BOMA MANAGEMENT AND TRANSLOCATION OF WHITE RHINO IN THE KRUGER NATIONAL PARK

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INTRODUCTION

The Kruger National Park (KNP) is situated in the north-eastern corner of South Africa bordering Mozambique in the east and Zimbabwe in the north and covers an area of 1948528 ha (Figure 1). In 1961 the first white rhino were re-introduced from the Umfolozi Game Reserve to the KNP, over a twelve year period a total of 345 white rhino were relocated to the KNP. By 1998 their numbers had increased to 2954. In the KNP animals are translocated to provide other national parks, conservation organizations, breeders and game farmers with a source of founder populations of a species or to increase the numbers of, and introduce genetic diversity into an existing population.

CAPTURE OF THE WHITE RHINO

White rhino are routinely anaesthetised for marking, collection of samples, translocation and treatment, the emphasis will however be placed on the translocation of white rhino for overseas destinations in this article. The anaesthesia is complicated by the white rhino's sensitivity to opioids, severe respiratory depression under anaesthesia, hypertension due to opioids and peculiar anatomical features.

SELECTION OF ANIMALS

Preference is given to the younger range of adult animals (6-14 years), sub-adults (4-5 years) and calves (older than 9 months). The ideal unit is a 9-11 year old cow with her year old calf, as a "normal" cow would again be in early pregnancy at this stage. In this way three animals are actually translocated. Older animals have a shorter breeding time left and generally adapt with greater difficulty to the boma and are therefore not selected. Bulls in the age class of 7-10 years are normally selected as they are still wandering in small groups and are not yet as aggressive as the territorial bulls. Only healthy animals are selected.

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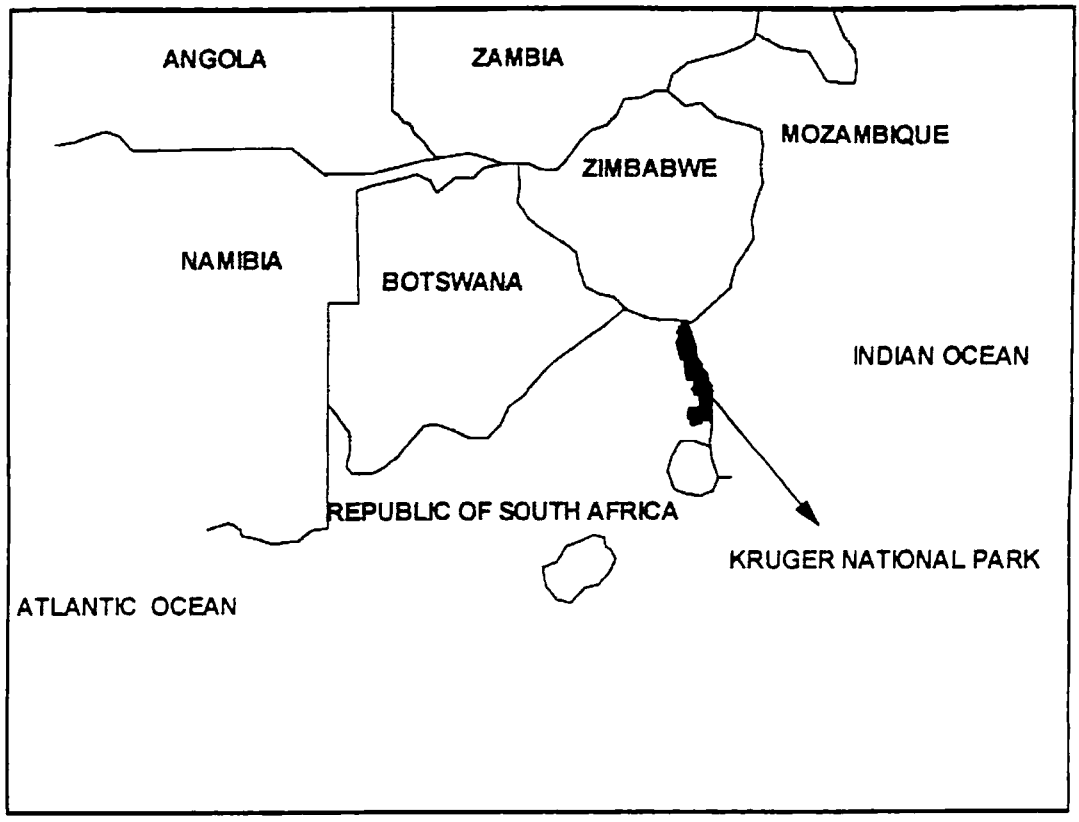


Figure 1. Locality map of the Kruger National Park, Republic of South Africa.

CHEMICAL IMMOBILIZATION

Dart system

An aluminium dart system with an acetic acid/bicarbonate charge is used during field captures from the helicopter. The drug is discharged only once the collar of the dart hits the skin to ensure deep intra-muscular deposition of the drugs. Needle lengths are 50 mm and are collared to ensure the dart stays in place.

The Dan-Inject system with smooth 60mm needles is used for darting rhino in the boma.

Drugs

Using the correct amount of drugs for different sizes of animals is of the utmost importance and darts are normally only made up once the animals are sited. The preferred combinations for field anaesthesia are shown in Table 1.

Table 1. Drug combinations in the anaesthesia of white rhino.

