

TRANSPORTATION AND BOMA MANAGEMENT OF RHINOS

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This paper is a summary of an extensive account in *The Capture and Care Manual*, edited by A A McKenzie and published by Wildlife Decision Support Services and the SA Veterinary Foundation. Published by permission of the editor.

TRANSPORTATION

Precautions

- *Ensure that adequately robust crates are used, and that facilities at the receiving end are suitable for accommodating rhinos.*
- *Ensure that rhinos do not lie down in the crate for at least the first six hours.*

WHITE RHINOS¹

All rhinos are crated and transported individually - even cows and calves.

Crate design

Two types of crates are used, one for the capture operation and one for transportation from the bomas to the final destination (i.e. delivery crate).

Export or delivery crate

This crate is attached to the end of the front pen at the boma for crate training, and is the type of crate that is used for single deliveries and for export. The frame consists of 75 mm channel iron. The roof consists of 43 mm pine planking and extends for approximately $\frac{3}{4}$ of the length of the crate from the front (i.e., only the animal's hindquarters are exposed). The sides consist of pine planking. The inside of the sides and roof are clad with steel. The floor consists of 43 mm pine planking. A ventilation gap is left between the floor and the sides of the crate.

Doors

- Doors are fitted at the front and back of the crate. The doors consist of upper and lower parts made of 50 x 50 mm angle iron and 43 mm pine planking. The lower door is 480 mm high, while the height of the upper door depends on the size of the crate. Both parts can be opened, closed, and secured independently. The doors are mounted on bolts, not hinges, so that they can be removed altogether in hot weather. This is particularly important during sea travel.
- The bottom door is usually kept closed to stop feed and dung being pushed out of the crate, and to prevent the animal's back legs from sliding between the bars and out of the crate (a potentially life-threatening situation). This door is opened to water the animal and to remove dung and old feed.
- Both sections of the front door must be clad with sheet metal (see above). It is not necessary to clad the back door.

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- Doors must always fit easily. Double lock-nuts are used to secure the doors during transit.

Bars

- There are four holes in the floor and roof of the crate just inside the front door. Sixty mm pipes are secured in these holes to form bars at the front of the crate. These retain the animal in the crate when the doors are open. The bottom third of the middle two poles is bent outwards such that the gap at the level of the floor is sufficient to allow a plastic basin containing water to be inserted into the crate.
- Similar bars, without the bent lower sections, are fitted at the back of the crate.

Skids (100 x 50 mm channel iron) and steel eyes are fitted as in the case of the capture crate. The skids also help to keep the wooden floor off the ground, thus preventing rotting of the floor.

Size

The size of the crate is important, and must be individually determined for each animal. The crate must be large enough to allow the animal to lie down comfortably, but must not be so large that the animal can turn around, or that the animal can be thrown around in the crate during transit. The dimensions of the four standard-sized crates used by the Natal Parks Board are given in Table 1.

Table 1: The inside dimensions of crates used by the Natal Parks Board for the transportation and shipment of black and white rhinoceros

Crate	Animal	Height (m)	Length (m)	Width (m)
Size 1 crate	Juvenile	1,4	2,6	0,9
Size 2 crate	Sub-adult	1,6	3,0	1,1
Size 3 crate	Adult	1,8	3,3	1,3
Size 4 crate	Large bull	1,8	3,6	1,5

Mass transport crate

A large steel crate consisting of six compartments mounted on a low-bed truck is used for the mass transport of rhinos. A middle wall and sliding doors are used to divide the interior of the crate into compartments of 1,2 x 3,6 m each. The crate is 2 m high. The entire crate can be lifted off the low-bed truck for cleaning and maintenance.

Post-capture transportation

The route from the capture site to the destination must be negotiated with great care to avoid injuries, smothering, and slipping. Remember, the animal is still very groggy and unsteady on its feet.

Transportation to final destination

There are two approaches to the transportation of rhino.

- They can either be captured, loaded and transported direct to their destination; or
- They can first undergo an adaptation period of at least six weeks in bomas before transportation to their final destination.

If the journey is going to be longer than 8-10 hours, it is preferable to first boma-train the animal. There are several advantages to the boma training period.

- It is always advisable to keep the rhino in a boma at the receiving end for a few days before release. The idea behind this is to let the animal settle down and adapt to its new surroundings. It is therefore preferable to have a boma-trained animal that one knows is eating and will eat in the boma at the receiving end. Rhinos released directly into the veld (especially if they are not boma trained) usually scatter, breaking fences and ending up on neighbouring properties.

- The transportation is not that stressful to the animal, as it is used to being confined. The animal is, therefore, calmer when off-loaded.

- Animals that are caught and delivered directly, especially if the trip is longer than eight hours, are very likely to break their horns off in the crate.

Field-caught animals must be monitored closely for the duration of the trip and may need to be tranquillized. Boma-trained animals very seldom require additional tranquillization and only need to be checked on approximately every three hours *en route*.

Direct method

In the early days, field-caught white rhinos were transported successfully to destinations up to 2000 km away (46 hours) using a combination of various drugs. Azaperone is now used if necessary; however, we seldom transport field-caught rhinos to destinations more than 12 hours away. Recommended doses are as follows:

Adult	150-200 mg
Sub-adult	100 mg
Juvenile	50 mg

Note: if the animal is still groggy but fighting the crate, start off with lower doses. Azaperone has a wide safety margin and has no deleterious effect on body temperature.

Boma method

The loading and transportation of boma-trained rhinos will be described in detail.

After the animal has spent an adaptation period of at least six weeks in the bomas it is ready to be transported. The animal is closed into the front section of the front pen and it is darted with a minute amount of etorphine to facilitate loading and to keep it calm in the crate. The dosages are as follows:

Adult	0,5 mg
Sub-adult	0,25 mg
Juvenile	0,125 mg

Before darting, the water trough must be emptied as the animal may trip on the edge of the trough and fall with its head in the water.

