

# Dispersal and social behaviour of the three adult female white rhinos at Ziwa Rhino Sanctuary in the immediate period before, during and after calving

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## Abstract

The paper presents details of the dispersal and social behaviour of the three adult female white rhinos at Ziwa Rhino Sanctuary in Uganda in the period one month before, the month during and one month after calving where published information from other reserves is limited. All six births occurred during night-time hours in areas of dense habitat. Births took place within 32 hours of the older calves being chased away by their mothers. Each female moved within the rhinos' preferred habitat of open woodland with short grass and spent most of her time alone with her new calf and little time associating with other rhinos in the population. Apart from the chasing away of the older calves, there was no indicator of an impending birth.

## Résumé

Le document donne les détails de la dispersion et du comportement social des trois rhinocéros blancs femelles adultes au sanctuaire de Ziwa au cours du mois avant, pendant le mois et le mois après le vêlage là où les informations publiées à partir d'autres réserves sont limitées. Les six naissances ont eu lieu durant la nuit dans des zones d'habitat dense. Les naissances ont eu lieu dans les 32 heures après que les jeunes rhinocéros plus âgés aient été chassés par leurs mères. Chaque femelle s'est déplacée vers l'habitat de rhinocéros préféré de forêts claires aux herbes courtes où elle a passé la plupart de son temps seule avec son nouveau bébé en s'associant peu avec d'autres rhinocéros dans la population. En dehors du fait d'avoir chassé des jeunes rhinocéros plus âgés, il n'y avait aucun autre indicateur d'une naissance imminente.

## Introduction

A search of the published literature on the behaviour of white rhino females and their associates at and around the birth of a new calf showed that there was a paucity of detailed information on the subject. Owen-Smith (1975) is the research most often referred to in papers relevant to the social behaviour of white rhinos. He reported that calves were driven away by their mothers prior to the birth of a subsequent calf, but gave no details as to how soon after the former calf was driven away the new birth took place or at what time of day or in what type of habitat births took place.

No reports could be found to indicate whether the behaviour of the female in the weeks leading up to the birth of a new calf altered in any way that could be

used as an indicator of an impending birth. Such an indicator may be useful in the management of the cow and calf where additional security may be required to ensure their survival.

Limited information exists on the changes to the social behaviour of a white rhino population after the birth of calves. Owen-Smith (1975) reported that a newly released calf might be found with a mother-offspring pair but that such associations were mostly temporary and the pair was not related to it. Owen-Smith also stated that most subadults not accompanying cows were associated with a similarly aged companion of the same or opposite sex with a group structure of up to five individuals. Shrader and Owen-Smith (2002) concluded that new subadults prefer to seek an association rather than remain alone.

This paper presents a detailed analysis of the dispersal and social behaviour of the three adult female white rhinos at Ziwa Rhino Sanctuary in the period one month before, the month during and one month after the three females calved. Published information from other reserves is limited. The study identifies the time of day, location and habitat when the rhinos calved, the length of time between the older calf being chased away and the new birth, whether the females changed their location or habitat immediately before and immediately after calving, and whether there was a noticeable effect on the females' sociability (associations) with the other rhinos in the population.

A principle objective of the study was to determine if the females made any noticeable changes within the few days leading up to the birth of their new calves that reserve managers could use as indicators of an impending birth.

## Method

Ziwa Rhino Sanctuary covers 64.2 km<sup>2</sup> in Nagasongola District, central Uganda. Before becoming a wildlife sanctuary in 2004 the area was part of a cattle farming operation. About 30% of the reserve is swamp, but only the southern swamp area is always water bound. Other swamp areas dry out in times of low rainfall and flood during high rainfall.

For security and monitoring purposes, the reserve is organized into five sectors: Karakwende (K), Mikerenge (M), Wangoriro (W), Rwanyanya (R) and Lugogo (L). Each sector is further organized into either three or four numbered blocks. Figure 1 shows the location of each of the sectors and blocks.

At the start of 2011, the white rhino population of Ziwa Rhino Sanctuary consisted of three adult

males—Taleo, Moja and Hassani—and three adult females with calves—Nandi and calf Obama, Bella and calf Augustu, Kori and calf Justus. The calves were the first-borns of the three females. In June 2011, Nandi produced a second calf, Malaika, while Bella had Donna and Kori had Laloyo in January 2012.

The rhinos at Ziwa are held under heavy 24-hour-a-day security by armed guards and monitoring rangers. Since June 2010 to better understand the behaviour and movements of the rhinos the monitors have kept an hourly record of the location, key activities of each rhino and their associations with conspecifics (for more details see Patton et al. 2011).

Rangers monitoring each of the Ziwa rhinos—six adults and six calves—follow the animals on foot from a distance but keeping them in sight as much as possible. During the hours of darkness, rangers have torches, which they use to observe the rhinos whenever they hear any sound of activity, and at least at 15-minute intervals to check on the rhinos. During full moon periods the rhinos are easily observed without the need for torches.

