DEPARTMENT OF PLANNING, INDUSTRY & ENVIRONMENT

# Guidelines for the initial treatment and care of rescued wombats

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Cover photo: Bare-nosed wombat (*Vombatus ursinus*) joey. Aditi Sriram/DPIE

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# 1. Introduction

The purpose of this document is to standardise the initial treatment of wombats requiring rescue or rehabilitation, in line with the *Code of Practice for Injured, Sick and Orphaned Wombats* (the 'Wombat Code') (OEH 2018).

Understanding that each case is different and should be assessed individually, this document aims to provide guidance for licensed wildlife rehabilitators in New South Wales on initial assessment and first aid treatment principles for rescued wombats.

> The primary objective of rehabilitation is the successful reintegration of the individual into the wild population. This determines decision-making about the care and treatment of wild wombats.

Of the three species of wombats, two occur in New South Wales and are relevant to these guidelines, including the bare-nosed or common wombat (*Vombatus ursinus*) and the endangered southern hairy-nosed wombat (*Lasiorhinus latifrons*). The northern hairy-nosed wombat (*Lasiorhinus krefftii*) is presumed extinct in New South Wales.

This document provides guidance on the initial care and management of wombats following rescue, from capture to physical examination, initial stabilisation and treatment before presentation to a veterinarian. It provides advice on managing the more common rescue encounters in wombats, including trauma, sarcoptic mange (mange), burns and orphaned joeys.

# 2. Capture, restraint and physical examination

As outlined in the Wombat Code, rescuers must aim to have the wombat assessed by a veterinarian or experienced wildlife rehabilitator within 24 hours of rescue to establish an accurate diagnosis and provide the best outcomes for the patient.

> The initial assessment aims to identify the severity of wounds, injuries or illness, to determine the best course of action.

Figure 1 provides an outline of the initial decision-making process for wombat rescue cases. It is important to keep in mind that the ultimate goal of rescue and rehabilitation is to successfully reintegrate the individual into the wild population.

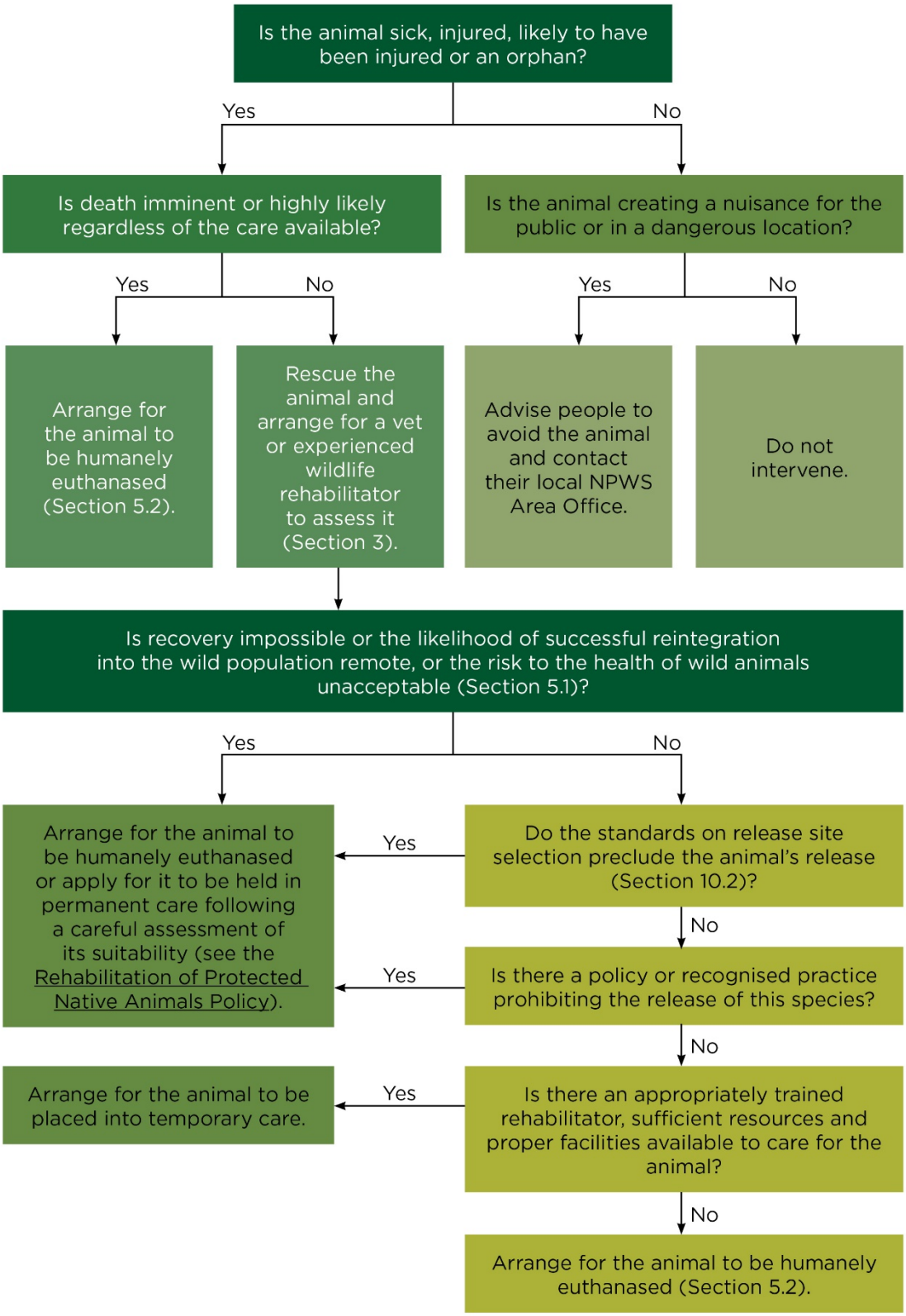


**Figure 1 Decision tree directing the course of action for wombat rescue encounters**

(From the Wombat Code. Section numbers refer to numbering used in the code.)

## Personnel safety

Before handling wombats, rescuers should be aware of possible safety risks and take necessary precautions to minimise harm to themselves and the animal. Sick or injured wildlife can cause injury (bites or scratches), and disease transmission is possible both to and from humans.

- Protect yourself and the animal by using appropriate personal protective equipment (PPE).
- Avoid handling wildlife if it is not necessary or you do not feel confident and capable to do so.
- Use PPE as a barrier where possible – wear gloves or use a towel as a barrier.
- Wear appropriate clothing – robust long sleeves, covered shoes.
- Wear a dust mask if available and particularly if the animal is showing signs of disease.
- Wash your hands before and after handling animals and removing gloves (or use alcohol-based hand sanitiser).
- If bitten or scratched, clean the injury with warm water and soap (or disinfectant) and seek medical advice. Always tell medical staff that you have been handling wildlife.

## Distance examination

When attending a wombat rescue, conduct an initial distance examination to assess the situation and inform decision-making. Assess the animal's behaviour and the environment. Animals should be observed from a safe distance for gait and posture, presence of external wounds or injuries, and signs of pain or distress.

During the distance examination, monitor for the presence of young. Joeys may venture out of the pouch for brief periods from seven months of age and can be observed alongside the female. If a joey is found on its own, observe for the presence of an adult female nearby. If there is no sign of an adult wombat in the vicinity, an experienced wombat rehabilitator should be contacted to determine if rescue is indicated. Orphaned joeys less than 12 months of age will require rescue for assessment and care as they are still dependent on the mother for nutrition.

- **Behaviour:** Wombats are predominantly nocturnal, although they can be observed during the day basking or foraging during low light conditions. In colder climates wombats will graze in the daytime when temperatures fall below 21$^{o}$C. Wombats can also be observed during the daytime when displaced from burrows due to flooding, human activity or territorial aggression. However, wombats observed in the open during the day warrant further investigation as in most instances, this is considered abnormal behaviour (Bryant & Reiss 2008).
- **Signs of pain or distress**: Teeth grinding (bruxism), vocalising, pawing at abdomen hunched posture or lethargy can indicate pain or distress. The absence of these signs should not be assumed as an absence of pain, as wombats can mask signs of pain.
- **Gait and posture**: Lameness or abnormal gait or posture can indicate musculoskeletal or neurological injuries or disease.
- **External injuries and wounds**: Changes to the skin and coat, including hair loss, crusting and wounds can indicate stress, injury, infectious disease (i.e. mange) or trauma.

During the distance examination, assess the feasibility of capture.

Adult free-ranging wombats can be difficult to capture. Experienced personnel and appropriate equipment are required to successfully capture an adult wombat with minimal stress to the animal and ensuring the safety of personnel involved. A distance examination and consultation with an experienced wombat rehabilitator allows the opportunity to consider the need for continued monitoring of the animal or if immediate rescue is indicated (see ‘Rescuing adult wombats’, below).

## Attending to dead wombats

Motor vehicle-related injuries are one of the most common reasons for rescue in wombats (DPIE 2020). A high percentage of motor vehicle-related incidents result in mortality. When a member of the public reports a dead wombat, it is important to assess the animal to determine if further intervention is required and, importantly, in females, to check the pouch for the presence of young.

> When attending to a roadside rescue, always ensure personnel safety when working close to traffic.

