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NATSOP-CAM004 NATIONAL STANDARD OPERATING PROCEDURE: FIELD IMMOBILISATION OF CAMELS

Voluntarily adopted by the Vertebrate Pest Committee 2012 with the Invasive Plants and Animals Committee endorsing minor updates September 2017.

BACKGROUND

Feral camels (*Camelus dromedarius*) are widespread throughout central Australia. They pose serious environmental and agricultural threats including degradation of soil, waterholes and native plant communities; competition with native animals and domestic stock; damage to infrastructure; erosion of waterways; and spread of weeds.

Large vertebrate pests are usually managed by culling or commercial harvest. However, at times they can be difficult to locate because of the vast area that they inhabit or because of the inaccessibility of terrain.

Radio-collared 'Judas' animals can be used to enhance population control programs. The technique involves immobilising an individual, attaching a telemetry collar, and releasing the collared animal to re-join its herd. The collared individuals are subsequently tracked via GPS and communications satellites, and periodically other members of the animal's herd can be either mustered or shot. The technique is particularly useful when the target population occurs in medium to low densities, or are widely dispersed in remote areas.

This technique is effective for camels because they are principally social animals and females in particular are known to locate another group if they become isolated. It should be noted that camels are not naturally aggressive animals and prefer to flee from the helicopter and personnel. However, if it is necessary to handle or lasso them, it should be done with great care as they are large and heavy animals.

The immobilisation technique we describe involves using Schedule 8 and Schedule 4 drugs to immobilise the camels with the use of darts discharged from a tranquilliser rifle operated from a helicopter. It is a high risk technique and restrictions apply under State and Federal legislation relating to Scheduled substances, firearms, aviation and animal welfare. This National Standard Operating Procedure (NATSOP) meets the legislative requirements and maximises the safety of and the welfare of the staff and animals involved.

GENERAL CONSIDERATIONS

- The Judas technique should only be used in a strategic manner as part of a coordinated program designed to achieve sustained effective control.
- For safety reasons, darting from a helicopter cannot be undertaken in adverse weather conditions (e.g. strong wind, rain, low cloud).
- Darting is difficult and sometimes dangerous in heavily wooded areas; this situation should be avoided.
- Darting of feral camels should only be performed by competent, trained personnel who have been tested and accredited for suitability to the task and marksmanship and who hold the appropriate licences. Firearms accreditation must also cover firearms used for euthanasia of feral camels (e.g. .308 rifles).
- All non-veterinary staff required to use immobilising chemicals must be trained thoroughly in their safe and humane use by a veterinarian.
- Animal welfare standards must be strictly observed when capturing animals for use in Judas operations.

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- Helicopter pilots must hold the appropriate licences and permits including approval from the Civil Aviation Safety Authority and be skilled and experienced in aerial shooting operations.

- Storage, use and transportation of firearms and ammunition must comply with relevant legislative requirements.

- Storage, use and transportation of veterinary chemicals must comply with relevant legislative requirements.

- Schedule 4 and Schedule 8 chemicals are subject to regulatory controls under State or Territory legislation and can only be obtained via a prescription from a registered veterinarian. It is ILLEGAL to be in possession of these drugs unless they have been prescribed by a veterinarian for a specific purpose, or the user holds a Schedule 4 and Schedule 8 drug license for this specific purpose. Under the Standard for the Uniform Scheduling of Medicines and Poisons (SUSMP), Schedule 8 drugs involve additional legal constraints relating to storage and recording of use

HEALTH AND SAFETY CONSIDERATIONS

- Darting from a helicopter can be hazardous particularly in areas of rugged topography. The combination of low-level flight, close proximity to obstacles and the use of firearms and dangerous chemicals make this task extremely hazardous.

- Safety protocols must be strictly followed and the appropriate policy documents for aerial operations, chemical and firearms use should be adhered to.

- Camels are large, potentially dangerous animals. The risk of serious injury from being kicked by an uncoordinated sedated animal is high unless all staff position themselves safely.

- Personnel involved in this activity must hold a current Senior First Aid Certificate.

- Firearm users must strictly observe all relevant safety guidelines relating to firearm ownership, possession and use.

- When not in use, firearms must be securely stored in a compartment that meets State or Territory legal requirements.

- When not in use, Schedule 4 and Schedule 8 drugs must be securely stored in a compartment that meets State or Territory legal requirements.

- Adequate hearing protection should be worn. Repeated exposure to firearm and helicopter noise can cause irreversible hearing damage.

