# Does dehorning lead to a change in inter-calf intervals in free-ranging white rhinoceros?

*Samuel G Penny[1]*, Rachel L White[1], Dougal MacTavish[2], Lynne MacTavish[1,2], Dawn M Scott[1], Angelo P Pernetta[1]*

[1]Ecology Conservation and Zoonosis Research Group, School of Pharmacy and Biomolecular Sciences, University of Brighton, Brighton, UK
[2]Rustenburg, Northwest Province, South Africa
*corresponding author: s.penny2@brighton.ac.uk

## Introduction

Understanding changes in fecundity can aid the evaluation of rhino reproductive health (Rachlow and Berger 1998). Immobilisations of wildlife as part of management activities have been implicated in decreases in reproductive success for some species. For example, resulting in abortion in mountain goats (*Oreamnos americanus*) (Côté et al. 1998) or post-natal calf loss in moose (Alces alces) (Solberg et al. 2003). Immobilisation-induced declines in rhino productivity may therefore be of concern when dehorning (Lindsey and Taylor 2011). Dehorning, also known as horn trimming, refers to the controlled removal of a portion of a rhino's horn by veterinary procedure. The procedure requires the animals to be immobilised via anaesthesia and does not typically result in injury to focal animals (Badenhorst et al. 2016). Previous work examining the inter-calving intervals (ICIs) of free-ranging black rhinos (*Diceros bicornis*) showed that individuals that underwent the most frequent immobilisations (for either radio collaring, dehorning, ear notching, or translocation) had the longest ICIs (Alibhai et al 2001). However, Atkinson et al. (2002) contested this conclusion, due to flaws in the study's statistical analysis and design. This included pseudo-replication and that a rhino's immobilisation history may have in part been a function of its health and age. Furthermore, a more recent study of black rhinos found no link between immobilisations and ICIs, whereby the ICIs of a dehorned population in Zimbabwe were no longer than the southern African regional average (Du Toit and Anderson 2013). However, data on the ICIs of free-ranging dehorned white rhino populations are not available. Here we present differences in ICIs before and after a dehorning procedure.

## Methods

Thirty-one births were recorded from seven white rhinos (*Ceratotherium simum*) on a reserve in Northwest Province, South Africa between 25 November 1996 and 06 December 2019 (Table 1). The reserve is privately owned, covers an area of 4,932 ha and topographically is relatively flat, ranging from 1,050 m to 1,170 m above sea level. Vegetation is within the Central Bushveld Bioregion and consists of broad-leaved deciduous bushveld, with a mosaic of pediment grasslands and thickets (Mucina et al. 2006). The reserve's revenue is generated through ecotourism, education, commercial hunting and the capture and sale of wildlife to restock other Protected Areas. White rhinos were first introduced to the site in 1992 and the majority of other native medium to large bodied (>10 kg) browsers and grazers are also present. The white rhinos live off natural food sources throughout the year but have access to several artificial mineral licks and water sources. The white rhinos receive limited husbandry and veterinary care, have a natural breeding strategy and undergo biological management (see Emslie and Brooks 1999). This includes the removal and replacement of a related adult male. Despite being fenced, the population meets the African Rhino Specialist Group (AfRSG) criterion for a wild population (Leader-Williams et al. 1997). Furthermore, the population is representative of those found elsewhere in Southern Africa, where rhino populations are usually fenced

Table 1. Births at the reserve between 25 November 1992 and 27 January 2020. Emboldened dates indicate a mother was dehorned prior to calf birth. Asterisk indicates a stillbirth.

| PARITY | Rhino ID | | | | | | |
|---|---|---|---|---|---|---|---|
| | F1 | F2 | F3 | F4 | F5 | F6 | F7 |
| 1 | 25 Nov 96 | 01 Dec 97 | 01 Dec 97 | 06 Feb 06 | 18 May 12 | **25 Jan 16** | **10 Apr 17** |
| 2 | 23 Jan 02 | 15 Jan 01 | 20 Jul 01 | 15 Nov 08 | **02 Apr 16** | **13 Jan 19** | |
| 3 | 24 May 04 | 04 Apr 03* | 07 Apr 05 | 28 May 12 | **06 Dec 19** | | |
| 4 | 20 Apr 06 | **01 Jan 06** | 29Mar 08 | **21 Jun 15** | | | |
| 5 | 06 Dec 08 | **15 Apr 08** | 22 Mar 10 | **15 Mar 18** | | | |
| 6 | | **10 Apr 11** | 13 Feb 13 | | | | |
| 7 | | **17 Mar 14** | **15 May 15** | | | | |
| 8 | | | **04 Mar 18** | | | | |
| Status | Translocated | Poached | - | - | - | - | - |

