African Rhino Specialist Group

# ASSESSMENT OF THE BUFFALO DREAM RANCH CAPTIVE BREEDING OPERATION'S WHITE RHINO POPULATION STATUS AND PERFOMANCE

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**IUCN SCC African Rhino Specialist Group**

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# EXECUTIVE SUMMARY

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- This report provides an independent assessment by the IUCN SSC's African Rhino Specialist Group (AfRSG) of the Buffalo Dream Ranch white rhino population's genetic and demographic viability, its role in meeting South Africa's white rhino Biodiversity Management Plan, and its status in African continental rhino conservation, in light of the application to register as a CBO with CITES.

- This review followed requests for an independent assessment from owner Mr John Hume, North West Province Department of Rural, Environment and Agriculture development, and the South African Department of Environmental Affairs (DEA).

- The Buffalo Dream Ranch (BDR) is a registered Captive Breeding Operation (CBO) with the North West Provincial conservation authorities. Owner Mr John Hume wishes to register it with the DEA as an operation that breeds *Ceratotherium simum simum* in captivity for commercial and conservation purposes in terms of CITES Resolution Conf. 12.10 (Rev.CoP15).

- Buffalo Dream Ranch (BDR) had its first white rhino introductions in 2008. By 30 June 2018, 957 white rhino introductions had taken place on of 8167 hectare property. 1050 calves have been born on the property since 2009, including more recently the first F2 generation offspring. At 30 June 2018 the population numbered 1,615 rhinos.

- The lead reviewer had visited the property to view operations in 2014 and 2016. She was provided with the up-to-date BDR studbook and database (to 30-June-2018) for assessment purposes and additional relevant site information as requested. BDR population statistics and performance characteristics were summarised and rated according to standardized methods and indices developed by the AFRSG and regional SADC Rhino Management Group for rhino status reporting.

- The operation fits the definition of a semi-intensive conservation system defined in population "wildness" terms. It also fits the definition of a "controlled environment" as defined in CITES Resolution Conf. 10.16 (Rev.), terminology point d), and is classed as Captive Breeding Operation by the South African National Biodiversity Institute (SANBI). The rhinos are kept in 21 sub-populations, each in individually-fenced duel-camp areas (of 200 to 573 hectares for breeding camps), supplied with supplementary feed for up to 48% of their annual dietary needs, and able to use natural grazing for 52% of their diet. Over 100 staff are employed for daily rhino monitoring, camp maintenance and basic security, rhino husbandry, and veterinary needs. Additional personnel attend to anti-poaching matters. Ecologically the camps are monitored and managed according to sound ecological guidelines including full growing-season veld resting of camp-halves every alternate year and maintaining of rhino below maximum allowable stocking densities.

- Between 27 and 157 rhinos were introduced each year from 2008 to 2016, sourced from 98 different sites in South Africa. Of the total 957 introductions, 299 were male and 658 were female. Of the 1050 births, 183 were conceived off site before the mother's translocation to BDR. These together with the introduced rhino comprise the F0 generation. 865 calves were conceived and born on-site, with one or both parents being F0 animals - thus comprising genetically the F1 generation. Another two calves born onsite in 2018 to F1 mothers were recorded mating with an F1 male, thus producing the first two F2 calves. For certainty, parentage has been verified by DNA analysis, hence confirming the ability of the CBO to produce F2's.

- The sub-populations are managed to ensure diverse founder genetics; free mate choice of 2 to 7 breeding males by the 20-50 odd breeding females per breeding camp; no selective breeding; minimising of inbreeding

via replacement of breeding males periodically; and removal of subadults to create new sub-populations of mixed genetics in new camps.

- The population has achieved very good net growth rates averaging 8.7% per year since 2008. 32 rhinos were lost to poaching, however poaching rates averaged only 0.6% of the population, compared over 5% poached per year on average in the rest of South Africa. The underlying biological growth rate averaged 9.64%, while mortality rates excluding poaching have been well below 4%/year. BDR performance greatly exceeds that in much more intensively-managed overseas captive breeding establishments, which have until recently have been overall below wild rhino benchmarks (as used in the AfRSG and SADC Rhino Management Group) in most aspects.

- The BDR performance parameters including female breeding rates have exceeded regional minimum benchmarks, and most fall into the category of good to very good. The current F1 animals are mostly of subadult age and their breeding rates cannot yet be fully judged. The greatest challenge has been Clostridial disease outbreaks (c. 47 deaths), for which vaccines were developed and are being perfected.

- The BDR population now constitutes the widest genetic base for white rhino outside of Hluhluwe-iMfolozi Game Reserve (the source of all *C.s.simum* in Africa) and Kruger National Park.

- While prioritising wild populations, provision for the undertaking of captive breeding operations like BDR are included in South Africa's Biodiversity Management Plan for white rhino.

- Under feared continuance of 2017 poaching rates in South Africa and projections of basically zero net population growth in the rest of SA's metapopulation, BDR are predicted to contribute 1,990 rhino (11%) of the predicted country total of the 17,813 rhino in year 2020. This number will valuably assist towards SA not missing by too huge an amount its white rhino national target (not modified for exports from SA) of 20,400 rhino by 2020.

- The BDR population is rated by the IUCN African Rhino Specialist Group as a continentally ***Key1***, (> 100 animals -stable or increasing over the last 5 years) white rhino population. The rating holds because the animals are genetically the same as wild populations and are maintained in circumstances which allow mate choice, largely normal social behaviours and interactions, and reasonable exposure to natural food and various environmental and disease challenges.

- From a South African and continental view, the BDR population constitutes a viable and valuable contingency operation for the protection and production of white rhino at a time of major poaching threats where several populations including Kruger NP have declined. It has the potential to help restock sites within SA and Africa if needed, and to supply international approved operations that wish to breed white rhino for approved purposes.

- Finally, because rhino poaching is driven to a significant extent by the perceived rarity - of rhino, and of rhino horn supply - in the mind of Asian users/dealers, the BDR CBO, by breeding large numbers of rhino towards boosting SA and continental numbers and maintaining a significant horn stockpile, is helping to some extent counteract the dangerous and perverse underlying market forces driving poaching.

# INTRODUCTION

## The reason for this assessment

In December 2017, the Department of Environmental Affairs (DEA) received an application by Mr John F. Hume to register Buffalo Dream Ranch (BDR), provincially-licenced Captive Breeding Operation (CBO), as an operation that breeds *Ceratotherium simum simum* in captivity for commercial purposes in terms of CITES Resolution Conf. 12.10 (Rev.CoP15). The application at that time had not yet produced true F2 generation progeny on the BDR site as the calves in question had parents born on BDR but conceived on another site (Mauricedale), formerly managed under a similar management regime with supplementary feeding, but which was not registered for captive breeding with a provincial authority.

More recently the BDR provincially- registered captive breeding operation has reported that two locally-conceived and born true F1 generation females (i.e. females conceived and born on BDR) have each produced true F2 calves after recorded matings with a locally-conceived and born F1 generation male. DNA verification has been obtained as requested by the DEA to support a resubmission for registration and a CBO under CITES.

Given the December 2017 application, and the need for the applicant and North West Department of Rural, Environmental and Agricultural Development to furnish additional information in regard to the CITES-compliant registration of this white rhino Captive Breeding Operation through the DEA, IUCN's Species Survival Commission's African Rhino Specialist Group (AfRSG) was requested by Mr Hume to independently review and assess the status and performance of the BDR population, to comment on its current and potential place in South Africa's white rhino conservation efforts as specified in this species' National Biodiversity Plan, and its role as a rated AfRSG continentally ***Key1*** population. The Chair of the AfRSG appointed AfRSG and SADC RMG member Keryn Adcock to undertake the core assessment given her knowledge of the operation and her work compiling rhino status report summaries for the SADC RMG since 1994. Other AfRSG members were also asked for their input (Dave Balfour, Richard Emslie, Susie Ellis). *Issues of the financial sustainability and economics of the operation are not part of this review as Mr Hume will provide such information separately for the relevant Authorities*.

**Terms of Reference for the AfRSG assessment of the population performance of the Buffalo Dream Ranch Captive Breeding Operation** (reference Izak du Toit/GAR8/0104 dated 5 July 2018, for his Client Mr John F. Hume).

The AfRSG agrees to undertake an independent evaluation and report on the of the Captive Breeding Operation (CBO) of white rhinoceros population on the Buffalo Dream Ranch (BDR). The terms of reference will address the following issues (*not necessarily in this order*) with emphasis of items 4, 5, 7 & 8 below:

1. Provide a brief background to the BDR Captive Breeding Operation (CBO), including objectives and site description, and its categorization as a CBO rather than wild population by SANBI.

2. Detail how the operations fits in with the approved Biodiversity Management Plan (BMP) for the white rhino in South Africa, 2015-2020 and the draft criteria for captive breeding of white rhinos developed by a Rhino Management Group working group (SADC RMG).

3. Describe and evaluate the management characteristics of the operation, and standards of husbandry of the rhino and maintenance of the CBO natural ecosystem (veld).

4. Calculate and interpret (in comparison to wild, ranched and Zoo situations), various measures of BDR white rhino population performance, including these: a. The fecundity of different female cohorts, including the F1 rhino: b. Mortality rates and causes, including comparison to the rest of South Africa and Africa, specifically c. The achieved (net) and underlying biological rates of population growth rates.

5. Evidence for production of F2 calves at BDR, as required for an initial CITES CBO registration.

6. Describe and comment on the genetic foundation of the population, genetic management activities to prevent excessive inbreeding, and the resulting current and future potential genetic characteristics of the herd. Should these rhinos still be considered genetically as part of the National herd?

7. Comment on the AfRSG rating of the population.

8. Draw conclusions on the current and potential contribution of the BDR white rhino to rhino conservation

## Assessment Methods

Through the Buffalo Dream Ranch Resident Veterinarian Dr Michelle Otto, the lead AfRSG reviewer received a wide variety of relevant BDR information. This included complete BDR Studbook information and their detailed monitoring database from the start of the operation to 30 June 2018; the current updated BDR Management Plan (Otto, 2018a); and Dr Otto's own highly detailed Veterinary Review Report of the biological management and breeding efficiency of Buffalo Dream Ranch captive white rhinoceros breeding operation.

For purposes of data analysis for the AfRSG assessment, the lead reviewer transformed the relevant studbook and monitoring database information into a standardized and semi-automated rhino population analysis format (spreadsheet file), devised previously by the lead reviewer for the regional SADC Rhino Management Group to track key population performance parameters from detailed individual rhino history databases. Additional statistical parameters relevant to the BDR captive situation were added to facilitate extraction of most questions one may think of to ask of the available data (Appendix 5 lists data fields used). Definitions of relevant CITES terms and other definitions and abbreviations used in this document are given in Appendix 4.

In addition, it should be noted that the lead reviewer has twice (in 2014 and 2016) visited the BDR CBO, and had with Dr Richard Emslie of the AfRSG and SADC RMG observed several of the rhino duel-camp systems, viewed some of the security measures being implemented, visually examined the veld condition in several camps and accessed veld assessment reports, observed a rhino supplementary feeding spot in action, and visited the onsite rhino orphanage (Dr Emslie also visited the site in the height of the 2016 drought as part of the "South Africa Rhino Lab"). A preliminary review report was also produced (Adcock and Emslie 2015). The current review work here was done by Keryn Adcock *pro bono* for rhino conservation purposes. Other listed reviewers have also not been paid by Mr Hume or the BDR CBO, thus the report can be considered independent.

## BDR background, site information and management strategy

The document **"**Management Plan for a Southern White Rhinoceros (*Ceratotherium simum simum*) Captive Breeding Operations on Buffalo Dream Ranch", Otto 2018a, provides comprehensive details on the BDR site and operational strategy. The plan is only briefly described below - ***More details from the management plan are summarized in Appendix 1. A site map from the management plan is shown in Appendix 1. Site photos can be seen in Appendix 6.***

Briefly, the BDR captive breeding operation is in the North West Province West of Klerksdorp, and covers several land portions purchased at different times, now comprising a total of cover 8167 ha. The first land was purchased in 2008 and the first rhino were purchased and introduced that same year. Annual rainfall average is from 600-650mm, and the vegetation is primarily open Highveld grassland on flat to undulating terrain.

The rhino are currently maintained in a system of 21 camps: 6 are bachelor camps of males, 14 have breeding groups with around 25 to 55 breeding females each, and 2 to 7 breeding males per camp, plus varying amounts of calves and subadults. Breeding camps are 240 to 573 ha in size. The last camp is an orphanage to care for ill calves or those whose mother may have died. Camps are all game-fenced and have shade and water provisioned.

The camps are divided into two halves, one of which is rested over the growing season until after grass seed-fall, with each half being rested in alternate years. Veld condition is regularly assessed by a professional. A varied supplementary feed mix is supplied to the rhino for usually 9 months of the year making up to 48% of the rhinos' annual dietary needs, with the rest being obtained by natural grazing.

**Stocking densities**: Breeding female densities are maintained so there is at least 9 ha per female, and total rhino numbers per camp are maintained to have at least 3 ha per animal of any age or sex. Breeding bull densities are kept with at least 8 ha/bull.

The site employs over 100 staff, about half from local communities in the area. Key staff including a full time Veterinarian, veterinary nurse and general manager, and a dedicated Camp Master for each camp. Security is multi-faceted as described in the BDR management plan and Otto 2018b. This includes regular dehorning of

animals. All live rhino (except infants) and all horn pieces are marked with TRAFFIC compliant systems and have samples sent for DNA analysis with Onderstepoort's Veterinary Genetic Laboratory (RhODIS).

## Objectives of the BDR CBO

The stated primary objective of the Buffalo Dream Ranch CBO is the breeding, protection and conservation of white rhino in circumstances where the species is under severe pressure and immediate threat of poaching. BDR aims to achieve both of the objectives stipulated under the definition of "Captive Breeding Operation" in Section 1 of TOPS, i.e. for conservation purposes and for commercial purposes. Saving rhino is the first priority of this enterprise (2018 Management Plan Update, Otto 2018).

The stated Secondary and/or implied objectives relating to white rhino include, but are not limited to: education, training, anti-poaching security, hand rearing orphaned rhino, veterinary care and vaccination programs, veld management, rotational grazing programs, scientific research, data collection and evaluation, and pursuing and investigating viable commercial models aimed at sustainable utilisation of white rhino as a renewable natural resource.

# FINDINGS

## Population overview

The BDR population went from 0 in early 2008 to 1615 at end of June 2018, due to introductions and births. **Figure 1 on the next page gives a graphic summary of population history events and numbers over time.** 957 rhinos were introduced from 98 different sources over 9 years forming the main founder stock, to which can be added 183 calves from females arriving pregnant. These together constitute the "F0" generation. 865 calves were conceived and born on BDR constituting the F1 generation, 10% of which died before 1 year old. Two more, in May & June 2018, were from F1 mothers and an F1 father conceived and born on BDR (confirmed by DNA analysis), producing the first two F2 generation calves.

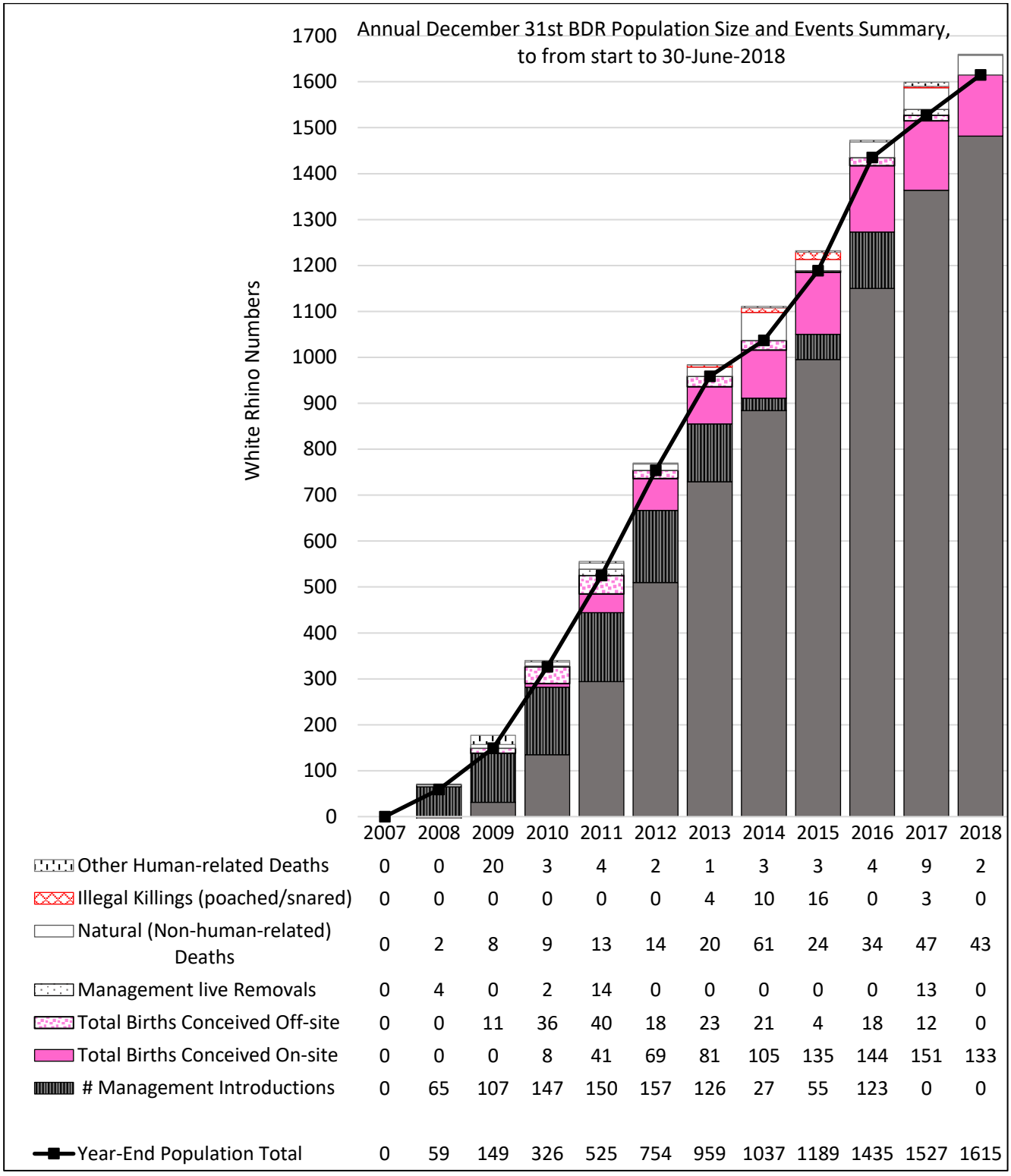
**Table 1. Summary of Introductions, births and deaths for each generation at BDR**

| | Introduced: Conceived Wild Born Wild | Introduced: Conceived Wild Born Wild | Conceived Wild Born On BDR | Born On BDR | Born On BDR | |
|---|---|---|---|---|---|---|
| **Generation** | **F0-P** | **F0-Pi** | **F0** | **F1** | **F2** | **Total** |
| **PRESENT at 30/6/2018** | **494** | **252** | **136** | **731** | **2** | **1615** |
| DIED | 135 | 57 | 42 | 125 | | 359 |
| REMOVED | 3 | 16 | 5 | 9 | | 33 |
| **Total** | **632** | **325** | **183** | **865** | **2** | **2007** |
| % Died by 30/6/2018 | 21% | 18% | 23% | 14% | | |

F0-P = an older introduced rhino including a mother, F0-Pi = introduced calf (arriving with its F0-P mother), F0 = calf conceived off site but born onsite to an introduced rhino arriving pregnant, F1 is a calf conceived and born onsite, but at least one of its parents was conceived off-site; F2 = a calf born to an F1 mother and father i.e. both parents were conceived and born on site (captive-bred).

