Husbandry guidelines for Common Ringtail Possums, *Pseudocheirus peregrinus* Mammalia: Pseudocheiridae

Ault Ringtail Possum
Image: Casey Poolman

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Disclaimer

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Workplace Health and Safety risks warning

Ringtail Possums are not an aggressive possum and will mostly try to freeze or hide when handled, however they can and do bite, which can be deep and penetrating.

When handling possums always be careful not to get bitten, do not put your hands around its mouth. You should always use two hands and be firm but gentle. Adult Ringtail Possums should be gripped by the back of the neck and around the shoulders with one hand and around the base of the tail with the other. This should allow you to control the animal without hurting it and reduces the risk of you being bitten or scratched.

Contents

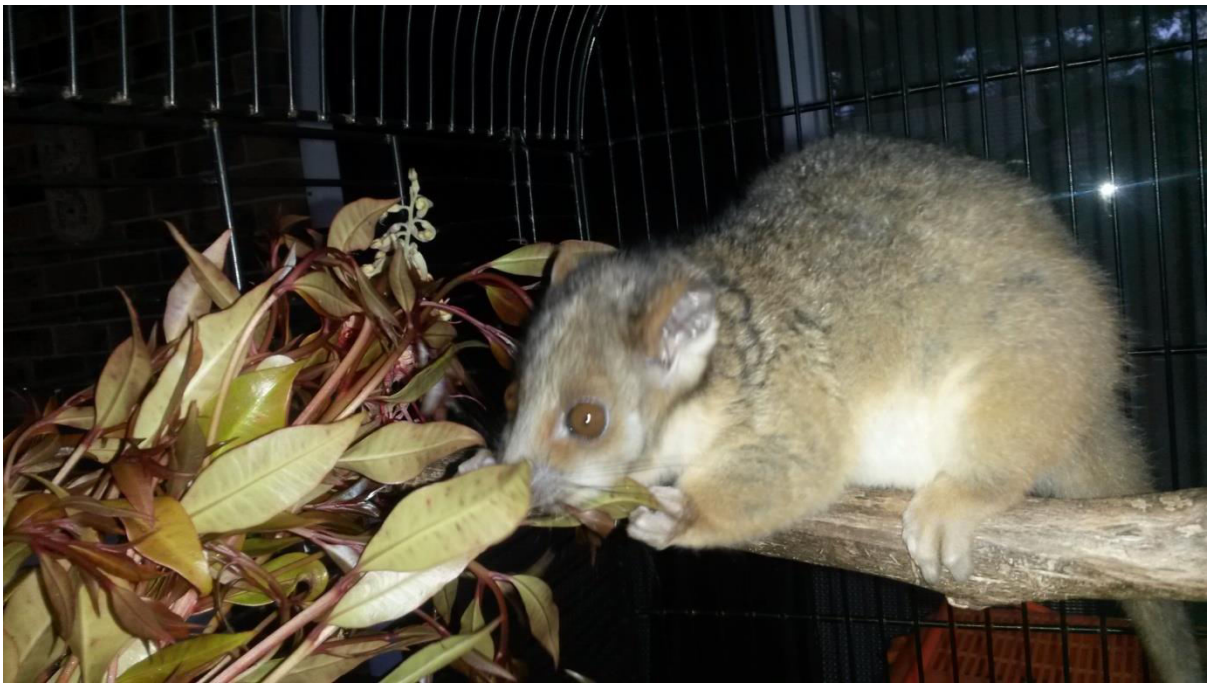
1. Introduction

The Common Ringtail Possum is one of the most common large possum species on the eastern coast of Australia. They are frequent visitors to people's backyards and enjoy eating people's flowers.

They are usually a grey-brown colour above with white under parts and an orangey hint between. Their tail is mostly grey-brown with white at the end. They often carry their tail rolled up, thus the name 'ringtail'.

Common Ringtail Possums often come into the care of zoos when people find them hurt or orphaned and take them to a local zoo.

Through this husbandry manual you will see a lot of personal observations. I have worked with wild Common Ringtail Possums for five years as part of a wildlife rescue group, where my main role is to raise orphaned Ringtail Possums for release back into the wild. I have learnt a lot through books but even more through hands on experience.
I have also observed a pair of Ringtails kept at Australia Walkabout Wildlife Park and their behaviour.



Juvenile Ringtail
Image: C.Poolman

2. Taxonomy

Pseudocheirus peregrinus is Greek for 'false hand' meaning their tail which they use as a fifth limb to carry nesting materials.

2.1 Nomenclature

Species: Peregrinus
Genus: Pseudocheirus
Family: Pseudocheiridae
Order: Diprotodontia
Subclass: Marsupialia
Class: Mammalia
Subphylum: Vertebrata
Kingdom: Animalia

2.2 Subspecies

P. p. peregrinus - subspecies found in Queensland, inland NSW and Victoria and South Australia.
P. P. pulcher – found in south-eastern Queensland and north coastal NSW.
P. p. cooki – found in coastal southern NSW and Victoria.
P. p. convolutor – found in Tasmania.
(Kerle 2001)

2.3 Recent synonyms

Didelphis peregrinus Boddaert -1785, *Phalangista cookii* Desmarest - 1818

2.4 Other common names

Ring-tail Possum, Queensland Possum, Ringie

3. Natural history

3.1 Morphometrics

3.1.1 Mass and basic body measurements

	Southern specimens:	Northern specimens
Weight (g)	700-1100	660-880
Head/body length (mm)	300-350	300-344
Tail length (mm)	300-350	317-381
Ear length (mm)	35-40	-

Table 1: measurements (Kerle 2001)

3.1.2 Sexual dimorphism

Males are generally larger in size and also have visible testicles whereas females will have a pouch.

3.1.3 Distinguishing features

The Ringtail Possum is smaller than the well known Brushtail Possum, also the last few centimetres of the tail is white. When not in use they hold their tail curled up, thus the name 'ringtail'.

Tail of a Common Ringtail Possum.
Image: C.Poolman

3.2 Distribution and habitat

Ringtails are found in east coast Australian forests and urban gardens. They prefer dense foliage to build a drey in and keep hidden.
They are arboreal and common in bush land, along creek-lines, in parks and backyards. (Henderson n.d.) They can be found in many areas as their main food is Eucalyptus which is widely spread across the East coast of Australia.
They build their own spherical nests, called dreys, which makes it possible for them to live in many places as they don't need to rely on tree hollows. A drey is made out of sticks and bark with leaf litter used to make it comfortable. Ringtail possums will have more than one drey in their home range and each drey will have more than one entrance/exit to make escape easy if a predator approaches from one opening.

Distribution of the Common Ringtail Possum
Image: ABC Science

3.3 Conservation status

IUNC status – Least concern

3.4 Longevity

3.4.1 In the wild

Life span averages >6 years in the wild. (Jackson 2003)

3.4.2 In captivity

Average of 5-6 years with the oldest known being 8 years. (Jackson 2003)

3.4.3 Techniques used to determine age in adults

There are various ways to determine the age on an adult possum. Using a combination of; body weight, body length, scent gland development in males, pouch development in females and tooth wear should give you a good idea. (Jackson 2003)

4. Housing requirements

All possum species are best displayed in nocturnal houses so that visitors can see their natural behaviours of a day. (Jackson 2003) However they can also be kept in outdoor enclosures.

4.1 Exhibit/enclosure design

If in an outdoor enclosure it should be made with wire mesh with the gaps being no bigger than 2cm x 2cm, this will prevent the possums from escaping and any snakes from getting in to prey on your animals (pers. obs).

They should have plenty of room to move around and branches of all different sizes for climbing and jumping. 'Adequate climbing and gliding opportunities must be provided.' (Industries 1986)

Most of an outdoor enclosure should be relatively open to allow airflow; however the nest boxes should be under shelter, protected from wind and rain. (Jackson 2003)

Leaf litter should be used as a substrate (Jackson 2003).

