



DEPARTMENT OF PLANNING, INDUSTRY & ENVIRONMENT

Best Practice Guidelines for the use of Koalas in Scientific Research



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Cover photo: Lachlan Wilmott.

Acknowledgments: These guidelines have been prepared for DPIE by Aditi Sriram. We would like to thank Hannah Ryan, Lachlan Wilmott, George Madani, Billie Roberts, Guy Ballard, Bronwyn Fancourt, Valentina Mella, Sarah Model, Renae Hockey, Nicole Gallahar, Tania Duratovic, Derek Spielman, Robert Wheeler, Stephen Jackson, Lynette Chave and Gillian Hay for their comments and assistance during the preparation of these guidelines.

Published by:

Environment, Energy and Science
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ISBN 978-1-922493-04-0
EES 2020/0387
September 2020

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1. Introduction

This document is intended as a resource and reference guide for researchers working with free-ranging koalas and for animal ethics committees (AEC) reviewing and approving koala research. It provides guidelines on trapping, handling, health assessments and the use of koalas in scientific research. The document aligns with the Department of Planning, Industry and Environment *Code of Practice for Injured, Sick and Orphaned Koalas* (OEH 2018). It has been prepared in consultation with experts in koala captures, koala research and veterinary care of koalas.

All koala research must comply with the NSW *Animal Research Act 1985* and the *Australian Code for the Care and Use of Animals for Scientific Purposes* (NHMRC 2013).

2. Trapping and catching

A pre-catch assessment, such as a site-assessment plan, should be undertaken before catching. The following variables should be considered:

Personnel

Most captures require a team of people, with at least one experienced handler or catcher. A veterinarian is required in field captures if sedation or anaesthesia are used. For captures without the use of sedation or anaesthesia, it is advisable to have a veterinarian on standby or to be able to transport the animal to a veterinarian if required.

Environmental factors

Avoid capturing koalas during hot weather (>30°C), heavy rainfall or high winds. Hot weather can cause hyperthermia and wet conditions can affect insulating properties of koala fur and cause hypothermia. These conditions are also dangerous for personnel involved in the capture.

Note: the environmental thresholds identified above serve as guidelines and will vary geographically and depending on AEC approval. For example, captures may be considered during cooler periods of the day (early mornings) in hot weather conditions (>30°C). The appropriateness of the site for capture must be considered and included in the site-assessment plan to assess the risk to personnel and the koala (e.g. the height of the tree, the health of the tree, proximity of the tree to drop-offs or cliff edges).

Individual animal factors

Catching methods might need to be varied if pouch or back young are present. However, unless a female koala has been recently caught, or has well-developed pouch young, it is usually difficult to identify the presence of pouch young.

Females with back young can be captured using the methods described below (see Section 3. Trapping techniques). Ideally, back young should remain on the mothers back during capture and remain together with the mother during the procedure where possible. Care

needs to be taken not to dislodge back young when capturing the mother as this may lead to injury. Older pouch young may voluntarily leave the mother and remain on the tree, if this does not distress either. These animals need to be monitored in the tree and the mother released back to the young as soon as possible.

Injured or diseased animals and animals with low body condition might require special care. Veterinary advice should be sought before capture of an injured or sick koala to avoid further injury. Alternatively, before starting trapping activities notify a local veterinarian or veterinary clinic experienced with wildlife so any sick or injured koalas captured can receive treatment.

Stress during trapping or catching

It is important to minimise loud noises as much as possible. Ensure any nearby dogs are restrained and kept well out of sight and only have people needed for capture and handling present. If working near roads or traffic, take measures (e.g. erecting a barrier) to prevent the koala from moving towards the road in case the koala evades the catch as it descends the tree.

Make sure personnel are briefed, roles are delegated, and the catch is well-planned to ensure efficiency and to reduce catch times so that stress to the animal is minimised.

Stress is an inherent part of captures, however, monitoring for significant stress should indicate the need to modify or abort the capture. The capture team should include personnel with experience in koala capture and behaviour capable of making such decisions.

