

# POST-RELEASE MOVEMENTS OF REINTRODUCED WHITE RHINOCEROS AT MOMBO, OKAVANGO DELTA

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## Abstract

The post-release movements of three distinct groups of White Rhino are considered and compared. The influence of boma- and free-release techniques are compared and the effects of physical features and social conditions on rhino movements noted. It is argued that boma-releases were more effective in enabling rhino to establish home ranges near the release site and that free-releases should be contemplated only in emergency situations.

## Introduction

There is much debate in game capture and translocation circles as to the length of time that Black Rhino *Diceros bicornis* and White Rhino *Ceratotherium simum* need to be kept in bomas prior to release into new areas. One camp favours shorter boma periods, or perhaps no boma time at all, although much may depend on the length of the journey, and the difference, if any, between their old and new environments. A countervailing school of thought has it that rhinos should be kept in bomas for a longer period of time, as this reduces the distance they will move away once released.

As part of the Joint Okavango Wilderness Safaris (OWS) and Department of Wildlife and National Parks (DWNP) rhino reintroduction project, over the last four years at Mombo, we have released several different groups of rhinos. Our subsequent sightings data has allowed some analysis of the movements of three different categories of white rhino following their release from the Mombo bomas: Group I) white rhinos boma-released into an area without an existing rhino population, Group II) white rhinos boma-released into an area with an existing population of (translocated) white rhinos, and Group III) white rhinos free-released into an area with an existing rhino population.

In the course of monitoring operations all sightings of identified rhino were logged and here the post-release movements of these three distinct groups are considered. Not every rhino was located every day after release and individuals were typically located more frequently immediately after their release, and less frequently with time. This was a function of both proximity to our base of operations as well as the fact that on release all rhino had functioning horn implant transmitters and in the period after release the DWNP helicopter was available to establish initial movements of the rhino. Once radio transmitters began to fail and telemetry became less effective, more traditional methods of location such as tracking on foot were utilised with the end result that fewer rhino could be

located on a regular basis. In addition some rhino moved long distances from this central area and these individuals were sometimes not seen for several months at a time. Nonetheless general trends in the movement of all rhino could be established in both the first month when they were located regularly and also over the first year after release when they were located less regularly. These two different periods are both considered here and differing release techniques and circumstances analysed as to their impact on rhino movements after release.

## Methods

From release, rhinos were tracked and located by dedicated monitoring patrols. Rhino monitoring at Mombo is an ongoing joint venture between OWS staff and the Anti-Poaching Unit (APU) of the DWNP. Considerable assistance has been gratefully received from the Botswana Defence Force (BDF) and from professional guides and guests at the two safari Camps in the Mombo Medium Density Tourism Zone (MMDTZ) who have reported game drive sightings. Most monitoring patrols were conducted by vehicle and / or on foot, and occasionally by helicopter or fixed-wing aircraft. Weapons were always carried. Back-up could be called in very rapidly in the event of a contact with poachers, although to date no poachers have been encountered within the MMDTZ. Nor has any evidence of infiltrations into the MMDTZ been recorded. The level of security surrounding these rhinos means that they live in what is known as an Intensive Protection Zone (IPZ).

The monitoring patrols had two complementary purposes: data collection and security / law-enforcement. Law-enforcement is the responsibility of the government personnel involved, while OWS staff members are concerned with data collection and monitoring. Such monitoring has been aimed at furthering the conservation and understanding of rhino in the Moremi Game Reserve and surrounding area. Our rhino monitoring teams have focussed on locating and – crucially – identifying rhinos. Prior to release each rhino had a unique pattern of notches cut into its ears to facilitate identification in the

field. Whenever rhinos are located, a number of details are recorded: activity, vegetation, weather, condition, group composition and behaviour of the rhino. The precise positions of located rhinos are recorded using handheld GPS receivers. These co-ordinates are then plotted onto maps. As all data considered in this paper has been obtained by GPS, distances mentioned are straight-line distances and do not necessarily reflect the actual distances covered by the rhino.

