

## Kenya Wildlife Service



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# Immobilization and Translocation Protocol for Black Rhinoceros (*Diceros bicornis*) and White Rhinoceros (*Ceratotherium simum*) in Kenya (2018)

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## **1. INTRODUCTION**

This protocol has been developed to guide the immobilisation and translocation of black rhinoceros (*Diceros bicornis*) and white rhinoceros (*Ceratotherium simum*) in Kenya. It has been developed due to increasing needs for veterinary interventions in the two species for various purposes including diagnosis and treatment of sick and injured animals, fitting of monitoring devices and ear-notches, movement of vulnerable populations, establishment of rhino sanctuaries, translocations to manage social and ecological carrying capacities in established rhino sanctuaries and diversification of genetic pools as well as release of hand-raised rescued animals already rehabilitated for wild release. In particular, translocations of the two species in Kenya are now frequent mainly because of the need to keep individuals in fenced sanctuaries because of the poaching threats for their horns and the need for active management of rhino populations for rapid growth.

This protocol is intended to ensure that immobilisation and translocation of rhinos are carried out using 'best practices' by giving recommendations on the practical aspects. The protocol is based on IUCN guidelines for reintroductions and other conservation translocations as well as internationally recognised practices to ensure acceptable standards of animal welfare. The protocol does not represent an inflexible code of conduct and can be modified on prevailing circumstances to ensure the objectives of any intervention are met. The primary target audience are wildlife veterinarians and veterinary para-professionals.

The protocol is to be implemented in the context of prevailing Kenyan laws and policies pertaining to biodiversity conservation and sustainable management of natural resources and veterinary practice, including the Wildlife Conservation and Management Act of 2013, Veterinary Surgeons and Veterinary Para-professional Act 2011, Prevention to Cruelty Act Cap 360, the Veterinary Surgeons and Veterinary Para-Professionals Regulations of 2013 and the Veterinary Surgeons and Veterinary Paraprofessionals (Code of Ethics) Regulations of 2015. If the immobilisation is for purposes of translocation, this protocol shall be read together with the Guidelines for Translocation of Wildlife Species in Kenya (2018).

## **2. BIOLOGY OF THE BLACK AND WHITE RHINOCEROSES**

The following characteristics are important to note when immobilizing black and white rhinoceroses.

### **2.1 Black Rhino**

- The preferred habitat of the species is dense vegetation making immobilization difficult.

- The black rhino is strong, aggressive and potentially dangerous when approached on the ground (on vehicle or on foot). At full speed, it can attain a speed of 30-40 km/h, consideration which is vital if darting on foot.
- When placed in captivity, they are initially very aggressive but calm down quickly within 2-3 days.
- When approached, they respond by charging if the approach is too close or by running away depending on temperament of the individual animal.
- The black rhino has poor eyesight but has very keen sense of hearing and smell.
- When confined, it can display aggressive behaviors that lead to self-inflicted injuries, important considerations during translocations where appropriate boma designs and tranquillization are recommended as the 'best practice'.
- They respond better to immobilization drugs (Opioids) and tranquillizers, and may require slightly higher dosage rates than the white rhino

## **2.2 White Rhino**

- Is very strong, and potentially dangerous animal. It can be aggressive when disturbed or when it feels threatened.
- It is very aggressive and more dangerous in captivity until they clam down. They adapt poorly in bomas and may take up to 12 days to eat properly. Some animals may have to be released because they do not settle down in bomas.
- Has poor eyesight, but has keen smell and hearing
- Is gregarious, usually being found in small groups
- The species is sensitive to immobilization drugs (Opioids) and may manifest marked physiological side effects. It tends to run a long way after darting
- Unlike the black rhino, white rhinos inhabit relatively open areas, but tends to flee into dense bush when disturbed.

## **3. PRE-IMMOBILIZATION PREPARATIONS**

This shall vary depending on the purpose of the intervention.

### **3.1 Immobilization for Translocation**

- If the immobilization is for translocation purposes, then adequate planning is critical including the long term commitment to protect, monitor and manage the translocated animals.
- Pre-translocation activities shall include good scientific and technical inputs to inform planning; careful consideration of the justification and objectives of the proposed

translocation; feasibility assessments to determine whether the translocation should proceed as planned; ecological suitability assessments; source populations including number, sex and age structures; resources available; security; land ownership and size and disease risk assessment to ensure translocated animals are not exposed to novel infections or new pathogens are introduced into the recipient area. Every rhino translocation shall be in conformity with the requirements of applicable environmental management and compliance regulations.