For the floor you will don't generally need to worry about Ringtail Possums digging out, however Goannas and other predators may try to dig in, also if you are going to house other terrestrial animals in the enclosure, such as echidnas, it will need to be dig-proof.
You may use a wire mesh or concrete. Concrete is easier for cleaning and replacing substrate but you will also need to make sure it drains well. If you do use concrete the cage can be bolted to the concrete floor giving it extra security.
Leaf litter must completely cover the floor, preferably to a depth of 2cm or more, this will reduce the likeliness that the possum will come into contact with the flooring and injuring itself, and give them cushioning should they fall from a branch (pers. obs).

The aviary should have a double door system (airlock) so the possums cannot follow you out easily. Doors should have bolt locks or latches so they are securely closed and can also be locked so that only those allowed entry can access the aviary.
Aviary should be checked over every morning to make sure there are no maintenance issues. When you sweep up the leaf litter on the floor you should check the concrete is in good condition and there are no cracks. The wire mesh should have no breaks or bends. There should be no rust.
Any deterioration to the aviary should be reported immediately and steps taken to fix or replace.

4.2 Social needs

Ringtail Possums are very social, usually living in family groups of four or five. A Ringtail Possum should always be kept in pairs or more, as they enjoy playing and looking after each other.

Although social they still have disagreements, this means they need the area to be large enough to separate them and therefore the larger the family group the larger the cage should be.

Secondary dreys should be made available as well as little hideouts made from hanging foliage, 'it is essential that there are several more nest boxes available than the number of animals to ensure that subordinates always have easy access to a den site.' (Government 2014)

Although social they still have disagreements, this means they need the area to be large enough to separate them

4.3 Spatial requirements

Aviary should measure around 2.8m long, 2.8m wide and 3m high with 2mx2m extra floor space for each additional animal. (Jackson 2003)

4.4 Position of enclosures

Enclosure should be protected from poor weather and strong winds with nest boxes out of full sunlight. (Jackson 2003)

4.5 Weather protection

Ringtail Possums require an area that is protected from the elements, usually around their nest box and a platform for feeding in bad weather, but otherwise they should be able to experience the weather. If there is snow or a storm you should make sure their drey is in a protected area where they can sleep comfortably. 'If held outdoors, nest boxes and tree hollows must be placed in a position of the enclosure where they are protected from inclement weather.' (Industries 1986)

4.6 Temperature requirements

Adult Ringtail Possums do not need any special heating. As a nocturnal animal they should be kept out of direct sunlight, this means either having plants around their cage or using shade cloth.

They also don't require any filtering of air, so long as they are kept in an area not being polluted by smoke or any fumes. They can handle natural humidity level changes.
If there is a hot day, over 35°c, considerations should be made. These are nocturnal animals and so will not be able to do much to cool themselves of a day as it is against their nature to be active while the sun is out, so it is up to you to keep them from dehydrating or suffering heat stress. 'During long periods of extremely hot weather, it is essential to monitor animals several times each day for heat stress.' (Government 2014)

Lots of fresh water should be available as well as spraying down the cage with a mist attachment or hanging cool wet towels to lower the temperature. You may even wrap a frozen water bottle in a cotton cloth and put inside the nest box. If these do not work they will have to be taken to an inside facility to be kept cool. The inside facility will not need to be as large as they should be sleeping of a day and not need to move around much (pers. obs).

4.7 Cleaning

Aviaries should be cleaned daily, to remove old food and faeces and to clean and refresh their water (Jackson 2003). The best time to do this is around the middle of the day while they sleep. The floor should be swept to collect up faeces and urine soaked leaf litter. Branches should be wiped over once every 3 days. Ringtails like to have their scent around so using a gentle disinfectant and warm water should be enough without disturbing the animals too much. They will come out to re-mark it when they feel it is safe to do so.

They like to defecate into their water so it should be changed every morning (pers. obs).
Very old leaf litter should be removed and the left over foliage from the night can be used as new leaf litter.
Food holders should be taken out and rinsed thoroughly before being put back and fresh water added.

4.8 Nestboxes and/or bedding material

Ringtails make their own dreys in the wild; however you can build your own using hanging plant wire frames with coconut fibre. You can also use wooden possum boxes with straw for bedding.
Ringtails require lots of access to native leaves for them to add to their drey or make their own.

Or you can make them a nestbox with inner dimensions of 20 x 30 x 45cm with an entrance diameter of 8cm. (Jackson 2003)

4.9 Enclosure furnishings

The enclosure should be furnished with lots of native leaves and flowers. Their main diet is Eucalyptus so at least three different kinds of Eucalyptus leaves should always be available and Eucalypt flowers where possible.

The enclosure should have lots of climbing branches allowing maximum use of the space. Using fresh branches with leaves will also provide food, cover and behavioural enrichment through smell. (Jackson 2003)

Leaf litter should completely cover the bottom.

They love Lilly Pilly berries as well as the fresh leaf tips.
They prefer red Grevillea flowers over yellow (pers. obs).

They will also eat; Wattle, Banksia, most varieties of Callistemon.
Most of the cage should be filled with Eucalypt with flowers and berries given in small amounts as extras.
Branches should be put into holders, secured in various spots around the aviary that contains water so that they stay fresh.
Lots of leaves and branches and even logs should be place around the cage so the Possums can explore easily.

You need to keep an eye on what they do and don't eat, they will pick their favourites so make sure there is plenty of what they like available.

Food should be hung around the cage, encouraging the possums to climb and jump in order to reach them. (Jackson 2003)

5. General husbandry

5.1 Hygiene and cleaning

All enclosures should be cleaned daily to remove faeces and uneaten food as well as cleaning and refilling their water dishes. (Jackson 2003)

5.2 Record keeping

Each individual animal should have records kept. A dairy and a program like ZIMS or ARKs are a good place to start.

For each animal, records should be kept of;

- Identification
- Veterinary exams
- Treatments
- Any injuries or illnesses
- Behavioural changes or problems
- Reproductive behaviour and condition
- Weights and measurements
- Diet and any changes
- Any handling and the animals reaction
- Conditioning
- Births
- deaths

5.3 Methods of identification

Ear tags are not ideal as they can cause sore wound and be torn out. (Jackson 2003)
Visual identification should not be your only source of identification.
You can use a microchip, such as a passive integrated transponder tags; 'PIT' tags. These should be inserted subcutaneously between the shoulder blades. (Council 2014)

5.4 Routine data collection

Record keeping is an integral part of all husbandry programs. Using a program such as ARKs means that standardised records can be kept of all your animals, as well as being transferred between zoos when needed.

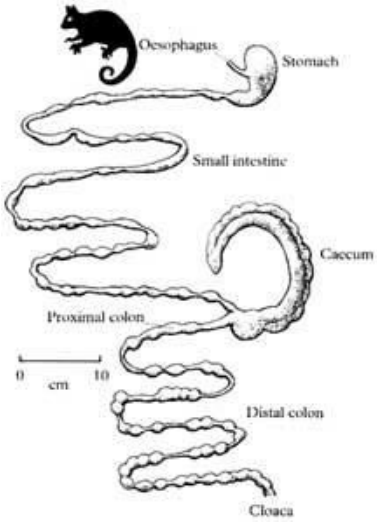
Your records should include:

- Individual identification – visual as well as permanent identification methods.
- Gender
- Age – if not known at least a general idea
- Parentage
- Source and Provenance – including if there is a specific reason it is a captive animal
- Temperament
- Veterinary notes
- Reproductive status
- Behavioural changes
- Diet – also breeding diet if needed
- Weights and measurements
- Enclosures – what it requires as well as where it has been in the past
- Any training or conditioning
- Handling procedure

- Use – if the animal is able to be used for interactions or education and if so record when the animal is used, for how long and it's temperament during.
- Death – with a post mortem result.
  (Jackson 2003)

6. Feeding requirements

Ringtail Possums are folivores and as such are hindgut fermenters, meaning that they ferment the leaves in their caecum. In the caecum are specialised bacteria that make the leaves they eat easier to digest.
Ringtails also practise coprophagia. During the day they produce caecal pellets, these are soft and contain undigested nutrients. The possum will eat these in order to re-digest the matter and get as much nutrients out of the leaves they have eaten as possible. (Norris 2004)



Ringtail Possum digestive system Image: Prof. Ian Hume

6.1 Diet in the wild

Ringtail possums are folivores and their main diet is Eucalyptus leaves. (Henderson n.d.) However they do supplement their diet with more easily digested foods such as blossoms, flowers and fruit. (Jackson 2003)
To maximise digestion Ringtail Possums practise coprophagia. Where they re-ingest soft faeces of high nutritional value in order to gain access to nutrients that would otherwise be lost. (Jackson 2003) This is usually done during the day; they will curl up into a ball in their drey, with their head near their cloaca to make eating the soft faeces easy.