Each rhino when released was fitted with a radio transmitter and a unique frequency. At ground level, the performance of the transmitters was approximately that a signal could be detected up to 5km (although occasionally as much as 8km) away. From an aircraft, signals could be detected up to 20km+ from the transmitting rhino as there were fewer obstructions to the radio signals. In combination with conventional tracking of spoor, radio telemetry tracking proved to be an adequate tool for rhino monitoring in the study area. As with any monitoring operation, our approach had to find a compromise between locating all the rhinos regularly, and not disturbing them or affecting their behaviour or movements. Of course it is impossible to quantify what effect, if any, their encounters with monitoring vehicles had on the movements of individual rhinos. Certainly over time the majority of rhinos seemed to become more familiar with the presence of vehicles and humans on foot.

We do not have necessarily compatible data sets for all rhinos. Some were seen very frequently, others much less so. The frequency with which any particular rhino was sighted depended on a variety of factors beyond our control, including each rhino's distance from the patrol bases, its propensity to move around or remain in a relatively confined area, and the performance of individual radio transmitters.

**Results**

Results are presented in graph form. Precise tabulated data has not been provided for security reasons. For Groups I and II, results for the first month after release, as well as for the first year are presented. Together with the distances from the point of release on specific days during the first month I have included trend lines so as to demonstrate the general movements of the rhino from this release point. Movements from this release point over the first year are reflected here by only five locations but nonetheless provide some indication of longer term movements. In the case of Group III limited data was available and only the movements of the first month are presented. Distances reflected in the graphs are straight line distances and not necessarily distance actually travelled from the release point.

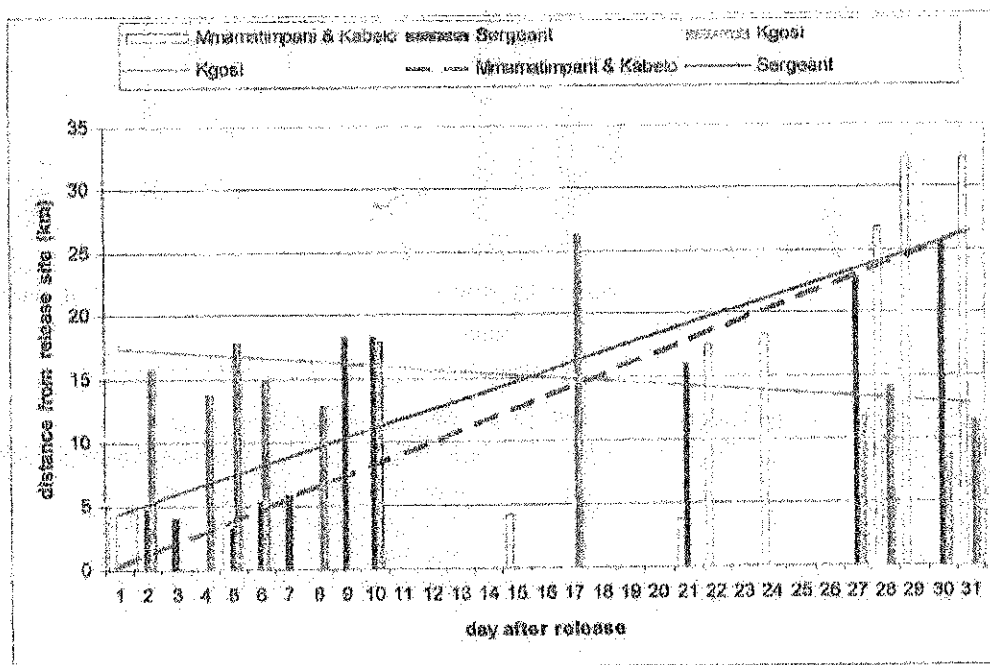


Figure 1: Group I rhino movements in the first 30 days after release ('Mmamatiapani' = adult cow; 'Kabelo' = subadult cow; 'Sergeant' = adult bull; 'Kgosi' = adult bull)

