

# Reproductive Management of the Captive Rhinoceros

*A Collaborative Approach to Maximize Rhino Health and Reproduction*

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## INTRODUCTION

The focus of our rhinoceros research has been the characterization of basic reproductive biology by ultrasound and its application to captive management of these endangered species, work intricately dependent upon a dedicated and collaborative animal care and health team. Our rhino care and research objectives are facilitated by a rhino internship position created to help with ongoing reproductive studies of the black rhinoceros (*Diceros bicornis minor*) and white rhinoceros (*Ceratotherium simum simum*). The rhino internship has evolved into a position which provides a significant benefit to our research, daily care, and medical management of our rhinoceros. This position provides hands-on training and experience in the care of captive rhinoceros through exposure to research, medicine and husbandry of these endangered perissodactyls.

Our reproductive research of rhinos provides two important benefits to rhinoceros conservation. The first and most obvious benefit is the elucidation of new information about rhinoceros biology through data collection and analysis. The information accumulated will serve to improve our knowledge of the basic reproductive function of the rhinoceros - information essential to their successful management in captivity and possibly in the wild. The second benefit is an application of the first: development of an intensive program to monitor rhinos with ultrasound in order to characterize their reproductive state.

## RHINOCEROS REPRODUCTIVE RESEARCH

### *Procedure and conditioning*

The reproductive management of captive African rhinos can be enhanced through the application of transrectal ultrasonography, without the need for sedation. Routine daily examinations have been facilitated by the use of a "free-stall" chute that eliminates the stress of confinement and allows the rhino to choose its own response to the process (Figure 1). Our rhino keeper and interns have dedicated long hours to conditioning rhinos through feeding and touching the subjects while in the chute, allowing for the eventual application of transrectal ultrasound in even our most "wild" rhinos.

### *Characterization of basic biology*

Reproductive studies in the southern white rhinoceros (*Ceratotherium simum simum*) have focused on the characterization of ovarian dynamics and early pregnancy in one female over a 15 month period. A 5.0 MHz convex array transducer facilitated reproductive examinations, with a modified 10 foot transducer cable and extensor needed for ovarian examinations. The interovulatory interval in the subject white rhinoceros averaged 33 days (n=2). Two nonconceptive periods lasting approximately 10 weeks were observed in association with early embryonic death. A possible sign of infertility in this female was the identification of intrauterine fluid collections in late diestrous, as has been reported in the horse.

Reproductive work in the southern black rhinoceros (*Diceros bicornis minor*) has involved the documentation of normal gestational parameters and the characterization of the estrous cycle in two females. Ultrasonography in the black rhino was performed with a 5.0 MHz linear array transducer, without the need for an extensor. Weekly examination during a black rhino gestational period from Day 56 through parturition on Day 475 allowed for the documentation of: fetal heart rate, fetal mobility/orientation within the uterus, and measurements of various fetal parts (Figure 2). A second gestational monitoring period facilitated characterization of the early black rhino embryo from Day 27 through late fetal stages. Preliminary results in these rhinos suggest that the measurement of fetal foot and eye diameter may be useful for assessment of gestational age in the black rhinoceros. If sufficient data were collected to document and chart fetal dimensions such as eye diameter or skull length as has been done in the horse, gestational age charts could be developed for the rhino. Initial ultrasonographic investigations of ovarian function in the black rhino confirm previous hormonally and behaviorally-based reports of a cycle length of 25 days. For both species of African rhinoceros, concurrent fecal hormone assays confirmed ultrasonographically identified reproductive cycle dynamics.

