

Capturing wild animals

The capture of wild animals plays a prominent role in the wildlife industry in southern Africa. At some time or other, every game ranch manager will have to deal with animal capture. This could be the capture of animals for direct sale to other ranchers or at wildlife auctions, or the buying of new animals for a ranch. Animal capture is often discussed when game ranchers meet. However, most wild animals are captured and transported by professional capture teams. When this happens, the game rancher must enter into a formal agreement with the capture team.

The various modern capture methods require a high degree of expertise and experience, as well as knowledge of the anatomy, physiology and habits of the wild animals to be captured. Many game ranch managers who are considering animal capture lack this expertise and experience. Moreover, the following factors must also be considered:

- The high cost of capture equipment, such as nets, plastic sheeting, dart guns, darts and immobilizing drugs, especially when the equipment is not used regularly
- The high cost of hiring a helicopter and transport vehicles
- The hiring of additional labour, because many game ranches do not have sufficient labour to assist with capture operations

When all these factors are considered, it is advisable for most game ranchers to contract the services of professional and specialized animal capture teams rather than to attempt the capture operation themselves. Information and advice on different aspects of wild animal capture can be obtained from the conservation offices of the provincial conservation authorities, some of

whom have their own well-equipped animal capture teams. The ultimate success of the capture, transport and re-establishment of wild animals on game ranches is not determined only by the capture of the animals. Rather, it is more often determined by how the animals are handled, transported and kept after capture and whether they adapt and breed successfully in their new environment.

Most people who have tried to capture wild animals in the past will testify that it is a difficult and exacting task. It is usually time consuming and requires much advance planning. It can be expensive, especially when there are losses caused by injuries, capture myopathy, and the incorrect use of tranquillizing and immobilizing drugs. There can also be deaths due to maladaptation to the new habitat. In the past, there were often heavy and unnecessary losses, but with the present knowledge and more efficient capture and transport methods, most losses can and must be minimized.

Game ranchers should nevertheless know enough about the various capture techniques. The more common mechanical and chemical capture methods such as using plastic capture bomas, nets, pop-up and drop-down corrals, mobile corrals, net guns, night capture and chemical immobilization will therefore be discussed below. The book *The capture and care manual* edited by McKenzie (1993) is also recommended. The code of the South African Bureau of Standards for the translocation of certain species of herbivores (SABS 0331) also contains useful information.

1 BASIC PRINCIPLES

Certain aspects of the philosophy of animal capture are discussed briefly here to promote a bet-

ter understanding of the principles and techniques involved.

1.1 Capture stress

Stress is the manifestation of a complex physiological and psychological interaction that is difficult to define in simple terms. A simple explanation is that it is the resistance of the body to harmful and damaging external forces. Each force stimulates an opposing reaction that tends to weaken the body. Stress can simply be compared with a piece of wire that appears to be strong, but snaps and breaks when bent continually. The precise moment at which the wire will snap or break is difficult to predict. However, once the wire has been weakened, it is vulnerable to more weakening and it is difficult to stop this process. Once the wire has snapped, it cannot be returned to its previous state. Captured animals are under continuous stress and may eventually succumb to it.

A wild animal that is disturbed and herded unnaturally will flee instinctively for its life and run until it is out of danger or exhausted. Eventually when it can continue no longer, it will lie down breathlessly, but will not give up easily. When it is pushed to the extreme, it will surrender physically and die from exhaustion and the resultant heart failure. Anxiety and fear are clearly related to capture stress. An animal in good physical condition is not necessarily fit. Wild animals should not be forced to run fast or for long distances. In a natural environment an animal seldom has to run far to escape danger. Underlying factors such as disease, young or old age, advanced pregnancy, nutritional and mineral deficiencies, and weakness caused by internal parasites and other factors that are not obvious may have severe adverse effects on the animals, lower their resistance and make them more susceptible to capture stress and exhaustion. Difficult terrain, such as deep sand or stony veld, can hinder the animals when they flee. Adult male animals that are stressed and trapped tend to fight with one another and the resultant injuries may be fatal.

Varying degrees of stress occur during capture. Stress factors are activated soon after capture begins and can continue long after the capture is over. The following are some factors that tend to exacerbate stress in wild animals:

- An instinctive or inborn fear of any danger, but especially the fear and anxiety related to being captured – this includes fear of the proximity of humans, vehicles and helicopters
- Sudden and excessive muscular activity when the animals flee from danger
- Bodily injuries inflicted while running through obstacles such as dense bush, or by being tangled in nets or confined in box traps or crates
- Injuries caused by other animals or incurred in attempting to escape from box traps or crates
- Strange and unnatural surroundings such as capture bomas, holding pens and crates, and the accompanying noises and smells of fuel and humans
- Food and water that are strange and unfamiliar

All aspects of any capture procedure will result in stress for a wild animal. Since excessive stress usually causes death, and because the success of a capture is judged by the minimization of mortalities, it is essential that stress should be avoided or limited as far as possible.

1.2 Prevention of stress

When animals are captured, the important stress factors must be eliminated long before the breaking point is reached. Stress is one of the most important causes of capture myopathy and mortality during capture. For successful capture, all forms of stress should be avoided as far as possible. Although not in order of importance, the following steps will reduce stress and promote more successful animal capture:

- Plan all facets carefully and thoroughly before the capture operation commences.
- Discuss the planned operation and procedures thoroughly with all the staff who will be involved, so that every person knows exactly what his or her duties are.
- It is important to demonstrate practical aspects such as how to hold an animal, even though this may appear unnecessary.
- Animals that can run only a short distance tend to overheat quickly. Therefore, all capture operations should be scheduled for the cooler months of the year. In the warmer areas of South Africa, capture should take place in the early morning only, and be completed before it gets too hot. It is not advisable to capture animals when the maximum day temperature is above 25°C.

- As a general rule, animals should never be captured in hot weather or in the middle of the day when it is hot, and all capture operations should be planned with this rule in mind.
- In many parts of South Africa and Namibia, capture usually starts during the middle of April and ends at the beginning of October. It is not advisable to capture animals outside this period because certain animals will then be heavily pregnant, their physical condition will be poor at the end of the winter, and ambient temperatures will be increasing steadily to above 25°C.
- Capture in the late afternoon is not advisable because delays may necessitate handling and loading the animals in the dark. Unless the capture staff are well equipped with special lamps and lights to work in the dark with wild animals that have been recently captured, this practice should be avoided at all costs. Working with wild animals in the dark can be dangerous to both the animals and the staff.
- To avoid overheating and exhaustion, the animals should never be herded too far or too fast. When they are being herded towards a capture area by helicopter, they should be given an opportunity to rest before being regrouped slowly and finally pushed into the capture boma.
- Animals must never be herded and captured in hot, humid or rainy weather. This applies especially in subtropical coastal areas.
- Animals must not be captured after a heavy rainstorm when the ground and grass are wet and slippery. Under these conditions, the animals may slip and tear muscles or strain tendons.
- Many animals, but especially browsers such as kudu and giraffe, lose physical condition during the winter as a result of the reduced availability of food and lower energy levels in the vegetation. It is therefore inadvisable to capture these animals at the end of the winter.
- Animals should not be handled or disturbed unnecessarily after their capture.
- Animals living in family groups must be caught and kept in these groups as far as possible. When a group of animals are herded into a capture boma, other small groups or individual territorial rams, bulls or stallions are often also chased in. This may present problems, and there would be less fighting and fewer injuries if the various animals and families were not mixed. This is especially important in the case of Burchell's zebra and the mountain zebra.
- Tranquillizers are recommended for most species after their capture, but they should always be used with care. Special care should be taken not to overdose an animal or to inject it twice. An overdose of tranquillizer may result in the animal lying down in the transport vehicle and being trampled by other animals. All tranquillized animals must be marked clearly for identification.
- The correct use of tranquillizers ensures that the animals are captured and transported in an effective and humane manner.
- All possible precautions must be taken to prevent animals from hurting themselves and one another in the crates or holding pens.
- Aggressive animals must be separated from the others. Bulls and rams that tend to fight with one another must be crated individually or kept apart from the others to prevent them from being injured. When animals such as gemsbok, roan antelope, sable antelope, red hartebeest, impala rams, eland and blue wildebeest are trapped or confined in a small area, they may attack, gore and wound one another fatally.
- Unnecessary noise from the staff and any onlookers must be avoided, especially immediately after the animals have been captured. Any loud noises, unnecessary shouting and revving of vehicle engines must also be avoided.
- It is advisable to exclude spectators from the capture area during capture and at the holding pens for the first few days after the capture.

2 CAPTURE METHODS

Thousands of animals are caught and sold annually to be translocated to game ranches and game reserves all over southern Africa. Animal capture and translocation have become a specialized and well-organized industry that operates within the strict ethical codes established by the South African Bureau of Standards (SABS 0331) for the translocation of certain species of herbivores. Professional capture organizations and some provincial conservation authorities have invested huge sums of money in capture equipment and trained

staff for their capture teams. It is wise to use these services when they are available. Some of the older, more established game ranchers do have capture equipment and they capture their own animals successfully on a small scale. However, when animals are to be captured in large numbers, it is best to leave the capture to reputable, professional animal capture teams who have the necessary expertise, ethics and equipment.

2.1 Planning a capture

Any capture operation is a major undertaking. It requires proper planning that includes the following:

- Know the type and number of the animals to be captured.
- Avoid capture during the mating season.
- Know the physical condition of the animals, the number of young, and the possible presence of animals in advanced pregnancy.
- Know the sexes and ages of the animals to be captured.
- Consider the time of year, and especially the maximum environmental temperature and relative humidity of the air. Animals should never be captured during the hot summer months, especially when the females are heavily pregnant or already have unweaned young.
- Know the safest and most effective capture method for the specific type of animal to be captured. The method chosen will also dictate the capture and transport equipment, labour and holding facilities required.
- Know the terrain, especially in terms of physical hindrances or deficiencies for the capture method to be used.
- Consider the necessity of using immobilizing and tranquillizing drugs, and the availability of those drugs.
- Consider the availability of vehicles and single or mass transport crates to transport the captured animals to holding pens or their final destination.
- Consider and adhere to animal health requirements, such as the quarantining of animals in foot-and-mouth control areas. This information is available from the state or provincial veterinary authorities.
- Obtain in advance all the conservation permits that may be required for the capture, holding and transporting of the animals to be captured.
- Obtain in advance all the import and export permits required between different regions and countries.
- Obtain in advance the relevant no-objection conservation and veterinary transport permits where these are required.

2.1.1 Negotiations with the client

Before the animals can actually be captured, the following important agreements must be reached and preparations made by the animal capture team and the game rancher to avoid unnecessary delays and expenses.

The necessary permits requiring the following information must be arranged:

- The name, address, fax, telephone and cell-phone number of the owner of the animals
- The name and registration number of the game ranch, and the district in which it is located
- The exemption permit number for the game ranch and the expiry date of this permit
- The VAT number for the enterprise
- A statement as to whether the animals have been captured before. When there has been an attempt at capture before, a statement on the success or not of such capture must be added.
- A statement on who will do the required animal count on the game ranch and at what cost
- Where applicable, the registration number of the game ranch for the keeping of buffalo

For animals purchased directly from a game rancher, clarity must first be obtained regarding the following:

- Which species occur on the ranch and in what numbers
- The reliability of the count done and the counting technique used
- The species, numbers, sexes and ages of the animals to be captured
- The purchase or sale price per individual animal
- How and when payment will be made
- At whose risk the animals are to be captured and transported
- The nature of the capture terrain and its accessibility to the capture team and their vehicles

- The fencing of the game ranch and the presence of internal camps
- The size of the game ranch
- Veterinary restrictions, such as foot-and-mouth disease
- Suitable accommodation for the animal capture team
- Convenient and preferred dates for the capture. This will depend on the time of year, the ambient temperature expected at that time, the mating and reproductive season of the animals to be captured, avoidance of keeping stressed animals in pens in cold weather, and possible transport of heavily pregnant animals that can give birth during transport.

Should a helicopter be used for capture or an aerial animal count, permission from the neighbouring landowners must be obtained in advance. This regulation has been imposed to prevent the helicopter from disturbing animals in the surrounding areas.

2.1.2 Number and type of animal

The number of animals to be captured largely determines the capture method to be used. Unless the animals are extremely valuable or occur in inaccessible terrain, it may not be worth the effort or money to rent a helicopter and erect a capture boma. Similarly, a helicopter will not be used to capture a small number of animals that can be captured in other less expensive ways. However, a helicopter can be useful for other purposes, such as tracking and immobilizing animals that have accidentally broken through the fence and escaped. Using a helicopter in this case can save many hours of frustration and also promote good neighbourly relations.

Some animals can be captured by using a specific method only; others can be captured by several methods. For example, a white rhinoceros can be captured safely and effectively and be handled by using immobilizing and tranquillizing drugs. The following animals can be captured successfully by the plastic boma method: Burchell's zebra, blesbok, bontebok, blue wildebeest, buffalo, eland, gemsbok, giraffe, impala, kudu, nyala, red hartebeest, springbok, sable antelope, tsessebe and waterbuck. However, it is sometimes difficult to capture black wildebeest, Burchell's zebra, impala, kudu bulls and springbok by this method, and alternative methods then have to be used. When adult kudu bulls with their wide

spread of horns are captured, the capture team must ensure in advance that the loading ramp and gate are wide enough to accommodate the horns. If they are not wide enough, the animals may have to be immobilized or sedated for loading.

Some animals such as black wildebeest, impala, springbok and tsessebe are difficult to herd by helicopter because they do not fear the helicopter or they change direction while running. This also happens when animals have been captured before by helicopter, or are exhausted from running. Nyala and bushbuck are not easily herded by helicopter. They usually run in any direction and try to hide. Kudu bulls and impala rams often refuse to move. Under these conditions, methods other than the use of a capture boma and a helicopter may be required.

Certain male animals such as black wildebeest, blue wildebeest, eland, gemsbok, impala, kudu, red hartebeest, roan antelope, sable antelope, tsessebe and waterbuck sometimes fight with one another or with the females soon after they have been captured. They should therefore be separated to prevent injuries. This may necessitate immobilization and separation in the boma or the placing of plastic pipes over their horns during the loading process. Injecting them with a tranquillizer will also stop the fighting.

Certain animals such as blesbok, blue wildebeest, giraffe and impala can be held in the capture boma overnight. However, the capture team must ensure that the curtains are firmly tied to the ground so that they will not lift in the wind or under pressure from the animals. Should a curtain lift it will allow the animals to escape. The curtains should also not flap in the wind during the night because this will disturb the animals, place them under stress, or even cause them to break out and flee.

Herd animals such as black and blue wildebeest, Burchell's zebra, impala, red hartebeest and tsessebe are captured effectively and easily in family groups by using a helicopter and a plastic capture boma. When family units are kept together, it helps reduce and even eliminate fighting, injuries and mortality. In many cases, it is desirable that captured animals be given a tranquillizer by injection immediately after capture to calm the animals and to facilitate handling.

2.2 Capture bomas

A large number and variety of wild animals can be caught by using a capture boma and a heli-

copter. In southern Africa, this method is likely to remain popular because it causes little disturbance and there is limited physical handling of animals and less resultant stress. Owing to the high cost of the equipment, the helicopter, the transport vehicles and a large labour force, most game ranch managers are not able to use this method themselves. It is better for such managers to negotiate with a professional capture team to do the work. Most of the medium- and large-sized herbivores can be captured by this method. Even giraffe, which usually cause problems, can be captured using this system, provided the height of the cables for the curtains and of the plastic sheeting in the capture boma is increased to allow for the height of a giraffe.

Different operators have now adapted the original Oelofse method. It is a versatile capture method that has been used with chemical immobilization and tranquillization in recent years for the capture of rare and difficult animals, such as roan antelope, sable antelope and tsessebe. By using this method the animals can be captured in

the shortest possible time, loaded into crates and transported to their destination with a minimum of delay. Heavily pregnant animals and females with young should preferably not be captured. These animals should rather be captured at another time of the year. There have been cases where eland calved in their crates en route to their destination. This is totally unacceptable.

The original capture boma technique (Figure 33.1) was developed in the erstwhile Zululand game reserves by Jan Oelofse of the former Natal Parks Board when he was in charge of their capture unit. Some of the variations that have subsequently evolved are depicted in Figures 33.2 to 33.4. Examples of the erected capture bomas are given in Figures 33.4 and 33.5. The design basically consists of the following parts:

- A: Capture funnel
- B: Capture area
- C: Holding area
- D: Loading funnel
- E: Loading ramp

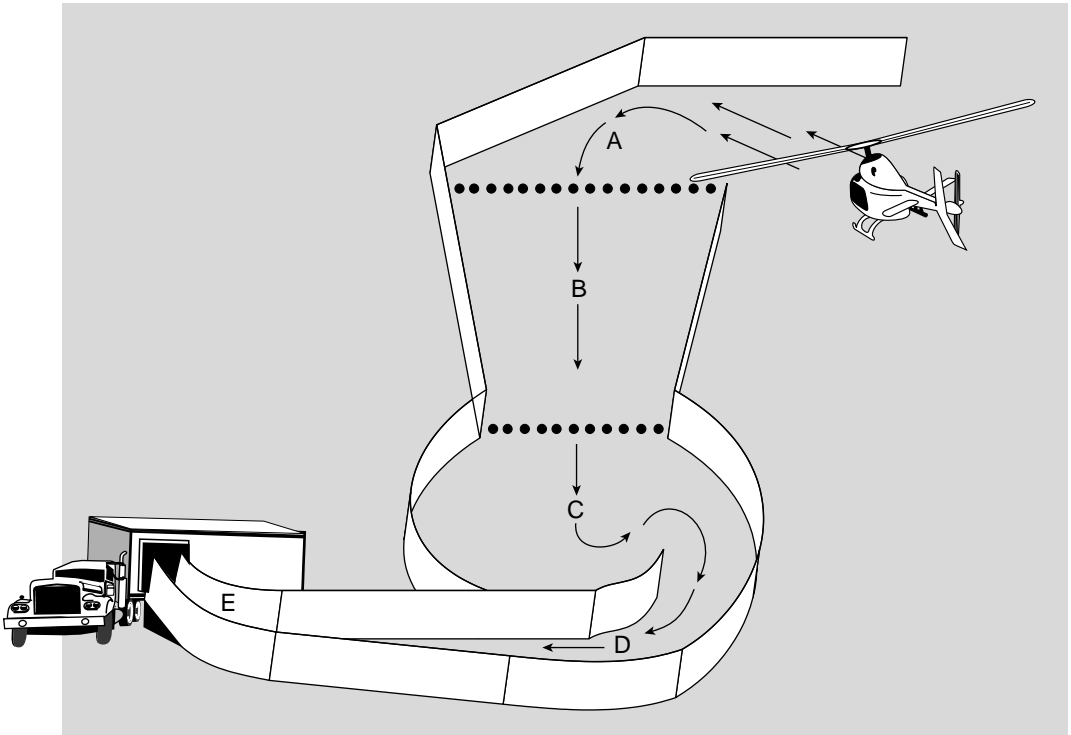


Figure 33.1 A plastic capture boma based on the Oelofse method. A = capture funnel, B = capture area, C = holding area, D = loading funnel, and E = loading ramp. (Based on the Oelofse method.)

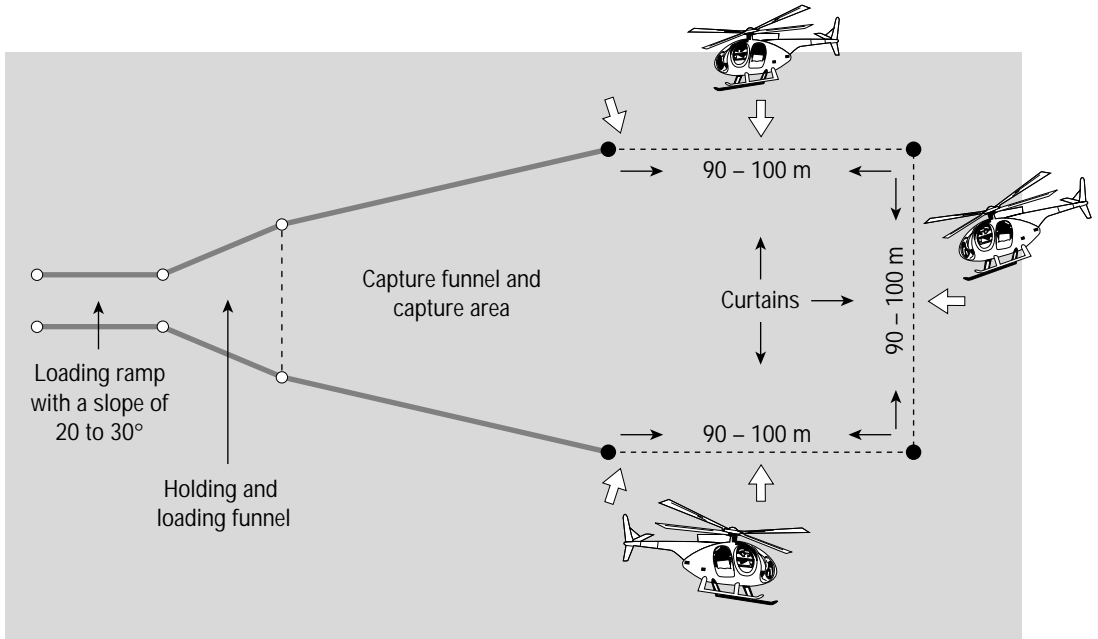


Figure 33.2 The Alec Rough capture boma into which animals can be herded from three possible directions.

Curtains are suspended from a high cable between the capture funnel and the capture area, and between the capture area and the holding area. Several colours are used, including black, black and orange, black and green, and tan. Tan is the least effective of these colours. These curtains can be opened and closed (Figure 33.5). There is also a short curtain between the holding area and the loading funnel. An alternative to the system is to erect a second loading funnel adjacent to the main one and to divide the second one into pens, with gates covered with plastic material or hessian (Figure 33.4). These pens may be used to hold animals temporarily and to give them a chance to rest and cool off. The holding area can also be divided into various compartments with plastic curtains so that animals can be held there temporarily. When the terrain and vegetation allow it, the entrance to the boma can be moved when the wind direction changes. This can be done by changing a side curtain or by elongating or swinging the entrance section, while the loading section remains unchanged.

The Oelofse method can be modified so that the capture does not depend on a specific wind direction. The Alec Rough capture boma is such a modification. It is designed so that animals can be

herded into the boma from three different directions when the vegetation allows this. Where the original Oelofse method had only one curtain, there are now three sets of curtains (Figure 33.2). The Johann van Rooyen capture boma (Figure 33.3) also provides for changes in wind direction by using two sets of curtains.