Once the animal has been darted, everybody moves away and all machinery and noise is stopped. It usually takes about 10-15 minutes for the animal to become visibly affected. An animal attendant then waves a white cloth or feed bag in a slow, rhythmic fashion in front of the entrance to the crate. If affected enough, the animal is drawn towards it. This person then moves around to the other end of the crate and waves the cloth or bag in the same fashion: the animal usually walks into the crate. The crate door at the front end is taken off, but the steel poles are left in place to retain the animal in the crate. This whole process, from the time of darting, usually takes 20-30 minutes. The animal should be allowed to settle down for a few minutes before sliding poles horizontally into the boma gate behind it: an overhasty approach could result in the animal taking fright and reversing out of the crate. Once these horizontal poles are in place, the vertical poles are placed through the holes in the roof and the floor at the rear of the crate.

If the animal goes down, or seems likely to go down, nalorphine may be administered, preferably intravenously:

Adult	50 mg
Sub-adult	25 mg
Juvenile	10 mg

The crate is loaded onto the truck with the animal facing backwards, the doors are put on, and the crate is secured in position. The journey should only commence once the person doing the loading is completely happy with the animal's condition.

Enough teff to serve as feed and bedding must always be put in with the animal.

The animal must be kept on its feet for at least the first six hours (i.e., until the drug has completely worn off), even if the cattle-prodder has to be used for this purpose. If the animal lies down while still in a drugged state it may develop neuromuscular problems from lying too long on a specific hind leg. It is important to check the animal half-hourly for the first two hours, then hourly for the next four hours, and then every three hours once the drug wears off. The animals tend to stand and eat peacefully right up to the destination. They usually lie down periodically: this is in order, provided the drug has worn off.

Occasionally, an individual animal may need to be tranquillized *en route*. Azaperone is recommended at the doses given above. If the animal is still affected by the etorphine but is fighting in the crate, start off with a lower dose: one does not want the animal to collapse or smother itself.

An important point to bear in mind while transporting rhino (both black and white) is the outside temperature. The Natal Parks Board mass transporter has six crates - each equipped with a roof hatch that can be closed when it gets too cold or starts raining. We use a temperature of 20°C (this may sound warm: remember the wind-chill factor) as a guideline in deciding when to close the hatches. If individual animals are transported, each crate is accompanied by tarpaulins with which to cover the crate should this become necessary. An important point to remember here is that there must still be sufficient ventilation once the crate has been closed.

Off-loading

The receiving pens should be prepared and water and food supplied before off-loading so that the animal may be left undisturbed once off-loaded.

Once the crate is lined up with the gate of the receiving boma, the door is simply opened and the animal is allowed to walk out in its own time. If it refuses to move, a cloth may be waved slowly at the entrance to the boma to entice the animal out of its crate. If this fails, the animal's hindquarters can be stroked with the extension handle of the prodder. Only if this fails should one consider using the prodder itself, and then only sparingly.

It is important to keep unnecessary spectators, noise and movement to an absolute minimum during the off-loading process. Spectators should be kept as far from the pens as possible while the animals are being off-loaded. They should not be allowed to approach the pens even after all the animals have been off-loaded.

Occasionally a rhino will not get out of the crate, even resisting a cattle prodder. It is best to just leave the animal and go away for an hour or so: the animal will usually be out by the time you return. Be sure to leave somebody reliable keeping watch from a distance. If this does not work either, one can tranquillize the animal using azaperone (see above). The animal is then left to come out on its own.

Another point to remember at off-loading is to separate a cow and calf into different pens even if only for the first few minutes. An agitated cow may attack her calf.

Release

If the animals have been boma-trained before transportation to their destination it is only necessary to keep them in the receiving bomas for a few days, i.e., until they settle down. It is not necessary to reduce their daily lucerne/teff quota before release.

It is advisable to release only one animal at a time (except a cow/calf combination) to avoid fighting. The best method is to open the gate at dawn and allow the animal to leave on its own. Disturbance must be kept to a minimum. The next pen is only opened 24 hours later.

It may be necessary to provide a water source just outside the bomas if it is thought that the animals may take some time to find water in their new environment.

BLACK RHINOCEROS⁴

As in the case of white rhinos, black rhinos are all crated and transported individually. The Natal Parks Board recommends transporting boma-trained animals only, for two main reasons. First, the initial aggressiveness of the black rhino immediately after capture is such that the journey immediately after capture should be as short as possible. Second, unlike white rhinos, black rhinos are completely awake after administration of the antidote, and are thus stressed by the sudden exposure to the strange sights, sounds and smells of the crate.

Because black rhinos adapt so much more readily to captivity than white rhinos, it is possible to transport them after a boma-training period of only four weeks. A boma-training period of at least six weeks is, however, recommended. The advantages of boma training white rhinos also apply to black rhinos.

Loading

The loading procedure for black rhinos is exactly the same as for white rhinos with a few exceptions.

The black rhino is smaller and is more susceptible to etorphine than the white rhino. The recommended doses are:

Adult	0,25 mg
Sub-adule	0,125 mg
Juvenile	0,0625 mg

Black rhinos often refuse to enter a crate. They stand at the entrance to the crate with their legs splayed, head down, and salivating. If this occurs, a cloth is used to cover the animal's eyes and a rope is slipped over its head. The animal is then pulled into the crate while being guided and supported by an attendant on either side.

If it appears that the animal may go down, nalorphine may be administered at a lower dosage rate than in white rhinos. This becomes necessary much more frequently with black rhinos than with white rhinos.

Adult	20-25 mg
Sub-adult	10-15 mg
Juvenile	5-8 mg (all i.v.)

Transportation

In the author's experience it has never been necessary to tranquillize boma-trained black rhinos *en route* to their new destination. They travel extremely well and usually eat large amounts of lucerne

during the journey. This seems to keep them quiet: for this reason it is advisable to take along a good supply of lucerne for the journey. Remember to supply adequate bedding.

If tranquillization does become necessary, the recommended doses of azaperone are as follows:

Adult	100 mg
Sub-adult	50 mg
Juvenile	25 mg

Off-loading

Black rhinos are usually off-loaded more easily than white rhinos. It has been found that if they are allowed to disembark in their own time, which is usually not very long, they are less aggressive in the receiving pens. After disembarkation they often run around and perform for a while. As in the case of white rhinos, a cloth or the handle of a prodder may have to be used to get the animal out of the crate. One seldom has to use the prodder itself. Unnecessary or excessive use of a cattle prodder to get a reluctant animal to disembark will merely aggravate the situation.