They also eat Lilly Pilly and Callistemon leaves. With all leaves they prefer the fresh tips that are usually a lighter green or even reddish in colour. They also eat native flowers such as; Grevillea, Wattle, Banksia, Callistemon and Eucalypt.
Where they can find native fruits they also enjoy them, their favourite being Lilly Pilly berries.

6.2 Captive diet

A captive diet for Ringtail Possums should mainly consist of their native foods, which should be supplied fresh daily. This will keep them as healthy as possible. It is very important to provide a natural diet as Ringtails practise coprophagy in order to obtain additional nutrition.

Fruits such as apple, banana, grapes or pear can be used for enrichment or training as the possums really love these sweet treats and they should only be given occasionally. Fruits should be cut into small pieces and not offered as a whole. Be very careful to not give too much fruit, as the high sugar content can cause problems.

If a possum is not gaining weigh properly or losing weight it can be given poached apple or mashed banana with High Protein Supplement powder mixed in, 5g of powder for every 50g of fruit (pers. obs).
Starchy foods should never be given to Ringtail possums.

A good base daily diet per animal includes;
4g apple
4g pear or other hard fruit
4g carrot
3g banana
with supplements;
2g good quality pet food kibble – twice a week
1 almond, shelled – three or four times a week

5 sultanas – three or four times a week
Plus fresh native flowers and browse as available. (Jackson 2003)

6.3 Supplements

High Protein Powder may be given to any possum that is losing weight or not gaining weight properly. This can be sprinkled onto their flowers or mixed up in some mashed banana or pureed apple (pers. obs).
Protexin Powder is a probiotic and should be used in conjunction with or after antibiotics. This powder can be mixed in with water or Lectade or even possum milk for young ones, 1g for young possums and 2g for adults, per day (pers. obs).
Any animal suffering from dehydration can be given Lectade; it is a sweet tasting rehydration fluid that possums enjoy (pers. obs).
Divetelact can be used on adults as a boost for them in their diet.
Vet advice should be sought before offering any supplements as something else may be going on.

6.4 Presentation of food

Fresh browse and flowers should be put into containers of water around the aviary as the water will keep the leaves fresh. Multiple containers should be placed off the ground, amongst the branches, this will encourage them to climb the whole space and use their natural foraging behaviours.
On hot days, misting water on the leaves will keep the possums hydrated.

Ringtail Possums get most of their water from their food but a container of water should be offered. These will need to be thoroughly cleaned daily as Possums tend to defecate in their water.

Fruit and vegetables should be in a feed dish on a platform. (Jackson 2003) This will make collecting and cleaning easy.

7. Handling and transport

The International Air Transport Association (IATA) has a live animals acceptance checklist [1] to help make sure you have everything prepared for any transportation requiring flight, however it is good to use as a guide for any transporting of an animal.

7.1 Timing of capture and handling

As Ringtail Possums are nocturnal the best time to capture them is during the day whilst they are sleeping in their drey or nest box (Jackson 2003).

7.2 Catching bags

The bag should be made of natural fibres so the animal can breathe and does not over heat. It should also be large enough to contain the animal with room to twist the top and tie closed with a rubber band or other suitable holder. Cotton, calico or hessian bags are preferable. (Jackson 2003)

7.3 Capture and restraint techniques

If they are in their nest box you may block off the entrance hole and move the box to the ground where you can carefully open it and place a catching bag over the animal(s). If they are out and about in the enclosure you may you a catching net. You can restrain them by holding the head and shoulders with one hand and the feet and tail with the other. (Jackson 2003)

Possums may also be conditioned to come over to you for a treat, or even to get into a bag themselves.

7.4 Weighing and examination

Weighing is best done using hanging scales once they are in a catching bag. (Jackson 2003)

7.5 Release

Ringtail Possums are best released directly into their nest box if they were caught from there, or onto a branch or tree trunk. (Jackson 2003)

7.6 Transport requirements

Each Australian sate or territory has its own rules and regulations regarding Australian wildlife. Make sure you meet with the legal requirements for the state/territory where the animal is from as well as where the animal is going.
Australia also has the Export Control (Animals) Order 2004[2] that you must comply with.
For international travel you must check that you meet the requirements under the IATA's Live Animals Regulations.

7.6.1 Box design

Ringtail Possums are relatively easily transported. They should ideally be placed in a catching bag inside a nesting box with the entrance blocked. This provides another barrier if they escape from the catching bag and also protects them from other objects falling on them. Also provide nesting material so they do not roll around too much. For long distances, more than several hours, the animal should be placed inside the box without a catching bag and given adequate nesting material. (Jackson 2003)

Nesting box should be made of wood. *(see appendices)*

[1] http://www.iata.org/whatwedo/cargo/live-animals/Documents/animalschecklist-en.pdf
[2] https://www.legislation.gov.au/Details/F2012C00134

7.6.2 Furnishings

They should be provided with soft nesting material inside the wooden box. (Jackson 2003)

7.6.3 Water and food

When transporting animals water should always be available. You should secure a water container that has no sharp edges to the side of the box. In order to avoid water spilling everywhere you may us a clean sponge or rag that is soaking with fresh water inside the container. (Jackson 2003)

Food that is not easily spoiled may be provided. (Jackson 2003)
Where possible fresh leaves and flowers will provide food for the possum that will not spoil easily. However where this is not possible you may use some fruits and vegetables.

7.6.4 Animals per box

Ideally it should be one animal per box. And females with pouch young should not be transported unless the young are only recently born and still attached to the teat. (Jackson 2003)

7.6.5 Timing of transportation

Ideally you should transfer possums overnight or in a cooler part of the day. (Jackson 2003)

7.6.6 Release from box

Once in a new enclosure, unblock the entrance to the box and uncover the animals head then allow the animal to emerge when it is ready. Once the animal is emerged you may removed the box and bag. (Jackson 2003)

8. Health requirements

8.1 Daily health checks

Every day you should observe each possum. It is important that you are familiar with their behaviour so you can notice any deviations. If you provide a small amount of the possums favourite food to encourage the animals to approach you this will help you to observe their condition, movement and development. (Jackson 2003)

Each day you should assess:

- coat condition
- fur not on the animal, indicating fighting or mating
- discharge from the eyes, ears, nose, mouth or cloaca
- appetite
- faeces – number and consistency
- changes in demeanour
- injuries
- presence of pouch young

8.2 Detailed physical examination

8.2.1 Chemical restraint

Fasting before anaesthetic is not required for adult possums as they are not prone to regurgitation. If they are being hand-reared they should be fasted for one hour prior to avoid potential regurgitation of the formula. (Jackson 2003)

Sedation can be done with diazepam at 0.5-1.0 mg/kg given intramuscularly in the thigh muscle for minor procedures and handling. (Jackson 2003)

Tiletamine/zolazepam is the injectable agent of choice. It can be used at 4-10 mg/kg intramuscularly or 1-3 mg/kg intravenously in the lateral coccygeal vein near the base of the tail. (Jackson 2003)

You may also use inhalation anaesthesia, either Isoflurane or halothane in oxygen. Mask induction is simple, rapid and smooth with maintenance via the mask or intubation. (Jackson 2003)

8.2.2 Physical examination

Physical examination should always include the following;

- Body condition – can be asses by muscle palpation or examining the base of the tail. Possums store their fat in their tail. The tail should feel smooth, if you can feel the bumps of the bones then the possum is underweight (pers. obs).
- Temperature – taken via the cloaca, usually 35-36°C.
- Weight – done monthly and compared to see any trends.
- Pulse rate – taken over the femoral artery of direct heart rate.
- Respiratory rate – monitored via listening to the lungs.
- Fur – check for loss, ectoparasites, infections or trauma.
- Eyes – should be clear, bright and alert with normal light response, corneal reflex and no discharge.
- Any lumps on the body
- Cloaca is clean

You may also include;

- Females - Pouch – condition and if any lactation is occurring or young present.
- Males – check testes; size and consistency. Extrude penis and assess.
  (Jackson 2003)

8.3 Known health problems

1. Swollen Paw Syndrome

SPS affects sub-adult and adult possums of both sexes and while primarily a disease of wild ringtail possums it does occasionally develop in captive possums. (Rose 2005)

1.1 Causes

Not much is known about SPS but it is assumed that restricted blood flow is a cause. Some research into Cleradini insects found in the drey of an affected animal is being done. (Derek Spielman n.d.)