The theory on which the capture boma technique is based is that the animals perceive the plastic sheeting as a solid wall and feel trapped inside it. The best plastic sheeting is made of woven synthetic polypropylene, which is light and easy to handle. Unfortunately, this material deteriorates with age because it is broken down by ultraviolet rays and becomes brittle when exposed to the sun for long. It also tears easily when it is brittle and has to be replaced regularly.

There are curtains between the capture funnel and the capture area, and between the capture area and the holding area. These curtains slide on a lower and a higher cable, and are drawn whenever the animals have moved past them to the loading funnel and loading ramp. There is also a short curtain between the holding area and the loading funnel that can be replaced by a gate covered with plastic sheeting or hessian.

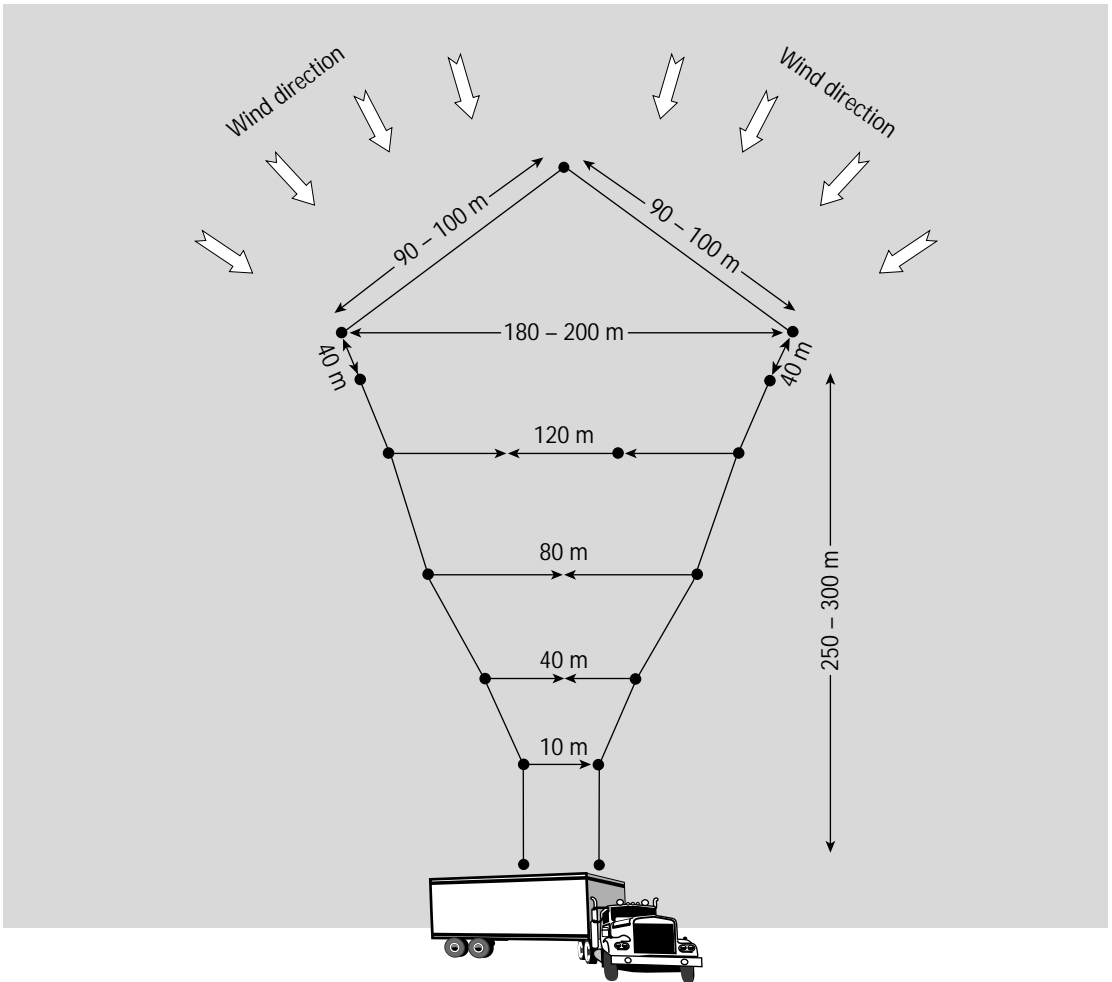


Figure 33.3 The Johann van Rooyen capture boma with two sets of curtains to allow for changes in the wind direction.

The posts that are used for the capture funnel, capture area and holding area are set into the ground approximately 15 m from one another, and are anchored with strong supports. One cable at the ground level and another 3 m above the ground are tied to the posts. The plastic sheeting is clipped to the cables with specially made clips and rings or with short pieces of soft baling wire. In the holding area and the loading funnel the posts are set closer to one another, and the plastic sheeting is reinforced on the outside with nets or wire mesh (Figure 33.5). The normal sheeting height of 3 m should prevent even animals that are known to jump high, such as impala, kudu and waterbuck, from attempting to jump out.

2.2.1 Advantages and disadvantages

The main advantages of using plastic bomas in wild animal capture are:

- There is limited physical handling of animals.
- Deaths and injuries are minimized.
- A large number of animals can be captured and moved within a short time.

The main disadvantages of using plastic bomas in wild animal capture are:

- It is expensive to purchase, maintain and replace the equipment.
- The use of a helicopter increases the capture costs per animal.



Plastic sheeting reinforced with a net.
Photo: J. du P. Bothma.



Open plastic curtain between the capture and holding area.
Photo: J. du P. Bothma.



Eland in the loading funnel.
Photo: J. van Rooyen.



The final herding of animals into the boma with a helicopter.
Photo: J. du P. Bothma.



Keeping animals in a plastic pen next to the loading funnel.
Photo: H. Ebedes.



Loading wild animals into a transport vehicle from a capture boma.
Photo: J. du P. Bothma.

Figure 33.4 The capture of wild animals with capture bomas.



Figure 33.5 Tsessebe being herded by helicopter deeper into a plastic capture boma.

Photo: Gauteng Nature Conservation.

- When the animals become aware of the existence of a capture boma in a specific part of the ranch, the boma must be moved to a new site.
- The success of this method is limited in any area where there is not adequate natural vegetation to camouflage the boma.
- Mortalities from overexertion can occur when an inexperienced helicopter pilot herds the animals too far or too fast.
- It is essential to success to have the support of an experienced ground crew.
- Strong winds can make it dangerous or even impossible to use a helicopter. However, no

animal can be caught if there is no wind to remove the scent of a capture boma, its equipment and staff.

- Unnatural scents, such as fuel or perfume, and the noise of plastic flapping in a strong wind may upset or frighten the animals and cause them to avoid the capture boma. When they have already been caught, it may cause them to continue milling around in the boma.
- In areas where large predators like lions and cheetahs occur, the captured animals must not be left in the boma overnight because the predators may crawl underneath the plastic and injure or kill some or all of the animals trapped in the boma.
- Strong gusts of wind may sometimes lift the plastic and allow the animals to escape.
- When different types of animal such as blue wildebeest and Burchell's zebra are herded into the capture boma together, they may attack and injure one another.

2.2.2 Factors determining success

The successful capture of wild animals in a capture boma requires that the following factors be considered:

The expertise and experience of the helicopter pilot are most important. The pilot must be careful whenever he is flying, but must also possess a degree of daring. It is important that the pilot understands the behaviour of the animals. Moreover, the pilot must have a rapport with the animals to know precisely how far and for how long they can be herded. Any evasive action taken by a specific type of animal must also be anticipated and countered before it can develop.

The herding of the animals towards the capture boma by helicopter must make allowances for the following:

- When the wind is blowing strongly, it will make flying and capture difficult or impossible. Gusts of wind can tear the plastic sheeting. Winds from the wrong direction can carry the scent of humans and equipment from the capture boma to the animals, and frighten them away from the boma.
- Herd manageable groups of animals slowly over a short distance, allowing periods of rest for them to regroup.
- Capture only at an ambient temperature of 25°C or less.

- Split aggressive male animals from the group before they reach the boma.
- Only animals that are in a good physical condition should be collected and herded to the boma.

The capture boma itself should adhere to the following guidelines:

- The entrance and sides should be effectively camouflaged.
- The plastic curtains should be in good repair.
- There should be excellent cooperation and agility amongst the ground team.
- There should be excellent communication with two-way radios between the pilot and the ground team.
- Competent persons should close the curtains at the correct moment when the animals have entered the boma.
- Keep the milling of captured animals in the boma to the minimum.
- Capture the animals without excessively tiring them.
- Load the animals as quickly and as quietly as possible, and with the minimum of force.

When transporting wild animals, it is essential to:

- Separate the animals into small groups when necessary.
- Inject tranquillizers as recommended.
- Have correctly designed crates.
- Herd the animals carefully into the transport vehicle or crates.
- Stop at regular intervals to inspect the animals and crates.
- Cover the crates timeously to protect the animals from rain or cold.
- Use the shortest possible route to the destination without subjecting the animals to undue stress over poor or badly maintained roads.
- Ensure that the driver has detailed instructions regarding the preferred routes to and the exact destination at which the animals must be offloaded.

When offloading animals it is important to:

- Offload only during daylight when at all possible. Any exceptions must be true emergencies.
- Keep the offloading ramp and area free of loose objects or obstructions that can injure the animals.

- Park the vehicle correctly against the offloading ramp, with no space between the rear or sides of the vehicle and the ramp to prevent leg injuries.
- Let the animals move calmly and quietly out of the crate at their own time and pace.

The following general guidelines are also relevant:

- Ensure that the habitat in the release area is suitable for the particular species.
- Do not move the animals from excellent to poor grazing.
- Do not follow the animals after offloading to see what they do. Allow them to remain calm and settle into their new habitat first.
- Supply water along the fence line, especially in corners, because many newly released animals will patrol the fences for a while and may gather in such corners.
- Give feedback regarding losses and successful adaptation to the animal capturer or seller.

2.2.3 Costs

Cost is an important consideration in animal capture using a capture boma. It includes the following:

- The purchase of cables, nets and plastic sheeting
- Suitable vehicles for transporting the staff to the capture site
- Suitable vehicles for transporting the animals to the holding pens and later to their destination
- Capture equipment, such as dart guns and darts
- Immobilizing and tranquillizing drugs, antibiotics and other medication
- Additional labour costs
- Food for the captive animals
- Suitable holding facilities

Moreover, the least expensive method of capture is not necessarily the most effective and safest. To decrease costs, a group of ranchers in a given area can combine their capture requirements either by contracting the services of a professional animal capture team collectively, or by joining forces to purchase and maintain the necessary capture equipment.

2.2.4 Capture area

Aspects of the terrain where the animals are to be captured, such as dense bush, open grass plains, mountainous areas, vleis or the presence of large rivers, must be kept in mind when determining the safest and most cost-effective and efficient capture methods. It is often necessary to herd plains animals into thick bushy areas where the nets or capture bomas can be camouflaged effectively. Animals in mountainous areas may have to be herded carefully to lower-lying areas for capture and loading.

2.2.5 Terrain inspection

When selecting the terrain for the boma capture of wild animals, the following matters are important:

- Ensure that the animal species to be captured does indeed occur on the game ranch.
- Determine in what physical condition the animals are.
- Establish whether there are any heavily pregnant animals, or females with young calves or lambs.
- Determine whether it is possible to camouflage the plastic sheeting and nets in the bush.
- Determine whether there are gulleys, stones, ridges, sand or clayey soil in the area.
- Determine whether there are any internal fences or camps.
- Estimate how far the animals will have to be herded to a capture site.
- Determine how many capture bomas will have to be built to capture all the animals, and calculate the time required to do so in advance.
- Determine whether the animals can be fed on natural food or whether other food must be provided.
- Determine whether the transport vehicles will be able to move around the game ranch and in what condition the roads are.

2.2.6 Boma construction

When the site for the capture area has been identified and the necessary vegetation has been cleared for the erection of the plastic walls, the curtains can be erected. First, two cables are erected and fixed to trees or posts. One of the cables runs along the ground and the other about

2.5 to 3 m above the ground. The woven polypropylene plastic sheeting is fixed to the cables with short pieces of binding wire or clips. If the curtains have reinforced ring attachments, the cables can be threaded through them. After the lines have been anchored, the cables are pulled tight. If the curtains are too low, use taller posts for extra height. The plastic curtains must yield to a certain degree to prevent them from tearing should a large animal jump against them. The curtains must also have a draw handle and a test run must be made in advance to ensure that the curtains fill the open space properly and that they do not catch on anything. The entrance to the boma should be camouflaged thoroughly with leafy branches. The loading area and vehicle should also be camouflaged. For certain animals, such as impala and Burchell's zebra, the bottom cable can be removed to make the entrance less visible. Where branches are cut, the pale cut marks on the trees can be camouflaged with mud. It is especially important to make sure that the loading vehicles cannot be seen from the entrance to the boma.

The holding area can be divided into pens or compartments by drawing curtains that are fixed to cables over the capture area (Figure 33.4). The pens are linked by gates covered with hessian or plastic, and can be covered with hessian or 80% shade cloth to provide shade and shut out light. Pens have the following advantages:

- They can be used to sort the animals and to determine their sex and age before they are loaded.
- Adult male animals can be separated from the rest of the animals to prevent fighting during transportation.
- Young and suckling animals can be held there to be loaded separately and to prevent them from being trampled by bigger animals during transportation.
- Different types of animal can be captured and kept in a holding pen until suitable transport is available.

The holding area and the loading funnel must be reinforced from the outside with net or mesh to prevent the animals from escaping (Figure 33.5). The one area in the capture boma where the animals are usually most frightened is at the loading ramp. This section must be solid and sturdy so that the animals cannot flatten it and escape. The sides of the loading funnel must be 3 to 4 m high

to prevent animals such as waterbuck, kudu and impala from jumping out (Figure 33.4).

Should the reflection of the sun on the side curtains at the entrance to the boma cause a problem, a double layer of sheeting can help to solve it. There should be a flagpole with a small flag at the corners of the boma entrance so that the boma entrance is clearly visible to the helicopter pilot from a distance. Attach a clearly visible windsock or marker to the flagpole to show the pilot the current wind direction. This will ensure that the animals are not herded towards the boma from the wrong wind direction, causing them to scent the people, equipment and vehicles and to balk at entering the boma. When the funnel is too wide between the second and fourth curtains, a split curtain can be erected parallel to the sides through the middle of the boma towards the loading area. This will create narrower funnels that will reduce the milling of animals such as impala and blue wildebeest, and will speed up the loading process (Figure 33.6).

The distance from the boma entrance to the loading ramp can sometimes be as much as 150 to 250 m, depending on the available cover from the bush, the boma depth and the loading terrain. The boma depth is the distance from the first curtain to where the animals realize for the first time that they are in an enclosure. This portion must be at least 50 to 70 m deep, so that the first curtain can be shut before the animals can turn around and escape. Also, it is preferable to use a capture boma with five to six interior dividing curtains. This prevents the animals from running around in the boma and facilitates the loading process. Where the dividing and side curtains meet, or where the different curtains are tied together, they must be joined properly to prevent an animal from escaping should it jump against the sides. The curtains can be reinforced by planting additional posts if the distance between the trees being used as posts is too large.

It is also essential to have a landing pad for the helicopter at least 100 m from the loading area. A fuel dump for refueling the helicopter should be located in this area. Before the actual capture starts, the boma entrance should be finally inspected to ensure that all is in order.

■ SELECTING AND PLANNING THE CAPTURE SITE

The selection of a specific capture site within a capture area may be more easily done from a heli-

copter initially. In doing the selection, it is important to note where the game ranch fences are. Also, note the occurrence and location of animal trails and concentrations of animals in selecting the best site. The terrain for the boma should be relatively bushy to camouflage the capture boma, and it should be easily accessible to all vehicles. Where there are animal trails or footpaths, plan the entrance of the boma so that these trails or paths naturally lead to the middle of the entrance. Reject areas where there are ridges, stones, sand and clayey soil, gulleys, plains and fences as capture sites because the animals may easily fracture their limbs or sustain injuries in such terrain. The vehicles may also get stuck in sand or clay, especially if the sand is loose and the clay saturated. Internal fences hamper the process of herding the animals to the boma. Plan the capture boma bearing in mind the expected wind direction. The Weather Bureau at tel. 012 309 3911 can help by predicting the prevailing wind direction for that area before and during the capture operation. The animals should always be driven into the boma with the wind blowing *towards* the boma.

The capture boma should preferably not be near a waterhole because this will disturb the other animals on the game ranch. Wild animals are nervous enough when approaching a waterhole because of predators and they should not be further unsettled. The boma should also not be too close to the preferred foraging areas of the animals to be captured. If it is, the animals may be disturbed by the human activities during the erection of the capture boma, and may move away. The entrance to the capture boma should not be close to roads or fences.

Once a suitable capture site has been seen from the air, it can be inspected and properly planned on foot. To do this, the ground is marked, or markers such as pieces of toilet paper are tied to the branches of trees to demarcate the borders of the capture boma clearly. The markers should be removed as soon as the necessary passages have been opened and the boma construction has been completed.

The capture boma must be erected as quietly as possible. Large trees can be used instead of anchor posts from which to hang the curtains as this saves time, especially if post holes have to be dug in hard or stony soil. Such a capture boma does not look as neat as one with posts, but it is practical and can be erected quickly. The branches that are cut off must be removed from the capture boma so that the animals do not injure themselves

when they charge into the boma. The wooden posts used as corner anchors must be fixed properly with cable ties. Should an animal jump against a curtain or should a strong wind blow, the boma walls must remain erect and not allow the animals to escape. The animals should also not be able to injure themselves on the cables or anchors inside the boma. The cables should be high enough and the anchors covered with branches.

■ BOMA ENTRANCE

The correct planning of the capture boma entrance is important because wild animals can see and smell well and will only be caught when they are surprised by the boma. Some aspects relating to the boma entrance have already been mentioned. In addition, the funnel and the capture boma itself should be camouflaged as carefully as possible. Choose a bushy area for the boma and ensure that the sides of the funnel entrance and the walls are not visible to the animals until they are deep enough into the boma to be shut in by the curtains without being able to turn back.

Wild animals do not like moving over open terrain when they are herded by a helicopter, and they usually run to bushy areas. The capture boma entrance should therefore be in a thicket next to an open section of veld. The animals will usually run towards the thicket, and the helicopter can fly low behind them over the open terrain, thus forcing them to move through the entrance more easily. If the helicopter maintains pressure on the animals, it decreases the chance that they will see the entrance, hesitate and turn around. If this happens, it is unlikely that the same animals will be caught again at that capture site and another one will have to be built elsewhere at extra cost in time and money.

The herded animals usually move quickly through the bush when they discover that they are in a strange situation. In dense vegetation, branches may injure the animals. It is important that the boma entrance should look as natural as possible, therefore do not cut or remove the grass at the entrance. Also, do not cut any branches used for camouflage at the entrance and do not drag such branches along the ground at the boma entrance. Furthermore, it is important that there is no movement of people at the boma entrance before the capture, nor should foreign objects such as paper, cigarette butts or bottles be left lying around at the entrance. The staff should not

smoke, urinate, defecate or make fires near the boma entrance, nor leave too many footprints. To make the curtains less visible, they can be painted on one or both sides with a suitable camouflage paint well in advance of the capture to get rid of the smell of the paint. A neutral beige colour is usually acceptable but black, black and orange, or black and green curtains are better.

■ EQUIPMENT AND MATERIAL NEEDED

The following are needed to build a normal capture boma:

- A roll of plastic sheeting 1500 m long × 3 m wide and cut as follows: 16 lengths of 55 m, eight lengths of 40 m, six lengths of 30 m, five lengths of 20 m and two lengths of 10 m. The ideal colours for the sheeting are black, rust-brown (orange) and black, and green and black.
- A 3500 m roll of 4 to 6 mm cable cut as follows: four lengths of 300 m, four lengths of 150 m, four lengths of 120 m, four lengths of 100 m, four lengths of 80 m, two lengths of 60 m, two lengths of 40 m, two lengths of 20 m and two lengths of 10 m. Six anchor cables of 15 m and 15 cables of 10 m are usually used.
- In addition, there must be:
 - 26 cable reels
 - 8 cable reel stands
 - 8 stepladders
 - 3 crowbars
 - 2 or 3 shovels
 - 2 or 3 pickaxes
 - 8 bowsaws
 - 4 hacking knives
 - 8 cable pullers
 - 16 cable claws
 - 10 wooden posts of 75 to 99 mm in diameter
 - 16 steel pipes of 50 mm × 3 m
 - 50 cable lifting pipes of 40 mm × 3 m
 - 3 fencing pliers
 - 3 hammers of 5 kg each
 - 15 anchor bars of 0.9 m
 - 15 anchor bars of 1.5 m
 - a 200 litre water drum
 - 3 complete toolboxes
 - 2 shields of 2.4 × 1.2 m and 1.2 × 1.2 m respectively

A well-stocked, comprehensive medical kit for the capture team should contain the following: an

antiseptic solution, antiseptic ointment, bandages and splints, cotton wool, tampons, sterilized suture material and needles, a pair of scissors, a needle holder, forceps, tweezers, adhesive bandages, elastoplast, adhesive plaster, eye and eardrops, sterile water ampoules to rinse the eyes, sterile syringes of 1 and 5 ml, needles of various gauges, pain and headache tablets, flu and cold tablets, antihistamine tablets, anti-inflammatory tablets, a cough mixture, a laxative, medication for diarrhoea, cramps and nausea, sterile gauze for open wounds, and an ointment for burns. Insect repellents are also handy.

The following additional equipment must be available: a variety of ropes, a complete set of darting equipment, darting syringes, needles and pole-syringes, a pair of scissors, cotton wool, blindfolds of various sizes, gloves, antiseptic cat gut and suture needles for animals, a rectal animal thermometer, marking paint, PVC pipes in various lengths and diameters for covering the horns, soap, a towel and water to wash hands, Stockholm tar to treat horn wounds, vitamins and electrolytes to add to the water, pour-on acaricides, anthelmintics for internal parasites, sample bottles containing 10% formalin and 70% ethyl alcohol for the collection of tissue samples for histopathological examinations, sharp knives and a saw to skin and open carcasses for post-mortem examination.

A coolbox containing the following is also required: chemical immobilizing drugs, tranquilizers, broad spectrum antibiotics, vitamins, cortisone, eye ointment, wound spray and wound ointments. Enough water in handy containers should be available to keep the immobilized animals cool, and a tarpaulin on which to work and treat the animals, and a stretcher for carrying the immobilized animals should also be available.