**Table 2. Basic Summary numbers of the BDR population**

| | | | |
|---|---|---|---|
| **Total WR Alive at 30/06/2018** | 1615 | | |
| | | | |
| Total Management Introductions | 957 | Total Management Live Removals | 33 |
| # Males Introduced | 299 | Management Hunts | N/A |
| # Females Introduced | 658 | # Males Removed | 19 |
| % of introduced = female | 68.8% | # Females Removed | 14 |
| | | | |
| Total deaths | 359 | % First Year Calf Mortality | 10.0% |
| | | | |
| Natural (Non-human-related) Deaths | 275 | | |
| Illegal Killings (poached) | 32 | | |
| Other Human-related Deaths | 51 | (wire in gut, fence-related, capture/translocation related, post-release stress or post-release fighting) | |
| | | | |
| Total Births | 1050 | Calf Sex Ratio: % Male Births | 54.0% |
| Total Births Conceived on-site | 867 | *# calves born on BDR which died at <=1 year of age* | *105* |
| Total Births Conceived Off-site | 183 | Average % of Adult females calving per year | 36.7% |
| **# of Male Calves Born** | 564 | Total # of births to Subadults (<7yrs age) | 50 |
| **# of Female Calves Born** | 480 | | |
| **# of Unsexed Calves Born** | 6 | Average Observed Inter-calving Interval (Years) | 2.36 |




| | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Other Human-related Deaths | 0 | 0 | 20 | 3 | 4 | 2 | 1 | 3 | 3 | 4 | 9 | 2 |
| Illegal Killings (poached/snared) | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 10 | 16 | 0 | 3 | 0 |
| Natural (Non-human-related) Deaths | 0 | 2 | 8 | 9 | 13 | 14 | 20 | 61 | 24 | 34 | 47 | 43 |
| Management live Removals | 0 | 4 | 0 | 2 | 14 | 0 | 0 | 0 | 0 | 0 | 13 | 0 |
| Total Births Conceived Off-site | 0 | 0 | 11 | 36 | 40 | 18 | 23 | 21 | 4 | 18 | 12 | 0 |
| Total Births Conceived On-site | 0 | 0 | 0 | 8 | 41 | 69 | 81 | 105 | 135 | 144 | 151 | 133 |
| # Management Introductions | 0 | 65 | 107 | 147 | 150 | 157 | 126 | 27 | 55 | 123 | 0 | 0 |
| Year-End Population Total | 0 | 59 | 149 | 326 | 525 | 754 | 959 | 1037 | 1189 | 1435 | 1527 | 1615 |

**Figure 1.** Graphed history of the BDR population since it began with the main summary numbers tabulated. All items above the births denote animals ”removed” each year by mortalities or live removals. (***Note*** the last, 2018 column represents **half-year numbers** and will be higher by December 2018). [The top “births” segment marks all final year-end totals (shown by black line) because the base grey segment represents only the “unchanged” rhino present throughout a year].

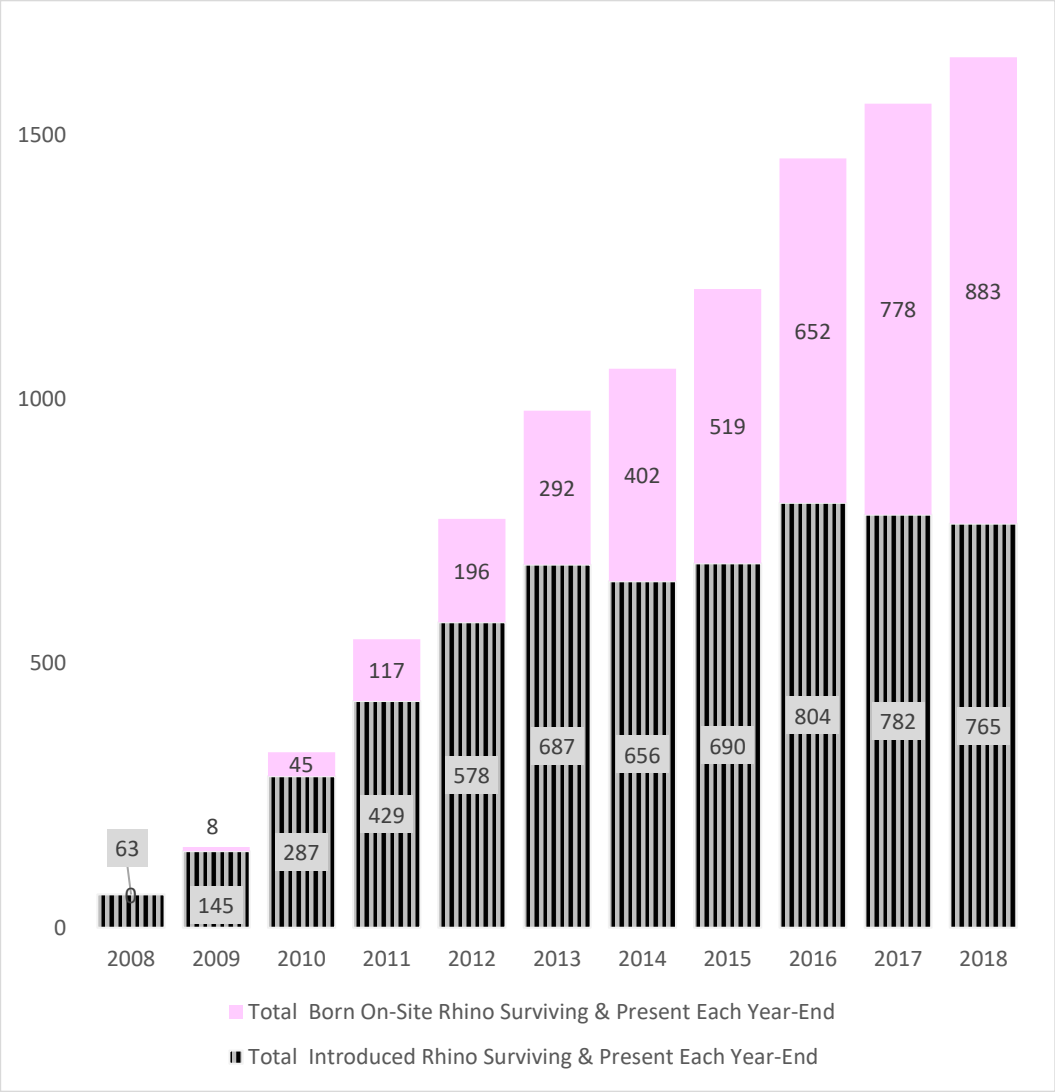



**Figure 2.** Numbers of Introduced rhino (barred) and rhino born on-site present at the end of each year at BDR.

The relative numbers of introduced versus born-onsite rhino present each year-end can be seen in figure 2 above. The numbers of white rhino present that were born on BDR exceeded the number of founders present on-site in 2018. Over the 10 years from mid-2008 to mid-2018, 192 of the introduced rhino died and 19 were removed. 5 F0 calves (conceived offsite but born onsite) were removed, and 9 F1's were removed. 42 F0 calves conceived offsite but born onsite died over the period, and 125 F1 calves born onsite died (i.e. total 167 calves born on-site died over the 10 years). Table 3 gives the basic numbers summary for BDR over time.

**Table 3**. Basic summary data for BDR from 2008 to 30 June 2018

| | ANNUAL YEAR-END SUMMARY | | | | | | | | | | (to 30 June) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Overall Basic Data Summary** | **2008** | **2009** | **2010** | **2011** | **2012** | **2013** | **2014** | **2015** | **2016** | **2017** | **2018** |
| Year-End Population Total | 59 | 149 | 326 | 525 | 754 | 959 | 1037 | 1189 | 1435 | 1527 | 1615 |
| # Management Introductions | 65 | 107 | 147 | 150 | 157 | 126 | 27 | 55 | 123 | 0 | 0 |
| Total Births Conceived On-site | 0 | 0 | 8 | 41 | 69 | 81 | 105 | 135 | 144 | 151 | 133 |
| Total Births Conceived Off-site | 0 | 11 | 36 | 40 | 18 | 23 | 21 | 4 | 18 | 12 | 0 |
| Natural (Non-human-related) Deaths | 2 | 8 | 9 | 13 | 14 | 20 | 61 | 24 | 34 | 47 | 43 |
| Illegal Killings (poached/snared) | 0 | 0 | 0 | 0 | 0 | 4 | 10 | 16 | 0 | 2 | 0 |
| Other Human-related Deaths | 0 | 20 | 3 | 4 | 2 | 1 | 3 | 3 | 4 | 10 | 2 |
| Management Live Removals | 4 | 0 | 2 | 14 | 0 | 0 | 0 | 0 | 0 | 13 | 0 |
| Management Hunts (also in human-rel deaths) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| # Rhino missing presumed dead (incl. in above mortalities) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Management Removals & Introductions Summary** | | | | | | | | | | | |
| # Males Removed | 4 | 0 | 2 | 4 | 0 | 0 | 0 | 0 | 0 | 9 | 0 |
| # Females Removed | 0 | 0 | 0 | 10 | 0 | 0 | 0 | 0 | 0 | 4 | 0 |
| # Males Introduced | 23 | 33 | 14 | 58 | 60 | 47 | 9 | 14 | 41 | 0 | 0 |
| # Females Introduced | 42 | 74 | 133 | 92 | 97 | 79 | 18 | 41 | 82 | 0 | 0 |

# Population performance

**Population growth performance at BDR has been very good**: Using regionally-accepted population performance indicators as used in SADC RMG Status reporting, and in SADC rhino guidelines (Du Toit, 2006), the BDR population has shown a very strong overall performance, achieving over 8.7% net growth per year in recent years with an underlying biological growth rate of over 9.7% per year (figure 3 and table 4). Growth rates of over 7.5% are rated good to excellent. [*growth rates account for introductions and removals: underlying biological growth rates differ from net achieved growth rates in that they treat all human-related deaths as "removals" in the calculation, to see what the rhino are achieving themselves excluding human actions*).

The first rhino poaching cases at BDR were in 2013. However poaching rates averaged only 0.6% of the BDR population from 2013 compared to 5.4% per year nationally (7.6%/yr in Kruger NP and 4%/yr in the rest of the country excluding BDR). Deaths from all other cause at BDR have been below 4 % (2 to 3.5%) per year, except for in 2009 (introduction losses-see later) -see table 3 above, figure 3 and table 4 below. Mortality rates of under 3% per year are normal (SADC RMG data), but once over 4% on average, are worrisome.

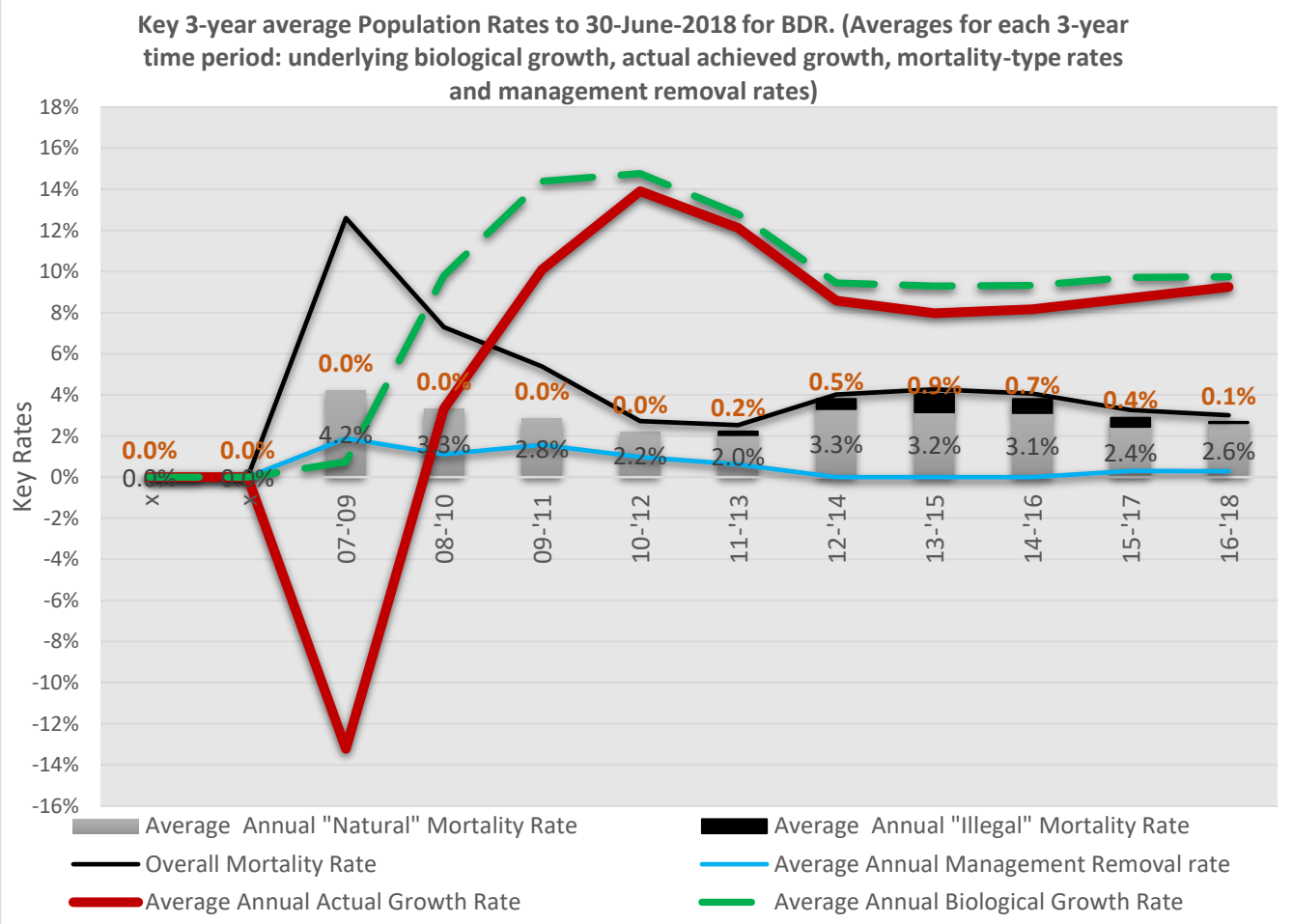



**Figure 3. Summary graph showing 3-year moving- window average population rates at BDR for key performance indicators**. Poaching rates (illegal mortality rates) are given in text above the bars (columns), natural deaths are given in the bar/column. 3-year running annual growth-rate averages are used as they smooth out year to year fluctuations due to non-annual calving intervals in rhino (gestation is 1.33 years) and allow overall time trends to be seen more clearly).

Dr Otto (2018b) has undertaken a detailed assessment of all aspects of the female breeding. *The reviewer's own analysis concurs overall with Otto's results which are calculated on a financial year, not a calendar- year basis as done here.* The only notable difference is in the way we calculate the Index of adult (7 years plus) females calving per year. The SADC RMG have always used the year-end adult female number while Otto

used the year-start number. Due to the frequent introductions of rhino over time into BDR, this report has now used the average number of adult females present in the year, to calculate this parameter - averaged over 3 year periods in the table below.

Like Otto, the AfRSG review also found that the **female breeding parameters at BDR are within normal ranges as found in many wild populations** (see Appendix 2 for a summary of published and unpublish white rhino performance information collated by the AfRSG).

**Table 4. List of the main performance parameters for BDR averaged for consecutive 3-year periods.**

| 3-YEAR MOVING AVERAGE SUMMARY | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Key Rates for 3-Year Periods | x | 07-'09 | 08-'10 | 09-'11 | 10-'12 | 11-'13 | 12-'14 | 13-'15 | 14-'16 | 15-'17 | 2016-'30-June'18 |
| Average Annual Biological Growth Rate | | 0.7% | 9.8% | 14.4% | 14.8% | 12.8% | 9.4% | 9.3% | 9.3% | 9.7% | 9.8% |
| Average Annual Actual Growth Rate | | -13.2% | 3.3% | 10.1% | 13.9% | 12.1% | 8.6% | 8.0% | 8.2% | 8.7% | 9.3% |
| Average Annual "Natural" Mortality Rate | | 4.2% | 3.3% | 2.8% | 2.2% | 2.0% | 3.3% | 3.2% | 3.1% | 2.4% | 2.6% |
| Average Annual "Illegal" Mortality Rate | | 0.0% | 0.0% | 0.0% | 0.0% | 0.2% | 0.5% | 0.9% | 0.7% | 0.4% | 0.1% |
| Overall Mortality Rate | | 12.6% | 7.3% | 5.4% | 2.7% | 2.5% | 4.0% | 4.3% | 4.1% | 3.3% | 3.0% |
| Average Annual Management Removal rate | | 1.9% | 1.1% | 1.6% | 1.0% | 0.6% | 0.0% | 0.0% | 0.0% | 0.3% | 0.3% |
| Key Breeding Rates for 3-Year Periods | x | 07-'09 | 08-'10 | 09-'11 | 10-'12 | 11-'13 | 12-'14 | 13-'15 | 14-'16 | 15-'17 | 16-'18 |
| Index Avg % of Adult Females Caving per Year * | | 20.2% | 29.1% | 32.9% | 32.9% | 32.1% | 32.5% | 35.3% | 38.2% | 37.7% | 40.6% |
| Average Observed Inter-calving Interval (Years) | | NA | NA | 1.97 | 2.07 | 2.15 | 2.34 | 2.47 | 2.49 | 2.41 | 2.34 |
| Average Observed Age at First Calving (Years) | | NA | NA | 6.05 | 6.26 | 6.87 | 7.05 | 7.21 | 7.40 | 7.38 | 7.42 |
| Avg. 0-1yr Calves as a % of Population at Year End | | 6.7% | 10.9% | 13.1% | 13.6% | 12.4% | 11.6% | 11.0% | 11.1% | 10.6% | 9.5% |
| Min. Expected calves per period (for 3 yr age ICI) | | 23 | 68 | 138 | 215 | 282 | 325 | 349 | 372 | 411 | 376 |
| Actual calves per 3-year period | | 11 | 55 | 136 | 212 | 272 | 317 | 369 | 427 | 464 | 458 |
| Average Infant mortality rate for period | | 27.3% | 18.2% | 13.2% | 10.4% | 8.1% | 7.6% | 8.7% | 10.3% | 11.4% | 10.5% |
| Average Adult Females/Male for period | | 9.08 | 14.29 | 10.73 | 7.39 | 5.39 | 4.35 | 3.45 | 2.93 | 2.63 | 2.42 |

With inter-calving intervals averaging 2.36 years or 28.3 months, actively-breeding females are showing good to excellent fecundity. This is similar to the reported 2.35 year average interval reported in European captive populations (Reid et.al. 2012), and below the 2.63 weighted average observed mean ICI reported in 20 wild populations (**see Appendix 2 for comparative data summary from other sites**).

**Table 5. Inter Calving Interval summary for females by reserve-type origin.**

| Female (Mother) Origin | Average Inter Calving Interval (yrs) | Min ICI (yrs) | Max ICI (yrs) | Std Dev of ICIs (yrs) | N (intervals) |
|---|---|---|---|---|---|
| Captive-Born BDR | 1.74 | 1.74 | 1.74 | na | 1 |
| Extensive Reserve | 2.31 | 1.40 | 3.97 | 0.50 | 153 |
| Game Farms | 2.39 | 1.32 | 7.88 | 0.63 | 382 |
| Mauricedale | 2.36 | 1.39 | 4.40 | 0.62 | 51 |
| **Grand Total** | **2.36** | **1.32** | **7.88** | **0.59** | **587** |

**Table 6. Age at first calving summary for females by generation**

| Female (Mother) generation at BDR | Average Age at First Calving, Yrs | Minimum AFC, Yrs | Maximum AFC, Yrs | Standard Deviation, yrs | n |
|---|---|---|---|---|---|
| F0-P (adult introduced) | 8.11 | 5.84 | 14.27 | 1.96 | 30 |
| F0-Pi (Calf- introduced with mother) | 7.05 | 4.99 | 9.73 | 1.1 | 51 |
| F0 Conceived off BDR, born on | 6.45 | 5.70 | 7.74 | 0.67 | 10 |
| F1 Conceived and born on BDR | 6.94 | 6.04 | 8.36 | 0.93 | 8 |
| **Grand Total** | **7.30** | **4.99** | **14.27** | | **99** |

Ages at first calving were averaged for female generations at BDR, and they ranged from 4.99 years to 14.2 years, averaging 7.3 years overall. Introduced females had older AFCs on average, mainly among females from Mauricedale and several other game farms.

The 7.3 years average AFC is within the normal range of many wild populations, but is not as young as in many wild sites across Africa where the average AFC is 6.7 years (Std. Dev. +-0.5).