- Detailed pre-translocation assessments that will require to be undertaken before any translocation of wildlife in Kenya are outlined in the Guidelines for Translocation of Wildlife Species in Kenya (2018). The guidelines also outline prerequisite logistical coordination and planning activities, as well as the critical personnel required and their capacities and experiences.
- The translocation team shall be facilitated with appropriate equipment including dart guns and accessories, adequate and appropriate veterinary supplies, crates, slings, cotton ropes, generator, water containers/jerricans, at least 6 capture rangers to assist in processing and loading, blind folds, ear plugs/cotton wool, pole syringes, electric prod and batteries, oxygen with administration accessories, etc.
- The veterinarian responsible shall at all times ensure optimal health and welfare of the rhino being immobilized. He/she shall focus on the physical interventions of the translocation, including loading, transportation and boma management.
- Darting shall be avoided at all costs in adverse terrains such as near cliffs and water bodies as well as very thick vegetation that may make recovery from the ground difficult or impossible.

### **3.2 Immobilization for Other Interventions**

- Immobilizations for other interventions may include treatment of disease or injury, ear-notching and fitting of radio horn-transmitters.
- Just like for immobilization for translocation purposes, the veterinarian responsible shall at all times ensure optimal health and welfare of the rhino being immobilized.

### **3.3 Other Considerations during Rhino Interventions**

- There is limited published information of diseases in free-ranging rhinos.
- However, the rhinos belong to the same order with equids (Perissodactyla), and are therefore related in anatomy, physiology, parasites, diseases, nutrition and response to drugs. The larger knowledge in horse veterinary issues can therefore be used to better understand diseases in rhinos
- Opportunistic pathogens and parasites can occur in free-ranging rhinos during periods of starvation or stressful conditions that can arise during capture and translocations. Thus, 'best practices' shall be adopted to reduce stress

- Mortalities during translocations can also occur from trauma (during capture, transport, boma holding or after release from territorial fights), which is of critical importance during black rhino translocations. Appropriate measures shall therefore be taken during translocations to minimize trauma.
- Veterinary and capture teams shall be provided with strong cotton ropes, blind folds and cotton wool/or tailor-made ear plugs for blocking the ears.
- There shall be a member of the team who shall have skills and experience to fit radio horn transmitters and prescribed ear-notch patterns.
- For animals to be translocated, the horns shall be tipped to blunt them to reduce chances of horns getting stuck in gaps in crates and bomas breaking them off, and also reduce post-release fighting injuries/mortality risks.
- The dart shall be removed and the wound treated with a topical antibiotic ointment to prevent secondary bacterial infections of the wound which can spread underneath the skin leading to serious complications.
- Sometimes because of the stress of capture which can compromise the immune status of the animal, an antibiotic (preferably long acting preparations) shall be administered intramuscularly, the dosage being dependent on the weight of the animals.
- An eye ointment shall be administered to both eyes to prevent corneal desiccation.
- Other interventions (e.g. treatments of infections) and injuries shall be administered according to the findings of the veterinarian in-charge
- The team shall have appropriate materials to collect and preserve the following samples according to established protocols for immediate and future studies including genetic studies: EDTA blood, serum, ticks, fecal, tissues (from notches made on the ears) and other samples depending on incidental findings.
- Other veterinary considerations shall be followed as outlined in the Guidelines for Translocation of Wildlife Species in Kenya (2018)

### **3.4 Darting Procedures**

- Darting of black and white rhinos shall be from a helicopter, or from the ground (on vehicle or on foot, provided the terrain is suitable and loss of the animal in thick bush is a very low risk). If done from the ground, ample daylight should be available in case the animal is lost).
- Radio communication between different teams involved in any capture (air, veterinary, capture, security and scientists) shall be maintained to ensure coordination and success of the operation.
- The preferred dart placement areas shall be parts of the body with good muscle cover preferably on the rump, hindquarters, neck and shoulder.

### **3.4.1 Helicopter darting**

- Darting will be done by an experienced veterinarian and pilot.
- The helicopter shall also have a spotter to identify the target rhino. Once identified, the rhino shall be herded towards an open safe area before darting. The ground support team shall be close by before darting commences.
- After darting, the helicopter shall withdraw and monitor the rhino movement from a distance.
- The helicopter shall control the direction of the rhino after darting to prevent it going into difficult terrain and thick vegetation
- Once the animal goes down, the veterinarian shall be dropped by the helicopter and the pilot shall guide the ground teams to the location of the animal.