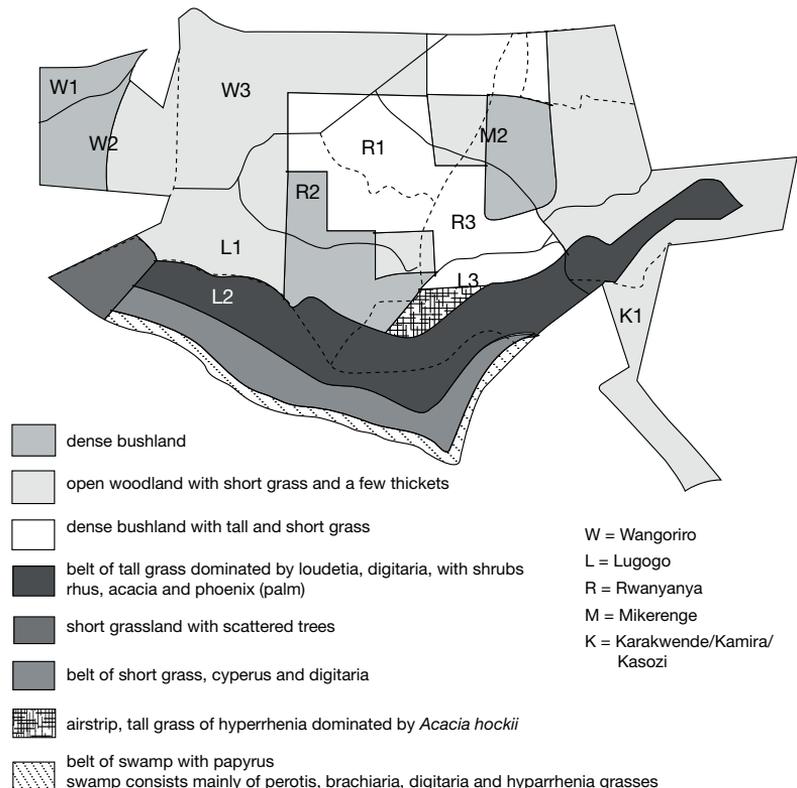


Figure 1. Basic vegetation map of Ziwa Rhino Sanctuary.

The rangers completed a daily sighting form for each hour of the 24 hours of each day of each of the months from June 2010 to May 2012. For each rhino the rangers recorded the location—sector and block; type of habitat—wet swamp, dry swamp or other; one of three main activities—feeding, resting, moving; plus any of four secondary activities—drinking, wallowing, mating or fighting—that might also have occurred during each hour. All other rhinos found in close proximity (within 10 m) were recorded as an association.

Data were entered using Microsoft Excel 2007 on a Toshiba Satellite Pro laptop. Macros were written to automate the consolidation and analysis of the data. For location and habitat type, the analysis was based on the number of rhinos found in each location and habitat type for each hour of the day; for activities the analysis was based on the number of hours spent on the activity per day. The daily data were not always complete as there were occasions when the particular rhino was out of sight (especially in thick bush habitat) or had run off and had to be found again, especially after a disturbance at night.

Data analysis was carried out for female 1 (Nandi) for the period May–July 2011, and females 2 (Bella) and 3 (Kori) for the period December 2011–February 2012. The number of hours between the time the female chased the older calf away and gave birth to the new calf was determined along with the location and time of birth of each new calf. The number of hours and percentage of time that each female spent in each sector in the period before and after calving and the difference between the two were considered. The associations between the three adult females with the other rhinos in the population before and after the birth of their new calves were analysed by the number of hours and the number of events where an association took place in the relevant time periods.

## Results

Table 1 shows details of the birth date, location and time of day of the six calves born at Ziwa. All births

occurred during night-time but in different sectors and blocks. Nandi pushed away her first calf, Obama, around 32 hours before her new calf, Malaika, was born. Bella pushed away her first calf, Augustu, around 8 hours before she gave birth to her new calf, Donna. Bella started getting aggressive with Augustu 3 hours before he finally parted. Kori’s first calf, Justus, left Kori without aggression (together with Obama and Augustu) around 3 hours before her new calf, Laloyo, was born.

The three females moved independently of each other. Table 2 shows the total number of hours analysed for each female, the number of major changes of location made during these hours and the average number of hours per change in location for the research period. A major location change was determined when the rhino was recorded in a different sector or block after an hour.