Approach the animal from behind and assess if the animal is breathing or showing signs of movement. To confirm death, place a hand on the animal’s chest to feel for a heartbeat and check for a corneal reflex by touching the animal’s eye and confirming the lack of a blink response. Once confident the animal is dead and does not require immediate attention, a pouch check should be performed in female wombats (see ‘Rescuing joeys’). If a joey is present, following its rescue, the female should be assessed for injuries as this can provide information about the condition of the joey.

**Figure 2 A dead female wombat placed on its back for a pouch check**

Note the elongated teat (black arrow) suggesting the female was actively caring for a joey. Photo: Kerstin Schweth/WRSC.

The presence of an elongated teat in a female wombat indicates she was actively caring for a joey (Figure 2). Emerging joeys and young at foot may move away from the dead female following the incident and the surrounding area must be monitored regularly to locate the joey. Take care when monitoring, as active searching may cause the joey to hide or move further away.

# Capturing wombats

The capture of wombats should be performed only by appropriately trained people. Wombats are prone to stress, and considerations about safety and methods of capturing adult wombats vary compared to the capture of joeys. Wombats can be aggressive and can cause significant injury to people, including biting, scratching and charging.

> Personnel safety and animal welfare are primary considerations when undertaking wombat rescues.

Before undertaking the rescue, if rescue is needed, assess the appropriate capture technique, equipment required, and the safety of the animal and people involved. Ensure the required equipment and facilities to transport and house the animal are organised before the rescue.

Equipment useful for wombat rescues includes:

- binoculars
- blankets and towels to cover the animal and to cover its head
- a secure, sturdy, well-ventilated transport container (i.e. crate)
- pouches for joeys, multiple sizes are ideal (see ‘Housing’ in Section 4)
- heat source (e.g. hot water bottle, thermos with hot water, heat packs) and thermometer to check temperature
- sharp scissors – for cutting the pouch or teat of dead females to retrieve young
- head torch or alternative light source
- personal protective equipment – disposable gloves, long-sleeved shirts, disinfectant, hi-vis vest.

## Rescuing adult wombats

Adult wombats may require rescue for various reasons, including motor vehicle trauma and disease (mange). Adult wombats are particularly prone to stress and are likely to have poor outcomes associated with prolonged periods in captivity. This should be taken into consideration when rescuing adult wombats.

Rescue of a subadult or adult wombat, where possible, should be undertaken with a minimum of two trained people. Refer to the Wombat Code for standards and guidelines on rescue.

> Planning and preparation are vital to ensure capture of adult wombats is efficient, with minimal stress to the animal.

Considerations before the rescue of free-ranging adult wombats include:

- **Environmental conditions** – ambient temperature, topography, access to the animal, and hazards (e.g. moving traffic) need to be considered. Wombats are particularly prone to heat stress; therefore, where possible, capture should be avoided in hot weather conditions.
- **Severity of injury or disease** – wombats with severe mange, with other signs of illness or injury, or in poor body condition will require veterinary assessment and treatment, and, in certain cases, euthanasia. Ensure an experienced wombat rehabilitator or veterinarian can be contacted to assist with assessment and decision-making.
- **Available facilities** – rehabilitation of adult wombats requires specialised facilities and experienced personnel. Availability of resources and facilities for rehabilitation must be considered in the decision-making process.
- **Trained personnel and equipment** – adult wombats may require sedation or anaesthesia (or both) during or soon after capture. Before undertaking the rescue, ensure personnel, equipment and veterinary support is available.

## Methods of capture

Adult wombats are fast, can weigh between 20 to 40 kilograms, and can be aggressive (biting and scratching). When pursued, wombats may retreat down a burrow to avoid capture. Wombats have a hard sacral plate on their rump. This is used to compact burrow walls and additionally as a defence mechanism (Bryant & Reiss 2008).

Do not attempt to remove wombats from burrows, as they can cause significant injury by crushing hands against the burrow wall.

### Hand capture

Adult wombats are strong and can be difficult to capture and restrain. If the animal can be approached, throw a blanket over it to cover its head and usher into a transport container. Alternatively, the handler can approach the wombat from behind and grasp it around the chest, just behind the front legs. Lift the animal off the ground and hold the wombat firmly against the handler's chest. Place it into a sturdy transport container as soon as possible.

**Figure 3 Restraining an adult wombat following capture by hand**

Note: the handler has a firm hold around the wombat's chest and a supporting hand under its rump.
Photo: Aditi Sriram/DPIE.

Smoking or flooding of burrows must **not** be used to capture wombats.

### Chemical immobilisation

Chemical immobilisation must be performed by a veterinarian or under the direct supervision of a veterinarian. Drugs can be delivered via the use of an extended pole-syringe or via intramuscular hand injection following brief restraint where it is possible to safely do so (Vogelnest 2019). If a veterinarian chooses to utilise chemical immobilisation, ensure the animal cannot access a burrow (block nearby burrows) before the administration of sedation or anaesthesia to facilitate retrieval and monitoring.

### Traps or netting

Various methods including hoop nets and traps can be used to capture wombats (Figures 4 and 5). Vogelnest (2019) provides detailed descriptions of the various capture techniques. Wombats tend to be trap-shy. Traps must be closely monitored and should not be set for more than two to three consecutive nights (NHMRC 2014). Large, heavy-gauge, steel wire mesh cage traps are ideal for use, as collapsible traps are often not strong enough to contain wombats. Once restrained in a trap or net, sedation or anaesthesia is often required to facilitate handling. Trapped wombats are likely to become extremely stressed; therefore the wombat must be moved out of the trap and into a suitable transport container as soon as possible.

**Figure 4 Example of a robust net used for capturing wombats**
Photo: Aditi Sriram/DPIE.

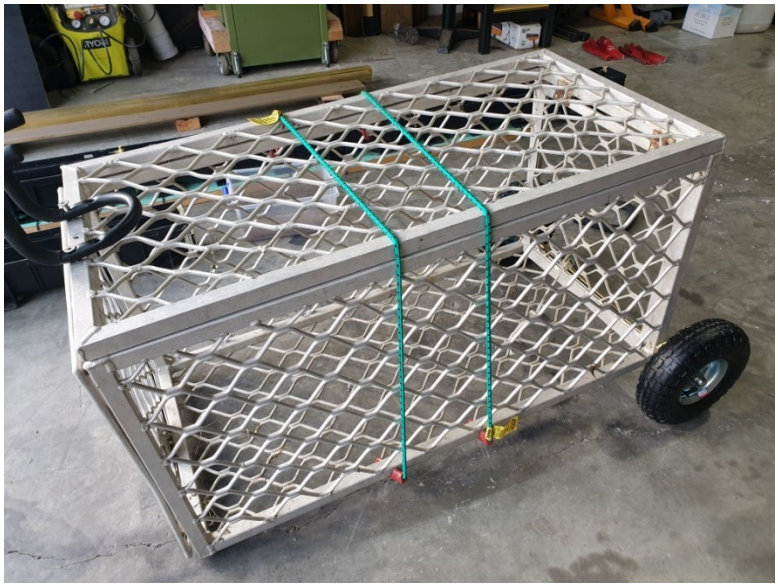

**Figure 5 Example of a trap designed for capturing wombats**

An aluminium security mesh trap with detachable wheels. The trap has a swinging front door and a rear door that slides up. The top also opens for easier access to the animal. Photo: Debbie Breen/NATF.

## Rescuing joeys

Dependent joeys are commonly rescued due to the injury or death of the mother or may be found apparently abandoned.

> The pouch of dead adult female wombats should be checked thoroughly and both nipples examined.

### Pouch young still in pouch

Wombats have a rear-opening pouch and well-developed sphincter muscles (Bryant & Reiss 2008) which can make retrieving a joey from the pouch difficult. When attending to dead female wombats, the pouch can be accessed by positioning the female on her back. Blunt-ended scissors may be used to cut the pouch. Place a hand in the pouch to shield the joey when cutting the pouch.

Unfurred joeys may be attached to the teat. If the joey cannot be manipulated off the teat by applying gentle pressure to the sides of the mouth, do not make further effort to do so. Attempting to remove a joey that is fused to the teat can result in injury. Instead, if the mother is dead, the teat can be cut, as close to the mother's body as possible, and the joey removed with the teat. Once out of the pouch, place a large safety pin into the teat to ensure the joey does not swallow it, and place the joey into an artificial pouch.

When removing joeys from the pouch, do not pull on the limbs alone. Larger, fully furred joeys can be difficult to manipulate out of the pouch and may try to escape. Ensure you have a catch bag or artificial pouch and transport container ready to restrain the joey as soon as it is out of the mother's pouch.

Do not attempt to remove the joey from the pouch if the mother is still alive. If you need to transport the injured mother with the joey, make sure the transport container is secure and provides adequate support (e.g. using towels) during transport.

Contact an experienced wombat rehabilitator as soon as possible.

### Emerging joeys and young at foot

During a pouch check, an elongated teat in a female with an empty pouch suggests she was caring for an emerging joey or young at foot. Emerging joeys and young at foot are not yet weaned and are still dependent on the mother.

Young at foot may remain in the vicinity of the dead female or return to the carcass and may call for the mother. The surrounding area must be searched and monitored regularly for a few days.

If an orphaned joey is observed, an experienced wombat rehabilitator must be contacted to assess the joey. Fully emerged joeys can be difficult to capture and restrain. Following an assessment by an experienced wombat rehabilitator, a decision can be made to monitor the animal in situ or capture the animal for assessment and care.