### **3.4.2 Foot darting**

- This method requires an experienced veterinarian when dealing with one or two animals.
- A light aircraft (or drone) may be required for monitoring the animal after darting depending on the terrain and vegetation cover to avoid losing the animal after darting. Observers may be placed at strategic high ground points to observe the movement of the rhino where a light aircraft is not available.
- Approach shall be by a limited number of personnel, preferably a veterinarian and a security ranger with a high caliber rifle to provide security.
- The animal shall be approached against the wind to ensure it doesn't smell the darting team.

### **3.4.3 Vehicle darting**

The same approaches as for foot darting shall apply, including approach against the wind, light aircraft and placement of observers at vantage points to assist monitor the animal after darting.

## **3.5 Immobilization Drugs**

- The drugs, dosage rates and drug combinations shall depend on the species of rhino as well as the local conditions including terrain, age, sex and health status (body condition) of the animal.
- The immobilization drugs that can be used are one of, or a combination of opioid derivatives Etorphine hydrochloride, Fentanyl, Carfentanyl, Thiafentanil (A3080/Thianil®) and Butorphanol tartrate.

- For black rhino and due to the quicker knock down, Thiofentanil or a 50:50 mix of Thiofentanil and Etorphine is preferred for short procedures in the field (e.g. ear-notching). Thiofentanil is not recommended for white rhino.
- Butorphanol/Medetomidine mix may be useful in a boma environment or in a severely compromised rhino, but is not recommended for the field immobilization of healthy rhinoceros.
- For translocation, immobilization with Etorphine is preferred.
- The opioid shall be mixed with an appropriate short acting sedative or tranquillizer such as Midazolam, Azaperone tartrate, Xylazine hydrochloride, Medetomidine or Detomidine.
- Of the above drug combinations, Etorphine combined with Azaperone is by far the most frequently used drug combination for free-ranging rhinos with good results. The alpha<sub>2</sub> agonist drugs (Xylazine, Medetomidine and Detomidine) although having an antidote unlike Azaperone, have many side effects including respiratory and cardiovascular depression and shall always be used with caution.
- Whereas some general guidelines on dosages are provided in Table 1, the final decision on which drugs to use, their dosage rates and combinations shall be made by the responsible veterinarian for the operation depending on prevailing circumstances including the health status of the animal, the terrain (use of higher dosages so as to achieve fast immobilization) and excitation status of the animal. The veterinarian in-charge shall also be responsible for preparation of darts.
- Details of the animal including the age, sex, and body condition shall be provided to the veterinarian in advance to enable determination of appropriate drug dosages.

**Table 1: Recommended dosages for immobilization of the free ranging black rhino**

| No. | Age                      | Opioid (Etorphine Hydrochloride) | Tranquillizer (Azaperone tartrate) |
|-----|--------------------------|----------------------------------|------------------------------------|
|     | <b>Black Rhino</b>       |                                  |                                    |
| 1.  | Adult (> 5 years)        | 4.0 to 4.5 mg                    | 100-150mg                          |
| 2.  | Sub-adults (3-4 years)   | 3 to 3.5 mg                      | 30-40 mg                           |
| 3   | Juveniles (1 to 2 years) | 1 to 2 mg                        | 20-30mg                            |
|     | <b>White rhino</b>       |                                  |                                    |
| 4   | Adult                    | 3.5 to 4 mg                      | 40-60 mg                           |
| 5   | Sub-adult                | 2-3.5mg                          | 30-40 mg                           |
| 6   | Juveniles                | 1 to 2 mg                        | 15-20 mg                           |
| 7   | Calves                   | 0.5-1mg                          | 15-20mg                            |

- Hyalase is always used in the black rhino (2,500- 5,000 IU). However, it might exacerbate the opioid side effects in white rhino and since they respond better to herding by the helicopter, it may not be recommended for white rhino.
- Animals under one year of age shall be handled with caution as they are prone to respiratory depression and side effects of capture drugs.

- Relocating animals <18 months without their dams can have negative survival statistics, and shall be considered carefully.
- Animals held in confinement, hand-raised animals, sick animals and old animals require lower drug dosages compared to free ranging healthy animal in optimum body condition. It may be challenging when having to “rescue” rhino in drought situations. 1mg Etorphine may be sufficient for an adult in very poor condition.
- The type of dart and projector (rifle) used will be decided according to the preference of the veterinarian responsible for the operation. Darting shall always be undertaken by an experienced wildlife veterinarian.
- Sometimes, some animals may remain standing and semi-narcotized. In such circumstances, Midazolam (a Benzodiazepine sedative) at 5-10mg intramuscularly or intravenously, or 100mg ketamine intravenously (for adults) may be administered to make the animal recumbent.
- While capturing white rhinos, the veterinarian responsible shall make himself familiar with the marked physiological side effects from the opioid derivative etorphine hydrochloride. The respiratory depression and muscle tremors are pronounced and a partial antagonist Butorphanol at 10-20x the mg dose of etorphine (e.g. 4mg etorphine + 40-80mg) MUST be administered as soon as the animal becomes recumbent. Alternatively, when using etorphine to immobilize white rhinoceros, the concomitant use of Butorphanol at the same dosage in the dart cab also be the standard practice. The administration of oxygen per bifurcated nose tube @ 10L/min should also be standard practice, if available.

