



Grey Kangaroo Relocation using Chemical Immobilisation Techniques

Standard Operating Procedure

July 2017

Version 1.0



Department of **Biodiversity,
Conservation and Attractions**

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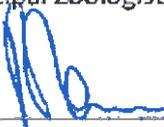
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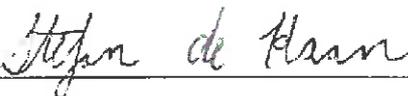
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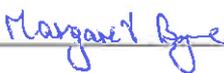
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Table of Contents

1. Purpose.....	1
2. Scope.....	1
3. Definitions	1
4. Level of Impact and Welfare Considerations.....	2
5. Personnel	7
6. Equipment.....	8
7. Sedation Drug(s).....	8
8. Procedure.....	8
9. Competencies and Approvals	10
10. Occupational Health and Safety	11
11. References and Further Reading	12

1. Purpose

Chemical sedation is one tool used to capture animals for treatment, surgery, relocation, data collection and for the fitting of telemetry collars. This method allows for specific animals to be targeted, captured, processed, relocated and released. This form of live capture can reduce stress and injury that could be caused by other forms of restraint or capture, and provides a suitable method for capturing nervous or aggressive individuals that could cause significant physical risk to themselves and the capturers.

This standard operating procedure (SOP) provides details on the processes approved for the chemical capture of western grey kangaroos for the purpose of relocation. Deviation from the procedure presented here must be documented and approved as part of the licencing process. This SOP may be used as a guide for the chemical capture of other macropod species and/or for other purposes.

Relocation is one tool available to manage issues related to the presence of grey kangaroos, particularly in urban areas. Before undertaking this approach, the situation should be carefully assessed considering the type and extent of the issue, the long-term impact on fauna, public opinion and all alternative management options. This SOP is to be applied when it has been determined that relocation is the agreed option.

2. Scope

This SOP applies to the chemical immobilisation of western grey kangaroos (*Macropus fuliginosus*) for relocation purposes. It covers the planning, capture (sedation), transport and recovery phases. All persons undertaking the relocation of grey kangaroos using chemical immobilisation in Western Australia must be familiar with and comply with the contents of this SOP.

The relocation of grey kangaroos in Western Australia must be undertaken in accordance with the *Wildlife Conservation Act 1950*, *Wildlife Conservation Regulations 1970* and the *Animal Welfare Act 2002*.

3. Definitions

Authorised Person: A person listed on the licence issued under the *Wildlife Conservation Regulations 1970* to undertake chemical immobilisation of western grey kangaroos for relocation purposes, on behalf of the licensee.

Capture myopathy (or exertional rhabdomyolysis or stress myopathy): A consequential condition of capture and handling of many species of mammals and birds that results in degeneration of skeletal and/or cardiac muscle.

Dart: A pointed missile that can be delivered by a delivery device, which can contain anaesthetic drugs.

Delivery device: A device that can deliver anaesthetic drugs. The delivery device may provide for remote (i.e. compressed air or blow pipe) or direct (i.e. jab stick or hand injection) delivery.

Licensee: The land owner or manager of the land who has been issued a licence under the *Wildlife Conservation Regulations 1970* to chemically immobilise western grey kangaroos for relocation purposes. The licensee is required to adhere to conditions listed on the licence and is vicariously liable for any breaches undertaken by persons authorised on the license.

Management plan: A document that details the approach and procedure of the chemical immobilisation and capture, and relocation activity. It must address welfare considerations and procedures and be presented as part of the license application.

Operator: The person who delivers the chemical that sedates the grey kangaroo, who is listed on the license as an authorised person, and has the skills, experience and any other relevant licences or permits required to undertake this activity. This person is responsible for the chemical capture process and after-care of the animal.

Young at foot: A young kangaroo that stays with its mother, often suckles and is dependent on her for its survival, but may no longer spend considerable time in the pouch.