2.2.7 Capture operation

Each person involved in the capture must be briefed exactly and carefully on his duties. The person in charge of the capture should discuss the operation with all the capture staff in advance so that each person knows precisely what to do during the capture. A trial run is recommended to detect any potential problems.

All the capture staff should be in their respective positions well before the herding starts. The transport vehicles must be in position to load the animals immediately. Animals that have been captured should be loaded as soon as possible, espe-

cially waterbuck, tsessebe, kudu and eland. Staff must wear suitable clothing, such as overalls and boots. Neither visitors nor staff should be allowed to drive around in the vicinity of the capture operation and past the animals being herded to the boma by the helicopter, especially not in the direction from which they are being herded.

Effective radio communication between the helicopter pilot and the ground team is vital to ensure that the capture process runs smoothly. Mobile two-way radio sets or a loudspeaker on the helicopter can be used. Problems in the capture boma can then be identified and corrected timeously from the air. No passengers are allowed in the helicopter while animals are being herded because the additional weight makes the handling of the helicopter difficult.

It is essential that the animals be delivered before sunset if at all possible. Therefore, plan the capture or loading of the animals accordingly. When everything is ready for the capture, a suitable group of animals should be located by the helicopter pilot and herded slowly towards the entrance of the capture funnel. The animals should never be herded over a long distance or too fast, otherwise overheating and overexertion will occur. Animals near a waterhole may have drunk recently and it may be detrimental to herd them far. When the animals are herded over a long distance, they must be given adequate rest periods before finally being herded into the capture area. This should be done without allowing the herded animals to scatter and escape. The number of animals herded at a given time should be manageable and transportable, and a large group should never be captured at one time.

When the animals approach the funnel entrance, they should be herded quickly over the last distance. As soon as they are all in the capture area, the helicopter pilot gives a pre-arranged signal and the curtains are shut. The assistants must wait for the signal from the helicopter pilot before starting to close the entrance, because he has the only clear view of what is happening on the ground. The helicopter is then used to push the animals further towards the holding area, and sometimes even through the loading funnel and into the transport vehicle if the specific group of animals is being loaded and transported directly (Figure 33.5).

The assistants who draw the curtains must do so at the right time. As the animals move closer to the loading ramp, they are progressively cut off, and the assistants who manned the first cur-

tain can now move on to the next curtain. All the animals are then herded slowly further towards the loading ramp with the help of the helicopter or the assistants. This is fairly easy to do with animals such as impala, blue wildebeest, giraffe or blesbok. Unnecessary milling and the resultant exhaustion of the animals in the boma must be avoided. Animals that may prove to be difficult to load, such as impala, blue wildebeest and gemsbok, can be given a chance to rest in the loading funnel before they are finally loaded.

Sometimes the animals can be herded towards the smaller part of the capture boma without the help of the helicopter but by using between one and three people on foot. It is usually not necessary to use a vehicle or a large number of people or to make a great deal of noise to herd these animals. Captured animals should never be made more nervous than they already are. To herd animals on foot, a loose piece of curtain can be held up by a few people and shaken lightly while they move in a line towards the animals. If the animals refuse to move towards the loading ramp, they can be handled as shown in Figure 33.6. The capture team must always work carefully to prevent the animals from jumping against the curtains unnecessarily. They should also always ensure that no loose curtains flap in the wind near the loading ramp because this will frighten the animals away from the ramp.

The persons managing the loading ramp and crate doors on the vehicles, and those who draw the curtains should be dressed correctly so that they are not easily visible to the animals. They must work as quietly as possible and make no unnecessary movements near the capture site. Inquisitive spectators, cameras, brightly coloured hats and clothes, highly perfumed people, children and dogs are forbidden in and around the capture boma. Photographers who scramble around the loading ramp and vehicles get in the way of the staff and can easily disrupt the most carefully planned capture operation.

If only a few animals are captured at the first attempt, they can be kept in the holding area of the capture boma until more animals are brought in. Family groups of animals should preferably be captured and loaded together because this results in fewer social problems such as fighting. A family group loads and transports more easily than unrelated animals, and they tend to stay together and adapt better to their new environment. The loading of animals will be discussed in Chapter 35, which deals with transporting wild animals.

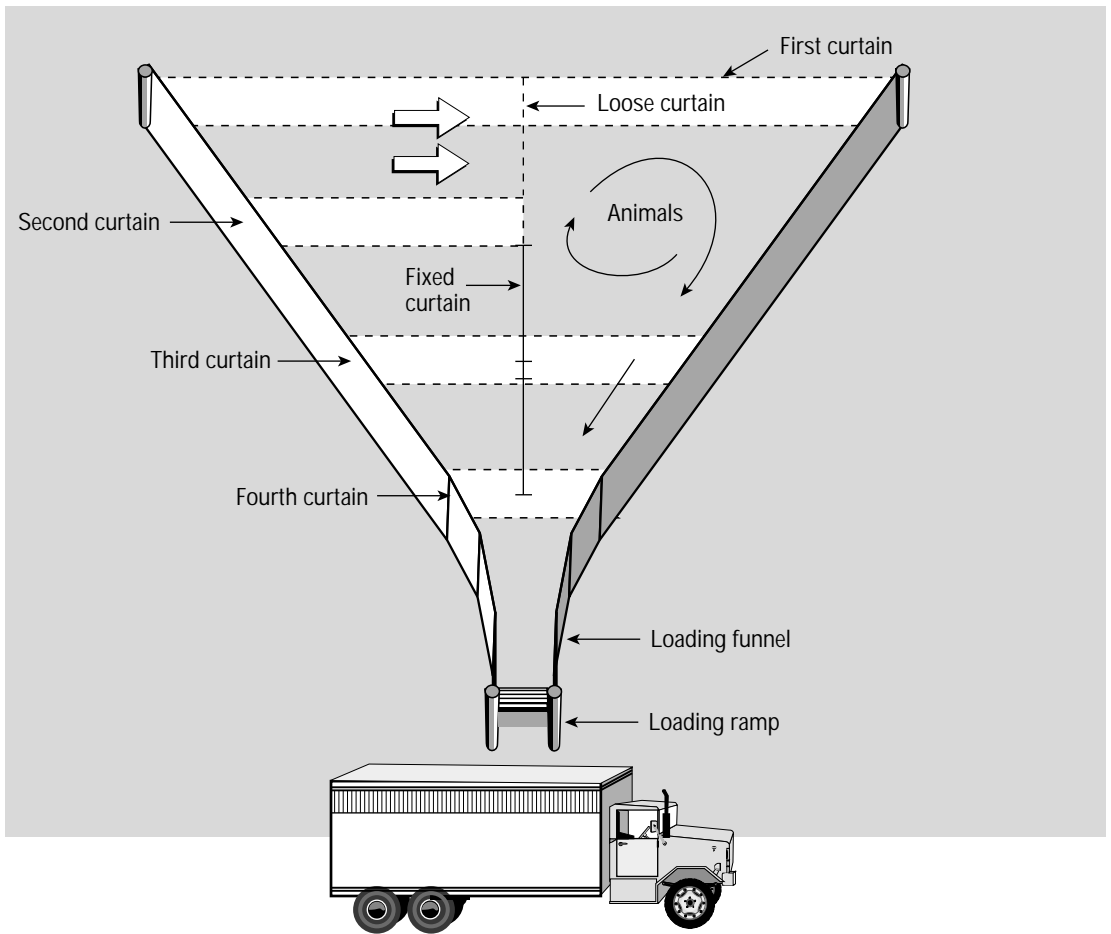


Figure 33.6 Handling animals that mill around in the capture boma and do not want to move onto the loading ramp. A loose plastic curtain held up by a few people is moved towards the centre of the capture boma. A portion of the next fixed curtain is drawn towards the loose curtain to make the area in which the animals are milling about smaller. This results in the animals moving towards the loading area. This process can be repeated. It is known as the Johann van Rooyen method.

The capture team is responsible for cleaning up the capture site and repairing any fences or gates that may have been damaged during the capture before leaving the property.

2.3 Capture nets

Capturing wild animals with nets is an old and popular technique. It is less expensive than the capture boma method. Since the nets are strong and are not damaged by weather, they can also be used repeatedly. Nets are easy to erect and

less material and labour are required than for a capture boma. Nets are especially used for the capture of animals that live in dense bush, such as nyala and bushbuck, and for plains animals such as springbok, blesbok, black wildebeest, oribi and steenbok.

Capture nets are available in lengths of 50 and 100 m and in various mesh sizes. Nets with a mesh size of 100 mm are required for the capture of smaller animals, whereas nets with a mesh size of 150 to 200 mm are suitable for larger and heavier animals. Nets are usually made of nylon

and have a breaking strain of 200 to 1000 kg. ALNET manufactures the following nets that are suitable for wild animal capture:

- 100 m × 2.5 m with a 150 mm mesh: 3 mm nylon strand, khaki coloured with ropes
- 100 m × 2.0 m with a 100 mm mesh: 4 mm nylon strand, khaki coloured with ropes
- 50 m × 2.5 m with a 150 mm mesh: 4 mm nylon strand, khaki coloured with ropes

ALNET (Pty) Ltd, P.O. Box 646, Edenvale 1810; P.O. Box 4995, Cape Town 8000; and P.O. Box 863, Durban 4000.

The animals are herded towards the nets by men on the ground, on horseback, or with scrambler motorbikes and light trucks. A helicopter can also be used, and although this is more expensive, it saves time and has an increased success rate that usually compensates for the extra cost.

The number of animals to be captured must be predetermined every time so that sufficient labour can be arranged in advance to take care of and handle the animals caught in the nets. One of the main causes of mortality in net capture is that too many animals are herded into the nets for the number of workers available to handle them properly and to see to their needs after capture. The success of net capture depends on the competent, supportive handling of the animals after capture. If too many animals are captured at once and there are not enough trained assistants to remove them from the nets, the animals may sustain injuries or may overexert themselves while struggling to escape. It requires two people per animal to handle most animals captured in nets. Even an animal the size of a springbok requires two assistants to control it until it can be injected with a tranquillizer and be calmed. Blindfolds that are large enough are essential to pacify the captured animals. The main causes of mortality in animals captured in nets are suffocation and broken necks. Some animals break limbs and then have to be put down.

Some animals may become so entangled in the nets that they cannot be removed easily and they may suffocate. In such cases, the net must be cut to save the life of the animal. Therefore, each member of the team must always carry a suitable sharp hunting or pocket knife. Wild animals can be captured with nets in various ways, as discussed below.

2.3.1 *Suspended nets*

This is the standard or conventional capture method. Although it is not always recommended, it is sometimes the only method available. The main disadvantage of this method is that injuries occur easily and overexertion causes mortalities when the animals struggle in the nets and cannot be handled soon enough. Depending on the size of the animals, the nets are suspended to a height of 3 to 4 m above the ground level between two cables. In bushy areas, the upper cable may be fastened to the trunks and branches of trees while wooden droppers are used as supports (Figure 33.7). On open plains or in open savannas, wooden or aluminium posts with forked ends are used to support the nets. The length of netting used will depend on the number of animals to be captured, the terrain and the number of available assistants. The following guidelines apply here:

- For each animal the size of an impala two adult assistants are necessary, and for black and blue wildebeest, red hartebeest and larger animals three to four or more may be necessary.
- The manner in and expertise with which the animals are removed from the nets and held are critical to the success of the capture.
- The nets are often erected near perimeter fences. This helps to herd the animals in a fixed direction (Figures 33.9 and 33.10), although the animals may injure themselves by running into the fence.
- The nets should be camouflaged as well as possible. In open habitats, the colour of the nets must blend with the colour of the vegetation.
- The nets must be erected along existing animal trails.
- The normal flight paths of the animals should be studied several days before the nets are erected and capture starts. This will help to place the nets in the most effective position across a flight path.

2.3.2 *Drop-nets*

Drop-nets 30 and 50 m long are attached to a light cable with soft binding wire or twine (Figure 33.11). The attachments must be of such a nature that the nets are tied to the cable lightly, but will drop when hit sharply. When the ties break, the nets fall onto the animals and entangle them. The



Figure 33.7 A drop-net erected in a savanna area.

Photo: Gauteng Nature Conservation.



Figure 33.8 A mobile loading ramp and pens for use with a capture boma.

Photo: H. Ebedes.

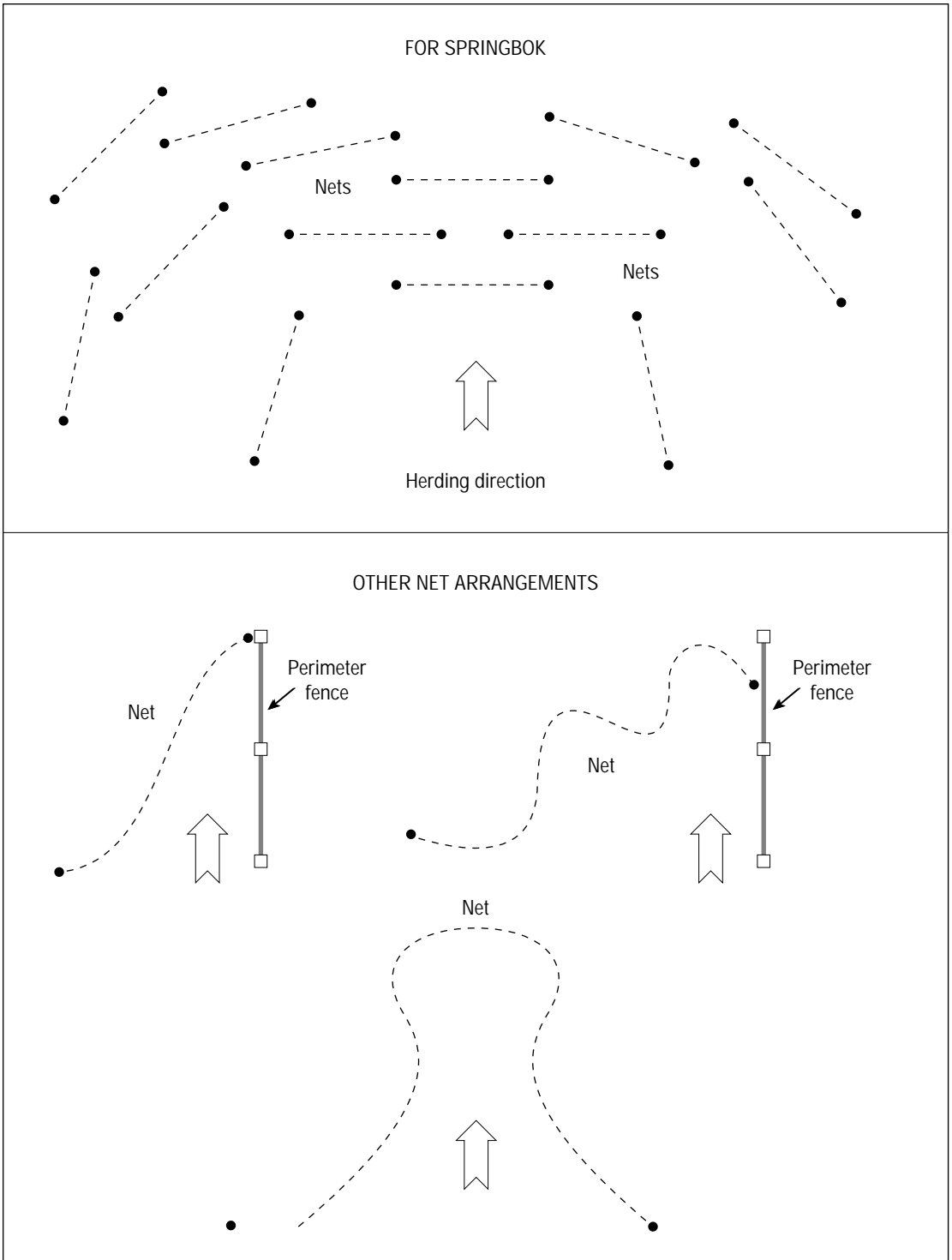


Figure 33.9 Possible arrangements of drop-nets for the capture of wild animals.

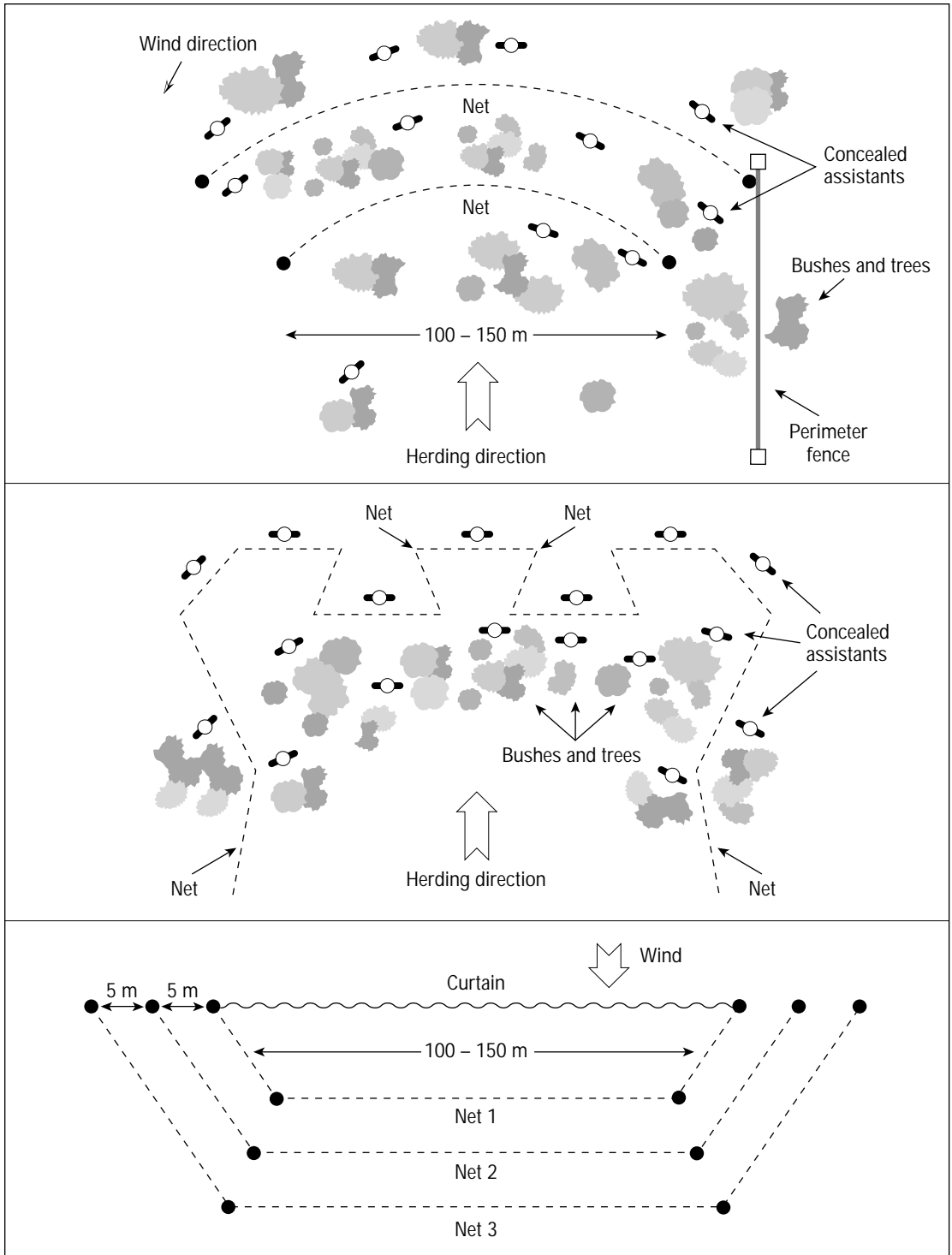


Figure 33.10 Three alternatives for the erection of nets in bushy areas and alongside fences in savanna areas.

Source: Pienaar (1973).

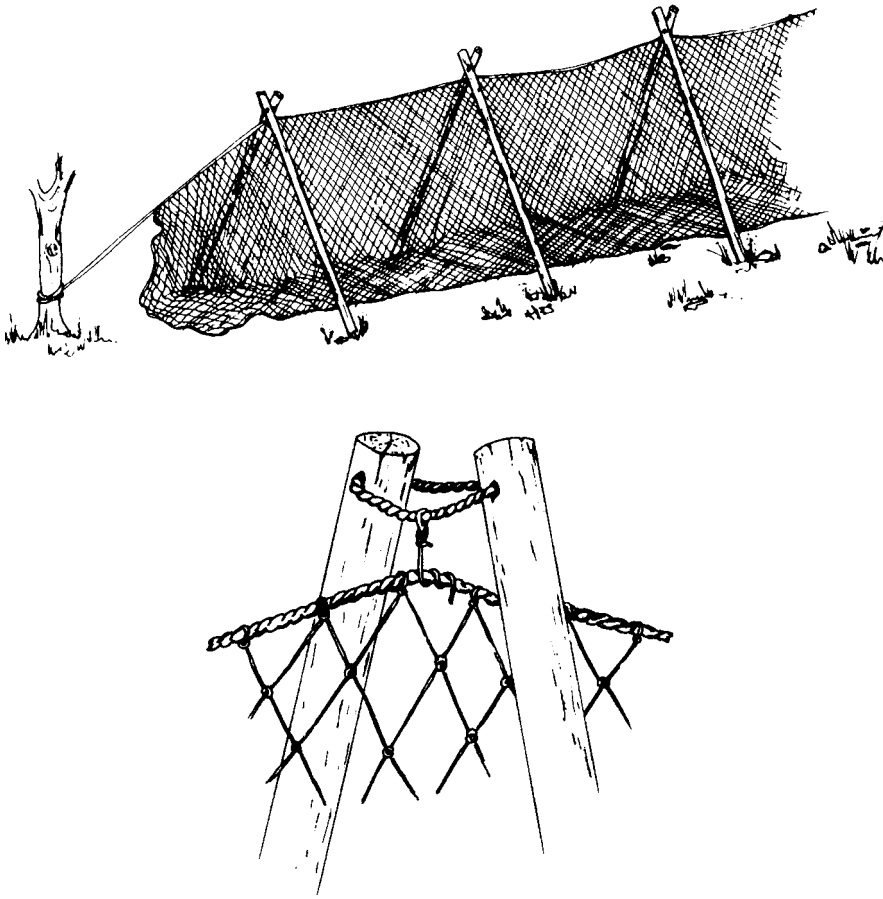


Figure 33.11 Erecting drop-nets with support posts in open plains.