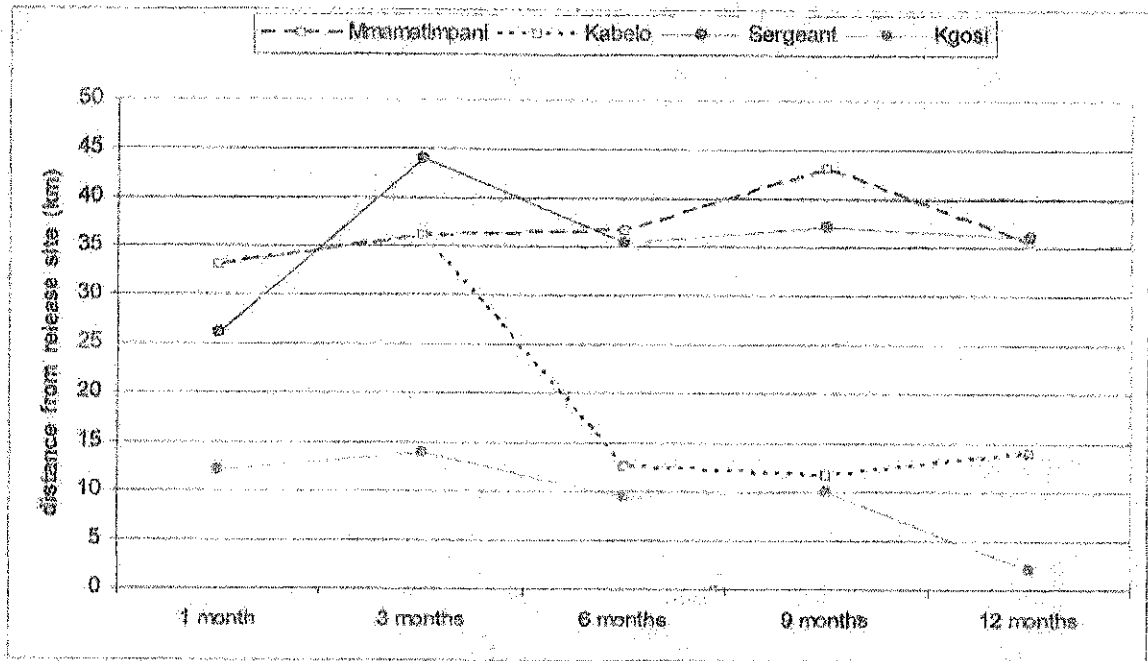


Figure 2: Group I rhino movements in the first year after release - note that the two females, represented as a single series in Figure 1, separated some time beyond three months after their release and are thereafter represented by two separate series in Figure 2.

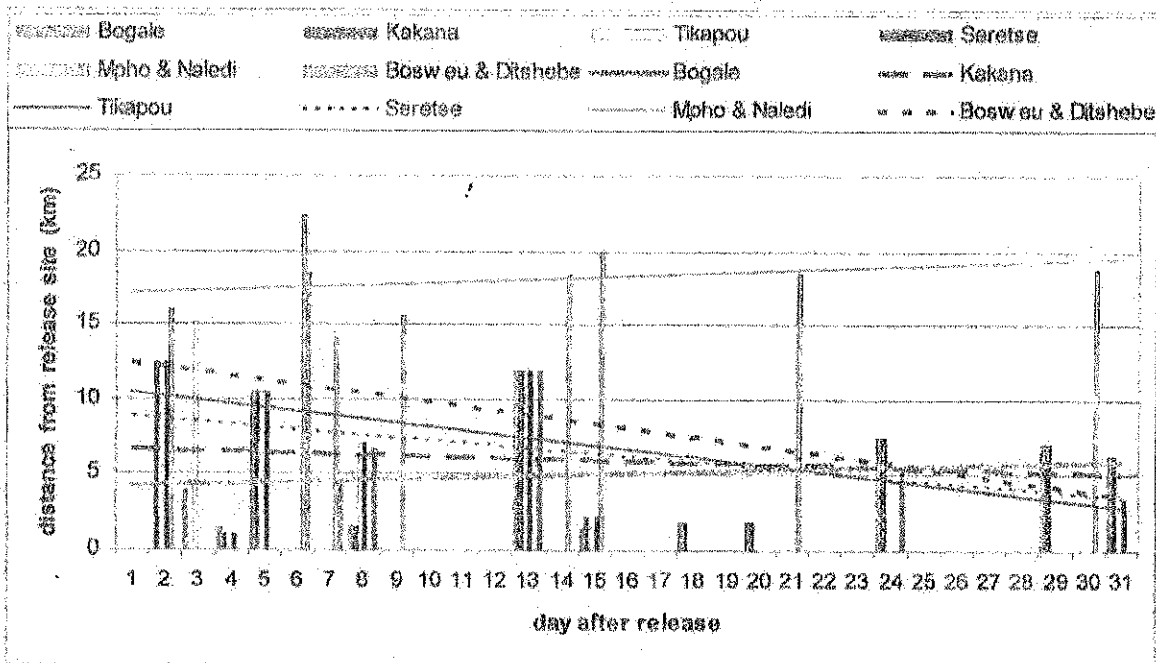


Figure 3: Group II rhino movements in the first 30 days after release ('Bogale' = adult cow; 'Kakana' = subadult male; 'Tikapou' = subadult cow; 'Seretse' = subadult male; 'Mpho' = subadult male; 'Naledi' = subadult female; 'Bosweu' = subadult male; 'Ditshebe' = subadult female)