## Transport

Wombats should be transported in sturdy, secure transport containers appropriate for the animal's size and stage of development. To reduce stress, the transport container should be designed to prevent the wombat from seeing out of the container. A top-opening container is preferable for ease of extraction. Transport containers should be well-ventilated, and ambient temperatures, appropriate to the individual animal, must be maintained and regularly monitored during transport (see Table 1).

> Transport should be planned and efficient, with minimal stressors. Avoid domestic animals, loud music, voices, and cigarette smoke, and aim to keep transport times minimal.

Purpose-built wooden crates with wire mesh panels for ventilation – or for debilitated animals, large dog crates – can be used for transport. Due to the stress associated with handling and transport, the decision to transport an adult wombat should be made in consultation with an experienced wombat rehabilitator or veterinarian.

Adult wombats can overheat (become hyperthermic) during rescue and transportation. Hyperthermia should be corrected before transporting the animal. Transport of wombats should be avoided when ambient temperatures are high.

**Table 1 Ambient temperatures to be maintained during transport of wombats (adapted from the Wombat Code)**

| | | Ambient temp |
|---|---|---|
| Adult wombats | | < 25°C |
| Joeys | Unfurred | 28 – 30°C |
| | Furred | 28°C |

Pouch young can be transported in an artificial pouch within a secure container. The joey must be able to lie comfortably within the pouch, in a position similar to being in the mother's pouch. Joeys requiring rescue are commonly hypothermic (cold). Supplementary warmth can be provided using hot packs or hot water bottles, ensuring the heat source is not in direct contact with the joey. A thermometer should be used to monitor temperatures within the artificial pouch during transport.

# Physical examination

A detailed examination, investigating the parameters described below, can provide the overall health assessment necessary to determine treatment needs and prognosis. While progressing through the physical examination, ensure to make notes and keep records (see Section 8 ‘Record keeping’).

Emerging joeys, young at foot and adult wombats, can be difficult to restrain for a thorough physical examination adequately. Physical restraint may also result in undue stress to the animal. Animals that are severely debilitated may allow approach and handling without difficulty; however, these animals must be handled with care and veterinary advice sought as soon as possible.

Sedation or anaesthesia, administered by a veterinarian, is recommended to reduce stress associated with handling and allow for a thorough assessment. The following section on physical examination in wombats refers to pouch young, where a preliminary examination can be conducted in the majority of cases without the need for sedation or anaesthesia.

> When performing a physical examination, the aim to is to be thorough and minimise stress. Handling should be tailored to each individual animal based on its health status and temperament.

Pouch young can be examined while in an artificial pouch by carefully extracting or uncovering different parts of the body for examination. This allows the joey to remain in the safety and security of the pouch with its head covered, reducing the stress associated with handling.

It is important to continually monitor the animal for signs of stress during handling. Prolonged or repetitive handling is stressful, may exacerbate the injury and is detrimental to the animal’s health. Equipment required for the physical examination and possible treatment should be prepared and available before initiating handling.

If the joey starts showing signs of stress (see below), replace it into the pouch and within the container and let the animal settle in a warm, dark, quiet location. Contact an experienced wombat rehabilitator or veterinarian to advise on the management of the joey. Sedation administered by a veterinarian can facilitate examination in stressed joeys or those not tolerant to handling and restraint.

## Signs of stress

Wombats tend to be stoic in nature, and signs of stress may be subtle and not readily recognised. Signs of stress in wombats can include:

- vocalising
- charging or aggression
- urinating and defaecating
- teeth grinding
- increased heart rate and respiration rate.

As outlined in the Wombat Code, following initial assessment and stabilisation, the rehabilitator must aim to have the wombat assessed by a veterinarian or an experienced wildlife rehabilitator within 24 hours of rescue.

In situations where it is not logistically possible to have the animal physically assessed, contact a veterinarian or an experienced wildlife rehabilitator on the phone for advice on continued care until the animal can be transported.

## Demeanour

Observe the behaviour and general demeanour of the animal during the physical examination and compare this with what is expected based on its stage of development.

Although an understanding of normal behaviour in wombats may require experience, observations from the initial physical examination can be used to discuss the animal's condition with experienced wombat rehabilitators and as a comparison throughout the rehabilitation process.

A change in the animal's demeanour, from alert and responsive on initial assessment to quiet and lethargic a few hours later, may indicate deterioration in the animal's health and a requirement for further assessment and veterinary intervention.

## Body condition and body weight

Body condition is a subjective assessment and can be determined by palpating muscle and fat coverage over the ribs, spine and pelvis. Body condition can also be crudely assessed on distance examination in free-ranging wombats. Animals in poor body condition may have a pronounced pelvis, spine and ribs and may also have poor coat condition.

Body weight is an important indicator of health. Recording an initial weight soon after rescue will provide a baseline for each individual animal. Continued monitoring of weight at regular intervals throughout the rehabilitation process will provide valuable information on the health and development of the joey. The Wombat Code provides standards on the frequency of monitoring for wombats in care.

It is easiest to weigh joeys while they are still in the pouch. Once the joey is out of the pouch, its weight can be calculated by subtracting the weight of the pouch from the total weight of the joey and the pouch.

Weight loss or failure to gain weight could indicate stress, dehydration, malnutrition, gastrointestinal problems (e.g. intestinal parasites, infections, dysfunction) or underlying disease, and requires further investigation.

## Identifying the species and determining age

Identifying the species and developmental stage of a wombat joey is vital to providing it with optimal husbandry and care. The rate of development between southern hairy-nosed and bare-nosed wombats varies. Most physical characteristics and developmental traits, such as pouch emergence and weaning, occur earlier for southern hairy-nosed wombats than for bare-nosed wombats (Hogan et al. 2013).

A wombat joey's weight, physical characteristics and head measurements can be used as guidelines to determine an age factor and estimate age.

> Determining age is vital as it directs decision-making about husbandry requirements and the prognosis for each individual animal.

- **Age factor** is a numerical representation of age as a proportion of total expected pouch life, and provides an indication of the stage of a joey's development (Campbell-Ward 2019a).
- **Weight** can be influenced by factors other than age, such as gut fill, hydration, muscle mass, fat stores and illness.
- **Physical characteristics** such as the growth of hair, presence of incisors, ear position, and whether the eyes are open or closed, are good indicators of developmental stage.

- **Body measurements,** specifically head length, is a good parameter to estimate age in wombat joeys (Taggart et al. 2008). Head length is measured from the tip of the nose to the back of the skull (see Figure 6).


**Figure 6 Standard head length measurement of joeys**

Image adapted from Sharman et al. 1964.

Growth charts detailing typical or expected weight, physical characteristics, body measurements and the corresponding age for bare-nosed and southern hairy-nosed wombats can be found in Wombaroo Milk Replacers and Food Supplements for Native Animals (see Appendix A).

Weight, physical characteristics and head length should be measured and recorded for pouch young during the physical assessment. Using this information, and based on the health status of the joey, a decision on viability can be made in discussion with an experienced wombat rehabilitator. Pouch young at five months of age and older (approximately 800 grams in weight) are ideal candidates for hand-rearing (Bryant & Reiss 2008). Very young, unfurred pouch young, less than three months of age (less than 80 grams), are generally considered poor candidates for rehabilitation as their prognosis for survival is poor. They are highly dependent on immunity from the mother's milk, are at a vulnerable stage of development, and require intensive and specialised care (McCracken 2008). As such, euthanasia should be considered for orphaned joeys less than three months of age and less than 80 grams in weight.

## Sex

Sex can be determined by the presence or absence of a pouch in females or external testicles in males.

## Hydration status

Hydration status is assessed by checking skin turgor and assessing the mucous membranes and eye position. In dehydrated animals, skin may be dry or wrinkly, and when gently pinched to lift or tent the skin it will be slow (taking more than one second) to return to normal position. However, wombats tend to have inelastic skin, and checking for skin tent is not always a reliable test of hydration. Sunken eyes and dry or tacky gums are also indicators of more severe dehydration. Reduced volumes of urine and in later stages of development, urine concentration can also indicate dehydration.

**Figure 7 A wombat joey restrained in a pouch for examination of the nostrils and ears**

The wombat's head is covered and its limbs are contained within the pouch during the examination. Photo: Aditi Sriram/DPIE.

## Eyes, nostrils and ears

Changes in the appearance of the transparent, outermost surface of the eye (cornea), discharge from the eyes, redness (inflammation of the conjunctival tissues) or crusting and thickening of the skin around the eyes can indicate trauma or infectious disease. Mange can result in changes to the skin around the eyes and in severe cases cause vision impairment in wombats. Compare the two eyes and check for asymmetry in the pupil size as this can indicate neurological dysfunction resulting from head trauma. A partially closed eye or squinting can indicate pain, and these animals should be seen by a veterinarian for assessment and pain relief as soon as possible.

Assess the nose and ears for signs of discharge or wounds. Check the nostrils for dirt or mucus which can obstruct the airway. Discharge from the nostrils can indicate inflammation or infection of the respiratory tract. Detailed eye and ear exams require veterinary expertise and equipment.

## Dental examination

Wombats have rootless, continually growing teeth (Bryant & Reiss 2008). Malocclusion of the teeth (imperfect alignment of teeth), for example, due to trauma, can lead to chronic, recurring dental problems as the teeth continue to grow and do not wear as they normally should. Wombat joeys with malocclusion of the teeth due to jaw misalignment require prompt veterinary assessment.