- Extreme care must be taken when handling Schedule 4 and Schedule 8 drugs that can affect humans. For example, medetomidine and ketamine are potent sedatives in humans and self-injection is extremely hazardous. To minimise self-injection risks, Schedule 4 and Schedule 8 drugs should not be handled while inside the helicopter. All darts, including back ups, should be pre-prepared on the ground and kept safely in an esky or equivalent dart holding equipment in the helicopter and not loaded into the dart gun. All staff should be trained and prepared to administer first aid or resuscitation as required.

- If veterinary chemicals come into contact with skin, immediately wash the area with soap and water.

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- All used needles, syringes and darts should be placed into a 'sharp medical waste container' as soon as they have been used. Handling of needles and darts should be kept to a minimum.

RESOURCES REQUIRED

- Helicopter
- Four-seater helicopter meeting the minimum safety guidelines for the State or Territory.
- Intercom helmets
- Full 'cameraman' or 'shoulder' safety harness and anchor point designed for this purpose
- Darting rifles, darts and allied equipment
- Dart guns powered by explosive charge should be used (e.g. Pneudart 196). CO2 powered dart guns may not be sufficiently powerful for helicopter darting.
- 6 – 7ml darts should be used with 20 gauge, 38mm barbed needles or similar. It is unlikely that telemetry darts would be required as the camels are seen in open terrain.
- The accuracy and precision of all firearms and users should be tested against inanimate targets prior to the commencement of any shooting operation.
- Lockable firearm box
- Lockable ammunition box

Drugs

- Dart container – upright container fixed to the user or helicopter, with individual compartments and snapshut lid.
- Drugs required are medetomidine (20-40mg/ml), ketamine (1g vials), butorphanol (10 or 50mg/ml), atipamezole (5mg/ml) and naltrexone (50mg/ml)
- All drugs must be kept in cool conditions (8ºC) out of direct sunlight. During transportation, drugs should be kept in a solid esky or refrigerator.
- It is important to ensure that all drugs are within the expiry period specified by the manufacturer.
- Atipamezole should be administered using a 20 mL syringe and an 18 gauge, (1.25 inch needle) or similar.
- A drug register book must be carried to record amounts of ketamine used.
- Secure storage of Schedule 4 and Schedule 8 drugs

Other items

- Radio collars – the total weight (collar, transmitter, battery, aerial and bonding material) should be less than 5% of the animal's bodyweight.
- Device for collar activation (usually a magnet)
- UHF radio tracking receiver and antennae
- A handheld GPS unit should be used to record animal locations
- Rifle and ammunition suitable for euthanasia of injured animals – .308 calibre
- Binoculars/range finder
- Recording sheets
- Pulse oximeter for monitoring animal heart rate and oxygen levels during sedation
- 20 m x 12 mm rope for securing the camel
- Hessian sack for covering the camels head
- PVC or nitrile gloves
- Leather gloves
- Glasses for dart gun operator
- Stop watch

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Using Medetomidine + Ketamine + Butorphanol (mean doses):

Chemical name	Type	Route	Dose	
			400 kg	600 kg
Medetomidine	Anaesthetic combination	IM	48 mg	72 mg
Ketamine		IM	0.92 g	1.5 g
Butorphanol		IM	20 mg	30 mg
Atipamezole	Reversal	IM	92 mg (minimum)	138 mg (minimum)
Naltrexone		IV	68 mg	102 mg

Using Medetomidine + Ketamine combination (mean doses):

Medetomidine	Anaesthetic combination	IM	88 mg	132 mg
Ketamine		IM	1 g	1.5 g
Atipamezole	Reversal	IM	96 mg (minimum)	144 mg (minimum)

NB: IM = intramuscular injection; IV = intravenous injection

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SURVIVAL KIT (INCLUDING A FIRST AID KIT) EMERGENCY LOCATING BEACON (EPIRB) PREPARATION

Drug regime

Based on previous experiences with wild camels, standard zoo dose rates do not apply because the animal is usually more agitated and excited than in captivity. It has been noted that wild camels require three to four times the normal standard captive camel dose rates of xylazine and ketamine, which requires several darts because the volume becomes very large. Hence a new drug regime has been developed which reduces the volume to be administered to one dart only.

Concentrated medetomidine and ketamine are used with butorphanol to minimise volumes and induction times and atipamazole and naltrexone are used to reverse two of the drugs.

There may be a residual ketamine effect but this wears off quickly and appears to have a minimal effect on the animal once the reversal drugs are administered.