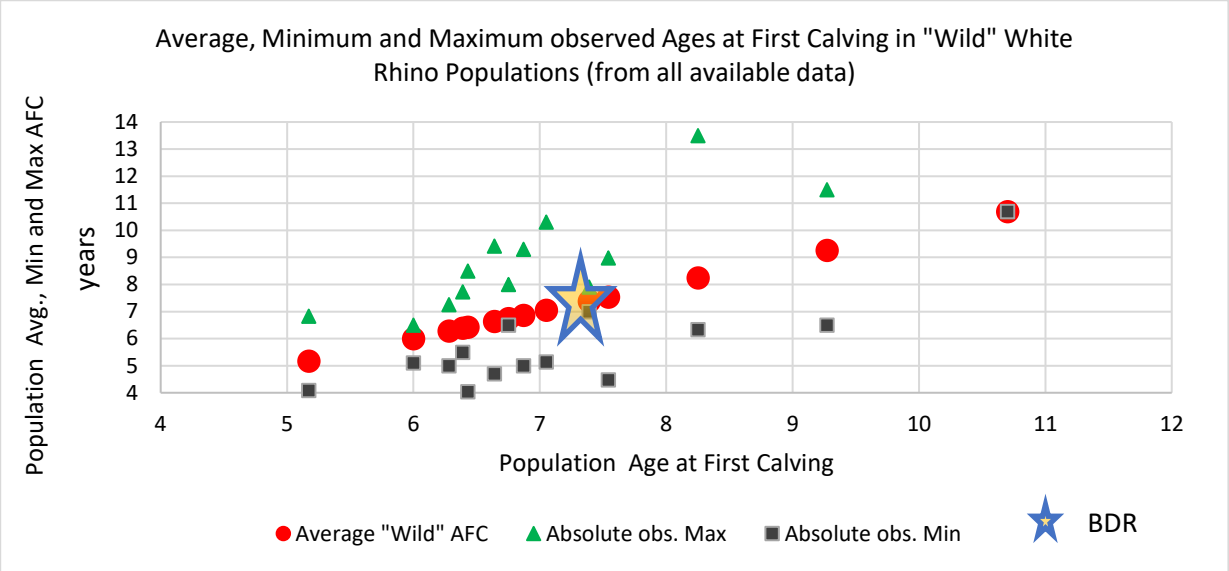



**Figure 4. AFC averages and range in other wild rhino areas, showing overall BDR average (Star).**

The eight F1 females who have conceived on BDR had an average AFC of 6.8 years (range 5 to 8.4 years). It is important to n*ote that the age structure of females born on BDR is still young:* all F1 female are below 8.5 years of age as shown in table 7. *It is thus a bit premature to be evaluating the fecundity of these females*. Never-the less the AFC's are trending slightly higher than the best wild populations. Otto (2018b) is currently investigating whether having moved the subadults to new breeding camps, at the time they would normally have a higher chance of being mated and falling pregnant, has affected pregnancy rates. The SADC Rhino Management Group (Adcock et.al. 2010) had detected an effect in black rhino where translocations at +-4 to 6.5yr subadult age appears to delay age at first caving compared to unmoved females. Kenyan rhino custodians have also observed such phenomena (confidential data provided to AfRSG from 3 Kenyan conservancies), and evidence of this is present in the BDR female introduction data (**see Appendix 8**).

**Table 7. Age Structure of Females Born On BDR, and reproductive performance to 30 June 2018**

| F0 Females | # of Females in Age Category | # Calves born to these females | F1 Females | # of Females in Age Category | # Calves born to these females |
|---|---|---|---|---|---|
| **Female Conceived Off BDR** | **69** | **11** | **Female Conceived On BDR** | **123** | **8** |
| Adult 7 to 8.5 | 26 | 10 | Adult 7 to 8.5 | 15 | 4 |
| Subadult 6 to <7 | 7 | 0 | Subadult 6 to <7 | 20 | 4 |
| Subadult 5 to <6 | 5* | 1 | Subadult 5 to <6 | 40 | 0 |
| Subadult 4 to <5 | 9 | 0 | Subadult 4 to <5 | 24 | 0 |

* 1 female who gave birth has since died

The ratio of # births to # adult females in the population (which is an index of the average % of adult females calving per year) has been at mainly **only moderate levels over the past 10 years (see table 8 below). The ratio has however approached good levels (nearer 40% of females calving per year) in recent years**. Overall the ratio has averaged 36.7%. *This index of calving performance for a population is a better overall indicator of fecundity as it accounts for not only reproducing females but also females which are of reproductive age but are not*

*reproducing*. Ratios of >40% are good to excellent, 33-40% indicate moderate to good female calving levels, 29-33% represents moderate calving and <29% represents poor female calving levels (du Toit 2006).

Comparable data is only available from 8 wild populations, where the average ratios of calves per adult female are extremely good at 42.1%. Captive populations in Europe from 2012-2017 have shown very low levels of female fecundity of <13% of females calving per year (Versteege 2015, 2018 - **see Appendix 2** for details and references).

**Table 8: Key reproductive statistics per year-end, for the BDR operation to June 2018.**

| Annual Breeding summary | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| # of 0-1yr Calves at Year End | 5 | 9 | 44 | 78 | 97 | 102 | 119 | 128 | 158 | 153 | 123 |
| Number of adult females (7+) present (Yr end) | 31 | 78 | 191 | 257 | 313 | 363 | 343 | 366 | 452 | 484 | 515 |
| Number of adult males (7+) present (Yr end) | 4 | 8 | 9 | 32 | 62 | 79 | 93 | 139 | 164 | 192 | 244 |
| % of adult females (7+) in the population | 52.5% | 52.3% | 58.6% | 49.0% | 41.5% | 37.9% | 33.1% | 30.8% | 31.5% | 31.7% | 31.9% |
| % of adult males (7+) in the population | 6.8% | 5.4% | 2.8% | 6.1% | 8.2% | 8.2% | 9.0% | 11.7% | 11.4% | 12.6% | 15.1% |
| # of Male Calves Born | 0 | 9 | 17 | 40 | 46 | 52 | 72 | 76 | 92 | 85 | 75 |
| # of Female Calves Born | 0 | 2 | 27 | 41 | 41 | 52 | 52 | 60 | 70 | 77 | 58 |
| # of Unsexed Calves Born | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 3 | 0 | 1 | 0 |
| Calf Sex Ratio: % Male Births | NA | 82% | 39% | 49% | 53% | 50% | 58% | 56% | 57% | 52% | 56% |
| *# calves which died at <=1 year of age* | 0 | 3 | 7 | 8 | 7 | 7 | 10 | 15 | 19 | 19 | 10 |
| % of Calves Surviving Their First Year | NA | NA | 84.1% | 90.1% | 92.0% | 93.3% | 92.1% | 89.2% | 88.3% | 88.3% | 92.5% |
| Total # of births to Subadults (<7yrs age) | 0 | 0 | 0 | 1 | 2 | 3 | 11 | 5 | 14 | 11 | 3 |
| Average Observed Inter-calving Interval (Years) | NA | NA | NA | 1.97 | 2.11 | 2.23 | 2.49 | 2.56 | 2.42 | 2.28 | 2.32 |
| Average Observed Age at First Calving (Years) | NA | NA | NA | 6.05 | 6.33 | 7.28 | 7.11 | 7.32 | 7.59 | 7.05 | 7.52 |

**Overall mortality levels at BDR are within comparable rates found in many wild rhino areas**. Some causes (**see Appendix 3 for a full summary**) are however slightly different to those found at other sites: A good account of mortality factors at BDR is given by Dr Otto (2018b). BDR Records provided to the AfRSG are detailed and confirm that the main mortality challenges to the BDR population performance are, or have been, as follows (our own categorisation is used to summarize provided mortality descriptions which may differ from Otto's):

- 2009 introductions suffered **losses from translocation stress** and adaptation problems (c.20 direct deaths).
- **Clostridial outbreaks** have occurred in 2014 and 2018, after seasonally heavy rains, causing at least 28 and 19 deaths in these years respectively. Vaccination protocols have been mostly successful in minimising these events, and research into better vaccines and other measures to prevent such deaths are ongoing by Dr Otto. Other rhino sites in Africa have benefited from the vaccine development too.
- Poaching has claimed 32 rhino on BDR, but **poaching rates from 2013 (the first year poaching occurred at BDR) have averaged 0.6%** of the population per year, which is **well below national poaching averages of 5.4% per year from 2013** (or 4% in the rest of SA excluding Kruger NP). Additional strong and innovative security measures have been instituted.
- Lightning claimed 20 rhino, pneumonia 16, and internal parasites claimed 15.
- **Human related deaths are occurring quite often**, primarily due to ingestion of small wire pieces left over in the soil seemingly from previous stock and crop farming activities at the site (such death as classed as human-related by the AfRSG reviewer, but are not differentiated like this at BDR).
- **Infant mortality rates average 10%, and while not very excessive, are higher than ideal**. Some wild areas with top predators have below 1 or 2 % infant mortality (Appendix 2). Most losses occurred as foetuses/newborns around the time of birth (31 cases), and from mothers not having enough milk (11). Birth or developmental defects have also occurred (12 cases). Fighting/ knocks by other rhino and cold weather accounted for 10 more infant deaths each. *European captive infant mortality is much higher that BDR's, at 19.6%.*

**Table 9. Overall Comparative Summary: BDR performance against benchmarks and comparison to wild and European captive white rhino populations.** (Benchmarks are as used in confidential regional black rhino status report summaries (Adcock 2007), or as in du Toit (2006).

| Performance Indicator | SADC RMG Benchmarks | BDR overall | BDR recent years | WILD (population Averages) | European Captive*** |
|---|---|---|---|---|---|
| **Average Annual Biological Growth Rate** | **>5%, ideally >=7.5%** | **9.64%** | **9.80%** | 9.7% (7.1 to 11.7)* | Since 1994, <1% |
| **Average Annual Actual Growth Rate** | **>5%, ideally >=7.5%** | **8.70%** | **9.30%** | 7.3% (2.9 to 10.3)* | Since 1994, <1% |
| **Average Annual non-Poaching Mortality Rate** | **ideally <3% else <4%** | **3.28%** | **2.90%** | Little info, usually <3% | 4.2% from 1994, 2% from 2013 |
| **Average Annual Mortality Rate from Illegal activity** | **Ideally 0%, else <1%** | **0.33%** | **0.10%** | 5-6% in South Africa | N/A |
| **Overall Mortality Rate** | **ideally <3% else <4%** | **3.61%** | **3.00%** | no data synthesized as yet | 4.2% from 1994-2017, but 2% from 2013-2017 |
| **Index Avg % of Adult Females Calving per Year** | **>33.3%, ideally near 40%** | **36.7%** | **40.6%** | 42.1% (34 to 57%) | <13% |
| **Average Observed Inter-calving Interval (Years)** | **<3 years, ideally <=2.5 years** | **2.36** | **2.35** | 2.6% (2.2 to 2.8%) | 2.35% |
| **Average Observed Age at First Calving (Years)** | **<8 years, ideally <7 years** | **7.3** | **7.52** | 6.7 (6 to 9.7) | 8.6 to 9.9** |
| **Average Infant mortality** | **no benchmark yet - ideally <10%** | **10%** | **10.50%** | 0.3 to 10.5% | 19.60% |
| **Birth Sex Ratio** | **no benchmark - ideally <=53% male** | **54.0%** | **56.4%** | 53.8% (30 to 66%) | 60% from 2015 |

(Date averaged from Appendix 2 population averages, except for: *Growth rate data from 9 AfRSG Key1 populations not including Kruger National Park, ** reported in Reid et.al. 2012, *** calculated from data provided in Versteege 2015 and 2018).

The table 9 summary above shows that **BDR passes all the benchmarks by which the SADC RMG assess population performance. BDR has performance within the range of most wild populations.**

White rhino in European Captive institutions have in comparison poor overall performance relative to African sites, and only pass one benchmark (inter calving interval). Note, however, that the overseas Zoo associations do sometimes limit breeding rates of their rhino due to space limitations at their institutes, so a direct comparison with wild rhino is not strictly possible.

Comparative data for Kruger National park could not be easily synthesized for comparison by the reviewer. The reported annual calf recruitment rates are similar to reported annual poaching rates in the more recent years (+-8%/year) (Ferreira et.al. 2017), which should mean a no-net-growth situation, however population estimates from 2010 to 2016, accounting for live removals, show an average -3.3% per year decline in numbers. Confidence intervals around Kruger NP estimates are wide, making trends difficult to assess.

## Continental performance comparison and AfRSG Key1 population rating.

Compared to several other AfRSG continentally ***Key1*** populations, **the value of the very good BDR overall growth in contributing to the actual net continental rhino growth can be seen** from figure 5 (Left side).

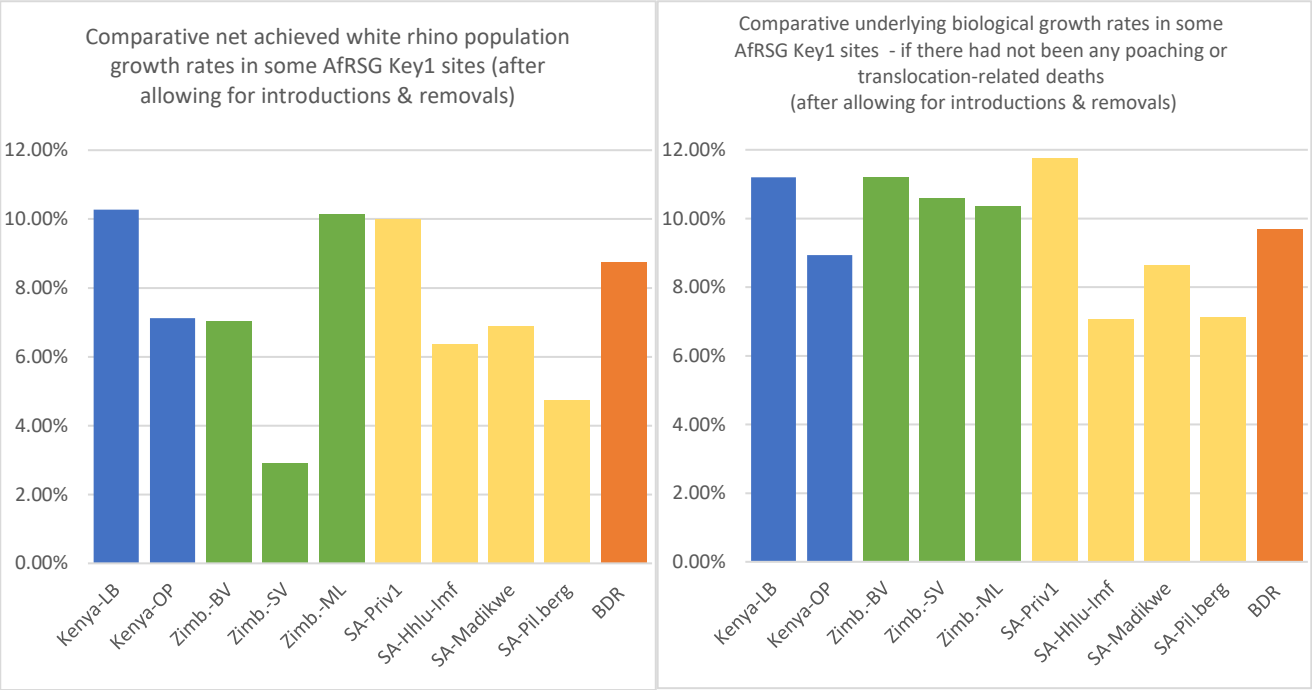



**Figure 5. Graphs of achieved (left) and underlying (right) growth rates in some other AfRSG Key1 populations and BDR** (Data from a 6.5 year period other sites, AfRSG, Dr R.H. Emslie, SA Priv.1 is confidential data analysed by K. Adcock)

It is also clear from this figure that while many rhino areas are struggling with poaching impacts, there are some ***Key1*** sites which, like BDR, have controlled poaching well and have achieved very high rhino growth rates. Such extensive sites conserve and protect white rhino extremely well over large natural areas even under the current conditions of very high poaching and illegal horn-demand, and simultaneously allow fully natural social and evolutionary processes to work in their rhino population, while achieving conservation of extensive, intact ecosystems with more complete natural species compositions and processes.

**The IUCN SSC's African Rhino Specialist Group rates the Buffalo Dream Ranch population as a *KEY1* (>100, stable or increasing over the last 5 years) population of continental conservation significance in Africa.** These rhinos can be considered as part of the continental metapopulation *as long as* they remain genetically well-representative of the species (i.e. with some mate choice and no selective breeding or domestication) and are maintained only in *semi-intensive* management (as opposed to intensive, zoo-like management) with exposure to natural habitat, food, parasites and diseases, and are able to maintain their natural social behaviours.

Under such conditions, these rhinos provide a safety-net and still have the potential to be used to re-stock or supplement wild areas across SA and the rest of Africa. The AfRSG would not support the undertaking of any greater intensification of management and husbandry of *in situ* rhino CBOs in Africa – hence the importance of sound CBO guidelines for South Africa.

The AfRSG would strongly recommend that as some stage the BDR CBO allow a relocation of some F1 or F2 rhino back to wild, suitable reserves in SA or Africa, to validate the insurance policy argument and test the principle of these rhino's continued relevance to integrated environmental conservation. Given that the animals are not overly domesticated and spend much of their time grazing natural veld, it is probable their introduction back to the wild, albeit at lower densities and with a buffered release phase, will be viable.

# Habitat considerations

As far as could be established from SANBI maps and information online, there are **no significant Critical Biodiversity habitats** on BDR, although a few very small pans and minor drainage lines may have such status within BDR. There BDR falls across areas classified as Endangered: Vaal-Wet Sandy Grassland, Code GH 10. At the North West provincial conservation planning level, some small patches of “Ecological Support level 1” vegetation occur in BDR, which may include bird migration routes and potential wildlife corridors (figure 6).

The AfRSG reviewers determined that the **BDR CBO falls within The Vaal Grasslands focus area (#39), which the National Protected Area Expansion Strategy (NPAES) 2008 has earmarked for supposed protected area expansion**. This focus area straddles Gauteng and North West Provinces, and reportedly includes the last remaining unfragmented areas of dry highveld grasslands. The 2008 NPEAS classes this area as being of high importance for Protected Area expansion (figure 7), but the 2016 NPEAS review does not class this as a Priority Area.(**see Appendix 7**). These classifications have not been communicated to the owner by North West environmental officials issuing permits to BDR.

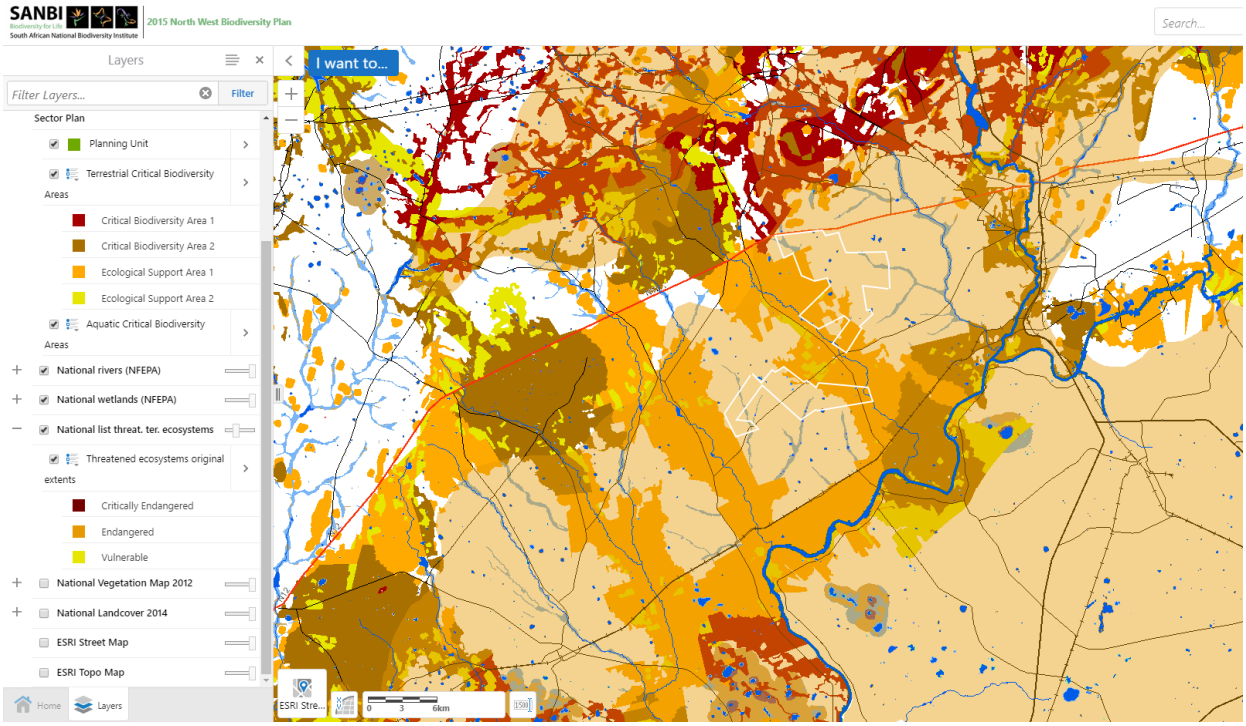



**Figure 6. Map of Biodiversity Areas and threatened ecosystems in and around BDR.**

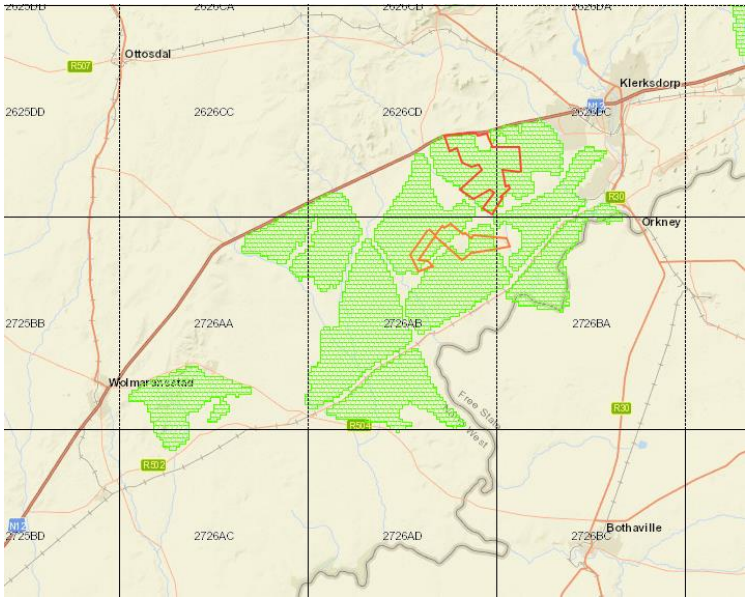



**Figure 7. Demarcated areas in and around BDR of the Vaal Grasslands focus area (#39),** which the National Protected Area Expansion Strategy (NPAES) 2008 has earmarked for supposed protected area expansion. However, in the 2016 NPEAS review the locality in and near BDR is classed as “Ecosystems where targets (for protection) are not met”, and BDR does not fall into a *Priority* Focus Area for Protected Area Expansion.