Assess the face and jaw for symmetry. Check the mouth for evidence of discharge and the incisors for malocclusion or breaks. Trauma resulting from motor vehicle accidents can result in trauma to joeys in the pouch and resultant fractures or jaw misalignment.

Approach dental examination with care, as fractures or trauma can be painful. A thorough dental examination, including examination of the cheek teeth, requires sedation, veterinary expertise and equipment.

**Figure 8 Examination of incisors and mucous membrane colour in a wombat joey**
Photo: Aditi Sriram/DPIE.

## Skin and coat condition

Visual examination of the skin and coat in wombats can provide valuable information on the animal's condition and the presence of wounds or disease. Although conditions such as mange are presumptively diagnosed on visual examination, a thorough assessment of the animal is necessary to exclude conditions which may present with similar signs (e.g. bacterial or fungal infections and wounds resulting from fighting or dog attack).

- Bruising or grazing wounds indicate trauma and will require a thorough veterinary assessment for internal injuries.
- Dry, rough and scaly skin in joeys can indicate exposure to poor environmental conditions.
- Large numbers of external parasites such as ticks can indicate poor condition and underlying disease processes. A thorough search for ticks should be performed, looking in the ears and around the face, body and the cloaca.
- Identify wet patches or blood staining on the coat to check for deeper wounds or evidence of trauma (e.g. dog bite wounds).

Changes in the coat or skin including alopecia (hair loss), erythema (reddening of skin), thickening of skin or wounds requires thorough examination and veterinary diagnostic tests to differentiate possible causes such as mange, dermatophytosis (ringworm) or fight wounds.

- Patches of hair loss or redness can indicate dermatophytosis (ringworm) and should be assessed further by a veterinarian. When handling suspected cases, PPE must be used to prevent transmission to people (see Section 7 'Zoonotic diseases').
- Wombats are known to be territorial and can sustain wounds from fighting. Fight wounds can vary in severity from patches of hair loss to deeper wounds. Wounds from fighting are generally observed along a wombat's back and rump, but fighting can also result in injury to the ears and face.
- Skin and coat changes associated with mange are described in 'Mange' in Section 5.

## Heart and respiratory rate

If available, use a stethoscope to listen to the heart by placing it over the mid-chest region. Alternatively, a pulse rate can be calculated by palpating the femoral pulse, on the inner

thigh. Normal resting heart rates in joeys can vary between 70 to 200 beats per minute (McCracken 2008). Abnormally low heart rates in joeys are of concern and require further investigation for underlying causes (Campbell-Ward 2019a).

Wombats are particularly prone to lower respiratory tract disease (Campbell-Ward 2019b). Pneumonia can be a result of primary fungal or bacterial infection or secondary to aspiration (inhaling formula, food or foreign material) in joeys (Bryant & Reiss 2008). Monitor for abnormal breathing sounds, including wheezing or crackling. At rest, respiration should be effortless. Laboured breathing or increased respiratory rate (more than 40 breaths per minute) may indicate underlying respiratory disease and is a signal that the animal should be assessed by a veterinarian as soon as possible.

## Circulation

Circulation can be assessed by examining the colour of the gums. Healthy joeys should have pink gums. Pale gums can indicate shock, anaemia or blood loss. In these cases, veterinary attention is required as soon as possible.

## Abdominal palpation

Abnormal distension or pain on gentle palpation of the abdomen, especially when concurrent signs such as inappetence (lack of appetite) or lethargy are observed, should be seen by a veterinarian for further assessment as soon as possible.

## Musculoskeletal injuries

Assess motor function in the limbs (the animal's ability to consciously move limbs). Depending on the joey's developmental stage, this can be performed by placing the joey on the ground in a small, quiet room and assessing mobility and balance. Abnormalities in gait or movement can indicate musculoskeletal or neurological dysfunction. Musculoskeletal injuries in wombats are not easily identified on physical examination due to their stocky build. Carefully palpate limbs for swelling, wounds or pain. Dislocations and fractures are a common consequence of trauma. Veterinary assessment and often imaging techniques (e.g. radiographs) are required to diagnose musculoskeletal injuries in wombats.

**Figure 9 Examination of the forelimb and digits**

The wombat joey is restrained within the pouch with its head covered during examination. Photo: Aditi Sriram/DPIE.

### Body temperature

Assessing body temperature in joeys can be difficult due to small body size and cloacal anatomy. Rectal temperature is assessed by inserting a lubricated thermometer into the cloaca and into the rectum (opening closest to the tail). This should only be performed by experienced persons. Normal body temperature in wombat pouch young is between 34ºC and 37ºC. Alternatively feeling the animal's ears, digits and feet can provide a basic idea of whether the body temperature is low (hypothermia) or high (hyperthermia).

Adult wombats have a relatively low metabolism and normal body temp (34–35ºC), allowing them to conserve energy and water (Bryant & Reiss 2008). Body temperatures fluctuate and can fall below this range during resting times. Adult wombats are more tolerant of cold conditions compared to hot ones and their activity levels are temperature dependent (Campbell-Ward 2019b).

### Faecal output

Assess the quantity and quality of faeces produced. Faecal colour and consistency can vary with age in joeys. Abnormal colour or consistency of faeces can indicate stress, infection, parasites, poor diet or gastrointestinal dysfunction. Monitor for signs of straining, infrequent defaecation or abnormally dry faeces as these can indicate constipation.

In joeys, diarrhoea can develop due to changes in diet (e.g. transition to artificial formula) and stress. If diarrhoea persists for longer than 24 hours, seek veterinary advice to investigate the cause of diarrhoea.

# 3. Euthanasia

As stated in the Wombat Code, a wombat must be euthanased where recovery is not possible, the animal is suffering from an incurable disease that poses a risk to wild animals, death is imminent, or the animal is suffering from chronic unrelievable pain. The Wombat Code, including the decision-making tree (Figure 1), provides further standards and guidelines on euthanasia.

> Euthanasia should be performed by a veterinarian where available.

Intravenous barbiturate overdose, administered by a veterinarian, is the recommended method of euthanasia for wombats in care. Wombats can be difficult to restrain, and physical restraint can cause considerable stress to the animal. The wombat should be sedated or anaesthetised before euthanasia as this provides a better opportunity for venous access and reduces the stress associated with restraint. In very small, unattached, unfurred pouch young, where intravenous access is difficult, barbiturates can be administered via the intra-hepatic (into the liver) or intra-peritoneal (into the abdominal cavity) routes in an anaesthetised animal (Campbell-Ward 2019a).

Where access to a veterinarian is not possible, a method appropriate for the size and condition of the wombat, ensuring minimal pain and suffering, should be employed, e.g. shooting with an appropriate firearm. Shooting should be undertaken by a licensed, skilled and experienced wildlife rehabilitation provider or an appropriate agency, such as the NSW National Parks and Wildlife Service (NPWS), the Royal Society for the Prevention of Cruelty to Animals (RSPCA) or NSW Police Force.

The Wombat Code provides standards and guidelines on disposal of the carcass following euthanasia. Dead wombats with suspected mange should be handled with care as

transmission of mange to another wombat or person is possible. Carcasses suspected to be contaminated with mange must be incinerated, taken to a licensed waste facility, or buried.

# 4. Initial treatment – stabilisation

Adult wombats are particularly prone to stress in captivity. They may require sedation or anaesthesia, administered by or under the supervision of a veterinarian, to facilitate handling for examination and initial treatment. In some circumstances and where possible, adult wombats can be treated in situ (e.g. for mange). Euthanasia should be considered in severely ill or injured adult wombats where prognosis for recovery is poor or the animal will require a prolonged period of time in care.

Although the principles around initial treatment are similar in adults as in joeys, the following section refers primarily to dependent pouch young.

## Temperature

Marsupials are ectothermic (body temperature relying on the surroundings) at birth and therefore depend on the pouch environment to maintain body temperature. As they transition through pouch life, they develop the ability of endothermy (self-regulating body temperature) (Campbell-Ward 2019a).

Rescued pouch young commonly present as hypothermic due to their small body size (high surface area to volume ratio) and lack of fur and body fat (Campbell-Ward 2019a) and require active warming to return to normal body temperatures (34–37ºC).

Rescued wombat joeys require supplemental heat. However, they have a greater tendency to overheat compared to other marsupials (Bryant & Reiss 2008). Ensure ambient temperatures are regularly monitored and maintained within the recommended range (see Table 1).

Pouch young can be actively warmed using external heat sources such as heat packs, hot water bottles or heat mats, or using thermostatically controlled warming devices such as incubators or humidicribs. If using external heat sources, ensure they are not directly in contact with the joey.

Aim to slowly correct body temperature over a two- to three-hour period (Campbell-Ward 2019a). Monitor ambient temperature and assess the joey at regular intervals to ensure the joey does not overheat. Red feet in pouch young can indicate heat stress (Bryant & Reiss 2008).

## Fluid rehydration

It is safe to assume the majority of rescued wombats will present with dehydration, and if left untreated, dehydration can progress to shock (Campbell-Ward 2019a). Orphaned, unwell, or anorexic joeys can develop dehydration as result of reduced fluid intake. Dehydration can also result from excess fluid losses due to diarrhoea.

The primary routes of fluid supplementation in wombats are oral (PO) and intravenous (IV). Wombats have thick skin and lack a significant subcutaneous space (Bryant & Reiss 2008), therefore there can be a limit on the volume of fluids that can be administered subcutaneously (SC). Mild dehydration can be treated by the PO route. Ensure hypothermia

is corrected before offering oral fluids. In moderate to severe cases of dehydration, the animal should be referred to a veterinarian for assessment and IV fluid therapy.