## REPRODUCTIVE MANAGEMENT

### *Ultrasonography as a tool for applied reproductive management*

Ultrasonography is a tool being applied in captive management to resolve some of the basic mysteries surrounding rhinoceros reproduction. Managed breeding decisions can be enhanced with this technique through objective reproductive assessments of individual animals. The ability to characterize the reproductive state of the rhinoceros is the first, essential step to management of a healthy and reproductively efficient captive breeding program. As in the management of mares on a broodmare farm, the basic information provided by routine reproductive examination is fundamental to managed reproduction. The following summary highlights some of the more important changes this information can facilitate, and includes specific case studies that illustrate use of ultrasound as a management tool for enhancement of reproductive efficiency in the rhino:

- 1) Prediction of estrus and impending ovulation in females that lack overt signs of behavioral estrus.
- 2) Timed breeding in individual animals (or species such as Sumatran rhino) that are incompatible outside of estrus.
- 3) The documentation of reproductive state. For example, this information allows separation of male and female following confirmed conception.
- 4) Shortening of the inter-calf interval in rhinos through early confirmation of return to cycling post-calving and documentation of pregnancy.
- 5) Identification and therapeutic management of infertility.
- 6) Nutritional modifications needed to meet the increasing demands of late gestation.
- 7) Facility modifications and preparations necessary for an impending birth.

### CASE STUDY I

#### *Conditioning and reproductive assessment of an untractable black rhinoceros*

An approximately 12 year-old female southern black rhinoceros (*Diceros bicornis minor*) was captured in Zimbabwe, held in a boma for several months, and then transferred to the Fossil Rim Wildlife Center in Texas, U.S.A. in April of 1992. Starting in January of 1995, a full-time intern began intensive conditioning of the rhino to allow hands-on examinations with the hopes of eventually performing transrectal ultrasound evaluations without sedation. The conditioning process involved exposing the female to long hours of human contact along with visual, tactile, and auditory stimuli, including the intermittent playing of a radio to add background noise to her normal environment.

The positive conditioning process began with food such as apples and sweet potatoes as a reward for tolerating the proximity of people. This soon expanded to the application of human touch on different areas of the rhino's body at the time of feeding. Over a period of several months, the rhino began to trust her human caretakers enough to facilitate twice daily examination and treatment of a potentially serious hoof crack. The rhino was never restrained physically or chemically for the purposes of conditioning, examination, or treatment. Starting in July of 1995, the female was exposed to daily rectal examination in the chute without chemical restraint. Within 2 weeks the application of transrectal ultrasound was successful, and documented that this female was late-term pregnant. This was important management information as it allowed for both nutritional and facility modifications needed in preparation for an impending birth.

The management implications of this work are obvious regarding captive rhinoceros propagation. In this case, a decision to postpone immobilization of the black rhino female for more aggressive treatment of the hoof crack was based partly on ultrasonographic confirmation of late-term pregnancy. Furthermore, the conditioning process not only allowed for the transrectal ultrasound examinations, but enabled successful treatment and monitoring of the hoof problem in a previously untractable rhino.

## CASE STUDY II

### *Medical and reproductive management of a pregnant black rhinoceros*

On June 15, 1996, a 5.5 year-old female southern black rhinoceros (*Diceros bicornis minor*) was bitten on the upper lip by a suspected rattlesnake (*Crotalus sp.*). The rhino was approximately 8 months pregnant at the time of envenomation, and the subject of an ultrasonographic study to document normal fetal changes throughout gestation in this species. The pregnant cow developed signs of respiratory distress, marked swelling at the site of the bite, and a skin reaction. Following several days of supportive care, the rhino appeared to have recovered. The rhino managers were concerned; however, that the envenomation may have adversely affected the fetus - a routine ultrasound exam confirmed that the fetus appeared healthy with a visible heartbeat. Another medical problem occurred several months previously in which the same female was treated with the antibiotic Trimethoprim-sulfa and subsequently developed a severe skin reaction to this medication. Ultrasound was used as a "tool" to assess fetal viability during a suspected allergic drug reaction in this rhino.

## CASE STUDY III

### *Facilitated breeding to shorten the inter-birth interval in a black rhino cow with young calf*

An adult female southern black rhinoceros (*Diceros bicornis minor*) was part of a study to ultrasonographically characterize the reproductive cycle of this species. Although this female did show obvious signs of estrus, we were able to document the ovarian changes that accompanied these behavioral events. In this way, the rhino keeper and researcher were able to work together to predict when this female would return to estrus and thus help plan an introduction of the male to facilitate a "timed breeding". A complicating factor in this effort was the simultaneous concerns over compromising the health of this cow's ~9 mo-old calf if included in the breeding process, a common factor that has been primarily responsible for an unacceptably long interbirth interval in most captive breeding situations for the black rhinoceros. In this case, ultrasonography together with behavioral observation were utilized to plan a separation of cow and calf for a short period (~5 hrs) and introduction of the male and female for breeding. The female eventually bred successfully producing an estimated interbirth interval of approximately 26 months with pregnancy confirmed via ultrasonographic identification of a 27 day-old embryonic vesicle. This technique of timed breeding would be especially useful in individual rhinos that lack overt signs of behavioral estrus.