4. Level of Impact and Welfare Considerations

There are risks with the use of anaesthetic drugs to chemically immobilise an animal, which can have significant impacts on an animal's welfare. Potential impacts of chemical immobilisation of an animal include:

Death or injury via:

- Capture myopathy resulting in death in minutes, 24-48 hours or even days and months later;
- Inappropriate selection of anaesthetic regime for the target animal; and/or
- Increased vulnerability during the recovery phase (e.g. to predation).

Dart impact damage:

- Trauma to the skin, sub-cutis and muscles resulting in:
 - Infection;
 - Abscess formation;
 - Septicaemia; and/or
 - Tetanus.
- Open wounds becoming infected or attracting the interests of insects or birds; and
- Injury from the dart hitting the wrong region (i.e. bone fractures), the dart not penetrating at a right angle, or the dart striking the animal with too much velocity that it enters the body cavity.

Stress or injury from:

- The animal encountering an obstacle or falling while under initial stages of sedation;
- Being inappropriately managed during transportation or while regaining consciousness;
- Starvation, if not released in an area with adequate resources or is unaccustomed to foraging in a different habitat;
- Dehydration; and/or
- Exposure causing hyperthermia or hypothermia.

Side effects of the anaesthesia:

- Decreased metabolic condition and cognitive ability in the short term, rendering the animal less able to forage, evade predators and appropriately interact with conspecifics; and/or
- Decreased lactation ability, causing malnourishment to dependents.

To reduce the level of impact of sedation, containment, transportation and relocation on the welfare of target individuals, the following must be considered, addressed and detailed in the management plan.

4.1 Experience

The operator must have adequate experience and training in the use of this technique, effects of the anaesthetic drugs and the behaviour of grey kangaroos to reduce potential risks of negative animal welfare impacts. It is acknowledged there may be unavoidable deaths and injuries associated with this technique, however, knowledge, training and experience will reduce adverse outcomes.

4.2 Equipment

The operator is responsible for equipment being in optimal working order. The operator must be familiar with the equipment, its effective distance and level of precision. The operator must ensure the target animal is within the optimal range of distance before firing, is stationary and has a suitable target region clearly exposed. The target area for grey kangaroos is the large muscle mass on the thigh of a hind limb. The intent should be to have the needle insert the agent into the muscle mass while avoiding bone.

If an animal is struck by a dart that has been embedded in the animal but has failed to discharge the intended dose of sedative, or should an otherwise successfully darted animal not be able to be located once the sedative has taken effect, darting of any further animals must be suspended until that animal is located and effectively sedated, or until all reasonable attempts have been made to locate the animal. Two hours of searching is generally deemed adequate. The level of effort should be recorded and reported (refer to section 8.3).

Where a darted animal shows signs of insufficient depth of sedation after 15 minutes, then a second dart should be used. If the dart has failed to discharge then a second dart with a full-strength dose of the sedative can be used. If the dart has partially discharged or the discharged sedative has not resulted in sufficient depth of sedation, then a second dart should be fired. The dosage of this second dart is that assessed as necessary to adequately sedate the kangaroo.

Visual contact should be maintained with the darted animal until the sedative has taken effect and the animal can be approached safely.

All used and misfired darts must be collected before leaving the site. All darts must be accounted for or reported to the Department if they cannot be accounted for (refer to section 8.3).

Depth of sedation is influenced by the quantity and strength of the drugs administered, the administration site, body mass, time after the initial injection and activity immediately prior to and after being given a sedative. Lynch and Martin (2003) defined six classifications of depths of sedation (Table 1). Stage 4 is considered appropriate for capturing and relocating animals.

Table 1. Classification of depths of sedation (from Lynch and Martin 2003).

Stage	Definition
0	No effect
1	Light sedation. Reduced alertness unless stimulated by touch or sharp sound. Very slight unsteadiness when moving.
2	Moderate sedation. Obvious unsteadiness when moving. Body sway when at rest.
3	Heavy sedation. Minimal responsiveness when handled. Can be gently examined without arousal but will respond to more vigorous handling or painful stimuli such as ear tagging.
4	Light anaesthesia. Moderate muscle tone. Brisk palpebral reflex. No responses to mild pain such as ear tagging or biopsy collection.
5	Surgical anaesthesia. Little muscle tone. Sluggish palpebral reflex.
6	Deep anaesthesia. Respiratory depression. Complete loss of muscle tone. No palpebral response.