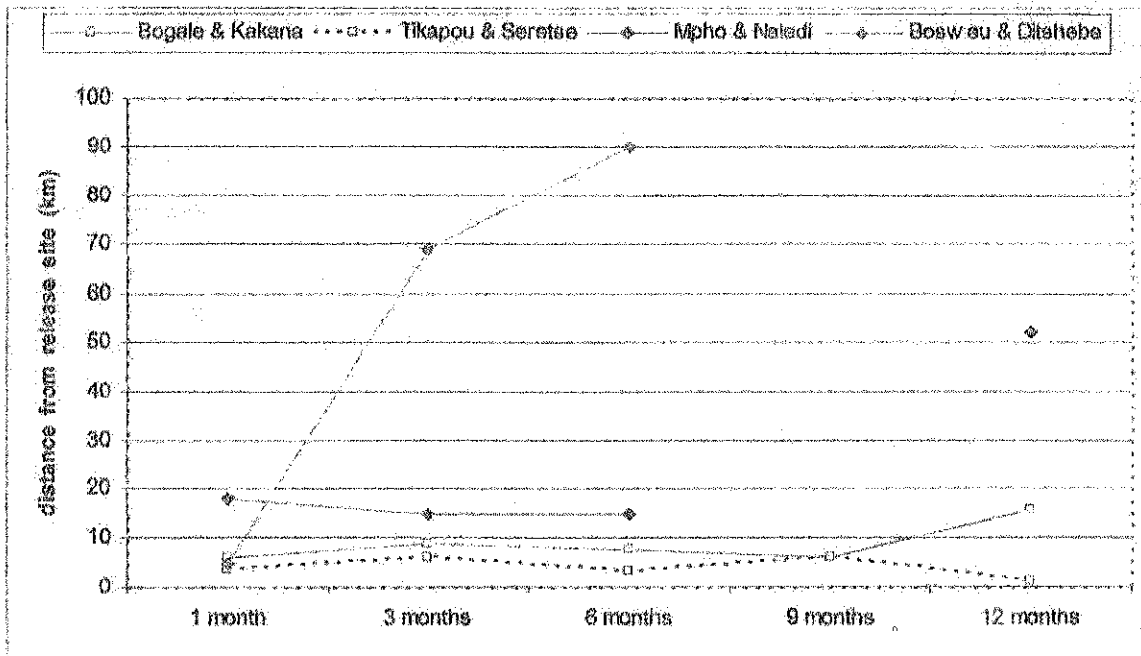


Figure 4: Group II rhino movements in the year following release – note that by the end of the first 30 days following their release, these 8 rhinos had formed 4 pairs which remained largely fixed over the first year (and beyond in some cases) and there is therefore only a need for 4 series in this graph.