ANIMAL	M99	AZAPERONE	HYALAZE
Adult bull	4 – 5 mg	25 mg	5000 IU
Adult cow	4 mg	20 mg	5000 IU
Sub-adult	1.8 – 2.5 mg	15 – 20 mg	5000 IU
Calf	0.5 – 1 mg	10 mg	5000 IU

Once down, each and every rhino receives an intravenous catheter (18-20 G; 2 inch Jelco) inserted into an ear vein and 5-15mg Nalorphine is administered immediately to stimulate respiration. Dopram and Oxygen (O_2) supplementation is kept on standby as alternatives if more stimulation is needed. The Azaperone dosages are low in comparison and we have experienced difficulties in walking rhino if they received dosages above 30 mg.

For boma anaesthesia, 0.25-0.8mg M99 with 20-30 mg Azaperone is used if a standing immobilisation is required or 75 % of the field dosages of M99 with 10-50 mg Azaperone if recumbency in adults is required.

Animal manipulation

Rhino are heavy animals and difficult to manipulate once recumbent. One should always plan for the worst case scenario and have all equipment handy. The list should include:

Ropes: One strong soft cotton rope ± 20m with a 1 inch diameter for the head and a shorter rope of ±10m for a brake on the hind foot.

Blindfolds and earplugs: Blindfolds can be made of towels with Velcro on the ends. Earplugs should have long strings attached to them to avoid them being forgotten in the rhino's ears.

Axes: It may be necessary to remove some trees and branches around the rhino before administration of the antidote to avoid injury once the rhino stands and walks.

Shovels: They are used to dig/fill holes in the path of the walking rhino, or to remove sharp stumps in close proximity to the recumbent rhino.

Electric cattle prodders: They are used with much success on rhino if used with discretion, stimulating them to stand up after administration of the partial antagonist.

Animal monitoring

Although a pulse oxymeter can be used, procedures to load animals are generally fast. A rhino is loaded within 15 minutes after darting and respiratory rate, pulse, temperature and blood colour (seen in blood samples and use Jelco) are used to indicate the state of the recumbent rhino.

Physiological manipulation

Water is used to cool down rhino in extreme temperatures, but copious amounts are necessary to obtain any effect, it is therefore better to complete the capture early in the mornings when it is still cool.

Oxygen supplementation: It is not difficult to insert an endotracheal tube into rhino via the nose through which O_2 can be supplemented. The diameter of this tube should be far less than that of the trachea. A commercial horse stomach tube is adequate.

Intravenous line: As discussed before, a 18-20 G; 2 inch Jelco is inserted into an ear vein and left in place until the rhino is released into the boma. This is useful in emergencies, especially when the blood pressures drops.

Combined anaesthesia of cows and calves

Good success has been achieved in Kruger by darting the cow and calf in quick succession using a double barrel dart gun, then pulling away completely allowing the two animals to remain together and become recumbent in very close proximity. The cow should be darted first as the calf will remain with its mother, and can often be darted while standing by the recumbent cow. However, the opposite is not true.

Dart site and angle

A large muscle area should be selected for dart placement. The darts must be placed at right angles to the skin to avoid sub-cutaneous deposition of the drug. Preference is given to the gluteal and rump region from the helicopter while the neck area seems to work best in a boma situation.

Other interesting points

White rhino show a characteristic reduction in speed, a shortened gait often dragging their feet, followed by a high stepping gait, standing and sideways movement as soon as the drugs take effect. Prior to recumbency the head is held up high. A blindfold is placed over the animal's eyes to reduce stimulation.

The rhino can be assisted into recumbency by pulling on a rope on the hind foot or by pushing its body over. Although they tolerate lateral recumbency, sternal recumbency is preferred with the exception of heavily pregnant females. The pressure from the foetus on the diaphragm may be elevated by sternal recumbency. Animals should not lie downhill and any objects such as dangerous stumps or rocks should be removed.

The rhino should always be blindfolded and earplugs inserted. Special care should be given to their position, to avoid them lying on their back legs too long as this results in occlusion of the blood supply and later a reluctancy to stand. It is good management to shift their weight from time to time during recumbency, or to throw them over into lateral recumbency before they are walked or pulled into a crate.

The dart wound is treated immediately with an intra-mammary broad-spectrum antibiotic preparation.

Temperature should not exceed 39 degrees Celsius and can be reduced by pouring copious amounts of cool water onto the animals or by covering them with branches.

White rhino are notoriously poor ventilators and it is good practice to administer 5-15mg of Nalorphine I.V. immediately when the jelco is inserted, as this increase the rate and depth of respiration and has a positive effect on blood gas values. A primitive but good method to monitor this is to allow the blood to drip from the Jelco. As blood colour is directly correlated to oxygenation, we have learned to interpret this and act accordingly. Initial respiration rates can be as low as 3-4 per minute but should increase to 6-12 per minute after the Nalorphine administration.

White rhino typically show muscle shivering, or rising of the front quarters, or typical running movements of the legs if in lateral recumbency. Generally it is not regarded to be a problem as the animals are loaded as quickly as possible.

It is difficult to monitor depth of anaesthesia in rhino. Ear movement, increase and deepening of respiration rate and attempts to stand up are some of the better indicators.

Loading a white rhino into a crate

If the crate can be placed in front of the rhino, the middle of a rope is tied with a blood knot around the rhinos blindfolded head, with the knot in position behind the smaller horn and over the blindfold. The two loose ends are laid out in front of the rhino, through the crate and tied to a strong vehicle, or 10-12 men are placed in front to pull the rhino into the crate once revived.