Spectators, movement and noise at the off-loading site should be restricted to an absolute minimum as these factors further aggravate the animal. As with white rhinos, it is essential to separate a cow and her calf on disembarkation. The cow's behaviour should be closely monitored before reuniting the two - this may only take 10 minutes if the cow is calm, but longer if the cow is very agitated.

Release

It is essential that black rhinos are taking in sufficient local browse before being released. It is not necessary to reduce their daily lucerne quota before release.

ACCOMMODATION

Accommodation of the white rhinoceros is described below. Aspects of accommodation for the black rhinoceros that differ from that of the white rhinoceros are discussed at the end of the paper².

WHITE RHINOCEROS

The white rhino...

- *Is big, strong, dangerous, and unpredictable.*
- *Is a gregarious animal and therefore likes to see and be with other animals of the same species*
- *Will calm down more quickly in captivity if the walls of the bomas allow it to see animals in the neighboring bomas, and to see and get used to the activity around the bomas.*

Precautions

- Accommodation facilities should be of a very sturdy nature: a rhino will search for a weak point and will work at it until it gets out.
- The rhino must be put into a big boma initially to allow it to settle down.
- The boma should be in a quiet area away from roads and other potential stresses in order to minimize problems that may be encountered with adaptation to captivity.
- It is very important not to allow visitors until captive rhinos have settled down. The human element should be restricted to necessary personnel only.

HOW TO ACCOMMODATE THE WHITE RHINOCEROS

Bomas are used for an adaptation and training period before transportation of the captive animals to another area. Alternatively, the bomas may be used to receive animals and to familiarize them to the local conditions before release. The bomas must be strong as captive rhinos will always attempt to break out of confinement.

Siting

The siting of the bomas is very important, both from a drainage as well as from a climatic point of view.

- The boma should preferably be in the centre of the reserve to minimize contact with fences immediately after release.
- The site should be in an area with good quality natural food available in the immediate vicinity. This makes collection of feed during the boma period easier, and provides a suitable habitat when the animals are released.
- The boma must be close to a reliable water source for the provision of water during the boma-training period. An adult rhino may drink up to 50 l of water per day.
- The boma must be easily accessible to vehicles that will deliver the rhinos.
- Large trees are necessary for shade - alternatively, artificial shade must be provided.
- The substrate must be solid to prevent animals from pushing over boma poles.
- The boma must be protected from cold winds.
- The boma must be away from busy roads, houses and other human disturbances.
- There must be minimal gravel and loose rock in the boma to prevent the development of foot problems.
- The area must be well protected against veld fires. Surround the boma site with good firebreaks. Although rhinos may not be injured by a fire, they may panic at the sight, sound or smell of a fire and are likely to injure themselves in the process.
- The slope of the land must be taken into account - it is preferable to have a net drainage of water away from the front bomas, i.e., from the front to the back bomas.
- It is also desirable to have the bomas facing north-south, with the front bomas on the northern side. This ensures maximum shade in summer and maximum sun in winter.
- It is important that the bomas be situated where the animal can simply be released if it does not adapt to captivity.

Plan - training bomas

For boma training of white rhinos, a system of large and small pens should be used. The front pens should be 12 x 6 m in size - this size is perfectly adequate even for two animals. The back pens should be at least 20 x 20 m (the bigger - the better). The back pens are used to accustom the rhinos to captivity, while the front pens are used to accustom them to close confinement. Newly-captured animals are off-loaded into the back pens, and are only confined to the front pens once they have settled down. As the back pens are emptied, more animals can be captured and introduced to the pens. The front pens are subdivided into two compartments so that the animal can be closed in one section to facilitate cleaning of the other section, and *vice versa*. There should be gates connecting all the front and back pens to each other. The transportation crates are attached to the front pens for crate training.

Plan - receiving bomas

If rhinos are being received for short-term accommodation prior to release, a system of pens should be used, with one spare pen being used to rotate animals for cleaning purposes. This may become

necessary if the animals are kept for a prolonged period. The sizes of the pens should be increased (to at least 20 x 20 m) if wild-caught animals are introduced directly into these receiving pens. In such cases, it is obviously not necessary for the roof/shelter to extend the full length of the pens. Only one release gate is required if all the animals are boma trained (i.e., eating) beforehand.

Wall

The wall must be sufficiently strong to contain a rhino at full charge. However, at the same time it is important that the animals should be able to see each other and be able to see outside. Captive rhinos calm down more quickly under these conditions.

Cable bomas are not recommended under any circumstances because:

- The animal may climb the cables and escape from the boma; or
- In attempting to climb the cables the animal may get its head or shoulders stuck in between the cables and may severely injure or even kill itself.

Problems with cable bomas have been witnessed by the author on several occasions. For these reasons bomas made from vertical poles embedded in the soil are recommended. These poles should all be tannalized and not creosote poles, as creosote causes skin irritation and has been reported to cause gastric ulcers (rhinos tend to lick the poles). Creosote has also recently been implicated in a liver necrosis and failure syndrome in black rhinos.

Three-metre poles of 130-150 mm diameter are embedded 1 m deep into soil or concrete every 1-1,5 m (depending on the soil consistency). Two horizontal poles are affixed to the outside of the vertical ones. The lower horizontal pole is close to the ground, and the upper one ca 300 mm from the top of the vertical poles. Three or four 2 m poles of the same diameter are bolted to the horizontal poles in between the upright poles, with a gap of ca 150 mm between the poles. One can use either 12 mm carriage bolts (the best) or, alternatively, 12 mm reinforcing rod with both ends bent over and knocked into the wood. It is very important to ensure that there are no sharp ends projecting into the boma. It is important that the vertical poles be bolted on the inside of the horizontal poles. If the animal hits or pushes against the vertical poles, the force is then transferred onto the horizontal poles. If the vertical poles are on the outside, the force is transferred onto the bolts.

Gates

Simple gates can be constructed using double vertical posts through which horizontal wooden gum poles are inserted. These gates are relatively cheap to construct, but are difficult to operate. A rhino often rushes through the gate before all the poles have been removed, and may be tripped or injured by the remaining poles. The rhino may also collide with partially withdrawn poles: this may result in injury to an unwary gate operator. Sliding gates consisting of metal frames and vertical metal poles are strongly recommended. These are easily operated from a catwalk above the pens.