### Oral supplementation

For wombats able to hold their head up and swallow, and without signs of head trauma or neurological problems (see 'Trauma' in Section 5), fluids can be given orally using an appropriately sized and shaped teat attached to a syringe or bottle. Electrolyte solutions such as 'Lectade' or 'Vytrate' can be used as a fluid supplement. Fluids should be warmed to approximately 30–35$^{o}$C and the syringe, bottle and teat sterilised before and after use.

> Rescued orphaned wombats may not readily accept teats or syringe feeding. Contact an experienced wombat rehabilitator for advice on offering oral fluids and nutrition.

Quantities of oral fluid supplementation required are based on calculation of maintenance needs and fluid losses. The frequency will depend on how willing the joey is to accept oral fluids. Do not force the animal if it is not willing to drink, as this results in stress, increases the risk of aspiration (fluid in the airways) and is counterproductive.

It is preferable to offer fluids to the joey while it is in the artificial pouch in a quiet, dark environment, with its eyes covered. Oral fluids can be provided by holding the head, gently opening the mouth and placing the teat in the side of the mouth. Once the joey begins sucking, the teat can be positioned to the front of the mouth. Monitor the joey for active swallowing. Joeys in early stages of development need to be fed with a syringe with specially designed teats or feeding tubes which fit on to the syringe. Syringe feeding should only be undertaken by experienced wombat rehabilitators. Advice should be sought from experienced wombat rehabilitators on the use of teats particular to the stage of development and the quantity and frequency of oral fluids to be delivered.

### Intravenous fluid therapy

This is the recommended route for rehydrating a moderately or severely dehydrated animal, however, it requires veterinary expertise, sterile techniques and appropriate equipment.

> If moderate to severe dehydration is suspected, and where oral fluid supplementation is not possible or adequate, urgent referral to a veterinary facility for assessment and fluid therapy is warranted.

## Hypoglycaemia

Hypoglycaemia (low blood glucose) is a common presentation in orphaned joeys. Blood glucose levels can decrease due to periods of inappetence or anorexia or due to inappropriate feeding regimens. They can result in weakness, seizures and if left untreated, can result in mortality.

If the animal's history suggests a prolonged period of orphaning (delayed rescue) or if the joey appears weak, is unwilling to feed or shows more severe symptoms suggestive of hypoglycaemia (seizures, collapse), seek veterinary assistance immediately to test and where necessary, correct blood glucose levels.

Depending on the severity, feeding and oral supplementation of glucose-containing fluids or hospitalisation for IV infusions of glucose, supportive care and careful monitoring may be recommended.

## Pain relief (analgesia)

Wombats are generally stoic and may not always show obvious signs of pain. Signs of pain can include:

- teeth grinding
- pawing at abdomen
- lack of appetite (inappetence)
- back arching
- lethargy.

In the majority of rescue cases, especially with signs of trauma, pain relief is **crucial** for the welfare of the animal. The provision of pain relief must be a priority and should be based on veterinary advice.

Depending on the assessment of injuries, and in consultation with a veterinarian, appropriate drugs can be administered via various routes to alleviate pain. Certain medications are avoided in case of adverse effects, especially in young developing animals. Therefore, once initially assessed, consultation with a veterinarian regarding the most appropriate drug and route of delivery is imperative. Ensure animals are hydrated before or in addition to the provision of certain medications to reduce the risk of adverse effects.

## Nutrition

The composition of marsupial milk changes significantly during the different stages of development of the joey (Wombaroo Food Products 2020), catering to changing requirements during development. Hand-reared joeys must be offered milk substitutes appropriate to their stage of development. Hand-rearing also requires the use of specific equipment and techniques, i.e. using the correct teat size and shape, milk formula, knowledge of feeding technique, frequency and quantity and sterilisation of feeding equipment. Incorrect feeding techniques can result in stress and negative outcomes for the joey, including malnutrition, aspiration and chronic problems such misalignment of the jaws and consequent dental malocclusion.

Hypothermia **must** be corrected, and joeys rehydrated before feeding.

Wombats are milk-dependent until approximately 12 to 15 months of age. Compared to other marsupials, wombat pouch young can take longer to adapt to formula and supplementary feeding (Bryant & Reiss 2008). Various milk formulae are used for nutritional support in rescued wombats (e.g. ‘Wombaroo’, ‘Biolac’, ‘DiVetelact’). The Wombat Code outlines frequency of feeding depending on stage of development.

It is vital that joeys are assessed and stabilised (dehydration corrected, temperature normalised) and medical intervention provided where necessary before initiating feeding. Following stabilisation, transfer joeys to an experienced wombat rehabilitator for continued care as soon as possible.

# Wound care

Wombats with wounds should be assessed by a veterinarian to diagnose and treat the wounds appropriately. Depending on the severity of wounds, surgery or medical (antibiotic) therapy may be required.

Before veterinary assessment, superficial contaminated wounds can be flushed using lukewarm saline or topical antiseptics such as chlorhexidine or povidone iodine (e.g. 'Betadine'). Use a syringe with an 18-gauge needle attached to create pressure and direction when flushing. In some cases, wounds may not be readily apparent due to the degree of coat contamination (e.g. mud or debris concealing underlying wounds). Where the coat is severely contaminated and requires thorough flushing, monitor the animal for signs of stress and hypothermia during handling and flushing.

> The benefits of flushing or irrigating wounds cannot be underestimated, as it helps clear debris, decreases potential for infection, hydrates tissues and optimises wound healing.

When using antiseptics, dilute solutions with saline or clean water and avoid flushing around the eyes or mouth (oral cavity). If chlorhexidine does get into the eyes, wash it out with saline or clean water immediately.

Wounds and injuries to the feet should be promptly assessed by a veterinarian. Wombats housed in inappropriate conditions may sustain foot trauma as a result of escape attempts (Bryant & Reiss 2008). Wounds which appear superficial on visual inspection may progress to affect deeper structures such as bones and tendons. Wombats with foot wounds should be maintained on clean substrate while awaiting veterinary assessment.

**Figure 10 Examination of a deep wound on the digit of the left forelimb in a wombat joey**

Note the abnormal position of the nail of the affected digit. The digit is swollen and has a wound surrounded by discoloured skin. Photo: Aditi Sriram/DPIE.

## Bandaging

Wet or oozing wounds (exudative) may benefit from bandaging following flushing and in the interim period before veterinary assessment. Bandaging can wick exudate away from the wound and prevent desiccation and further contamination of wounds. Due to the body shape of wombats, bandaging may not always be practical, and may be difficult to maintain in position. Wombats may also try to chew the bandages and potentially ingest bandaging material.

Where the animal's temperament will allow for it, and the anatomical location is practical to bandage, a temporary dressing and bandage can be applied until the animal can be assessed by a veterinarian. Following flushing and washing hands, prepare all required materials including putting on disposable gloves. Superficial dressings such as low-adherent, absorbent wound dressing (e.g. 'Melolin') can be applied and bandaged in place with layers of wound-care padding (e.g. 'Soffban') and a cohesive bandaging material (e.g. 'Vet Wrap') to stabilise the bandage (Figure 11). Ensure bandages are not constricting as this can disrupt blood supply and healing.

Bandages should be maintained clean and dry and should be changed if there is 'strike-through' – fluid from the wound wicking through to external bandaging layers.


**Figure 11 Bandaging material commonly used for wound care**
'Melolin' (left), 'Soffban' (centre) and 'Vet Wrap' (right). Photo: Aditi Sriram/DPIE.

## Managing bleeding

For external bleeding wounds, apply pressure using gauze swabs and bandage with wound padding (e.g. 'Soffban') and cohesive bandaging (e.g. 'Vet Wrap') to apply even pressure. Ensure the bandage is applying pressure but is not constricting, as this can impede blood supply and damage tissue below the bandaged area. If you can still pass a finger between the skin and the bandage, that is adequate pressure. For wounds that are in a location that cannot be bandaged, apply digital pressure using gauze swabs and hold the pressure for a minimum of three to five minutes or until bleeding stops.

If there is profuse blood loss from a wound, or the source of bleeding is from deeper tissues (e.g. muscle rather than superficial skin wounds), apply a bandage and transport to a veterinarian as soon as possible.

## Fractures

Fractures are a common consequence of trauma. Joeys orphaned due to trauma-related incidents must be assessed for musculoskeletal injuries. The prognosis for recovery depends on the fracture type and location. Open fractures, where bone is exposed through the skin generally carry a poorer prognosis when compared to closed fractures (skin overlying fracture is intact).

Signs of a fractures may include swelling, pain, deformity and loss of function. Where a fracture is suspected, veterinary assistance must be sought as soon as possible to relieve pain, confirm the diagnosis and prognosis, and provide appropriate treatment. In the interim, it is important to restrict movement and minimise stress. Ensure there is sufficient cushioning during transport.

# Husbandry

Husbandry requirements for wombats in the initial period following rescue differ to requirements for wombats in longer term care. They should be adapted to each individual depending on the animal's developmental stage, injuries and health status.

Adult wombats require specialised husbandry and are prone to stress associated with captivity. The following section provides guidelines on housing in the initial period following rescue. Wombats must be assessed by a veterinarian or experienced wildlife rehabilitator within 24 hours of rescue. Joeys must be transferred to an experienced wombat rehabilitator as soon as possible for temporary care and hand-rearing until suitable for release.