4.3 Temperature

Grey kangaroos cannot effectively thermoregulate during sedation so are at increased risk of hyperthermia and hypothermia during relocation activities. Sedation activities should therefore be avoided in extreme temperatures. Relocations should be avoided during summer and only undertaken at night (between sunset and sunrise) with written approval, and will only be considered when there is a specific reason or no other alternative. If the forecast temperature for the relocation day (by the Bureau of Meteorology www.bom.gov.au) at 1800hrs the day prior to the relocation exceeds 33 degrees Celsius (°C), then the relocation must not occur. In practice, sedation should not be undertaken when temperatures are greater than 25°C (Roberts *et al.* 2010) so scheduling relocations early in the day is strongly recommended.

4.4 Capture myopathy

Capture myopathy is a condition associated with the capture and handling of many species of mammals and birds that results in degeneration of skeletal and/or cardiac muscle. Macropods can be affected by capture myopathy. Capture myopathy (or exertional rhabdomyolysis or stress myopathy) occurs when muscle damage results from extreme exertion, struggling or stress resulting in a rapid increase in lactic acid in the muscles, which if not cleared leads to acidosis, a drop in the body fluid pH, heart failure and the muscle deterioration. Dying muscles release myoglobin which can damage the kidney and lungs. The following four types of capture myopathy are reported:

- death in minutes due to a release of potassium from damaged muscles causing heart failure;
- death in 24 to 48 hours, caused by staggering and muscle rupture;
- muscle and kidney damage, and where the animal is often seen lying in an awkward position, and death often occurs after a couple of days; and
- death occurs days or even months after the event and is often due to a heart attack.

This condition can also result in abnormalities to posture and gait, resulting in increased susceptibility to predation.

Prevention is essential as treatment options are prolonged and have low success rates. Capture myopathy can be minimised by reducing the stress level, which in most cases relates to the length of exposure to a stressful situation. Fast, efficient and practiced procedures and an appreciation of what causes stress in macropods are the best defence against capture myopathy. An animal suffering from capture myopathy should be humanely euthanased.

4.5 Dependent young

Where practical, an operator should avoid darting females that have pouch young because drugs may have an adverse effect on lactation, reproduction, or cognitive and metabolic abilities. These effects could increase the likelihood of injury or separation of dependent young. Where it is unavoidable, then every attempt should be made to keep the young with its mother in the pouch.

Specifically, operators should avoid darting females with very large pouch young or young at foot. These joeys (i.e. 6-15kg) are still dependant on their mother and have a very low chance of survival if separated from their mother. If relocation of females with dependant young cannot be avoided or deferred, a plan to deal with the joeys must be determined in the management plan. The separation of mother and dependant young is not acceptable. Options must include either:

- Hand capture¹ of young at foot and released with its mother. For this technique to be successful, the identification of mother and joey must be maintained throughout the process and they must be released together. The joey should be captured prior to darting the mother. Hand capturing joeys may inflict additional stress on the animal. If small in size, it may be possible to re-insert the joey into the pouch while the mother is sedated. This technique requires close surveillance during the recovery period to ensure the joey remains with its mother when it has recovered.
- Darting of young at foot and release with mother. For this technique to be successful, the identification of mother and joey must be maintained throughout the process and they must be released together. Where practical, the joey should be captured prior to darting the mother. The target area on a joey for darting is very small and there is a much higher risk of the dart breaking a bone or causing permanent injury. Darting a joey less than 10kg should not be undertaken.
- Hand capture¹ of young at foot and placed with a registered wildlife rehabilitator until independent, then released to the same release location as its mother. This is not considered the preferred option and should only be used if all other options fail. Note that hand capture may inflict additional stress on the animal. If this scenario is likely, the identification of a registered wildlife rehabilitator and negotiations for them to accept joeys must be made during the planning phase and identified in the management plan. There may be a requirement for a financial contribution to cover the cost of raising joeys and this should be negotiated and resolved during the planning phase. The licensee remains responsible for ensuring the animal is released at a suitable location.
- Humane euthanasia of the young at foot.