**The BDR CBO has not caused unduly fragmented wild land:** In buying up and using land previously under livestock farming (and some cropping), the formation of the BDR CBO has to some extent led to a *de-fragmentation* (reduction in fence-dissection) of previous stock grazing-paddock units, creating larger continuous fenced units than under livestock or crops. Since BDR establishment, several other vulnerable species have returned to this land, these include Blue cranes (*Grus paradisea*), Secretary birds (*Sagittarius serpentarius*), Aardwolf (*Proteles cristata*) the giant African bull frog (*Pyxicephalus adspersus*). Figure 9 provides a view of BDR and surrounding farmlands.


**Figure 9. Google Earth view of the BDR CBO vicinity**, shows that although the operation still uses camp systems, there are now slightly fewer, larger contiguous land units compared to the conventional livestock camp/paddocks and crop farming systems (the pattern of pervious farming activity at the site BDR can still be seen and will take many years to become less visible.

**Habitat management at BDR**. The BDR Management plan specifies that continual analysis of the vegetation is undertaken, using findings to determine and adjust the camp stocking rates and plan veld burns. The veld assessments are done by a qualified vegetations scientist Mr Francois De Wet. The duel-camp system developed by Mr Hume is vital in maintaining the sustainability of grass production and preventing veld degradation. There is growing support across Africa for this approach: Fynn (2016) in a key published feature for the Grassland Society of South Africa Newsletter highlighted that "to achieve optimum herbivore production and rangeland sustainability, the veld management strategy must aim to provide year-long recovery periods for perennial grasses, while at the same time ensuring that the grazed portions of a ranch are maintained in an immature, high quality state over a wet season. To achieve this, the ranch (or camps) should be divided into a grazed half and a rested half, switching between the two states (rested versus grazed) in alternate year." The images below (figure 8) clearly show this type of system being followed at BDR, although camps-halves are rested for a growing season, not always a full year, until seed set and fall of the grasses. During the recent droughts (2015/16), animals were for the first time allowed access to both camps during the growing season.

**Figure 8: May 2017 Google Earth scene at BDR (left image) and March 2018 image (Right image)**, each showing Camps 1/ 2 (two at top right), 3 /4, (two at bottom right), 5/6 (top left) and HF (bottom left), with lighter, grazed camp-sections and darker, resting sections switching sides between the 2 images.

During the recent droughts (2015/16), animals were for the first time allowed access to both camps during the growing season. Supplementary feeding is also key to reducing veld grazing impacts, and BDR have developed a multi-source approach with on-site feed mixers using specifications of a specialist dietician, to ensuring sound feed supply - as described in detail in Otto 2018a and b.

BDR also undertakes veld rehabilitation work where needed, alien plant removal, and monitors/encourages other wildlife species where possible.

In conversation with the vegetation scientist Mr Francois De Wet, the lead reviewer heard that the site resilience at BDR is very good, due to a decent clay content in the soils in most places. Some camps had slight overgrazing (heavy grazing) before the 2016 drought but had shown no signs of a decline in basal cover. However, the grass tuft densities and productivity at BDR and at several other sites he'd been assessing in South Africa, such as Sabi Sand, had been affected by the severe 2015/16 drought, and were still recovering. Only one BDR camp shows signs of some veld degradation. He is currently analysing very recent veld assessment data from BDR. He also emphasised that he could clearly observe how important and valuable the seasonal veld resting in alternate camp-halves per year was, in maintaining the sustainability and productivity of the BDR grazing system.

# Genetic considerations

**The BDR CBO is taking enough steps to ensure the conservation of white rhino heterozygosity and prevent inbreeding**:

1) **The founding stock are of sufficiently high source diversity to form a valuable and viable genetic basis for breeding; and are well-representative of Southern white rhino.** The 957 introduced founder rhino were sourced from 98 different sites covering both the main extensive parks of South Africa (including Hluhluwe-iMfolozi, Kruger National Park and adjacent private reserves, and North West Provincial reserve Madikwe), and a variety of game farms and are thus highly representative of the Southern white rhino subspecies (all of which derive ultimately from the genetic base of Hluhluwe-iMfolozi Park – the original source of all current *C.s.simum* populations). The AfRSG have a minimum recommended founder group size of 20, which is far exceeded at BDR.

   Southern white rhino went through a genetic bottleneck of only 20-50 white rhino in 1885, and as a result have limited genetic diversity. The BDR compilation of founders probably represent the best possible under current circumstances.

**Table 10. Source areas for introductions to BDR showing the wide range of founder origins (Site names have been abbreviated)**

| Extensive Reserves Code | 198 |
|---|---|
| GRF | 2 |
| HIP | 40 |
| KLAS | 13 |
| KNP | 95 |
| KWA | 2 |
| LNR | 2 |
| MADI | 6 |
| SASA | 3 |
| SELA | 4 |
| SONG | 2 |
| THBU | 7 |
| TIMB | 18 |
| TSWA | 4 |

| Game Farms | 585 | Game Farm # in | | Game Farm # in | | Game Farm # in | |
|---|---|---|---|---|---|---|---|
| ABOS | 3 | GILB | 6 | L15 | 3 | SHAM | 2 |
| BIES | 15 | GROF | 7 | LEGA | 2 | SHED | 11 |
| BLAA | 16 | GROP | 4 | LOOD | 2 | SHEL | 1 |
| BOBE | 5 | HAHO | 1 | LUMA | 2 | SHIG | 61 |
| BOON | 38 | HANO | 3 | LUTO | 17 | SHIN | 4 |
| BUCH | 3 | HARB | 5 | MACO | 6 | SPEK | 22 |
| BUFO | 16 | HBFO | 1 | MAFU | 1 | STEL | 5 |
| BUFS | 2 | HOOS | 4 | MOTW | 6 | THMA | 9 |
| BUY | 1 | HOWA | 3 | MP1 | 2 | TSRL | 5 |
| BUYS | 16 | HUMO | 4 | MUST | 4 | VALA | 11 |
| CAND | 1 | JAPI | 1 | NAB | 1 | VAWA | 7 |
| DER | 2 | KAFO | 7 | NGON | 5 | VEKR | 4 |
| DONK | 6 | KARI | 2 | NOVR | 1 | VLHO | 7 |
| DOOR | 2 | KARS | 1 | PAAR | 3 | WAKL | 5 |
| DUIK | 1 | KIMB | 3 | PRAC | 57 | WIFO | 3 |
| EMAN | 19 | KLAPR | 5 | REBO | 10 | WITB | 3 |
| ERFD | 3 | KLIS | 2 | RHRA | 5 | WITP | 2 |
| EZUL | 8 | KLMO | 10 | RIAN | 5 | XXL | 2 |
| FALA | 2 | KLPL | 5 | RIFO | 4 | ZONN | 6 |
| FINF | 1 | KOS | 11 | ROKR | 2 | ZOVL | 10 |
| FRAH | 9 | KREE | 1 | SAHU | 9 | Semi-intensive | |
| | | | | SCHK | 3 | MAUR | 174 |

   To date 30/6/2018), the 848 F1 calves were conceived and born on-site to 403 different introduced females. After accounting for calf deaths, 373 different introduced females have contributed surviving calves into the breeding program so far. 508 introduced females remain in the BDR operation, 455 of which are of age 7 years or older, so that additional founder females should still be able to contribute to calving and genetic diversity.

The fatherhood of 342 of the 867 calves conceived on BDR were recorded in the studbook, and these comprised 75 different males. 13 males contributed 51% of the know-father births. As over half of F1s have unknown fathers, these estimates of male contribution so far to the next generations are only approximate. **The various generations at BDR should all become genetically characterised regarding genetic lineages once all their DNA samples have been processed. BDR should establish more specific goals for genetic diversity once the DNA analyses have been completed.**

2) **All rhino over infant age are marked in accordance with National and IUCN captive breeding guidelines** using approved ear notch systems, horn and body microchips, and have DNA samples. **Highly detailed Studbook records and additional monitoring and management history data are kept** per camp and per rhino, which include known sibling and parent relationships – these data are continuously used to assist genetic management of the population.
3) **The population is managed sufficiently well to ensure more natural breeding systems are maintained among the rhino, in that females have free choice of more than one mate.** On average two to seven breeding age males are present in the breeding camps with 20-50 breeding females (see table 11 below for snapshot examples of camp sex/age composition). Artificial insemination or other intensive breeding manipulations are not undertaken.
4) **Males are monitored for their breeding contribution as much as currently possible, and male succession plans to minimise inbreeding are in place.** Observed matings at BDR and matching of these with birth records (accounting for gestation periods), show that at least 75 different males have been involved in breeding of new calves at BDR. Plans are in place, and will soon be executed, for each specific camp to replace any bulls which may have dominated breeding for several years (e.g. camps 1 /2, 6/9, 14/15 and 18/19). Otto (2018a and 2018b) describes the management of males in detail, noting that a successor male is chosen based on the male having no or low genetic relatedness to the camp females, and also his temperament (not fighting excessively) and his breeding acceptability to the females.
5) **laboratory facilities are being constructed to store and manage rhino samples for research purposes including genetic analysis and parentage**, involving local and international veterinary Universities.
6) **Offspring conceived and born in breeding camps are moved out** at a weened, subadult stage, to new, separate camps, constituted with a mix of genetic lineages, **thus preventing undue inbreeding in the previous and new camp subpopulations**. Otto (2018a and 2018b) describes the management. The Studbook and camp records show that from late 2015 to 2018, newer camps incorporated 332 transferred offspring from the older breeding camps. (**see table 11 below** for camp compositions 2014 and 2018)

| 09-Oct-14 | 09-Oct-14 | 09-Oct-14 | 09-Oct-14 | 09-Oct-14 | 09-Oct-14 | | | 28-Jun-18 | 30-Jun-18 | 30-Jun-18 | 30-Jun-18 | 30-Jun-18 | 30-Jun-18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Camp Size (hectares) | (ha/rhino) | Total White Rhino | Breeding Females | Breeding Males | Subadults and Infants | Camp | Camp Type | Camp Size (hectares) | (ha/rhino) | Total White Rhino | Breeding Females | Breeding Males | Subadults and Infants |
| 262 | 3.64 | 72 | 27 | 4 | 41 | 1/2 | Breeding | 262 | 3.74 | 70 | 30 | 2 | 39 |
| 247 | 4.41 | 56 | 24 | 2 | 30 | 3/4 | Breeding | 247 | 4.41 | 56 | 25 | 5 | 26 |
| 426 | 4.30 | 99 | 39 | 5 | 55 | 5 /6/ 5A | Breeding | 426 | 4.44 | 96 | 40 | 5 | 51 |
| 240 | 3.87 | 62 | 24 | 11 | 27 | HF | Breeding | 240 | 3.69 | 65 | 27 | 6 | 32 |
| 458 | 4.32 | 106 | 35 | 13 | 58 | 8/9 | Breeding | 519 | 4.25 | 122 | 56 | 3 | 60 |
| 10/10A start 2015 | | | | | | 10/10A (T1/T2) | Breeding | 436 | 3.38 | 129 | 51 | 2 | 76 |
| 400 | 3.67 | 109 | 37 | 7 | 65 | 12/12A | Breeding | 400 | 3.51 | 114 | 33 | 4 | 71 |
| 587 | 4.81 | 122 | 47 | 5 | 70 | 14/15 | Breeding | 526 | 3.63 | 145 | 52 | 5 | 88 |
| 464 | 4.88 | 95 | 48 | 9 | 38 | 16/17 | Breeding | 464 | 3.54 | 131 | 55 | 7 | 68 |
| 573 | 4.48 | 128 | 50 | 5 | 73 | 18/19 | Breeding | 573 | 3.79 | 151 | 52 | 5 | 93 |
| 250 | 6.76 | 37 | N/A | 37 | 0 | 20 | Bachelor | 386 | 8.21 | 47 | N/A | N/A | |
| 200 | 10.00 | 20 | N/A | 18 | 2 | 23/24 | Bachelor | 200 | 8 | 25 | N/A | N/A | |
| 100 | 9.09 | 11 | N/A | 11 | 0 | 25/26 | Bachelor | 100 | 7.69 | 13 | N/A | N/A | |
| 388 | 5.54 | 70 | 33 | 4 | 33 | 11/11A | Breeding | 388 | 4.04 | 96 | 41 | 4 | 54 |
| E1/E2 started Dec 2014 | | | | | | E1/E2 | Bachelor | 250 | 8.06 | 31 | N/A | N/A | |
| E3/4 started Dec 2015 | | | | | | E3/E4 | Bachelor | 531 | 6.48 | 82 | N/A | N/A | |
| (E5 started Sep 2017) | | | | | | E5 | Bachelor | 179 | 89.5 | 2 | N/A | N/A | |
| FR1 started Jan 2017 | | | | | | FR1 | Breeding | 457 | 8.46 | 54 | 37 | 5 | 46 |
| FR2 started Sep 2016 | | | | | | FR2 | Breeding | 497 | 7 | 71 | 39 | 4 | 26 |
| FR3/4 started Jun 2016 | | | | | | FR3/4 | Breeding | 526 | 7.85 | 67 | 7 | 0 | 30 |
| 25 | N/A | 24 | N/A | 1 | 23 | HR | Orphanage | 25 | N/A | 48 | N/A | N/A | |
| | | 1011 | | | | | | | | 1615 | | | |

**Table 11. Stocking levels and group compositions at BDR at two different time periods**, showing the new camps created mainly from the F1 progeny and F0 animals born onsite to females arriving pregnant.

**The BDR CBO could be maintained without the introduction of specimens from the wild, except for the occasional addition of animals for genetic exchange** (e.g. once per generation as per AfRSG guidelines). It is noted that the owner Mr Hume has the objective to achieve an operational scale which produces over 200 offspring per year – this is projected to happen by end of 2018 with current rhino stock. Additional introductions should be primarily for genetic diversity reasons, if the needs arises.

**Evidence of F2 Births:** As per CITES Resolution Conf. 10.16 (Rev.), second generation offspring (F2) or subsequent generations (F3, F4 etc.) are specimens produced in a controlled environment from parents (*i.e. both parents*) that were also produced in a controlled environment. **We are satisfied that there is good, logically consistent evidence that indeed two F2 generation calves meeting these CITES requirements have been produced at the BDR CBO**:

1) The BDR Studbook shows the birth of a true F generation 2 female calf on 23-May-2018, called DG31E1A/ GUGU. The mother is DG31E1, a young female aged 6.4 at the time of giving birth. This young mother was herself *conceived and born* on BDR in camp 10/10A in December 2011, to introduced female DG31. Mother DG31E1 is thus categorized as a true F1 generation animal at BDR. She was moved to Camp FR2 in September 2016 and she conceived a the F2 calf there in January 2017 after being recorded mating with the F1 male AN2E2* who was conceived on BDR, and born in October 2011, to a female introduced in 2008 from a game farm.
2) This confirmed F1 male AN2E2*was also recorded as mating with the F1 generation female KP59E2/ PAMELA. This young F1 female was conceived on BDR and born on 11 Feb 2012, to a Kruger Park female introduced in June 2009. KP59E2 and AN2E2* had also been moved from camp 10/10A to Camp FR2 in September 2016. KP59E2 gave birth to the F2 generation calf KP59E2A/ VIVIAN on 19 June 2018, her age being 6.35 at that date.

   **The recent DNA parentage testing has now confirmed the F2 validity of these calves** DG31E1A/ GUGU and KP59E2A/ VIVIAN, after Dr Otto sent relevant samples for parentage testing (Inqaba Biotechical Industries Pty LTD, DNA Profile numbers CS18-801 for F2 calf DG31E1A/ GUGU, CS18-802 for F1 Mother DG31E1, CS18-803 for F2 calf KP59E2A/ VIVIAN, CS18-804 for KP59E2/ PAMELA, CS18-807 for F1 male AN2E2* who fathered both calves.) Reference numbers for the report: SA2018/46896.

3) **The production of the F2-generation calves in Camp FR2 occurred under the same husbandry system/approach that the BDR F0 and F1 rhino generations are maintained under**. Camps and the rhino breeding systems are all run using the same approach as described in the BDR 2018 Management Plan (Otto 2018).

**The BDR breeding stock was established in accordance with the provisions of CITES and relevant national laws and in a manner not detrimental to the survival of the species in the wild.** The 957 rhinos introduced over 2008 to 2016 to BDR were either legally purchased from State or private sites with Provincial approval via *documented permits*, or were already owned by Mr Hume on his other property in Mpumalanga (and were translocated for security reasons). The sales to Mr Hume were willing sales, where either 1) on the State and private sites, the rhino were surplus to requirements of the populations being managed and needed removal to maintain suitable densities for enhanced breeding – in most cases funds from such sales assist with conservation area management costs and security costs of remaining rhino; or 2) the rhino were put up for sale by sites wanting to find other homes for their rhino due to the high risks of them being poached. Several owners and conservation authorities were at the time unable to adequately secure these rhinos due to limited finances or manpower, as costs of anti-poaching have escalated hugely since 2008. In some cases, Mr Hume was approached directly to take on such rhino when owners feared for their imminent loss by poaching.

It is evident (based on reviewer site visits and the management plan details) that the **BDR CBO white rhino are maintained in a semi-intensive management system**, given the system of duel camps and supplementary feeding of 48% of annual diets. This was also the conclusion reached by the December 7, 2015 workshop "Captive

breeding of white rhino in South Africa" held by the South African National Biodiversity Institute. Semi-intensive management is defined as being kept at higher than natural densities but still allowing most natural rhino social behaviours, and some interactions with natural habitat, with mate selection partially limited via lowering male-to-female sex ratios, and partial supplementation of dietary need (Child *et al*. In prep). This denfinition is similar to the "semi-wild" classification proposed by Leader-Williams *et al*. (1997)).

**Additionally, the BDR CBO fits the requirements of a "controlled environment" as defined in Resolution Conf. 10.16 (Rev.), terminology point d):** "a controlled environment is an environment that is manipulated for the purpose of producing animals of a particular species, that has boundaries designed to prevent animals, eggs or gametes of the species from entering or leaving the controlled environment, and the general characteristics of which may include but are not limited to: artificial housing; waste removal; health care; protection from predators; and artificially supplied food". This was also agreed at the 2015 SANBI workshop on captive breeding of white rhino in South Africa.

**The BDR land (its farms and farm portions) are registered with the North West Provincial Conservation Authorities as a Captive Breeding Operation under current CAPTIVE BREEDING REGISTRATION (renewed) CERTIFICATE NO. 10704.**

# BDR CBO in the context of South Africa's Biodiversity Management Plan for white rhino (2016-2020)

**The Biodiversity Management Plan target for white rhinos is to achieve a meta-population of 20,400 in South Africa by 2020** (to be adjusted for any removals from SA). **Due to declines in estimates for SA's largest population Kruger NP, the country is not likely to achieve the plan target. However, BDR breeding program will assist SA in not missing this target by an even larger amount than could be.**

If BDR maintains its average net growth of at least 8.7% per year, **BDR animals should contribute around 1,990 rhino to the National total by year 2020 – that is roughly 11% of the projected 2020 SA metapopulation**. Numbers in the rest of SA are predicted to remain around or just below 16,000. This is shown in the figure 9 below. The projections for this graph use growth rates for Kruger NP based on their population estimates, removals and poaching data (also see Ferreira et al. 2015, 2017), and in the rest of South Africa's white rhino. *They assume that 2017 levels of poaching continuing across SA*.