## Housing

Wombats should initially be housed individually until they have had a thorough assessment by a veterinarian or experienced wombat rehabilitator. This functions as a period of quarantine to reduce the risk of disease transmission.

> Wombats should be maintained in 'intensive care' housing for the initial 24 hours at least.

Wombats must be housed in a warm and quiet environment free from stressors including loud noises, domestic pets and noxious smells.

Ensure that enclosures are escape-proof. Wombats are strong diggers and are known to chew through and climb over barriers. Burrow substitutes, such as a wooden box, a hollow log or a large-diameter concrete pipe can be provided as long as they allow access to the wombat (Bryant & Reiss 2008). In the initial period following rescue, try not to provide digging opportunities for debilitated wombats, as the act of digging can consume energy for an already debilitated animal (Bryant & Reiss 2008).

Pouch young are housed in artificial pouches, mimicking the mother's pouch environment as closely as possible. Artificial pouches consist of an inner liner (e.g. cotton) and an insulating outer layer (e.g. wool). Ensure there are no loose threads or seams on the inside of the pouch as this can result in entanglements or ingestion of threads. The inner liner should be changed regularly if soiled, and pouches washed in unscented laundry detergent. Artificial pouches should not be tied closed and should be placed within a secure container (e.g. wooden crate). If musculoskeletal injuries are suspected, ensure the container has adequate cushioning. Keep the crate covered and minimise noise to reduce stress. It is important to ensure joeys are not disturbed or handled unnecessarily.

External heat sources (heat pads, hot water bottles, heat lamps) can be used to maintain temperatures appropriate to the developmental stage of the joey (see Table 1). Electrical heat sources must be regulated by a thermostat. Ensure heat pads and hot water bottles are not in direct contact with the joey to avoid burn injuries.

Wombats are particularly susceptible to heat stress. Cooling behaviours observed in wombats include salivating on fore legs and chest and lying on their backs to expose the thinly furred axillae (armpits) and inguinal (groin) areas (Bryant & Reiss 2008). Ambient temperature must be monitored regularly with a thermometer or thermostat.

**Figure 11 A wombat joey in an artificial pouch**

The pouch has an inner liner (green and white) and outer insulating layer (pink). Photo: Aditi Sriram/DPIE.

### Minimising stress

Wombats are vulnerable to the detrimental effects of stress. Excessive handling, exposure to humans or animals, other animals, loud noises and unfamiliar environments must be minimised while the wombat is in care. Try to disturb the animal as little as possible.

# 5. Common rescue encounters

## Trauma

Trauma resulting from motor vehicle collision is the most common reason wombats require rescue in New South Wales (DPIE 2020). Trauma resulting from dog attacks and intraspecific aggression (fighting) is also discussed below. The majority of cases of motor vehicle trauma are fatal. In relation to those that survive, the welfare of the animal and the probability of successful recovery and release must be considered.

Follow the basic principles for initial stabilisation (as set out above). Following a traumatic incident, the majority of animals will be in shock. Therefore, following an initial assessment, it may be useful to allow the animal to rest in a warm, quiet location while preparing for treatment. If there are severe injuries requiring immediate medical attention, treatment should not be delayed, and the animal should be referred for veterinary care as soon as possible.

### Motor vehicle trauma

#### Head trauma

Animals with head trauma may display a variety of clinical signs and care must be taken with handling these patients. Neurological injury can result in an inability to swallow; therefore, be especially careful when offering oral fluids. Suspected head trauma requires prompt veterinary assessment. Signs related to head trauma can include:

- blood from the nostrils, mouth or ears
- abnormal or irregular pupil size, indicating injury to the brain or nervous system

- head tilt or incoordination, inability to stand
- head wounds or asymmetry of the face.

Drooling from the mouth or blood in and around the mouth, nostrils or eyes can be a common presentation of skull fractures. Wombats with jaw fractures may have a misaligned jaw or hold their mouth open (see ‘Dental examination’ in Section 2). Radiographs or more advanced imaging techniques are required to accurately assess fractures of the skull or jaw.

Broken or missing teeth and jaw misalignment carry a poor prognosis and must be assessed by a veterinarian.

**Figure 12 Malocclusion of the incisors in a wombat joey**

Note the lower incisors are set back compared to the upper incisors, creating an overbite and malocclusion. Photo: Kerstin Schweth/WRSC.

### Haemorrhage

Check for signs of external bleeding. Additionally, the following signs might indicate significant blood loss, including internal haemorrhage:

- pale or blue-tinged mucous membrane colour
- blood in the urine or faeces, coughing up blood or blood in the saliva
- bruising of the skin.

### Limb fractures and dislocations

These are common complications of trauma and can result in lameness or a focal area of pain and swelling.

Immobilising a fracture, by bandaging or confinement, is vital to reduce pain and tissue trauma.

- Pouch young can be immobilised by housing them in a confined, cushioned carrier. The patient should be assessed by a veterinarian as soon as possible and kept confined, with minimal handling, until then.
- Open fractures (where there are deep external wounds over the fracture site or bone is exposed) are at increased risk of infection and complications and may carry a poor prognosis, especially if veterinary treatment is delayed. Animals with open fractures

should be taken to a veterinarian for anaesthesia and assessment as soon as possible. In the interim, again, ensure the patient's mobility is restricted.

- An important consideration in decision-making about fracture management in wombats includes the availability of facilities and experienced personnel for post-operative patient care. Strict confinement is imperative for fracture management, and restricting activity in adult wombats can be difficult.

### Dog attack

- Signs of a dog attack may include saliva staining of the fur, grazes and puncture wounds. Careful assessment of apparently superficial injuries might reveal deeper and more serious damage to deeper structures such as muscle, bone, joints or even internal organs. In animals with bruising or wounds around the chest or abdomen, the possibility of internal injuries must be investigated, and this requires veterinary assessment which may include diagnostic tests (e.g. radiographs or ultrasound). Severe dog attack injuries require surgical and antibiotic treatment prescribed by a veterinarian.
- Ensure an initial assessment has been performed once the animal is stabilised, and part the fur to check for puncture wounds and bruising.
- Dog bite wounds are contaminated with bacteria and require antibiotic treatment. Antibiotics need to be prescribed by a veterinarian, and the choice of medication and duration of treatment will depend on the severity and extent of injuries.
- Flush and treat external wounds as described in 'Wound care' in Section 4.

## Mange

Sarcoptic mange (mange) is a disease caused by the parasite *Sarcoptes scabiei*. The disease is present throughout the range of the bare-nosed wombat and occasionally occurs in southern hairy-nosed wombats. It has significant health and welfare implications for individual animals (DPIPWE 2020; Campbell-Ward 2019b). If left untreated, mange can result in the death of the affected individual.

The mange mite burrows into the epidermis (outer layer of skin) and causes inflammation, thickening of skin and intense pruritis (itchiness). Changes to the skin can result in secondary infections, poor thermoregulation and dehydration (Rowe et al. 2019). Wombats affected by mange have a higher energetic demand, are active outside the burrow for longer periods, spend more time scratching and drinking and less time walking but do not spend more time feeding (Simpson et al. 2016; Martin et al. 2018). Wombats with severe mange are generally in poor body condition.

Skin changes observed in mange affected wombats include:

- alopecia (hair loss)
- erythema (skin reddening)
- parakeratosis (skin thickening)
- excoriations, fissures and wounds.

### Diagnosing mange in wombats

- In free-ranging wombats, where capture and physical assessment may not be feasible, mange is presumptively diagnosed based on observation of typical skin changes. Definitive diagnosis of mange requires veterinary diagnostic testing including skin scraping and microscopic examination to identify the mite or eggs (Fraser et al. 2018). A veterinary examination will also allow for an overall assessment of the animal's health.

Fight wounds and bacterial and fungal infections can superficially mimic mange infection and should be considered before initiating treatment in wombats. If a wombat with suspected mange is identified, an experienced wombat rehabilitator should be contacted for mange assessment and to determine a management plan.

