

**Technical Report: Observation of the Capture and
Translocation of Greater One-Horned Rhinoceros,
Rhinoceros unicornis from Royal Chitwan National Park to
Royal Bardia National Park. Nepal, 2002.**



Mark W. Atkinson BVSc MRCVS
Director of Animal Health
The Wilds
14000 International Road
Cumberland
Ohio 43732
U.S.A



1. Introduction

In March 2002, a total of 10 rhinos were translocated from Royal Chitwan National Park (599 sq. mi, total population of *R. unicornis* = 542 animals) to Royal Bardia National Park (601 sq. mi, total population of *R. unicornis* = 63) as part of the ongoing rhinoceros translocation program in Nepal. This project is a joint initiative of the Department of National Parks and Wildlife Conservation (DNPWC) and the King Mahendra Trust for Nature Conservation (KMTNC) with the financial support of WWF and the US Fish and Wildlife Service. The major objective for the translocation was to further protect *R. unicornis* by helping establish a viable population of animals in an alternative, geographically distinct habitat. In addition, the reduction of rhino numbers in the Chitwan area is aimed at minimizing the incidence of rhino-human interactions and other conflicts in and around the park.



Map of The Kingdom of Nepal

Following my recent appointment as veterinary advisor for Asian rhinos to the North American Rhinoceros Species Survival Plan (SSP), I initiated a thorough investigation of veterinary issues associated with *R. unicornis* in captivity. A brief overview of the major health concern may be found below. With the encouragement and generous financial support of WWF-US (Dr. Steven A. Osofsky), the International Rhino Foundation - IRF (Dr. Thomas J. Foose) and *the Wilds*, and with the approval and support of the DNPWC and WWF-Nepal, I was fortunate to be able to take advantage of an opportunity to travel to Nepal to observe the translocation exercise. I found the overall experience to be extremely valuable and some specific aspects have been highlighted in this report.

2. Overview of major health concerns in captive *R. unicornis*

Recent investigations performed by veterinarians and animal managers both at *the Wilds* and at several zoological institutions in Europe, have highlighted a significant chronic, medical condition in captive *R. unicornis* known as chronic pododermatitis.





Chronic Pododermatitis and nail overgrowth in a captive R. unicornis

Chronic pododermatitis, also known as chronic foot disease or CFD, is a poorly understood but common medical condition, which affects between 60 and 100% of adult *R. unicornis* in captivity (von Houwald 1997, von Houwald and Flach 1998, von Houwald 2001). The majority of affected animals are adult males. This condition generally affects the hind feet and is characterized by nail overgrowth, non-healing fissures and ulcers located between the sole of the central toe and the adjacent pad and by pad overgrowth, bruising and chronic infection. Potential contributing factors include housing conditions, massive body size and weight, inappropriate diet, husbandry techniques and genetic predisposition. Although little is known about the extent to which this condition affects the North American captive population, preliminary data suggests it may be widespread.

Descriptions of other diseases, conditions and general health parameters in captive *R. unicornis* have been exhaustively searched for but not found in the scientific literature. Furthermore, review of the literature reveals a dearth of consistent and valid physiological information for this species. For example, 'normal' physiological reference values published by ISIS are based on a sample size of <40, taken from a maximum of 18 animals from a total of 9 institutions. The current population size in North America is 51 animals (AZA Master Plan, 2000) with 25 males and 26 females being housed in 24 zoological institutions.

As managers of captive individuals of an endangered species, we recognize the responsibility we have to ensure the best possible healthcare, housing, husbandry and management conditions for the animals in our charge. Recognizing the potential severity of chronic pododermatitis in this species and its probable link to husbandry practices, we are fully aware of the responsibility we assume when importing wild-caught animals to supplement the captive population. Zoo veterinarians understand

that a greater level of knowledge of anatomy, physiology, nutrition and general health parameters in 'normal' individuals of this species is essential.

In order to better understand both general health concerns and the specific changes occurring in the feet of affected animals in North American zoos, it is critical that we gain a better understanding of what constitutes 'normal'. The most effective way of developing this knowledge is to establish professional relationships with animal managers in range states, collaborate on *in situ* research programs and closely observe the physiological and anatomical features of recently captured wild animals.