The selection of the antagonist is very critical at this stage. Normally, for adults, a bolus of 40 mg Nalorphine in combination with 1-2,5 mg Diprenorphine results in a smooth recovery without excessive struggling against the pulling team. If the animal is to awake, it will fight against the pulling action. Care must also be taken to guide the animal into the crate so that the pulling action is not against the crate itself. Once inside the back of the crate is blocked off and the ropes and blindfolds removed. At the same time the remaining Diprenorphine is administered through the Jelco (3 times the M99 dosage) as well as additional Azaperone (roughly 100-200 mg for adults and 50-80 mg for sub-adults; calves are only given Azaparone in cases of severe anxiety (20-40 mg).

Regular stops on the way to the boma are made to inspect the animals. Animals lying sternally and breathing well with good ear movement are generally left alone while pressing animals and front leg collapsing ones are rectified by gentle electrical stimulation.

Walking a white rhino

It is often not possible to place the transport crate close to the recumbent animal due to evironmental restrictions. Fortunately it is possible to walk a white rhino; up to a mile or more if needed; from the site of recumbency to more suitable terrain, or to the crate.

This is conducted by tying the middle of a rope (blood knot) around the rhinos blindfolded head. The two loose ends of ±10m each are laid out in front of the rhino and 4-5 men are placed on each rope to act as pullers. A second rope of 10 m is tied with a slipknot around one hind leg. This rope acts as a brake and 2 strong men should handle it. The route that will be followed to the crate should be discussed and cleared, and 2 persons should walk ahead to remove loose branches and rocks that may jeopardise the walking rhino.

Small dosages of Nalorphine (20 mg increments in adults and sub-adults; 10 mg in calves) are given through the Jelco into the ear vein and the animal is stimulated with the electric prodder to test its response. A good response is normally when the animal lifts its head and starts walking with the front legs. More stimulation at the back in co-ordination with the handlers in the front pulling the ropes results in a smooth walk.

EMERGENCIES

Here we are only referring to the animal! Most problems are experienced with animals going into respiratory difficulty and but rarely into complete arrest, which have to be dealt with fast and immediately. If no improvement is experienced with the administration of Nalorphine, the operation is abandoned and Naltrexone

is administered IV without delay. This normally results in an extremely lively rhino within a short period of time.

Excessive fighting in the crates is normally handled with large dosages of Azaperone, varying from between 200-400 mg IM. Again this is seldom seen as diprenorphine is used as antagonist (which is not a complete antagonist) once the animal is inside the crate.

OFF-LOADING AT THE BOMA

The receiving pen in the boma should be prepared, and water and food supplied before off-loading captured animals so that there are no disturbance after the off-loading. The animals are evaluated before they are let out of the crates and generally the following are done: a pour-on acaricide (0,5 % Deadline, Bayer) is poured onto them to kill all ticks. Additional Azaperone is normally administered depending on the animal, mostly about 100-200 mg for adults and 50-80 mg for sub-adults. Adults also receive 100-200 mg of Acuphase (Clopixol), which is a long-acting tranquiliser. Naltrexone (complete antagonist) is administered routinely to all animals to ensure that no re-narcotisation will take place, 1 cc (50 mg) is given intra-muscularly in adults and 0,5 cc in calves and sub-adults. A last check is done to ensure all rags have been removed from the ears and Jelco catheters are out.

Calves are released before their mothers into the same boma.

CAPTIVE HOUSING OF WHITE RHINO

Most white rhino that are translocated are kept in a "boma" to tame them down, adapt them to the lucerne and teff mixture and to acclimatize them to their new environment. When constructing a rhino boma only strong, solid material should be used, because a rhino will search for a weak point and work on that point until it escapes.

Some requirements that need to be taken into consideration when planning a boma are the following:

- The area selected should be on high-lying soil with good drainage to prevent muddy, unhygienic conditions.
- There must be enough shade and where possible natural trees must be kept else additional shade must be provided.
- A rubbing post as well as a wallow must be provided and must be situated in such a way that the wallow can easily be refilled.
- A water trough that can be cleaned daily should be constructed and should be large enough to contain between 150 – 200 liters of water, with the sides not higher than 300 mm.

- A concrete slab, which serves as a feeding area, must be provided under a solid roof and must be cleaned daily.

CONSTRUCTION OF THE BOMA

- Figure 2 shows the design and the dimensions of the boma used in the KNP.
- Use tanalith treated saligna poles that are 3,0 m long with a top diameter of 150 – 175 mm, these are concreted into the ground 2,5 m apart in $1m^3$ holes.
- Two 6,0 m treated poles with the same diameter as the above are then hung horizontally (equally spaced 500 mm from the top and the bottom) onto the planted poles, onto which 2,0 m treated poles also with the same diameter are hung 100 mm apart with 12 mm round steel bar that is bent around on both ends.
- Steel sliding gates with a width of approximately 2.0 m should be used between pens, this enables easy movement of animals.
- In the KNP the animals are loaded and offloaded with a truck mounted mobile crane (16-20 ton/m^2 capacity) and no ramps are used.
- Two catwalks are also included in the design and are essential for observation especially in the first 14 days after capture.