### **3.6 Monitoring of Anaesthesia**

- Once an animal goes down, the following shall be done immediately:
  - Apply blindfold. Ear plugs may also be applied
  - In the black rhino, 5-10mg Butorphanol will be administered IV to partially reverse the respiratory depression induced by Etorphine. However, this may generally not be useful in black rhino, and shall depend on the anaesthetic status of the animal as assessed by the veterinarian responsible.
  - In white rhino, Butorphanol at 10-20x the mg dose of etorphine (e.g. 4mg etorphine + 40-80mg) MUST be administered as soon as the animal becomes recumbent if already not included in the dart. If using lower doses of Butorphanol, the white rhino may become increasingly hypoxic during long procedures. If Butorphanol is not available, Diprenorphine (1/20 – 1/10) of full reversal can be used instead.

- Immediately thereafter an intravenous catheter can be placed in an ear vein for quick access in case of an emergency.
- Airways shall be confirmed to be patent, that the animal is breathing and that there is sufficient circulation as evidenced by color of blood and mucous membranes and capillary refill time.
- If an oxygen cylinder and appropriate accessories are available, the animal shall be insufflated (supplied with oxygen through the nostrils) at approximately 10L/min for adults.
- The heart rate, respiration rate and pulse rate shall be monitored regularly (at least every 5 minutes) using appropriate accessories. The guiding ranges are as follows:
- Respiration:- 6-10 per minute. If the number of breaths are below 3/minute, emergency drugs shall be considered to be administered. This shall include additional Butorphanol and Doxapram.
- Body temperature:- 36.5°C to 38.5°C. Overheated animals shall be cooled with copious amounts of water all over the body while providing adequate air movement in windless conditions. Animals with temperature above 39°C shall be revived to avoid complications associated with hyperthermia.
- Anesthetic emergencies will occur even in the most well prepared cases and ideal conditions. This calls for prompt action to deal with the cause. Immobilized black and white rhinos constantly demand attention of the veterinarian until they are loaded and safely released.

## **4. LOADING, REVERSAL OF ANESTHESIA AND TRANQUILISATION**

### **4.1 Loading of Rhinos**

- Processing and loading into the crate requires an experienced capture team with appropriate equipment. The crate is placed in front of the sternly recumbent rhino. A strong non-abrasive cotton rope with a knot is tied behind the posterior horn. The rope is threaded through a hole at the back of the crate where a sufficient number of people to pull the animal gently into the crate once it wakes up. At least three quarters of the head is placed inside the crate during processing for loading. Sufficient number of people are also placed on either side of the rhino and at the back to guide it into the crate when it stands up.
- The translocation team shall be availed with appropriate recovery, loading and transportation systems. These shall include but not limited to hydraulic lifting cranes, crates, trucks and four-wheel vehicles. Saws and axes (chain saw ideal) should be at hand in case access for trucks in wooded areas is a problem or if a rhino goes down in thick bush.

- Once the animal is in the crate, the blind fold and ear plugs are removed. Observation shall be made to ensure the animal is not pressing its nostrils onto the crate blocking the nostrils.