There are variable signs of stress which a koala may display during capture or handling:

- constant ear flicking
- vocalising (grunting, low whining or high-pitched sounds)
- urinating or defaecating
- increased respiratory rate (normal respiratory rate is 10–15 breaths/minute).

In a survey by Radford et al. (2006), most (68%) captured animals displayed signs associated with stress (as listed above); however, no signs of compromise were noted on clinical examination of these animals post-capture.

Experience with capture and working with koalas will allow personnel to determine if the signs of stress are transient, which is not unexpected during capture attempts, or prolonged and possibly detrimental to the health of the animal. Abort capture if the koala displays signs of progressive or severe stress.

Panting or open mouth breathing in a koala is a sign of severe stress and is a consistent indicator to abandon capture (Radford et al. 2006).

Capture of multiple animals

Biosecurity must be considered when capturing and processing multiple animals to prevent pathogen transmission between individuals. Biosecurity considerations include:

- Individuals should be housed separately post-capture, except for a mother and her dependent young.
- Separate catch bags should be used for each capture.

- Equipment must be thoroughly cleaned, with 60–70% alcohol or chlorhexidine-based disinfectant before use between individuals. All organic material should first be washed and removed before cleaning with a disinfectant.
- Personnel should wear personal protective equipment (PPE) (i.e. gloves) or ensure handwashing and disinfection protocols are instituted before and between handling animals.

Record keeping

Details of all koalas that are caught should be recorded using a standardised capture data sheet (See Appendix 1 for example) that should include information such as:

- capture date and time
- location
- personnel present
- capture method
- duration of capture (from initiation of capture to release)
- sex
- weight and body condition score
- if sedated or anaesthetised, record drug name, dose, time and route of delivery of drugs and personnel involved including who administered the drug
- approximate age – based on tooth wear
- reproductive status
- health status (demeanour, gait, physical examination)
- signs of injury or disease
- samples collected
- identification method used and individual ID recorded
- if a radio collar is attached include VHF frequency
- release date and time.

If release was not possible, record specific actions taken (i.e. animal unwell and taken in to care).

3. Trapping techniques

Flag technique

Method

This requires extendable poles with a 'flag' (piece of fabric or a plastic bag) attached to one end (Figure 1). The poles are manipulated by operators on the ground, or if the koala is high in the tree, can be operated by a qualified and experienced tree climber. The aim is to wave the flag above the koala's head so the koala perceives a threat from above and descends the tree. As the koala arrives at the base of the tree, a catch bag is used to capture the koala. When the koala is at shoulder height, have the catch bag positioned below the koala, so that the koala climbs into it, gently pushing the head in. More than one flag or pole might be required to direct the koala down the tree (Figure 1). A person experienced with koala capture and handling is essential.

Equipment

- Extendable aluminium or plastic poles with a flag attached to the end
- Large catch bag made of thick cotton with a diameter of 45–60 centimetres and a depth of 60–90 centimetres, e.g. calico bag or large canvas postal bag. Avoid using bags with loose threads or loose weaving (e.g. hessian sacks) to prevent koala claws being entangled.



Figure 1 The flag technique

Left: Personnel on the ground with extendable pole with flag attached. Photo: Aditi Sriram.
Right: Two flags used to direct the koala to descend the tree. Photo: George Madani.

Advantages

- Thought to pose fewer risks than the safety line (or noose) and flag technique (see below).
- An experienced tree climber and catcher is an advantage, but not necessary if the tree is small or the koala is low in the tree.

Disadvantages

- If the koala is higher up the tree than the length of the pole, capture can be difficult or impossible.
- In areas where the flagging technique is commonly used, koalas can get 'acclimatised' to the flag and be less responsive, resulting in failed captures.
- This method, being less direct than the noose and flag method, can prolong capture time.

Safety line (or noose) and flag technique

Method

This requires an experienced koala catcher with tree climbing experience who has participated in multiple koala captures using this technique in variable situations (including difficult captures with animals high in the canopy) (Madani et al. 2020). This experience allows the catcher to identify when a capture is safe to attempt and when to abort the capture.