Source: Adapted from Hofmeyr et al. (1977).

height of the net depends on the type of animal being captured. A net 3 m high is usually sufficient for most medium-sized and large animals. In savanna areas, tree trunks, bushes and support posts are used to support the nets. In grassveld areas, only support posts are used (Figure 33.7). The nets must hang loosely and approximately the bottom 1 m of the net should lie flat on the ground, first to trap and entangle the limbs of the animal and then to prevent the animal from lifting the net with its horns to escape.

There are many different ways of arranging the nets to prevent the animals from escaping and ensuring that the maximum number of animals can be caught (Figures 33.9 to 33.11). A series of

nets should be put up, so that any animal escaping from the first net will be captured in the second or third net (Figure 33.10). The nets must be well camouflaged, and their placement is crucial. Knowledge of the flight and feeding behaviour of the animals is essential when a suitable terrain is selected for erecting nets.

Sites for drop-net capture can be changed easily because the dismantling and setting up of drop-nets take little time. However, the terrain where the nets are set up must not be changed too often, because this may disturb the normal daily routine of the animals in such a way that they become restless and wary. This makes them difficult to capture.

The nets should be erected downwind of the herding point to prevent human scent from reaching the animals to be captured. The animals can be herded towards the site by six to eight people on horseback, by vehicles moving close to one another in a line, or by a long line of beaters making a noise by hitting sticks or tin cans. A helicopter can also be used. Two or three scrambler motorbikes may be used, provided they are handled by responsible people who know exactly what their duties are. The motorbikes can especially be used for herding any animals that stray to the sides. Motorbikes have been used successfully in the capture of black wildebeest, springbok and blesbok.

The assistants who are to capture and handle the animals must be well hidden near the nets (Figure 33.10). They must be instructed properly and must know exactly what their duties are and how the animals must be held, blindfolded, extricated from the nets and loaded into the crates or transport vehicles. As soon as the animals reach the nets, enough help must be on hand to remove the animals from the nets as quickly as possible and to cover their eyes with a blindfold. This will prevent further entanglement and possible suffocation. Special attention must be given to the head and neck areas of the captured animals. The animals must be prevented from choking and suffocating. When released from the net and held physically, the animals must be handled gently but firmly. There should be enough help available to hold the animals without too much wrestling and struggling. A blindfold must be placed over the eyes as soon as the head and neck have been extricated from the nets. The animals must be handled carefully when being loaded. Stretchers must be used to move the animals from the nets to the loading site and vehicles. The head and neck should always be kept above the chest while the animal is being held or carried to prevent bloat or the vomiting of rumen contents and subsequent choking. Care should always be taken not to put any pressure on the throat region because the windpipe can be closed off easily and the animal may suffocate.

When tranquillizers or immobilizing drugs are used, the person responsible and his assistants must be at the capture site so that the drugs can be injected immediately after capture. These drugs must be administered while the animals are still caught in the nets, but this should not delay the release of the animals from the nets. The animals will calm down within a few minutes after

the drugs have been injected by a competent person. After the injection has been given, the animal must be held down firmly in a comfortable position for another five to ten minutes to allow the tranquillizer to take effect. All loud noises and undue shouting are forbidden because these may cause further stress.

If drop-nets are used in thick bush, small movable holding pens or temporary pens made of hessian and wire mesh fencing can be erected near the capture site to hold the animals until the full quota of animals has been captured. A certain degree of sorting can take place here. If the animals are not tranquillized and calm, they should not be kept in the temporary pens for too long because this increases their stress. Animals are transported better when they are loaded soon after their capture.

2.3.3 Drop-nets combined with a capture boma

This method is known as the Hofmeyr method and was originally developed by Hofmeyr et al. (1977) specifically for the mass capture of springbok in Namibia. However, it can be adapted for the mass capture of other wild animals such as blesbok and impala (Figure 33.12).

Two fixed nets are erected and suspended between a perimeter game ranch fence and a circular capture boma. A wall of plastic sheeting or hessian is erected about 150 to 300 m from, and parallel to, the fence. This wall and the fence and net form a wide-mouthed funnel leading to the boma into which the springbok are herded. The capture boma has two openings that are closed by curtains at points E and F in Figure 33.12. It also has a capture funnel, holding area, loading funnel and loading ramp. Capture team assistants hide in the bushes near the nets.

The animals are herded towards the boma and those animals that run along the fence are captured in the nets. Animals that try to avoid the net by veering off, run into the capture boma and the holding area. The assistants remove the animals that are captured in the net. They are then blindfolded, injected with tranquillizers and loaded immediately into the transport crates. The animals captured in the boma are herded towards the loading funnel where they are sorted according to age and sex, tranquillized and loaded.

The animals are transported as soon as possible after capture. Using this method with haloperidol tranquillization soon after capture has

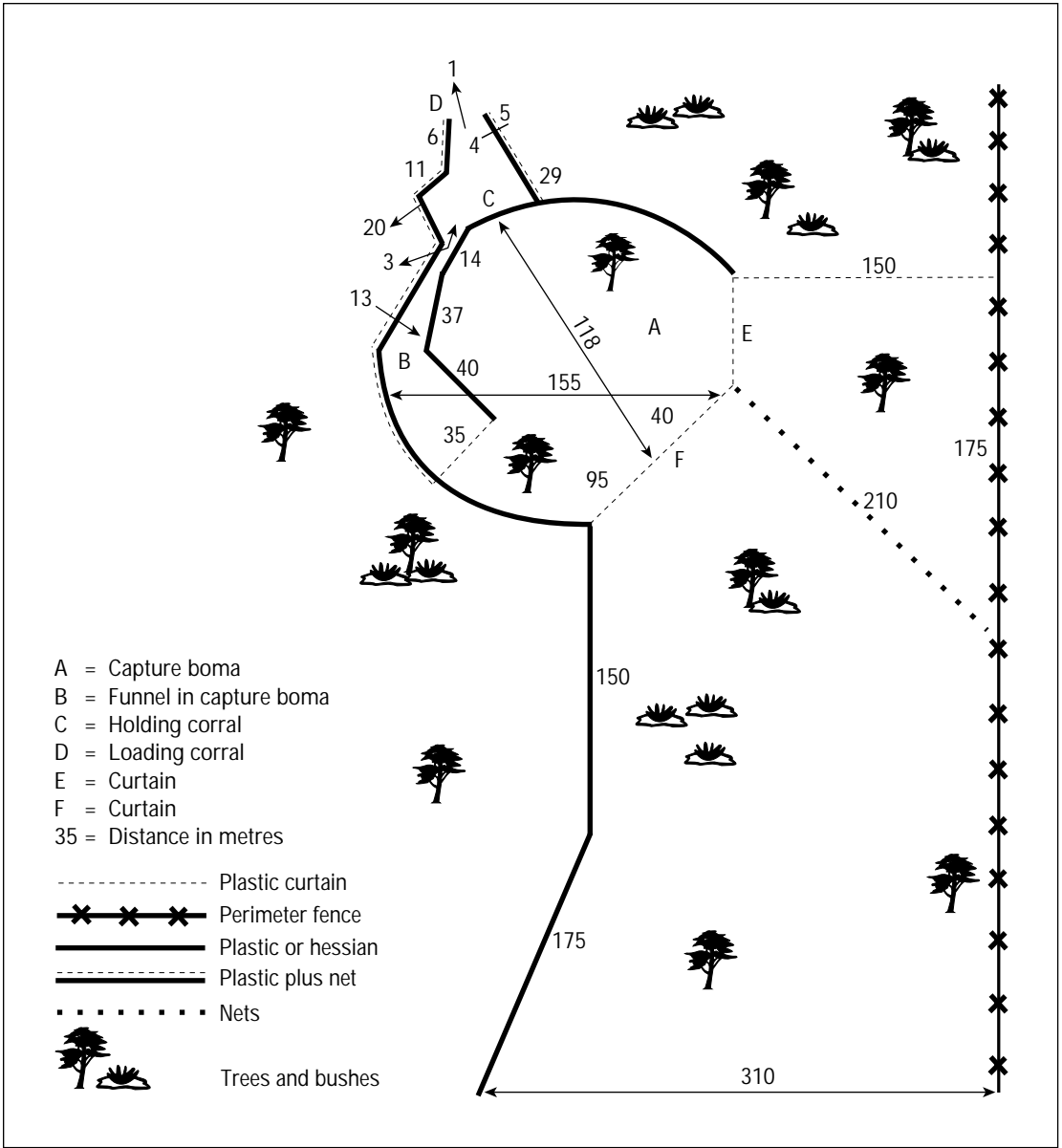


Figure 33.12 Drop-nets combined with a capture boma for the mass capture of springbok. Note that placement of the nets next to a perimeter fence may lead to unnecessary injuries.

Source: Adapted from Hofmeyr et al. (1977).

resulted in significantly fewer injuries and mortalities than with other methods of capture and transportation without tranquillization. The use of haloperidol (Table 33.1) has resulted in a dramatic drop in deaths amongst springbok due to net capture. In the past, these mortalities were

unrealistically high, but ever since haloperidol has been used in the capture and transporting of springbok, the mortality rate was decreased from over 50% to 2% or less. Achieving a low mortality rate requires the transportation of the animals to be optimal.

Table 33.1 Doses of haloperidol in mg for the tranquilization of wild animals after their capture

Animal	Adult male	Adult female	Young animal	Lamb or calf
Blesbok	15	10	5–10	5
Burchell's zebra	30–40	25–30	15–20	–
Duiker: common	5	5	5	2–5
Hartebeest: Lichtenstein's	10–15	12	10	–
Hartebeest: red	15–20	10–15	10	5
Impala	10–15	10	5	5
Kudu	20–30	15	10	5
Lechwe	10–15	12	8	5
Nyala	15–20	15	10	5
Oribi	10	5	–	–
Reedbuck	10	10	5	–
Springbok	10–15	5–10	5	2–5
Steenbok	5	5	2	2
Tsessebe	20	15–20	10	5
Wildebeest: black	15–20	10	5	5
Wildebeest: blue	20–25	15	10	5

Note: All the syringes and needles used for the injections must be sterilized before use and be kept in a clean and safe place.

2.4 Pop-up and drop-down corrals, and the SLAM system

Pop-up corrals are based on the principle of trapping animals in a corral of plastic sheeting hidden in a ditch around the capture area. Drop-down corrals follow the reverse procedure, with nets dropping from overhead storage to the ground. Special trigger mechanisms activate the corral in both cases. Pop-up and drop-down corrals can be erected around waterholes. If one does not want any disturbance at or around a waterhole, or does not want to spoil the beauty of the waterhole, the corral can be erected elsewhere and the animals can be attracted to that area with supplementary feed, antelope cubes and salt licks.

The erection of a pop-up corral requires considerable preparation. A level, continuous ditch 300 mm wide × 300 mm deep with a circumference of approximately 300 m is dug around the capture site. If the capture site is to be used for a few years, the ditch should be lined with concrete. The capture sheeting is then hidden in the ditch (Figure 33.13) and covered with loose soil and grass. Holes the same depth as the ditch are

dug 5 m apart next to the ditch and lined with concrete. The holes should be just wide enough for metal posts to fit firmly into them. Alternatively, suitable metal sleeves can be concreted into the ground to hold the posts firmly.

The metal pipes are placed into the holes and anchored with a support. Each pipe has a pulley welded to the top. A thin cable attached to a weight in the pipe and to the cable of the capture sheeting runs over the pulley. When the weight in the pipe moves downwards, the capture sheet is pulled up. A clip holds the weight in a raised position. As soon as the clip is activated by a manual or radio trigger mechanism, the weight is released. As it falls to the base of the pipe, the capture sheeting is pulled upwards. The weights keep the sheeting raised.

The usual plastic capture sheet is approximately 3 m wide and has seams along the upper and lower edges. Two thin steel cables are threaded through both seams and the sheet now measures approximately 2.5 m. The sheet is folded neatly and placed in the ditch. As mentioned before, each pipe has a thin cable attached to the weight in the pipe and fixed to the sheeting. A loading

and sorting facility should be included in the layout.

A few days before the capture, the weights are raised, anchored with the clip, and the rolled-up sheet and cable are hidden in the ditch. A layer of

sand or grass is strewn over the ditch and sheet to camouflage it so that animals are not disturbed. When the capture corral is not erected at a waterhole, bales of forage, antelope cubes, salt or mineral licks can be placed in the middle of the



Figure 33.13 Part of a radio-controlled pop-up corral. The ditch – with the plastic sheeting, cable, metal pipe, trigger mechanism and radio antenna (see arrow) – is clearly visible.

Photo: H. Ebedes.

capture area to attract the animals to the area. When the desired animals are within the capture area, the trigger mechanism is activated.

Capture corrals are used by the South African National Parks at the Golden Gate Highlands National Park and elsewhere. Two versions of pop-up corrals, both protected by patents, are available commercially in South Africa. The original Rivsco capture corral is activated by a manual trigger mechanism. In another patented version, the trigger mechanism is controlled by a device activated by a remote-controlled radio signal. This signal can be activated from a distance of up to 1 km. The advantage of the radio-controlled method is that the person activating the trigger release signal does not have to be near the capture area because the triggers are activated from a distance.

A special radio-controlled trigger mechanism for pop-up and passive capture bomas is available from Wildlife Decision Support Services, P.O. Box 73528, Lynnwood Ridge 0040, South Africa, or at tel. 012 991 3083.

The National Zoological Gardens have pop-up and drop-down corrals at their breeding stations at Lichtenburg and Potgietersrus, and they use these methods successfully to capture different animals. For eland and kudu, the sides of the corral are raised to 4 m to prevent them from jumping out. More information can be obtained by visiting these breeding stations once arrangements have been made with the Director of the National Zoological Gardens in Pretoria.

The advantage of pop-up and drop-down corrals is that the animals are never herded. This eliminates shock and capture myopathy. Selected animals can be captured throughout the year. After the initial expense of the labour, plastic sheeting, posts, solenoids and electronics, there is little additional expenditure or maintenance. When no capturing is being done, the plastic sheeting should be stored because it deteriorates in sunlight. The animals must be tranquillized and loaded immediately after their capture, so that they do not run around the capture corral for too long and exhaust themselves trying to escape.

The disadvantages of the system are that some animals drink only at night, and it is difficult to capture animals in the dark. Nor is it desirable to load animals in the dark. Furthermore, capturing

at a waterhole always creates a disturbance and it may take some time before the animals remaining in the area settle down again.

A new static live animal manipulation system (SLAM) was described briefly in Anon. (2001). This system uses a series of interconnecting gates and a set of curtains that are drawn with a radio-controlled trigger mechanism. The system is mobile and can be erected and moved easily.

More details are available from
Erich or Rudolf Graupner
P.O. Box 55, Bray 8620
or e-mail: graupner@worldonline.co.za
or at tel. 082 826 2444 or 082 829 2000

2.5 Permanent capture bomas

This passive capture system is based on establishing small capture camps of about 50 ha, each with a funnel, capture boma and loading ramp near to or around a waterhole. The layout of these camps forces the animals to move through a large gate from a large camp to the small camp containing the capture boma if they want to drink water. The capture funnel and capture boma have 3 m high walls with 21 steel strands along the side fence of the camp. To capture the animals, the gate is simply closed to prevent them from returning to the large camp. The animals are held in the small camp for a few days. When they have become used to the small camp, plastic or hessian sheeting is hung along the sides of the funnel and capture boma. The animals are then herded with vehicles, horses or on foot towards the capture boma and funnel. As soon as they are trapped, the curtains or gates are closed behind them and the animals are loaded into the transport vehicles or the crates at a loading ramp. The animals can also be lured to the capture boma by salt licks, mineral licks and feed, such as lucerne. Old lands previously planted with teff, lucerne or beans can also be used to lure the animals to the vicinity of the capture boma.

Another form of passive capture of wild animals comprises a permanent boma of about 1 ha constructed around a waterhole or lick. The boma is tear- or pear-shaped. The narrow end has an entrance that can be closed off with pop-up, drop-down or movable curtains. Next to the entrance, a loading funnel leads to a loading ramp. The loading funnel has successive curtains to cut off the return of the animals. The capturing of the animals is controlled from a lookout tower. More details appear in Du Plessis & Du Plessis (2000).

Animals captured in passive capture bomas should never be culled (shot) in the boma because it will prevent other animals from entering the boma for a long time after such culling.

2.6 Lasso capture

Animals are herded using light trucks or horses and are captured on the run with a pole lasso and thongs. This method is often referred to as "Hatari style" capture. The name comes from a motion picture produced in East Africa in which wild animals, especially rhinoceroses, were captured using a lasso. This method, however, is not recommended anymore because the animals have to be chased far at a fast pace and the stress factor is high, not only for the animal that is being captured, but also for the rest of the herd and even for the capture team. It requires great concentration and skill and is dangerous to all concerned.

In earlier times, this method was commonly used in Africa for supplying animals to zoos, but by current standards it is considered cruel and unacceptable. In East Africa thousands of animals, including black rhinoceroses, were captured by using the pole lasso. Many died as a result of capture myopathy and stress, with some dying weeks or months after capture. Nevertheless, the method will be described here briefly to give a proper perspective on what should and should not be done. Its use also marked the birth of what has become a highly professional skill.

For this method, the capturers use a light aluminium or dry bamboo pole 3 m long to hold a cotton thong or rope lasso. The animals are chased over open ground with two light trucks. The target animal is selected, cut off from the group and manoeuvred between the vehicles until the assistants on the back of the vehicles are able to slip their lassos around its horns and head. The vehicles then slow down and the animal is controlled using the ropes on either side of it. A tranquillizer should not be administered at this stage because the animal is in a highly excited and stressed state and is hyperventilating. Once the animal has calmed down somewhat, it can be given a tranquillizer and loaded into a crate.

Young giraffe, gemsbok, eland and red hartebeest have been captured by chasing them on horseback or in two vehicles as described. A capture thong is then placed around the horns or, in the case of a giraffe, around the neck. In Namibia, this method is still used for eland and giraffe. The

animals are herded slowly towards an open plain and then captured there as quickly as possible. An experienced person can drive next to a running eland, grab it by the horn and pull it towards the slowing truck. It will show little resistance.

2.7 Net guns

Although the net gun is not used often in South Africa, some professional animal capture operators do use net guns in special circumstances to capture large antelope in open areas. Gemsbok can be captured successfully with net guns in large, open, arid areas where other methods are too expensive or inefficient. In New Zealand and Australia, deer are captured successfully with net guns.

Square or triangular nylon nets to which metal weights have been attached are loaded into a special canister. The net is loaded into a three- or four-barrelled shotgun fired with a blank cartridge. The size of the net and the mesh size depend on the type of animal to be captured. Net guns can be mounted on the helicopter skid and be fired remotely by the pilot, or they can be hand held and fired by an assistant from the passenger side of the helicopter. Net guns that fire square nets are especially effective in open areas such as grasslands where there are only a few trees and shrubs. In areas with tall trees, a triangular net is more effective because it has a longer range.

In the inaccessible mountainous areas of New Zealand, deer are captured routinely from helicopters with net guns. After capture, the animals are blindfolded and injected with a tranquillizer or immobilizer. When the drug has taken effect, the fore- and hind legs on each side are tied with a wide, soft leather thong. The animal is then loaded onto a special stretcher and taken by helicopter to a holding area where it recovers. The stretcher or bag is designed so that the head and chest of the animal are higher than the body to prevent bloat and pressure on the diaphragm and lungs. A rope tied to the bag and the helicopter skid prevents the animal from swinging around in the air. The head points backwards. The animal is transported to a temporary holding area or to a vehicle where the antidote and a long-acting antibiotic are administered.

Alpine Helicopters from Wanaka and Paxarms from Timaru, both in New Zealand, manufacture net guns. Alpine Helicopters manufactures two versions: a net gun that can be hand held and

fired from the passenger side of a helicopter from which the door has been removed, and a net gun fixed to the skid of the helicopter and fired by the pilot from a control on the steering column.

2.8 Night capture with spotlights

This method has been used successfully for capturing impala and nyala because these animals can be blinded temporarily by strong spotlights. They can then be captured and handled. The capture must be arranged for dark, moonless nights when the animals cannot see well and are easily blinded. The members of the capture team should all preferably wear dark clothing or overalls and non-slip shoes.

One or two light trucks are used to move into an area where impala and nyala have been seen recently. Each vehicle has a team of catchers and one or two assistants to operate the spotlights. As soon as the animals are located in the beam of the headlights, the lights are dimmed and the vehicles move carefully through the bush to opposite sides of the animals. The vehicle drivers try to get as close as possible to the animals. When the vehicles are close enough, the spotlights are switched on. The animals are then blinded and confused. Members of the capture team now jump from the vehicles, quickly stalk the animals and catch the closest ones by grabbing females by the hind leg just above the hock joint, and males by the horns.

It takes two people to hold an adult impala. With big rams, one person holds the horns firmly near the head and the second person holds the flanks. Adult ewes are held around the neck and the flank. Young animals and lambs can be handled by one person. If possible, the animal should be restrained in a lying position on its sternum with its legs folded underneath it. The head of the animal must be held upright so that it does not sustain any injuries when it struggles.

Captured animals are blindfolded and injected with a tranquillizer such as haloperidol (Table 33.1) before they are loaded. It takes three to ten minutes for the tranquillizer to be effective. Once the animals have become tranquil, they are loaded into a dark crate on a third vehicle to be moved to a holding area. The blindfolds are removed only after the animals have been loaded. The animals can also be transported directly in the capture vehicle, provided the floor is padded with an old mattress or bags lightly filled with straw to prevent injuries to the legs during trans-

port. The animals must be supported in a sternal position all the time, with their heads lifted and the front and hind legs in the normal lying position.

Some people who have experience with this capture method recommend that the legs of the captured animals be tied with soft rope, leather thongs or nylon stockings. If this is done, one must ensure that the legs are not bound too tightly or for too long, otherwise the blood circulation may be cut off and this may result in permanent damage to the lower legs, crippling the animal for life. However, if the animals are adequately tranquillized it is not necessary to tie their legs. The animals must not be transported in hessian bags or even kept in bags temporarily. In their attempts to escape from the bags, they will become stressed and overheated. They may then easily die of overheating, overexertion and capture myopathy.

Ewes must not be captured when they are heavily pregnant or when they are nursing small lambs. The capture should be arranged when the lambs have already been weaned and are old enough to fend for themselves. This will be when the lambs are five to six months old. If the capture takes place when the lambs have not yet been weaned, every attempt should be made to capture the lambs with their mothers. When there are many impala lambs of a suitable size and age, it may be advantageous to concentrate on capturing lambs only. This is a sound policy because weaned impala lambs adapt and acclimatize better to a new habitat than adult animals, and it means that the adult ewes are left behind to produce more lambs for future capture.