ADAPTATION OF THE ANIMALS TO THE BOMA

In the adaptation or boma training phase of white rhino a system of large and small pens are used (Figure 2). White rhino are prone to not feed for at least some period after wild capture. The large back pen is 20 X 50 m (or bigger where possible), the front small pens are each 10 X 20 m but are subdivided into two compartments for cleaning purposes. Transportation crates are attached to the front pens for crate training.

Newly captured animals are off-loaded in the large back pens to accustom them to confinement, they are kept in this pen for seven days unless they start feeding before this in which case they may be moved to the smaller front pens (nights 3 – 5 are critical because this is when the animals may try to escape). The next seven days are crucial because it is in this period that one has to make sure that the animal(s) are eating and defecating properly. A good indication of the status of the animal is its dung; the amount, consistency and the colour thereof. Rhino normally defecate for the first two days after capture, then stops for approximately two days when they normally start eating. Initially the colour of the dung is dark from the grass eaten in the field. When eating properly each animal should have two or three dung heaps that are firm (not putty like) in which grass fiber's are visible with an olive green colour.

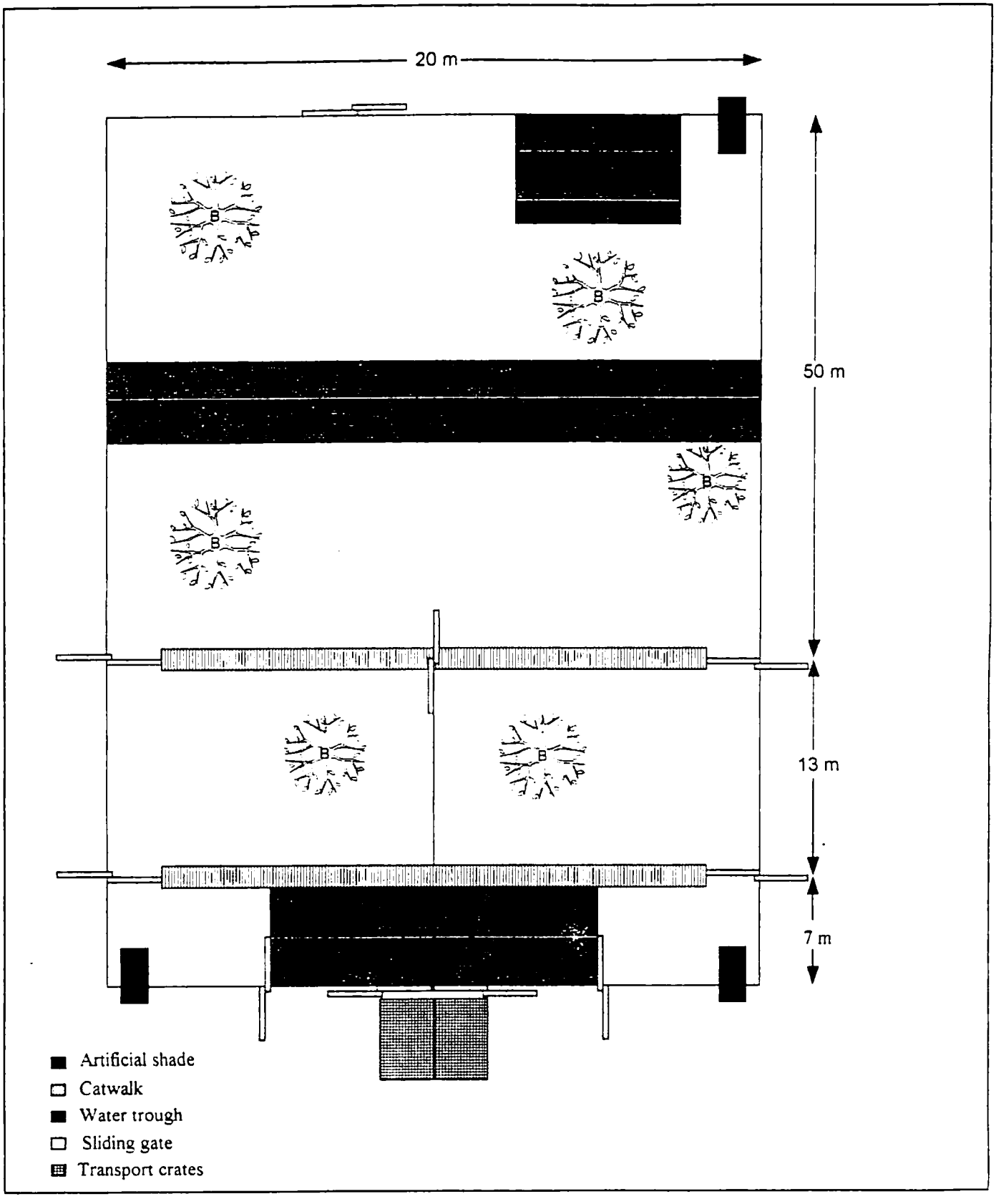


Figure 2. Design and dimensions of the boma used in the KNP.

Animals are normally released if they haven't eaten properly for 12-14 days. They are released at the capture site, 10% of wild captive white rhino are normally "non-eaters". Most problems are experienced with single, adult animals that find it difficult to adapt.

Feeding of animals

As it is difficult to get wild captive white rhino to eat in the boma, highly palatable grass such as freshly cut *Panicum spp.* should initially be fed. Once the animals have taken to the fresh grass it can be mixed with commercial *Eragrostis tef.* This should always be made available separately and mixed with about 30% lucerne from day one. Only the best quality teff and lucerne must be used in order to stimulate the animals to eat. Rhinos are fed twice a day throughout captivity. Animals are fed according to their size, adult animals will eat approximately 25–40kg of mixed feed per day.