1.2 Symptoms

As the name suggests the animal with this disease has swollen paws. As the disease advances they can have ulcerated paws, dermatitis of the nose, alopecia, necrosis of the tips of the toes or ulcerated lesions on the tail tip. Most animals will still be bright, alert and eat and drink fine. (Rose 2005)

1.3 Prevention

Making sure the possum receives good nutrition and is checked daily. As not much is known about SPS it is important to check the paws daily and if redness and swelling is apparent have a vet check them. (Rose 2005)

1.4 Treatment

If caught early a vet may give the possum antibiotic injections and a vaso-dilator. It is important to restore blood flow otherwise the paw and toes may become necrotic and fall off or have to be amputated. Early detection is very important to recovery.

2. Caecal Stasis

This is a static or blocked caecum, which is usually caused by abnormal development of the caecum.

2.1 Causes

Use of antibiotic therapy and a diet high in sugars during the critical stage of caecal development. (Bellamy n.d.)

2.2 Symptoms

Appetite may decrease. Abdomen will be distended but not bloated and feels doughy to palpate. Animal will look skinny but have a spongy belly. Coat becomes dull (Bellamy n.d.).

2.3 Prevention

Good nutrition and plenty of native foods from their wild diet is very important. Making sure not to give too much sugar and if antibiotics is needed, use of a probiotic to keep gut bacteria should be considered (Bellamy n.d.).

2.4 Treatment

Caught early use of probiotics and an immune system booster such as Impact may help. A good idea is to make what is referred to as 'poo tea' where you take the soft faeces from a healthy ringtail possum and mix it in with a possum milk or hydrating mixture and feed it to the sick possum. As Ringtails practise coprophagy, eating the soft faeces they produce of a day is normal. Giving a sick possum the faeces from a healthy possum should re-introduce healthy gut bacteria to the sick possum and help them get better.

3. Toxoplasmosis

Toxoplasma gondii is a coccidian parasite with worldwide distribution and a broad host range. Australian marsupials are very susceptible to toxoplasmosis. This disease is zoonotic so animals infected must be quarantined and strict hygiene protocols followed. (Rose 2005)

3.1 Causes

Ingesting vegetation or water contaminated with felid faecal material, usually from a cat. (Rose 2005)

3.2 Symptoms

Clinical signs range from mild malaise to mortality and animals infect may be; depressed, weak, anorexic, pyrexic, dyspnoeic, ataxic, hemiplegic, quadriplegic, comatose, convulsive or may show signs of; muscle stiffness, diarrhoea, emesis, uveitis, retinitis or cataract formation. (Rose 2005)

3.3 Prevention

Keeping cats away from the animals and their food sources as well as cleaning any food before giving it to the possum. (Rose 2005)

3.4 Treatment

If discovered early, boosting their immune system may help the animal recover. A drug that will eliminate the toxoplasmosis organism from tissues has not been discovered yet. (Rose 2005)

4. Conjunctivitis

4.1 Causes

Caused by an infection or foreign matter entering the eye. If a ringtail possum injures its eye or near the eye area, or gets something in their eye, such as; chemicals, bacteria or smoke it can cause conjunctivitis. (Rose 2005)

4.2 Symptoms

Inflammation of the membrane covering the eyeballs, discharge from the eye, around the eye is very pink. (Rose 2005)

4.3 Prevention

Make sure that there isn't anything in the enclosure that the animal may injure itself on. Do not use any un-approved chemicals in the enclosure area. (Rose 2005)

4.4 Treatment

Flush the eye with warm, very diluted salt water, this will help clean the area out and possibly remove the irritant. Take the animal to a vet where they will examine the area and possibly do tests to find the cause and then possibly prescribe an ointment. (Rose 2005)

5. Candida

Ringtail possums being hand reared can be susceptible to overgrowth of *Candida* sp. yeast within their gastrointestinal tracts. (Rose 2005)

5.1 Causes

Poor hygiene, inappropriate formulas, antibiotic therapy or stress in young hand-raised possums. In adult possums broad-spectrum antibiotics that are given orally can be a cause. (Rose 2005)

5.2 Symptoms

Weight loss, depression, anorexia, vomiting and diarrhoea. Oral infections may have visible white plaques along the mucosa. (Rose 2005)

Diarrhoea from Candida often has a foul yeast-like smell with a yellowish-green and sometimes frothy or curdled appearance. (Jackson 2003)

5.3 Prevention

Proper hygiene and formulas for hand rearing young possums, reducing stress wherever possible and use of probiotics.

5.4 Treatment

A vet will be able to diagnose based on an examination of oral or moist skin lesion smears. The vet will then choose an appropriate anti-fungal to administer. (Rose 2005)

6. Mites

Mites live on or in the skin. This disease is zoonotic so animals infected must be quarantined and strict hygiene protocols followed. (Rose 2005)

6.1 Causes

Mites will often come from other animals.

6.2 Symptoms

Mites cause skin infections which can be itchy and cause fur loss. There will be skin irritation and scratching with the tiny mites sometime visible, they are often red. (Rose 2005)

6.3 Prevention

Follow strict hygiene practises and as mites are zoonotic you will need to quarantine the infected animal.

6.4 Treatment

A vet will do a skin scrape to identify the mites and then prescribe needed medication.

7. Paralysis Ticks

Ticks are a part of bush life and are zoonotic, so be wary that any ticks don't get onto you or another animal. Quarantine will not be needed just for the tick but should be practised, as well as proper hygiene as the animal likely has something else wrong with it. (Rose 2005)

7.1 Causes

Paralysis ticks will often only be able to latch on to a slow moving possum, so check for injuries or other underlying conditions.

7.2 Symptoms

Paralysis ticks don't affect native animals the same as they do us or introduced species. In most cases they don't seem to bother the animal much at all and the only clue to their presence is if you see it. However the animal may be sick and showing other symptoms which the tick(s) may make worse, i.e. weakness or lethargy.
Ticks are most commonly found around the head area and on the ears of possums (pers. obs).

7.3 Prevention

Keeping your animals in good health and doing visual checks every day is the best way to make sure they don't get any ticks.

7.4 Treatment

Remove the tick as much as possible, you can buy tick removers from pet shops that are very handy. Make sure to kill the tick, this can be done by drowning them in turpentine or crushing them between two hard surfaces, as they are very hard to crush.

A quick clean of the bite site on the possum and a check for any other ticks should also be done and a vet check scheduled to make sure nothing else is wrong.

8. Diarrhoea

Diarrhoea can be a symptom of many things and should always be noted and acted upon quickly.

8.1 Causes

It could be because of a change in diet or from overfeeding; the formulas you put a young possum on are different to their mother's milk and may take some time for the animal to adjust. Also when the formulas change it may irritate their stomach. You can try watering down the formula or slowing down the process of changing formulas.
Stress can also cause diarrhoea.
It is important to confirm that the first two options are not the cause before attempting medical intervention, so be sure to check what you are feeding the animal as well as how it is housed and its temperature.

If there is a very unpleasant smell to the diarrhoea then very likely is caused by a bacterial infection which means the animal requires antibiotics. This should be avoided where possible as antibiotics kill the developing gut flora which the animal requires to stay healthy. A course of probiotics should be given after any antibiotics to help restore the gut flora.

8.2 Symptoms

Runny faeces, sometimes the animal will also appear 'flat' and lethargic.

8.3 Prevention

Good hygiene and following the formula feed table.