The success of the capture depends largely on the capture terrain and the fitness and expertise of the capture team. Before the capture starts, all the helpers must be briefed fully as to what they must do, and on how to catch and hold the animals. The importance of correct handling to prevent injuries and eventual mortalities cannot be overemphasized. The capture team leader must also stress that team members must not break the beam between the animals and the spotlight (by walking through it) to ensure that the animals remain blinded. All those involved should understand this clearly.

When an animal is caught, support or help must be available immediately because one person alone cannot manage an adult animal. Although a large man may be able to catch and hold an adult impala, he may injure the struggling

animal. Once the animal is captured, it must be held securely because it will be difficult to recapture it if it were to escape. However, this does not mean that the animal must be handled or treated roughly. Rough treatment of any animal causes stress. When the hind leg is not gripped properly above the hock, the hip can be dislocated. The team leader must determine what degree of manhandling can be allowed. Any broken horns or necks should immediately indicate that the assistants are too rough in their handling of the captured animals.

2.9 The role of helicopters

Although helicopters are now commonplace, it is only since World War II that they have been licensed for commercial use. Since then, the uses of this versatile aircraft have multiplied. In southern Africa, the United States of America, Canada and New Zealand, helicopters have been used successfully for the capture of wild animals. In 1967, a South African Police Service helicopter was first used for locating and darting black rhinoceroses in Namibia. Since then, rhinoceroses have been captured in the Namib Desert and other arid and inhospitable areas by darting and immobilizing them from helicopters where no other method could have been successful. During a study of elephant migration routes in the Etosha National Park, ten animals were immobilized, marked and fitted with collars in one day. Without a helicopter, it is doubtful whether more than three or four could have been handled in a single day.

In 1973, more than 400 Cape buffalo were immobilized in Botswana in 36 days using a Bell three-seater helicopter in research on foot-and-mouth disease. This is a mean of 12 buffalo per day. Without a helicopter, it would have been impossible to capture so many animals under the prevailing conditions. In another capture operation in Bushmanland in Namibia, 74 roan antelope were immobilized from a helicopter in terrain inaccessible to motor vehicles. In a capture operation lasting several days in the Kasungu National Park in Malawi, more than 70 adult and young Lichtenstein's hartebeest were herded by helicopter into a plastic capture boma where they were injected with a tranquillizer before being transported without the loss of a single animal.

Many more examples can be cited of how helicopters have helped in conservation efforts all over the world. Today, helicopters are used rou-

tinely to capture and save rare and endangered animals, and to capture tens of thousands of other animals for relocation and auctions. Some professional capture teams use their own staff to fly their own helicopters. Others make use of experienced pilots who either own their helicopters or merely contract their services or rent out their equipment. When the services of an animal capture operator are required, it is advisable to make arrangements early in the year so that a capture programme can be compiled for the short capture season. Private helicopters with trained pilots may also be contracted for special and unexpected capture procedures.

2.9.1 Methods used

Helicopters can be used for the capture of wild animals in three ways:

- Herding animals towards a capture site with a capture boma or nets
- Immobilizing animals with darts from a helicopter
- Capturing animals by using a net gun

These methods save time and prevent costly repairs to ground vehicles. One of the most important advantages is that family groups can be captured. This aids the transportation, relocation and adaptation of the animals to their new habitat. The main aim of any capture technique is to capture the required number of animals using the quickest and least expensive method that will cause the least stress and injuries to the animals. A helicopter is ideal for this purpose.

2.9.2 The pilot

Since it is well known that there are many possible causes of capture myopathy and that precautions have to be taken to prevent stress in wild animals, the helicopter pilot herding the animals has several tasks and should have the following abilities, qualities and knowledge:

- Besides being sympathetic towards animals, the pilot should be able to fly low and execute daring but safe manoeuvres in bush conditions. The welfare of the animals must always be the first priority.
- The pilot should have a fair knowledge of the behaviour of the animals to be captured, and should especially know how they behave when they are being herded.

- The pilot should advise the seller or buyer when the herding of the animals by helicopter is no longer economical.
- The pilot should report the sighting of any animal carcasses to the owner.
- It is important that the pilot has proper radio communication with the capture team at all times. The pilot should advise the ground team timeously as to the number of animals being herded, especially when tranquillizers or horn pipes are needed or male animals have to be separated from the rest. The capture team can also advise the pilot of changes in the wind direction or of any problems they may have, such as not being ready for the capture.
- Planning the erection of a capture boma from a helicopter saves time. Any roads leading to the site can be identified and scouted, and animal concentrations can be found by following the direction of animal trails. Thus, it can be established whether the boma is centrally and correctly placed.
- Special attention should be paid to tall trees, telephone lines, radio towers and power lines that could be a safety hazard.
- The pilot can help to plan the boma, thus easing the pressure on him if the boma is planned correctly with his needs in mind. This will also save capture time and expenses. It is therefore necessary for the pilot to have a sound knowledge of boma planning, erection and function.
- The pilot should be able to recognize the sex and age differences of the animals to be captured.
- The pilot should fly low and slowly along the boma entrance to sweep the entrance before the capture. Any drag marks of the capture materials, and human scent and tracks will be blown away by the down draft caused by the rotor blades of the helicopter.
- A trial run is recommended to see whether there are any unforeseen problems.
- The pilot should be able to handle considerable stress with aplomb. Patience is also required when herding the animals.
- He should allow the animals time to rest. The animals should also be herded slowly but surely while being kept together. It is only at the end that the animals should be pushed quickly into the capture boma or nets.
- It must always be remembered that the first signs of capture myopathy and stress may be seen when the animals are kept together and herded. A good pilot is therefore in an excellent position to prevent or limit the degree of capture myopathy and stress in wild animals.
- Animals found near a waterhole may have drunk recently and it may be detrimental to herd them over a long distance to the capture boma.
- Some animals such as impala, black wildebeest, springbok and tsessebe are difficult to herd because they do not fear the helicopter. Moreover, they can easily change direction while running. This happens especially when the animals have been herded before or are exhausted.
- Nyala and bushbuck are not herded easily by helicopter. They usually run off in any direction and try to hide under trees. Kudu bulls and impala rams often refuse to move at all.
- The pilot should note any animals that are next to or close to the perimeter fences. He should prevent them from jumping over the fence or going through it and escaping.
- Animals should not be captured after a heavy rainstorm when the ground and grass are wet and slippery. Under these conditions, the herded animals may slip and injure themselves by tearing muscles and straining tendons.
- Various species should not be mixed because they may fight and even kill one another.
- The animals should be herded from as close to the capture boma as possible because this saves time and money, and is less stressful for them.
- Animals in poor physical condition should be herded slowly and with exceptional care.
- All animals, but especially impala, should never be herded when the ambient temperature exceeds 25°C.
- Animals should never be herded fast through areas where ridges, rocks, deep sand, gulleys or dense bush occur because the animals may fracture their limbs or sustain other injuries.

2.9.3 The animals being herded

The pilot should treat and herd the animals in the following way:

- The pilot should be familiar with the calving times of the animals to be captured. Cows with young, unweaned calves should never be captured.
- Only manageable groups of animals should be herded at a time. Capturing too many animals at one time causes loading and sorting problems that may result in deaths.
- The animals should be directed to the boma entrance from a distance, whenever possible. This will make the drive easier because some animals are not easily turned when running at speed.
- The pilot should herd the animals past the first three curtains and then move the helicopter away. From there and on to the loading area the animals should be herded by the ground staff.
- Certain male animals such as adult impala rams fight with one another or with the females in a boma. They should be separated from the group before they reach the entrance, and can be captured at a later stage.
- The pilot should herd the animals along the shortest and easiest route to the capture boma.
- Different family groups of especially Burchell's zebra and the mountain zebra *should never be mixed during the capture*. Mixing different family groups is the major source of trauma and injury for zebra.
- Animals that are found near the boma entrance but are not part of the capture quota should be turned away before they enter the capture boma.
- Animals that refuse to enter the boma should be encouraged to join the groups that were cut out of the herd near the boma. If they are not turned away, they will refuse to enter the boma again, causing some of the herded animals to follow them and thus preventing their capture.

2.9.4 The helicopter

The helicopter should be treated in the following way:

- The helicopter should not be parked on the ground in an area where cattle or other animals such as eland, spotted hyaenas, rhinoceroses, elephants, baboons or monkeys can damage it.
- The helicopter must be serviced before every

take-off and all flights must be conducted in a responsible and professional manner.

- Fuel drums must not be left uncovered or at such an angle that dew or rainwater can enter them.
- Pumps with filters should be used when refuelling the helicopter.
- The plug of the fuel tank must be secured tightly after each filling.
- Staff must ensure that the refuelling hose does not become entangled in the helicopter frame before take-off.
- Landing in the boma entrance should be avoided because fuel and oil spills and smells may result in the animals refusing to enter the boma.
- The landing zone must be on level ground in an open area. It must be sprayed with water to prevent dust, and any loose branches must be removed. Avoid areas in sandy regions that contain burrows of animals.

2.9.5 Immobilizing animals from the air

When an animal is immobilized from a helicopter, it must never be chased too far before being darted. The approach and descent to dart the animal must be rapid and precise. Once the animal has been darted, the helicopter must move away immediately to let the animal settle down until the drug has taken effect. The animal must be watched from a distance until it lies down. It must never be herded further once it has been darted, as this will increase the stress and may lead to injuries or capture myopathy.

2.10 Chemical capture

Various drugs are used to immobilize and tranquillize wild animals so that they become manageable. These immobilizing and tranquillizing drugs are usually administered by means of special aluminium or plastic darts. The darts are fired from a distance by any of a variety of dart guns. The drugs can also be injected with ordinary syringes and special pole-syringes after the animals have been captured in nets or by other mechanical means.

When an expert uses this capture technique it looks simple and easy. However, it is naive to think that any novice armed with a syringe, darts and a dart gun can immobilize or tranquillize wild

animals successfully. Knowledge, scientific background, training and expertise are all necessary to perform a capture operation correctly. A person using drugs for wild animal capture must especially know what to do when things go wrong. However, when all goes well it is indeed remarkably easy.

Chemical immobilization is used primarily when individual animals have to be captured from a herd, or for the capture of dangerous and unmanageable animals such as elephants, rhinoceroses and hippopotamuses. It is also used to capture aggressive and difficult animals, such as gemsbok, roan antelope, sable antelope, adult eland and kudu bulls. Giraffe can be captured successfully with immobilizing drugs and this is cheaper than other methods. Moreover, it allows young animals to be selected and it therefore becomes unnecessary to herd an entire family group just to capture some young animals. Other reasons for using chemicals to capture wild animals are:

- To examine and treat sick and injured animals or animals caught in snares or traps
- To remove aggressive individuals from a group of animals that were captured by other means
- To select and sort specific animals from a group
- To mark animals for ecological and other studies
- To capture and retrieve animals that have escaped from a wildlife area
- To collect blood for disease studies and surveillance, such as for foot-and-mouth disease surveys
- Safari darting or green hunting

Chemical immobilization is a safe and effective capture method when applied correctly and competently, and has the following main advantages:

- It is the safest and most economical method for capturing rare and valuable animals. However, it must be emphasized that a responsible and experienced person must perform it.
- It is more economical than other methods when only a small number or single animals are to be captured.
- It is the safest method for capturing, handling, loading and transporting large and/or aggressive animals.
- It is a useful method for removing aggressive or injured animals from holding pens or transport crates.

- Because there are antidotes to reverse the effect of some of the drugs, even an overdose of these capture drugs is unlikely to kill the animals.

Chemical immobilization has the following main disadvantages:

- The two main immobilizing drugs currently available in South Africa are M-99 (Novartis) or etorphine hydrochloride, and Fentanyl (Janssen Pharmaceutica) or fentanyl citrate. Both these drugs are strictly controlled by the Medicines Control Board. According to current legislation, these immobilizing drugs are classified as Schedule 7 medicines and may not be sold to any person other than a veterinarian or a pharmacist who can dispense them upon receiving a veterinary prescription. Various other clauses in the relevant Act make it difficult for a non-medical person to possess and use these immobilizing drugs without special permission from the Director-General of Health.
- The handling of the darting equipment, immobilizing drugs and the immobilized animals after capture requires a certain level of professional expertise.
- The firing range of some dart guns is limited and animals are often too far away for this immobilization method to be used. Animals in a group or herd are often disturbed by the shot and may run away. It then becomes difficult to approach them again.
- Immobilized ruminants must at all times lie on their sternum or chest to prevent bloating and the inhalation of fluids or the stomach contents into the lungs, with subsequent suffocation or pneumonia.
- When a dart does not penetrate a suitable muscle, the absorption and action of the immobilizing drug are delayed. The animal may then exhaust itself before the drug becomes effective. This could result in the animal dying of exhaustion or capture myopathy.
- If a dart does not function properly or is incorrectly loaded, or if only a small portion of the immobilizing drug is injected or the dose is inadequate, the animal can exhaust itself by running too far. This can lead to capture myopathy. The immobilizing drug is then often incorrectly blamed.

- The tracking of immobilized animals in dense bush or rocky areas may damage the retrieval vehicles. It can also result in the immobilized animal not being reached in time.
- When the animal cannot be darted from the ground or from a vehicle, a helicopter has to be used.
- The best capture equipment and immobilizing drugs available are expensive because they are imported.
- Some drugs may have adverse and untreatable effects or side effects on an animal.
- Most of the immobilizing drugs are safe if used correctly, but animals can die from overdoses, especially if the correct antidotes or other life-saving respiratory and cardiac stimulants are not administered timeously.

2.10.1 Immobilization and tranquillization

The two terms “immobilization” and “tranquillization” are often confused. **Immobilization** occurs when the animal that has been drugged is brought to a standstill, is unaware of its surroundings and is usually anaesthetized. The voluntary muscles of the animal are immobilized. The animal usually lies down, can be handled easily and without danger and feels no pain. **Tranquillization** occurs when an animal is aware of its surroundings but does not appear to mind where it is, even if in a strange and unfamiliar place. The animal can usually stand, but it may also lie down. However, it cannot be handled easily and reacts to stimuli such as pain or noises. Tranquillizers modify the behaviour of the animal and tranquillized animals often lose their fear of humans. They may also lose their aggression. High doses or an overdose of a tranquillizer may act as a **sedative** and cause the animal to fall asleep. Excessive doses of some tranquillizers have a cataleptic or stiffening effect on the body, so that the animal remains immobile and in a fixed position for several hours. When this condition persists, the animal does not eat or drink and it may eventually die of starvation or dehydration.

Tranquillizers are used primarily for the relief of anxiety and fear and the decrease of motor activity. They are usually mixed with immobilizing drugs for the capture of most types of animal. The combined effect of these drugs is more powerful than that of any one alone and consequently

enhances immobilization and improves muscle relaxation. Tranquillizers must be used in combination with the immobilizers M-99 and Fentanyl for immobilizing animals such as eland, kudu, nyala, waterbuck and gemsbok, because these animals become excited before immobilization is effective. Tranquillizers will also help prevent unnecessary struggling, shock and anxiety. Moreover, they keep the animal calm after the effects of the immobilizing drugs have been reversed.

2.10.2 Immobilizing and tranquillizing drugs

Two immobilizing drugs, M-99 (Novartis) and Fentanyl (Janssen Pharmaceutica), are commercially available in South Africa for the immobilization of wild herbivores. They are both morphine products and are often called opiates because they are derived from the poppy seed in a way similar to opium. The drugs are classified as narcotics and are dangerous to humans because they are habit-forming and can lead to severe drug dependency and addiction. The drug M-99 is 10 000 times more potent than morphine. These drugs can also be lethal to humans and are imported under strict international control especially for use on animals.

Owing to their addictive properties and the danger of these drugs to humans, they are strictly controlled by the Department of Health. The greatest danger is that humans are particularly sensitive to these drugs and being exposed to even the minutest quantity can be fatal. The drugs must therefore be handled with extreme care and caution, and be kept under the control of a responsible person at all times. The drugs should be locked away in a safe place, and protective rubber gloves must always be worn when handling them.

By law, a register has to be kept of the quantities of these drugs received and used. The register must be controlled and brought up to date every three months. Legally, the drugs are classified under Schedule 7 and their importation and distribution are controlled by the Medicines Control Board. However, permission for non-professional persons to stock and use these drugs can be obtained from the Director-General of Health on the recommendation of the Medicines Control Board. In terms of Act 13 of 1938, a habit-forming drug may be supplied by a pharmacist to any person who has a prescription. In this case, the prescription must be issued by a veterinarian and

must state: **“For animal treatment only”**. The following information must also be given on the prescription:

- The name and quantity of the drug prescribed
- The name and address of the person or institution requiring the drug
- The name, address and qualification of the person signing the prescription
- The date of issue of the prescription

A veterinarian who prescribes immobilizing drugs for a capture operator or game ranch manager for the capture of wild animals may still be held responsible for its use or abuse. The veterinarian can also be held liable for any accidents, poisoning or death of any human or animal caused by the accidental or deliberate use or abuse of the drugs. To prevent this liability, the veterinarian must obtain a legal indemnity from the person to whom a prescription is issued. It is understandable therefore that veterinarians are extremely reluctant to issue such prescriptions.

In the United States of America, federal law restricts the use of narcotics to specially licensed veterinarians. It is exclusively restricted to veterinarians working in zoos and those with practices in which they treat wild animals. Researchers involved in bona fide research or in animal control programmes where wild animals are captured can also obtain licences to stock and use M-99. In Zimbabwe and Namibia, all the capture operators must be licensed to use M-99. In many other countries, the use of M-99 is totally forbidden.

It is preferable that experienced wildlife veterinarians are involved in the immobilization of valuable animals. Much has been published on the capture of wild animals in southern Africa and a list of some of the scientific publications that may be of interest appears at the end of this chapter. For more detailed information on immobilizing drugs, the reader is referred to the book *The capture and care manual* by McKenzie (1993).

■ THE DANGER TO HUMANS

Immobilizing drugs are dangerous to humans and animals and must always be handled with the greatest of care. Humans are especially sensitive to M-99 because it has a depressant effect on respiration. ***The injection or consumption of only a drop of M-99 is sufficient to kill an adult man within a few minutes if the correct antidote treatment is not administered immediately.*** Whenever immobilizing drugs are used for the capture of animals, a sufficient

supply of made-up antidote such as Narcan, Lethidrone or Naltroxone (Kyron Laboratory) and sterile syringes and needles must always be available to be injected immediately in possible emergencies.

Symptoms of M-99 toxicity in humans

As there always is a possibility that someone may be injected accidentally by an immobilizing drug such as M-99, its symptoms in humans are described briefly. They are:

- Dizziness
- Nausea
- Excitement or depression
- Hallucinations
- Drowsiness
- Pinpoint pupils
- Slow and shallow breathing and respiratory depression
- Weak pulse rate and a drop in blood pressure
- Cyanosis of the mucous membranes, causing the patient to turn blue
- Loss of consciousness
- Heart failure and death

Procedures after exposure to M-99

Notwithstanding the following procedures for emergencies in the field, medical help should always be sought immediately. Even when the person has apparently recovered completely after receiving the treatment mentioned below, he should still be examined by a medical practitioner. If there is any danger that M-99 may have been absorbed, ***the antidote must be injected immediately*** and the following procedure followed:

- If the drug has been spilled onto broken skin or splashed into the eyes, inject the antidote immediately. Then wash the affected parts with an abundance of water.
- When a person has been accidentally injected intramuscularly or subcutaneously, inject one of the following antidotes: 1 ml of Narcan (0.4 mg of naloxone hydrochloride) intravenously or intramuscularly. Repeat the dose at intervals of two to three minutes if the symptoms are not reversed. Inject 1 ml of Lethidrone (10 mg of nalorphine) intravenously or intramuscularly if Narcan is not available. Repeat at intervals of five minutes when necessary, up to a total dose of 4 ml of Lethidrone.

- If neither Narcan nor Lethidrone is available, then 0.1 to 0.2 mg of M-5050 should be injected intravenously. Repeat if the breathing of the patient does not become stronger and regular.

It is vital that normal respiration and heartbeat are maintained until medical help is obtained. When necessary, artificial respiration, mouth-to-mouth resuscitation and external heart massage must be applied. Also, ensure that the patient is in the correct position for first aid before artificial respiration or mouth-to-mouth resuscitation is applied. The following additional guidelines are important:

- Whenever immobilizing drugs are used in the field, it is always advisable to have a specific person present who knows what to do in the case of an emergency.
- A supply of Narcan *must always be available*. However, ensure in advance that the expiry date has not elapsed.
- Always wear rubber or plastic gloves when filling darts with M-99 (Novartis) or Fentanyl (Janssen Pharmaceutica).
- Never talk, smoke or eat while working with these drugs; therefore concentrate only on the task at hand.

It must be emphasized again that M-99 and Fentanyl should under no circumstances be used by unqualified, non-professional people.

■ M-99 (NOVARTIS) AND FENTANYL (JANSSEN PHARMACEUTICA)

M-99 and Fentanyl are both recommended for the immobilization of herbivorous animals in southern Africa (Table 33.2). These drugs are also effective for cattle, and are particularly useful for Brahman cattle that have become wild and unmanageable and have to be captured and handled. Both Burchell's zebra and the mountain zebra have an inherent resistance to Fentanyl and they cannot be captured using this drug (Table 33.2).

The effect of M-99 varies in different species of animals and even amongst individuals of the same species. For example, a dose of 4 mg of M-99 is required to immobilize a gemsbok weighing 220 kg. The same dose is also used for an adult white rhinoceros of 2500 kg. For an adult Cape buffalo a dose of 10 mg M-99 is required, but the same dose is used for an elephant cow, which is six times heavier. Adult animals, but especially

adult bulls and rams, need higher doses of the drugs than young, old or sick individuals, and ewes or cows of the same species.

M-99 is available in glass vials of 5 ml containing 9.8 mg etorphine hydrochloride per millilitre. This should be regarded as 10 mg etorphine hydrochloride per millilitre. A tuberculin syringe graded in tenths of a millilitre is used to measure off the correct dose. For example, when a dose of 4 mg of M-99 is required to immobilize a gemsbok, then 0.4 ml must be withdrawn from the 10 mg/ml concentrate of M-99. Fentanyl is sold as fentanyl citrate powder. It is a potent immobilizing drug with strong analgesic properties and is ten times less potent than M-99 sterile. Solutions of Fentanyl should be made up by a chemist.