Water must always be available *ad. lib.* and troughs must be cleaned thoroughly on a daily basis and disinfected twice weekly. Vitamin B complex syrup is added to the water as an appetite stimulant at a dilution rate of 5 ml per liter of water, until the animals are eating properly. This is always done in the evenings since vitamin B complex is inactivated by sunlight.

HABITUATION

Once the animals are moved into the small pens and are eating properly, the taming and crate training is started. The taming involves spending time with animals, getting them use to the presence of humans.

Crate training

As mentioned before, transportation crates are attached to the exit gates of the small pens adjacent to the concrete feeding slab. When the crate is opened the feed is placed in the opening of the crate and gradually moved deeper into the crate until the rhinos whole body is inside the crate when feeding. This procedure is carried out to get the animal used to being in a confined space.

Depending on the distance and the method of transportation the process of crate training is extended and intensified. When transporting animals for approximately one day by road, normally within the same country, animals should have been crate trained for at least two weeks and eating all their food inside the crates.

When transporting white rhinos by air it is preferred to boma train and crate train the animals for at least 5 months. In the last 4 - 6 weeks before transportation the final intensified crate training is done. This

involves getting the animals to drink from a plastic water trough inside the crate and confining the animals to the crate. Initially the plastic trough is put in the empty concrete trough and then gradually moved towards the crate and finally into the crate, where it is attached to the front of the crate. The animals then needs to be conditioned to only drink when water is provided to them, to accustom them to a routine which will be followed during transportation. In this phase water is only provided twice a day. Finally the animals may be confined in the crates for a day, in a shady place, just to get them use to being confined for a prolonged period. This is done in the same way as when the animals will be loaded eventually and involves darting the animals with M99. If this procedure is followed it should be done more than seven days before the final transportation date to prevent any effects from the drug being present when the animal is darted again.

POTENTIAL PROBLEMS DURING ADAPTATION AND HABITUATION

Injuries

Some animals show superficial wounds to the face especially from day 3 – 5 from trying to escape. Because rhinos are so bulky and heavy they are prone to pressure sores, especially just above the front feet on the fetlock joints and on the hock joints. For this reason the front pen is covered with a layer of fine river sand which also serves to absorb urine. When the front horn is broken off, usually in the transport crate after capture or when a animal charges the walls of the boma, a big bleeding wound results which normally looks worse than it really is. The wound will dry up and heal on it own, but it is better to treat it. All of the above injuries can be treated with a 1:500 acriflavine solution mixed with lotagen concentrate and administered with a pressurised garden spray. This antiseptic solution promotes scab formation. If considered necessary the animals may be darted, wounds cleaned and antibiotics administered. Wounds should always be checked for blowfly maggots, which can be treated by spraying the wounds with Cylence (a Bayer product with Cyfluthrin 1% as active ingredient).

Diarrhoea

Diarrhoea is usually caused by a dietary problem or an infection. Lucerne should be withdrawn and the animals should be treated with a diarrhoea powder such as biolyte (Milborrow) which contains electrolytes, glucose and furazolidone, this is best administered through the drinking water.

Constipation

This condition is seldom seen in rhinos, and is associated with an animal that is not eating. Symptoms are hard or no dung, loss of appetite, listlessness and rapid breathing due to stomach discomfort. To treat this condition magnesium sulfate (Epsom salts) is used, which is dissolved in 50 l of drinking water at a rate of between 50 g for a juvenile to 500 g for a big adult bull. This may be repeated after 36-48 hours if necessary. Care should be taken not to give rise to diarrhoea when giving Epsom salts.

DISEASES OF CONCERN

There is very little known or published with regards to endemic diseases of white rhino.

Bacterial diseases

Anthrax has been diagnosed in white rhino and has caused sporadic mortalities during natural epizootics amongst free-ranging ungulates. It appears to be incidental casualties and are not important role players during these epizootics.

Salmonellosis caused by *Salmonella typhimurium, S. kottbus* and *S. enteritidis* have all been diagnosed in captive animals, and are fulminating infections that cause acute fatalities. In most cases the fodder is the source of *Salmonella* and it is therefore important to check on the quality of the lucerne and teff.

Bovine tuberculosis is one bacterial disease that probably causes the most concern. This disease has however never been reported in free-ranging white rhino. The veterinarians in the KNP and Hluhluwe/Umfolozi Park do on average 15 white rhino necropsies per year between them, and have never diagnosed a case of bovine tuberculosis in this species.

Viral diseases

These are probably of the greatest concern to the regulatory authorities.

Foot and mouth disease (FMD) has never been reported in white Rhino, being perissodactyls it is unlikely that they will be susceptible to this disease. In excess of 50 white rhino sera tested negative for the presence of antibodies to FMD, all of these sera originated from the KNP which is an endemic FMD area with frequent cyclic endemics in several cloven hoof species.

Orbiviruses – no seralogical evidence of infection of either Blue Tongue or African Horse Sickness has ever been reported in white rhino.

Other Arboviruses – no seralogical evidence of white rhino being susceptible to Equine Encephalosis, Lumpy Skin Disease, Rift Valley Fever or Bovine Ephemeral Fever has ever been found.