8.4 Treatment

Any animal with diarrhoea must be given fluids to make sure they do not dehydrate. If they will not drink water a hydrating fluid such as lectade can be used. A course of probiotics can also help.
If the cause is bacterial than the possum will need antibiotics. Antibiotics should always be injected into Ringtail Possums and not given orally; oral antibiotics can affect the caecum function, kills the good bacteria as well and affect the fermentation process which is needed for digestion.

9. Bloat

Bloat can be found in both adult and juvenile Ringtail Possums.

9*.1 Causes*

Due to a build up of gas in the gastrointestinal tract. The intestines can then twist and strangulate causing rapid death. (Jackson 2003)

9.2 Symptoms

The possum's abdomen will be extremely distended, feeling tight and make a drum sound when you tap it. (Jackson 2003)

9.3 Prevention

Make sure the animals are on an appropriate diet and have access to plenty of native browse. (Jackson 2003)

9.4 Treatment

Caught early a vet may be able to perform a transabdominal removal of the gas with a trocar and cannula. However if the animal has progressed too far they will die. (Jackson 2003)

10 Salmonella

Salmonella only seems to target immunosuppressed or stressed possums.

10.*1 Causes*

Overcrowding, stressful events and young Ringtails being reared in aviaries. (Rose 2005)

10.2 Symptoms

In young possums you may see haemorrhagic enteritis and septicaemia. In adult possums you may see hepatic necrosis and paratyphoid nodule formation. (Rose 2005)

10.3 Prevention

Good hygiene and reducing stress.

10.4 Treatment

Broad-spectrum antibiotics may work but once clinical signs are apparent animals may not respond well to therapy. (Jackson 2003)

8.4 Quarantine requirements

All newly acquired animals must be kept in isolation until it has been examined before being places with other animals.

Any animal with a contagious disease should be removed from the enclosure and placed in quarantine. The enclosure should be sterilized and any other animals in the enclosure or in contact with the diseased animal must be taken for examination.

Quarantine should be a minimum of 40 days from the moments the last animal(s) is placed into quarantine. (Director General 2006)

9. Behaviour

9.1 Activity

Ringtail possums are nocturnal and have very good night vision, they also have a very good sense of hearing and smell, and they use these to recognise each other, as well as possums from other family groups and to be alerted to possible threats.
Ringtails are very social, curious and playful. Ringtails spend the night feeding, exploring and playing, as well as looking after the young in their group.

The normal behaviour of a Ringtail Possum is to climb with their tail curled up behind them or used to help balance. They are curious and will check on anything newly added to their home area or aviary. When startled or scared they will freeze and even sometime play 'possum' and then dart off quickly when the chance arrives. Other species of possum and glider do not seem to bother them at all. They will seek out fellow Ringtail Possums as they thrive on social interaction with their own kind.

9.2 Social behaviour

Ringtail Possums are very social and live in family groups. (Henderson n.d.) They don't vocalise often, using scent to communicate. Family groups can be up to 10 possums with usually only one adult male and female being the main pair. Juveniles and joeys make up the rest of the family.
Ringtails socialise by playing and can often be seen climbing in the trees in small groups, with the younger possums jumping around the adult.
Ringtails are usually only vocal in aggressive encounters or when an infant is calling to its parent. Their call is much softer than the Brushtail Possums and a high-pitched chirruping twitter is used when active to maintain contact with other Ringtails. (Kerle 2001)

9.3 Reproductive behaviour

Observations of wild Ringtail possum found that 60% of males stayed with one female at a time and the bond lasted through the breeding season, although they would ‘sneaky breed; with other females. (Jackson 2003)

Males actively initiate and keep up contact with their mate through constant visit, at least once a night, throughout the year and more often during breeding season. They will also actively defend their mate from other males. (Jackson 2003)

At the onset of breeding season mates will groom each other, share nests and forage together for two to three months. The mother mostly looks after them until the last weeks of dependency when the young may travel on their fathers back and nest with him. After the first litter is weaned the father will spend his time between the mother and sometimes going with the sub-adults and helping them construct a drey. (Kerle 2001)

9.4 Bathing

Ringtails sometimes groom each other, which is a form of communication and helps them transfer scent. Grooming doesn't take up a lot of time, playing and eating seems to be more important. Ringtails will self-groom when required.

9.5 Behavioural problems

Ringtail Possums appear to suffer little from behavioural problems. (Jackson 2003)

9.6 Signs of stress

Ringtail Possums can show many signs of stress.
Minor stress can include; body tremors, curling in a ball and hiding or 'playing possum' - pretending to be dead.
Major signs of stress include; loosing fur, refusing to eat or drink, biting, refusal to eat, diarrhoea and a lower pitched squeaking noise.
Ringtails are very vulnerable to stress, so reducing the stress factors is very important. Avoiding noises and smells that are unnatural as well as avoiding introducing too many new things to the possum at once will keep stress to a minimum (pers. obs).
Young Possums are more susceptible to stress.
Any abnormal behaviour can be stress, and biting doesn't just mean biting you, a possum may bite at another possum or whatever you are keeping it in, like a pouch liner. Ringtail Joeys that are being hand raised often bite their pouch when stressed (pers. obs).

Possums can drop fur the same way some lizards can drop their tails. Be careful to check that there are no patches of fur missing on the possum, this can sometimes be hard to see as only a small patch has gone and the surrounding patches cover the area. A visual check should be carried out with your hands also running over the fur to move it about and see any bald spots.

Ringtail possums are not normally vocal, so any vocalisations need to be given attention as it will usually be from stress, a fight or because a joey is calling for its mum because it has become separated. (Kerle 2001)

If you are holding a possum and you can feel body tremors it is best to put that possum back into its home where it is safe. The tremors feel like the animal is shivering, but if the animal is not cold and the weather is nice than its most likely to be stress related.

9.7 Behavioural enrichment

Enrichment activities for Ringtail Possums may include;

- Providing native browse
- Providing various nesting materials
- Placing food in different spots throughout the enclosure
- Housing them with other terrestrial species as appropriate.
  (Jackson 2003)

Other ideas for enrichment include;

- Ropes and branches that can move when the possum is climbing on it
- Changing the layout of the climbable furnishings
- Adding different scents to different spots
- Hiding food
- Interaction with animal
  (pers. obs)

9.8 Introductions and removals

Social species, such as Ringtail Possums, use scent to maintain group structure, so when you introduce a new possum or remove one you need to carefully observe the group to make sure there are no problems like aggression. (Jackson 2003)
You need to watch that the group can adjust to new dynamics when introducing or removing an animal.

9.9 Intraspecific compatibility

Ringtail Possums are social animals that exhibit monogamy. The suggested sex ratio is solitary or 1:1 (Jackson 2003).

Through observation of Ringtail Possums in captivity at Australia Walkabout Wildlife Park I noted that one male was kept with two adult females from separate families. This caused fighting between the two females and the females and the male. However, once one female was removed the male and female left together got along very well and have successfully mated.

9.10 Interspecific compatibility

Ringtail Possums are mainly an arboreal animal that requires a large aviary; this means that a number of terrestrial species can be successfully held with them. (Jackson 2003)

In the wild Ringtail Possums will share their territory with many native terrestrial animals without problems.

Species that you can house with Ringtail Possums include; Short-Beaked Echidna *Tachyglossus aculeatus*, Long-nosed Bandicoots *Perameles nasuta*, Eastern-barred Bandicoots *Perameles gunnii*, Long-footed Potoroos *Potorous longipes*, Long-nosed Potoroos *Potorous tridactylus* and Brush-tailed Bettongs *Bettongia penicillata*. (Jackson 2003)

There has also been Ringtail Possums successfully housed with Leadbeater's Possums. (Jackson 2003)

9.11 Suitability to captivity

Ringtail Possums fare well in captivity, especially when paired up (pers. Obs) or when acquired while still young.

Ringtail Possums are easily imprinted and easy to hand raise and tame. If housed correctly they won't suffer from stress of behavioural problems.

10. Breeding

There is not much known about Common Ringtail Possum breeding in captivity as they are not frequently kept as pets and as they are not considered endangered there are no set breeding programs for them and zoos are frequently handed in new Ringtails so there is no need to breed them. (Jackson 2003)

10.1 Mating system

Ringtails are seen to live in family groups, with one adult male, one adult female and their young from last season as well as any new offspring. The males are even known to help out with raising the young. (Kerle 2001)
It is commonly believed that they practice monogamy.
Both of the adult bonded pair will mark their territory mainly using urine. The male and female pair will start sharing a nest if they weren't already and they will show aggression towards any other Ringtail Possums that aren't their young from last season.