Once in position, the tree climber and catcher uses an extendable pole to direct and place a safety line or noose around the koala's neck (Figure 2). The noose has a stopper (i.e. knot to prevent overtightening and asphyxiation), is made of soft rope material ideally more than eight millimetres thick, and the running or loose end of the noose leads back along the pole to the catcher.

When the noose is around the koala's neck and secured by the catcher, a flag is attached to the end of the pole used to place the noose and is waved above the koala to direct it to descend the tree or towards the catcher in the tree. Using gentle tension, the noose prevents the koala from ascending the tree or moving away from the catcher. Once at the base of the tree or reachable by the catcher in the tree, the koala can be placed in a catch bag and the noose removed. If caught and placed in a catch bag in the tree, the bag can be gently lowered via an attached rope to personnel on the ground.

Equipment

- Extendable aluminium poles less than seven metres long, with a hook and point attachment for attaching the noose and flag (Madani et al. 2020).
- Tree climbing equipment and pertinent PPE (e.g. helmets).
- Catch bag.



Figure 2 The noose and flag technique

A noose being placed around the koala's neck using an extendable pole. Photo: George Madani.

Advantages

- This technique is reported to be efficient and non-harmful and is commonly used by researchers (Madani et al. 2020).
- It is relatively more time efficient and targeted than other techniques.
- There are no reported effects on the survival of individuals repeatedly captured with this method (Madani et al. 2020).

Disadvantages

- As with the flag technique, there is a chance the koala could climb further up the tree out of reach while the catcher is trying to position the noose.
- Once the animal is noosed, the catcher is generally committed to the capture as although possible, it is not easy to remove the noose.
- There is a risk that the noose rope can entangle or snag on a branch.
- An experienced tree climber and catcher and tree climbing equipment are required.

Koala trap

Method

Once the koala is identified in a tree, a cordon or fence is built around the base of the tree, say three metres away from the trunk, funnelling through a single exit into a cage trap. The trap is not baited but instead functions as a perceived opening or exit in the fence, luring the koala into the trap. Corflute panels or similar smooth materials are used to construct the fence. It must be high enough (minimum height one metre), to prevent the koala from climbing out. The panels must far enough from the trunk to prevent the koala jumping over the fence while descending the tree (Figure 3). A towel, tarpaulin or catch bag can be used to cover the top and sides of the trap to protect from potential adverse weather conditions.

Traps should be checked regularly, at least every two hours, or set up with a reliable trap alert system (Ashman & Whisson 2020). Ashman and Whisson's (2020) study demonstrated that 90% of koalas descended the tree within 24 hours of trap deployment. It is recommended that koala traps be deployed for no longer than three continuous days, after which it is advisable to choose alternate methods of capture. If the koala has not entered the trap in this period, the trap may function as a deterrent to the koala descending the tree and may act as a stressor. Traps can be deployed for longer periods when attempting to capture a sick or injured animal, however, consideration must be given to the urgency of capture of these animals and alternative methods employed where appropriate.

Equipment

- Cage trap – there are various cage traps designed for this purpose. Ensure the trap is large enough to allow the koala to safely turn inside and has a cover to protect from the weather.
- Fence – corflute or similar smooth material and posts (minimum height one metre) with a single opening funnelling into the trap.
- Catch bag.
- Trap monitoring devices.



Figure 3 Koala trap set-up

Construction of a temporary fence funnelling into a trap. Additionally, covering the trap with a towel or catch bag can provide security and protection from wind or rain. Photo: George Madani.

Advantages

- Does not require experienced tree climbing personnel or equipment and uses relatively easy to set up, portable equipment.
- Perceived as less stressful as it allows the koala to descend the tree of its own volition; however, the presence of the trap can deter the koala from descending.

Disadvantages

- Can only be used in sparse habitat where tree canopies do not overlap, as koalas can then move between trees rather than descending the tree.
- Vegetation might have to be cleared.
- Can be time and personnel intensive as the trap must be checked regularly to minimise stress and energy expenditure due to prolonged periods in the trap (Ashman & Whisson 2020).