The wild-to-wild capture and translocation (from the Royal Chitwan National Park to the Royal Bardia National Park, Nepal) of 10 *R. unicornis* was performed by the Department of National Parks and Wildlife Conservation (DNPWC) between the 10th and the 15th of March 2002. Attending this capture and observing wild-caught animals provided a unique opportunity to:

- Visually assess general body condition and health status
- Perform close visual examination and measurement of the feet of individual animals
- Collect appropriate photographic records of the feet

3. Capture and Translocation of *R. unicornis* from Royal Chitwan to Royal Bardia National Parks

A total of 10 sub-adult and adult *R. unicornis* were successfully captured, transported and released during this exercise. Five female (4 adult, 1 sub-adult) and 5 male (5 sub-adult) *R. unicornis* were selected for translocation. Of these, 8 animals were chemically restrained using combinations of etorphine and acepromazine (LA Immobilon[®]) administered by remote injection (Palmer Cap-Chur[®] dart) (Table 1).

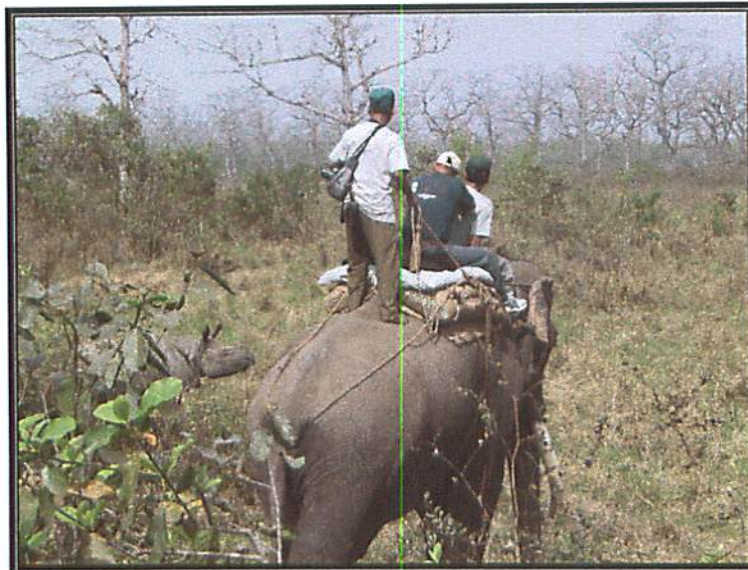
Table 1. *R. unicornis* captured and translocated from Royal Chitwan National Park, Nepal.

Date	Age	Sex	Weight (est.)	Immob Drugs (E = etorphine; ACP = acepromazine)
3/10/02	Ad	F	1600 Kg	E 3.0 mg + ACP 10 mg
3/10/02	Ad	F	1700	E 3.0 mg + ACP 10 mg
3/10/02	Sub Ad	M	1000	E 1.5 mg + ACP 7 mg
3/10/02	Sub Ad	M	1000	E 3.0 mg + ACP 10 mg
3/13/02	Sub Ad	M	1200	E 1.5 mg + ACP 7 mg
3/13/02	Sub Ad	F	1500	E 1.5 mg + ACP 7 mg
3/13/02	Ad	F	2000	E 3.0 mg + ACP 10 mg
3/14/02	Ad	F	2000	E 3.0 mg + ACP 10 mg
3/15/02	Sub Ad	M	1000	-
3/15/02	Sub Ad	M	1000	-



Selected animals were located by observers on elephant-back and following observation and selection of appropriate immobilizing drug dosages, were darted from a distance of 10 – 20 meters. Animals were herded to appropriate recovery sites and following recumbency were carefully monitored, cooled with water, administered intramuscular long-acting antibiotics (benzathene penicillin), fitted with a radio-telemetry device and then loaded onto a padded wooden pallet for transfer to the transport crates. Dart-wound sites were treated with topical antibiotic preparations following needle removal.

Once the animal was secure in the crate, antagonism of narcotic effect was achieved by the intravenous administration of diprenorphine (Revivon[®]). No further drugs were administered. Transport to the release site occurred in the late afternoon and evening to avoid traveling during the heat of the day. Free-release occurred on arrival in the Royal Bardia National Park and dispersal was monitored and recorded by park biologists utilizing observation and radio-telemetry.