10.2 Ease of breeding

Ringtails are polyoestrus and polyovular animals.
If after mating an egg is not fertilised, females will return to their oestrus cycle. If a young possum does not survive to make it to the pouch and begin suckling then the female will go back into oestrus. Unlike a placental mammal, oestrus is only disrupted when the female begins lactating. (Kerle 2001)

10.3 Reproductive condition

Females can be examined by putting them inside a transparent plastic tube and using an otoscope to examine the pouch.

10.3.1 Females

Females reach sexual maturity at between ten and twelve months old. (Jackson 2003)

There are several categories for females;
Non-parous – meaning they have never bred. The pouch should be small, clean and dry with no skin folds and very small teats.
Parous – meaning she has bred before but not currently. The pouch will be small and dry but distinct and dirty, with slightly elongated teats.
Pregnant – pouch will be pink, possibly with skin folds visible on the lateral margins.
Pouch young present – they will be in the pouch and still attached to the teat.
Lactating – young not present in the pouch but still suckling. The pouch area will be large with flaccid skin folds, hair sparse and stain, skin smooth and dark pink and teats elongated.
Post lactation – teats expressing only clear liquid and/or regressing.
(Jackson 2003)

10.3.2 Males

Males reach sexual maturity at twelve months old. (Jackson 2003)

Males will develop a scent gland on their chest.

During breeding season the testes can increase in size. You can measure testes by measuring the length, width and depth in millimetres and calculate the volume using the equation:
$V = \pi/6 \times (length) \times (width)^2$ (Jackson 2003)

10.4 Techniques used to control breeding

To encourage breeding try to mimic the conditions they would have in the wild during breeding season and make sure they have an area that is safe from the weather, even adding a heat lamp if the weather is not warm. You may also take the joeys from the mother once they are old enough to be hand-reared in order to promote a second breeding season in the adults.

To discourage breeding do not over supply food and keep fresh foliage to a minimum, you may even have the male de-sexed or removed from the female.

10.5 Occurrence of hybrids

There are no known hybrids.

10.6 Timing of breeding

Births can occur any time between April and December, mostly during May and July and occasionally in the season of spring. The pair may mate again in late October and produce a second litter in mid to late November. This timing is not consistent throughout the species; in North Queensland most females give birth at the beginning of the season while in Sydney there is mainly spring breeding. (Kerle 2001)

10.7 Age at first breeding and last breeding

Females are able to breed in the winter of the year following their birth. Most will begin breeding when they are 14 months old. Males will mature a little earlier. (Kerle 2001)

10.8 Ability to breed every year

Ringtail Possums appear to be able to breed at least once per year and generally continues from reaching sexual maturity until death. (Jackson 2003)

10.9 Ability to breed more than once per year

The second season of births is a consequence of breeding again by females who have either lost their young or successfully reared their first litter. It is most likely the latter as the loss of an entire litter is rare. (Kerle 2001)

10.10 Nesting, hollow or other requirements

Ringtails will build their own dreys so be sure to supply them with plenty of native leaves to choose from. This should include fresh eucalypts and casuarina. (Jackson 2003)
You should also supply a nesting box and choices of non-native nesting materials such as; straw and coconut fibre.

10.11 Breeding diet

Ringtail possums don't have a specific breeding diet. (Jackson 2003) However you should make sure there is plenty of food, including native plants to eat and you may add high protein supplement.

10.12 Oestrous cycle and gestation period

Oestrous cycle in 28 days with the gestation being between 14 and 16 days. (Jackson 2003)

10.13 Litter size

Females have four nipples and can raise anywhere between one to four joeys but typically they have twins. (Kerle 2001).

10.14 Age at weaning

Lactation mostly stops when the young are about 26 weeks old but can happen as early as 20 weeks and as late as 34 weeks. (Kerle 2001)

10.15 Age of removal from parents

Once they are weaned they can safely be removed from their parents.

10.16 Growth and development

The growth and development of a Ringtail Possum is measured by weight, length of their tail and the length of their rear foot. See table 4 for growth measurements.
Newborns weigh 0.3g and are about 15mm long.

Age	**Notes**
42 days	Begin releasing nipple (Kerle 2001)
60 days	Start vocalising (Kerle 2001)
90 days	Eyes opening (Wombaroo n.d.)
100 days	Eyes open, sparse fur (Kerle 2001)
110 days	Emerging from pouch (Wombaroo n.d.)
120+ days	Leave pouch permanently (weigh approx 65-90g) (Kerle 2001)
160 days	Eating significant leaf (Wombaroo n.d.)
210 days	Release/Dispersal age (Wombaroo n.d.)
Weight	**Notes**
50-80g	Flat fur, requires artificial heat. (Henderson n.d.)
80-100g	Fluffy furred, may start to nibble on native leaves. (Henderson n.d.)
100g-200g	Should be toileting on their own. (Henderson n.d.)

Table 2: developmental milestones of Ringtail Possums

11. Artificial rearing

11.1 Housing

For a controlled environment you will need a wooden or styrofoam box with a heat pad and thermostat to keep the temperature consistent. Something similar to a humidicrib is desirable. The temperature should be checked at every feed, the animal should also be felt to see if they are cool or too warm. The thermostat should be regularly maintained to make sure it is working properly so no animals will suffer negatively. You should also put a container of water in the corner to keep a nice humidity for the joeys (pers. obs).

If you a hand-rearing a joey Ringtail then you will need access to a controlled environment. Any joey that is unfurred may survive for 3 days but there has been no success hand raising them that young.

Ringtail Possum joeys with flat fur.
Image: C.Poolman

45g+ (flat fur)

Until it is fully furred it will require something similar to a humidicrib, where the temperature is easily controlled by a keeper. Temperature should be about 30°C until they are able to thermoregulate at about 80g+ (Henderson n.d.).
They have a better chance of survival if kept with a sibling(s) or even buddied up with any other ringtail the same size. Keep them secured in a beanie or knitted pouch with liner (Henderson n.d.), both should be made of natural fibres so they breathe such as cotton and wool.

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no animals will suffer negatively. You should also put a container of water in the corner to keep a nice humidity for the joeys (pers. obs).

80g+ (fluffy furred)
Once they are able to thermoregulate they will not need extra heat unless stressed and require gentle heat, or if the weather is particularly cold, possibly just needing warmth of a night. You are now able to leave the top of the pouch open so they can explore their cage of a night, little native branches with leaves should be placed around the beanie so they can climb in and out. (Henderson n.d.)

150g+
At this age they should be in a large cage so they can move freely about, they should also be introduced to either a drey or a small possum box with nesting material such as coconut fibre or straw. They will be moving about a lot of a night, learning to jump and use their tail, so it is important they have the room to do this and lots of branches to practise on, different sizes and types are also good (pers. obs).
You may even be able to put their cage outside in an area that is sheltered from wind and rain so they can start experiencing the sounds and smells of the outside (pers. obs).

250g+
From here on they can be in a sheltered outside aviary with a drey. (Henderson n.d.)

11.2 Temperature requirements

Until it is fully furred it will require something similar to a humidicrib, where the temperature is easily controlled by a keeper. Temperature should be about 30°C until they are able to thermoregulate at about 80g+ (Henderson n.d.).

11.3 Diet and feeding routine

Wombaroo Possum Milk Replacer should be used to hand-rear a Ringtail Possum, using Impact Colostrum Supplement as an added booster for them.
There are two milk replacers available from Wombaroo

Possum Milk Replacer	Notes
<0.8	For joeys with less than 80% of their pouch life completed. Joeys will be furless, pink, eyes closed and ears dropped. Their faeces will be yellow custard to toothpaste consistency
>0.8	For joeys with greater than 80% of their pouch life completed. Fur will be short to start with and they will start spending time outside of the pouch. Their faeces will be toothpaste to soft then firm pellets.

Table 3: Possum milk replacers (Wombaroo n.d.)