#### **4.2 Walking a Rhino into a Crate**

- Where terrains are inaccessible, partial reversal techniques can be used to enable walking animals into crates for loading may be considered
- Animals to be walked are blind folded and tailor-made ear plugs or cotton wool placed into the ears. A strong rope with a knot is tied behind the posterior horn (head rope) and another on one of the hind legs (braking rope). At least 4 people are placed on each rope, at least 2 on each shoulder, one person to the side to control the team and at least two people walking in front clearing obstacles.
- For the black rhino, partially reversal is achieved with incremental doses of 5 mg of Butorphanol given at least 10 minutes before each increment. Black rhino are extremely sensitive to the partial antidote and even 10mg Butorphanol can result in an “explosive” wake up. The veterinarian responsible shall thus administer and monitor the animal very careful.
- For the white rhino, Butorphanol at 10-15mg/mg Etorphine works well. However, if enough Butorphanol was used in the immobilization mixture, white rhino can often be induced to stand by prodding, without additional antagonist. If unsuccessful, small doses of diprenorphine (1/10 of the full reversal dose of Diprenorphine) works better especially in large adult white rhino.
- After each injection of the antidotes, wait a few minutes and check the rhino’s response to a prodder or water on the ears. If there is no response, another dose is given. Once the animal stands, it is guided by the head rope and people on the sides. If it goes too fast, the brake rope is used to slow it down.
- When animal is on its feet, the head rope is used to guide the animal while the rope on the hind leg is used as a brake. Diprenorphine is injected once the animal is loaded into the crate. For the white rhino, a full reversal dose is given. For black rhino a total dose of 10mg Butorphanol and between 0.8 and 2mg Diprenorphine is sufficient.
- Powerful helicopters can also be used to airlift animals from inaccessible areas to areas where they can be loaded.
- It is however recommended that darting in adverse terrains shall be avoided at all times to avoid situations where animals cannot be recovered from the ground. Further, the Guidelines for Translocation of Wildlife Species in Kenya (2018) recommend that planning and timing for any translocations shall be done when conditions are favourable at both donor and recipient areas so to avoid eventualities where recovery shall be difficult or impossible to undertake from the ground

### **4.3 Reversal of anesthesia**

The reversal of anesthesia shall depend on whether the animal is to be released immediately into the field (after treatment, ear-notching, etc.) or it is for translocation.

#### **4.3.1 Black rhino**

- If the black rhino is to be released immediately into the field, then full reversal shall be obtained by giving at least 2-2.5 mg of Diprenorphine for every milligram of Etorphine used. Half shall be given intramuscularly, and the other half intravenously. Alternatively, 20-30 mg Naltrexone for every mg of Etorphine can be used, IM. Naltrexone has a half-life of 48 hours. The IM administrations is intended to take care of re-narcotization by allowing slow release from the IM injection and avoids explosive wake-up. It is recommended that because use of Diprenorphine for field reversal may cause re-narcotization, complete reversal be achieved by using Naltrexone Potential disturbances such as vehicles and people shall be removed before reversal.
- For animals to be translocated, the objective of the reversal process will be to wake the animal up so that it walks into the transportation crate but is still sedated enough so that it cannot injure itself in the new confinement. Small doses of diprenorphine can be given to obtain a state of tranquilization from the partial agonist effects of the drug. Recommended doses for reviving black rhino are 10mg Butorphanol and between 0.8 and 2 mg Diprenorphine depending on the initial etorphine dose. If a 4-4.5 mg dose M99 has been used, then the higher dose of 2mg Diprenorphine is administered.
- Animals to be translocated can also be injected with small doses of Etorphine and Azaperone prior to release into a boma so that a near immobilized state is achieved. Should the animal become immobilized after release, IM diprenorphine Hydrochloride shall be administered to reverse this state. With field to field translocations the rhino can safely be immobilized again using a full dose of Etorphine 4-5 hours after the initial immobilization.

#### **4.3.2 White rhino**

- For non-translocation interventions, Naltrexone 20-30mg (half IV and half IM) shall be used for a more complete antagonism of Etorphine. Diprenorphine alone does not sufficiently reverse etorphine in white rhinos.
- If for translocation, the full reversal of Diprenorphine can safely be given once rhino is in the crate. The agonistic effects are marked and will keep the rhino sedated for approximately 4 hours.
- Diprenorphine hydrochloride can also be used to walk the rhino into the crate should it go down in inaccessible areas by recovery equipment. Administer up to 1/10 of full reversal dose of Diprenorphine. This works better than using Butorphenol.

- White rhinos sometimes manifest re-narcotization and Naltrexone at 20-30mg/mg etorphine must be administered IM at release just before opening the crate, to avoid this phenomenon.

#### 4.4 Tranquillization

- Animals to be translocated shall be injected short and long acting tranquillizers depending on the length of the transportation, and for boma adaptation to reduce stress and prevent self-inflicted injuries. This shall be done prior to administration of the opioid reversal agent.
- For the black rhino, this can be achieved using alone or in combination, Azaperone, midazolam and Zuclopenthicol acetate (Clopixol Acuphase). The use of Perphenazine enanthate (Trilafon LA) in black rhino shall be the discretion of the veterinarian responsible depending on length of time of transportation and boma holding period.
- For white rhino, tranquillization can be achieved by using Azaperone and Zuclopenthicol acetate (Clopixol Acuphase).
- A guideline of tranquillizers' dosage rates is provided in Table 2 below.