■ DOMOSEDAN (FARMOS) OR DETOMIDINE (FARMOS)

This potent immobilizing drug is used mainly on horses and cattle. It comes in 10 mg/ml in a 5 ml vial. Domosedan is used as a replacement for Rompun in combination with M-99 (Novartis) for the capture of eland, kudu, gemsbok, sable antelope, tsessebe, red hartebeest, black and blue wildebeest, giraffe and Burchell's zebra. Domosedan is effective at a low dosage, has a rapid action and no significant side effects. The dose is 0.2 to 0.4 ml/100 kg of body weight when combined with M-99.

The tranquillizing effects of Domosedan were tested on gemsbok. The gemsbok were caught in a plastic capture boma and loaded into a mass crate. It is usually difficult to load and transport gemsbok without their injuring one another. When confined and forced into close contact, gemsbok fight with one another, often with fatal consequences. The horns must always be piped after capture. It is difficult to offload gemsbok because they refuse to move out of the crate. Under the effect of 10 mg of Domosedan, there was no fighting during the 30-minute journey from the capture site to the holding pens, and the gemsbok were offloaded without any difficulty.

■ AZAPERONE (JANSSEN PHARMACEUTICA)

Azaperone is combined with M-99 (Novartis) and Fentanyl (Janssen Pharmaceutica) for immobilizing a variety of animals, as indicated in Table 33.2. It has the side effect of stimulating the appetite, therefore it is not unusual to see an animal under its influence, or one that has just recovered from

such treatment, standing up and eating. At the recommended doses, azaperone does not influence the heat-regulating mechanisms of the body or depress respiration. In some animals that receive an overdose a condition called *torticollis*, in which the neck is bent backwards, may develop. Azaperone is marketed under three commercial names:

- **Stresnil (Janssen Pharmaceutica):** A solution of 40 mg/ml in a 50 ml bottle. This preparation is intended primarily for tranquillizing pigs, but it is also used for many other types of animal.
- **Azaperone tartrate (Kyron Laboratory):** 100 mg/ml in 50 ml or 100 ml bottle. This is especially produced for wild animals.
- **Azaperone veterinary powder (Janssen Pharmaceutica):** 0.5 g and 5 g powder. The powder can be made up as follows: a mixture of 1 g of azaperone powder and 0.5 g of tartaric acid is dissolved in a few millilitres of water by heating it in a water bath. The solution is then cooled and diluted to the required volume. For example, it is diluted with 10 ml of sterile water to make a 100 mg/ml solution, and with 100 ml of water to make a 10 mg/ml solution.

Larger quantities of 100 mg/ml azaperone can be made up as follows: 10 g of azaperone and 4.9 g of tartaric acid are heated in 20 ml of sterile water until dissolved. The solution is made up to 100 ml with sterile water and then filtered. This preparation is affected by light and must be stored in a vial of dark glass.

It is advisable to have the solutions made up by a chemist. In cold weather, the solution may crystallize. If this happens, the vial should be heated in warm water and shaken gently to dissolve the crystals. It is important that the date on which the solution is made up be written on the label because the preparation ages and can be kept for only about two years. Solutions of current azaperone are colourless. *When the solution ages and turns yellow, it must not be used.*

The doses that are used to tranquillize animals are usually given as 0.5 mg to 2 mg per kg of body weight. However, when azaperone is used in combination with M-99 (Novartis) or Fentanyl (Janssen Pharmaceutica), a lower dose is recommended. Although azaperone is reputed to be a safe drug, it is not advisable to exceed the highest dose, because it may have side effects. For example, a dose of 150 mg must never be exceeded for adult eland, otherwise the animal will lie down.

■ ROMPUN (BAYER) OR XYLAZINE HYDROCHLORIDE

Rompun has a multiple effect. At low doses it serves as a tranquillizer, and at higher doses it has analgesic, muscle relaxant and immobilizing properties. It can also be used as a sedative that will make animals drowsy for several hours. In European zoos, it is one of the main immobilizing drugs used for calming and immobilizing a variety of animals, including deer and carnivores. It is a safe and reliable drug that can be administered to many types of animal, and it is often used by veterinarians as an immobilizing drug when working under field conditions.

Rompun is available in two forms: as a 2% solution that contains 20 mg/ml in 25 ml bottles, and a 500 mg powder in a glass vial. The powder can be dissolved with a special solvent to make up various concentrations such as 50 mg/ml, 100 mg/ml and 250 mg/ml. These concentrations are obtained by dissolving the powder in 10 ml, 5 ml and 2 ml of solvent respectively. After an intramuscular injection of Rompun, the animal becomes drowsy and the muscles relax within ten to 15 minutes. One of the first signs of sedation is that the animal lowers its head. The effect can last for several hours. The animal can remain on its feet or lie down. Even when it lies down, it is often still able to stand up when approached and can run away. When the animal lies down on its side, it should be propped up on its sternum. In some animals, such as eland and kudu, the tongue relaxes and protrudes from the mouth. In most animals the heart and respiration rates decrease.

There are two antidotes for Rompun. If an overdose of Rompun is accompanied by depressed respiration, a drop in blood pressure and the inability of the animal to stand up after the effects of the M-99 have been reversed, the following preparations can be used:

- **Dopram injectable (Continental Ethicals):** A 20 ml glass vial containing 20 mg/ml. Usually when 0.5 to 1 mg per kg of body weight is injected slowly and intravenously, it will cause an almost immediate improvement in respiration. This dose can be repeated at regular intervals if the animal does not respond satisfactorily. Alternatively, a single dose of 2 mg per kg of body weight can be injected slowly and intravenously.
- **Yohimbine hydrochloride (Kyron Laboratory):** Two strengths are available for large and small ani-

Table 33.2 Doses for the chemical immobilization of healthy wild animals in southern Africa. The doses are in milligrams and are for adult animals. The doses can be reduced for subadult animals and animals in poor physical condition. Either M-99 (Novartis) or Fentanyl (Janssen Pharmaceutica) is recommended as an immobilizer

Animal	M-99	Fentanyl	Tranquillizer: azaperone	Antidote M-5050
Blesbok and bontebok	3	30	40–60	6
Buffalo	8–10	80–100	150–200	16–20
Bushbuck	2	20	60	4
Damara dik-dik	–	3	5	0.6
Duiker: common	1.5	10	20	2
Duiker: red and blue	–	3	5	0.6
Eland	Bull: 10–14 Cow: 6–8	– –	Bull and cow: 180–200	Bull: 20–24 Cow: 12–16
Gemsbok	4–5	–	100	8–10
Giraffe	8–12	–	60–80	16–24
Grysbok	0.5	–	10	1
Hartebeest: red	4–5	–	80	8–10
Hippopotamus	2–3	–	–	4–6
Impala	–	10–20	50	2–4
Klipspringer	0.5–1	–	20	1–2
Kudu	4–6	40–60	100	8–12
Lechwe: red	4–6	–	80	8–12
Nyala	3–4	30–40	50–60	6–8
Oribi	1	10	30	2
Reedbuck: common	1.5–2	20	40	3–4
Reedbuck: mountain	1–2	–	40	2–4
Rhinoceros: black	2–4	–	80	4–8
Rhinoceros: white	3–5	–	100	6–10
Roan antelope	6–8	–	100	12–16
Sable antelope	5–7	–	100	10–14
Springbok*	1	10	20	2
Steenbok	0.5	5	10–20	1–2
Tsessebe	3–4	–	80	6–8
Waterbuck	5–7	–	100–150	10–14
Wildebeest: black	3–4	–	60–80	6–8
Wildebeest: blue	4–5	–	100	8–10
Zebra: Burchell's	5–8	Not to be used	80–100	10–16
Zebra: mountain	5–8	Not to be used	60–80	10–16

Notes: 1–2 ampoules of hyaluronidase or Hyalase 1500 units can be added to accelerate the absorption of the immobilizing drugs into the blood circulation and therefore to reduce the down time. Increase the M-99 (Novartis) dose for a large Kalahari springbok to 3 mg.

mals. Large animals need 6.25 mg/ml; dose: 0.125 mg per kg of body weight injected intravenously. Small animals require 1.25 mg/ml; dose: 1 ml per 10 kg of body weight injected intravenously.

■ OTHER TRANQUILLIZERS

Other tranquillizers such as Serenace (Searle), haloperidol (Kyron Laboratory), Combelen (Bayer), Valium 10 (Roche) and Dormicum (Roche) will not be discussed here because they are not combined with immobilizing drugs. Some of these tranquillizers and the long-acting tranquillizers will be discussed in Chapter 35 on the transportation of wild animals. Haloperidol has already been discussed earlier in this chapter in the section on capture with nets.

2.10.3 Combining tranquillizers with immobilizing drugs

Tranquillizers such as Rompun (Bayer) and azaperone (Janssen Pharmaceutica) are sometimes used in combination with immobilizing drugs to achieve more effective immobilization (Table 33.2). This combined effect is known as *synergism*. Synergism means that the combined effect of the immobilizing drug and the tranquillizer is far greater than the individual effect of either of the two drugs. Further advantages are that the safety margin of each of the drugs is increased and that less of each drug has to be used.

Animals such as eland, nyala, bushbuck, kudu, waterbuck and gemsbok cannot be captured with an immobilizing drug only, and combining it with tranquillizers such as azaperone or Rompun is essential. Kudu and eland become overexcited during the initial induction stage after the administration of M-99 (Novartis) and may continue running until they are totally exhausted. Gemsbok, roan antelope and sable antelope are affected by M-99 alone. However, they cannot be handled under its influence only because they are not completely immobilized and may gore someone when they have to be handled. A tranquillizer must therefore be added for these animals. M-99 on its own increases the blood pressure and will cause lung oedema.

An overdose of tranquillizers should be avoided because it may have harmful side effects on the animal. Tranquillizers such as acetylpromazine disrupt the heat regulation of the body. The body temperature can increase to fever level

on hot days or may become subnormal on cold days. Animals with dark pigmentation, such as sable antelope and waterbuck, are particularly vulnerable to this effect and can die from overheating and shock. However, as a rule, no animal should be captured on hot days of $\leq 25^{\circ}\text{C}$ whether tranquillizers are used or not. The tranquillizers Domosedan, azaperone and Rompun are used most commonly in combination with M-99 and Fentanyl in southern Africa.

2.10.4 Antidotes for M-99 and Fentanyl

M-99 and Fentanyl have three main advantages for the capture of wild animals:

- They are effective for immobilizing animals in a relatively short time.
- At the correct dose they are safe for most species of animals.
- The immobilizing effect can be reversed or neutralized at any time and an animal can be awake within a few minutes after an injection of the antidote. The relevant antidotes are: M-5050 or diprenorphine hydrochloride, Lethidrone or nalorphine hydrochloride, and Narcan or naloxone hydrochloride.

M-5050 is the specific antidote for M-99. A 5 ml vial of M-5050 contains 12 mg/ml. A supply of M-5050 is included in the package whenever M-99 is sold. This is not the case with Fentanyl, and antidotes such as Lethidrone, Nalorphine, Naltroxone or Narcan have to be bought separately. The reversal ratio of M-5050 to M-99 is 2:1. This means that 2 mg of M-5050 must be injected to reverse every 1 mg of M-99. The antidotes are effective when injected either intravenously or intramuscularly. Intravenous injections can be given into one of the jugular veins in the neck, the vein in the foreleg, the vein just above the hock in the hind leg, or into one of the ear veins. The intravenous route has a more rapid effect than the intramuscular one and the animal is usually revived within a few minutes after the intravenous injection. If a suitable vein cannot be found, the injection can be given intramuscularly. However, remember that an intramuscular injection has a slower reversal effect. Naltroxone (Kyron Laboratory) is the drug of choice because it is the only antagonist that is fully effective in recycling carfentanil. It should be given in the ratios of 90 Naltroxone to 1 carfentanil, and 20 Naltroxone to 1 etorphine.

If the animal is to be released immediately

after it has regained consciousness and will not be seen again, it is sound policy to inject an additional small dose of antidote intramuscularly. This prevents the possibility of reimmobilization or recycling of the immobilizing drug when the animal starts to move about. The symptoms of reimmobilization are that the animal walks around in an uncontrolled semi-drugged state, cannot stop walking, has a glazed expression in the eyes and may lie down as if it were again immobilized. This can happen several hours after the animal has been revived. Antidotes should always be given, even when an animal appears to be recovering on its own. This prevents the immobilizing drug from recycling a few hours later. When reimmobilization occurs, the animal has to be recaptured or darted with the antidote. Should this not be done, the animal may move around continually and eventually exhaust or injure itself.

Antidotes specifically reverse the effect of particular immobilizing drugs and have no effect on the tranquillizers that are combined with the immobilizing drugs. An animal that has recovered from the immobilizing drug therefore is often still under the influence of the tranquillizer. This is to the advantage of the animal when it has to be transported to a new area, because it will be calm and endure the journey that much better.

2.10.5 *Animal reaction and darting target areas*

There is a time lapse between the moment that the immobilizing drug is injected until it takes effect. The time that the animal takes to lie down depends mainly on two factors: the amount of immobilizing drug and the target area. The recommended dart target sites or areas to be aimed at are the hindquarters and the shoulders. They are indicated in Figure 33.14. If an animal is darted with the correct amount of the drug, and the dart hits a well-muscled area with a rich blood supply, the drug can be absorbed rapidly and a reaction can be expected within four minutes. The animal will lie down within ten minutes. However, before the animal is completely immobilized and lies down, some of the following signs may be observed:

- The animal is restless and agitated, and does not stand still.
- The animal is disorientated and appears to be unaware of where it is. It usually moves away from the group.

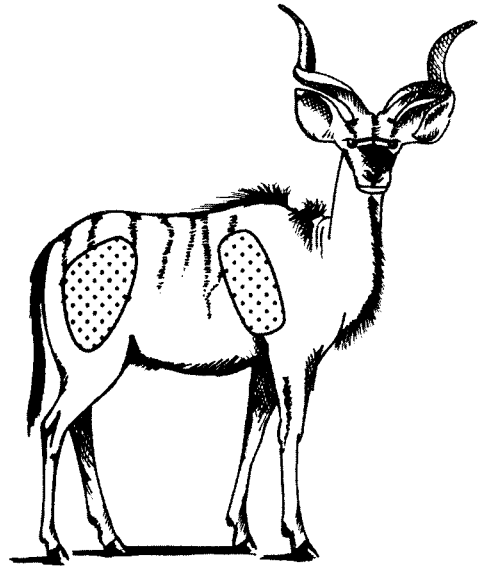


Figure 33.14

Dotted target areas for the chemical immobilization of a wild antelope.

- The animal moves around in circles and often lifts its feet up high.
- The animal walks around aimlessly and appears to stumble over its own feet.
- The animal's coordination becomes affected and it may start swaying from side to side shortly before it lies down.
- The animal lies down on its sternum with its head held up. Because a few more minutes are required before such an animal is fully under the influence of the immobilizing drug, it should be left alone, provided it is lying in the proper position.

The proper position for an immobilized animal varies between feeding types. When the immobilized animal is a ruminant and it lies flat on its side, it should be helped onto its sternum immediately to prevent bloat and the inhalation of the rumen content. Zebras usually lie on their sides but there is little danger that they will bloat. Elephants must lie on their sides when immobilized because lying on the sternum interferes with their breathing and this could be fatal. The shorter the down time and the more rapid the immobilization, the less stress there is on the animal and the less opportunity for capture myopathy to develop.

It is important to become familiar with the darting equipment before trying to use it to capture an animal. The person who is going to handle the equipment must practise filling and loading the dart correctly and firing the dart gun so that the dart can be placed accurately. The following areas of the body are unsuitable for darting and must be avoided: the flank, the abdominal region, the chest, neck, legs and head. Stomach and chest shots must be avoided because the absorption of drugs is slower there and there is a danger that the rumen, intestines or lungs may be struck and injured by the dart needle. A dart shot into a rib will either fracture the bone or the drug may not be absorbed, because the needle is embedded in the bone or it is bent back by the impact.

If a dart has been placed badly and the animal shows no sign of immobilization after four minutes or there is no indication that the drug will take effect within ten minutes, then a second dart should be prepared and fired as quickly as possible. Should this not be done, the animal may flee and exhaust or injure itself.

2.10.6 Capturing giraffe

Giraffe must not be captured when the ambient temperature exceeds 25°C or when they are in a poor physical condition, as they sometimes are at the end of the winter. The best time to capture giraffe is in the late summer when food is still abundant and the animals are in excellent physical condition. Giraffe are captured using a combination of chemical immobilization and mechanical capture methods. In natural conditions, giraffe never have to run far or fast. When they are herded by a helicopter and then darted they are subjected to abnormal stress. As giraffe are sensitive animals, they become anxious and panic-stricken in stressful situations. Giraffe capture is a highly specialized procedure and requires good teamwork. Since they are so heavy, limp and unmanageable when immobilized, large adult giraffe should not be captured unless it is absolutely necessary.

In Namibia, high doses of M-99 (Novartis) combined with the enzyme hyalase have been used to capture giraffe. The hyalase accelerates the absorption of the M-99 to achieve rapid immobilization. In this method, 1500 i.u. of hyalase is added to each dart. Hyalase is a freeze-dried powder that mixes easily with M-99. No tranquillizers are used. The recommended M-99 doses are:

young animals 3 to 4 mg, adult cows 6 to 8 mg, young bulls 8 mg, and adult bulls 10 to 12 mg. These doses result in rapid immobilization and the antidote must be injected as soon as the animal is down and approachable. Giraffe that have drunk water recently must not be captured because there is a danger that under the influence of immobilization they may vomit the water and inhale it.

After the animal has been darted it first runs away, stumbles after a while and appears as if it cannot see well. The capture team must then quickly move closer in a vehicle to a point about 50 m in front of the animal. On either side of the giraffe there must be three persons holding a 20 m long soft nylon rope. They should stand in the path of the animal and hold the rope at chest height of the giraffe. When the giraffe runs into the rope, the men run with it and gradually slow the giraffe down using the rope. Two more men place a second rope of 10 m around the legs from any side and begin to pull. This rope pulls the legs together and the animal usually falls to one side. One person then catches the head and holds it above chest height. It takes approximately six to eight minutes after darting for the animal to fall. The full dose of M-5050 antidote is then injected intravenously immediately.

The giraffe must now be blindfolded. Next, the 20 m rope is placed around the neck and used to control and lead the animal to a crate on a giraffe trailer as soon as it stands up again. The double doors of the trailer and the two ropes that are attached to the doors form a funnel through which the animal is guided into the trailer. The ropes around the neck of the animal are now crossed behind the animal and used to pull it fully into the crate.

2.10.7 Capturing fallow deer

There are exotic fallow deer on some game ranches in the Eastern Cape and Free State. They can be immobilized using a combination of M-99 (Novartis) and Rompun (Bayer), but preferably by a combination of Rompun and Ketamine. Some fallow deer are sensitive to M-99 and appear to have convulsions and make strange nervous movements. When this occurs, the antidote must be administered as soon as possible after the immobilization. The usual immobilizing dose for an adult deer is 3 mg of M-99, combined with 20 mg of Rompun. The antidote for the M-99 is 6 mg of M-5050. Alternatively, 100 mg of

Rompun can be combined with 100 mg of Ketamine to immobilize the animal. The antidote for Rompun is 0.3 mg/kg of Yohimbine injected intravenously. There is no antidote for Ketamine.

2.10.8 Handling immobilized animals

When an animal is immobilized, it should be under the expert care of an experienced wildlife veterinarian. The veterinarian is able to monitor the whole immobilization process and will know what to do should something go wrong. Ruminants must always lie on their sternums, with their legs folded under their bodies in a resting position and their heads and necks held higher than their chests to avoid bloat. The head of the animal must be held upright and usually one person is needed just for this task. The mouth must be lower than the rest of the head so that any excess saliva can drain away, because the animal cannot swallow when immobilized. Two or three people may be required to care for an adult buffalo.

Immobilized animals should never lie in the sun for too long. When it is hot, shade should be provided or the animal must be carried to a shady tree. Large animals should be carried on a stretcher. In cold weather, blankets or sacks should be used to cover the body of the animal to prevent it from losing too much heat. Although animals should never be captured in hot weather, this sometimes happens in emergencies. Because of the danger that the immobilized animal may overheat, it can be sprayed lightly with water to cause evaporation and cooling.

Some animals do not close their eyes and cannot blink when they are immobilized. Their eyes must therefore be protected against the sun and wind by tying a dark, soft blindfold over them. This keeps the dust out and prevents damage to the cornea. When an immobilized animal is transported over dusty roads, the eyes must also be protected by a blindfold. Eye ointment such as Terramycin eye/ear suspension should be placed in the eyes to lubricate them and prevent them from drying out. Animals can hear well while they are immobilized, therefore it is advisable to make as little noise as possible near any immobilized animal.

2.10.9 Antibiotics

As a precaution against infection, antibiotics are injected after capture. A long-acting antibiotic such as Compropen, Lentrax, Peni-LA or

Duplocillin can be injected subcutaneously or intramuscularly. Antibiotic intramammary preparations for the treatment of mastitis can be squeezed into the dart wound to counter infection and the possible formation of an abscess at the dart site.

2.10.10 Equipment

Special darts are fired from dart guns to inject the immobilizing and tranquillizing drugs into wild animals from a reasonable distance. Blowpipes, home-made modified automatic syringes mounted in a light metal pipe, and pole-syringes are used to inject animals that are in close proximity, such as animals in crates or crush passageways. Most of the equipment listed below is available commercially in South Africa.

The Big Five Veterinary and Pharmaceutical (Pty) Ltd at P.O. Box 12780, Onderstepoort 0110, South Africa, tel. 012 546 5005, fax 012 546 5066 and e-mail: bigfive@jil.co.za distributes darting equipment and drugs.

■ TELINJECT EQUIPMENT

Several models of Telinject dart guns and various types of blowpipe and lightweight reusable plastic darts are available in South Africa. Some Telinject dart guns have interchangeable barrels. Depending on the barrel diameter used, darts of 1 ml, 3 ml and 5 ml capacity can be used.

There are four models and some variations of the Telinject dart gun available:

- **The Vario 1V.31 NP pistol model:** This pistol is the simplest of all the models. Pressure to fire the dart is built up by using either a foot-pump or a carbon dioxide cartridge. The pistol has an effective range of 20 to 25 m, but it does not have an accurate sight. It is recommended for darting animals in pens and at close range.
- **The Vario 1V.31 NK or Vario 1V rifle model:** This model is the 1V.31 NP pistol built into a rifle stock. It has a sight with two possible settings for accurate aiming up to 30 m. Pressure is supplied by a footpump or a carbon dioxide cartridge.
- **The Vario 2V.310 rifle model:** This powerful dart gun has an effective range for firing darts over

distances of 1 to 50 m. It has an integral safety catch and a built-in pressure gauge that allows the pressure to be monitored while aiming. A valve that can release the pressure allows for a reduction in the force of impact in the event of an animal moving closer. A large, reloadable carbon dioxide cylinder with a shoulder strap for convenient carrying is available, but normally the firing pressure is built up with a footpump. However, the trigger mechanism is not as quiet as that of the Vario 1V model, and it makes a slight clicking sound when fired.