## CASE STUDY IV

### *Infertility diagnosis, therapy, and anesthetic considerations in a white rhinoceros*

A 35 yr-old southern white rhinoceros (*Ceratotherium simum simum*) was diagnosed with a chronic uterine enlargement via routine ultrasound exam. This female was reproductively evaluated without sedation in the free-stall chute as previously described. Although chute conditioning of the rhinoceros has limited the need for anesthesia, occasions still arise when anesthesia becomes necessary. Immobilization

of this rhino was performed on multiple occasions for diagnostic and therapeutic reasons. At these times, we have found that a well-conditioned animal can be safely anesthetized with a less-potent anesthetic drug combination utilizing butorphanol and azaperone. The benefits of this combination include reduced risks of adverse side-effects compared to the more commonly used potent narcotics (ie. etorphine or carfentanil); this technique would not be possible without a rhino well-conditioned to people and medical procedures. For example, use of butorphanol/azaperone for "standing" anesthesia in a white rhino facilitated the first successful laparoscopic surgery in this species, and was only possible in a conditioned rhinoceros within a controlled environment. Ultrasound has proven to be an essential tool to diagnose, assess, treat and monitor this case.

### MEDICAL ISSUES AND NUTRITION

The medical care of the black rhinoceros species, in particular, is facilitated by a well-conditioned rhino in collaboration with an attentive rhino keeper and intern. For example, the ability to examine the rhinoceros without anesthesia and its associated risks is a key component of our daily management. The conditioned rhinoceros allows touching over all parts of its body and evaluation of feet, hooves, eyes, ears, and oral cavity. In addition, routine blood collection is facilitated by a rhino care staff that works closely with the animals through feeding in the chute and touching of legs and ears where blood collection is performed. Early detection of important diseases of the black rhinoceros is essential to successful management and treatment. Frequent evaluation of the oral cavity for ulceration or dental disease is done routinely when rhinos are fed their daily vitamin E. Observation of mucous membrane color (especially the conjunctival area) is critical in a species that has a propensity for hemic disorders including hemolytic anemia and a nonhemolytic vasculopathy. Another very important part of medical care of the rhino involves the keepers ability to pick up on subtle variances in an animal's behavior, movement or appearance that can only come from a close relationship with his/her animals.

One of the most significant factors in health of the black rhinoceros, nutrition is another area where the rhino keeper is essential to management and research of an improved captive diet. Browse studies including palatability of different local species as well as the possible use of frozen browse are two examples of keeper-based projects designed to facilitate improved dietary management of our black rhinos.