**Table 2: Dosages for tranquillizers used in black and white rhinos**

| <b>Drug</b>                | <b>Black rhino</b>                                   | <b>White Rhino</b>                        | <b>Length of activity</b>                                |
|----------------------------|--|---|--|
| Azaperone                  | 100-250mg adult, 50mg sub-adult, 25 mg Juvenile      | 60mg adult, 30mg sub-adult, 20mg juvenile | 2-4 hours. Can be repeated every 4-6 hours if used alone |
| Midazolam                  | 20 – 30mg  |   |  |
| Zuclohexicol acetate       | 200-400mg Adult, 100-150mg sub-adult , 80mg juvenile | 50-100mg for adults                       | Take effect in 1 hour and last 3 days                    |
| Perphenazine (Trilafon LA) | 200-300mg Adult, 200mg sub-adult , 100mg juvenile    |   | Takes effects after 12hours and lasts up to 7 days       |

## 5. POST-CAPTURE IDENTIFICATION

- There shall be a technician experienced to insert a horn transmitter and transponders for purposes of post-release monitoring. The transmitter hole shall be drilled on the side of the horn at least 7 cm from the horn base.
- The rhino program shall verify that the horn transmitter and transponders are functional before they are inserted. The rhino program shall also provide the ear-notch patterns for identification of the rhino.

## 6. RHINO CRATES

- Specially made crates for each species shall be available. The size shall be dependent on the species and age.
- The crates shall be strong enough so as to contain the animals. They can be either constructed of metal or wood with angle-line iron bars reinforcements and have strong steel doors. If a metal crate is used, the inside should be rubberized so that the rubber absorbs much of the sound and prevent the crate from being too hot or too cold.
- The crate shall allow the rhino to stand up and lie down comfortably. However, it shouldn't be too long as the animal might tend to rush forwards and sustain injuries on the nostrils, horns and lips.
- Guidelines for crate inside dimensions for adult animals is as follows:
  - Black rhino: 3m long, 1.2m wide, and 2.0m high.
  - White rhino: 3.6m long, 1.3m wide, 1.8m high
- The crates shall have good footing which can be a heavy-duty woven rubber mat well bolted down with a flat bar. There shall be provision for drainage at the back of the crate.
- The front third and back third of the top should be open to allow for good movement of air and access by the veterinarian to administer any drugs.

## 7. TRANSPORTATION

During transportation, the animals shall be inspected regularly for the following:

- Head pressing on the crate that might block the nostrils can arise because the animal is not fully revived. For the black rhino, Butorphanol can be administered or 1 mg Diprenorphine in cases of excessive head pressing. For the white rhino, about 2mg Naltrexone can be administered. The animal should be able to stand up after this intervention. However, head pressing shall be distinguished from actively pushing using hind legs or simply leaning before intervention is done.
- A veterinarian shall always escort the animal and give additional tranquilizers if required. The veterinarian shall not wait until the animal is totally alert as it might injure itself. Instead, he/she shall anticipate the animal's tranquilization needs and intervene as necessary.
- Other than Administering Acuphase at loading, additional sedation is not usually required for Boma to field translocation. For field to field translocations, Midazolam or Azaperone (Midazolam however preferred over Azaperone) can be administered when necessary. Avoid any unnecessary stops on route. Overnight transportation can be planned where feasible to off load at first light even if it means slowing down to meet the schedule instead of stopping and waiting for the sun to come up.

- For other considerations during transport, reference shall be made to the Guidelines for Translocation of Wildlife Species in Kenya (2018).

## **8. RELEASE APPROACHES**

- The use of drugs before release (hard or soft) including opioids to partially narcotize rhinos and use of tranquillizers to reduce stress, injuries and mortalities have been described under the section reversal of anesthesia and tranquillization. This method also reduces distances animals travel upon release.
- The selection of the appropriate translocation approach is critical. This can either be hard release, soft release (field to boma), boma to field or boma to boma.
- The method selected shall be determined based on distance the animals are to be moved, if source and recipient areas have similar or very different habitats as well as available resources. For instance, if to be moved very long distances, holding them at the source site for training to reduce stress and make them calm for ease transportation can be considered. At the release site, such animals can be hard released (boma to field) or further held in bomas at the release site (boma to boma). Alternatively, field to boma approach can also be used for animals being moved long distances.
- However, hard release shall be the preferred translocation approach. This method is particularly useful if ecological and nutritional conditions at source and recipient areas are similar because it is most efficient, cost effective and has the lowest risks. The white rhinos especially does not adapt well to bomas and artificial feeding.
- For other considerations, reference shall be made to Guidelines for Translocation of Wildlife Species in Kenya (2018).