4. Transportation

Koalas must be transported individually, i.e. multiple koalas (other than mother and dependent young) must not be bagged or crated together.

Koalas can be transported very short distances in a catch bag. However, if travelling for longer distances a purpose-built wooden crate or transport box that is well-ventilated and padded with a securely fixed fork branch for the koala to sit in is required (Figure 4). A rolled-up towel can be provided as a 'clutch log' for the koala to grasp during transport. For longer distance transport, ensure ambient temperature is monitored and maintained within the range of 20–25°C for adult koalas.



Figure 4 Temporary transport crate for a koala

Sturdy laundry baskets, towel substrate and a rolled-up towel are used for support. Velcro straps hold the basket lid on securely. Photo: Cheyne Flanagan.

5. Release

Koalas should be released at the site where they were captured, if possible, back to the original tree from which they were captured.

If the original capture location is unsuitable for release (e.g. if there is damage to the tree, or there is another koala in the tree), refer to the Code of Practice for Injured, Sick and Orphaned Koalas for guidance on the selection of an alternative release site as close as possible to the original tree. For larger movements between capture and release sites, refer to the *Translocation Operational Policy* (DPIE 2019).

Each koala should be assessed before its release to ensure it has suitably recovered, particularly if sedation or general anaesthesia was used.

After release, monitor the animal to ensure it can climb and is showing normal behaviours (e.g. climbing to the top of the tree, sleeping, eating) post-release. If the koala has problems climbing or displays any unusual behaviours the animal should be re-captured immediately and taken into care for further observation.

Where there are multiple captures at the same location, it is advisable to mark animals using an obvious visual marker (e.g. non-toxic, coloured animal or stock-marker crayon or spray) to avoid unintended recaptures. This is recommended even where ear tags are being used as ear tags might not always be easily visible in the field.

6. Handling

Capture and handling of koalas must only be performed by appropriately trained personnel. Handlers must be aware of the koala's demeanour during handling and monitor for signs of stress.

Capture

Equipment

Large canvas bags make ideal catching bags for koalas. Place the bag under the koala's rump and work it over the koala's head (Figure 5). The arms and legs can then be detached from the tree and the koala placed gently into the bag. Koalas have strong curved claws which must be carefully disengaged from the tree before placing the koala into the bag. Once in the bag, secure the opening with a tie (ensuring no part of the koala is caught in the neck of the bag). The koala can then be restrained within the bag in preparation for examination.



Figure 5 Bagging a koala descending a tree following its capture by noose and flag

Photo: George Madani.

Techniques

- Restrain the koala in a sitting position – hold both wrists and ankles with the koala facing away from the handler. Ensure the koala is supported on your lap or object (Figure 6). This will allow for examination of limbs, abdomen, chest and head. Non-anaesthetised animals might try to bite, in which case the head might need to be restrained by an additional person. A towel or catching bag placed over the koala's head might help to calm it during examination.

- Koalas can also be restrained from behind with one hand at the base of the neck holding the scruff firmly and the other at the base of the rump. Koalas can be gently lifted and moved short distances using this technique.
- If the koala has been sedated, it can remain in the catch bag and different parts exposed out of the bag and examined. Monitor the koala's head position within the bag constantly to avoid accidental suffocation or being bitten through the bag.
- Young can be examined by giving them a stuffed toy (e.g. a teddy) to grasp onto during examination.



Figure 6 Koala under sedation being restrained

The koala is being restrained by holding its wrists and ankles, with its body supported on the handler's lap. Photo: Marie-Claire Demens.

7. Health assessment

A standardised clinical assessment provides valuable information on the health status of the animal and maximises the benefit of the capture. Protocols for health assessment vary depending on research requirements.

The collection of diagnostic samples for research (i.e. disease and genetic investigations) should also be considered during captures if appropriate AEC approval has been obtained.