Tranquiliser darts and darting rifle

- Personal protective equipment must be worn when loading darts (PVC or nitrile gloves, safety glasses).
- The number of animals to be immobilised (and hence the number of darts required) should be determined before each trip. Prepare two darts per animal.
- Darts must be prepared in a clean and quiet environment without interruption. It is important to let someone know that you are doing this procedure.
- Normally Pneudarts are used – 6ml or 7ml with 38mm length barbed needles.
- The amount of medetomidine required is added to the 1g vial of ketamine which is then shaken to improve solubility.
- The butorphanol is added too but you must ensure the total volume does not exceed 6ml or 7ml depending on the size of the dart being used
- Darting syringes are loaded in a vertical position. Using a 50mm 18/20G needle and 10 ml syringe the drugs are drawn up and injected slowly through the centre of the darting syringe needle. Avoid any spillage. A 50 mm length needle is essential to avoid spillage and back flow.
- Once the drug is placed in the darting syringe the end of the darting needle is ‘sealed’ using vaseline to avoid losing drugs.
- Ensure the dart rifle is cleaned and oiled.
- The loaded darts are placed in the esky.
- Ensure you have sufficient charges if using a Pneudart rifle – normally colour green charge is required and the setting on the rifle is 4 for this size of dart and the distance recommended.
- Update the drugs register when preparation is complete

Radio collar testing

- Test radio collars immediately before deployment by removing the deactivator and checking signal on a receiver.
- Fine tune the receiver frequency for maximum signal strength and record the frequency.
- Etch the transmitter with its frequency.
- Replace deactivator to turn the transmitter off.

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FIELD IMMOBILISATION PROCEDURES

Pre-flight

- Animals should not be tranquillised in temperatures greater than 33°C.
- A decision is made as to the sex and size of camels to be darted before leaving. It is important to avoid darting female camels with young calves at foot and very heavily pregnant animals.
- Darts are prepared immediately before the helicopter flight and should be based on the correct sex and size of animal being targeted. Two darts for each animal should be made in case of misfires.
- The darts are securely loaded in a container in the helicopter and not loaded into the breach of the dart gun.
- All belts and harnesses should be attached and the darters' door removed
- Ensure the dart rifle's safety catch is on.
- Ensure the intercom system between pilot and darter is working adequately
- Ensure all necessary darting equipment is available.
- Fill magazine with correct blank charges but do not insert into gun.

In-flight pursuit of camels and operation of dart rifle

- Shoot only under favourable weather conditions. Avoid adverse weather conditions such as strong wind, rain or low cloud.
- Shoot only in open areas where visibility is high. Avoid dense cover, such as vegetated creek lines, woodlands and forests.
- Once in the air and a group of camels has been sighted, they should be approached so that the age and sex of the group can be determined and a suitable candidate for immobilisation chosen.
- Once a target is sighted and has been positively identified, the pilot should position the helicopter as close as is safe to the rear of the target animal to permit the darter the best opportunity for a clean shot.
- Minimise the pursuit time to reduce the stress on the target animal in particular as this may have an adverse effect on the induction of anaesthesia and the smoothness of the anaesthesia.
- Continuous dialogue with the pilot is required to ensure the target animal continues to be sighted.
- Insert magazine into darting rifle – ensuring safety catch is still on and the barrel is directed outside the cockpit of the helicopter.
- While ensuring the dart rifle is pointing downwards carefully remove the prepared dart from the holding container and insert into breach of the dart rifle.
- When pilot agrees, get ready to aim.
- On final approach to darting position, communicate with the pilot "ready to dart".
- Ensure safety catch is off and the rifle is loaded.
- Continuous dialogue is required to ensure the pilot is in the correct position for darting. Sometimes trees cause the pilot to veer off-line in which case the pilot should communicate with the darter.
- The helicopter speed should be at the same speed as the running camel and the distance should be 5-15m from the darter.
- In this instance and using 6ml-7ml Pneudarts use 0.22 calibre medium (green) pneudart charges at pressure 3 (ie G3).
- Once in the correct position, the camel is darted as quickly as possible.
- If correctly darted communicate this to the pilot.
- Preferred sites are the gluteal muscle mass or the hamstring muscle mass.
- If darted into solid muscle, then the contents of the dart should inject into the muscle mass.
- If the dart hits bone, i.e. pelvis, then it's possible the contents will not be fully discharged.

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- If the dart bounces out immediately it is normally safe to assume the contents will not be discharged into the muscle.
- In either of the last two cases, another dart should be loaded and the pilot and darter prepare to dart the same animal again.
- The time of each dart injection explaining success or not is recorded on the sheet.
- Ensure dart rifle safety is on after successful darting.