Rickettsial diseases

The rickettsial disease of the highest zoosanitary importance is probably Heartwater (Cowdriosis), since white rhino are a primary predilection host for *amblyomma* ticks, the natural vectors of this disease. Unfortunately nothing is known about the role of white rhinos in the epidemiological cycle of this disease. Clinical Heartwater has never been reported in white rhino, and this is not surprising as this is primarily a disease of ruminants, and perissodactyls are refractory to infection. It is unknown whether white rhino become infected with this organism or have any maintenance potential which could result in them serving as reservoir of Cowdria organisms in the presence of a patent vector. Studies are presently being undertaken to determine the status of Heartwater.

Protozoal diseases

Unidentified Babesia and Theileria like piroplasms have been described in blood smears of white rhino. It is not known whether these are host specific, or whether there is any potential for interspecies transmission. Trypanosomiasis has been described in both black and white rhino in east Africa and Zimbabwe. No tsetse flies have however been found in the KNP during intensive surveillance since 1983. With the exception of *Trypanosoma theilera*, non tsetse transmitted trypanosomes such as *T. vivax* or *T. evansi* have been identified in thousands of blood smears examined in the laboratory in Skukuza over the past few decades. This laboratory receives between twenty and two hundred blood smears a month from a variety of species, as part of anthrax surveillance actions.

Ectoparasites

White rhinos in their natural states are frequently infected with a large range of ixodid ticks, including those of the genera *Amblyomma, Rhipicephalus, Dermocentor* and *Hyalomma*. Many of these are potential vectors or reservoirs of both protozoal or rickettsial diseases of veterinary importance, therefore all rhinos are treated with a suitable acaricide prior to transportation to ensure that they are tick free, and kept tick free for the entire boma period.

Endoparasites

Many endoparasites including arthropod larvae, nematodes, trimatodes and cestodes are found in white rhino. Most appear to be fairly host specific. For deworming of white rhino an intramuscular injection of

1% Doramectin at a rate of 1mg per 50kg is recommended and is effective against a broad range of helminths and arthropods.

TRANSPORTATION OF WHITE RHINO

PERMITS FOR TRANSPORTATION

Each country normally has their own regulation concerning permits. Some permits are however standard and will be required for the export of all white rhino. Although permit are regarded to be a formality, it is important to have all the necessary permits to avoid delays and unwanted stops.

- Cites import permit. Obtained from the conservation body in the country of final destination.

- Cites export permit. Obtained from the local conservation body, one has to be in possession of the cites import permit before this permit will be issued.

- Veterinary health certificate. Obtained from the local State Veterinarian, and is completed to comply with the importing country's requirements.

- Bank form (f178/nep in South Africa). Obtained from the Foreign Exchange Department of any bank. This is completed by the exporter and attested to by the bank.

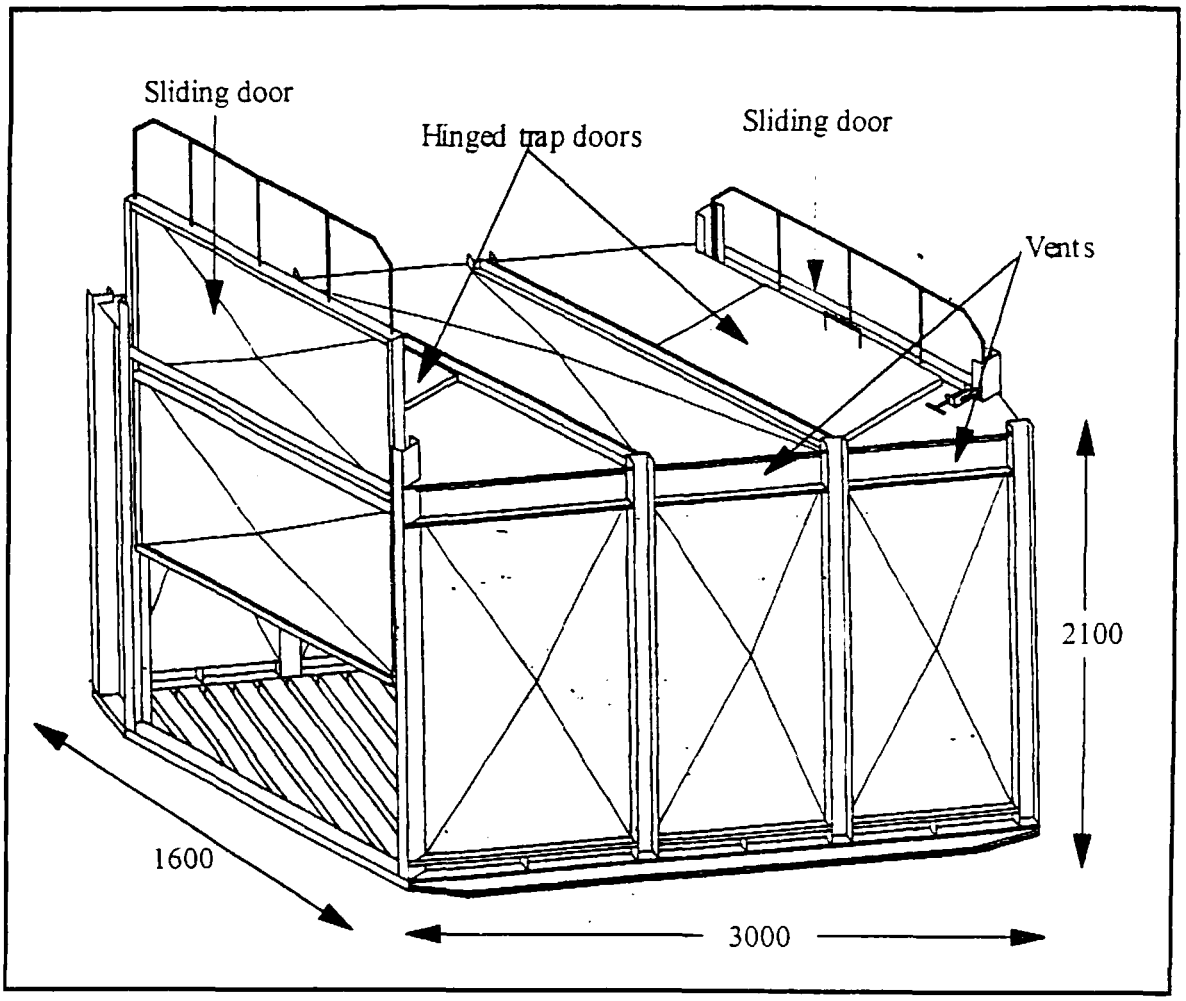
- Airway bill. Obtained from the carrying airline and completed by the exporter or the airline.