## **9. HOLDING FACILITIES (BOMAS) AND MANAGEMENT**

### **9.1 Site and design**

- Careful selection of the boma site is necessary. For bomas from which rhinos are going to be released directly into the field and which will only be used once or a few times at the most, bomas shall be sited:
  - Centrally in the release area to minimize contact with fences immediately after release
  - Away from fences
  - Close to good quality water source
  - Away from hazards (e.g. cliffs, etc.)
  - Area of good habitat
  - Away from human disturbance
  - An area with natural shade (e.g. from large trees). If no natural shade is available, then artificial shade must be provided.

- For bomas that are going to be used frequently over many years, mostly for removing rhinos from an area, other factors that will be important to consider will be:
  - Easy access and close to roads
  - Good supply of water
  - Good supply of browse nearby for feeding.
- Bomas shall have:
  - Good drainage
  - Substrate in the bomas shall not be too dusty nor too slippery if it gets wet (might have to truck in sand or gravel)
  - Attention to prevailing wind:- upwind from close human habitation and downwind from water for release
  - Cold: - cold can be much more lethal than heat. Bomas shall not be constructed in very low lying areas. Bomas shall be positioned to keep out cold winds.
  - Heat:- position the bomas where there is some air movement and, if possible, where trees can provide shade
  - Sun- angle of the sun can be an important consideration in hot and cold area.
- The bomas shall meet the animal's spatial requirements. They shall be at least 100m<sup>2</sup> (10x10m), but the bigger the better. The boma shall be divided into two compartments to facilitate cleaning by alternately moving the animal to one side.
- Boma construction materials can either be wood or metal plates. They shall be very sturdy with poles firmly fixed and concreted in place and connected with strong supporting frames. A rhino will initially test the limits of its enclosure by pushing and bashing the walls and doors. If it finds a weakness, it will focus its efforts on that particular spot.
- Walls shall be between 2.20 m and 2.40 m high, taking care to ensure that there are no places lower than this as an adult black rhino can get its legs over a wall/door of approximately 190 cm.
- Once released into the boma, black rhinos can be aggressive to each other. The boma therefore should not allow to see animals in neighboring bomas and is important to cut off the tip of the anterior horn to prevent self-inflicted injuries/horn breaking off. White rhinos calm more quickly if the walls of the boma allow animals to see those in neighboring bomas, and see and get used to the activity around the bomas.
- Doors shall be 1.5m wide and strong so as to contain the animals. When initially confined, the rhino test the walls and especially the doors, probably because they move, are noisy and are usually lower than the boma walls. There must not be a gap under the door, as the rhino can get its horn under it and lift the door off or break its horn off. The locking mechanisms must be reliable as rhino can force a door open and either escape or get into an adjacent pen. Doors can be sliding or made of poles:

- Sliding doors are either all steel (plate on a pipe or square tube frame) or wooden with a steel frame. To prevent injury to the rhino and damage to the door, both wooden and steel doors should be covered with conveyor belting. Conveyor belting also makes the door quieter if it is hit or pushed. The sliding door moves on an overhead steel beam (best if it moves on bearings). The door is supported below by a beam or pipe and when closed should slot into a gap inside the boma. Sliding doors must always open to the outside of the boma. There should be little or no gap between the door and the supporting beam. Too much of a gap and the rhino will force its horn in there and either break off its horn or the door. It must also be impossible for the rhino to lift the door (put a spacer between the door and the supporting beam). The height of the sliding door (or other boma door) must not be too dissimilar to the boma wall height or the black rhino will try to climb over it. It is also important that it moves easily and there is minimal movement and noise if a rhino hits it from the side. Good handles should be welded to the doors on the outside. Handles and/or a door stop should be placed carefully to prevent the door operator hand from being crushed should the rhino push the door while it is being opened. There must be a very stout locking mechanism to keep the door closed and it is also good if there is a mechanism to hold it when opened.
- Pole doors are strong and easy to make but they are cumbersome and slow to use. They can be either horizontal or vertical. Horizontal ones comprise of a stack of poles between two vertical poles on either side of the door. Two vertical poles, one on either end, prevent the rhino from sliding the horizontal poles out. One of these is fixed and the other, the locking pole, is removable. It is also important that there are stoppers at the top of the pole door to prevent the rhino from lifting the poles out. Horizontal pole doors are a good option between the boma and the outside. Vertical pole doors are not a bad option, but can be awkward to utilise. They can be more dangerous for the person opening the door, as one has to balance above the door and the rhino often tries to force its way through when the door is only half open.
- It is best to have a solid roof of corrugated iron to keep rain out and/or provide shade where there is no natural shade. In places that can get very cold, the solid roof also helps keep heat in. The roof should be about 280 cm or more from the ground. A roof that is too low inhibits ventilation and is easily broken by a black rhino standing up on its hind legs against the wall. The roof should be angled so that rainwater flows away from the boma. If this can't be done, then gutters should be used to take water away. There should be no single poles supporting the roof in the middle of the boma.