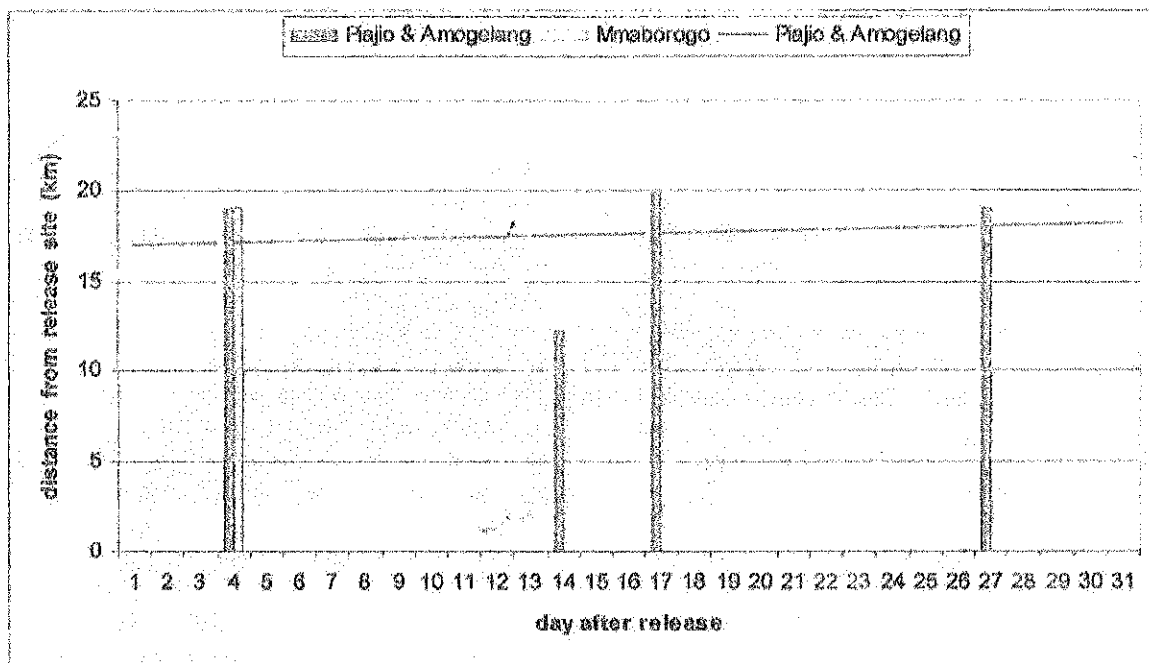


Figure 5: Group III rhino movements in the first 30 days after release

**Discussion**

*Group I – initial movements*

Group I was the initial release group of white rhino and was comprised of two adult bulls ('Kgosi' and 'Sergeant'), an adult cow ('Mmammatimpani') and a subadult cow ('Kabelo'). All had been homo'd for between 21 and 23 days (dependent on the order in which they arrived and were released) and were released into an area with no extant rhino population. The November 2001 release date saw high temperatures, the start of the rainy season, and the retreat of the annual Okavango Delta flood. The retreating

flood opens up large areas of previously-inundated floodplain to grazing animals, and our observations suggest that these areas are favoured by white rhino. Still-flooded areas and permanent wetlands were the only significant impediments to movement faced by the rhino after release. The two rhino cows, familiar with each other from the Mokolodi bomas, were released together, and the two bulls an hour apart the following day. This was done in order to lower the chance of aggressive encounters between the bulls.

The two cows remained together throughout the first month after their release. They initially moved north of the bomas but their progress in this direction was checked by the presence of permanent water and their initial movements were not substantial. Fifteen days after release they were still only just over 4km from the bomas. Hereafter however the two cows moved south past the bomas, into an area without the obstacle of permanent channels, and were thus able to move much greater distances. On the thirtieth day after their release they were over 33km from the bomas.

The two adult bulls, perhaps in an effort to avoid potential conflict, adopted contrasting patterns of movement. At first, as well as being wary of each other they would have been wary of any other territorial bull that might be in the area. The smaller of the two bulls ('Sergeant') initially remained close to the bomas. On the seventh day after release he was still less than 6km from the bomas. At this point however he began to explore further afield, and by day nine was almost 19km from the bomas. The larger bull ('Kgosi') covered larger initial distances and by day two was over 16km away. He remained at a fairly constant distance from the bomas until day 10, when, some 19km from the bomas, he encountered 'Sergeant' who was by now moving away from the area. This encounter (a stand off dissolved by both bulls leaving the scene) was witnessed by one of our monitoring teams and appears to have convinced 'Kgosi' to move further away, as by day 17 he was 27km from the release point. He then began to return towards the bomas and by day 30 was only 12km from the release site. 'Sergeant' meanwhile continued to move further afield and was over 26km away on day 30.

Thirty days after the release therefore, three of the four rhino ('Mmamatiimpani', 'Kabelo' & 'Sergeant') had moved further than 25km from the release site, and only one rhino ('Kgosi') could be considered to remain in the area of the bomas. Rather than boma time, movements immediately after release seem to have been influenced both by physical features (deep permanent water in the case of the cows) and intra-specific interaction (in the case of the bulls, and also perhaps in the case of the younger cow who remained in the company of the older cow for the duration of this period).