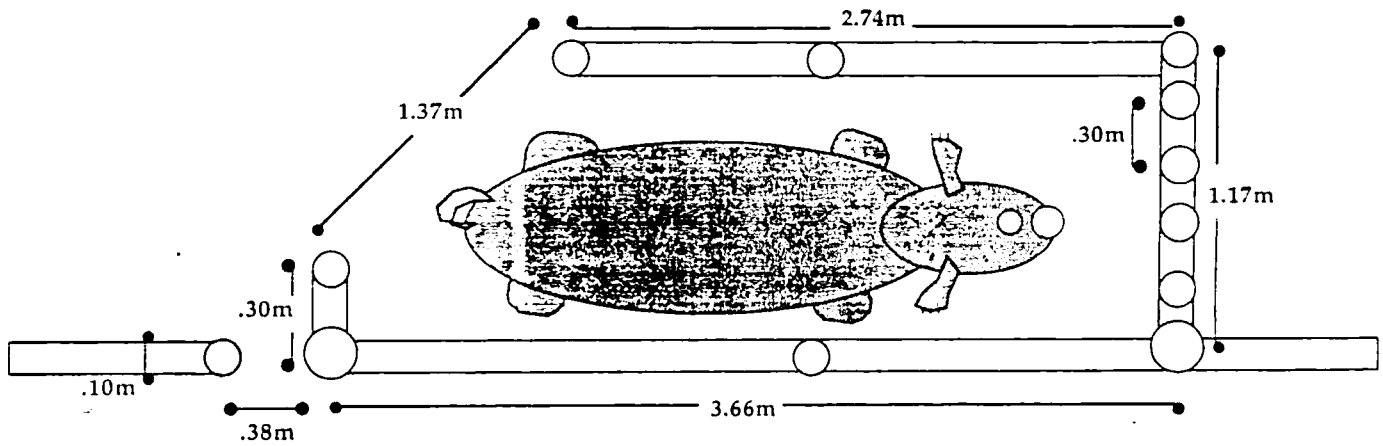
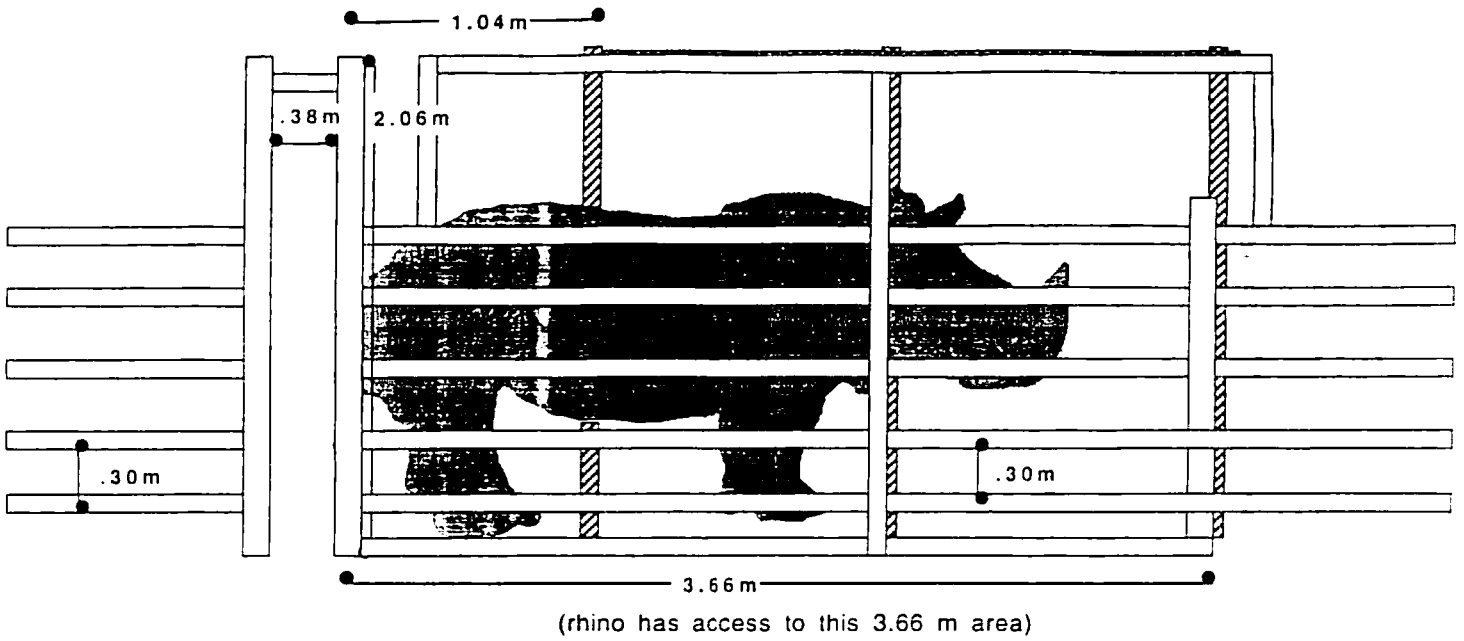
### CONCLUSIONS

The rhino keeper and intern are an integral part of Fossil Rim's animal care and health team. This collaborative approach is important to successful management of the captive rhinoceros by providing the following key benefits:

- 1) Close monitoring of behavioral aspects for reproductive research
- 2) Early identification and monitoring of medical conditions and disease
- 3) Nutritional management of the rhino
- 4) Training of interns

scale: 1 cm = .61 m

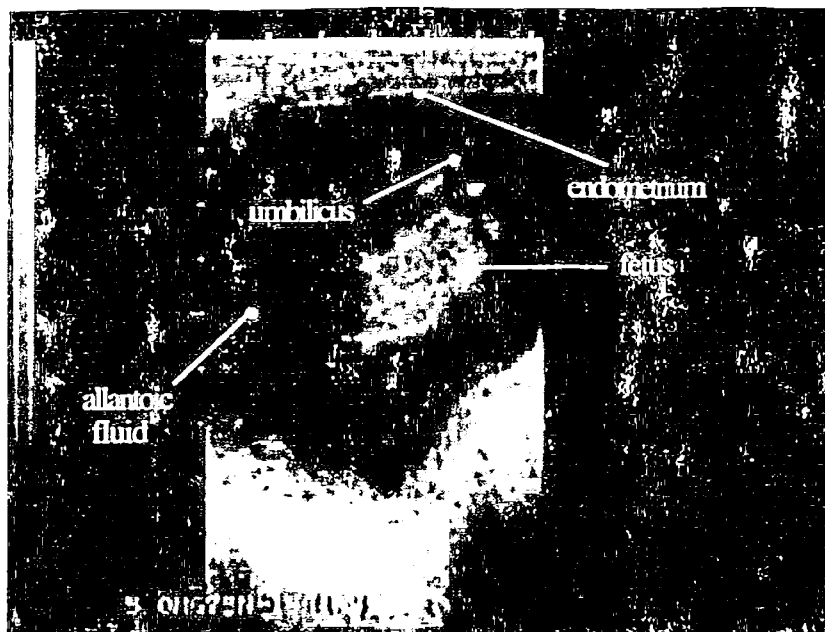
▨ = structure on left side of chute



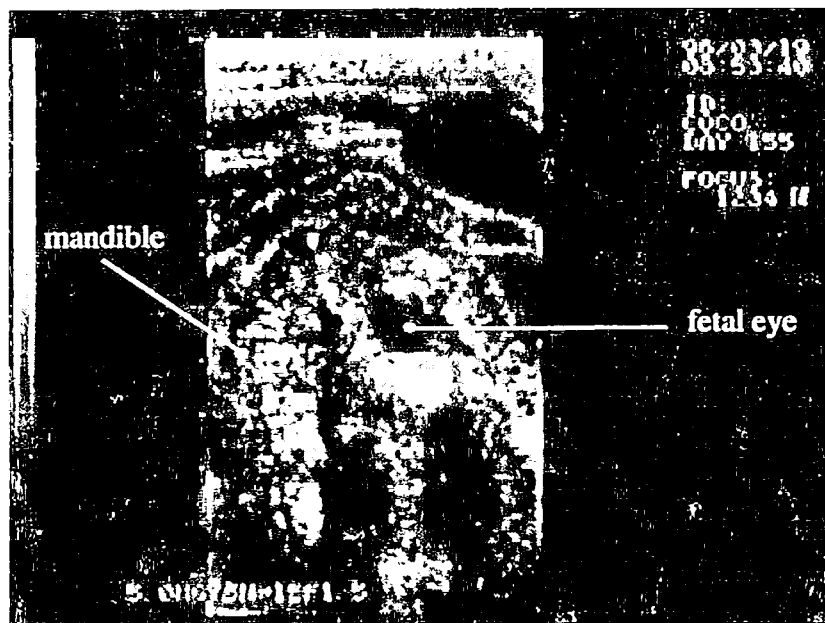
**Figure 1**

Diagrammatic representation of the "free-stall" chute that has facilitated transrectal ultrasonographic reproductive evaluation in the black rhinoceros (Adapted from Radcliffe, Bommarito, and Osofsky, 1996. *Pachyderm* No. 21).

Figure 2



Ultrasound image of a 56 day-old black rhinoceros fetus.



Ultrasound image of the fetal head and eye in a 155 day-old black rhinoceros fetus.