Water troughs

Water troughs should be ca 1 x 0,5 m. The sides should be elevated not more than 300 mm above the ground. The elevated sides are to prevent sand from getting into the drinking water. The trough need only be about 400 mm deep, and must have an outlet pipe to facilitate cleaning and draining. The corners of the trough should be rounded to avoid injuries. The inside surface should be smooth and rounded to facilitate easy cleaning and to minimize the build-up of algae and bacteria. It is preferable to have the whole trough inside the boma. If the trough is half in and half out the boma, the rhino may get its horn stuck underneath the horizontal bar while drinking and either drown, break off its horn, or escape. The author has witnessed an animal escaping in this fashion.

Feeding facilities

The feeding area should also be under a roof. A slightly (30 mm) raised concrete slab, ca 3 x 1,5 m. should be built under the roofed area on which to put the feed.

Shade and shelter

The front half of the front pens and all the crates should be totally under roof. The back pens should also have an area under roof where the animal can shelter from sun and rain. The animals favour the corners furthest from any movement or action, i.e., the corners where the bomas meet. It is therefore advisable to put the roofs in these corners.

It is difficult to shield the animals totally from wind. Sections of the boma (e.g., corners) can be closed totally with poles. Plastic should not be used: it flaps in the wind and stresses the animals. The animals may not go near the plastic, or may rip it to pieces: in either case, the purpose of the shelter is defeated.

Off-loading ramp

Depending on the type transport vehicle, the loading ramp may have to be dug into the ground. Raised ramps may also be used, but for off-loading of newly-caught animals that may be a bit groggy, dug-in ramps leading directly onto the surface of the bomas are preferred. Animals should only be off-loaded into the large back boma, not into the smaller front bomas.

BLACK RHINOCEROS

The accommodation facilities described above can be used for the black rhinoceros, with the following exceptions and modifications:

- Black rhinos are introduced directly into the smaller front pens, so the larger back pens are not required.
- When a newly-caught black rhino is introduced into the front pen it should be isolated in the front section of the pen for a few days until it has settled down. Thereafter it can use both sections except when it is isolated in one section while the other section is cleaned.
- The corners of the pen should be 'rounded off' by passing poles horizontally across the corners. This is because the animals tend to run around the pen after off-loading, and may injure themselves in the corners.
- A concrete feeding slab should not be provided in the pen as black rhinos may injure themselves against the slab when they are first introduced into the pen.
- The receiving pen design must be used for boma-trained as well as wild-caught black rhinos - i.e., the pens should not be enlarged for wild-caught black rhinos.

CARE OF RHINOS IN CAPTIVITY

HOW TO CARE FOR WHITE RHINOS³

The white rhino...

- Is big, strong, dangerous, and unpredictable.
- Is a selective grazer, preferring short, palatable grasses.
- Is a gregarious animal and therefore likes to see and be with other animals of the same species.

- Adapts with great difficulty to captivity, from a stress and nutritional point of view. Younger animals adapt better and quicker than adults.
- Tends to adapt more slowly and less readily to captivity if alone - it is usually with these animals that one runs into problems.
- Is unpredictable from a nutritional point of view - some simply will not eat in captivity for no apparent reason.
- Will try to escape until it resigns itself to captivity and settles down. Almost all escape attempts occur at night. Nights 3,4, and 5 of captivity are most critical in this respect.

Precautions

- It is essential to have a night guard who is in contact with the person in control of the bomas in case of attempted escape by the rhino(s).
- The rhino must be put into a big pen initially to allow it to settle down.
- Antelope cubes should not be fed to rhinos: they may contain cotton seed products. Cotton seed contains gossypol which is potentially toxic to monogastric animals such as the rhino.
- Do not allow visitors until the rhino have settled down. The human element should be restricted to boma personnel only.
- Try, if possible, to capture and accommodate pairs of animals from the same herd: these animals will be more likely to adapt to captivity.

BOMA MANAGEMENT

When catching animals to place in bomas one would obviously like animals that are going to adapt as soon as possible. This can be very important, bearing in mind the problems one has in getting white rhinos to adapt to captivity. There are three groups of animals that usually adapt fairly readily to captivity:

- A cow with a calf at foot;
- Animals that are running together in the wild; and
- Sub-adult animals, even if they are caught and put on their own.

Most problems are experienced with single, adult animals: the older they are, the more difficult they find it to adapt.

Water is given *ad lib* (bearing in mind that an adult drinks 40-50 l daily) and the water trough is rinsed out, cleaned, and refilled twice daily. The trough should be disinfected twice weekly with a chlorine compound (e.g., Bacterex™). Until the animal is eating properly, vitamin B-complex syrup is added to the water as an appetite stimulant at a dilution rate of 250 ml per 50 l of water. The vitamin B-complex is always added to the water in the evenings, as it is inactivated by sunlight.

It is very important to monitor defaecation from the first day. Rhinos usually defaecate on the first and second days, then stop for four to five days until they start eating again. If the animal only defaecates on the first two days, but not again, Epsom salts can be put in the water from day nine post-capture. Usually these are the animals that are refusing to eat, and it is found that if and when they defaecate they will start eating. Special care must be taken when administering Epsom salts (see below).

The animal should not be moved to the front pens until it is eating well. A spare back pen (for cleaning purposes) is not normally necessary because the animal can be moved forwards into the smaller front pens after 2-3 weeks. This is done by opening the gate between the front and back pens and letting the animal walk in and out of the front pen at will for a day or two. The animal can then be fed in the front pen for a couple of days before closing it in the front pen. This usually does

not present problems as the animal is well used to captivity by this stage. Once the animal has settled down in the front pen (3-4 days), the pen cleaning can be commenced on a daily basis.

Because rhinos are so bulky and heavy they are very prone to pressure sores, especially just above the front feet on the fetlock joints and on the hock joints. For this reason a layer of fine river sand (200 mm deep) is put into the front pens. This sand also serves to absorb urine. All the sand should be removed and replaced on a weekly basis. The animal is kept in the front pen for at least 3-4 weeks before it is ready to be transported to its final destination (a total of at least six weeks of boma training).

Off-loading

Ensure that the water trough is empty, as a sedated animal could drown in it. Water should only be given once the animal has fully recovered from the effects of the drugs.