Induction of anaesthesia

- Once darted, the pilot should move away and take an advantage point about 1000m above the group to reduce the stress on the group. This clearance may need to be adjusted in open areas; greater than 1000m may be necessary, but the darted camel must remain in sight.
- The group should slow down and the target animal will be seen to fall behind the group or start to show ataxia.
- Normally if the dose rate is correct and there has not been too much pursuit of the animal, induction should take 10 minutes ± 3 minutes.
- The normal process of induction is for the animal to slow down, become ataxic, start to sway and then stop – often recumbency will soon follow.
- On occasions, some camels will stop and not become recumbent preferring to stand legs apart. The camel should be lassoed around the neck and pulled to the ground by personnel following the Model Code of Practice for the Welfare of Animals (PISC 2006).
- Safety of all personnel is paramount at all times. If, after 15-20 minutes, the animal is not sufficiently sedated to be approached for lassoing, then the camel should be darted again either from the helicopter, or from the ground if the darter can approach sufficiently closely. Adjust the dart rifle power settings as required.

Assessment and approach

- All equipment including the dart rifle and drugs should be taken from the helicopter to the site of the animal.
- Once the camel is on the ground, if lying on its side, immediately place it in sternal recumbency to avoid regurgitation and inhalation of ingesta.
- The animal will then need to be restrained by ropes to provide safety. Roping, or hobbling the front legs together across the knees or ankles is recommended.
- The head and eyes should be covered using a hessian sack or similar material, and the camels' head must be held up to prevent if from falling into lateral recumbency. The person holding the head needs to be mindful of OHS procedures for heavy lifting.
- The dart should be immediately removed from the darting site and placed in a sharps container. The wound should be cleaned with diluted betadine and antibiotics (i.e. orbenin eye ointment or mastitis treatment, inserted into the wound).

Monitoring of anaesthesia and health assessment

- Once in sternal recumbency and the legs are tied, the animal should be monitored and assessed.
- Rectal temperature should be taken and noted – temperatures over 40°C require water to be poured over the head and between the hind limbs to improve evaporative cooling.
- Both the respiratory rate and pulse rate should be taken and pulse oximeter attached to the tongue to assess oxygen saturation and heart rate, which are recorded.
- Someone should be assigned to observe and record the respiration at all times.
- Assess the capillary refill time and mucous membrane colour by pressing the mucous membrane to blanch the skin and then releasing the pressure. Normally, skin should perfuse

into the blanched area within 1-2 seconds. A longer time period may suggest poor tissue perfusion which maybe related to an excessively deep plane of anaesthesia.
- The overall condition of the animal should be assessed and in particular teeth wear should be noted.
- If a veterinarian is present, the pregnancy/lactational status should be checked and recorded.
- In the unlikely event the animal has sustained life threatening injuries during capture and restraint, it must be humanely euthanased. If there is doubt that the animal will have a full recovery even after giving reversal drugs, then it should be humanely euthanased.

Treatments

- Given the stress of the whole process it is incumbent on the team to ensure the health of the camel is optimised to guarantee the animal will travel with the tracking device for the longest time.
- The camel is treated with long acting antibiotics intramuscularly (i.e. long acting penicillins), vitamin E/selenium intramuscularly (Selvite) and anthelmintics subcutaneously at normal cattle dose rates by estimated weight. All treatments are recorded on the sheet.
- Attachment and testing of radio collars
- Switch radio transmitter on by removing the deactivator and check the signal. Record the capture location using a handheld GPS.
- The collar must be fitted so that it can move up the tapered neck of the animal as it grows or gains weight. Tight collars will constrict the neck of an animal as it grows, while loose collars may come off or catch in vegetation. As a general rule, the collar should not be able to be pulled over the camels head.
- Test the backup UHF beacon with a UHF radio receiver.

Reversal

- Once the radio collar has been checked to be working and once all other procedures have been done, the ropes are removed from the animal. The camel continues to be held in sternal recumbency with head upright.
- Under no circumstances should any reversal drugs be given until the ropes have been removed.
- The reversal drugs are administered intramuscularly into the neck, biceps or triceps muscle. The head cover is kept on until the animal is standing.
- The success of the reversal drugs is illustrated by the increase in rate and depth of respiration, the tongue and lips have more motor control, the camel often eructates or belches and then will start to show muscle movement. Between 5 minutes and 10 minutes should elapse before the camel will attempt to stand – often only one attempt is needed. Personnel should stand at a safe distance in case the camel falls over when attempting to stand.
- The camel will then stand and start to shake and become alert to their surroundings. Sometimes the camel will walk away or stand for a short while before the full effects of the reversal drugs have taken effect. They are more responsive to activities in their immediate vicinity. Leaving the Hessian sack on the camels' head (if it stays without assistance) will not impede its recovery. In fact, it may prevent the camel from trying to escape before it is ready.
- The camel should be observed from a safe distance to see if it can walk safely and normally. Normally, an animal that is alert enough to be left, walks or trots steadily, looks back regularly and vocalises. The animal can then be left, under the assumption it will continue to recover uneventfully from the anaesthetic procedure.