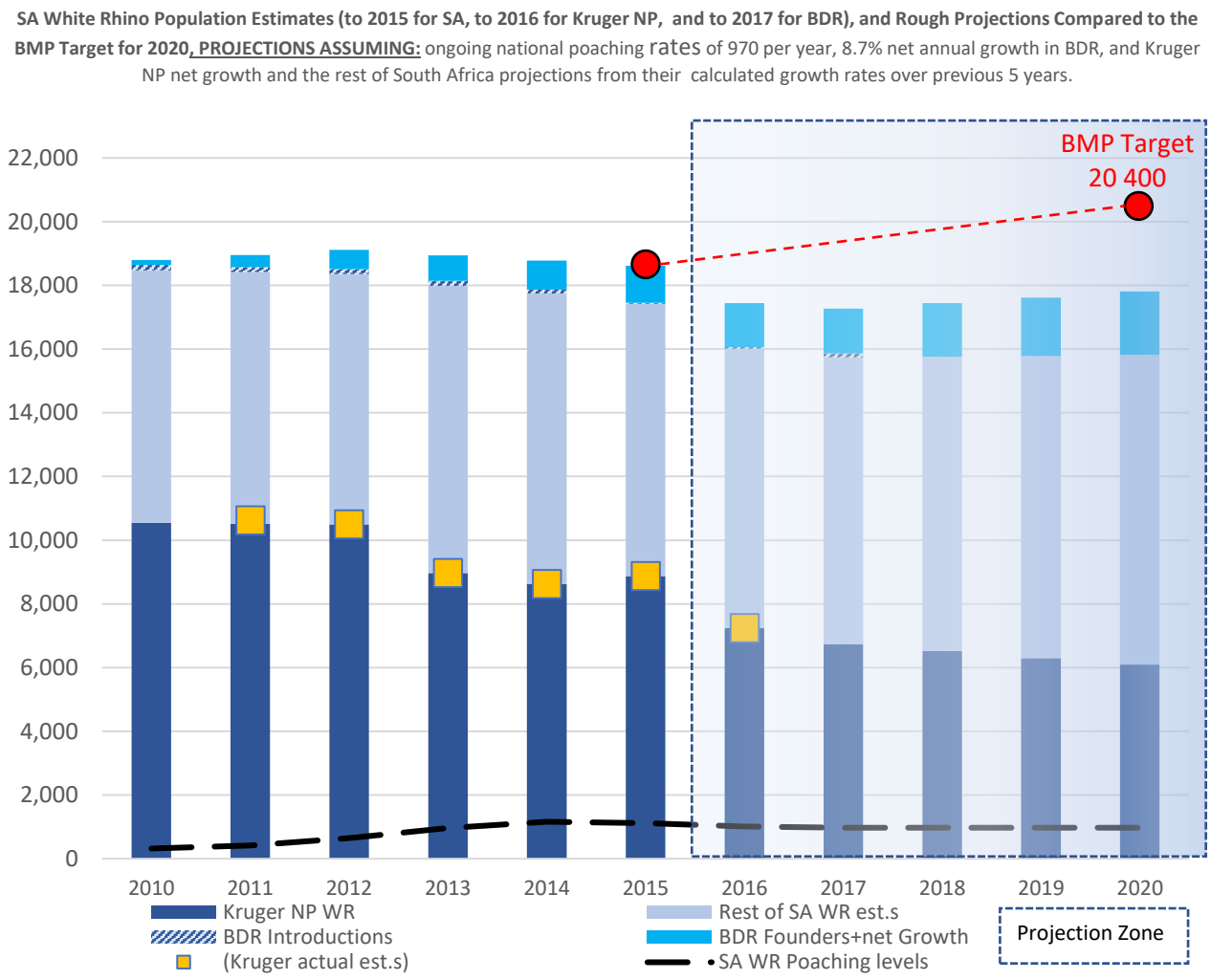



**Figure 9: White rhino estimates for rest of SA to end 2015, Kruger NP estimates till 2016 (as a 2017 estimate not officially released yet) and BDR estimates to date, with rough projections for BDR and South Africa to 2020, against conservation planning targets for the species**. Estimates are based on reported SA white rhino totals to 2015 (AfRSG), and Kruger NP estimates to 2016, national white rhino poaching data (AfRSG), and BDR data to Dec. 2017. Projections made assuming a), poaching of 970/year across SA continues, b) the past 5-year growth rate in the rest of SA (not accounting for translocations out of country or animals in from KNP), c) the past 5-year growth rate in KNP of -3.3%/yr (*which does account for past live removals*) continues d) projections for BDR assume ongoing 8.7% rhino growth is achieved, with rhino retained on-site.

*Note that making accurate projections is very difficult especially without good data*: At writing, the minister of the Environment has not yet released 2017 white rhino estimates from Kruger NP, which may be lower than 2016's estimates. A survey is just now underway of white rhino numbers on private land and other state parks or provincial reserves, i.e. rest of SA, which will help clarify trends and assist in conservation planning for this species. The National Target of 20, 400 also needs be adjusted once data on any white rhino exports from SA are accounted for. Never-the-less it is clear that BDR's population could continue to play a very strong contingency role in rhino conservation as long as the threat and impacts of poaching are not being reduced in South Africa and the rest of Africa. We need to remember that if poaching can be reduced via good security or successful reduction of illegal horn demand, white rhino numbers will rise rapidly as normal biological growth rates of 8-10% could resume in many the continents rhino areas.

**The Buffalo Dream Ranch Captive Breeding Operation (BDR CBO) has a place within the vision and conservation targets of South Africa's Biodiversity Management Plan for white rhino (2016-2020** - Gazetted in 2015**)**.

The BMP vision for white rhino is *"A world with reduced poaching and demand for illegal rhino horn, where the future survival of wild white rhinos is ensured in South Africa, through secure populations which are economically and ecologically sustainable, and which provide a source of founder rhinos to help repopulate former range states as needed*."

While larger "wild" populations remain the priority focus of the South African white rhino conservation effort**, the formation of Captive Breeding Operations for white rhino is recognised as a potentially valuable conservation option in the South African Biodiversity Management Plan for White Rhinoceros**, under point 5.3 (sustainability).

> Specifically, CBOs could play a role as an effective way to protect rhino from poaching while maintaining rapid population growth to help compensate for national losses, and to contribute to restocking South African and African range areas should these become secure enough from poaching threats at some point in time. *Poaching losses in several private and State areas, along with the State Veterinary ban on white rhino removals from Kruger National Park and adjacent areas due to bovine TB concerns, means that white rhino may not be easily sourced from the usual donor sites in future for other SA, African or overseas breeding programs.*
>
> *The BMP emphasises that CBOs or sites of intensification of rhino breeding should not lead to increased land fragmentation at the expense of continuous wild natural areas, nor to the selective breeding, domestication and genetic divergence of CBO rhino from wild rhino*. Additionally, CBO operations *should not de-incentivise the breeding and conservation of white rhino in extensive natural areas of public or private land*.
>
> **The BMP specifically called for setting up of guidelines for CBOs**, and more recently a SADC Rhino Management Group working group helped SANBI produce CBO guidelines (Selier et.al 2018), many of which are based on the operational experience of the BDR white rhino breeding program. The stringency of the Nation CBO guidelines (in final draft stage), as well as the case example of BDR itself, will set a high bar for standards of running white rhino CBOs, requiring high capital input and highly professional management.

**An additional comment can be made in the wider context of the BMP and poaching threat to rhino:**

Besides the existence value of the BDR breeding population, the continued existence of Mr Hume's large horn stockpile and those of State and other private sites sends the strong message to any illegal players who are speculating on the extinction of rhino who might be helping drive the illegal demand for horn, that horn is not an ever-increasingly rare and valuable item which may soon become unavailable. This is an important: At a recent AfRSG meeting in Kruger Park, a World Bank economist advised that the existence of large, secure, legal stockpiles of horn are vital in preventing an all-out slaughter of all the worlds' remaining rhino by poachers at the behest of illegal horn speculators, should these species be perceived to be on their last legs with horn soon becoming unobtainable. The rarer rhinos become, and the rarer horn becomes, the more desirable it becomes in the mind of Asian horn buyers/ users (Susan Scott pers.com. 2018). The existence of the BDR CBO is thus contributing to counteract these market forces driving poaching.

**Please see APPENDIX 9 Part A and B for additional, more general comments, and questions and answers on the current BDR situation and envisaged future as asked by the European Association of Zoos and Aquaria representative, European Rhino TAG Chair, and US reviewers from the United States Association of Zoos & Aquariums (AZA) and their Rhino TAG Chair.**

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*(For references on white rhino performance parameters in wild and captive rhino see **Appendix 2**)*


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**Selier, S.A.J., Emslie, R., Adcock, K., Otto, M., and Pfab, M. (Final draft 2018).** Criteria for the captive breeding of white rhinoceros (Ceratotherium simum simum) in South Africa.

**Susan Scott pers. Com. (2018).** Co-producer with Bonné de Bod, of the award-winning film S T R O O P - journey into the rhino horn war @stroopdiefilm -, an Independent feature documentary film (4 years of research/filming) on the rhino poaching crisis, including interviews with Asian horn dealers and horn buyers/users:

K. Adcock (question via messenger to Susan Scott on the Stroop facebook page): Did you get any kind of inkling whether users/buyers of poached horn might stop (based on an understanding that their demand for horn is hurting rhino)

Susan Scott (reply) no... they are not going to stop. In fact, we got the opposite feeling. The more rare something is, the more valuable and therefore desirable it is. Before we got to Asia I could not understand how someone could think like that. But after having been there... there is no connection to nature and even in speaking to Buddhist monks, there is a sense of karma. So if there is cruelty to an animal then it must've done something in a previous life. I'm generalizing here, but we have to understand that there is a real difference in mindset towards the planet. Caretaker vs Miner/Developer/Taker I guess.

# Appendix 1

## Background

In 1992, Mr. John F. Hume established a Wildlife Ranch in Malelane, Mpumalanga, called Mauricedale Game Ranch (6700ha). From 1993, over 13 years, Mauricedale successfully bred 143 white rhino from a breeding herd of 130 animals purchased form a variety of game farms and Kruger National Park. This operation kept and bred the rhino in a controlled environment with electrified game fencing surrounding the ranch, supplementary feed provision for 7-8 months of the year, full time presence of veterinary care, and artificially constructed water sources and mud-bath sites. When the poaching upsurge began at Mauricedale and in nearby Kruger National Park and surrounding areas in 2007, Mr. Hume sought an alternative location where his rhino breeding programme could be more secure. A North West farm property – in a remote location with flat, open expansive Savanna grassland was purchased in 2008, and in 2009, after the purchase of additional neighbouring land, the Buffalo Dream Ranch was officially registered as a captive breeding operation for Southern White Rhinoceroses in South Africa. Rhino were purchased for BDR from many sources starting in 2008, and the Mauricedale breeding herd as moved to BDR during 2012-2013. The North West provincial government department tasked with environmental/conservation issues has records of all such rhino introductions via their permit system. Experience gained at Mauricedale provided the foundation for the operational strategy at the BDR CBO, i.e. using a multiple enclosure (or camp) system to allow for improved metapopulation genetic management, higher productivity, better supplementary feeding and better protection.

## CBO formation and registration

The overall Buffalo Dream Ranch Captive Breeding Operation (CBO) is conducted on more than one farm or farming portion (i.e. more than one land-unit title deed). The current individual farming portions comprising four (4) individually registered captive breeding operations (i.e. effectively 4 CBOs, managed as a single unit – see Appendix 1 for registration details). Each has been valuated, approved and registered with the North West province Chief Directorate of Environmental Services. As the need or opportunity arises, additional farming portions have been, and will be acquired and registered with North West authorities by the owner Mr John F. Hume, to incorporate additional habitat for the progeny and for further breeding of white rhino.

**The individual standing permits (CBO registrations) as they currently stand (June 2018) and corresponding farming portions at BDR are listed below:**

Standing permit number 25873 comprises Portions 2, 3, 5, 7, 10, 11, 15, 16 of the Farm Elandslaagte 427; Portion 1, 6 and the Remaining portions of the Farm Elandslaagte 330 Registration Division IP, North West Province;

Standing permit number 25874 comprises Portions 1, 5, 12, 14, 16 and 24 of the Farm Yzerspruit 15, Registration Division HP, North West Province;

Standing permit number 25875 comprises Portion 6 and Portion G of the Farm Opraap 334, Registration Division IP, North West Province;

Standing permit number 25876 comprises Portions 2, 3, 11, 12, 13, 14, 15 and Remainder of the Farm Doornplaat 14, Registration Division HP, North West Province;

More recently, additional farming portions have been purchased and the relevant permits have been applied for and approved by the North West Department.

## Staffing

The owner of the BDR CBO and all its white rhino is Mr John Frederick Hume. Key staff include the General Manager Mr Johnny Hennop and the resident veterinarian Dr Michelle Otto, BVSc, BSc Vet Bio. In addition, a resident Veterinary nurse oversees the care of orphaned or indolent calves at a special on-site facility. For managerial purposes, the BDR property is subdivided into three sections, each with its own Sectional Manager and supporting staff. Each camp has a designated Camp Master and assistant, tasked with active surveillance of

each rhino twice a day to monitor and visually assess each rhino and report any incidences of change in habits or activity to management (e.g. any mating(s), pregnancy statuses, calving(s), injuries or illnesses, mortalities etc.). The Camp Master also oversees the upkeep of the enclosure's infrastructure and maintenance.

## Location

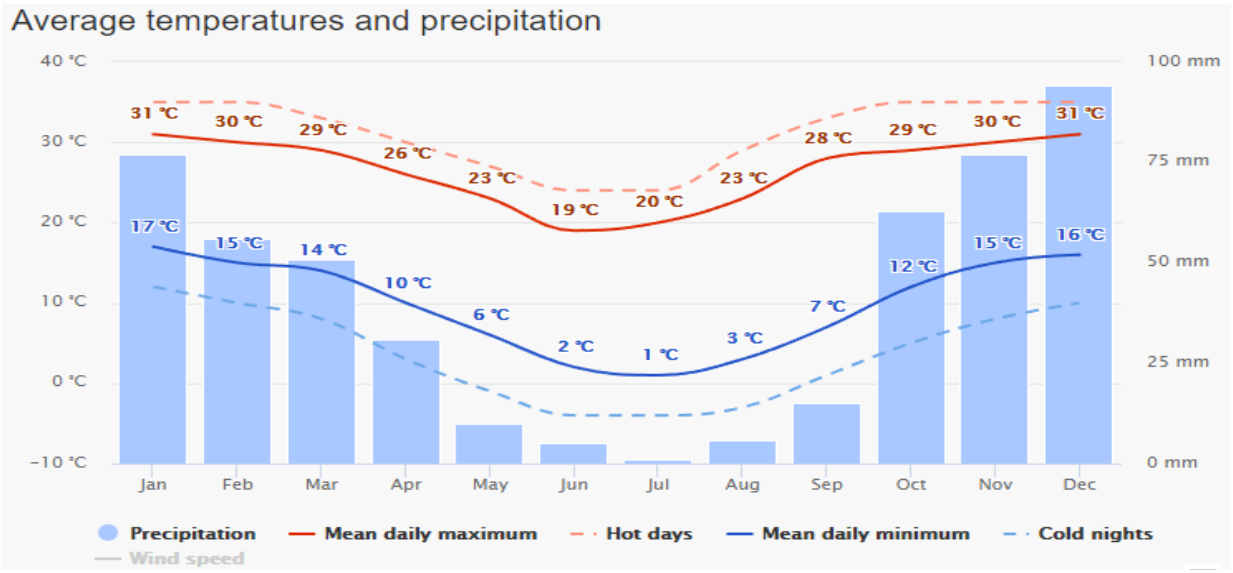
BDR is situated 30 km by road from the town Klerksdorp in the North West Province of South Africa (NE point 27° 00' 09" S, 26° 26' 58" E). The district is a major agricultural hub, and land use surrounding BDR is primarily cattle ranching.

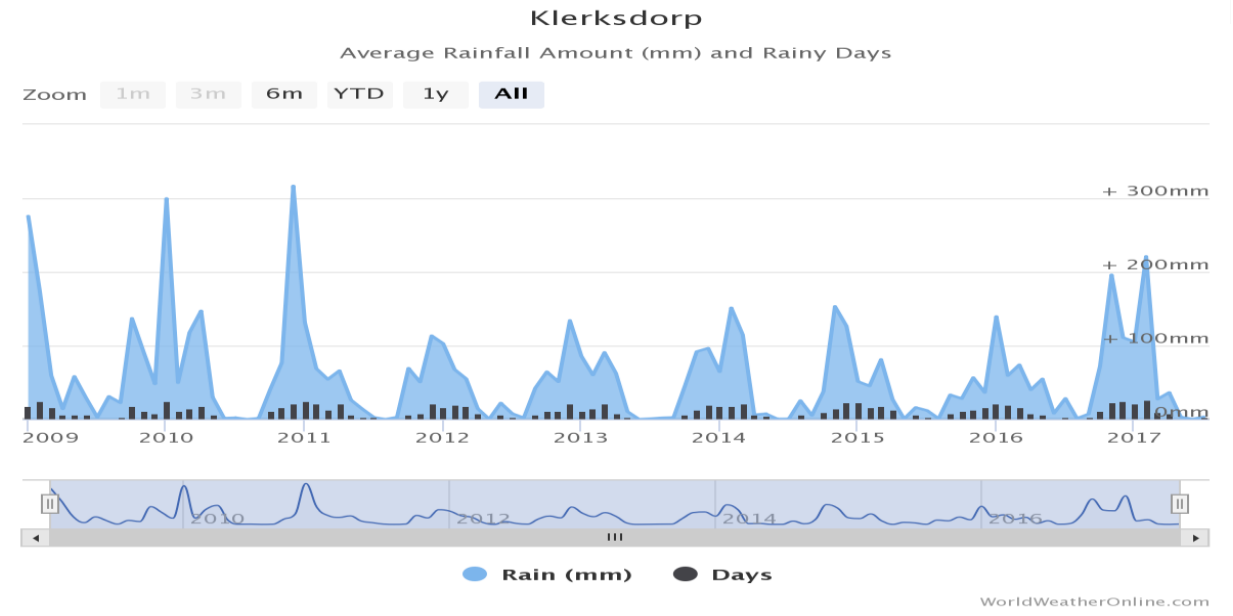
## Land area available

The total BDR operation covers 8167 ha. This the includes four original registered CBO land units covering 7164 ha and newly registered additions to the CBO totalling 328 ha. A small portion of the land is used for buildings, domestic production animals, Hand-rear facility and utilities.

## Climate

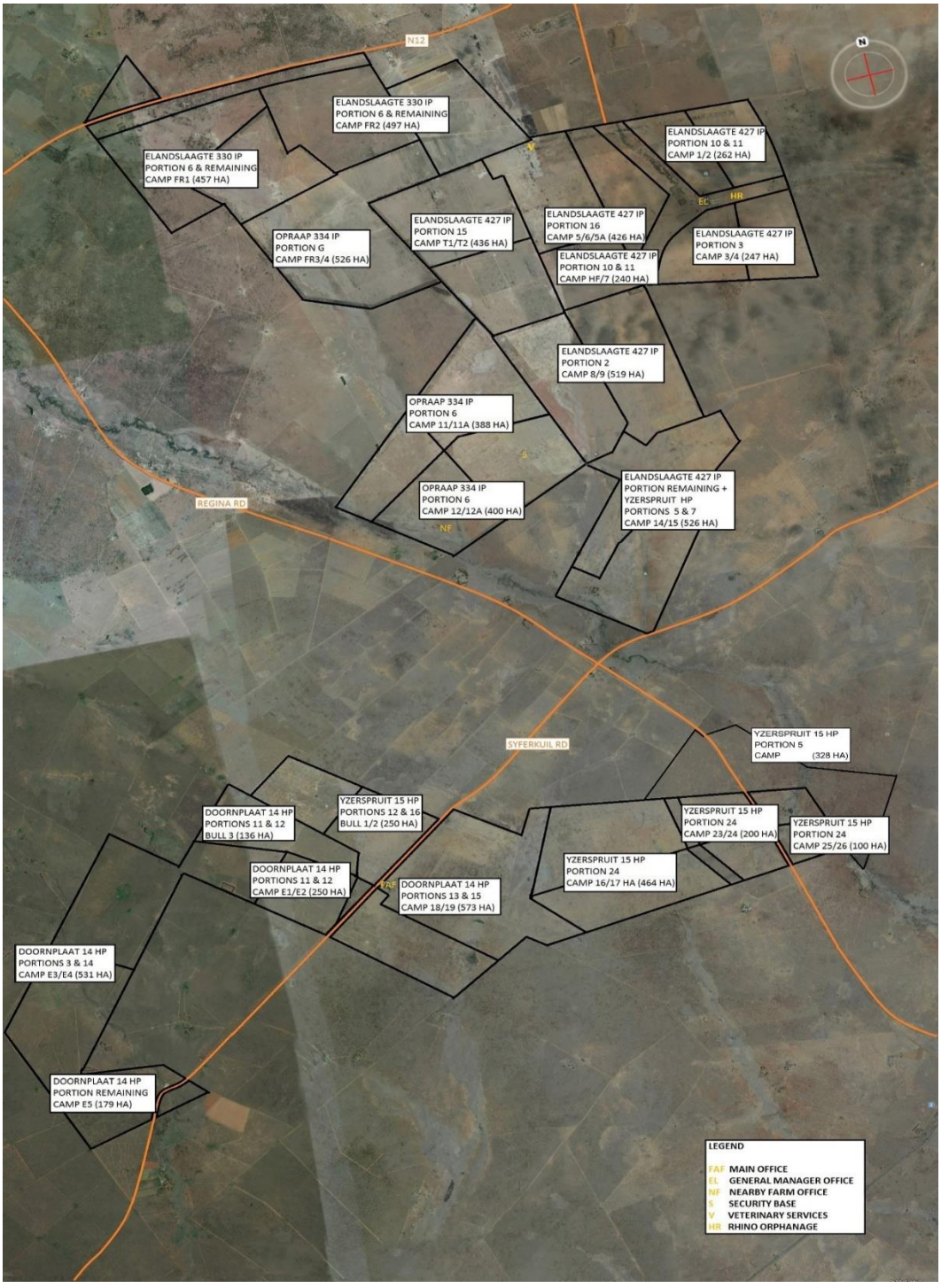
The mean annual rainfall of the surrounding region is 652.2 mm, but rainfall data from 1993 to 2010 show mean annual rainfall of 610.9 mm. Rainfall occurs mostly over December to March months, with January (normally) being the wettest month. The wet season stretches from the beginning of October to the beginning of April. The dry season is between the end of April to the end of September. Summers are warm with averages over 30° C in summer, while winters are cool with 3 months where the average minimum temperature is 1-3° C, with occasional severe frost after cold fronts.