When the animal is off-loaded at the bomas it is usually still very groggy and remains so for at least six hours. If it is very hot, the animal may be hosed down once off-loaded into the pen.

The animal often lies down after off-loading (white rhino only). This is acceptable as long as the animal doesn't lie down for longer than 20 minutes at a time (to avoid neuromuscular damage to the hind legs). It is advisable to have a staff member equipped with a long-handled cattle prodder attending to the animal until it recovers. Sometimes the animal leans against the poles of the boma. Care must be taken to ensure that the animal does not smother itself, especially if it is in a corner.

Crate training

Once in the small pens, the animal is fed on a concrete slab for about four days. From then on the crate is opened and the feed is placed at the opening to the crate. The feed is gradually placed deeper and deeper into the crate until the animal's whole body is inside the crate when feeding. This crate is similar to the one in which the animal will travel to its final destination, and this procedure is carried out to get the animal used to a very confined space.

The rhino should be eating all its food in the crate for at least 14 days before translocating it to its final destination.

Feeding

Because it is so difficult to get captive white rhino to eat, highly palatable grasses such as *Cynodon dactylon* (quickgrass) and *Panicum* spp. (buffalo grass) must be given if possible. These species can be found growing in shady, damp areas and on river banks. Freshly-cut kikuyu grass, if available, is also very good.

Freshly-cut green grass is fed twice daily under the feeding roof on the concrete slab; old grass is removed after each feed. It may be found that the animal starts nibbling from day three or day four, and only starts eating well from about day seven. *Eragrostis tef* can then be mixed with the natural grass and increased so that by day 12 the rhino is eating teff only. The vitamin B-complex supplement in the water can then be withdrawn. At this stage start mixing in lucerne up to a maximum of about 10% of the total hay diet: anything higher than this can lead to loose stools and even diarrhoea. The time taken to reach this stage will vary from one animal to the next.

It is essential to feed the best quality teff and lucerne available in order to get the animal to eat. This feed must be kept dry. The teff and lucerne must be checked for mould - this can lead to colic, diarrhoea, or even death. Rodent control is essential - rats can carry *Salmonella*, a bacterium that causes a severe diarrhoea in rhino.

Rhinos should be fed twice daily throughout their period in captivity. Once eating well an adult should eat three-quarters to one bale of hay per day. Big bulls may eat up to 1½ bales. When the

animal is eating well, horse cubes can be sprinkled on top of the feed, increasing gradually to about 2,5 kg twice daily for adult animals.

Occasionally (10-20% of cases), an animal refuses to feed at all. A good rule of thumb is that if the animal has not taken food by day 10 it should be released by simply opening the gate. It is important that the bomas be situated where the animal can simply be released in this fashion. To have to dart an animal which has not eaten for 10 days, in order to load it again for translocation to a suitable release site could be a very risky and stressful procedure. It must be emphasized, however, that 10 days is a rough guideline only. Some animals lose condition very rapidly and might have to be released after only six days, whereas others might be able to last longer than 10 days (although this is very risky). Inclement weather, for example, can cause a perky animal that has not eaten for 10 days to succumb overnight. Experience has shown that it is always better to release the animal sooner rather than later.

Animals that are not in good condition when they reach the bomas will obviously have to be released sooner if they do not eat. An early visible guide to the condition of a rhino is the appearance of skin folds on the lower side of the abdomen just in front of the hind legs, extending forwards towards the thorax. These folds are only visible in animals that are in poor condition. They start off short and shallow, just in front of the hind legs, later increasing in length and thickness as the animal's condition worsens.

If a rhino is refusing to eat and there are others in the boma that have been there for a while and are eating well, one can try mixing them. This often has the desired effect and the animal starts eating immediately. One must monitor the animals closely for a while after mixing them to make sure that they do not fight. This measure works particularly well where younger animals are involved: it is when older animals are mixed that fighting may occur. Some operators report using diazepam (ValiumTM) as an appetite stimulant. We have tried it on four occasions without success (10 mg IM), but it is definitely worth further experimentation. One of the animals drank about 50 l of water after injection, but still did not eat.

Long-acting tranquillizers

Perphenazine enanthate (TrilafonTM) was used on isolated white rhinos in 1991 with promising results. However, it was used again in 1992 on a group of 19 animals (adults 200 mg, subadults 50 mg) with poor and inconsistent results. Most, but not all, of the animals were calm for the first 7-10 days and then became very wild again. Some of the animals appeared to be in a trance for longer than 10 days and were not interested in eating. One of these animals stood with its head in the feed without eating whilst its calf ate right next to it. Six animals out of this group had to be released because they did not eat, whereas normally only one or two would have had to be released because they did not eat. It is not advisable to use this drug routinely in white rhinos. If tranquillization should become necessary, however, the above doses should be adequate.

Clinical problems

Clinical problems should, where possible, be solved without resorting to immobilization. Immobilizing a rhino in a boma can be a risky procedure, depending on the condition of the animal. If immobilization does become necessary, use one third of the dose of opioid drug used at capture. Inclusion of a tranquillizer in the dart is not necessary. The animal must be monitored closely from the time of darting until the time it is given the antidote, and one must be prepared and equipped to give emergency treatment if necessary.

Wounds

Superficial wounds inflicted during capture can be treated with an antibiotic spray. Superficial wounds acquired in the bomas can be treated with a 1:500 acriflavine solution administered using a pressurized garden spray. This is an antiseptic solution that promotes scab formation. More serious, deeper wounds can be treated with iodine antiseptic solution (ProvidenceTM) followed by acriflavine glycerine (1:1000). Acriflavine glycerine is also an antiseptic solution that stimulates

granulation (healing), gets rid of dead tissue, and keeps the wound moist. Both the iodine and the acriflavine glycerine can be administered using a garden spray. The acriflavine glycerine is a bit thick, so it is mixed with a small amount of acriflavine solution so that a greater range may be attained when spraying the animal. Once the wound shows signs of healing well, the acriflavine glycerine is continued without the iodine, until the wound is shallow enough to use acriflavine solution on its own.