Table 2. Mean inter-calf intervals (ICIs) in months plus their standard deviation. Parentheses indicate number of ICIs. The overall mean was taken from the individual means rather than from all ICIs.

| Rhino ID | Mean inter-calf interval + SD (n) | | |
|---|---|---|---|
| | All | Horned | Dehorned |
| F1 | 36.6 ± 15.5 (4) | 36.6 ± 15.5 (4) | - |
| F2 | 39.7 ± 10.9 (5) | 49.2 ± 11.2 (2) | 33.3 ± 3.9 (3) |
| F3 | 35.2 ± 7.3 (7) | 37.0 ± 7.6 (5) | 30.8 ± 3.4 (2) |
| F4 | 36.8 ± 3.9 (4) | 38.4 ± 4.6 (2) | 35.3 ± 2.0 (2) |
| F5 | 46.0 ± 1.2 (2) | - | 46.0 ± 1.2 (2) |
| F6 | 36.1 (1) | - | 36.1 (1) |
| Mean | 38.4 ± 3.6 [6] | 40.3 ± 5.2 [4] | 36.2 ± 5.2 [5] |

with some degree of management interventions (Thompson et al. 2016). Since the initial introduction of white rhinos, their demographics have changed due to births, natural mortalities, translocations, and poaching losses.

Inter-calf intervals (ICIs) were calculated for all sequential births excluding one pre-term stillbirth. All birth dates were accurate to within two weeks of parturition. ICIs were classified as belonging to dehorned mothers if conception date occurred after the procedure. Conception dates were estimated by back-counting the average white rhino gestation length of 495 days from parturition (Linklater 2007). One of the seven rhinos (F1) did not undergo dehorning and was translocated prior to the procedure. Four rhinos (F2, F3, F4, F5) were breeding both prior to and after dehorning, while two (F6, F7) did not enter sexual maturity until after their first dehorning procedure. For the dehorned rhinos, F2 was dehorned once in July 2004, while F3 to F7 were dehorned three times each beginning in October 2014 (every 12 to 24 months). Rhinos were only immobilised for dehorning over the study period. Age of first reproduction was unknown for rhinos born outside of the reserve (F1, F2, F3).

## Results

Age of first reproduction of two rhinos that gave birth prior to dehorning was 99.6 months (F4) and 86.6 months (F5), and for the two rhinos that gave birth after dehorning it was 87.6 months (F6) and 85.4 months (F7). Average ICIs were lower in dehorned rhinos than horned rhinos (mean difference 4.1 months: Table 2). This pattern continues if only those rhinos with ICIs available before and after the procedure (F2, F3, F5) are considered.

## Discussion

Dehorning did not appear to influence the reproductive health of free-ranging white rhinos in this population. The mean ICIs of the dehorned rhinos fall between the mean ICIs of a fenced population of horned white rhinos reported by Rachlow and Berger (1998) over two periods within Whovi Game Park, Zimbabwe (early period: 34.8 ± SEM 1.2 months; n = 6 females; 21 intervals; late period: 39.6 ± 2.43 months; n = 8 females, 19 intervals). The age at first reproduction of dehorned rhinos also fell within the range reported within Whovi Game Park (78 to 138 months; Rachlow and Berger 1998). However, mean ICIs of the reserve are higher than those reported from horned white rhinos in Hluhluwe-Umfolozi Game Reserve (mean 30 months, births = 45; Owen-Smith 1973). Additionally, the ICIs of the dehorned rhinos were higher than those reported by Ververs et al. (2017) of a dehorned but game-ranched population (median: 29.2 months, n = 562 births) as was age of first reproduction (median 83.2 months). The ICIs of the dehorned rhinos were also higher than those reported from horned captive white rhinos (mean: 34 months, n = 40 births; Skinner et al. 2006). Although in both these latter cases the rhinos were heavily managed to maximise reproductive success and are not kept under natural conditions (Skinner et al. 2006; Ververs et al. 2017). Thus, these findings suggest that the reproductive performance of a free-ranging white rhino population was not compromised by the procedure. Future research would benefit from the monitoring of ICIs in other populations of dehorned white rhinos to aid in the design of evidence-based management strategies to maximise population growth rates.

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