The results show that the amount of data collected for Kori (total hours) is marginally outside the range of the standard deviation for the group with a consequent similarly marginal effect on the analysis of location changes and average hours per location. However, given the small number of individuals and variability in the efficiency of some rangers in maintaining contact with the monitored rhinos, the data collected can

Table 1. Data on birth of the six white rhino calves born at Ziwa

Calf name	Birth date	Birth location	Time of birth*
Obama	24 June 2009	R1/M2	in the early hours a.m.
Augustu	07 Oct 2009	R3	in the early hours a.m.
Justus	02 Jan 2010	L2	believed around 2 a.m.
Malaika	04 June 2011	L2	between 11 p.m. and 12 a.m.
Donna	10 Jan 2012	W2	around 11 p.m.
Laloyo	15 Jan 2012	R2	between 12 a.m. and 5 a.m.

\*All births occurred at night.

Table 2. Summary of location changes made by the Ziwa females in the research period

Name	Total hours (no.)	Location changes (no.)	Average hours per location change (no.)
Bella	2,142	136	15.7
Kori	1,832	107	17.1
Nandi	2,188	135	16.2
Mean	2,054	126	16.3
SD	194	17	0.71

be considered sufficiently consistent to individually compare the results of the three females.

All three females changed their preferred location after calving (Table 3). Nandi spent less time in sector L (-22%) and more time in sector W (+32%); Bella spent less time in sector W (-27%) and more time in sector L (+34%); Kori spent less time in sector W (-49%) and more time in sector L (+65%). The main vegetation type in both the sectors L and W is similar, open woodland with short grassland and dense thickets, but sector W is on higher ground than sector L.

The three females did not change their locations to calve, but they did move to a neighbouring sector/block: after 69 hours for Nandi, after 215 hours for Bella and after 288 hours for Kori.

Table 4 shows the effect of the birth of the new calf on the sociability of the three females with other individuals in the population and the immediate effect of the mothers releasing the three older calves on the social organization of the population.

The data show that the total length of associations

and the total number of events when an association took place were greatly reduced after calving for all three females. Obama remained in association with his mother Nandi for only 191 hours while Augustu and Justus had no association with their mothers at any time in the month following the new calvings.

## Discussion

The white rhino mother chasing away her older calf was the only indication of an impending birth in the wild. Our study showed that the female chased away the older calf between 3 and 32 hours before the birth of the new calf. Even the maximum of 32 hours gives little prior warning that the birth of a new calf is imminent.

### Location

The females made no major location change around the time of calving, during which the rhino was recorded in a different sector or block in the hour

Table 3. Location of the female rhinos at Ziwa in the period around their calving date

Block	Nandi			Bella			Kori		
	Before	After	Difference	Before	After	Difference	Before	After	Difference
K	45 (0)*	0 (0)	-45 (0)	7 (0)	0 (0)	-7 (0)	0 (0)	0 (0)	0 (0)
L	590 (77)	674 (55)	84 (-22)	31 (3)	441 (37)	410 (34)	139 (13)	867 (78)	728 (65)
M	6 (1)	0 (0)	-6 (-1)	25 (3)	0 (0)	-25 (-3)	0 (0)	0 (0)	0 (0)
R	104 (14)	129 (10)	25 (-4)	155 (17)	165 (14)	10 (-3)	274 (25)	93 (8)	-181 (-17)
W	16 (2)	417 (34)	401 (32)	691 (76)	593 (49)	-98 (-27)	671 (62)	144 (13)	-527 (-49)
Total	761	1220		909	1199		1078	1104	

\* Figures in parentheses are percentage of the equivalent time.

Table 4. Associations of the female rhinos with other rhinos at Ziwa before and after their calving, shown as total hours/no. of events

Association	Nandi			Bella			Kori		
	Before	After	Diff.	Before	After	Diff.	Before	After	Diff.
All associations	287/32	178/16*	-109/-16	250/18	128/12*	-122/-6	1194/18	41/7*	-1153/-11
<i>Males</i>									
Taleo	81/9	73/5	-8/-4	34/2	38/4	4/2	0/0	0/0	0/0
Moja	36/6	14/2	-22/-4	85/5	12/2	-73/-3	40/4	17/3	-23/-1
Hassani	91/9	91/9	0/0	55/6	53/4	-2/-2	18/1	8/2	-10/1
<i>First calves</i>									
Obama	ALL	191/1	191/1	52/2	0/0	-52/-2	953/7	0/0	-953/-7
Augustu	0/0	0/0	0/0	ALL	0/0	n/a	63/1	0/0	-63/-1
Justus	0/0	0/0	0/0	0/0	0/0	0/0	ALL	0/0	n/a
<i>Females</i>									
Nandi	-	-	-	0/0	9/1	9/1	4/1	0/0	-4/-1
Bella	27/3	0/0	-27/-3	-	-	-	53/3	16/1	-37/-2
Kori	52/5	0/0	-52/-5	24/3	16/1	-8/-2	-	-	-

\* not including the association with first calf

ALL represents the first calf was always associated with its mother at all times up to the birth of the new calf.

before. But all births took place in dense habitat and out of direct sight of the monitoring team. However, the females with their new calves moved into new areas relatively soon (3 days, 9 days and 12 days) after the births. Both before and after the new births, the females' locations were in open woodland with short grass and a few thickets. Owen-Smith (1975) and Schrader (2003) reported that white rhinos primarily fed on short to intermediate-height swards of green grass. This was similar to the finding at Ziwa but with the thickets allowing the females to calve in a more secluded and secure habitat.