#### *Group I – medium-term movements*

I then considered movements of these four rhino over the ensuing eleven months, taking five points at one, three, six, nine and twelve months after release as an indication of their medium term movements.

As noted above, 'Kgosi' remained in the greater Mombo area, establishing a territory here (evident from middens and typical scrape marks) and not venturing more than 15km from the release site in the following 12 months. By contrast, three months after the release, 'Sergeant' was almost 45km away although he subsequently moved

north up Chief's Island again and by the sixth month had also established a territory 35-40km from the release site, within which his movements were fairly consistent.

For the first three months the two cows remained together, but at some stage after this they separated and their movements beyond this point appear to have been influenced by the two different bulls. 'Kabelo', the younger female, moved back towards the release site and then remained in 'Kgosi's' territory often being located with him by monitoring patrols. At this stage 'Kabelo' was aged approximately four years and was not sexually mature. Over the same time period, the older sexually mature female, 'Mmamatiimpani', moved into 'Sergeant's' territory and was often located with him. Once within the respective bull's territories, the presence of these males seems to have been the biggest single influencing factor in the movements of the females. Twelve months after the release date, 'Kgosi' and 'Kabelo' were both within 15km of the release site; 'Sergeant' and 'Mmamatiimpani' were both over 35km from the bomas.

#### *Group II – initial movements*

The Group II rhino arrived together after a truck journey from quarantine facility across the border in South Africa and spent 24 hours in the crates before being offloaded at the Mombo bomas. The group was comprised of two adult cows, two subadult cows and four subadult bulls. All eight rhino spent 18 days in the Mombo bomas with some being boma'd in groups or pairs. The total cohort was released at the same time, some twenty months after the Group I rhino, towards the end of June 2003. June is a very different season to the November release of Group I: it is the middle of the Botswana winter, a cooler month with very little if any rainfall, and the annual flood approaching its peak and thus limiting the area of dry land. These rhino were also released into an area with an existing population of 14 white rhinos, including two established territorial bulls in one of which's territory ('Serondela', who had recently deposited 'Kgosi') the release site was located.

The decision to release all eight rhino together was a controversial one, taken by the then State Veterinarian, and appeared to cause substantial confusion to the rhinos. Two of the rhinos, a subadult male ('Mpho') and subadult female ('Naledi'), began to move away from the area almost immediately. Interestingly, they had not been boma'd together, but rather in adjacent bomas. A day after their release, they were already some 16km from the bomas. They continued moving away from the release site and were 22km from it by day 5. They then returned towards the bomas for several kilometres, before turning around again, thereafter remaining consistently 17-19km from the bomas, in a fairly inaccessible, swampy area that had no other resident rhinos.

A second mixed-sex pair of rhinos ('Bosweu' and 'Ditshebe'), who had been boma'd together, initially

moved some distance and were first relocated 18km away on day 5. From here they moved back north again and subsequently remained much closer to the bomas at only 4-7km away, with the exception of one foray to a point almost 12km away on day 12. They remained in this area for the rest of the first month, and only later began moving considerably further afield.

The remaining four rhinos appeared a little disorientated on release. Two subadult males, ('Seretse' and 'Kakana') initially moved away together, and a day later had reached a point over 12km from the release point. A subadult female ('Tikapou') moved more than 5km overnight after being released, and was 15km away by day 2. The adult female, ('Bogale') who had seemed agitated for much of the time in the bomas, and who had lost some condition since initial capture, remained fairly close to the bomas, and was only 1.54km away from the release site on day 3. On day 4, all 4 of these rhinos were located together, just over 10km from the bomas. This group fragmented into two different pairs however and both pairs moved independently back towards the release site with 'Bogale' and 'Kakana' approaching to within 2km of the bomas. By day 12 all 4 were together again some 12km from the bomas, and two days later had reverted to the original pairings although all four were very close to each other, and to the bomas. By day 17 the new pairings had been re-formed (one pairing lasting over 2 years and the other more than a year), and 'Bogale' and 'Kakana' began to drift away again. On day 30 they were 6km from the release site. The second pair, 'Tikapou' and 'Seretse', moved away in a different direction and was 4km away on day 30.