Septic wounds are first sprayed with 20% hydrogen peroxide. This is allowed to react with the wound surface for a few minutes before rinsing off with water. It may be necessary to repeat the process. Once the wound is cleaned, it is sprayed with iodine and acriflavine glycerine. This process must be carried out daily - even twice daily in severe cases.

If considered necessary, antibiotic injections can be given using 20 ml darts (Telinject™). Long-acting penicillin (e.g., Compropen™) can be given every 2-3 days, or an antibiotic with a broader spectrum (e.g., Potencil™) can be given daily. It is preferable to give these injections in the neck. The darts can be left to fall out on their own, or can be removed with a long piece of wire.

Occasionally, wounds may become infested with blowfly maggots, especially in summer. A tell-tale sign is the presence of a little hole with blood or serum oozing from it. This situation is easily remedied by spraying a solution of diazinon (Dazzel™) onto the wound at a dilution rate of 6 ml Dazzel per litre of water. It must be borne in mind that this is an organophosphate, and is thus extremely poisonous: for this reason all food and water should be removed from the pen before administering this medication. One treatment is usually sufficient.

The front horn may occasionally be broken off in the crate or when an animal charges the walls of the boma. The horn usually breaks off at the base. A big, bleeding wound results, but it is not as bad as it looks. The wound will dry up and heal on its own, but it is better to spray it with acriflavine solution to keep it clean and to encourage scab formation.

Pressure sores can be avoided by good management (see earlier). They are treated in exactly the same way as other wounds, but the underlying cause must be eliminated.

Constipation

This condition is seldom seen in captive rhinos. It is usually associated with an animal that is not eating. Symptoms that may be seen are loss of appetite, listlessness, very little or no dung in the boma (the foregoing symptoms can also be normal in a newly-caught animal), very hard dung, straining, and rapid breathing due to abdominal discomfort. Constipation is more likely to be seen in animals that are not in good condition anyway due to poor nutrition (e.g., during a drought when the grass is likely to be more difficult to digest than normal).

Magnesium sulphate (Epsom salts) is dissolved in 50 l of drinking water: 50 g for a juvenile, 100 g for a sub-adult, 200 g for a young adult, 400 g for an adult, and 500 g for a big bull. This may be repeated after 36-48 hours if necessary. Care must be taken when giving Epsom salts as one does not want to cause diarrhoea. Fresh rhino dung may also be put into the pen to try to stimulate the animal to defaecate. Very occasionally it may be necessary to immobilize the animal and remove the faecal balls (Flamand, pers. comm.)^b.

Diarrhoea

Diarrhoea is usually due to either a dietary problem or an infection. If it is a dietary problem, there could be one of two causes. Initially diarrhoea occurs while the animal is adapting to its new diet: this is transient. If diarrhoea occurs after the animal has been in captivity for some time, it is usually because it has taken in too much lucerne or cubes. Withdrawal of these feeds for a few days usually alleviates the problem.

It is advisable to treat the diarrhoea symptomatically. Kaolin is introduced to the drinking water: 50 g for a juvenile, 250 g for a sub-adult, and 500 g for an adult. Kaolin does not suspend readily, and the water must be agitated frequently: while its efficacy under these circumstances may be limited, there are few alternatives. An electrolyte/ glucose supplement (e.g., Entersol™) should also be added to the water.

If a bacterial infection is involved, it is usually *Salmonella typhimurium*. This is usually fatal. *Salmonella* is thought to be brought into the bomas by carrier animals (as in horses). The stressful conditions under which the animal finds itself leads to a drop in its resistance, and the animal can then develop a severe diarrhoea. Another possibility is that the feed might be contaminated by carrier rats and mice that defaecate or urinate on the feed.

If *Salmonella* is suspected or diagnosed, antibiotics such as furazolidone can be introduced into the water (e.g., Biolyte™ diarrhoea powder, which also contains electrolytes and glucose). As the antibiotics used in the water are poorly absorbed from the gut, and because the animal may die from a septicaemia, it is necessary to give parenteral antibiotics (e.g., Potencil™) as well. If the animal stops drinking and/or becomes recumbent, it can be put onto a drip and given antibiotics, vitamins and spasmolytics. The prognosis in these cases is very poor.

Unfortunately, *Salmonella* diarrhoea is fairly common in rhinos in pens. There is a vaccine available for *Salmonella typhimurium*, but it is not effective in rhinos. Research is being conducted on a new live vaccine and, at the time of writing, the preliminary results appear encouraging.

Once *Salmonella* has been diagnosed, the affected pen should be sterilized immediately.

- Remove all the soil in the pen to a depth of at least half a metre.
- Spray the surface with a solution of 2% formalin.
- Fill up the hole with fine river sand.
- Disinfect all the poles and the water trough.

When an animal develops diarrhoea, for whatever reason, an attendant must be set aside to look after this animal only. This person sees to the animal's feed and water needs, and does not go near any of the other rhinos. Scrubbing and cleaning equipment must be used only in the infected pen, and must be sterilized every time after use. The attendant should wash his hands with an antiseptic soap each time after working in the pen, and should also wear gum boots that are disinfected after use. He should also wear an overall every time he works at the pen, leaving both the overall and gum boots there. The overall should be changed daily.

Colic

Colic is occasionally seen in rhinos in captivity. Clinical signs of colic in the rhino include rolling, "crying", continual changes in position, repeated standing and lying down, and distress. Probable causes are mouldy feed, change in diet, etc. A single intramuscular injection of a spasmolytic (e.g., Finadyne™) is usually effective. Use 20 ml Telinject™ darts. An abscess may develop at the injection site.

Pneumonia

Pneumonia is uncommon in captive rhinos: it usually occurs only in animals that are not in good condition, often following a cold, wet spell. This is where shelter from the elements, especially rain, is very important. A cold animal is bad enough but a cold, wet animal is a dangerous combination. Pneumonia is a very difficult condition to diagnose by just looking at an animal. Listlessness and laboured, often noisy, breathing occur. The animal must be darted with antibiotics (e.g., Potencil™) and vitamin B-complex syrup should be included in the drinking water.

Fly and tick worry

This can pose a problem in summer. Flies tend to sit on wounds and generally irritate the animal. Bayticol™, which is a safe, synthetic pyrethroid, can be sprayed onto the animal weekly. This is effective against both stable flies (*Stomoxys* spp.) and ticks.