The clinical examination form and sample collection protocols produced by The University of Sydney [Koala Health Hub](#) allows for standardisation of procedures and therefore comparability between research projects.

8. Sedation and chemical restraint

Sedation or anaesthesia must be administered by a registered veterinarian or in the presence of a registered veterinarian (if AEC approval provides for another investigator to administer medication).

Induction and recovery must be closely monitored. The team must be prepared with a recovery protocol and required equipment and therapeutics to respond to complications.

Chemical restraint protocols

- Diazepam is a sedative agent useful for minor procedures (e.g. venepuncture) and to facilitate examination. It can also be used as a sedative or pre-medication before induction with gaseous anaesthesia.
- Alfaxalone is an ideal agent to induce deep sedation or light anaesthesia in koalas. Induction and recovery are smooth, predictable and result in an ideal anaesthetic plane which allows most procedures including physical examination, ear tagging, application of telemetry devices and sample collection (venepuncture, ocular or urogenital swabs). There is no reversal agent for alfaxalone.
- Gaseous anaesthetic agents such as isoflurane or sevoflurane combined with oxygen can be used to induce anaesthesia in koalas. The duration of anaesthetic can be manipulated by the veterinarian. Recoveries are generally rapid with shorter procedures. However, it requires specialised equipment such as vapourisers.
- Lynch and Martin (2003) reported on the use of a combination of tiletamine-zolazepam and medetomidine for remote drug delivery in koalas for capture purposes. This produces a more variable plane of sedation in koalas and recovery times can be prolonged.

Recovery time following sedation and anaesthesia depends on dose, chemical agent and individual factors. The koala should only be released once determined by a veterinarian to be fully conscious and sufficiently recovered for release.

Table 1 Anaesthetic or sedation drugs commonly used in koala captures¹

Anaesthetic agent	Dose rate and route of administration	Comments
Diazepam	0.5–1 mg/kg intramuscular (IM) 0.5 mg/kg intravenous (IV)	Sedation, allows for minor procedures.
Alfaxalone	1–3 mg/kg IM 0.5–1.5 mg/kg IV	2 mg/kg IM dose commonly used for physical examination, venepuncture and sample collection. Supplemental doses can be given if required.
Isoflurane or sevoflurane in oxygen	Variable. Delivered via mask or through intubation	Dose or concentration of inhalant agent is titrated up incrementally until ideal plane of anaesthesia achieved. Induction with alfaxalone before gaseous anaesthesia is preferred.
Tiletamine-zolazepam ('Zoletil') + medetomidine	Zoletil 3.5 mg/kg + Med 0.055 mg/kg IM	Reversal with atipamezole 2 mg IV.

9. Telemetry devices

Telemetry devices are commonly used to monitor the movement and activity of individual koalas and are generally attached as part of a modified collar. They are applied temporarily and can either be removed at sequential captures, designed with a timed-release mechanism or have a 'break-point' or 'weak-link' that breaks after a certain time.

Recent research projects have used VHF transmitters fitted to ear tags as alternatives to collars to track koalas for prolonged periods (greater than six months). These transmitters are lighter in weight than collar devices but can be more prone to loss through trauma to the ear (e.g. intra-species aggression).

Collars

The welfare of animals must be considered when attaching transmitters. Collars must be correctly applied to prevent discomfort or injury and should not interfere with movement, behaviour or daily activities of the koala (Matthews et al. 2013). Collars should be as inconspicuous as possible to avoid unwanted attention (e.g. from predators or humans). Collaring should be avoided if the probability of recapture to remove the device is low.

Below are some considerations for the use of telemetry devices on koalas.

¹ From Lynch & Martin 2003, Vogelnest & Portas 2019.

Age of koalas

Koalas as young as one year have been successfully collared (Bali & Delaney 1996) as have mothers with young. Consider the growth of young animals as collars can tighten as they grow. A shorter interval between recaptures to check the collar might be required in these cases.

