the impact of human activities on the park with recommendations on mitigation measures.
3.4.1	Map and monitor all reported problem-animal events.	3.4.1	All reported problem-animal events mapped (with GPS) as they occur.
3.4.3	Annual rabies vaccination program for domestic dogs in the villages initiated.	3.4.3	Rabies vaccination campaign for village dogs carried out by TANAPA and DVO once per year.
4.1.2	Research findings submitted through the appropriate channels.	4.1.2	Minimum of one article, paper or publication produced every year.
4.1.5	Participate in community education / sensitisation programmes on the effects of bush fires in the park.	4.1.5	Participation in CCS fire education programme documented in monthly reports.
5.1.1	Develop a list of research priorities for Ruaha NP.	5.1.1	List of research priorities available by end 2002.
5.2.2	Liaise with external researchers working in and around the park ecosystem.	5.2.2	Communicate with external researchers and participate in projects with opportunities for on-the-job training.
6.1.3	Contribute actively to zone management plan and General management plan production and revision.	6.1.3	PEMD SAP integrated into GMP and contributions to GMP revisions documented in monthly reports.
1.9.1	Document and map all reported occurrences of poaching in the park.	1.9.1	Distribution of poaching incidents and their effect on animal populations detailed in monthly / summary reports.