Abscesses

Abscesses are seldom seen in rhinos. Abscesses that do develop are usually as a result of a dart wound or injection. Because it is not possible to lance an abscess without immobilizing the animal, the abscess is usually left to rupture on its own. It is then treated as an open wound (i.e., hydrogen peroxide, iodine, acriflavine glycerine, etc.) The wound usually clears up fairly quickly. If the opening continues to ooze it may be necessary to immobilize the animal and flush the abscess. In such cases a long-acting antibiotic should also be used.

Eye infections

Eye infections may be caused by dust or a blow to the eye. An active infection is characterized by a yellow-green, thick discharge, whereas physical trauma is characterized by a watery, clear discharge. Try to wash away the debris with water. Depending on how tame the animal is, it may be possible to treat the eye with an antibiotic ointment: Orbenin OPH™ (every 48 hours), OpchlorVet™ (3-4 times daily), or Terracortril™ (twice daily). The latter contains cortisone, so one must make sure that there are no corneal lesions before administering it. The animal will not usually be tame enough to allow administration of an ointment. An iodine-based spray is very effective in such cases. Examples include Vidine™ and Oberdine™ wound, eye and footrot spray. These antibacterials can be administered from a distance of 10-20 cm. They should be administered at least twice daily until recovery.

Foot infections

These occur when bacteria invade wounds or cracks on the feet, and are usually only found when the animals are kept under wet, dirty conditions. Hydrogen peroxide, iodine, and acriflavine glycerine should be applied as described earlier. If the animal will not lie down long enough for the full treatment, try to ensure that at least the iodine and acriflavine glycerine are applied. Failing this, alternate treatment with these two drugs. It may be necessary to administer antibiotics (e.g., Compropen™ or, in severe cases, Potencil™).

HOW TO CARE FOR BLACK RHINOS⁵

The black rhino...

- Is a big, strong, aggressive, unpredictable, and potentially dangerous animal.
- Is by nature not usually a gregarious animal.
- Usually adapts readily and quickly to captivity. The age of the animal does not seem to influence its adaptation.
- Is a browser.

Precautions

As for the white rhino, with the following exceptions:

- Black rhinos start eating almost immediately in a pen.
- Black rhinos are initially even more aggressive than white rhinos so great care must be taken not to aggravate them unnecessarily. However, they calm down within a few days and ultimately become much tamer than captive white rhinos.
- Black rhinos can be put straight into the front pen because they adapt so readily to captivity.

BOMA MANAGEMENT

- All animals are housed individually, except in the case of a cow and her calf.
- The water trough should only be filled once the animal has settled down after its initial introduction to the pen. Vitamin B-complex syrup should be mixed into the water (250 ml per 50 l water). The vitamin B-complex supplementation can be discontinued as soon as the animal is eating well - usually about 10 days after capture. Water is given *ad lib*, and the water trough is emptied and cleaned twice daily. As in the case of the white rhino, the water trough should be disinfected twice weekly with a suitable disinfectant (e.g., Bacterex™).
- It is best to wait until the animal has settled down (4-5 days) before cleaning the pen. The pen is then cleaned on a daily basis. It is essential, however, to remove as much old browse and lucerne as possible twice a day from day one.
- The sand on the floor of the pen must be removed and replaced on a weekly basis

Off-loading

- The floor of the pen is covered with a thick layer of fine river sand and the water trough is cleaned and emptied before the rhino is off-loaded.
- At off-loading, the black rhino is usually very aggressive. For this reason, fresh browse is cut and hung from the poles all around the pen (thickly stacked) before the animal comes in. This serves to simulate the animal's natural environment.
- Personnel and movement in the vicinity of the boma should be limited to a minimum at off-loading.
- When the animal is off-loaded it is usually very aggressive and runs around the pen a few times before calming down. The animal usually starts chewing on the browse within a few minutes after off-loading.

Crate training

The animal must be crate-trained, as in the case of the white rhino. To achieve this, the lucerne is used to lure the rhino into the crate. The lucerne is moved closer and closer to the entrance of the crate every day, until eventually the animal is eating inside the crate.

Feeding

The diet of captive black rhinos must, at least initially, consist of a high proportion of the natural feed. Examples of suitable browse species include *Spirostachys africana* (tambotie), *Ziziphus mucronata* (buffalo thorn), *Acacia* spp., *Grewia* spp. and *Rhus* spp. Do not feed *Dichrostachys* spp.: although palatable, the robust thorns may penetrate the sole of the rhino's foot.

The browse must always be fresh, as wilted browse can cause prussic acid poisoning. Browse is fed twice daily, and the old, wilted browse is taken out on each occasion.

The browse is put onto the ground - there is no concrete slab, as the animal may injure itself on the slab after off-loading.

After 3-4 days, when the animal has settled down and is eating well, lucerne hay of the best available quality should be added to the diet. This is done by spreading a little lucerne over the browse each time it is put in, in the hope that the lucerne will be taken in together with the browse. The lucerne must be thoroughly inspected for mould and other contamination before feeding. Good rodent control is essential.

Some rhinos take to lucerne immediately, while others may take up to 2-3 weeks before they take it well. An adult rhino should eat 15-20 kg of lucerne per day. Once the lucerne is being taken well it can be fed in a heap on the ground next to the browse.

Horse cubes should be provided on top of the lucerne once the animal is eating well. Start gradually and build up to 2,5 kg twice daily in the case of an adult.

The browse is never taken away completely, although it may be reduced gradually as the lucerne intake increases.

In the author's experience, it has never happened that a captive black rhino refuses to eat. Also, we have never had a problem with constipation, probably because the animal starts eating immediately. The age of the animal does not seem to influence its adaptability.

Long-acting tranquillizers

Perphenazine (Trilafon™) and Zuclopenthixol (Clopixol-acuphase™) have been used by other operators on black rhino with apparently favourable results (Table 2). Long-acting tranquillizers are not normally necessary as these animals settle down very quickly without the use of drugs.