## **9.2 Management during holding period**

- Bomas shall be kept clean and well maintained.

- Noise and disturbance shall be kept to a minimum.
- Adequate and appropriate feed and clean fresh water and sufficient salt shall be provided to maintain animals' health condition. Feeds shall not be provided on the ground, as the rhino will ingest dirt/sand which may cause colic. Instead, a shallow hollow concreted slab shall be provided. For the white rhino, water troughs design shall need to ensure they can drink because their skulls and lip structures can prevent them from accessing conventional trough designs.
- There shall be at least one person with appropriate training and experience in animal health/husbandry to oversee and coordinate feeding and cleaning of the bomas during the holding period.
- A veterinarian shall be present for the first few days after capture and release into the boma. He/she shall make regular visits thereafter, but shall always be within reach to attend to any emergencies when called upon.
- The people at the bomas must have the right equipment including a prodder, torch, radio or phone, ropes and the other essential tools to handle any emergency.
- Armed rangers shall be stationed at the boma to provide security.

### **9.3 Holding period in boma**

- The length of time in boma has no specific recommendations but will be determined by a variety of factors including prevailing conditions during boma holding, but the longer the holding period the better. For ordinary translocation from one conservation area to another, this can be from two weeks.
- For White rhino, holding period can be up to six weeks. They drop off in condition for the first two weeks and take another four weeks to pick up.
- Because black rhino adapt more readily to bomas, the holding period can be reduced to a maximum of four weeks.
- To manage stress during the holding period, long acting tranquillizers shall be used (Table 2)
- For other considerations, reference shall be made to Guidelines for Translocation of Wildlife Species in Kenya (2018).

## **10. RELEASE FROM BOMAS**

- Rhino shall be released one at a time, with at least 24 hours between each. Young animals should be released first, followed by older females and, lastly, older males. This gives the young and the females' time to settle before the big bulls move in to establish themselves.
- It is best to release rhino in the early evening as it is getting dark. Being nocturnal, rhino see well at night and are more confident and more relaxed. Released in the early evening they have the whole first night to wander around and get used to the area

before day comes. Some preferred food like lucerne or browse may be placed outside the boma to draw the animal out and away from the boma. It is important to draw the rhino away from the boma because if it comes back to the other pens from the outside, the other rhinos in the boma will take umbrage at having a rhino approach them from an unknown side and get agitated, which may make the released rhino get excited that it charges off. In the afternoon before release, they must be watered and fed as usual.

- There should be absolutely no disturbance, lights, cameras, vehicles, drums, or other equipment close to the boma. The number of people should be as few as possible to minimise disturbance.
- When everything is quiet, carefully open the door between the pens and quietly back off preferably behind the boma to observe the rhino leave the boma. The animal might take some time before it leaves the boma.
- Should the animal refuse to leave the boma, close the doors and try again the next evening. The animal should not be chased (forced) to leave the boma. It must leave at its own time.
- Often a rhino will walk out of a boma and then return and possibly even do this a number of times, so water and food should be left until the following day.
- Once the rhino has left the boma, give it a while to wander off before making any movements for it might still be in the vicinity. When walking away, do it quietly away. If it is necessary to drive away from the boma, do so slowly and carefully.
- Once all the animals are released, the bomas can be left open with water until the rhinos are settled. If there is an animal that is of particular concern, e.g. a sub-adult in poor condition, food can also be left in the boma until you are certain the rhino is relaxed and eating.

## **11. POST RELEASE MONITORING**

- There shall be in place a post-release monitoring strategy of all or a sample of the individuals translocated for a sufficient period of time in order to assess the outcome of the translocation.
- The monitoring shall include studies on the ecological and behavioural aspects, long-term adaptation, collection and investigation of mortalities, interventions (veterinary aid and supplemental feeding amongst other interventions), amongst other studies.
- All translocated rhinos shall be fitted with horn transmitter implants and transponders to aid in the post-release monitoring.
- For the first few days after release, the rhino shall be given a chance to settle down with minimal disturbance. It is not usually necessary to actually see the animal for the first few days unless a problem is suspected.
- It is necessary to check fences to see that the rhino has not broken out, as newly released rhino often lie close to the fences.

- After about four days, it is a good idea to track the animal down to check on its condition and see that it is eating and appears alert. Thereafter, continue monitoring and try to see the rhino every few days.

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