## Geology, vegetation and soils

Site elevation is from c.1380 and 1400 m above sea level. Andesite is the most common geological substrate – an extrusive igneous, volcanic rock, of intermediate composition, with aphanitic to porphyritic texture. Andesite-derived soils have clay contents higher than for Sandstone or Quartzite-derived soils. Quartzite also occurs, forming more sandy soils. Sandy clay and sandy clay loam soils are well represented on upper parts of the terrain. These soils are widespread at BDR and mostly shallow, between 200 mm and 400 mm deep. Concave lower parts of the catena are characterized by more fertile Duplex clays and vertic soils with very high clay content. On unploughed land these clay soils are associated with almost pure stands of Red Grass (*Themeda triandra*). The vegetation is classed as Acocks (1953) Transition between Veld Type 48 (*Cymbopogon -Themeda* Veld) and Veld Type 50 (South-eastern variation of Dry *Cymbopogon - Themeda* Veld). Mucina & Rutherford (2006) classified the vegetation as transitional between Gh13 (Klerksdorp Thornveld) and Gh 10 (Vaal - Vet Sandy Grassland) vegetation types.



## Security measures

Security includes the following main elements:

- enclosed approved electrified game fencing around the entire property and the individual breeding camps to prevent the resident rhino from escaping and for their protection.
- A contracted external Security firm is retained for peripheral patrolling.
- A resident Security manager
- Resident specialized reaction and K9 units
- A security base built on the property.
- Specialized technological equipment and surveillance systems including radar and helicopter surveillance equipped with night vision and infra-red.
- A full time resident Helicopter pilot is also employed by the Buffalo Dream Ranch
- Active involvement in National as well as Local ongoing intelligence networks.
- Routine, humane dehorning of all white rhino older than 2 years on BDR are by trained personnel and the resident Wildlife Veterinarian. This is done both as a possible poaching deterrent, and helps prevent injuries between the rhino
- The location of the project and open nature of the terrain additionally hampers the undetected entry of poachers, thereby lowering the poaching incidence.

## Camp development history

Starting in 2008, the original introduced rhinos were divided among 5 breeding camps. As the project expanded and other land became available for purchase, new camps were added, and by 2010, 5 additional breeding camps and 2 bull or bachelor camps had been initiated.

By Year end of 2017, the project had 10 founder-based breeding camps, 4 predominantly progeny-based breeding subpopulations and 5 bull/ bachelor camps. Recently 315 hectares was purchased and is being readied for inclusion into bull camps for the project. The project is currently establishing the new progeny-based breeding subpopulations of FR1 and FR2, only utilizing 241 of the 457 hectares (52%) and 264 of the 497 hectares (53%) respectively, of the available space in these breeding camps. A small quarantine station to the extent of 40.5 hectares had been incorporated into enclosure 10/10A.

## Summary of BDR Operational layout and provisioning

The BDR CBO is based on a system of breeding herd camps (breeding subpopulations) and bachelor camps, ranging in size from 179 ha to 573 ha, individually enclosed with approved game fencing. Each camp is subdivided into two sister camp-sections. One sister camp-section is rested (closed off) during the rainy season of every alternate year, thus allowing the grass to go to seed in every camp-section every second year (i.e., rotational grazing). Veld condition assessments by a qualified vegetation scientist are carried out per camp each year, and any resulting recommendations regarding herbivore stocking densities are acted upon. Water provision is via water troughs and/or Earth-walled dams and/ or natural pans and/ or streams. The water troughs are cleaned weekly and routinely inspected to check for leakage and cleanliness. Water for the troughs are sourced from natural groundwater from several bore holes spread across the properties and pumped either by windmill, solar or electric pumps to ensure a continuous water supply and availability for the animals. In camps where shelter is limited, small areas of locally-indigenous trees are planted to aid in providing shade to the rhinoceroses.

Under the supplementary feeding system of providing 48% of the rhinos' annual dietary needs, the absolute maximum allowed rhino density is 3 ha/ rhino, for any camp, regardless of sex or age. This level was set by reference to vegetation studies of the BDR and North-West Departmental Scientist recommendations (Power 2014). BDR management have additionally determined, based on their studbook analyses, that the best breeding occurs at 9ha/ breeding female in the breeding camps. They recommend a capacity of 8ha/ adult male for the bachelor (bull) camps.

A permanently employed resident Wildlife Veterinarian, Dr Michelle Otto is tasked with monthly camp assessments and constant evaluation of the general health and husbandry of all rhino at the Buffalo Dream Ranch CBO's. Monthly camp assessments are done to assess the condition of the individual Breeding Camps with relation to the animal husbandry needs. Assessment includes amongst others: availability and access to clean water, mineral licks, mud baths, shade and rubbing posts etc., condition of the water troughs, Earth-fill dams, reservoirs, veld and grazing, roads, fences and gates, the presence of new invader plant species, cleanliness of camps, feeding sites, feed sheds and condition of contents etc.

## Summary of BDR Breeding policy and implementation

The breeding policy is summarised below by Otto, 2018: Breeding policies for Buffalo Dream Ranch Captive Breeding Operation (CBO)

| Breeding policy | Action(s) employed |
|---|---|
| 1.Source genetically diverse founder population | White rhinoceroses sourced from all over South Africa and relocated to Buffalo Dream Ranch Captive breeding operation by owner, Mr. J. F. Hume |
| 2.Establish different breeding subpopulations | Buffalo Dream Ranch CBOs currently has 10 founder subpopulation breeding enclosures and 4 predominantly progeny-based breeding subpopulation breeding enclosures |
| 3.Establish new breeding subpopulations from progeny born at the project | New land acquired, and four new breeding enclosures established consisting mostly out of progeny born at the Buffalo Dream Ranch CBO |
| 4.Manage stocking density in breeding subpopulations | Relevant sub adult progeny removed from main breeding enclosures and relocated to either new breeding or bachelor enclosures |
| 5.Prevent or limit inbreeding incidence | Biological management of metapopulation as well as subpopulation level done to ensure that sub adults removed from dam(s) and sire(s) to prevent potential inbreeding |
| 6.Establish a sustainable genetically viable and diverse white rhinoceros breeding population | Founder rhinoceros sourced from various independent populations during establishment of subpopulations. Addition of new founder members needed from time to time to replenish or refresh breeding stock in breeding subpopulation(s) |
| 7.Natural breeding system | All breeding occurs naturally with no artificial control or selection. No intervention in the form of oestrus monitoring, hormonal control or artificial insemination allowed. |

Breeding herd composition is maintained approximately averaging between 20-50 breeding cows per subpopulation (breeding camp) depending on the camp size, with an average of at least two dominant breeding bulls that know each other and respect each other's territories. In the same subpopulation are also on average of five (5) sub-adult or subordinate white rhinoceros males, some of which were born in the subpopulation. These sub-adult males are monitored constantly as they grow older and start to become sexually mature. If a specific maturing subordinate bull becomes acceptably integrated into the breeding herd composition within the subpopulation and provided he has no relations left in the subpopulation and the enclosure stocking rate allows it, such maturing subordinate bulls may be allowed to stay on and become breeding bulls themselves. If, however a maturing subordinate bull shows excessive aggressive behaviour it will be removed to an enclosure where only bulls are kept (referred to as a bull or bachelor camp). Selection of the breeding bulls is therefore determined by their innate breeding ability, temperament and social integration.

# Appendix 2. Comparative reproductive parameters from other white rhino sites.

**White rhino female calving parameters and population rates, calculated from data made available by certain rhino areas, or quoted from available literature. (Compiled for the AfRSG by Keryn Adcock 2018)**

| Site | Country | Reference | Average Age at First Calving | Range | Sample Size | Average Inter-Calving Interval | ICI Range | Sample Size (intervals) | Avg. Calf % Males at birth | Sample Size | Average Achieved Growth Rate | Avg. % 0-1 yr Infant Mortality | Average % Adult females calving per year |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| iMfolozi Madlozi 1968 to 1971, SA | SA | Owen-Smith (1988) | 6.75 | 6.5 to 8 | 6 | 2.63 | 1.83 to 3.42 | 35 | 66.0% | 53 | | | |
| Pretorius Kop enclosure Kruger National Park '65 to '78 | SA | Owen-Smith (1988) | | | | 2.7 | | 19 | 63.2% | 19 | | | |
| iMfolozi Madlozi 1968 to 1971; HIP | South Africa | Owen-Smith (1988) | | | | | | 170 females | | | 9.1%*** | 8.3% | 34.1% |
| iMfolozi Nqutheni 1968 | South Africa | Owen-Smith (1988) | | | | | | 55 females | | | | | 38.2% |
| iMfolozi Gqoyini 1968 | South Africa | Owen-Smith (1988) | | | | | | 35 females | | | | | 57.1% |
| iMfolozi Dengezi 1968 | South Africa | Owen-Smith (1988) | | | | | | 28 females | | | | | 35.7% |
| Imfolozi-Hluhluwe 1972 helicopter | South Africa | Owen-Smith (1988) | | | | | (0-1yr calves seen) | | 62.2% | 37 | | | |
| iMfolozi 1974 horseback | South Africa | Owen-Smith (1988) | | | | | (0-1yr calves seen) | | 60.4% | 53 | | | |
| Garamba NP, DRC, 1983-2004 | DRC | Smith (2006) | 8.25 | 6.33 to 13.5 | 10 | 2.5 | 1.75 to 4.75 | 35 | | | 9.50% | | |
| White rhino on private land, SA (2001) | South Africa | Hall-Martin & Castley (2002) | | | | | | | 53.3% | 180 | | | |
| Eastern Cape Reserves, SA | South Africa | Manqhai (2010) | | | | 2.5 | 1.7-3 (95% CI) | 74 | 59.0% | 148 | | | |
| Lichtenburg GBC, SA | South Africa | Skinner et.al.(2006) | 7.39 | 7 to 7.9 | 3 | 2.83 | 1.75 to 5.08 | 33 | | | | | |
| Kenyan Site1 | Kenya | A Kenyan Conservancy, 2017 | 6.64 | 4.70 to 9.42 | 18 | 2.43 | 1.5 to 4.0 | 83 | | | | 10.50% | 44.40% |
| Ugandan Site 1 | Uganda | Patton and Genada (in Prep.) | 7.54 | 4.47 to 8.98 | 4 | 2.08 | 1.94 to 2.34 | 4 | 42.9% | 7 | | | |
| Kenyan Site 2 | Kenya | Patton (2017) | 5.17 | 4.08 to 6.83 | 34 | | | | | | | | |
| Lapalala, SA | South Africa | van der Goot (2015) | | | | 2.58 | unknown | 17 | | | | | |
| Umfolozi, SA 1999 to 2003 | South Africa | White et.al. (2007) | | | | 2.73 | unknown | 21 | 56.8% | 44 | | | 42.9% |
| Small reserves, SA | South Africa | Metrione&Eyres (2014) | 6.5 to 7.5 | ni | ni | | | | | | | | |
| T E-Limpopo SA | South Africa | (Data from R.Els) | 6.43 | | 50 | 2.64 | | 199 | 49.0% | 286 | 10.00% | 0.70% | 42.4% |
| Ongava, Namibia | Namibia | Guerier (2012) | 6 | ni | 8 | 2.27 | 1.33 to 4.75 | 26 | 56.1% | 41 | 13% | | |
| Kyle Game Park, Zim. 1967 to 1975 | Zimbabwe | Owen-Smith (1988) | | | | 3.45 | | 23 | 30.4% | 23 | | | |
| Matopos, Zim. 1967 t0 1977 | Zimbabwe | Owen-Smith (1988) | | | | 2.85 | | 23 | 39.1% | 23 | | | |
| Motopos 1964 to 1994 (all areas all females) | Zimbabwe | Rachlow and Berger (1998) | 9.27 | 6.5 to 11.5 | 13 | 3 | 2.0 to 6.0 | 45 | | | | | |
| Motopos National Park, HA-Low density area '82 to '94 | Zimbabwe | Rachlow and Berger (1998) | 7.4 | 95% CI +-0.4 | 4 | 2.25 | 2.25 | 5 | | | | | |
| Motopos National Park, WGP-High density area '82 to '94 | Zimbabwe | Rachlow and Berger (1998) | 10.1 | 95% CI +-0.7 | 9 | | | | | | | | |
| Motopos National Park, WGP-1967 to 1974 | Zimbabwe | Rachlow and Berger (1998) | | | | 2.9 | 95% CI +-0.1 | 21 | | | 10.4% | | |
| Motopos National Park, WGP-1987 to 1994 | Zimbabwe | Rachlow and Berger (1998) | | | | 3.3 | 95% CI +-0.2 | 19 | | | 6.6% | | |
| Malilangwe, 1993 to 2017 | Zimbabwe | Clegg (2017) | 7.05 | 5.14-10.31 | 29 | 2.55 | 1.52-5.11 | 141 | 58.1% | 179 | 12.29% | <1% | 42%** |
| SVC 1990-end 2005, LRT | Zimbabwe | Anderson, N (2017) | 10.7 | 10.7 | 1 | 4.67 | 3 to 8 | 3 | 0% | 4 | 4.0% | 0 | |
| SVC start 2006-2017,LRT | Zimbabwe | Anderson, N (2017) | 6 | 5.1 to 6.5 | 9 | 2.2 | 1.25 to 2.8 | 27 | 55% | 34 | 3.5% | 0.30% | |
| BVC 1998 - 2017,LRT | Zimbabwe | Anderson, N (2017) | 6.28 | 5 to 7.25 | 5 | 2.22 | 1.75 to 3.25 | 33 | 60% | 71 | 9.2% | | |
| European Captives (EEP), 2001 to 2004 | European Zoos | Versteege 2015, 2018, Reid et.al. 2012 | 8.6 to 9.9 | ni | ni | 2.35 | ni | ni | 60.0% | 20 | | 19.60% | <13%**** |

***Hluhluwe-iMfolozi Park 1960 to 1980

** using #cows>7 years for prev year i.e. 1 year before birth of calves

**** c.115 to 124 females aged 7-34yrs present over 6 years produced 87 calves (2012 to 2017)

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Confidential data from **a Kenyan Conservancy, 2017**

**Else, R. 2018** Confidential data from a Limpopo Game Ranch.

## Appendix 3. Causes of Mortality Summary. Highlighted (shaded) causes are classed as human-related by the SADC Rhino Management Group.

| Death Causes at BDR by year (Reviewer categorization using BDR mortality discriptions) | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 to June | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Old Age | | | | | | 2 | 1 | | | 1 | 1 | 5 |
| Old age and heart issue | | | | | | | 1 | | | | | 1 |
| | | | | | | | | | | | | |
| Aborted | | 1 | | | 2 | | | 4 | 1 | | 2 | 10 |
| Calf died due to Birth complications | | | | | | | | 2 | 1 | 3 | 1 | 7 |
| Dystocia in female calving | 1 | | | | | | 1 | 1 | | 1 | | 4 |
| Suspected loss of late-term foetus | | | | | | | 2 | 3 | | | | 5 |
| Stillborn calf (near full-term) | | | | | 1 | 1 | | | 3 | 2 | 2 | 9 |
| | | | | | | | | | | | | |
| Insuffucient milk production by mother | | | 1 | 1 | 1 | 1 | 3 | 1 | | 2 | 1 | 11 |
| Death of Mother - Stress related | | | | 1 | | | 4 | 1 | | | 1 | 7 |
| | | | | | | | | | | | | |
| Birth or developmental defect | | | | | | 1 | 1 | | 5 | 3 | 2 | 12 |
| | | | | | | | | | | | | |
| Arthritis | | | | | | | | | | 1 | | 1 |
| Clostridium confirmed | | | | | 1 | 3 | 28 | 1 | | 6 | 19 | 58 |
| Clostridium suspected | | | | | | 2 | 2 | | | 2 | 4 | 10 |
| Encephalitis | | | | | | | 1 | | | | | 1 |
| Enteritis | | | | 3 | | | | | | | | 3 |
| Enteritis / Old Age | | | | 1 | | | | | | | | 1 |
| Gastro-intestinal infection | | | | | | | | | 5 | | | 5 |
| Gastro-intestinal infection & Injury | | | | | 1 | | | | | | | 1 |
| Heart-related | | | 1 | | | | | | | 2 | | 3 |
| Heart-related & Developmental | | | | | | | | | 1 | | | 1 |
| Infection | | | | | | | | | | 1 | | 1 |
| Kidney disease | | | | | | | | 1 | | | | 1 |
| Liver disease | | | | | 1 | | | | 1 | 2 | | 4 |
| Gastric obstruction | | | | | | | | | | | 2 | 2 |
| Pneumonia | | | | | 2 | 2 | 5 | 1 | | 2 | 4 | 16 |
| Renal problem | | | | | | | | | | | 1 | 1 |
| Septicemia | | | | | | | | | | 1 | | 1 |
| Parasites (intestinal etc) | | 2 | | 1 | | 3 | 4 | | 2 | 1 | 2 | 15 |
| | | | | | | | | | | | | |
| Fighting | 1 | 1 | | 4 | 2 | 2 | 1 | 2 | 5 | 7 | 1 | 26 |
| | | | | | | | | | | | | |
| Drowned | | | 1 | 1 | | | 2 | | | | | 4 |
| Electric Fence | | 1 | | | | | | | | 1 | | 2 |
| Fence structure | | | | | | | | 1 | | | | 1 |
| Accident - injury | | | | | | | | | | 3 | | 3 |
| Injury, added liver problems and Clostridium | | | | | | | | | | 1 | | 1 |
| Injury leading to Clostridium infection | | | | | | | 1 | | | | | 1 |
| | | | | | | | | | | | | |
| Jackal | | | | | | | 1 | | | | | 1 |
| | | | | | | | | | | | | |
| Cold | | 2 | 1 | 1 | 1 | | 1 | | 1 | | | 7 |
| Heat | | | | | | | | | 1 | | | 1 |
| Lightning | | 1 | | | 1 | 1 | 1 | 5 | 8 | 3 | | 20 |
| Nutrition and cold | | | 2 | | | | | | | | | 2 |
| | | | | | | | | | | | | |
| Old Bullet Wound (from pevious home) | | | | | | | | | | 1 | | 1 |
| Poaching | | | | | | 4 | 10 | 16 | | 2 | | 32 |
| | | | | | | | | | | | | |
| Cature / translocation related | | 4 | 1 | 1 | 2 | 1 | 1 | 1 | | 1 | | 12 |
| Capture & enteritis-related | | | | 1 | | | | | | | | 1 |
| Post-release stress and maladaptation | | 15 | | 1 | | | | | | 3 | 1 | 20 |
| Post release fighting | | | 2 | 1 | | | | | | | | 3 |
| | | | | | | | | | | | | |
| Wire in gut | | | | | 1 | 1 | 2 | 1 | 4 | 4 | 1 | 14 |
| | | | | | | | | | | | | |
| Unknown | | 1 | 3 | | | 1 | 1 | 2 | | 3 | | 11 |
| | | | | | | | | | | | | |
| **Total** | **2** | **28** | **12** | **17** | **16** | **25** | **74** | **43** | **38** | **59** | **45** | **359** |

# Appendix 4. Definitions (from Otto 2018b)

In accordance with the National Environmental Management: Biodiversity Act, 2004 (Act 10 of 2004) and/or TOPS, the following definitions apply

- "Captive Breeding Operation"; means a facility where specimens of a listed threatened or protected animal species are bred in a controlled environment for conservation purposes

- "bred in captivity" or "captive bred"; means the offspring born or otherwise produced in a controlled environment of parents that mated or otherwise transmitted their gametes in a controlled environment, as described in Resolutions Conference 10.16 (Rev.)

- "controlled environment"; means an enclosure designed to hold specimens of a listed threatened or protected species in a way that-

  a) Prevents them from escaping;
  b) Facilitates intensive human intervention or manipulation in the form of the provision of:
     (I) Food and water
     (II) Artificial housing; or
     (III) Health care; and
  c) Facilitates the intensive breeding or propagation of a listed threatened or protected species

- "listed threated or protected species" means a species listed as a threatened or protected species in terms of section 56(1) of the Biodiversity Act

- "Kept in captivity" or "captive kept"; in relation to a specimen of a listed threatened or protected species, means that the species is kept in a controlled environment for a purpose other than-

  a) Transfer or transport
  b) Quarantine; or
  c) Veterinary treatment

- "Sanctuary"; means a registered facility in which a permanent captive home is provided in a controlled environment for specimens of a listed threatened or protected species that would be unable to sustain themselves if released

As per CITES Resolution Conf. 10.16 (Rev.)