Equipment and personnel

There are several commonly used collar-type designs used to track koalas (Figure 7). The collars designed for koalas must account for their age and neck size. With novel collar designs, ideally, a pilot study is conducted on captive or free-ranging animals to assess the suitability of the collar for use on koalas. Requirements for collar design include:

- the collar must be non-abrasive and narrow
- avoid materials like neoprene as they can hold moisture and cause rubbing
- avoid brightly coloured materials
- include a 'weak-link' or 'break-point' in the collars so if there is unusual stress applied to the collar (due to entanglement) it can be released
- the collar, with devices attached, should be as light as possible and must not exceed 5% of the animal's body weight.

Collars can be applied either with or without sedation. An appropriately experienced veterinarian is required if using sedation or general anaesthesia.

Technique

The collar should rotate freely around the koala's neck but should be tight enough that it does not slip over its head. As a guide, collar tightness should allow two or three fingers to be passed between the collar and the animal comfortably. If the collar is too tight or too loose, it can cause rubbing, skin abrasions and increase risk of strangulation. If the collar is too loose, it may slip off the koala's head or may result in injury if the koala can pass a foot through the collar and get stuck.

Monitoring

Animals with telemetry devices must be monitored to ensure there are no prolonged adverse effects from capture or application of the device. The duration of collaring and monitoring can vary depending on research objectives, device specifications (e.g. battery life) and AEC requirements.

The frequency of monitoring also depends on the individual project. However, general recommendations following collaring are to track and monitor the animal the day after collaring, twice-weekly after for the first two weeks, once in the fortnight following, then monthly.

During recaptures (if applicable), transmitters should be inspected to ensure they are working, the collar's fit around the neck should be re-assessed, and the animal checked for chafing or any injuries related or unrelated to the collar.

If there is evidence of collar-associated injury the collar should be removed, suitable treatment should be provided and the responsible AEC must be notified.



Figure 7 Telemetry collar and koala release following its placement

An example of a koala telemetry collar (left) and koala release following placement of telemetry collar (right). Photo: Lachlan Wilmott.

10. Permanent identification

Two types of permanent identification are used in koalas in New South Wales:

Ear tags

Tags allow identification of individuals from a distance and do not require specialist equipment such as microchip scanners.

Equipment

- Numbered, sheep ear tags are appropriate for use (Figure 8). An ear tag must be small enough so it cannot enter the ear canal. Ear tags must also have two individual components, i.e. must not be attached at the tip, to prevent entrapment injuries (tags can be cut at the tip to split the loop if necessary).
- Ensure the applicator is compatible with the tags (Figure 8).
- Use alcohol wipes or povidone-iodine.

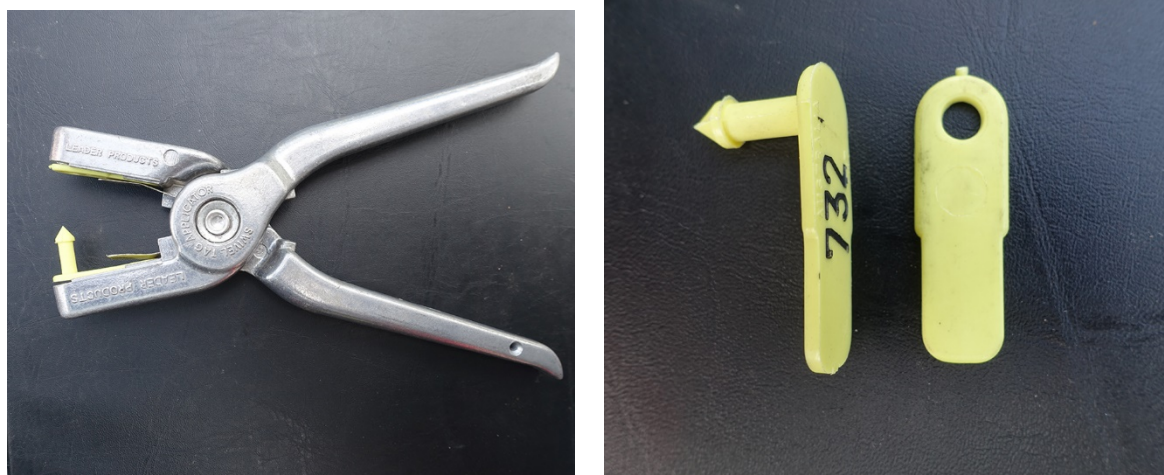


Figure 8 Two-piece ear tag set and applicator
Two-piece ear tag set (left) and applicator with yellow ear tags loaded (right).