Darting *R. unicornis* in Royal Chitwan National Park

4. Observations of the feet of wild *Rhinoceros unicornis*

Of the 10 captured *R. unicornis*, I had the opportunity to visually assess the feet of 8 animals. All animals exhibited similar anatomical features:

- ❑ Each hoof (toe nail) has an oval (medial to lateral) to semi-circular (central) shape.
- ❑ The central toe tends to be larger and longer with a more pronounced semi-circular shape than the medial and lateral toes.

- The palmar/plantar aspect of the sole of the central toe merges with the structures of the cushioning foot pad while the lateral and medial hooves remain more mobile with a more distinct dorsal edge and obvious interdigital separation.
- The horn wall of all toes appears to be long, dense and structurally very hard and forms an elevated 'rim' distinct from the sole, which tends to be markedly concave.
- The foot pad is roughened and hard with multiple superficial cracks and fissures present in the horny tissue.
- The hard horn wall 'rim' serves as the major weight-bearing surface of the foot during ambulation.

Due to logistical and timing limitations during the capture, accurate measurement of the hooves, soles and pad was not possible. These restrictions also prevented the creation of a representative silicone mold of a foot for later comparison with zoo animals. Photographs however, were taken whenever possible. No mature adult male animals were captured during this operation and consequently direct comparison with the most seriously affected animals in captivity was not possible. Despite the inability to obtain some basic recordable data on these animals, my observations of wild *R. unicornis* prior to, during and following chemical immobilization episodes provided me with greater insight into the structure, anatomy and function of the feet of wild animals. I believe this will prove invaluable during the further investigation of podiatric health concerns in captive zoo animals.



Rear foot of recently captured *R. unicornis*, Chitwan NP.

5. Relevance of findings to captive *R. unicornis*

Many captive *R. unicornis* in zoos in North America and Europe exhibit significantly different anatomical features than those listed above. Most notably, captive animals tend to exhibit overgrowth of the central toe, have shorter medial and lateral hoof wall surfaces, have abraded and flattened soles, bear significantly more weight on the cushioned pad of the foot which is structurally thin and prone to bruising and hemorrhage and frequently exhibit pathological changes consistent with chronic pododermatitis. The likely reasons for these abnormalities include rough, abrasive substrate such as concrete, chronic trauma, limited access to water / mud wallow, excessive body weight coupled with insufficient exercise, possible genetic predisposition and delayed or inadequate medical intervention and therapy.

While the majority of zoological animals affected however tend to be adult males and during this capture exercise no adult males were selected for translocation making a direct comparison difficult. These findings do however, confirm the speculative observations made by Friederike von Houwald (2001) in her excellent dissertation "Foot problems in Indian Rhinoceroses (*Rhinoceros unicornis*) in zoological gardens: Macroscopic and microscopic anatomy, pathology, and evaluation of the causes". Her evaluations of the feet of wild *R. unicornis* were based on photographs taken of animals at capture (courtesy of Dr. J. Flammand) and have been instrumental in the preliminary evaluation of the etiology of this condition.

Our observations of wild animals suggest that certain management and husbandry changes need to be incorporated into zoological management programs for *R. unicornis*. These will be discussed in a separate document after further investigation of the captive population in North America and will include 3 major components.

- Surgery: regular debridement of damaged tissue in affected individuals, aggressive trimming and paring of overgrown hoof wall and pad allowing modification of the weight-bearing surface and return to more 'normal' anatomy and ambulation (requires regular chemical immobilization).
- Medical treatment: antimicrobial and anti-inflammatory therapy where appropriate, application of moisturizing agents and topical wound treatment.
- Husbandry: modifying the flooring substrate of rhinoceros exhibits, providing access to natural areas, offering year-round access to water holes or mud wallows, regular assessment of hoof conformation, hoof trimming and nail care, evaluation of and changes to current diets.