- Bred in Captivity- Animal species as defined in Article I, paragraph (b)of the Convention, born or otherwise produced in a controlled environment and applied only if;
  - Parents mated or gametes were otherwise transferred in a controlled environment, OR the parents were in a controlled environment when development of the offspring began

- First-generation offspring (F1) are specimens produced in a controlled environment from parents at least one of which was conceived in or taken from the wild;

- Second generation offspring (F2) or subsequent generations (F3, F4 etc.) are specimens produced in a controlled environment from parents that were also produced in a controlled environment

The following definitions have been developed and adopted by the African Rhino Specialist Group AfRSG (Leader-Williams et al 1997), based on an original scheme developed by Stanley-Price (1993) and a later standard by the captive breeding community (Foose 1995):

- Semi-wild populations of rhinos occur mainly in small (<10km$^2$) areas, either in or out of the historical range of the taxon. They live at a compressed density and spacing, requiring routine partial food supplementation and a high degree of management, but breed naturally.

- Captive populations of rhinos usually occur in small to very small areas (<1km²), either in or out of the historical range of the taxon. They have a compressed density and spacing, requiring partial or full food supplementation with frequent husbandry and veterinary intervention, and have a *manipulated breeding system.* In such situations rhinos may often be held in special pens or barns and may have controlled access to limited areas of natural habitat.

- Key 1 Population: Population (n) increasing or stable and n > 100. More specifically, a population of rhinos whose survival is considered critical for the wider survival of the sub-species.

## Appendix 5: Data Parameters generated from Studbook and detailed monitoring data records for use in population assessment.

RecordNumber
Subspecies
RhinoID
EarNotchNo
Sex
BirthDate
BirthConfidence
Mother
Status
AgeAtCurrentDate
CurrentAgeCategory
RhoDIS# (genetic sample)

INTRO DATE to BDR
Origin
AgeAtIntroduction
InAgeClass
OriginReserveID
PreviousOwner
OrigenType
IntroPermit#

DeathDate
CauseOfDeathDetails
DeathCauseCategory
AgeAtDeath
DeathAgeClass
HumanRelated 1 or 0
IllegalActivityRelated 1 or 0

RemovalDate
Destination
AgeAtRemoval
RemAgeClass
DestinationReserveID
Removal Notes
RemPermit#

Main Notes
OtherNotes
Dates Earnotched & Notes
Dates Treated & Notes

CURRENT CAMP
DATE MOVED1
MOVED FROM1
DATE MOVED2
MOVED FROM2
DATE MOVED3
MOVED FROM3

BORN ONSITE?
DateOfFirstCalf
AgeAtFirstCalving
InterCalvingInterval
Father

ONSITE BIRTH YEAR
INTRO YEAR
AFC YEAR
LIVEREM YEAR
DIEDYEAR
CONCEIVED ON/ OFF BDR
WILD/CAPTIVE BORN
GENERATION AT BDR
GENETIC SOURCE (F0-P F0-Pi F0 F1 F2 etc)

TIME ON BDR-SinceArrival or BirthDate
Age at Arrival/Birth (Start Age)
Intro'dRhino-Time from Arrival till 7yrs old
Date when 7yrs old
Time on aged 5+ year old
Time on aged 6+ year old
Time on aged 7+ year old

Time to Birth since mum introduced
Mum's Time on since intro-d CATEGORY
MumsAgeAtThisCalf'sBirth
MumType of BDR-born Calf
Mum'sBirthdayConfidence
MumOriginType
OnsiteBirth order to Mum
1stCalf to Mum? 1 or 0
MumIntroYear
MumsAge at Intro
TOTAL CALVES BORN
TOTAL CALVES CONCEIVED ON

Probability of having 1st Calf given age**

(**determined from AfRSG-collated wild white rhino AFC cumulative frequency distribution data from several populations)

# Appendix 6: Site photographs

White rhino resting in a camp.

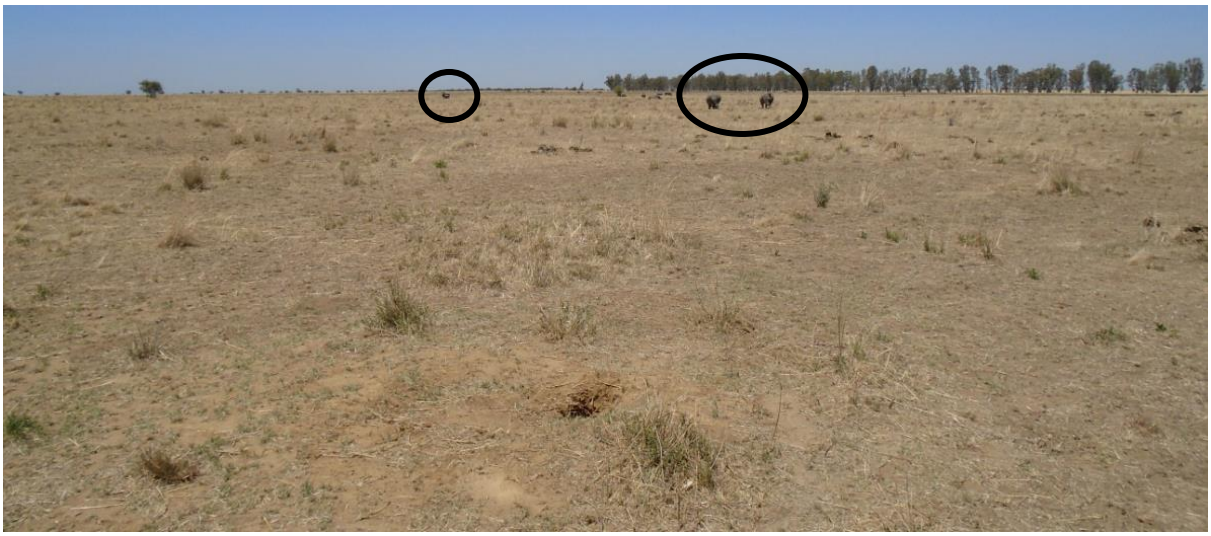
Adult female and calf with a sub-adult female - A typical scene in the camps for most of the day.

An adult male and a young female white rhino in one of the camp sections which had been rested that growing season.

White rhino supplementary feeding setup, designed so that there is one cement container for each rhino, and additional ones for buffalo in the camp. Rhino only come to the feeding area at feeding times and spend most of the day grazing or sleeping elsewhere in each camp.

Some flowering *Themeda triandra* in the sub-camp that had been rested last wet season. This species is sensitive to “overgrazing”.

Basal cover in heavily grazed area at end of winter/start of rainy season. This rooted cover level appears reasonable and is comparable to our experiences in parts of iMfolozi.



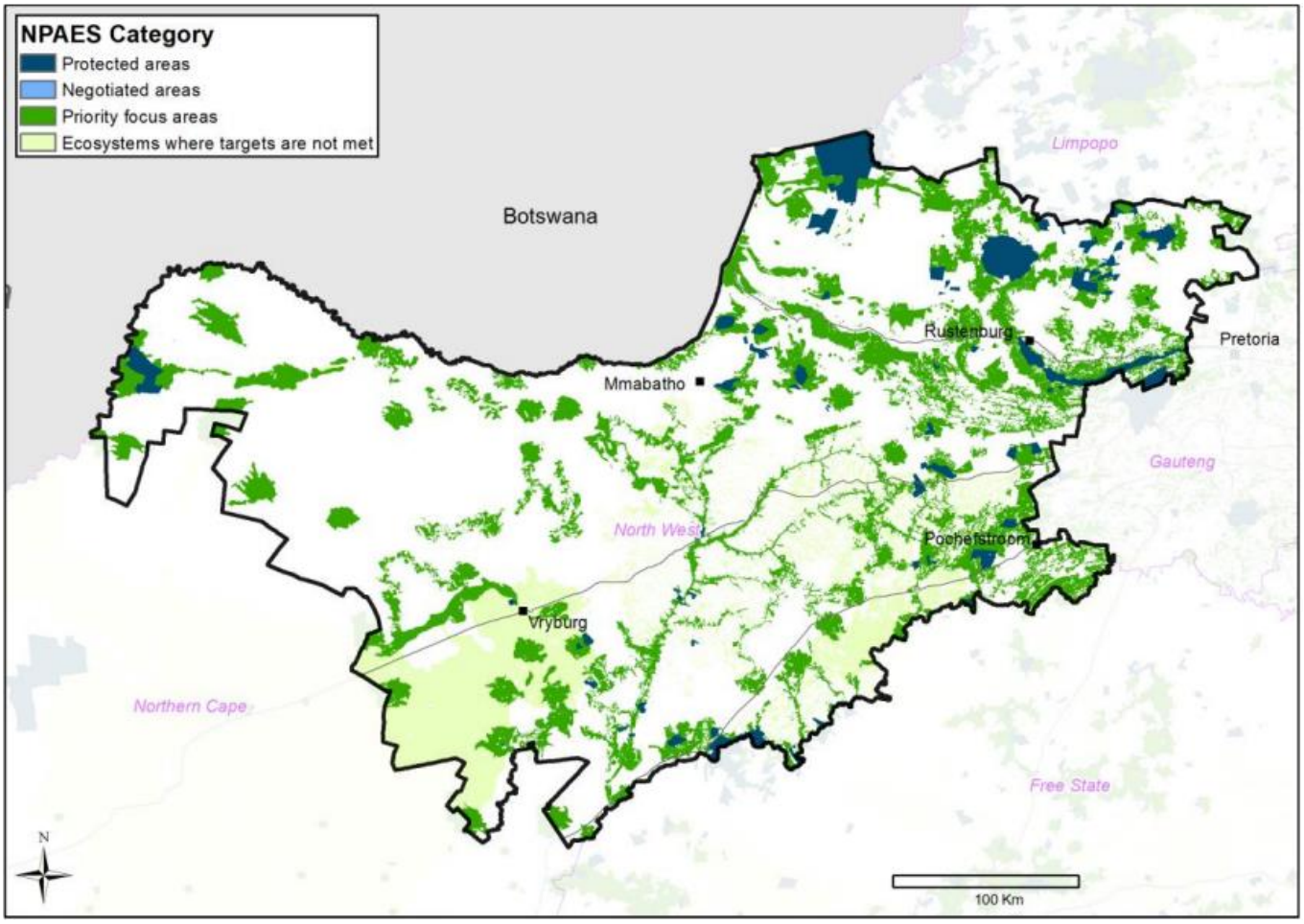
Some habitat shots with rhinos circled.

Pictures such as the one above showing feeding of pellets and Lucerne give a misleading impression of the intensity of the operation. For most of the day the rhinos disperse from these feeding stations leaving them empty with the rhinos being scattered through the camps as below (and some of the earlier photos above).

Feeding at “orphanage”. As the animals get older they are moved into other paddocks and human contact is scaled down so they can be eventually be integrated into the rest of the CBO when old enough

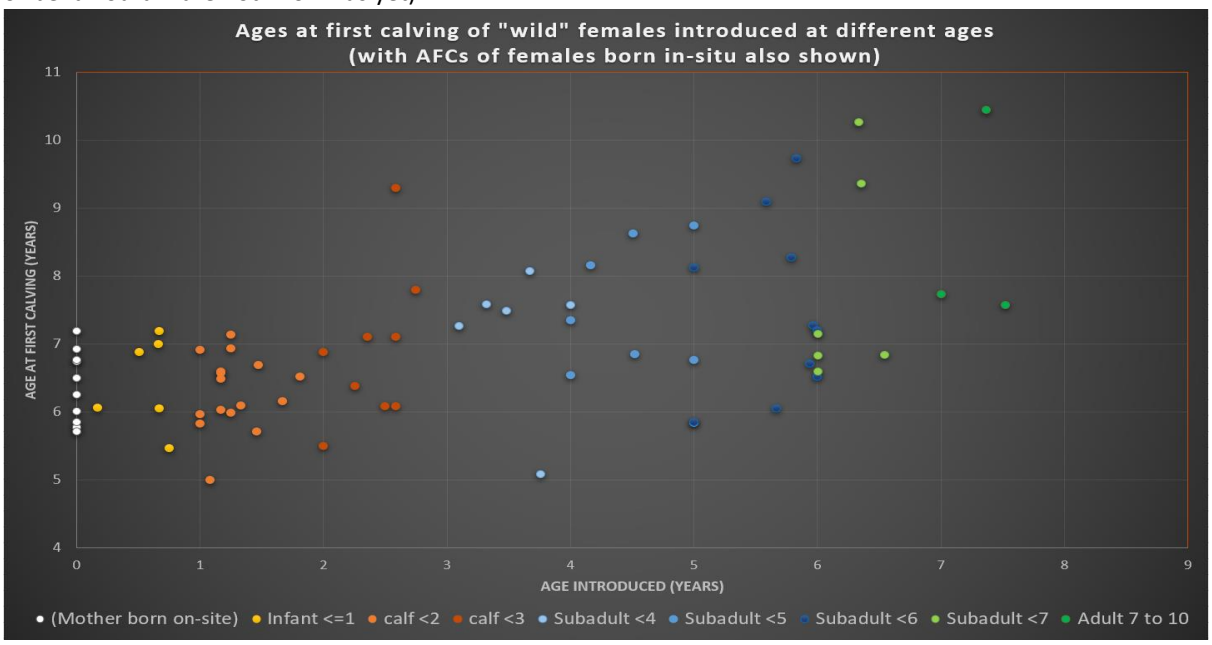
## Appendix 7. Figure 17 from 2016 review of Priority Areas for Protected Area Expansion.

Department of Environmental Affairs (2016) National Protected Areas Expansion Strategy for South Africa 2016. Department of Environmental Affairs, Pretoria, South Africa.




## Appendix 8. Effects of translocation of subadult females on their age at first calving.

Translocating subadult female rhino (3-6.9 yrs) from one site to another can sometimes result in older female ages at first calving. Females moved at younger ages are not affected. This trend has been seen in SADC Rhino Management group black rhino introduction data across Southern Africa (18 years of data). The exact reasons – whether physiological (stress-related) or behavioural - are not known as yet).



# APPENDIX 9: GENERAL QUESTIONS & ANSWERS OF INTEREST - PART A.

- Black text & red text are extracted from Adcock et al Review of BDR. – Marked *Extract*
- FRIEDERIKE VON HOUWALD COMMENTS/QUESTIONS IN BLUE – marked FVH (IUCN AfRSG / AsRSG member, European Association of Zoos and Aquaria representative, European Rhino TAG Chair and International Studbook Keeper for Greater one-horned rhinos)
- KERYN ADCOCK (AfRSG and SADC RMG)'S REPLY IN GREEN – marked KA
- BDR's DR MICHELLE OTTO/ MR JOHN HUME REPLIES IN BROWN - marked MO/ JH

Objectives of the BDR CBO - *Extract*

The stated primary objective of the Buffalo Dream Ranch CBO is the breeding, protection and conservation of white rhino in circumstances where the species is under severe pressure and immediate threat of poaching. BDR aims to achieve both of the objectives stipulated under the definition of "Captive Breeding Operation" in Section 1 of TOPS, i.e. for conservation purposes and for commercial purposes. Saving rhino is the first priority of this enterprise (2018 Management Plan Update, Otto 2018).

The stated Secondary and/or implied objectives relating to white rhino include, but are not limited to: education, training, anti-poaching security, hand rearing orphaned rhino, veterinary care and vaccination programs, veld management, rotational grazing programs, scientific research, data collection and evaluation, and pursuing and investigating viable commercial models aimed at sustainable utilisation of white rhino as a renewable natural resource.

**FVH -** A BREEDING PROGRAM USUALLY CONTAINS SEVERAL PLAYERS IN CAPTIVE / SEMI CAPTIVE SITUATIONS. BDR IS ONE, ARE THERE PLANS FOR OTHERS TO BE INCLUDED. OR IS THE CBO JUST SET UP FOR BDR? (ALL EGGS IN ONE BASKET?)

**MO/ JH -** BDR CBO is currently the only registered CBO for rhino in South Africa. Mr Hume is a member of PROA (private rhino owners association). Dr Otto also assisted SANBI with the setting up of the national rules and regulations for the National registration of CBO. Once more owners in South Africa register CBO's, being part of PROA, will allow direct negotiations between its members and Mr Hume for supplying rhino from the BDR (rather than simply sourcing from NP) for their own registered CBO's in the future. Private rhino ownership has played a pivotal role in rhino conservation in South Africa in the past and is currently still active in rhino conservation.

**FVH -** WHAT IS SPECIFICALLY MENT BY BDR WITH CONSERVATION PURPOSE / COMMERCIAL PURPOSE? TO BREED IN ORDER TO MAINTAIN A POPULATION AND TO SELL AND USE THE REVENUES TO BREED? IF SO, THIS SHOULD BE CLEARLY MENTIONED IN ORDER TO AVOID LOOP HOLES ( I ASSUME THAT KNP HAS ALSO GUIDELINES OF HOW TO USE THE MONEY FROM SALES FOR THEIR BUSINESS?)

**MO/ JH -** Rhino in South Africa are currently being poached at approx. 1000 lives lost per annum. Most NP are struggling to maintain positive annual population growth rates (including the Kruger NP). BDR on the other hand, is currently growing by above 8% p.a and has just celebrated 18 months with no poaching losses. From a conservation point of view, BDR is therefore succeeding in breeding and protecting its rhino population. This population is still part of South Africa's metapopulation and are managed in such a way that they can serve as a safety net and be reintroduced back into NP as well as other game farms if need be. The BDR CBO is privately funded by Mr Hume. The revenue generated from live sales of rhino as well as rhino horn will help make the BDR sustainable as well as allow the current successful breeding and protection strategies to continue in future.

KA - Ownership and use and sale of rhinos to generate revenue and help fund and incentivise conservation has formed a big part of the successful recovery of the species and is part of the national plan.

BDR CBO in the context of South Africa's Biodiversity Management Plan for white rhino (2016-2020) - *Extract*

**The Biodiversity Management Plan target for white rhinos is to achieve a meta-population of at least 20,400 in South Africa by 2020**. **Due to declines in estimates for SA's largest population Kruger NP, the country is not likely to achieve the plan target. However, BDR breeding program will assist SA in not missing this target by an even larger amount than could be.**

If BDR maintains its average net growth of at least 8.7% per year, **BDR animals should contribute around 1990 rhino to the National total by year 2020 – that is roughly 11% of the projected 2020 SA metapopulation**. Numbers in the rest of SA are predicted to remain around or just below 16 000. This is shown in the figure 9 below. The projections for this graph use growth rates for Kruger NP based on their population estimates, removals and poaching data (also see Ferreira et al. 2015, 2017), and in the rest of South Africa's white rhino. *They assume that 2017 levels of poaching continuing across SA*.

**FVH -** IF BDR IS CONTINUOUSLY BREEDING SO WELL, WHERE WILL THE RHINOS GO TO IF OTHER AREAS ARE NOT SAFE? ARE THEY ALLOWED TO SELL OUTSIDE OF SA? WHO WILL GUIDE THIS PROCESS?

**KA -** As a protected ('TOPS') species in SA there is huge amount of National legislation governing the touching/moving and translocation locally and internationally of rhino. All site they'd go to would have habitat, management and security assessed. Currently South African authorities have decided that only (5) should go to any 1 international institution outside of range provided they fit strict guidelines re facility conditions and husbandry and purpose etc.

**MO/ JH -** The main goal of the BDR CBO is the proliferation of rhino under current threat caused by the poaching crises in South Africa. The entire operation as well as national rhino management is strictly regulated by national as well as provincial permitting systems. BDR CBO has already exported rhino internationally and is currently in negotiations with other international CBO/ Zoological institutes to supply them with new rhino for their genetic diversification (rather than sourcing rhino from the NP)

**KA -** A relevant comment is that Kruger National Park is currently under a State Veterinary ban prohibiting movement of rhino out of the area due to the TB issue (which most experienced rhino vets think is an over-reaction and unjustified, and which threatens SA's ability to manage the species for maximum growth ).

**FVH -** WHAT IS THEIR OWN CARRYING CAPACITY?

**KA -** 9 HA per breeding female, 3 ha per total rhino stock. John Hume's plan is to continually add land to the CBO as the population grows. Mr Hume has another property where surplus males could be sent if needed.