So, a rather confused initial picture soon settled down. By day 30, six of the eight rhino were within or close to 'Serondela's' territory, and were within 7km of where they had been released. Interestingly none of the newly released Group II rhinos were seen to encounter 'Serondela', although this may well have happened (it seems likely that it would have done over the month long period). Certainly these new rhino would have been aware of the presence of a territorial bull, and vice versa, and this may have exerted some influence on the movements of the newly released cohort, some of which moved substantial initial distances only to return towards the release site within the first fortnight.

In contrast to the Group I release, the Group II release took place in winter and into an area with a resident rhino population. Both factors are thought to have limited the initial movements of the newly released rhino. Given the season, the flood was high (although below average in 2003 in the Mombo area) and presented a physical barrier to the rhino moving either west or north of the release site. The release site was also within the territory of an adult bull and this, it is suggested, also presented a limiting factor of a social nature.

#### *Group II – medium-term movements*

Given that all eight Group II rhinos had exactly the same boma experience, their movements over the subsequent year are particularly interesting. Pairings that were formed by the end of the first month remained in place throughout this period, although on occasion rhinos were of course seen separately or with additional rhino. Aside from this consistency however, movements of the four pairs were quite different.

Two pairings, 'Bogale' and 'Kakana' and 'Tikapou' and 'Seretse', for example displayed remarkably consistent movements (aside from the expected seasonal movements brought about by the availability of water and the inundation of floodplains) over the course of the first year and their proximity to our base of operations enabled good location data on all four rhino to be gathered. Until the end of the year long period, when the retreat of the annual flood appeared to cause 'Bogale' and 'Kakana' to move slightly further afield, both pairs of rhino remained within 10km of the release site and within the territory of 'Serondela'. 'Mpho' and 'Naledi' on the other hand, while remaining within 20km of the release site for the first six months then undertook substantial movement and at twelve months were more than 50km from the release site. By complete contrast 'Bosweu' and 'Ditshebe', who at 30 days were only 5.2km from the release site, undertook dramatic movements beyond the territory of Serondela. At three months these two rhino were almost 70km from the bomas and subsequently left the Moremi Game Reserve. In mid-October 2003, four months after their release, they were shot and killed by poachers almost 90km from the release site.

All eight rhino in Group II formed mixed sex pairs, all males were subadult bulls, while two females were adult cows and two subadult. Three of the four pairs did not venture more than 20km from the release site in the first six months while the fourth pair wandered considerably further than this in the four months they survived. Of the remaining three pairs, two remained in close proximity to the release site while the third moved beyond this only after six months. What were the factors that influenced this movement?

In the case of the wandering pair of 'Bosweu' and 'Ditshebe', the high waters present during the June 2003 release appear not to have limited their movements. They also soon moved beyond the social limitations of a territorial bull and seemingly moved at random. The remaining three pairs however seem initially to have been restricted both by the floodwaters as well as the territorial bull 'Serondela'. Once the floodwaters receded, one pair moved much further afield, while the two remaining pairs stayed within 'Serondela's' territory. This period also coincided with the release of a further nine white rhino and a temporary increase in density may also have resulted in the dispersal of the second pair.

Again the variation in post-release movement of rhinos that had an identical boma experience casts doubt on the theory that there is a correlation between length of time in release bomas, and distance travelled post-release. In addition since group composition of the four pairs was reasonably similar, and of the adult cows one remained very close to the release site and one wandered considerably, group composition would seem to offer no clues as to the variation in post-release movement by these rhino. Of course, distance from the bomas is a relatively unsophisticated measure of the influence on post-release movements of time spent in the bomas. In any event in the case of the Group II rhino, it cannot be argued in the light of their post-release movements that additional boma time would have meant a reduction in their movements post-release as, with an identical boma experience, there was considerable variation in their responses to being released.

Similarly to Group I physical features and social factors appear to have been the most influential factors in terms of post-release movements. With every successive release of rhinos, it is likely that social factors will become increasingly important as rhino stocking density increases. Physical factors are likely to vary in significance depending on the time of the year when rhinos are boma'd and released at Mombo, and the specific conditions prevailing at that time. The Okavango Delta is a very dynamic system and rainfall and floodwater volumes can vary significantly from year to year and from area to area within the Delta.