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RECORDS

A record sheet is used to record all activities pertaining to the timing of darting, the anaesthetic procedure and reversal. This is useful information to know, both in the immediate sense if you have to dart the camel again, and for researching the effectiveness of the anaesthetic regime. An example of a record sheet is attached as Appendix 1.

ANIMAL WELFARE AND EUTHANASIA

It is not anticipated that there will be any adverse effects, however, in the case that the animal is underdosed because the drug in the dart is not the optimal dose for the size of the animal, the induction process may be longer (up to 20 minutes) and may require a top up of anaesthetic drugs. In this case, it is possible during this induction period the camel may stumble into trees, possibly injuring its leg or brisket as it stumbles. In this event lassoing the camel and pulling it down may need to be incorporated.

As with all large animal anaesthetics where there has not been pre-anaesthetic withholding of food and water, there may be a possibility of regurgitation. This can be minimised by holding the head up while the camel is in sternal recumbency.

Over-dosing may lead to a very deep plane of anaesthesia leading to severe respiratory depression, cyanosis or adverse paleness of the mucous membranes. If this is the case, partial reversal maybe instituted to improve respiration and tissue perfusion.

Capture myopathy is a possible medium term sequela of a prolonged capture procedure. Camels appear to be less susceptible to this condition than other hoofed animals e.g. antelopes. Injection of vitamin E has been commonly used in a variety of species to attempt to prevent the onset of capture myopathy. Although there is no direct evidence to suggest it may work, it can be done for all tranquilised animals.

- Any injuries, regurgitation or severe respiratory depression (or if future capture myopathy may be suspected), will be assessed in the context of the entire procedure and the ability to treat and manage the problem in desert conditions. Should the future long-term survival of the animal be compromised any way, a decision must be made to euthanase the animal immediately.

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Location _____ Zone _____ Camel Mob size _____

COLLAR INFORMATION Collar ID: _____

Argos No: _____ VHF _____ GPS _____

DARTING INFORMATION

Time at first chase _____ Distance for darting _____ Charge _____

ANAESTHETIC DRUGS

Time darted	Drug	Dose	Success	Elapsed time		Effect

Time at first effect _____ Elapsed time _____

Time at 1st contact _____ Elapsed time _____

Time at recumbancy _____ Elapsed time _____

Time at start of procedure _____ Elapsed time _____

Time at end of procedure _____ Elapsed time _____

EXAMINATION

Time	Temp	Pulse	Resp	SO2	CRT	MM colour

Skin _____ PD _____ Teeth _____ BCS _____

Bloods Y / N

ANIMAL INFORMATION

Sex _____ Age Est _____ Est Wt _____

Hump circum _____ Thorac Girth _____ Hump Ht _____ Shoulder to thigh _____

Shoulder Ht _____ Abdo Girth _____ Other _____

REVERSAL AND OTHER DRUGS

Time	Drug	Dose	Route	Comments

Time at 1st reaction _____ Elapsed time _____

Time at Standing _____ Elapsed time _____

Time at Walking _____ Elapsed time _____

COMMENTS

Appendix: Example of Camel Immobilisation Record Sheet

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USE OF JUDAS CAMELS TO IMPROVE EFFICIENCY OF AERIAL SHOOTING

This document does not cover the aerial or ground shooting of feral camels in Judas operations. As a guide, refer to NATSOP-CAM001 National Standard Operating Procedure: Ground shooting of feral camels and NATSOP-CAM002 National Standard Operating Procedure: Aerial shooting of feral camels.

REFERENCES

1. Boardman WSJ, Lethbridge MR, Hampton JO, Smith I, Woolnough A, McEwen M-M, Miller GWJ and Caraguel CGB (2014) Evaluation of medetomidine—ketamine and medetomidine—ketamine—butorphanol for the field anesthesia of free ranging Dromedary camels (*Camelus dromedarius*) in Australia. *J Wildl Dis.* **50**(4): 873-882.

2. Williams OJ (2002). *Capture and handling of camels destined for the abattoir*. 2nd Edition. Central Australian Camels Industry Association Inc, Alice Springs, NT.

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Reference me as: Boardman W, Lethbridge M, Harper M and Woolnough A (2014) NATSOP-CAM004 National Standard Operating Procedure: Field immobilisation of camels. PestSmart website. https://pestsmart.org.au/toolkit-resource/field-immobilisation-of-camels/