## Mange scoring

- Various mange scoring scales have been developed to identify severity of mange in wombats and to track progress and treatment outcomes in individual animals (see Figure 13). An alternative mange scoring system can be found on the Wombat Protection Society of Australia (WPSA) website: Mange and disease.
- Mange scoring in free-ranging animals may be hampered by limited opportunities to closely observe the animals and the observer's experience. It does, however, provide a valuable opportunity to track progress of animals receiving treatment in care.

| Mange score | Hair loss | Mange severity status |
|---|---|---|
| X | Segment not observed | N/A |
| 0 | No sign of mange observed | Healthy |
| 1 | Ambiguous, possible hair thinning/skin reddening | Likely healthy |
| 2 | < 10% of segment affected by mange | Early mange |
| 3 | 10–40% of segment affected by mange | Moderate mange |
| 4 | 40–60% of segment affected by mange | Severe mange |
| 5 | 60–100% of segment affected by mange | Late-stage mange |

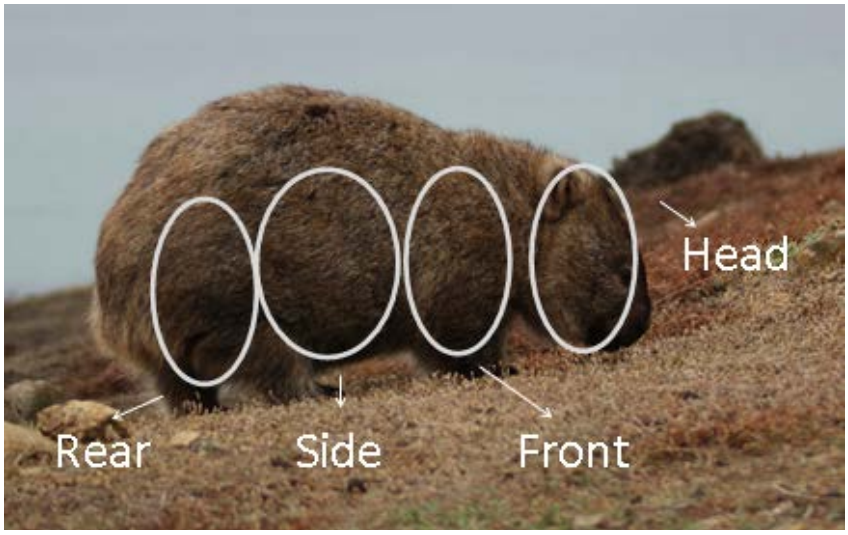


**Figure 13 Mange scoring guide for use in wombats**
(DPIPWE 2017)

## Mange treatment

Adult free-ranging wombats with mild to moderate mange are treated in situ to prevent adverse outcomes associated with the stress of capture and captivity. Where a young at foot joey is identified with a mange-affected adult female, both wombats may require treatment. Advice from an experienced wombat rehabilitator should be sought to assess the joey and determine the best treatment approach for the female and joey.

Topical application of moxidectin ('Cydectin®') is currently a widely used method of treating mange in situ in free-ranging wombats.

In situ treatment can be administered using 'burrow flaps' or using the 'pole and scoop' method. As moxidectin is currently considered 'off-label' for use in wombats, a permit for its use in wombats is required from the Australian Pesticides and Veterinary Medicines Authority (APVMA). All wombat mange treatment groups must receive written authorisation from the permit holder before using moxidectin ('Cydectin ®').

Novel therapeutics to treat mange in wombats are currently being investigated. Fluralaner ('Bravecto®') is a spot-on solution that has been identified recently as safe to use in adult and juvenile wombats (Wilkinson et al. 2021). A significant advantage of 'Bravecto®' is its duration of action, providing protection from re-infestation with mange mites for a period of up to three months (Wilkinson & Carver 2021). 'Bravecto®' is considered 'off-label' for use in wombats and can only be used under the direct supervision of a veterinarian until an APVMA permit for its use in wombats has been issued. For more information, including dosage and frequency of application, see Guidelines for the use of Fluralaner ('Bravecto® Spot-on Solution for Dogs') to Treat Sarcoptic Mange in Wombats.

Veterinary advice should be sought before using medication outside the scope of the APVMA permit to treat wombats.

Rescued orphaned wombats with suspected mange require a thorough assessment and supportive care in conjunction with mange treatment. Supportive care includes nutritional support, thermal support and hydration (see Section 4 'Initial treatment – stabilisation'). The current recommended treatment for mange is repeated dosing with an avermectin (e.g. ivermectin, moxidectin) until clinical signs are resolved (Campbell-Ward 2019b). Treatment must be undertaken in consultation with an experienced wildlife rehabilitator and a veterinarian.

Rescued wombats with mange must be kept under strict quarantine throughout their rehabilitation and appropriate PPE should be used to prevent transmission of mange to the handler (see Section 7 'Zoonotic diseases'). The mite can survive in the environment, in favourable conditions where humidity is high and temperature low, for up to 21 days (Vogelnest 2019). Hygiene and enclosure-cleaning protocols must be adequate to prevent transmission of mange between animals in care and to people. Pouches, bedding and towels can be decontaminated by machine-washing in hot water and drying using the hot cycle (CDC 2020).

Severely affected animals are less likely to recover when compared to animals with mild to moderate mange (Rowe et al. 2019) and may act as a significant source of transmission to other animals. Euthanasia should be considered in such animals, where a complete course of treatment is unlikely, the animal is in very poor body condition, or where mange lesions have resulted in apparent blindness or difficulty eating due to facial crusting. (DPIPWE 2020).

# Burns

Rescuer safety is vital when working in fire grounds. Information pertaining to safety, logistics and training required for rescues on fire grounds is outside the scope of this document. Only qualified personnel with appropriate training should attend to rescues on fire grounds.

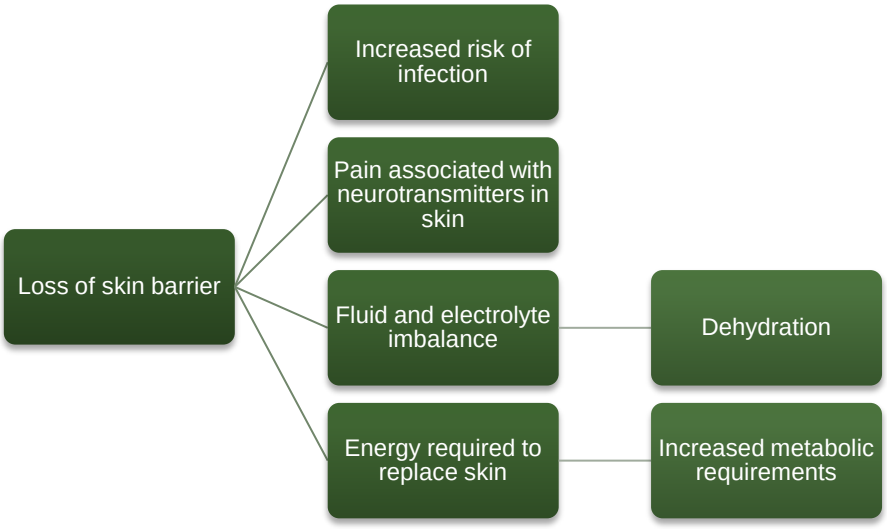


**Figure 14** **A brief outline of the pathology of burns**

Burn injuries should be classified based on their severity and extent. This is an important indicator of prognosis and will direct treatment. In addition to a burns assessment, an overall physical examination should be performed to check vital signs and identify concurrent injuries or illnesses present.

Keep welfare in mind when triaging burns cases as burn injuries are severely painful and the experience in itself is traumatic. Assessment and provision of pain relief by a veterinarian should be sought as soon as possible.

## Depth of burns

The classification of the depth of burns can be subjective depending on the experience of the person assessing the patient. Table 2 provides some guidance on classifying burns as superficial, partial or full thickness burns.

**Table 2** **Classification of burns**

| | Superficial | Partial thickness | Full thickness (3rd degree) |
|---|---|---|---|
| Pathology | Epidermis and upper dermis, most adnexal structures intact* | Epidermis and part of the dermis. Superficial adnexal structures affected | Epidermis, dermis and cell adnexal structures destroyed |
| Appearance | Red, pale pink | Dark pink to red | Dry, leathery, white, black (charred) or yellow. Eschar* may be present |

| | Superficial | Partial thickness | Full thickness (3rd degree) |
|---|---|---|---|
| Blisters | Large within hours | May be present | None |
| Sensation | Very painful | Less painful | Absent |

Adapted from T Duratovic (2016)
*Epidermis: outermost layer of skin
*Dermis: layer of skin below the epidermis
*Adnexal structures: skin-associated structures such as hairs, sweat glands, nails
*Eschar: dry, dark scab or falling away of dead skin.

## Extent and location of burns

Veterinary consultation is necessary to determine prognosis based on the extent and location of burn injury in wombats.

- Significant burns to the face, feet and genitals carries a poor prognosis and euthanasia must be considered.
- Burns to the feet can result in injury to deeper structures, including tendons and bones. It is difficult to immobilise the feet to allow healing and this must be considered when assessing burn injuries. Scarring and deformity can lead to permanent dysfunction, and the deeper tissues, including bone, may become progressively devitalised.
- Burn injuries require intensive wound care and veterinary oversight, and in adult wombats, this requires repetitive captures and immobilisation for treatment. For these reasons, following assessment, adult wombats may require euthanasia on site.

Radiant burns do not manifest until several days to weeks (up to four weeks) post exposure. Radiant burns should be suspected in animals with singed fur and these animals are required to be kept in care for several weeks to adequately assess the extent and development of injuries.

## Stabilising the patient

Following classification of the burn injury, veterinarians or experienced wombat rehabilitators should be contacted to discuss how best to stabilise the animal before transfer to a veterinary facility. General guidelines for stabilising wombats with burn injuries are:

- If the burns are ‘fresh’, there is a high likelihood there is remnant heat in the wounds; therefore, flush the wounds with lukewarm saline or cover with saline-soaked gauze swabs.
- Fluid therapy is vital as animals can develop shock from severe dehydration. IV fluids administered by a veterinarian is the recommended route of rehydration. If not possible, provide oral fluid replacement.
- For burns to the eyes or face, flush with tepid saline or clean water.
- For smoke inhalation or respiratory burns, observe the animal for signs of respiratory distress, such as open-mouth breathing, panting or increased respiratory rate. Animals showing these signs should be presented to a veterinarian as soon as possible as they may require oxygen therapy. Smoke inhalation can result in damage to the lungs and possible pneumonia. In the interim, improving humidity with nebulisers can improve clinical signs. If the animal will not tolerate a nebuliser mask held up to the face, a nebulising chamber can be created using blankets or towels to create a humid chamber.