**FVH -** WHAT IS THE POPULATION TARGET FOR BDR IN THE NEXT 10 – 20 YEARS?

**MO/ JH -** The aim is to be able to produce approximately 200 progeny per annum. This will allow 100 progenies to be available per annum for live sales, both nationally as well as internationally. This will help restock south African NP as well as other private rhino owners as well as provide new founders to international CBO/ Zoological institutes as well as keep Southern White rhino from going extinct like the Northern white rhino

**FVH -** WHERE DO THEY SET THE GENE DIVERSITY OF THEIR POPULATION?

**KA – Together with Hluhluwe-iMfolozi (the original source of all the world's white rhino bar two) and Kruger National Park the BDO population is one of the main genetic reservoirs for the species. No rhino population in history has been founded with so many animals from so many different populations.** Rapid breeding, low mortalities and diverse parent stock can help maintain the current diversity. Routine RhODIS DNA sampling (a legal requirement every time a rhino is darted for dehorning or translocation) should also provide genetic profiles to assist with conservation management in future.

**MO/ JH -** BDR CBO currently has the most diverse private genetical gene pool for Southern White rhino in the world. This was achieved by sourcing founders from across South Africa from various demographic regions. Considering that all living SWR originally came from a small pocket of surviving SWR in Hluhluwe in the 1900's, if there has been genetic drift or diversification, it will be present in the BDR CBO rhino population. Plans are already in motion to try and use the BDR CBO rhino population to investigate this.

**FVH -** WHEN DO THEY HAVE TO STOP BREEDING (IN CASE THE LAND IS OVERUSED BY TOO MANY ANIMALS AND TOO LITTLE REGENERATION TIME FOR THE LAND…) AND THEY CAN'T SELL…

**KA -** Hume's plan is, funding permitting, to continually add land to the CBO as the population grows.

**MO/ JH -** As a failsafe, and in case no additional land is immediately available, Mr Hume also owns a game ranch in Malalane to the extent of 6700 hectares to which excess bulls (currently in bull/ bachelor camps at the BDR CBO can be relocated, thereby freeing up additional space at the BDR CBO for expansion of its breeding herd in future.

**FVH -** WHAT WILL HAPPEN IF THEY HAVE TO STOP BREEDING AS NO ONE WILL / CAN TAKE THEM? IS THERE A PLAN THAT IS LOOKING AT AN EXIT SITUATION?

**KA -** Hume will be making such a plan. This is required for CITES registration of the CBO with our Biodiversity Institute / Dept Environment.

**MO/ JH -** If it comes to the point where no other choice exists but to liquidate, the BDR CBO which currently consists out of 4 separately registered CBO's (all adjacent to each other and managed currently as a single unit) can be sold off separately.

**FVH -** WHAT HAPPENS IF HUME GOES BANKRUPT (AS MENTIONED IN SEVERAL MEDIA?)

**KA -** Hume is seeking to explore and develop a more diverse and hopefully more sustainable funding model for the BDR CBO. This is required for CITES registration of the CBO with our Biodiversity Institute / Dept Environment. Indicating there are cash flow constraints (when you have assets that can be sold to raise capital) is not the same as bankruptcy risk.

**MO/ JH -** The media refers to declarations by Mr Hume that the current financial model being used to run the BDR CBO is not sustainable- it does not mean that the project will go bankrupt. Mr Hume currently has a stock pile of 6.5 tons of rhino horn that can be used to continue funding the project. In addition, international registration will allow for more live sales internationally as well increased horn trade. If the economic value of SWR increases because they are worth more alive than dead, more rhino owners in south Africa will reinvest in rhino and be able to afford to breed and protect rhino again allowing for more interest in the domestic trade in rhino as well.

- *Extract* The Buffalo Dream Ranch Captive Breeding Operation (BDR CBO) has a place within the vision and conservation targets of South Africa's Biodiversity Management Plan for white rhino (2016-2020 - Gazetted in 2015).

The BMP vision for white rhino is *"A world with reduced poaching and demand for illegal rhino horn, where the future survival of wild white rhinos is ensured in South Africa, through secure populations which are economically and ecologically sustainable, and which provide a source of founder rhinos to help repopulate former range states as needed*."

While larger "wild" populations remain the priority focus of the South African white rhino conservation effort, the formation of Captive Breeding Operations for white rhino is recognised as a potentially valuable conservation option in the South African Biodiversity Management Plan for White Rhinoceros, under point 5.3 (sustainability).

Specifically, CBOs could play a role as an effective way to protect rhino from poaching while maintaining rapid population growth to help compensate for national losses, and to contribute to restocking South African and African range areas should these become secure enough from poaching threats at some point in time.

*The BMP emphasises that CBOs or sites of intensification of rhino breeding should not lead to increased land fragmentation at the expense of continuous wild natural areas, nor to the selective breeding, domestication and genetic divergence of CBO rhino from wild rhino*. Additionally, CBO operations *should not de-incentivise the breeding and conservation of white rhino in extensive natural areas of public or private land*.

The BMP specifically called for setting up of guidelines for CBOs, and more recently a SADC Rhino Management Group working group helped SANBI produce CBO guidelines (Selier et.al 2018), many of which are based on the operational experience of the BDR white rhino breeding program.

**FVH -** THE (ABOVE) VISION AND OBJECTIVES OF THE SA WHITE RHINO BIODIVERSITY MANAGEMENT PLAN ARE CLEARLY STATED, BUT THEY ARE VAGUE (AS SO OFTEN IN THOSE DOCUMENTS): IS COMPENSATING FOR NATIONAL LOSSES MEANING THAT THEY BREED UNTIL THEY CAN PLACE THEM IN NP?

Visions are by their nature vague and more long term. The Plan does have a measurable short term number goal/target. South Africa and even regional rhino are managed as a metapopulation, they are spread across National and provincial parks and private sector under different management models. The diversity of metapopulation sites/ models helps spread risk. In the worst case of a National Park losing its rhino or reaching low numbers they could be restocked from such a source.

**MO/ JH -** BDR CBO is managed in such a way that any of the rhino can be used to restock any reserve in South Africa

**FVH -** WILL THEY SELL THEM TO NATIONAL PARKS OR DONATE? WILL NP ABLE TO BUY?

**KA -** Financing such a transfer would have to be negotiated between parties. State run parks have raised millions of Rands selling surplus rhinos in the past and used the funds for their own conservation.

**MO/ JH -** Yes

**FVH -** IS SUCH A BACKUP POPULATION A POSITIVE THING TO HAVE OR DOES IT CREATE DEPENDENCIES…? MAYBE ONE DAY JH / BDR WILL BE SO POWERFUL AS HE HAS SO MANY RHINOS THAT HE WILL BE IN THE POSITION TO OPEN THE MARKET… (WHICH IS NOT EXCLUDED IN THE REPORT AS IT IS CLEARLY STATED IN THE OBJECTIVES THAT HE WANTS TO INVESTIGATE IN VIABLE COMMERCIAL MODELS. ….

**KA -** By "open the market" I presume you mean horn trade? The National legislation will determine whether this is allowed to happen in general and SA would have to submit a proposal to CITES. There is a Parliamentary committee and many advisors including our Biodiversity Authority are assessing the issue.

More generally SA national plan for white rhino makes provisions to allow rhino to contribute sustainably to the national economy **as well as requiring them to be conserved to their maximum in the wild (i.e. parks and reserves).** Sustainable use is also enshrined in South Africa's constitution.

There is also a call for and wider interest in community-based white rhino initiatives to bring income to rural areas instead of poaching.

**FVH - VETERINARIAN ISSUES / THOUGHTS** -12 CALVES DIED OF DEFORMATION. WE SEE THIS AS A RESULT OF GENE LOSS IN CERTAIN SPECIES, NOT IN RHINOS THOUGH. DO THEY KNOW THE GENE DIVERSITY IN THEIR POPULATIONS? DO THEY KNOW THE RELATION OF THE FOUNDERS TO OTHERS WITHIN THE GROUP THEY ARE BREEDING WITH? GIVEN THE FACT THAT ONLY 20 WR SURVIVED SOME TIME AGO, THIS ASPECTS KIND OF SEEMS TO BE RATHER IMPORTANT TO LOOK AT VERY SOON, ESPECIALLY AS HE IS PRODUCING SO MANY OFFSPRING.

**KA -** BDR plan to use their DNA data can to study the genetics of rhino further working with SA and international universities. Because basically all the rhino have DNA samples they can look at parentage/ancestor and relatedness in detail and also start to link characteristics like fecundity or some other feature to genetic types perhaps, in time as understanding of the white rhino genome is developed. Looking at the source of defects will be one of the issues addressed in time.

In most other white rhino populations, the managers do not find deaths rapidly enough to enable proper detailed autopsies, so issues like defects are very rarely detected. BDR has opportunity to assist in this issue.

**MO/ JH -** Part of the management plan followed by the BDR CBO is for a complete veterinary post mortem to be conducted on all animals that die. This is not the case on most other reserves including National Parks. The incidence of birth defects is still very low but worth reporting and documenting so as to further our knowledge of SWR. Strict biological management and an updated studbook is in place at the BDR CBO so as to prevent active inbreeding in its subpopulations as well as investigate any potential genetic abnormalities that could arise

**FVH -** KEEPING BUFFALOS WITH RHINOS CARRIES THE RISK OF SPREADING TB. DO THEY KNOW THE STATUS QUO? TB IS A HOT TOPIC HERE IN EUROPE. IT IS VERY DIFFICULT TO TEST FOR (SKIN TESTS ETC IS NOT WORKING IN RHINOS RELIABLY) AND IN CASE THE RHINOS ARE MEANT TO BE MOVED BACK TO THE WILD HOW CAN THEY ASSURE THAT THEY ARE NOT CARRIES OF TB?

**KA -** The BDR has disease free buffalo.

**MO/ JH -** The buffalo herd is disease free and tested regularly. In addition, all the black rhino currently at the BDR CBO (all of which co-inhabit camps with buffalo) have been tested and screened for TB by Dr Michele Miller and all have been found to test negative. In addition, none of the post mortems thus far conducted on any of the white rhino at the project have giving any indication of TB or potential infections transferred from buffalo to rhino.

**FVH -** NOTICING THAT ANIMALS HAVE DIED FROM COLD OR HEAT I WAS JUST WONDERING IF HUSBANDRY COULD BE IMPROVED. THESE ARE UNNECESSARY LOSSES IN SEMI CAPTIVE SITUATIONS.

**KA -** The rhinos are in natural habitat similar to that occurring across 30 to 60% of South Africa climatically so they need to be exposed to such conditions re maintaining their tolerance for natural conditions and evolutionary selection.

**MO/ JH -** The BDR CBO is unique in existence in that it is registered as a CBO but the population is held in semi-intensive conditions. In other words they are kept in a controlled environment with supplementary feed during

the winter months as well as ad hoc veterinary care when needed, but ***they live in a natural environment similar to other rhino in South Africa.***

**FVH -** (WHAT IS….) THE ACTUAL PLAN OF WHAT THEY WANT TO ACHIEVE IN THE NEXT 5 YEARS, 10 YEARS, 20 YEARS,…?

**MO/ JH -** Mr Hume's goal is to prevent the SWR from going extinct. He has dedicated the last 20 years of his life as well as most of his life savings to achieve this. Unfortunately, the financial strain of rising security costs (due to the unrelenting onslaught of poaching) needed to continue achieving this in the future has now caused him to seek additional sources of funding to make the project sustainable. He is still focussed on breeding 200 progeny per annum which will allow for the restocking of national numbers. He currently holds a stock pile of 6.7 tonnes of rhino horn which can easily be used as a financial solution for the project to continue existing for the next decade plus (depending on legalization of the horn trade of course). In addition, he is also in negotiations with international CBO/ Zoological institutes to sign MOU which will allow him to supply them with rhino when needed rather than having them source rhino from our wild NP's. He is also part of the TRUE GREEN ALLIANCE (TGA), an NGO focussed on community development and enhancement which could also assist in giving ownership of rhino to rural communities.

**FVH -** (WHAT ARE MR HUME"S….) SOLUTIONS IN CASE IT DOES NOT WORK OUT THE WAY THEY WANT.

**MO/ JH -** If it comes to the point where no other choice exists but to liquidate, the BDR CBO which currently consists out of 4 separately registered CBO's (all adjacent to each other and managed currently as a single unit) can be sold off separately. It deserves to be mentioned that Mr Hume has not given up the fight for rhino or the CBO BDR and will continue in his effort to prevent this from happening.

## APPENDIX 9: GENERAL QUESTIONS & ANSWERS OF INTEREST - PART B.

- COMMENTS/QUESTIONS IN BLUE UNDERLINED (labelled US REVIEWERS): these are from United States reviewers: **Dr. Gina M. Ferrie** (Disney's Animal Kingdom), **Adam Eyres** (Fossil Rim Wildlife Centre and Association of Zoos & Aquariums (AZA) Rhino TAG chair), and **Dr Susie Ellis**, Executive Director, International Rhino Foundation; member of the International Union for Conservation of Nature's (IUCN) African Rhino Specialist Group and Asian Rhino Specialist Group; and Red List Authority of the latter group.
- BDR's DR MICHELLE OTTO/ MR JOHN HUME REPLIES IN BROWN - marked MO/ JH

US REVIEWERS: **GENERAL COMMENTS WERE**….

1) THE REPORT CLEARLY DEMONSTRATES THE SUCCESS OF BDR'S BREEDING OPERATION, WITH CONSIDERATION OF MANY ASPECTS OF THE BIOLOGY OF THE RHINOS, GROWTH AND MANAGEMENT OF THE POPULATION, AS WELL AS INDIVIDUAL HEALTH AND WELFARE CONSIDERATIONS OF THE RHINOS. SOME OF THE POSITIVES, ALSO LISTED BELOW, INCLUDE THEIR CONSIDERATION OF NATURAL BREEDING SITUATIONS (MALE TO FEMALE RATIO IN THE CAMPS), THE REPRODUCTIVE PARAMETERS OF FEMALES (INTER-CALF INTERVAL, AGE AT FIRST CALF), RELATIVELY LOW INFANT MORTALITY RATES, HIGH GROWTH RATE OF THE POPULATION.
2) WE ARE IN AGREEMENT WITH THE ASSESSMENT THAT BDR SHOULD BE CONSIDERED A MAJOR ASSET TO THE CONSERVATION OF SOUTHERN WHITE RHINOS IN AFRICA.

3) LAND ASSESSMENT: IT WAS GOOD TO SEE THE LAND USE ASSESSMENT WITH THE ROTATIONAL STRATEGY BEING USED, AND AN ASSESSMENT OF APPROPRIATE STOCKING DENSITIES.
4) **LOW NUMBERS OF F2 ANIMALS.** SINCE THE ANIMALS HAVE BEEN MANAGED FOR A RELATIVELY SHORT PERIOD OF TIME (10 YRS), WE ARE ALL IN AGREEMENT THAT THE CONCERN THAT THERE AREN'T MORE F2S SHOULD BE MINIMAL. IT'S ALMOST MATHEMATICALLY/BIOLOGICALLY IMPROBABLE THAT THERE WOULD BE THAT MANY MORE F2 OFFSPRING AT THIS POINT. THE MAJORITY OF THE FEMALES THAT ARE GIVING BIRTH ARE OLDER THAN 7 YEARS (1000 OUT OF 1050 BIRTHS, OR 95.2%) SO CONSIDERING GESTATION FOR THE F0 AND F1 USING THE 7 YEAR BIRTH, PUTS IT VERY CLOSE TO 10 YEARS. BDR WILL NEED TO CONTINUE TO DOCUMENT AND EXAMINE THIS AS ONE WOULD EXPECT TO SEE MORE F2 BIRTHS IN THE NEXT 1-2 YEARS.

US REVIEWERS: **Questions on Bull management**. More information on the management of the bull herds would be useful. While the population was purposefully stocked with a very high ratio of females to males, with a slightly male-dominated birth ratio (54%), the population is getting closer to an even sex ratio (currently 1 male to 2.5 females). This certainly makes one wonder how successful the bull herds are, how much more intensely are they being managed from a behaviour standpoint, how often they need wound management, etc. The mortality table considers death by fighting a natural death, which it certainly is, but we would be interested to see how this compares to the other wild populations, particularly that it seems like mortality due to fights may be increasing (5 and 7 in both 2016 and 2017). Some of this mortality may be an accepted risk but would be interesting to know how they are thinking about this, and will manage it, into the future.

MO/ JH. The current breeding population at the BDR CBO consists out of *n*= 602 rhino (545 cows versus 57 bulls). The bull to cow ratio of the breeding population overall is therefore 1 bull to 9 females. The BDR CBO currently has an excess of 200 adult bulls that are not part of the breeding population and have been placed in bull/ bachelor camps that are separate from the breeding subpopulations. Currently the stocking rate for the bull/ bachelor camps are managed at approximately 8 hectares per rhino. These *n*=200 extra bulls currently exist in 5 different bull/ bachelor camps. Additional land has just been purchased for the sole purpose of establishing additional bull/ bachelor camps in light of the need to remove more surplus males from the current breeding populations. It deserves to be mentioned that geographically, all the bull/ bachelor camps are kept separate from all the breeding camps and are not in close proximity or adjacent to any of the breeding camps. Even though there has been some mild fighting sporadically reported amongst some of the bulls, mostly due to a settling effect after new introductions into a specific bull/ bachelor camp, no serious injuries have to date been recorded that had needed veterinary intervention.

Only *n*=18 recorded cases (5%) of the deaths were due to intraspecific fighting to date. This consisted out of *n*=4 adult cows dying during the period of new population establishment soon after introduction, *n*=1 bull in a bull/ bachelor camp and *n*=13 subadult males ranging from age 12-38 months being bullied and dying from injuries in breeding camps during period (March 2008- 30 June 2018). Adjustments to the management plan of the project have since been made which ensures that sub adult males left in the subpopulations are more closely monitored. If any signs of bullying or fighting is noticed, these males are immediately removed from the relevant subpopulation for their own protection.

To date only a single death due to fighting has occurred in a bull/ bachelor herd. The policy followed by the project is to always introduce a new male into a bull/ bachelor herd along with at least one other male that he knows or is familiar with. This allows the males to have a companion during the settling effect into the new bull population to reduce stress as well as ease introduction. In the single incidence of mortality due to fighting that occurred in a bull/ bachelor camp, a young sub adult male sourced from Kwa-Zulu Natal was introduced along with another adult bull into the camp, after translocation from Kwa-Zulu Natal to the project. Both males were offloaded together at introduction to ensure that they had a companion during introduction to the project. Unfortunately, the younger male in this instance struggled to settle into the herd comprising out of older bulls. To reduce the incidence of this age-related settling effect problem, bulls due for introduction into these bull/bachelor camps are now only

introduced into camps with bulls of similar age and size to limit bullying of smaller or younger bulls as much as possible.

US REVIEWERS: **Questions on Mortalities**. As the report also points out, the numbers of mortalities caused by human-related events (non-poaching) seemed a bit higher than expected in an intensively managed situation. It appears that the biggest spikes were in 2009 which were mostly post-release related, but also in 2017 which is spread across multiple events, but mostly wire in gut as well as post-release. Would be nice to have a response from Hume as to what he is doing to change operations to attempt to reduce or eliminate these issues in the future. Surely going over all the pens with a detection device would be labour intensive but it would get rid of the problem of animals ingesting wire.

MO/ JH. The BDR CBO as well as South Africa experienced a severe drought during 2015/2016. The lack of available grazing and supplementary feed stuffs freely available resulted in the sourcing of inferior quality grass bales and reserves. Some of the wire was ingested along with the feed provided. To prevent this, large magnets have now been placed in the feed mixers to pick up any errand wire that could possibly be amongst the supplementary feed sourced from off the property. In addition, an active wire removal program has since been instituted whereby laborer's are frequently sent out to walk through the enclosures to pick up any stray wires lying in the veld.

US REVIEWERS: **Questions on Removals**. The data show that on occasion animals are removed completely from the population (Tables 1 and 2, page 6; text page 8). As far as we can tell, there is no documentation as to why these animals were removed, so we can only speculate. While the numbers removed are minimal (19 total across time), it would still be good to document the reasons for removal and to examine patterns.

MO/ JH. Removals were due to live sales of juvenile progeny from the project. These animals were either sourced from the orphanage or from breeding populations with high progeny numbers. None of the male progeny sold had been flagged for potential breeding and would have been placed in bull/ bachelor camps if not removed for sale

US REVIEWERS: **Questions on Limiting inbreeding**. Hume sourced from a lot of places and has produced a lot of offspring in a well-managed program that limits potential for inbreeding and provides best opportunities for multiple bulls to pass on their genes. The document states that the genetic diversity (is this based on pedigree only?), is greater than any other population in South Africa other than Hluhluwe-iMfolozi (and I'm not sure how they determined the diversity there). Has there been a genetic analysis carried out apart from simply looking at pedigrees?

MO/ JH. Genetic analysis is an on-going project
**(KA:** Note that the actual statement was that genetic diversity was greater than any other population other than Hluhluwe-iMfolozi and Kruger National Park)

US REVIEWERS: **Questions on Population Modelling**. Another useful future piece of information would be to think about conducting some modelling about extractions. If in fact this population can/will be used for restocking other populations, it would be nice to demonstrate the reproductive rates required, the growth rates that they can maintain, and what potential extraction rates could be considered and managed under various scenarios. All of the studbook analyses on demographic information is great, and they say that they can maintain a genetically healthy population, but a PVA type analysis would be an appropriate next step.

MO/ JH. Noted.