Female kangaroos that are sedated with a joey in the pouch must be closely monitored. The surgical tape “fixomul” may be applied to the pouch area to help prevent the joey from being ejected during the process. Fixomul can be left in place during the recovery phase.

¹ Hand captured joeys must be placed in a bag as soon as practical to prevent injury.

4.6 Animals in poor condition

Animals in poor body condition, diseased or carrying an excessive load of external parasites, and therefore at an elevated risk of not surviving when relocated must be humanely euthanised. All animals that are obviously stressed, suffering from capture myopathy, severely injured or whose chance of survival when relocated has been compromised must be humanely euthanised. Dependant young that have been separated from their mother and cannot be safely captured must be humanely euthanised.

4.7 Unexpected injury or death

An animal can be injured during capture when attempting to escape, due to misplaced shots, asphyxiation during transport, hyperthermia, hypothermia, inadequate post-sedation care, unusual reactions to chemicals, inadequate levels of sedation during transport, capture myopathy or misadventure. Therefore, adequate training and safety measures in the capture and restraint of a sedated animal should be in place prior to entering the field. Veterinary advice must be available during the process.

Sedation of any further kangaroos must be suspended immediately if a kangaroo already sedated requires medical attention and cannot be resumed until the appropriate medical care has been provided to the affected animal or the animal has been euthanised.

if unexpected deaths occur consult the supervising veterinary practitioner to consider the probable causes and act to prevent further deaths before continuing with the process.

Any adverse events must be reported to the Department of Biodiversity, Conservation and Attractions within 24 hours of the event by email to nature.protection@dbca.wa.gov.au (refer to section 8.3).

4.8 Release Site

Release sites must be determined during the planning phase and must be approved, in writing, by the relevant Department District Manager (or approved delegate). Licensees are encouraged to identify release sites and present them for approval. Alternatively, the licensee can seek advice from the Department (see contact details below).

All negotiations and approvals regarding release sites are to be via the relevant Department District Office (contact provided below). Note, depending on the release site, there may be a need for additional permits (i.e. a Disease Risk Area entry permit) or notifications required. The District Officer can provide further information on this on a case by case basis.

Perth Hills District: (08) 9290 6100; mundaring@dbca.wa.gov.au

Swan Coastal District: (08) 9303 7700; karl.brennan@dbca.wa.gov.au

The following should be considered when selecting release sites.

- Sufficiently distant or barred from the capture site, that the relocated kangaroo is not likely, or is unable, to return to the capture location;
- Minimal travel time (distance) while satisfying all other criteria;
- Contain enough suitable habitat to sustain the number of animals released and those already present;
- Be in State Forest or on private property. If it is private property, then the owner's written consent is required. If State Forest, then the Regional Manager's written consent is required;
- At least two kilometres in a straight line from any sealed road;
- Easily accessible by vehicle; and
- At least five kilometres from previous release sites used in the same calendar year.

5. Personnel

When using chemical immobilisation for the relocation of grey kangaroos there are several crucial personnel that must be involved or informed. All personnel undertaking a chemical immobilisation program need to be suitably trained. Chemical capture training courses are available in Western Australia.

5.1 The licensee

The licensee is the land owner or manager of the land where the kangaroos reside, who has been issued a licence under the *Wildlife Conservation Regulations 1970* to chemically immobilise western grey kangaroos for relocation purposes. The licensee is required to adhere to conditions listed on the licence and vicariously liable for any breaches undertaken by persons authorised on the licence.

5.2 The supervising veterinarian

The supervising veterinarian oversees all operators. The supervising veterinarian must be identified and consulted prior to undertaking the activity, or may undertake the activity directly. They must be registered with the Veterinary Surgeons' Board of Western Australia (VSBWA). The supervising veterinarian is responsible for ensuring the operator is preparing and administering the sedative in an appropriate manner and is appropriately trained and skilled in the tasks.