#### *Group III – initial movements*

Group 3, an adult cow ('Mmaborogo') and two subadult cows ('Piajio' & 'Amogelang'), were free-released in the northern part of Chief's Island on 1 November 2003. It had been intended that they be boma'd prior to release but as a result of the breakdown of one of the translocation trucks and the gathering heat of the morning this did not prove possible and a decision was made to release all three en route to the Mombo-bomas. All three had been boma'd together in the South African quarantine facilities and it was hoped that the group would stay intact. For the purposes of this comparison then, Group 3 provides a useful control: rhinos with no local boma experience prior to release.

Group 3 was released into an area with an existing white rhino population, and within, or on the fringes of, the territory of one of the adult bulls ('Sergeant'). Without boma experience and the chance to acclimatize, it might have been expected that on release these three rhino would be somewhat disorientated and prone to moving around a great deal before settling down. This is in fact what happened although Figure 5 does not represent this clearly, indicating that the two younger cows remained a fairly constant distance from the release site. What is not represented in Figure 5 is that these distances were at points north and south of the release site and therefore

do not reflect the actual distances traveled.

All three rhino initially stayed together and on day four were some 19km from the release point, a distance that is perhaps indicative of stress or disorientation. After this point the adult cow separated and was not relocated during this first month after release. The two younger cows then covered large distances without any apparent pattern during this period.

#### *Group III – medium-term movements*

As a result of their considerable movements it was not possible to establish a trend in the longer term movements of Group III and these are not presented in graph form here. It is worth noting these movements however since they appear to be related to the method of release.

After two months 'Mmaborogo' was 22km from the release site in the company of two established white rhino and within the territory of 'Serondela' north of Mombo, rather than 'Sergeant's' territory south east of Mombo where she had been released. The two younger cows were also present in 'Serondela's' territory. The subsequent movements of these three rhinos have been extremely interesting. 'Mmaborogo' soon disappeared again, and was finally located in October 2004 with 'Naledi' and 'Mpho' in the mopane belt in the centre of Chief's Island. 'Piajio' returned to 'Sergeant's' territory, and gave birth to a calf (sired by 'Sergeant') in November 2005. 'Amogelang' moved with one other white rhino cow to the Makgadikgadi Pans area (over 200km away), completely outside the Okavango Delta, and at the time of writing had been there for several months.

Two years on from their release, of the three free-released white rhinos, one is within a few kilometres of the release site, and the other two are considerable distances away, with one being extremely far away. All three now appear settled in the areas they have moved to. These movements seem to suggest that free-releasing rhinos, without any boma time at the release location, is likely to result in such rhinos making much more significant movements following release than rhinos which have been boma'd locally. These three rhinos made much more significant movements in both the short- and medium-term than the vast majority of the boma'd rhinos. One aspect that differed between the conditions of release for Group III as opposed to Groups I and II, is that the flood of 2003 was below average and there thus may have been fewer obstacles, in the form of flooded areas, to movement. An additional free-release of a similar group of white rhino when flood levels are at a comparable level to those of 2001 and 2002 would allow an evaluation of this but such a release is not planned. Given the fact that it took so long for the three free-released rhino to establish home ranges and even then in areas far beyond our study area, we regard this release technique as an emergency measure only.

Comparison of the longer term movements of the two most itinerant rhino from Group II is unfortunately not possible, but the movements of the Group III rhino would seem to suggest that in terms of encouraging newly released rhinos to establish themselves relatively close to the release site, and in a shorter period of time, no boma time is much less effective than some boma time.

#### **Conclusions**

A comparison of the movements of the three distinct groups of released white rhino allows some conclusions to be drawn, bearing in mind of course that these findings must be viewed in the context of their specific environment and circumstances and need not necessarily hold true for other areas.

- There is no direct correlation between the length of time a rhino spends in a boma, and the distance it travels after release; rhino which had exactly the same boma experience exhibited very different behaviour and movements post-release.
- Therefore it cannot be argued that keeping a rhino in a boma for a longer period of time means that it is less likely to move significant distances post-release.
- A rhino can be kept in a boma for too long, and beyond 21 days any potentially positive effects (e.g. increased acclimatisation) may be outweighed by increased stress, deteriorating condition, and associated risks of infection and disease.

- Some boma time does however seem preferable to none at all, especially when rhinos have undergone a long journey. Rhino boma'd for any length of time moved less far, and generally settled more quickly, than those which were free-released.
- Social and (seasonal) physical features seem to have a more significant impact on post-release movements than boma experience.
- Social factors can come into play immediately within a new population even when there is no existing population of that species in the area.

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