Technique

- Place tags in the applicator.
- Clip a patch of hair along the margin of the ears where the tag will be placed (Figure 9) ideally midway along the circumference of the ear.
- Disinfect the clipped area with alcohol wipes.
- Hold the koala's head firmly so it cannot pull its head away during the insertion process as this can lead to the ear tearing.
- Identify and avoid prominent blood vessels in the ear when selecting the appropriate area to apply the tag.
- Steady the ear with one hand, direct the applicator to the area to be tagged and with a swift and steady motion, apply the tag to the targeted area.
- Bleeding from the tag site can be managed with swabs and moderate pressure held on the site for three to five minutes.
- Check the placement of the tag and ensure that bleeding has stopped.
- Record tag information against the individual animal details.



Figure 9 Koalas under sedation with recently applied ear tags
Note clipped fur at the placement site, the size of the ear tags and the location of the placement of the tag. Photos: Marie-Claire Demens (left), Aditi Sriram (right).

Collecting tissue biopsy samples

Where a tissue biopsy sample is required for research, a biopsy punch can be used to collect a tissue sample from the ear, while simultaneously serving to create a tag ring. Any koala tissue samples collected as part of the research should be accessioned to the biobank at the Australian Museum. The ear tag can be placed into the deficit left behind following tissue biopsy collection. For collection of tissue biopsy protocols, refer to the [Koala Health Hub sampling protocols](#).

Microchips

Microchips can be used in addition to ear tags to provide an alternative form of identification in cases where ear tags are lost due to trauma.

Equipment

- Microchip scanner – handheld devices are easily portable.
- Microchips (Figure 10) – various brands are available (Trovan Unique™ is commonly used in New South Wales). Make sure the particular type of microchip is universally used in veterinary clinics to ensure most scanners will be compatible with the chip.
- Alcohol wipes or povidone-iodine.



Figure 10 Microchip scanner, implanter and needle with microchip

Microchip scanner (left), microchip implanter (middle) and a needle with microchip in sterile packaging (right).

Technique

Microchips are placed subcutaneously between the shoulder blades.

- First, scan the koala's body extensively to ensure it is not already microchipped. Microchips can migrate under the skin, therefore it is useful to scan all over the body to check before microchipping.
- Scan the microchip that will be implanted and check the number on the packet matches the scanner. Record the microchip number.

- Disinfect a small patch of skin between the shoulder blades with alcohol.
- Tent the skin with one hand and inject the needle at a 45° angle to the skin. Once through the skin, advance the needle parallel to the skin and once fully advanced, inject the microchip.
- Pinch the skin at the needle entrance and withdraw the needle with a smooth motion.
- Once the microchip is implanted, gently rub the fur over the implantation site to check that implantation has been successful. Implantation can fail if the chip has been injected through the skin and out the other side, or if the chip was not fully implanted and is sitting at the entrance hole.
- Scan the implantation site to ensure the microchip is working and the number matches the animal's record.

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Appendix 1

Koala collaring data sheet					
Date		Time		People present	
Location				Easting	
				Northing	
Tree species		Capture method		Time taken to capture	
Sex		Identification			
Age		Name			
Weight		Ear tags	Left ear		Right ear
Breeding condition		Colour		Colour	
General condition		Number		Number	
Sign of injury		GPS collar ID			
Sign of disease		VHF frequency			
Disease		Sedation			
Left eye					
Right eye					
UGT					
Disease		Samples			
Swabs	Left eye				
	Right eye				
	Urogenital				
	Nasal				
Comments					
Start time	Capture duration	Processing duration	Recovery duration	Release time	