The supervising veterinarian is required to advise on the quantity of anaesthetic drugs given to the animal, the post darting recovery and provide aid if the condition of the target animal deteriorates at any stage during the recovery process. It is the supervising veterinarian's personal choice to determine if they are required in the field during the darting process, however they must always be contactable during the darting process.

5.3 The operator

The operator is the person or persons that delivers the chemical that sedates the kangaroo, who is listed on the licence as an authorised person(s), and has the skills, experience and any other relevant licences or permits required to undertake this activity.

5.4 The support team

It may be appropriate to have other support personnel during the chemical capture program, namely a spotter, to determine where misfired darts have fallen, to retrieve darts at an appropriate time and to follow the darted animals. The size of the support team is dependent on the specific methods being used, location of capture, number of kangaroos being sedated, propensity of escape, etc.

6. Equipment

Various devices can be used to effectively deliver the required drugs for chemical immobilisation. Any device used for sedating kangaroos should be legal, effective, cause minimal stress and harm to the animals and provide for the safety of the operator and others. This may include dart guns, blow devices, jab sticks or syringes for hand injection.

Each remote delivery device will have a dart that is best suited for that device and specific instructions on how that dart should be loaded and used must be followed.

Darts must be loaded with drugs in the field as the animal weights vary and the correct dosage can only be determined through observations and consultation with the supervising veterinarian. Required dosages are dependent on the species body weight, temperament, and the animals' condition, and must be determined by the operator under supervision of a veterinarian. Dose rates for a range of body weights can be predetermined.

7. Sedation Drug(s)

The sedation drug(s) used for the chemical immobilisation of grey kangaroos, via a dart, must be determined in consultation with the supervising veterinarian, current literature and any limitations of the operator.

8. Procedure

8.1 Preparation prior to undertaking field activities

- Review of the situation to determine if relocation is the most appropriate option considering the number of animals, likelihood of survival, access, public exposure, etc.
- Develop a management plan which describes:
 - identification and approval of release sites (refer to section 4.8);
 - how animal welfare will be addressed;
 - how kangaroos can be contained and confined for darting;
 - how kangaroos will be darted and managed;
 - how animals will be transported; and
 - management of community enquiries, expectations and public complaints.
- Ensure all necessary licences and permits are obtained.
- Notify and confer with the supervising veterinarian of the proposed activity.
- Advise the Police of the proposed use of a firearm.
- Notify the Department by email (nature.protection@dbca.wa.gov.au) prior to field work commencing.
- Check all equipment and drugs are available and operational.

8.2 Field activities

Capture

- Re-survey the site, environmental conditions (wind and temperature) and the situation. Set up containment and confinement strategies as identified in the management plan, and other equipment. Assess all potential risks, any likely issues, including regarding dependant young (see section 4.5).
- Assemble darts and store securely.
- Undertake sedation activities ensuring that all animals and darts are accounted for.
- Once appropriately sedated, proceed to process macropods ready for transporting.

Transport of sedated animals

The specifics of processing and transporting the animals are at the discretion of operator but must be consistent with the management plan and account for the possible welfare impacts (refer to section 4 and in accordance with the Animal Welfare Act). Sedated kangaroos should be managed in a way that prevents injury to themselves or others, and minimises stress and discomfort.

Recovery phase

Once placed at the release site, animals are to be left to recover but must be monitored from a safe distance as not to disturb or startle the animals, and minimise stress. Only approach or handle the recovering animals if they are likely to cause harm or injury to themselves or others.

Once a kangaroo stands and is able to support its weight, it is deemed to have recovered and the monitoring can cease. Under no circumstances must an animal be left unmonitored until it can stand and support its weight. During this period animals are not to be exposed to harm.

If the animal has not regained normal locomotion skills within a set time, which should be predetermined prior to darting in consultation with supervising veterinarian, contact a veterinary practitioner. This must be reported as an adverse event to the Department (section 8.3).