- **The Vario 4V.310 rifle model:** This is a high-precision multi-purpose dart gun with an effective range of 1 to 50 m. It can be fitted with a telescopic sight to improve accuracy. Pressure can be built up with a footpump or a built-in carbon dioxide cartridge. The volume of gas is determined by the distance to the target, and can be set in advance.
- **The Variomat 1V.66 M rifle model:** This rifle has six barrels and is set for rapid fire. Six darts can be fired in a few seconds and a special adapter can be used to allow three darts to be fired simultaneously. This dart gun is particularly suited for large-scale operations from a helicopter when a group of animals has to be captured or inoculated against diseases such as anthrax and rabies.
- **The GUT 50 rifle model:** This dart gun is reputed to be the most accurate of all the Telinject models over distances of 1 to 50 m. It has a telescopic sight, simple breech loading, a safety catch, a pressure and a distance meter. It can be fired with carbon dioxide cartridges, or by pressure from a footpump.

Telinject blowpipes are available in 1 and 2 m lengths for short and long distance use. They have different pipe diameters for using 0.6 ml, 1 ml, 2 ml and 3 ml plastic darts. The blowpipes are supplied with a plastic mouthpiece and sights. Blowpipes can be used for darting animals up to 15 m away and are used for thin-skinned animals.

The darts are light and transparent so that the immobilizing drugs in the front compartment are clearly visible. Darts with a capacity of 1 ml, 3 ml and 5 ml are available, but the barrels of the gun have to be changed for each dart size. The darts are pressurized with compressed air. After the immobilizing drugs have been loaded in the front end, a needle sealed in a plastic cover is attached. Then about 15 ml of air is forced into the rear air

chamber by a 20 ml syringe fitted with a special adapter. The pressure in the rear air chamber is regulated by a blue valve. The pressure can be checked by gently probing the back of the valve with a blunt piece of thin wire that fits into the opening.

The needles may be smooth or collared and have a solid, hard tip and two small holes on the sides above the tip. These holes are closed by a plastic cover that slips back when the needle penetrates the skin and muscles of the animal. In this way, the pressurized immobilizing drug is released. Telinject equipment has the following advantages:

- The firing mechanism uses compressed air or carbon dioxide instead of a powder charge and is therefore silent. The advantage of this silence is that when an animal in a herd is darted, the others are not disturbed by the sound of the shot. The darted animal also does not become panic-stricken and run off because the impact of the dart is not associated with a loud noise.
- The darts are light and therefore do not damage the muscle tissue and injure the animal.
- The equipment is accurate at both close and long ranges when suitable allowances are made for wind velocity and direction.
- The equipment can be used for a large variety of animals, ranging from small animals such as steenbok and duiker to large animals such as eland and giraffe. With special needles, elephants and rhinoceroses can also be darted. Special needles are available for animals of different sizes.
- The darts are easy to fill and pressurize, and they load easily.
- The barrel does not have to be cleaned as often as that of a powder-charged dart gun.
- The mechanical parts require little maintenance.

As they are silent and cause minimal disturbance, these dart guns are especially useful for darting animals in capture bomas, nets, mass crates on transport vehicles, and in holding pens. The most important disadvantages of the Telinject equipment are:

- These dart guns are not as robust for bush work as other dart guns. In the case of the Vario 1V.31 NK rifle model, special care has to

be taken of the light aluminium barrel because it bends easily and will be damaged if handled roughly.

- Gas or air-powered dart guns do not have the effective long range of the powder-charged dart guns.

The representatives of Telinject equipment are Telinject SA, P.O. Box 596, Jukskei Park 2153, tel. 012 244 1463 or 082 443 7898.

■ DAN-INJECT EQUIPMENT

The Dan-inject range is based on the Telinject system, but with improved modifications. This equipment offers greater variation and the darts are reusable and well designed. The dart gun has a rifled barrel and uses a footpump or a 72 g carbon dioxide cylinder that can power up to 60 shots. A larger carbon dioxide cylinder and alternative barrels are also available. The pressure can be regulated, therefore adjustment for the effective range has a minimal effect on the animal. Consequently, darting is atraumatic. The standard darts of 10.5 mm in length for the rifled barrel come in 1.5 ml and 3 ml capacities. Longer darts of 13 mm are also available for use with a special stainless steel barrel that is easily changeable. The capacity of the longer darts is 5 ml and 10 ml. The darts are durable and are made of high-impact elastic and transparent nylon. Stainless steel needles 25, 30, 40, 60 and 100 mm long with or without barbs are available. Each needle is tested individually for pressure maintenance to ensure that it does not leak.

The Dan-inject dart gun and blowpipe range consists of the following:

- The JM standard model dart gun with a range of up to 60 m. It is fired with carbon dioxide gas and is quite robust. A manometer gives the gas pressure reading. The pressure can be changed without looking away from the telescopic sight.
- The JM special model dart gun, designed for rapidly changing requirements. It provides excellent accuracy when darting from a helicopter or a ground vehicle over ranges varying from 15 to 20 m. A detachable 11 mm rifle barrel can be installed quickly to give improved accuracy over longer distances of up to 60 m.
- A pistol with a footpump or a carbon dioxide

cylinder and a range of up to 25 m. Different barrel lengths are available. It is ideal for working in confined areas.

- The CBLow model blowpipe with a range of up to 15 m.
- The CATS model pole-syringe with an adjustable range of 1 to 3 m.
- A large variety of darts and needles, which can also be used in Telinject dart guns.

Dan-inject equipment is locally available from Fritz Rohr, Private Bag X402, Skukuza 1350, tel. 013 735 4000 or 013 735 5499, or 082 338 1376.

■ PALMER CAP-CHUR EQUIPMENT

Three types of dart gun manufactured by the Palmer Chemical and Equipment Company of the United States of America are available in South Africa. The following equipment is available:

- **Short-range Cap-Chur pistol:** This pistol is fired by gas pressure in a carbon dioxide cylinder and is accurate up to a distance of 15 m. The carbon dioxide used as a propellant is affected by the ambient temperature. On hot days, the gas expands and the range will be greater and the impact of the dart greater than on cold days when the opposite happens. This means that the accuracy of the pistol may vary. Therefore, it is important to take one or two practice shots to determine the effective range under the existing conditions before darting an animal.
- **Long-range dart projector:** This was the first dart gun to be used in Africa and it is still generally known as the "gas gun". Pressure comes from two small carbon dioxide cylinders stored in a special compartment under the barrel of the projector. The gas cylinders are manufactured by Crossman of the United States of America. However, should these be unavailable, the carbon dioxide cylinders or "soda bombs" used in soda siphons for making soda water may be substituted. The effective range is 25 to 30 m. This dart gun has many uses and often is the preferred weapon for immobilizing animals from a helicopter. A disadvantage of the Palmer gas gun is that the valves sometimes leak, thereby reducing the effective range.

- **Extra-long range dart projector:** This dart gun has a powder charge and is accurate up to 80 m. Two adapters for darting over long and short distances are supplied with the projector. In contrast to the other projectors that use gas cylinders with carbon dioxide, this one uses .22 blank charges or special charges known as Ramsets, which are also used in the building trade. The Ramsets come in an assortment of colours, depending on the load of black powder. The green Ramset contains a low charge, the yellow one is slightly more powerful, the red one is used for medium range and the black or purple ones for the longer ranges. Because of the powder charge, the barrel must be cleaned after each shot to prevent the powder from accumulating inside the barrel.

Different sizes of aluminium Palmer Cap-Chur dart and various lengths and types of dart needle are available. The size used depends on the volume of fluid required to capture a certain size and type of animal. Darts with a capacity of 1 ml, 2 ml, 3 ml and 5 ml are usually used. The immobilization darts can be used repeatedly. Darts that are slightly damaged and do not fit in the barrel easily must never be used because they may be inaccurate and unsafe. They may also block the barrel and wreck a carefully planned capture operation.

The dart is loaded as follows: the rubber plunger and the inside of the dart are lubricated with silicone grease. The rubber plunger must move freely and smoothly yet firmly within the dart. A round plastic rod is used for lubrication. A special detonator or percussion cap is fitted with the solid, rounded side against the inside of the hollow of the rubber plunger. The tailpiece is screwed on and the plunger containing the detonator is pressed tightly against the tailpiece with the plastic rod. The space in front of the plunger is filled with the drugs. The front section of the dart is filled with the correct volume of drugs and the nose-piece and needle are screwed on. As soon as the dart hits a hard object such as a muscle, the gunpowder of the detonator is activated. It explodes and the gas is released immediately to push the rubber plunger forward and force the immobilizing drug through the needle.

The detonators have two powder loads, one for use with 1 ml, 2 ml and 3 ml capacity darts and one for the heavier 5 ml and 10 ml darts. The two loads are sold separately in quantities of 50 detonators packed in padded glass containers. The

detonators must be kept securely in cotton wool to prevent the powder from shaking loose and falling out.

The Palmer Cap-Chur dart needles are available in different lengths, and can be smooth or have a collar or barb. The needles with a collar or barb remain attached to the animal and therefore ensure that the immobilizing drugs are injected thoroughly. This also helps to identify the darted animal and is especially useful when an animal is darted from a herd or family group. It is usually easy to remove the collared needle from the skin and muscle. Needles with barbs are difficult to remove, especially from animals with thick skins. Such a dart should be cut out carefully with a scalpel or a sharp pocket knife. An antibiotic ointment such as mastitis ointment should be applied to the wound to prevent infection and abscess formation. It is advisable to buy the correct size of dart, needle and detonator for the specific capture; 2 ml, 3 ml and 5 ml darts are usually adequate for immobilizing most animals.

The following guidelines will increase the effectiveness and success of capturing wild animals using Palmer Cap-Chur equipment:

- The rubber plunger must be well lubricated with silicone to ensure that it moves freely in the dart.
- The darts must be loaded freshly and should not be kept over until the next day.
- The detonator must be loaded correctly with the round solid part pressed tightly against the plunger while the open side faces the tailpiece.
- The volume of fluid must reach the level of the lowest part of the nose-piece. This will ensure that the dart has the correct weight and balance. Otherwise, the flight path of the dart may be affected and it will tend to curve downwards. Sterile water can be used to top up the dart to full capacity.
- The darts and needles should always be kept clean and stored in a dust-free container. Before use, the inside of the dart must be cleaned with a piece of cotton wool dipped in methylated spirits. However, the darts and needles must be kept free of spirits until just before they are used. This helps to prevent dirt and germs from entering the dart wound. When the aluminium dart parts are dirty, they should be cleaned by boiling them for a few minutes.

- It is important to practise loading the darts and shooting the dart gun before using it in the field. Special practice darts are available for this purpose. The practice darts must be filled with the correct quantity of water to ensure that the dart has the correct weight. An empty dart weighs less than a full one. Because it is lighter, an empty dart will also have a longer range than a full one. This may create a false impression of the range potential of the dart gun.
- Darting should not take place on a windy day because the wind affects the range and trajectory of the dart. Do not dart in a strong cross-wind because it will influence the trajectory and accuracy of the dart severely. When darting into the wind, the dart tends to lift and may miss its target.
- The darts may be reused, provided they are well cared for. Some darts may be damaged by a hard impact, or when they miss the animal and hit the ground. Such darts may then not fit into the barrel and should be disposed of properly. It is advisable to ensure that all the darts that are used are in good condition and fit freely in the barrel. Darts should never be forced into the barrel.
- When the animal is hit and the detonator explodes, the sound of the impact can be heard shortly after the report of the gun. This enables the operator to know whether the drug release mechanism has been activated.
- When darting into a hard object, release the pressure in the dart before removing it.

The local agents of Palmer Cap-Chur equipment are Photo Agencies, P.O. Box 3916, Johannesburg 2000, tel. 011 833 7200.

■ PAXARMS EQUIPMENT

The following equipment is available from Paxarms Limited:

- **Paxarms Mark 24B dart gun:** The dominant feature of this dart gun is its integrated system with which the power and consequent dart trajectory can be adjusted at the turn of a dial. The pressure system operates in metres so that no conversion calculation is required from pressure to distance readings. Because of the integrated sighting system, the dart impact is constant irrespective of the distance of the ani-

mal from the operator. With other systems where the trajectory is not adjustable, the animals are hit harder the further away they are. This results in unnecessary injury to darted animals and may also cause darts to bounce, tumble and even self-destruct. Unlike the powder-charged dart gun systems, the Paxarms dart gun can be used safely at close range, even on animals in pens. Various sighting options are available, including a red dot scope that is useful in poor light conditions and for darting from a helicopter. The compact nature and short barrel of the Paxarms dart gun make it ideal for work in confined spaces, such as in a ground vehicle or a helicopter.

- **Other drug delivery systems:** Paxarms darts can also be administered by using a drop-out pole-syringe or a close-range dart pistol. These options are useful for caged or confined animals, especially those that move too fast or are too aggressive to allow the use of a standard pole-syringe or hand-held syringe. Standard, multi-dose, automatic pole-syringes are available from Paxarms. They come with a dye marker to identify any animals that have already been injected.

Paxarms darts are made of high-strength polycarbonate plastic. The tailpiece of the dart consists of pre-stressed fins that make the dart extremely accurate. The robust needles screw onto the front of the dart, preventing any possible leakage of the drugs. Optional barbs on the needles allow the needles to be twisted or turned out of the skin of the darted animal, making it unnecessary to cut into the skin to remove the dart.

Paxarms darts work on air pressure. A secure valve maintains the pressure in the rear chamber. The darts can be fired without first pressurizing them, because the pressure in the barrel is transferred to the rear dart chamber when the dart gun is fired. This obviates the danger of having loaded and pressurized darts lying around. All the parts of a Paxarms dart are replaceable, thus making the system economical. Paxarms darts can be used in other darting systems as well. Radio transmitter darts are also available for tracking darted animals in dense vegetation or rugged terrain, or for finding lost darts. The radio transmitter fits into the tailpiece of a special dart. The drag of the tailpiece ensures that the dart remains accurate, even with the added weight of the transmitter.

Paxarms equipment is manufactured by Paxarms Limited, P.O. Box 317, Timaru, New Zealand. The local agents are Louis Fourie, P.O. Box 3632, Brits, South Africa 0250, tel. 012 252 1505, fax 012 252 1781 and e-mail: louispetrus@worldonline.co.za.

■ PNEU-DART EQUIPMENT

Pneu-dart in the United States of America manufactures six types of dart gun. The darts are pre-loaded with a charge that is used once.

Pneu-dart equipment is available locally from Wildlife Pharmaceuticals in Karino, Nelspruit at e-mail: jpraath@iafrica.com or tel. 082 805 3983.

■ DAYSTATE TRANQUILLIZER AND AIR-GUN MANUFACTURERS EQUIPMENT

This equipment is manufactured by Daystate Ltd, Newcastle Street, Stone, Staffordshire, United Kingdom. Two types of dart gun are available: the Mark1 dart gun is suitable for short distances and the Ranger dart gun for long distances. The darts operate with detonators similar to the Palmer Cap-Chur darts. A telescopic sight is available for the Ranger dart gun. This equipment is not currently available in South Africa.

■ BLOWPIPES AND POLE-SYRINGES

Telinject and Dan-inject blowpipes are commercially available locally. Blowpipes have a short effective range and are only used to dart animals in crush passageways, holding pens or crates. Because it is possible for dart syringes to leak, and because of the inherent danger of contact between the immobilizing drugs and the mouth or lips, it is not advisable to use M-99 or Fentanyl in blowpipes. Tranquillizers such as xylazine, azaperone and haloperidol are less dangerous to humans and can be used in blowpipes. Conservation officials often use blowpipes to immobilize predators such as cheetahs and leopards that have been captured in traps on game ranches. Pole- or stick-syringes are essential tools for injecting tranquillizers. Pole-syringes are available from the same agent that supplies Paxarms equipment.

The following useful hints will help when using pole-syringes to tranquillize wild animals:

- The pole-syringe must be pressed quickly and firmly against the animal until all the fluid has been injected. Because there is often spillage before the needle penetrates the skin, the dose used must be increased by 20% over that used in a dart. This means that when the original dart dose is 1 ml for example, then 1.2 ml of the drug must be drawn into the pole-syringe. When an animal kicks or shies away and the fluid is wasted, a second injection may be necessary.
- The best target sites for injection are the hindquarters or the shoulders. In an animal with horns the neck must be avoided, because the animal will see the pole and fight it with its horns or try to push it away.
- Animals that have already been injected with a tranquillizer must be marked so that they can be identified to avoid a second injection. Spray paint can be used to mark a horn or the back of an injected animal. It is good practice to mark and identify each animal *before it is injected*. The Paxarms pole-syringe comes with a dye marker.

■ IMPORTANT PRECAUTIONS

One has to have a fire-arm licence to purchase or possess any dart gun that fires with powder charges. All dart guns are dangerous weapons. If a human were to be shot with the usual antelope dose of M-99 (Novartis), there is little hope of survival. The dart can also cause serious physical damage, depending on which part of the body is hit. Like any other fire-arm, a dart gun should never be left lying around and unused darts should never be left in the barrel of the gun. To do so is to invite disaster. Clean the dart gun thoroughly after use.

2.10.11 Problems encountered during chemical immobilization

Various problems may occur during the chemical immobilization of wild animals. However, the following are the main problems that will be encountered:

■ BLOAT AND PNEUMONIA

When an animal starts to bloat under chemical immobilization, it is always an emergency. A

bloated animal may die within a short time. With any immobilized ruminant, it is important to ensure that the animal lies upright on its chest or sternum with its legs folded under it, as if it were resting. The head must be held upright. An animal in this position will not bloat easily, but it may still happen. Under normal conditions the gas formed in the foregut of the ruminant escapes easily through the mouth. In an immobilized animal that is lying in an unnatural position, the gases cannot escape easily and the animal then bloats rapidly. When the head is not held up high and straight, the rumen content may flow into the mouth and throat of the animal. It forms an obstruction in the throat, or can be inhaled into the lungs. When this happens the animal develops pneumonia and dies after a few days. There are four major causes of bloat in ruminants. They are:

- Obstruction of the oesophagus by a foreign object
- Pressure on the oesophagus or closure of the oesophageal opening into the rumen
- Paralysis of the foregut caused by toxic substances
- Frothy bloat that is caused by abnormal gas production as a result of eating legumes such as lucerne

In immobilized animals, only the first two causes are of practical interest. Sometimes the oesophageal opening in the rumen of an immobilized animal closes under the weight of the rumen content because the animal is lying in an unnatural position and cannot pass the gases normally. The rumen and abdomen distend increasingly, first on the left side and then on the right side. The build-up of gases increases and the rumen presses against the diaphragm, which impedes breathing. Breathing becomes increasingly difficult until the movement of the diaphragm is restricted to such a degree that the animal can no longer breathe, and it suffocates. When an immobilized animal regurgitates and inhales some of the rumen content, it can suffocate within a few minutes. Sometimes only a small amount of rumen content is inhaled into the lungs. Nevertheless, the animal will still die a few days later of foreign body pneumonia. A bloating animal must be treated immediately as follows:

- As soon as it is noted that the animal is bloating and has difficulty breathing, the head and neck must be lifted to above the level of the chest. This helps to release some of the gases.

The mouth and throat must be examined to determine whether any foreign objects are lodged there and these must be removed without delay.

- If the above procedure is ineffective and the bloating increases, a well-lubricated stomach tube or length of thin, clean, lubricated garden hose can be inserted through the mouth and oesophagus into the rumen. The gas will then escape through the pipe. The tip of the pipe must not touch the stomach contents because this will block the pipe. It is sometimes difficult to insert a stomach tube into the rumen as the pipe may slip into the trachea or lungs. Should this happen, breathing noises will be heard at the other end of the tube. When the tube is in the rumen, the stomach gases can be smelled. The pipe can now be manipulated carefully until all the gases have escaped. The oesophagus usually lies on the right side of the neck. When the stomach tube passes down the oesophagus, it can be seen and palpated through the skin of most thin-skinned animals.
- When no pipes are available the gas can be released by puncturing the rumen with a trocar and cannula or a thick, hypodermic, 12-gauge needle that is at least 100 mm long. The trocar and cannula must penetrate the rumen on the left side, more or less halfway behind the last rib and the anterior edge of the hip bone, in the centre of the triangular area of the upper flank. This area will be distended abnormally. Long-acting antibiotics such as Compropen must be injected intramuscularly or subcutaneously to prevent possible infection from developing when the rumen content comes into contact with the tissues.
- Should none of the above procedures succeed, a final alternative is to revive the animal by injecting the antidote intravenously so that the animal can get up and move around as soon as possible. With the movement of the animal, the gas will escape naturally in most cases.

The last two procedures are *emergency measures* designed to try to save the life of the animal. The best approach is to prevent bloat from occurring at all. To do this an immobilized animal must always have its head held upright, as described earlier. When the animal has to be kept immobilized for a long time, it must also be repositioned regularly by turning it from one side to the other. This also helps prevent the animal from suffering

from lameness and stiffness of the legs after recovering. Remember that animals other than ruminants have specific and different positions in which they must lie when immobilized.

■ OVERHEATING AND HEAT STRESS

Overheating and heat stress develop quickly in an immobilized animal and may be caused by the following:

- The animal may have been pushed too fast or ran away too quickly while being herded by a helicopter or capture vehicle.
- The animal may have been exposed to some form of exertion, such as trying to escape from a crate or holding pen.
- The animal may have been captured on a hot and humid day.
- The animal may have been in the sun after it was immobilized.
- The animal may have been loaded into a crate and remained in the sun for a long time before the vehicle departed.
- The animal may have been loaded into a hot crate that had been standing in the sun for a long time.
- Too many animals may have been loaded into a mass crate with poor ventilation.
- The ventilation of the crate may have been poor, or tarpaulins may have been used to cover the crates, which then reduced or cut off the ventilation.
- The animal may have been placed in a hessian or plastic sack on a warm day after having been chased or immobilized.
- The animal may have been injected with a phenothiazine type of tranquillizer on a warm day. These drugs affect the normal functioning of the special heat centre in the brain.
- Animals with dark hides or skins such as buffalo overheat more easily than those with lighter ones.

