

## Reproductive Disorders in White Rhinoceroses and the Value of Ultrasonographic Assessment

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Based on endocrine monitoring 50% of the female white rhinoceros EEP population is considered to have no luteal activity. This lack of luteal activity represents one significant cause for the limited reproductive success of white rhinoceroses in captivity. Ultrasound evaluations of the reproductive tract combined with long-term endocrine monitoring were conducted in n=11 an-oestrous and 4 cycling females to elucidate the ovarian and uterine status. Five sonographic types of an-oestrous (flat-lining) females were characterised: *type I* (n=3) small inactive ovaries, associated with uterine fluid accumulation in one older female; *type II* (n=2) persistent luteal structures; *type III* (n=1) animal with follicular cysts, *type IV* (n=4) young females with dynamic follicular development but lack of ovulation, *type V* (n=1) animal with massive para-ovarian tumour. In three regular cycling females cystic endometrial alteration was identified as predominant pathological finding. Due to the advanced status of alterations, a total of four females ( $\geq 27$  years) were considered post-reproductive. Only females  $\leq 11$  years were free of pathological alterations. Reproductive tract ultrasound resulted in (1) the accurate evaluation of the breeding potential, (2) the sonographic characterisation of an-oestrous females and (3) the selection of candidates for natural or artificial breeding efforts. Increased use of ultrasonography in rhinoceros reproduction is useful tool to enhance breeding success in captivity.

## Using Daily Keeper Questionnaires to Predict Estrus in Rhinos

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Recognizing and understanding the basic biological characteristics of reproduction in rhinos will help zoo managers facilitate their propagation. The Daily Keeper Questionnaire (DKQ) is part of a larger longitudinal research project on reproduction in African rhino species and is being tested on Zoo Atlanta's black rhinos (*Diceros bicornis*) to identify which behavioral and physical characteristics are the most reliable indicators of estrus. Various versions of the DKQ were developed as management tools to assist animal care staff in identifying and following estrus, gestation, and parturition in African rhinos. Predictive ability can allow staff to advantageously prepare for these reproductive events. The current version of the questionnaire for estrus has 15 behavioral and physical attributes of adult male and female rhinos related to reproduction. The items on the questionnaire are rated on a 0-4 scale and pertain to both the female and her mate(s), as the latter may be providing

indicators of the female's state. The DKQ was designed to capture the keepers' general impressions of the rhinos without requiring time away from daily routines for formal observations and takes only five minutes to complete at the end of each day. Preliminary results indicate that estrus prediction is possible for individual rhinos using this DKQ. Analysis of Zoo Atlanta's female's data suggests that increased agitation, interest in the male, aggression, and vulvar swelling or winking contribute most to keeper recognition of impending estrus. For the male, the most salient contributing factors are increased aggression, vocalization, agitation, horn digging, and following. Chin resting and mounting are strong factors which are indicative, though not predictive, of estrus. By participating in behavioral data collection, the keepers are generally more aware of the rhinos' changing dispositions, allowing improved daily management of the rhinos including preparations for breeding.

## Faecal steroid analysis in free-ranging female white rhinoceroses (*Ceratotherium simum simum*) on Otjiwa game ranch in Namibia

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Acyclicity is the major cause of low reproductive rates in captive white rhinoceroses; additional confounding factors are variable oestrous cycle lengths of 35 or 70 days and silent oestrus due to mate choice problems. The objectives of this study were to determine whether these conditions are present in wild populations. Study site was Otjiwa game ranch, Namibia (100 km<sup>2</sup>; n=26 white rhinoceroses). Fresh dung samples were serially collected after tracking by game scouts. Samples were stored in methanol and dried prior to analysis with an established 20-oxo-pregnane assay. All females of breeding age (n=8) had calves; calving intervals of less than 2.5 years in the older animals (n=6) indicate that infertility conditions are not present in this wild population. Farm size and brush coverage made tracking difficult and average individual sample collection interval was  $38.5 \pm 5.0$  d (range 1-100 d). This and the fact that females seem to become pregnant shortly after lactational anoestrus hindered statements on cyclicity. However, pregnancy diagnosis, even from single samples was 100% accurate after Day 120 (threshold value: 3000 ng/g faeces; significantly higher concentrations in >120d pregnant versus non-pregnant and <120d pregnant animals; p=0.001). In summary, pregnancy was accurately diagnosed by faecal steroid analysis in a wild white rhino population. Low reproductive rates, similar to those in the captive population were not present. For oestrous cycle diagnosis sample frequency during inter pregnancy periods needs to be increased. It can be concluded that faecal steroid analysis in wild white rhinoceros populations offers new perspectives for in situ and ex-situ management of this species.