8.3 Reporting

Any adverse events must be reported to the Department of Biodiversity, Conservation and Attractions within 24 hours of the event by email (nature.protection@dbca.wa.gov.au). An adverse event is an incident resulting in the injury or death of an animal, caused by the approved action, was not expected or deviates from the management plan. This may include, but is not limited to darts failing to discharge, animals unable to be located, unplanned deaths, injuries and issues with pouch young or young at foot. Include photos where possible. If there is a major incident that requires more immediate advice or attention, call the Department on (08) 9219 9837.

Within one month of the expiry of the licence, the licensee will provide an online return following the instructions below. A written report may also be submitted via email to nature.protection@dbca.wa.gov.au.

Table 2: Online return fields and instructions.

Fields:	Species	Number Taken	Date Collected or Destroyed	Condition when captured	Location collected	Date Released	Location Released	Comments
<i>Instructions:</i>	<i>State the species scientific name</i>	<i>Number of adult, independent animals taken</i>	<i>dd/mm/yy</i>	<i>Comment on condition of animals</i>	<i>Provide a description (i.e. address) and a GPS coordinate of the capture location</i>	<i>dd/mm/yy</i>	<i>Provide a description and a GPS coordinate of the release site. If multiple release site, use a separate row for each</i>	<i>Additional comments can be added here</i>
Example	<i>Macropus fuliginosus</i>	10	01/07/17	All animals in good to fair condition	Lot XX, Suburb, Perth. -31.1763 115.7859	01/07/17	Forest Block XX. -31.27485 115.0023	All animals recovered. No joey issues.

9. Competencies and Approvals

Competency Category	Competency Requirement
Management Plan	A management plan must be developed and provided to the Department during the licence application process.
Wildlife Licences	<ol style="list-style-type: none"> 1 License to take fauna for scientific purposes (Regulation 17), 2 License to take fauna for education or public purposes (relocation or education) (Regulation 15); or 3 License to take protected fauna causing damage to property (Regulation 5)
Firearms Licence	Attain appropriate licence(s)
Use of sedation drugs	The supervising veterinarian must ensure any person administering drugs is suitably experienced and skilled. The supervising veterinarian must be certified by the VSBWA.
Personnel skills and experience	<ol style="list-style-type: none"> 1 Relevant knowledge of macropod biology, ecology and behaviour; 2 Experience and training in the use of the delivery device to capture macropods; 3 Ability to identify safe environment where animals can be chemically immobilised without increased risk of injury or death, and public safety; 4 Experience in handling macropods; and 5 Experience in euthanising macropods or other large mammals.

10. Occupational Health and Safety

10.1 Safety in the field

It is the responsibility of the licensee and any authorised persons to ensure that their actions do not put themselves or the safety of others at risk. Firearms safety measures must be carefully followed. Care should be taken to ensure that any bystanders and other animals are not at risk of injury.

Drugs used in the chemical immobilisation of animals, can be dangerous to humans if accidentally exposed. To avoid this, conduct safe work practices and only those personnel suitably trained in the use and handling of drugs, do so.

It is good practice to insist members of the public, including wildlife carers and rehabilitators, do not remain in areas where kangaroos could be chemical sedated.

10.2 Animal related injuries

Care should be taken when handling animals to avoid bites, stings or scratches. All inflicted injuries (even superficial ones) should be appropriately treated as soon as possible to ameliorate possible allergic reaction, prevent infection and promote healing.

10.3 Zoonosis

There are several diseases carried by macropods that can be transmitted to humans (i.e. zoonosis such as Toxoplasmosis, Leptospirosis, Salmonella, etc.). All personnel must take precautions to minimise the risk of disease transmission to themselves, their families and wildlife. Advice on minimising disease risk is contained in Parks and Wildlife SOP 16.2 (2013).

Macropods often carry external parasites, including ticks. Persons involved in handling macropods should protect themselves from such parasites, regularly check for parasites and apply treatment as appropriate.

It is good practice for the licensee and other staff involved in the chemical capture program to use hand disinfectants.

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