6. Potential for Future Collaboration between *the Wilds*, WWF, IRF and the DNPWC, Nepal.

In light of the general lack of data pertaining to the health of *R. unicornis* both in the wild and in captivity, other research opportunities should be seriously considered by the DNPWC. Moreover, due to the significant lack of published material regarding normal physiologic and hematologic values in *R. unicornis*, future capture operations will provide a unique opportunity to gather extremely valuable baseline biological data.

I suggest that investigations of the following parameters should be undertaken:

- Physiologic changes occurring during field anesthesia data by evaluating pulse oximetry, blood gases etc.
- Biochemical data such as enzymes, glucose, total protein, electrolytes etc.
- Hormonal data such as cortisol, testosterone, progesterone etc.
- Hematologic data such as hemoglobin, hematocrit, red and white cell counts, differentials etc.
- Evidence of exposure to various infectious agents and toxins (with possible conservation implications for human, livestock and wildlife health.)

The determination of these data would require the physical examination and collection of blood samples from chemically immobilized animals (a rapid, minimally invasive procedure requiring no more than 5 to 10 minutes per animal). Samples would be evaluated by portable field equipment at the time of capture and again following sample preparation prior to storage in liquid nitrogen. The veterinarian and support technicians in the DNPWC have the capability to collect and process some of these samples. Technical support would be provided by a collaborating institution such as *the Wilds*.

7. Personal Comment

Professional relationships between veterinarians at *R. unicornis*-holding institutions in both North America and Europe (*ex situ*) continue to develop and strengthen. My recent visit to Nepal has provided me the opportunity to develop relationships with wildlife professionals *in situ* (Nepal and India). As veterinary advisor for Asian rhinos to the Rhinoceros SSP in North America, these relationships are likely to be highly productive and valuable finally providing a much needed "global" perspective on rhinoceros conservation issues.

In my opinion, the capture and translocation exercise was carried out in a safe, appropriate, stress-free and professional manner and the commitment to conservation of all the involved parties was obvious and impressive. Field capture of *R. unicornis* provides scientists involved with the program a unique and invaluable opportunity to advance global knowledge of this endangered species. The veterinary input to the translocation exercise was relatively minor however, despite the presence of a skilled, dedicated veterinarian within the department. Investigations of



animal health issues (including determination of normal physiological and anatomical parameters, biological aspects and ecological relationships with non-infectious disease and infectious disease processes) should be encouraged. The value of these investigations may prove invaluable to veterinarians and animal managers working with this unique species the world over. As a result, I would strongly encourage increased support of the veterinary unit within the DNPWC and of further scientific investigations of *R. unicornis* in Nepal.

8. Acknowledgements

I gratefully acknowledge the following individuals and organizations: Dr. Tirtha Man Maskey (DNPWC) for permission to attend the translocation; Robert Reece and Dr. Evan Blumer (*The Wilds*), Dr. Steve Osofsky (WWF-US) and Dr. Tom Foose (IRF) for encouragement and generous financial support; and Anil Manandhar (WWF-Nepal), and Dr. Kamal Gairhe (DNPWC) for their exceptional Nepali hospitality, help and encouragement before, during and after the translocation exercise.

9. Selected References

- Atkinson M.W., B. Hull, A.R. Gandolf and E.S. Blumer. 2001. Long-term medical and surgical management of chronic pododermatitis in a greater one-horned rhinoceros, *Rhinoceros unicornis*: a progress report. In: Scientific proceedings of the International Elephant and Rhino Research Symposium. Vienna, Austria.
- von Houwald F. 1997. Investigation of the prevalence and causes of chronic foot problems in greater one-horned rhinoceroses (*Rhinoceros unicornis*). MSc. Project Report, University of London, England. 50pp
- von Houwald F., and E.J. Flach. 1998. Prevalence of chronic foot disease in captive greater one-horned rhinoceros (*Rhinoceros unicornis*). Proc. 2nd Sci. Meet. European Assoc. Zoo Wildl. Vet. 21-24 May 1998, Chester, England.
- von Houwald F. 2001. Foot problems in Indian rhinoceroses (*Rhinoceros unicornis*) in zoological gardens: macroscopic and microscopic anatomy pathology and evaluation of the causes. Doctoral thesis, University of Zurich, Switzerland. 112 pp.