- Bill of entry/export (DA550). Obtained from the freight agent or Department of Customs and completed by the exporter.

- Customs Export. Obtained from the freight agent or Department of Customs and completed by the exporter.

CRATE DESIGN

Two types of crates are used in the transportation of white rhino, the one is a diamond shaped steel crate that is also used for the field capture, and the other is the export crate that consists of mainly steel and wood.



.Figure 3. Diamond shaped crate used in field capture as well as road Transport of rhino.

Table 2. Inside dimensions of export crates used by the KNP for the air transportation of rhino.

CRATE	ANIMAL	LENGTH (mm)	WIDTH (mm)	HEIGHT (mm)
1	Large bull	3580	1500	1820
2	Adult	3300	1310	1820
3	Sub-adult	3000	1100	1820
4	Juvenile	2570	900	1360

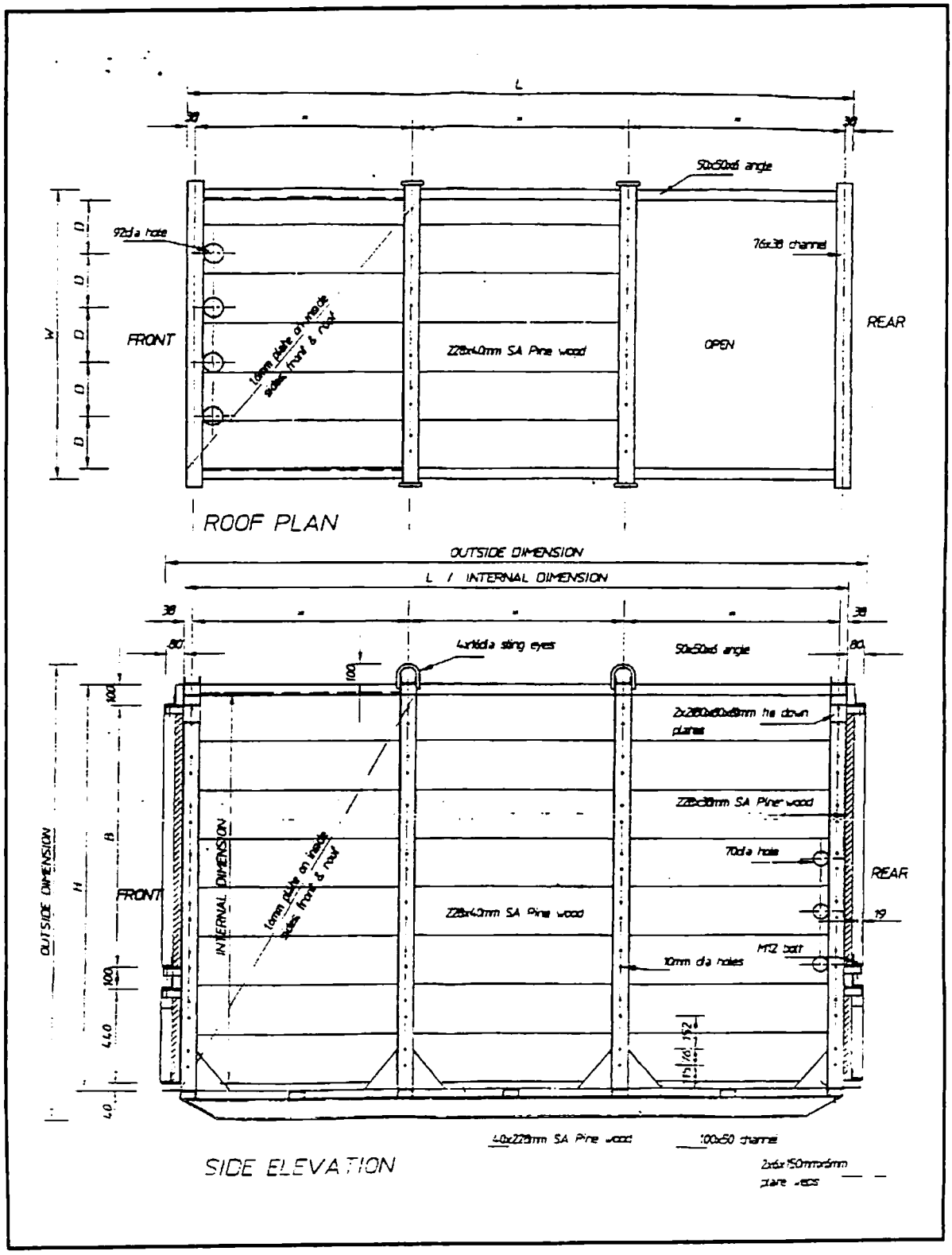


Figure 4. Design and dimensions of the export crate used in air transportation of rhino.