Table 2: Preliminary dosage rates of long-acting tranquillizers used in the black rhinoceros (M.D. Kock, personal communication)^c

Drug	Zuclopenthixol (Clopidol-acuphase)	Perphenazine (Trilafon)
Adult	0,24-0,41 mg/kg 300-600 mg total dose	0,2-0,6 mg/kg 300-500 mg total dose
Sub-adult	0,67-1 mg/kg 250-300 mg total dose	0,6-0,8 mg/kg 200-300 mg total dose
Juvenile	0,67-1 mg/kg 200-250 mg total dose	0,5-0,8 mg/kg 100-200 mg total dose

Clinical problems

Wounds

In addition to traumatic wounds as seen in white rhinos, black rhinos have unusual lesions normally just behind the front limbs on either side of the thorax. These may also occur on the chest, neck, and the top of the forelegs. The lesions are caused by the filarial nematode, *Stephanofilaria dinniki*, and are typically open, superficial sores that exude copious amounts of blood and serum. The nematode is transmitted from one animal to another by an unknown biting fly.

The distribution of these lesions is age related, and their severity seems to be aggravated when the animal is under stress, probably due to secondary bacterial infection. The lesions are also aggravated by oxpeckers and biting flies. The irritation induced by the lesions causes the animal to rub against objects, thus aggravating the situation even further.

In captive animals these lesions can be kept under control by:

- Maintaining a high plane of nutrition:
- Weekly spraying with a fly repellent, e.g., Bayticol™; and

^c M D Kock, Department of National Parks and Wildlife Management, P O Box 8365, Causeway, Harare, Zimbabwe

- Twice-daily spraying with a 1:500 acriflavine solution. Deeper, ulcerated lesions may also initially be treated with hydrogen peroxide, iodine, and acriflavine glycerine 1:1 000, followed eventually by acriflavine solution 1:500.

The lesions sometimes become infested with maggots, but this can easily be remedied using a suitable insecticidal spray (e.g., Dazzel™). Theoretically an ivermectin preparation (e.g., Ivomec™) could be used to kill the filarial nematodes. However, because of the deaths experienced with horses and black rhinos in Kenya, we do not think it is worth taking the risk. Note: when black rhinos are moved away from the eastern areas of southern Africa (Zululand and the Kruger National Park) to other areas, the lesions disappear completely. This is probably because the vector is not present in these areas.

Constipation and diarrhoea

Constipation is not a problem commonly encountered in captive black rhinos, probably because they eat so readily from the start. Diarrhoea is seen on very rare occasions, and then it usually only lasts for a day or two. It is usually seen within two days of capture. Kaolin can be put in the water but because of its poor solubility, its efficacy is questionable. An electrolyte/glucose supplement can be added to the water (as in white rhinos). *Salmonella typhimurium* fortunately has not been a problem in black rhinos in our pens.

Pneumonia

Pneumonia is very seldom seen in captive black rhinos, and then only in debilitated (e.g., snared) animals. The symptoms and treatment are as for white rhinos.

Fly and tick worry

The treatment is the same as for white rhinos.

Pigmented urine

Five black rhinos were transported to a farm ca 80 km west of Pretoria in June 1991. There they were fed *Spirostachys*, *Grewia*, lucerne, and horse cubes: exactly the same diet to which they were accustomed in the bomas at Umfolozi Game Reserve. However, two days after arrival it was observed that the urine of these rhinos was turning a dark red colour shortly after urination. The urine was initially the normal white/cream colour, but it gradually turned red, eventually looking like pure blood.

Blood, urine and browse samples were taken for analysis. Haematology was normal and no pathogenic parasites were found in blood smears. Liver and kidney function were found to be normal. However, spectrophotometry showed that the *Grewia* bark and the rhino urine contained at least one spectrophotometrically identical component. Liquid chromatography suggested that there were some elements present in the rhino urine that also occurred in the *Grewia* and *Spirostachys*. These elements bore a strong resemblance to rutosid, a chemical that also apparently occurs in the bark of *Japanica* sp. and the leaves of *Eucalyptus* sp.

The rhinos never showed any sign of malaise. They were released into their new environment, and were reported to be doing well. An interesting fact to note here is that five black rhinos from the Umfolozi bomas had been sent to the same farm in February 1991. These animals were fed exactly the same diet as those that arrived four months later. These animals did not develop this syndrome at all. In May 1992, a black rhino cow and her six-month-old calf were transported to the same farm. Again, the animals were from the Umfolozi bomas, and were fed the same diet as the June 1991 animals. Two days after arrival the cow developed the dark red urine, but also showed no signs of malaise. It therefore seems that there is a seasonality to the occurrence of this phenomenon. It appears that the pigment is present in both *Grewia* and *Spirostachys* spp., but only at certain times of the year. It is also apparent that the pigment does not adversely affect the

animals in any way. Although not a common problem as yet, this syndrome may become more prevalent as the frequency of translocation of black rhinos increases.

Colic, abscesses, eye infections, foot infections

The treatment is the same as for white rhinos.

DO NOT put animals, other than cow and calf, together in the same enclosure. Even in the case of a cow and calf, the individuals must be separated initially until they have calmed down.

REFERENCES

1. Rogers P.S. 1993. Transportation of the white rhinoceros *Ceratotherium simum*. In: McKenzie A.A. (ed.) *The Capture and Care Manual*. Pretoria: Wildlife Decision Support Services and The Veterinary Foundation. pp 529-533.
2. Rogers P.S. 1993. Accommodation of the white rhinoceros *Ceratotherium simum* and black rhinoceros *Diceros bicornis*. In: McKenzie A.A. (ed.) *The Capture and Care Manual*. Pretoria: Wildlife Decision Support Services and The Veterinary Foundation. pp 540-546.
3. Rogers P.S. 1993. Care of the white rhinoceros *Ceratotherium simum* in captivity. In: McKenzie A.A. (ed.) *The Capture and Care Manual*. Pretoria: Wildlife Decision Support Services and The Veterinary Foundation. pp 546-553.
4. Rogers P.S. 1993. Transportation of the black rhinoceros *Diceros bicornis*. In: McKenzie A.A. (ed.) *The Capture and Care Manual*. Pretoria: Wildlife Decision Support Services and The Veterinary Foundation. pp 556-558.
5. Rogers P.S. 1993. Care of the black rhinoceros *Diceros bicornis* in captivity. In: McKenzie A.A. (ed.) *The Capture and Care Manual*. Pretoria: Wildlife Decision Support Services and The Veterinary Foundation. pp 558-562.