Milk	Age (days)	Tail (mm)	Head (mm)	Weight (g)	Feed (mL/day)	Notes
<0.8	60	75	25	35	9	
	70	90	28	38	10	
	80	105	32	42	10	
	90	120	35	52	12	Eyes opening
Transition	92	123	35	54	12	9mL <0.8 + 3mL >0.8
	95	128	36	57	12	6mL <0.8 + 6mL >0.8
	98	132	37	60	12	3mL <0.8 + 9mL >0.8

>0.8	100	135	38	62	12	
	110	150	41	74	12	Emerging from pouch
	120	165	45	90	14	
	130	180	48	110	16	Fully out of pouch
	140	195	51	135	18	
Weaning	160	Growth rate now about 3-6g per day			12	Eating significant leaf
	180	Not valid			0	Fully weaned
	210					Release age

Table 4: Feeding/growth chart for Ringtail Possum joeys (Wombaroo n.d.)

To prepare 100mL Wombaroo possum milk replacer <0.8 you mix 16g of powder with 90ml of warm water.
To prepare 100mL Wombaroo possum milk replacer >0.8 you mix 25g of powder with 80ml of warm water.
Milk formulas should always be stored in the fridge and used as the label suggests. Most shouldn't be stored in the fridge for longer than a day or in the freezer for longer than 2 weeks. (Wombaroo n.d.)
Unused formula should be discarded. The animal will have mixed its saliva and bacteria into the formula and if stored that bacteria will grow. Fresh formula is always best to avoid contamination.

Drip feeding a joey using a teat.
Image: C.Poolman

Joeys from 50g to100g will need to be fed by dropping droplets of milk onto their lips; you can use a dropper, syringe or bottle with teat. Joeys from 100g+ should be able to lap milk from a dish at night. (Henderson n.d.)
Recently furred joeys should be fed every four hours, decreasing to once a day just before weaning. (Jackson 2003)
Milk for joeys should be blood-warm, so test it on your wrist before giving it to them. It should not feel hot or cold to your wrist. This is because the milk they would get from their mother would be warm and also giving them cold milk will decrease their temperature and hot milk may burn them.

Once they are at the stage of lapping they should be able to have milk that is cool but not cold (pers. obs).

Native foliage should be offered from a young age, they may not eat it but the smell will become familiar to them and keep them calm (pers. obs).
Observe when they start eating the foliage and give them as much as they will eat. The sooner they eat their natural foods the better for their digestive system and health. Eucalyptus leaf tips are a major source of food for Ringtails, and where possible at least 3 different species of eucalypt should be offered as each animal will have its favourites. They usually only eat the tips so make sure to notice if the tips have been eaten and replace with more each time (pers. obs).

Toileting
For joeys 45g to 100g they will need toileting after every feed; with a damp soft cloth or tissue gently brush at the cloaca to stimulate the possum to release waste which you then collect into the cloth. Some will say to use cotton wool but I find that it falls apart too easily; cotton makeup remover pads work well, as do tissues (pers. obs).
This will only need to be done until the possum starts going to the toilet on its own, which is generally around the time it starts emerging from the pouch (100g) but each possum is different. Be careful with toileting, if you do too much or too hard you can cause your joey discomfort and even a cloacal prolapsed. (Jackson 2003)

11.4 Specific requirements

They have a better chance of survival if kept with a sibling(s) or even buddied up with any other ringtail the same size. Keep them secured in a beanie or knitted pouch with liner (Henderson n.d.), both should be made of natural fibres so they breathe such as cotton and wool.
Be sure to only feed as fast as they swallow and that the hole in the teat is not too big. Too much milk going down too fast will result in it coming out the nose. (Jackson 2003)

11.5 Data recording

All records should be kept in a neat fashion and near to the animal so that anything may be noted straight away.
It is a good idea to have a book to write up the records in, as this is easy for everyone to access and the notes can later be added to a program such as ZIMS. Each page should have the days date and the animals age at the top and any notes filled out underneath, with subheadings for different sections such as feeding and weight.

Having the animal's age up the top next to the date will make it easier for you to check on its development without having to do the math every single time.

There may be an area specific to paperwork near where the hand-raised animals are kept and this is where the book should be. It is important that it is easily accessible, especially if more than one person is helping hand-raise the animal, so that anything unusual can be easily checked against previous knowledge on the animal.

Weights
When the animal is young weight should be checked every second or third day to make sure progress is being made and the correct formula is being used.

Once the animal is on >0.8 formula you will not need to check the weight as frequently, maybe every forth day just to make sure they are still on track.

Weights should be recorded when done, as well as whether there has been a gain or a loss since the last time the possum was weighed.

Measurements of the foot and tail can also be done with weights to track the growth of the possum.

Diet
The diet the possum is currently on, as well as how much and how frequently it is being fed, how well the animal eats, if the animal seemed hungry or disinterested, any change in formula or if any solid foods were introduced should all be recorded every day.

This is important because if any illness such as diarrhoea or weight loss comes up you will easily be able to see what the animal has been eating. (Jackson 2003)

Health
Any signs of ill health need to be noted immediately, in the case that the possum is fine and no injuries or symptoms of illness are apparent then a simple '(animal ID) appears healthy' will suffice. If there are injuries or illness you will need to update the book on how things are progressing such as, injury to tail is clear and has formed a scab with no other new wounds, or diarrhoea has cleared up.
Any changes in health will also need to be immediately reported to the head keeper and possibly the vet.

Progress
Any progress the animal makes as it gets older should be notified as it happens. For example; the first time the animal emerges from its pouch.
Stages to be noticed;

- Tips of ears no longer flat on head
- Eyelashes visible
- Eyes open
- Fur development – like a shadow, then flat fur, then fluffy
- Out of pouch
- Eating solids
- Self feeding
- Independent
  (Jackson 2003)

This will keep everyone informed of changes in behaviour of the animal as well as their routine; if the animal starts toileting itself then the keeper will no longer have to.
Any progress made should be checked against table 2 and 4 to make sure the animal is developing as expected.

If, for example, the animal is approaching 100 days old and it still has not opened its eyes then something else could be going on and a vet visit may be required.

11.6 Identification methods

Once a joey is furred you are able to use an implant chip to identify them (Jackson 2003).
I find that with joeys, if you do not have anything visual about them to help you tell the difference, e.g.; one is lighter in colour or one is male the other is female, then you may use kid safe nail polish

on one of their claws, or even spray some Cetrigen[3] on different parts of each joey (not the head) to make them more distinct (pers. obs).

11.7 Hygiene

Each joey should have its own feeding utensils that must be thoroughly washed and sterilised after each use and rinsed before the next. (Jackson 2003)
Proper hand washing technique must be practised before and after handling joeys, especially when toileting animals. (Jackson 2003)
All bedding materials should be changed frequently; a young animal should not be placed back into bedding that is soiled. (Heritage 2011)
It is easiest to feed and toilet them in their pouch liner then once all done, transfer them to a new, clean pouch liner, making sure it isn't cold (pers. obs).
Clean any milk or bodily fluids off the joey as soon as possible and make sure the joey is dry after. (Jackson 2003)

11.8 Behavioural considerations

Ringtails are social animals and as such this can lead to any hand-reared joeys imprinting on humans. Imprinting can cause lots of problems for Ringtails as it may make it hard for them to be amongst their own species and can make them dependant on humans. To avoid this you must minimise the direct contact you have with the animal and how often they see you. As they get older it should be easier to reduce the contact you have with the animal as they will rely on you less and have to be fed less. You should also avoid talking to the animal or patting/cuddling it.
Also raising more than one together helps them socialise with their own species and reduce the attachment to the raiser. (Jackson 2003)

11.9 Use of foster species

There is no documentation of foster species being readily used with any species of possum. (Jackson 2003)

11.10 Weaning

Ringtail joeys should be introduced to native leaves as soon as possible, they may not be able to eat it straight away but the smell will be familiar and of comfort (pers. obs). Once they are emerging from the pouch, 110 days old, they should be able to start eating solids. As they get older more should be given to them and native flowers also introduced. If they eat it all then make sure they have more the next night, the more native foods they eat the better for them and their health. Some Ringtails may even self-wean, where they ignore the offered milk and just eat the foliage offered. For those that don't self-wean, once they reach 160 days old you will need to increase the amount of foliage given whilst also reducing the amount of milk. Make sure they do not lose too much weight while you do this, gradual change is best and will be less stressful, and you have until they reach 210 days old to have them completely weaned (pers. obs).

