

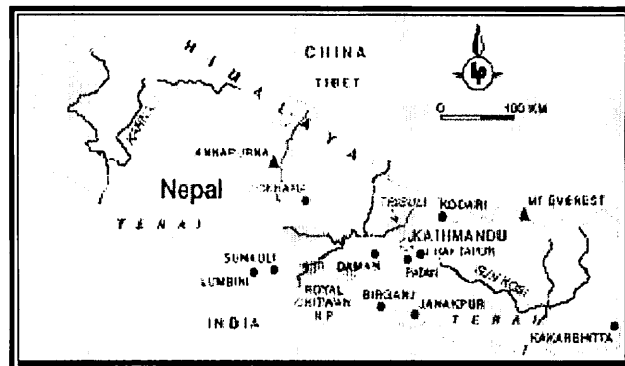
Capture and Translocation of Greater One-Horned Rhinoceros, *Rhinoceros*

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IRF website 2003

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

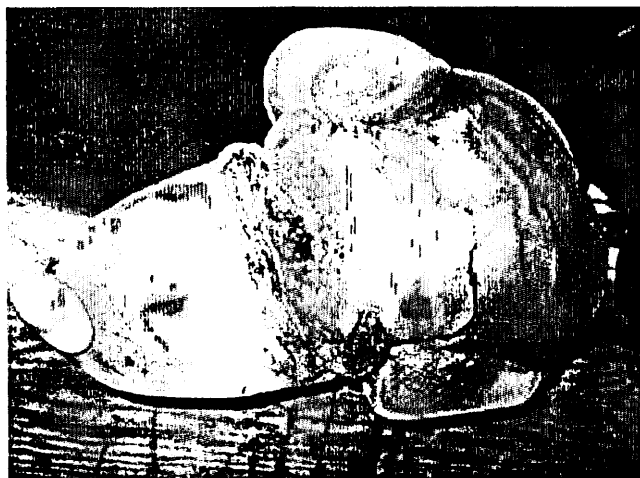


Map of The Kingdom of Nepal

Following my recent appointment as veterinary advisor for Asian rhinos to the North American Rhinoceros Taxon Advisory Group, I conducted a thorough investigation of veterinary issues associated with *R. unicornis* in captivity. A brief overview of the major health concerns is provided below. With the encouragement and generous financial support of *the Wilds*, WWF-US (Dr. Steven A. Osofsky) and the International Rhino Foundation - IRF (Dr. Thomas J. Foose) and with the approval and support of the DNPWC and WWF-Nepal, I was fortunate to have the advantage of an opportunity to travel to Nepal to observe the translocation exercise. The overall experience I found to be very educational 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 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 of 60 and 100% of adult *R. unicornis* in captivity (von Houwald 1997, von Houwald and Flach 1998, von Houwald 2001). The animals are adult males. This condition generally affects the hind feet and is characterized by nail overgrowth, non-healing ulcers located between the sole of the central toe and the adjacent pad and by pad overgrowth, bruising and chronic infection. Possible factors include massive body size and weight, inappropriate diet, housing conditions, husbandry techniques and genetic predisposition. Little is known about the extent to which this condition affects the North American captive population, preliminary data suggest it is widespread.

Descriptions of other diseases, conditions and general health parameters in captive *R. unicornis* have been exhaustively described and found in the scientific literature. Furthermore, review of the literature reveals a dearth of consistent and valid physiological reference values published by ISIS are based on a sample size of <40, taken from a total of 9 institutions. The current population size in North America is 51 animals (AZA Master Plan, 2000), with 24 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 housing, husbandry and management conditions for the animals in our charge. Recognizing the potential severity of chronic foot disease and its probable link to husbandry practices, we are fully aware of the responsibility we assume when importing wild animals to supplement the captive population. Zoo veterinarians understand that a greater level of knowledge of anatomy, physiology and 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, it is critical that we gain a better understanding of what constitutes 'normal'. The most effective way of developing this understanding is to establish professional relationships with animal managers in range states, collaborate on *in situ* research programs and collect 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) performed by the Department of National Parks and Wildlife Conservation (DNPWC) between the 10th and the 15th of March 2002 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

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

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 individuals were darted from a distance of 10 – 20 meters. Animals were herded to appropriate recovery sites and following recumbency was monitored, cooled with water, administered intramuscular long-acting antibiotics (benzathene penicillin), fitted with a radio-collars and then loaded onto a padded wooden pallet for transfer to the transport crates. Dart-wound sites were treated with topical antibiotics and following needle removal.

Once the animal was secure in the crate antagonism of narcotic effect was achieved by the intravenous administration of a reversal agent (e.g. flumazenil). No further drugs were administered. Transport to the release site occurred in the late afternoon and evening to avoid the heat of the day. Free-release occurred on arrival in the Royal Bardia National Park and dispersal was monitored and recorded by 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

- ➔ 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. The sole tends to be markedly concave.
- ➔ The foot pad is roughed 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 restrictions 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 were taken whenever possible. No mature adult male animals were captured during this operation and consequently direct observations of wild *R. unicornis* prior to, during and following chemical immobilization episodes provided me with greater insight into the anatomy and function of the feet of wild animals. I believe this will prove invaluable during the further investigation of podia 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 notably, captive animals tend to exhibit overgrowth of the central toe, have shorter medial and lateral hoof wall surfaces, flattened soles, bear significantly more weight on the cushioned pad of the foot which is structurally thin and prone to bruise and frequently exhibit pathological changes consistent with chronic pododermatitis. The likely reasons for these abnormalities are abrasive substrate such as concrete, chronic trauma, limited access to water / mud wallow, excessive body weight coupled 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 translocation making a direct comparison difficult. These findings do however, confirm the speculative observations made by Houwald (2001) in her excellent dissertation "Foot problems in Indian Rhinoceroses (*Rhinoceros unicornis*) in zoological gardens: a study of hoof and microscopic anatomy, pathology, and evaluation of the causes". Her evaluations of the feet of wild *R. unicornis* were taken of animals at capture (courtesy of Dr. J. Flammand) and have been instrumental in the preliminary evaluation of the condition.

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

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

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

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 values in *R. unicornis*, future capture operations would provide a unique opportunity to gather extremely valuable baseline 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, lion and rhino health.)

The determination of these data would require the physical examination and collection of blood samples from chemically restrained animals.

rapid, minimally invasive procedure requiring no more than 5 to 10 minutes per animal). Samples would be evaluated by p at the time of capture and again following sample preparation prior to storage in liquid nitrogen. The veterinarian and supp DNPWC have the capability to collect and process some of these samples. Technical support would be provided by a colle as *the Wilds*.

8. Acknowledgements

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

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Examination of immobilized *R. unicornis*