The females changing their location shortly after the birth of their new calves can be explained by the effect of the amount of rainfall in the relevant months on the level of waterlogging of the soil in the former and new locations. Sector L is in close proximity to the permanent swamp and has a high water table such that the ground gets waterlogged after rain. Sector W is on higher ground in the north-west of the reserve, which tends to dry out during periods of limited rain.

Before Nandi calved in June 2011, there had been heavy rainfall in May 2011, as there was in July. When accompanied by her new calf, Nandi showed a preference for sector W where the higher ground was drier than in sector L where she had stayed with her first calf.

The opposite was recorded for Bella and Kori when accompanied by their new calves. December 2011, January and February 2012 were all low rainfall months. The mothers and calves moved from the higher, drier ground of sector W to the lower ground of sector L where water was available despite the dry months.

Whether the presence of the new calf precipitated an earlier move in location is open to conjecture. On one hand, a newly born calf may be considered to be more susceptible to disease if constantly standing and lying in wet conditions, while on the other hand it is likely that a white rhino mother with a new calf at foot will need a higher than normal intake of water to maintain her milk supply. The mother may react to the presence of too much or too little water and change location accordingly.

With the knowledge that major changes in the chosen locations some days after the births may occur, security and monitoring may be enhanced at this time to ensure the maintenance of efficient and effective systems.

## Associations

All three females made fewer associations in the period immediately after the birth of their new calves than in the period immediately before.

Nandi associated strongly with the two males Hassani and Taleo both before and after she calved. Bella and Kori associated mostly with the male Moja. The association between Nandi and Hassani was considered to be non-sexual with no mating behaviour observed. The two were raised at the same location in the USA before they were translocated to Ziwa. Taleo was observed to have mated with Nandi, producing her first offspring, Obama, and was probably the parent of the new calf (subject to proofing by DNA evidence). The similarity in the amount of time Taleo spent in association with Nandi both before and after the female calved supports this conclusion.

The association between Kori and Moja was observed to be sexual with mating behaviour previously having been recorded. The absence of the other breeding male, Taleo, before and after the female calved and the presence of Moja indicate that Moja was most likely the parent of the new calf (subject to proofing by DNA evidence).

Obama was with his mother, Nandi, up to the time of the new birth. After the calving, Obama remained in close association with his mother for nearly 8 days (191 hours). He then moved away to form an association for 953 hours with the female Kori and her calf Justus up until the birth of Kori's new calf. Owen-Smith (1975) reported that a newly released calf might be found with a mother-offspring pair but that such associations were mostly temporary and the pair were not related to the calf. This was the situation recorded for Obama but it should be noted that at this time there was no alternative association to a mother-offspring pair as there were no other subadults in the population for Obama to associate with.

Augustu was in association with his mother, Bella, until the birth of the new calf but remained for only one day afterwards while Justus ceased association with his mother, Kori, the day before the birth of the new calf.

The three first calves joined up in association from 15 January, just a few hours after the final birth, that of Kori, and remained together for the rest of the reporting period. This form of association was also reported by Owen-Smith (1975), who stated that most subadults not accompanying cows were associated with a similarly aged companion of the

same or opposite sex with a group structure of up to five individuals. Owen-Smith regarded associations of more than two subadults to be unstable.

Shrader and Owen-Smith (2002) concluded that new subadults prefer to associate rather than remain alone. This was considered a security measure against the adult males. Owen-Smith (1974) reported an instance where a solitary subadult male was challenged tensely for 32 minutes by a territorial male. However, another territorial male had confronted this same subadult only briefly 5 months earlier, when the latter had another subadult male companion. Taleo, the dominant male in the Ziwa population, was found to be particularly aggressive towards any unaccompanied subadult.

## Conclusion

This paper presents details of the dispersal and social behaviour of three adult female white rhinos in the immediate period surrounding calving, a subject about which little has been published. A principle objective of the study was to determine if there were any noticeable behaviour changes of the females within the few days leading up to the birth of their new calves which could be used by reserve managers as indicators of an impending birth, for example, a noticeable shift in location or the older calf being found alone having been chased away by the mother.

The Ziwa females showed no change in location before the birth of the new calves. Each female remained with her current calf almost until the birth of the new calf. As such, there was no behavioural change that acted as an indicator of the impending calving.

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