Diamond shaped crate (Figure 3)

This is a rugged steel crate that is used in the field capture as well as the road transport of rhino within South Africa. The crate is built in the diamond shape to be able to fit two crates onto the 6m bed of a truck and is built out of channel iron and steel plate. The crate is well ventilated with vents on the sides at the top and the bottom, the doors should not contain vents. The reason is to prevent the rhino from getting its horn stuck in the vent and breaking it off.

Export crate (Figure 4)

This crate is used when transporting rhino by air, and is made out of channel iron and pine planking. The front third of the crate is clad with steel plates on the sides and the top. This size of the crate is individually determined by the size of the animal and must be large enough for the animal to be able to lie down comfortably but not so large that the animal is able to turn around, or is thrown around inside the crate during transit. The dimensions of four standard crates that are used by the KNP are given in Table 2. The doors that are fitted are also clad with steel plates and consist of a big top door (size depend on height of crate) and a small bottom door (480 mm).These doors are mounted with lock nuts so that they can be removed. The bottom door always stays on to keep the dung and feed inside the crate. Four vertical bars (60 mm pipe) are fitted through holes on top and the bottom in front just inside the doors of the crate. The two middle bars are bent and shaped so that the plastic water troughs can be slid through at the bottom. Three similar straight bars are fitted horizontally to the back of the crate through holes in the sides to close the animal in when loading it.

LOADING OF THE ANIMAL INSIDE THE CRATE

The animal is closed in the front pen and is darted with a minute amount of etorphine (Adult – 0.7 to 0.8mg; Sub-adult - 0.3 to 0.5mg; Juvenile – 0.2 to 0.3mg) without any Azaperone. After 10 – 15 minutes the animal will show a high stepping gait and the tendency to follow moving objects. A white rag tied to a long stick is waved in front of the rhino and slowly moved towards the crate, the rhino will then follow. Once in the crate the tranquilisers (see transport by air) and antidote are administered. During this process, it should be very quiet and no movement or sound made to distract the animal. The animal is then loaded onto a truck with its head facing backwards and transported to the closed airport or transported by road to its final destination.

TRANSPORT BY AIR TO FINAL DESTINATION

In the past almost all rhino were exported by sea, but in the KNP we prefer to do it by air, for obvious reasons. Although more expensive, the time of confinement is considerably shorter and potential problems are much less than by sea.

Crate training and proper habituation of the various animals normally ensures the minimal use of tranquilizers. We are of the opinion, through experience, that it is better to use drugs from the beginning of the translocation process (from when the animal is finally crated) until it reaches its new destination. The most docile and tame rhino can turn into a frantic and scared animal, throwing its full weight around in the crate, whilst the spirited animal in the boma can be the most docile animal when crated. Each rhino should be treated as an individual case and care should be taken on the entire route to ensure the maximum calmness in the new surroundings, be it in the plane or on the truck.

Azaperone (100 mg/ml) is the drug of choice for white rhino during transport and regular evaluation of all the rhino during the process should be done to ensure the full effect of tranquilization. After loading the animals in the crate for road transport to the nearest airport, it is not fully reversed as only diprenorphine is used to antagonize the M99's effects. Known difficult animals should then receive their first full dosage of Azaperone IM (Bull: 200-400 mg; Cow: 150-300 mg; Sub-adult: 100-200; Calf: 40-100 mg). Tamer animals can be started with half the Azaperone dosage, with the first full Azaperone dosage to be administered within 4-6 hours after being loaded. The animals should constantly be monitored, as we have moved animals to the USA without a single injection of Azaperone, but others had to be kept tranquilized the entire way. With "highly strung or spirited" animals as we call them, good effects have been obtained by using Acuphase (Clopixol) at a dosage rate of 200 mg per adult, in addition to the regular dosage of Azaperone. It is necessary to repeat Azaperone injections every 4-6 hours to keep a white rhino fully tranquilized. Notes should be kept of when the various animals received Azaperone as well as the dosage, and a good place to write this is on the crate itself with a permanent marker pen.

It is further important to note that the animals are most likely to react during loading into the plane and off-loading onto the trucks. During the take-off and landing process animals tend to react more as well, so one must ensure that the difficult animals are well tranquilized during these periods. Another important aspect is to ensure that animals are well fed during the entire trip. Well habituated animals eat well during the flight and the eating will decrease the boredom or anxiety. We have also noted that a period of rest (sleep) for the animals coinciding with their own "night time" in KNP also work wonders to calm them down. This is achieved by turning off all the lights in the plane's cargo hold for a few hours. Temperature regulation is also of the utmost importance during the flight. Care should be taken not to cool the cargo hold down too much.

Emergency situations have been described and experienced with road transport of wild white rhino going totally mad in their crates. If Azaperone and even double Azaperone dosages don't work for these animals, small amounts of M99 (0,5-0,75 mg) should be used in addition to the Azaperone to calm these animals down.

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