The following are symptoms of overheating and heat stress:

- The animal is hot and sweats profusely.
- The rectal temperature rises above 42°C.
- The animal breathes rapidly and gasps for air.
- The pulse rate is high.
- The animal is exhausted and may lie with its head flat on the ground.

It is best to prevent overheating and heat stress from occurring. The following golden rules can be extremely useful in this regard:

- Never capture or transport animals on days that are hotter than 25°C.
- Never transport animals in hessian sacks.
- The transport vehicles must be well ventilated. Use fans in crates to improve the air circulation on hot days, especially when the vehicle is parked.
- Make every effort to get the animals to their destination as speedily as possible. Moreover, take all the necessary care with regard to the transport of the animals.
- Always park stationary transport vehicles in the shade until the animals are either ready to be loaded or offloaded.
- Avoid the use of phenothiazine type of tranquillizers on hot days.

The treatment of overheating and heat stress is seldom effective. Nevertheless, the animal can be moved to a shady area where it can be sprayed with a fine water spray.

3 CAPTURE MYOPATHY

Capture myopathy is also known as “overstraining disease”. It is one of the major causes of death in wild animals that are captured for translocation. With the exception of starvation, more animals have probably died of capture myopathy in southern Africa over the past 30 years than from any other wildlife disease. Many factors during and after the capture play a role in causing the capture myopathy syndrome. These factors are discussed here in some detail, because the number of deaths may be decreased by giving sufficient attention to this condition while capturing wild animals. The mortality rate may vary from a few individuals to 50% of the captured group and more. Capture myopathy is characterized by lameness, stiffness, exhaustion, depression, poor appetite and torticollis (neck bending backwards). An important symptom is the damage and deterioration of the heart, skeletal muscles, lungs, liver and kidneys.

3.1 Causes

Whether an animal is captured mechanically or chemically, the main cause of capture myopathy is

unnatural overexertion and stress. Although wild animals in natural conditions are usually considered to be fit, in reality they seldom have to exert themselves and never have to run fast over long distances. When they are attacked or pursued by predators in natural conditions, they will make a determined effort to escape, but in doing so they will usually run for only a short distance and then rest when they are no longer being pursued. However, when they are herded with a helicopter or ground vehicle during a capture operation, they will continue to run in an attempt to escape this ever-present danger. An alarm reaction of fight or flight sets in. Because the animals fear for their lives, they will take flight and continue to flee until they have overexerted themselves and have damaged their muscles and internal organs irreparably in the process. After the eventual capture, the animals are subjected to even more anxiety and stress of a more psychological nature because of the close proximity of the very people from whom they were desperately trying to escape. Moreover, more stress may be caused to wild animals by the following:

- Strange and especially loud noises
- Strange smells that are always associated with danger
- Fuel smells and the close proximity of motor vehicles
- Limited space and captivity, such as in a capture boma, crates and transport vehicles
- The close proximity of other animals, especially when they are natural antagonists

These factors all create a need in the captured animals to escape. As they cannot do so, they remain in a stressful state or become more stressed.

When an animal overexerts itself many changes take place in its body. Briefly, the process involves the following: myoglobin from the damaged muscles is released into the bloodstream, the muscle glycogen is broken down and an excess of lactic acid is formed, which acidifies the blood. Other changes in the chemical composition of the blood also occur. Complicated reactions take place in the damaged tissue and the kidneys become infected. Most animals die either as a result of heart failure or degeneration of the kidneys. The details will not be discussed here. However, it is sufficient to know that any animal that is subjected to extreme physical exertion may suffer from torn and damaged muscles, and

that the resulting physiological and chemical effects interfere with the normal functioning of several vital internal organs. The damage to the skeletal and heart muscles is usually so severe that they do not heal naturally, and with our present knowledge they cannot be treated successfully either. The stress factors can work cumulatively and eventually have a detrimental effect on the animal. Physiological and psychological factors such as anxiety and fear also come into effect when the animal is forced to extremes of its endurance.

The above discussion mainly refers to capture myopathy in animals captured by mechanical means. However, when the animals are captured through chemical immobilization, a similar condition may result. An immobilized animal may keep running until it has exhausted itself in one of the following situations:

- When the full dose is not injected for one or other reason.
- When the dose is too low and is therefore only partially effective.
- When the dart misfires, is faulty or the needle is blocked.
- When the absorption of the drugs is incomplete as a result of poor dart penetration, such as when the dart imbeds in hard bone, tendon, fascia, fat, the abdominal cavity or a rib.

In the above cases, muscle damage occurs while the animal is still running or roaming around in a confused, half-drugged state. Capture myopathy can also develop after capture when an animal exhausts itself in an attempt to escape from a net, crate or holding pen. Nyalas captured in nets are particularly susceptible to capture myopathy. When nyalas are captured in nets, they should be injected immediately with a suitable tranquilizer. Nyalas have been known to become so panic-stricken that they have died in the nets within a few minutes, even before they could be injected. Fear and anxiety combined with capture, holding and transport can build up at such a rate that the animal becomes panicky and dies without much physical exertion.

Animals that are continually exposed to fear and anxiety such as being caught, then being forced into crates or herded into small, individual holding pens where there are no hiding places, can suffer from extreme muscle stress and capture myopathy. Capture myopathy can also occur when an animal is herded fast for a few minutes only. Tsessebe are especially susceptible to cap-

ture myopathy after a chase of only a few minutes. In one capture attempt, two of three Burchell's zebras that were herded quickly over a distance of 5 km died within 12 hours of the chase. The other zebra died within 30 minutes of being captured.

Animals are less susceptible to capture myopathy when they are released at their new destination soon after their capture. This is because they are not under the stress of captivity and transport and are able to recover in natural conditions. The following factors influence and hasten the onset of capture myopathy:

- Excessive unnatural muscle action exerted over a short or long period and to which the animal is not used, such as being herded towards a capture boma or when attempting to escape from a capture net
- Fear of being caught and the close proximity of humans, helicopters and ground vehicles
- Injuries and bruising sustained during and after the capture, and the pain related to these occurrences
- Maladaptation to captivity and the limited space of crates and holding pens
- New and strange environments and unnatural smells, such as the creosote that is used for treating the wood in the holding pens and crates, and the smells of strange animals such as cattle and sheep or other animals in transport crates
- Rough handling during the capture operation, such as when the animals are removed from nets or when they are being loaded or offloaded. For example, gemsbok do not offload easily and less experienced people often drag or pull them out of the transport crates by tying a rope around their horns.
- Unfamiliar materials and structures, such as nets, plastic and motor vehicles
- Antisocial and aggressive behaviour of other captured animals
- Repeated unsuccessful attempts to escape from captivity
- Human smells and the sounds, smell and sight of dogs
- Loss of appetite and exposure to strange food and water in the holding pens or after they have been released into a new habitat

The following factors can influence the susceptibility of animals to capture myopathy:

- Extremely old and extremely young animals are most susceptible to capture myopathy.
- Animals that are overweight or in poor physical condition are more susceptible to capture myopathy.
- Diseases and infections predispose animals to capture myopathy.
- Severe worm and tick infections cause anaemia and weaken the animal, making it more susceptible to capture myopathy. Heartworms will influence the circulation of blood in the heart.
- Heavily pregnant cows and ewes are more susceptible to capture myopathy than non-pregnant ones.
- Warm or cold weather, rain and high air humidity can all enhance the onset of capture myopathy in captured animals.
- Water sources with a high salt content lead to chronic kidney damage.
- Leached soils are low in selenium and lead to capture myopathy.

Overexertion, anxiety, fear and stress may occur during all the stages of capture, transport, captivity and adaptation to a new environment, and these factors should be controlled as well as possible to prevent capture myopathy. Fewer deaths seem to occur when the capture team is greatly experienced, has the necessary expertise and conducts its work in a quiet, professional manner, as opposed to a capture involving much shouting and manhandling of animals by inexperienced and ill-prepared capture teams.

3.2 Type of animal

Capture myopathy occurs in most wild animals that are subjected to overexertion and stress. Humans are also affected by myopathy and cases may occur amongst military recruits during the first phase of their physical conditioning, especially after exhausting exercises when the recruits are not yet fully fit. In southern Africa, the following animals appear to be especially susceptible to capture myopathy and special care has to be taken in their capture and transportation: roan antelope, nyala, tsessebe, red hartebeest, springbok, kudu and giraffe. Springbok that are captured in nets and not treated with tranquillizers shortly after their capture are particularly susceptible to capture myopathy, and mortalities of 50%

and higher have occurred. Possibly because they are nervous and suspicious by nature, impala females are also highly susceptible to capture myopathy and stress. A neck bent backwards – a condition known as *torticollis* – is often observed in impala as a physical manifestation of having been under stress at some time or another.

Roan antelope and tsessebe are exceptionally susceptible to capture myopathy. Nevertheless, several years ago a group of more than 70 roan antelope were successfully moved from Bushmanland in the eastern part of Namibia to the western part of the Etosha National Park. After a few trial runs, it was found that the safest way of transporting them was to immobilize them and fly them to their destination while they were under the influence of chemical immobilization. The same method was used to transport roan antelope by road for five to six hours from a game reserve to a quarantine area in Malawi. At the quarantine area, the animals were again immobilized before they were transported by air to their final destination. Before and during the flight the animals were kept anaesthetized for up to ten hours, and not a single animal died. By using chemical immobilization and tranquillization under expert veterinary supervision, all the possible causes of stress were eliminated.

Red hartebeest and tsessebe may die from capture myopathy shortly after capture, or even several days or weeks after being kept in quarantine. When confined in holding pens, tsessebe will normally run along the sides of the pen for hours on end without stopping in an attempt to escape. It appears as if the animals do not realize that they cannot escape. The use of tranquillizers has to a great extent reduced such mortalities.

3.3 Symptoms

Depending on the severity of the condition, the following symptoms of capture myopathy may be noted:

- Pain and anxiety – the animal appears to be uncomfortable and uneasy and has a pained expression in its eyes.
- Lameness and stiffness of one or more of the limbs – the animal moves with difficulty.
- Shivering.
- Rapid breathing.
- A neck bent backwards or *torticollis* – this symptom may occur both in animals with slender

necks, such as impala and kudu, and in animals with thick necks, such as gemsbok and zebras.

- Loss of appetite.
- Constipation.
- The passing of dark or coffee-coloured urine – this condition is known as *myoglobinuria* and is a conspicuous sign of capture myopathy.
- Muscle paralysis – the animal may attempt to stand up, but cannot get to its feet. The fetlocks may be locked in a spasm or cramp.
- Exhaustion – once the animal lies down it cannot get up again.

There are three degrees of severity of capture myopathy. The *hyper-acute phase* causes death from heart failure shortly after the capture. Initially it appears as though the animal is restless and agitated. Then it suddenly becomes depressed before dying. At a post-mortem examination, haemorrhages can be seen in the skeletal and heart muscles. The affected animals may die within an hour after capture. In the *acute phase* the animal may live for a few days and show some of the above symptoms before dying. In the *chronic phase* the animal is lame in one or more of its limbs and is unwilling to move. It appears that the animal is stiff or partially paralyzed. Such an animal may live for a few weeks or even months. The animal is depressed, does not eat well or drink water, and is usually constipated and thin. When subjected to any other stress factor at a later stage, the animal can develop the acute form of myopathy and die of heart failure. Often the heart and kidneys have old lesions that appear as grey-coloured areas to the naked eye. These lesions consist of connective tissue and can be confirmed when examined microscopically. Chronic capture myopathy frequently occurs in animals that appear to be healthy superficially.

3.4 Capture myopathy in the savannas

In savanna areas, some of the deaths that occur shortly after animals have been transported and released are sometimes incorrectly ascribed to plant poisoning or heartwater. A wild animal will not eat toxic plants such as gifblaar voluntarily. With the exception of animals such as springbok, eland and black wildebeest, most antelope are naturally but partially resistant to heartwater.

Heartwater can be confirmed by microscopic examination. Nevertheless, one still often hears of gemsbok, eland and other animals dying within five to seven days of release, and the cause of death is given as heartwater without the disease being confirmed microscopically. It is a known scientific fact that heartwater has an incubation period of not less than ten to 20 days after infection by bont ticks. It therefore appears more likely that such deaths are not caused by heartwater, but by capture myopathy. Deaths ascribed to plant poisoning and heartwater can be confirmed by a post-mortem examination conducted by a veterinarian. The same procedure can also identify deaths from capture myopathy, as will be explained below.

3.5 Post-mortem examination and capture myopathy lesions

A proper post-mortem examination or autopsy should be done on every animal that dies after capture or transportation to establish whether the death was caused by capture myopathy, other causes, or by some underlying disease. Post-mortem examinations sometimes also show a broken neck or visible wounds caused by fighting. When capture myopathy is confirmed as the cause of death, the person responsible for the capture and transportation should be informed to help minimize or even prevent future mortalities. This type of action can only benefit the game ranching industry. Post-mortem examinations should preferably be done by an experienced veterinarian because he is best qualified to recognize pathological changes caused by diseases and to interpret their significance. When no veterinarian is available and the carcass cannot be taken to a regional veterinary laboratory, the game rancher himself can do a basic post-mortem examination.

To be able to see all the lesions caused by capture myopathy properly, the skin must be removed from the carcass. The thick muscle groups of the fore- and hindquarters must be cut to establish whether there was haemorrhaging and damaged muscles. The examination should be done in sunlight or strong artificial light so that any abnormal changes are clearly visible. There must be water to wash the blood from the heart, liver and kidneys. The following are some of the lesions and changes indicative of capture myopathy:

- Haemorrhages and bruising under the skin and in some of the muscles of either or both the fore- or the hind limbs
- Haemorrhages on the outer and inner surfaces of the heart and the diaphragm
- Congestion or redness of the lungs and the accumulation of fluid in the lungs that presents as froth in the trachea and lungs
- A dull appearance of certain muscles of the limbs
- Congestion and degeneration of the liver and kidneys
- Dark-coloured urine in the bladder, a condition known as *myoglobinuria*. The darkly coloured urine originates from the muscle pigment myoglobin that is produced by the damaged muscles.
- In chronic cases there are pale or lightly coloured areas in the muscles. These are muscles that were damaged previously and had healed through the formation of connective tissue. Dull greyish-white areas occur just under the lining of the heart and in the heart muscle. Sometimes these pale lesions are also present in the kidneys.

To confirm a diagnosis of capture myopathy microscopically, samples of approximately 1 cc of the following organs and tissues must be collected and preserved in sample bottles containing 10% formalin: the affected muscles, the apex of the heart, and the affected areas of the heart, lungs, liver, kidneys, adrenal gland and the spleen.

The post-mortem examination must preferably be done while the carcass is fresh, when the lesions can be seen easily and before post-mortem changes set in. This usually means that it must be done less than 12 hours after the death of the animal. When post-mortem changes have occurred, they can cause confusion and the samples collected for microscopic examination to confirm a diagnosis may be useless.

A detailed history of the animal's life before its death must be provided with the samples when this is available. The following information must be written on the label of the bottle: name and address of the game ranch owner or manager, type of animal, its age and sex, date of death, organs and tissues collected. The samples should be sent to the nearest private or state veterinarian, who will forward them to a pathologist. Sam-

ples can also be sent to the Department of Pathology of the Faculty of Veterinary Science at the University of Pretoria (tel. 012 529 8000) or to the Veterinary Research Institute at Onderstepoort (tel. 012 529 9111).

3.6 Treatment and prevention

Many attempts have been made in the past to treat capture myopathy, but the results have been poor. The mere handling of the animal to administer treatment is often impractical and causes further stress. Intravenous glucose, saline fluids, corticosteroids and vitamin E or selenium have been administered in attempts to remedy the condition, but were unsuccessful in most cases. The best advice is to try to prevent the condition from occurring by exposing the animal to the least possible stress and exertion during its capture, transport and captivity. Until research yields better preventative measures, it appears that the only therapy that may play a role is the use of tranquillizers at capture and during transport.

3.6.1 *Tranquillizers*

Tranquillizers play an important role in the prevention of stress in animals. It has been proved that animals injected with a tranquillizer shortly after their capture have a better chance of survival and are also less liable to develop capture myopathy than untranquillized ones. Similar results have been achieved in the export of animals by air to foreign countries. To date, many thousands of animals have been treated with tranquillizers during capture and transport, with excellent results. In some cases, the mortalities associated with capture and transport have decreased from over 20% to less than 2%, only because of tranquillization. However, it is unfortunate that capture myopathy may never be eliminated entirely owing to the human factor and the use of capture methods that are not always above suspicion. Therefore, some degree of it may well have to be accepted.

3.6.2 *Taming and training enclosure*

Dr A.M. Harthoorn earlier conducted extensive research on the causes and treatment of capture myopathy. He developed a method of preventing the condition from occurring in rare animals. It involves a process of taming and training the ani-

mals so that they can endure the stress of capture and transport better (Figure 33.15). This method would probably work for most wild antelopes, but it is time-consuming and the benefits must be weighed against the additional investment in time and labour.

In this technique, the animals are first herded by helicopter into a special taming or training enclosure of 10 ha (250 × 400 m). They can also be attracted to the area by salt licks, water or supplementary food. Lengths of plastic sheeting are erected to form a wide funnel at one or more of the corners of the enclosure. This funnel facilitates the entry of the animals into the camp. The vegetation in the enclosure must be natural and similar to what the animals are used to. The rationale for this is that the animals will be less stressed in familiar and natural surroundings. The fence of the enclosure must be high enough to prevent the animals from jumping over it. The enclosure must be divided by a diagonal fence with an opening of about 50 to 80 m near one side of the fence and a narrower opening of about 10 to 20 m near the other side.

Every day the animals are made to run at a relaxed pace along the inside of the camp into the funnel-shaped area so that they exit at the narrow opening between the diagonal fence and the outer fence. The direction of movement is indicated in Figure 33.15. The animals are allowed to settle down once the run has been completed and are not disturbed again until the next day. Initially plastic curtains may be drawn from the diagonal fence to the outer fence to prevent the animals from turning back. After a few days, this may not be necessary any longer.

During the month that the animals are being trained to circle around the diagonal fence, the side and diagonal fences are gradually lined with plastic sheeting or hessian. The training runs continue and the animals become accustomed to the material over time. They therefore readily accept the alterations to the outer and diagonal fences. The whole process can take a month or more. Once the animals are accustomed to the enclosed area and have accepted the routine of taming and training, the narrow end is connected to a crush passage leading to a mobile loading ramp and transport crate. The final transfer is then completed with minimal stress. The following guidelines may increase the chances of success:

- It has been found that the animals become tame more quickly when someone is on duty at

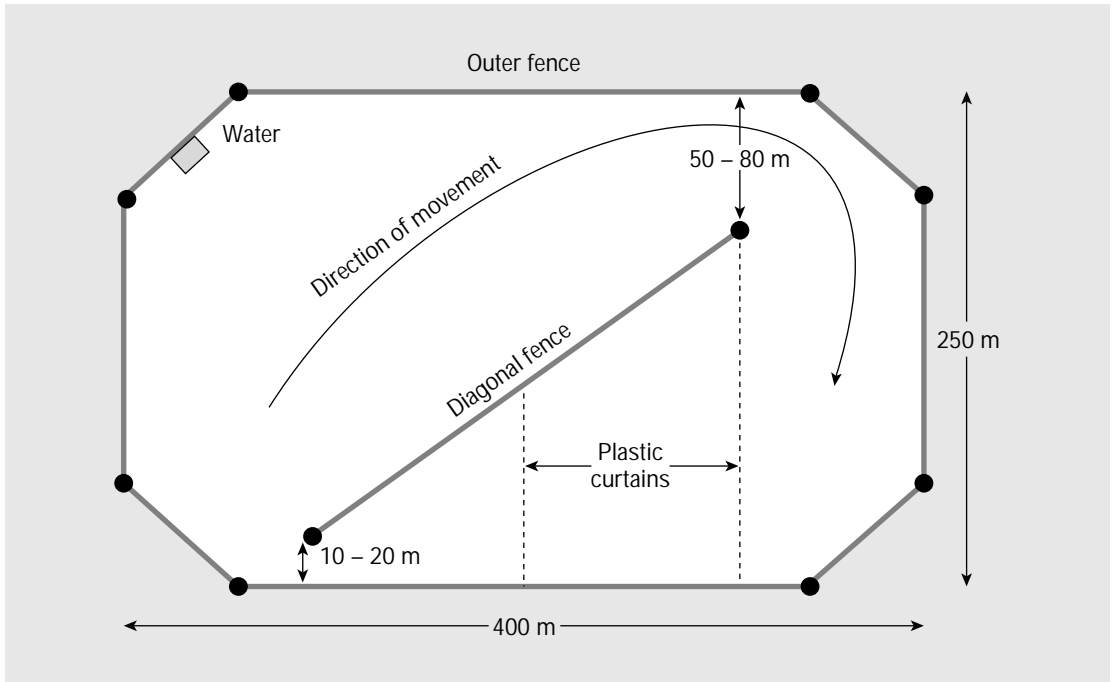


Figure 33.15 The taming and training method to reduce deaths by capture myopathy in captured antelope.

Source: Adapted from Harthoorn (1979).

the enclosure and walks around daily with a portable radio playing soothing music. This person should obviously not disturb the animals unduly. The tasks of this person are to cover the diagonal wire strands and the fence with plastic, to exercise the animals and to feed and water them.

- Lucerne or other suitable food should be supplied from the beginning at a central point. This is done to accustom the animals to supplementary food and also to supplement the forage in the enclosure.
- Some or all of the animals can be immobilized by using soundless darting equipment that does not create a disturbance. To do this, the animals can be moved into the triangular area between the diagonal and outer fences that can be partitioned off with curtains. The person responsible for the immobilization can hide behind the fence while the animals are herded slowly towards him by the person who cares for the animals and to whom they have grown accustomed.

- After all the animals in the enclosure have been captured, the plastic sheeting must be removed and stored because the sun and wind will spoil it.

This method has been used to capture and load sable antelope. It can also be used successfully for other types of antelope. It has the following advantages:

- The animals are subjected to the minimum of stress because they are herded slowly and are used to their surroundings.
- The coolest time of the day can be chosen for the capture.
- The method is never stressful and even pregnant animals can be captured.
- By supplying supplementary feed such as lucerne, many of the feeding problems that may be encountered at the new destination can be eliminated.
- The method allows close observation of the animals and the timeous treatment of sick or injured ones.

- The method limits the mortality rate in rare animals such as sable and roan antelope.
- The taming and training enclosure is permanent, requires minimum maintenance and can be used repeatedly.
- Additional enclosures can be built alongside the first one to handle other animals.

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