"A general rule is to decrease the formula by 5% per week as long as the joey continues to gain weight at a minimum of 5-10% of body weight per day." (Jackson 2003)

11.11 Rehabilitation and release procedures

As soon as a Ringtail joey is emerging from the pouch they should be given opportunities to climb and explore. As they get older they should be moved to bigger cages with more room. You should

[3] Cetrigen is a wound spray that is registered for use on all animals that gives a purple colour to the area it is applied to that will last for a few weeks.

use a variety of native branches for them to become used to what will be available in the wild. Also you should have thinner sticks that can move so they learn that the thinner the branch is the less secure it is. Branches that move will also help them learn to balance and use their tail. They should also be able to jump between branches and test their limits (pers. obs).
As soon as they are in a cage big enough to house a possum box or drey they should be given on and their pouch removed once they move into the box or drey.
A pre-release aviary should be at a minimum; 2m long, 1.5m wide and 1.8m high (Stanvic 2007)

Ringtail possum in a home-made drey eating eucalypt tips.
Image: C.Poolman

As the animal gets older it should be exposed to the outside climate more. A pre-release enclosure should be outside and have areas without solid roof so they will experience the weather. There should be enough undercover area where their box/drey is that if it is raining they can still access food and water without getting too wet if it is raining.

The animal will need foods that it will come across in the wild. Feeding the animal food that is available from the area that it will be released into is important to make sure the animal will be able to recognize its food and also that it will eat the food available to it.

Handling should be kept to a minimum in preparation for release. (Jackson 2003)

Important: Ringtail Possums are territorial so they must be released before they reach sexual maturity. Once they are sexually mature they will be seen as a threat to local Ringtail populations in the release area (pers. obs).

Soft Release
Soft release can be at a younger age than hard release as the animals still receive your support. This is great for any joeys that start becoming independent sooner than expected and wish to start experiencing the wild but are still too young for a hard release or for ones that are maybe a little bit

unsure as you will be able to keep an eye on them and support them.
For a soft release you basically just open the door to the cage and have a branch connecting the inside of the cage to a nearby tree so the Ringtail(s) are able to get in and out. This way the possum is able to experience the wild but still have a safe haven to come back to and a place where they know there is food and water.

Soft release is great for if the local Ringtail population has been visiting your possums in your aviary. Ringtails are social creatures and with natural curiosity they will notice the possum(s) in your cage and come to see. In my experience every time I have had a Ringtail in my pre-release aviary the locals have come to visit and I have even seen them play and communicate. This means they have been accepted by the locals which makes a soft release easy and also quick. In these situations the possums I soft released only came back to the cage once before disappearing completely as they had a new family to help them find their way.

Soft release can happen from 210 days old (350 grams). They may return every night for about a week so always make sure there is fresh food and water available if you find them back in the aviary in the morning. Once they stop visiting make sure to lock up your aviary as they should have had enough time to adjust and you don't want any other local wildlife taking up residence. (Stanvic 2007)

Hard Release
Hard release is when you take the possum box or drey that the animal has been sleeping with and put it up in a tree in the release area, with the possum(s) inside, and walk away.

Hard releases should only be done when you are 100% sure the animal will survive in the wild, this means that it no longer drinks milk, eats foods found locally in the release spot and is a very capable climber.

Hard release is usually done later than a soft release. The animal will be about 450g, 240 days old or more. A hard release can be done as late as possible as long as the possum is not sexually mature. You may check on the drey or possum box every week to see if the animal is still there. It can take longer for the animal to stop using the drey/box that you put up than with a soft release as everything will be new to them.
Only do a hard release when you know the weather will be fine for the first few nights after you release the animal. This gives the animal the best chance of survival as it is able to start finding its way and food straight away. If you release an animal and the next few nights there is a storm the possum may suffer negatively and puts them at risk of not finding foods, injury or even attack from prey animals.

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13. References

Anne Kerle (2001) *Possums The Brushtails, Ringtails and Greater Glider*

Stephen Jackson (2003) *Australian Mammals Biology and Captive Management*

Norma Henderson (2015) *Small Mammals of Eastern Australia Identification and Care*

14. Bibliography

Bellamy, DT, *Caecal Stasis in Ringtailed Possums*, <http://www.awrc.org.au/uploads/5/8/6/6/5866843/2003_bellamy_caecal_stasis_ringtail_possums.pdf>.

Council, NHAMR 2014, *A guide to the care and use of Australian native mammals in research and teaching*, <https://www.nhmrc.gov.au/_files_nhmrc/publications/attachments/ea29_guide_aus_native_mammals_141003.pdf>.

Derek Spielman, MKSH, *Necrotising Syndromes in Possums*, <http://www.awrc.org.au/uploads/5/8/6/6/5866843/spielman_nectrotising_syndromes_possum_2012s.pdf>.

Director General, NDOPI 2006, *Standards for Exhibiting Australians Mammals in New South Wales, Exhibited Animals Protection Act, 1986*, viewed 29 December 2016, <http://www.dpi.nsw.gov.au/__data/assets/pdf_file/0019/121537/australian-mammal-exhibition-standards.pdf>.

Government, A 2014, *A guide to the care and use of Australian Native Mammals in research and teaching*, viewed 21 July 2016, <https://www.nhmrc.gov.au/_files_nhmrc/publications/attachments/ea29_guide_aus_native_mammals_141003.pdf>.

Henderson, N, *Small Mammals of Eastern Australia Identification and Care*.

Heritage, OOEA 2011, *Code of Practice for Injured, Sick and Orphaned Protected Fauna*, <http://www.environment.nsw.gov.au/resources/wildlifelicences/110004FaunaRehab.pdf>.

Industries, NDOP 1986, *Standards for exhibiting Australian Mammals in NSW*, viewed 20 July 2016, <http://www.dpi.nsw.gov.au/__data/assets/pdf_file/0019/121537/australian-mammal-exhibition-standards.pdf>.

Jackson, S 2003, *Australian Mammals Biology and Captive Management*.

Kerle, A 2001, *Possums The Brushtails, Ringtails and Greater Glider*, UNSW, Sydney.

Norris, C 2004, *Ozark - The gut of the Ringtail Possum*, <http://www.ozarkwild.org/gutringtail.php>.

Rose, K 2005, *Common Diseases of Urban Wildlife MAMMALS*, viewed 31 August 2016, <http://arwh.org/sites/default/files/files-uploads/Common%20Diseases%20of%20Mammals_with%20images.pdf>.

Stanvic, S 2007, *Possums - juvenile to adult*, <http://www.ozarkwild.org/manuals/ssPossums07.pdf>.

Wombaroo, *Wombaroo*, <http://www.wombaroo.com.au/>.

Government and legislation, https://app.box.com/notes/66230386793?s=husrxokm80y6sh29qzgdski9c1ky8dqs.

IATA Live Animals Regulations, http://www.iata.org/publications/store/Pages/live-animals-regulations.aspx.

15. Glossary

Arboreal – lives in trees.

Ataxic – neurological sign consisting of lack of voluntary coordination of muscle movements.

Drey – spherical nest make up of leaves and twigs.

Dyspnoeic – difficulty with breathing.

Emesis – vomiting.

Folivore – an animal that specialises in eating leaves.

Hemiplegic – paralysis on one vertical half of the body.

Imprinting – a young animal comes to recognise another animal or person as a parent or object of trust.

Longevity – length of life.

Nocturnal – active of a night.

Oestrus – recurring period of fertility.

Polyoestrus – having more than one oestrus per year.

Polyovular – containing more than one ovum.

Pyrexic – abnormally high body temperature.

Retinitis – inflammation of the retina.

Sexual Dimorphism – differences in appearance between a male and female of the same species.

Terrestrial – lives on dry land.

Uveitis – inflammation of the pigmented layer of the eye.

16. Appendix

7.6.1 Box design