- Recovering from burns markedly increases metabolic requirements, therefore nutritional support is important. Appropriate diets should be provided to wombats based on their species and life stage. In severely affected animals, additional veterinary intervention such as the placement of a feeding tube may be required to ensure nutritional support is adequate. Euthanasia must be considered for animals for whom this is not feasible and those who tolerate the supportive treatment poorly.

### Treating burn wounds

All burn injuries require assessment by a veterinarian. Treatment for the burn wounds should be undertaken only once the patient is stabilised. This can be 24 hours after initial presentation. Sedation and pain relief are primary considerations in wombats with burns injuries.

Wear gloves when handling burn injuries to reduce the risk of wound contamination.

Prepare the required bandaging equipment beforehand so treatment can be performed quickly and efficiently.

Flush burns with lukewarm saline to remove debris and gently pat dry. Following veterinary advice, topical treatments such as ‘Solosite’, ‘Acticoat’ or ‘Flamazine’ (silver sulfadiazine) may be applied to wounds and bandaged to protect from further trauma, prevent desiccation and relieve pain from exposed nerve endings. Ensure bandages are not too tight or constricting, and when bandaging weight-bearing surfaces (hindlimbs) ensure bandages are well-padded. Bandage wounds with a low-adherent, absorbent dressing such as ‘Melolin’ as the primary dressing then use a padded bandaging material (‘Soffban’) and a cohesive bandage (‘Vet Wrap’) as consecutive layers.

In most cases, sedation or anaesthesia is required to perform bandage changes, therefore following initial stabilisation, transfer to a veterinary facility is advised. A veterinarian can confirm the severity of burns and determine the requirement for sedation or anaesthesia and frequency of bandage changes (which may be as frequent as once every two to three days).

## Orphaned joeys

Joeys requiring care are commonly rescued from injured or dead females, due to misadventure, or alternatively may be rescued from members of the public. It is not uncommon for joeys to be cared for by a member of the public before being brought to a licensed wildlife rehabilitator. In all cases, collecting a thorough history about the orphaned joeys is vital as it informs and directs the health assessment of the joey.

Along with an initial assessment, the developmental stage of the joey must be accurately identified (see ‘Physical examination’ in Section 2) to guide decision-making regarding viability of the joey.

> The rehabilitation of orphaned wombats is a long-term and intensive process. Following initial rescue, long-term care of joeys should be undertaken by or supervised by experienced wombat rehabilitators as it requires experience and time commitment. Aim to contact an experienced wombat rehabilitator as soon as possible for advice on husbandry, feeding and care of the joey until the animal can be transferred.

Wombats, especially young males, can develop inappropriate behaviours in captivity. The approach and experience of the rehabilitator is a vital factor influencing the development of and severity of such behaviours (Bryant & Reiss 2008).

Joeys rescued from members of the public with a history of poor husbandry and diet may present with gastrointestinal, respiratory or dermatological disease. Inappropriate or inadequate nutrition can result in diarrhoea, lethargy, dehydration and in some cases cataracts (Campbell-Ward 2019a). Inappropriate feeding technique can result in dental malocclusion, aspiration (inhalation of food) and resulting respiratory illness, presenting with lethargy, increased respiratory rate and effort, and nasal discharge. Pouch young can develop scaly, dry skin and secondary skin infections as a result of inappropriate pouch environment or malnutrition. A thorough history is vital in such cases and veterinary referral is recommended for further diagnosis, treatment and management advice.

# 6. Quarantine and managing infectious disease

Quarantine practices are vital in controlling and preventing infectious disease being transmitted between animals in care.

Treat all wombats as potentially infectious and take precautions to minimise disease transmission between animals, to humans, and from humans.

- House animals separately until disease status is determined by a veterinarian or experienced wombat rehabilitator.
- If an animal shows signs of disease (skin lesions, sneezing, coughing, diarrhoea, unusual behaviour), it must be quarantined and managed as potentially infectious until assessed by a veterinarian.
- Animals in quarantine must have their own cleaning and feeding equipment and pouches which are not to be shared with other animals.
- Thoroughly clean all enclosures, food and water bowls and equipment between animals. Cleaning feeding dishes, water bowels and other cage furniture is best done by first removing organic material by cleaning in a sink with detergent, followed by additional cleaning and sanitising by running them through a dishwasher.
- Ensure pouches, towels etc., in enclosures are thoroughly cleaned before and after use.
- Ensure biological materials such as leaves, wood, branches etc., are disposed of after use to prevent contamination between animals.
- Wash hands thoroughly before, after and between treating and handling individual animals.
- Use PPE as required: disposable gloves, covered clothing, alcohol-based hand sanitiser, dust mask, eye protection (see ‘Personnel safety’ in Section 2).

There are a range of available disinfectants with varying levels of efficacy against different pathogens. Follow manufacturer’s instructions when using disinfectants as contact time and dilution rates vary across products. Only surfaces that are impervious to water and completely free of organic material can be disinfected. Before disinfection, ensure surfaces are cleaned to remove organic debris.

If an unusual disease or mortality event is suspected, the wildlife rehabilitator must immediately contact their species coordinator to notify the Department of Primary Industries (DPI) Emergency Animal Disease Watch Hotline (24 hours) on 1800 675 888.

# 7. Zoonotic diseases

Zoonotic diseases are diseases transmissible from animals to humans. As a group, wildlife rehabilitators are at increased risk of zoonotic disease due to regular and close contact with wildlife (Hulst 2019). Knowledge of the disease, appropriate PPE, hygiene practices and vaccination where available are vital in reducing the risk of disease transmission. Zoonotic diseases of specific importance to wombats are listed below. Further information on zoonotic diseases can be found on the Department of Primary Industries website: Zoonoses – animal diseases that can infect people.

## Sarcoptic mange

**Transmission:** sarcoptic mange caused by the mite *Sarcoptes scabiei*, is transmitted to people through direct contact with infected animals.

**Symptoms in wombats:** symptoms of mange in wombats are discussed in detail earlier in this document (Section 5). Symptoms can range from hair loss and thickened skin to crusting, fissures and excoriations with secondary infection.

**Symptoms in people:** red itchy rash with papules (raised lesions) on the skin.

**Prevention:** wearing appropriate PPE when handling animals showing signs of mange. This includes gloves, covered clothing and permethrin-impregnated clothing (Hulst 2019).

## Salmonellosis

**Transmission:** the bacteria is shed in faeces and can be contracted orally through direct contact or indirect contact via fomites (inanimate objects that can transfer infectious pathogens).

**Symptoms in wombats:** most animals that shed salmonella are asymptomatic. In some wombats that show clinical signs, these are non-specific and can include diarrhoea, lethargy and anorexia (Wildlife Health Australia 2017).

**Symptoms in people:** can include nausea, vomiting, diarrhoea, fever and abdominal pain or cramps.

**Prevention:** hygiene and PPE are vital in protecting against salmonellosis and include hand washing, regular disinfection of equipment, and isolation of affected animals.

## Dermatophytosis (ringworm)

**Transmission:** can occur through direct contact or via fomites.

**Symptoms in wombats:** affected animals will have well-demarcated areas of hair loss, redness and flaking of the skin (Hulst 2019). Animals without any skin lesions can also be carriers of the fungus.

**Symptoms in people:** redness and flaky lesions on the skin, in areas which have contacted the fungus.

**Prevention:** personal hygiene and the use of appropriate PPE (gloves, long sleeves) when handling animals with suspicious skin lesions.

# 8. Record keeping

Accurate records must be maintained to track the progress and outcomes for wombats in care. If the wombat is referred to a wildlife hospital, these records provide vital clinical information to determine continued treatment and outcomes. They are also a useful resource for research and government organisations.

Records to be maintained include:

- Encounter details – date, circumstances, location, name and contact details of people involved.
- Individual identification – species, stage of development, sex, identification (microchip) if present.
- Initial physical examination findings.
- Daily notes – including treatments provided, progression or development of symptoms, weight, food intake, faecal output, behaviour etc. Maintain daily record sheets while the wombat is in care.
- Outcome – record the outcome for each individual coming into care. For example, whether the animal was transferred to a wildlife rehabilitator or veterinarian, if the animal was euthanased or if the animal died while in care.

Maintaining records is also recommended for wombats treated for mange in situ, including animal condition, location, treatment details and duration of treatment. These records, however, are not required to be submitted to NPWS as part of annual reporting requirements.

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# 10. Appendix A

**Table 3 Approximate weight and developmental stages in wombats based on age**

Modified from Bryant & Reiss (2008).

| Age | Weight (approximate) | | Stages of development |
|---|---|---|---|
| | Common wombat | Southern hairy-nosed wombat | |
| 90 days (3 months) | 150 grams | 130 grams | Hairless, ears unfolded, lips partially open |
| 120 days (4 months) | 390 grams | 290 grams | Beginnings of fine fur, eyes open, lips separating |
| 150 days (5 months) | 800 grams | 530 grams | Fine fur, lower incisors erupting |
| 180 days (6 months) | 1430 grams | 880 grams | Upper incisors erupting |
| 210 days (7 months) | 2250 grams | 1350 grams | Thicker fur, emerging from pouch |
| 240 days (8 months) | 3350 grams | 2200 grams | Fully furred, starting to emerge when out of burrow |
| 270 days (9 months) | 4600 grams | 3250 grams | Leaves pouch permanently |
| 12–15 months | 12–19 kilograms | | Weaned at 12–15 months |