

Husbandry Manual
for
The Long-nosed Potoroo

Potorous tridactylus

Mammalia: Potoroidae



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DISCLAIMER

This husbandry manual was designed to provide a guideline to the husbandry of the Long-nosed potoroo in captivity.

Whilst every care has been taken in the research and preparation of text, photographs, graphs and activity charts, no liability is accepted for any error, omission or reliance upon information or advice.

OCCUPATIONAL HEALTH AND SAFETY RISKS

OH&S Category- Innocuous

Zoonotic Disease

Strict hand washing prior to and after handling of the animal will reduce the risk of zoonotic diseases being transferred to the animal via the keeper from previously handling other animals prior to the handling of the Potoroo and will also ensure that zoonotic diseases are not transferred to the keeper and then possibly on to other exhibited animals.

Common zoonotic diseases are ringworm, mites, diarrhoea caused by bacteria such as salmonella or E.Coli and other more serious Zoonotic diseases such as Q fever and bacterial septicaemia resulting from an infected bite wound.

Careful planning when capturing and restraining and proper handling techniques (see handling & Transport section) will ensure the least possibility of being scratched or bitten by the Long-nosed Potoroo therefore reducing the possibility of disease transferal.

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1 Introduction

The Long-nosed Potoroo *Potorous Tridactylus* is a small, compact marsupial from the family Potoroidae. It is one of the modern recognised species of 'rat kangaroos'. With a long snout and bulbous eyes, short rounded ears, short, however muscular forearms and very strong hind limbs. Some Potoroos, particularly in the Southern part of Australia can have a white tip to their tail. They could be mistaken by the uninitiated as a Bettong, Bilby or a bandicoot. The short coat colour ranges from a light grey to a medium brown. They move on all fours when moving slowly and can hop at great speeds when required. Originally there were 11 species of 'rat kangaroos', the Desert rat kangaroo and the Broad faced Potoroo are now believed to be extinct. Many other species of rat kangaroos are either classified as vulnerable or endangered in most part of Australia. The Long-nosed Potoroo is vulnerable in NSW, endangered in SA, however, common in Tasmania due to less predatory animals in the state.

The Long-nosed Potoroo is very adaptable to captivity, and the author has also noted they are quite crepuscular in their habits although they are classified as nocturnal, and can therefore be housed in a nocturnal house; they are also very adaptable to diurnal habits and can be trained easily with food rewards.

The potential for the species in education and research is immense, at this time it has been found that the small number and large size of *P. tridactylus* chromosomes has led to the use of their cells - especially those of the kidney and the testis - in tissue culture studies (Tyndale-Biscoe 1973).

2 Taxonomy

2.1 Nomenclature

Class Mammalia
Order Diprotodontia
Family Potoroidae
Genus Potorous
Species Tridactylus

Subspecies

Potorous Tridactylus Tridactylus (Mainland Australia)
Potorous Tridactylus Apicalis (Tasmania)

2.2 Recent Synonyms: None

2.3 Other Common Names: Dark rat-kangaroo Long-nosed Rat kangaroo Wallaby rat

3 Natural History

The Long-nosed Potoroo was first described by Governor Arthur Phillip and surgeon-General John White in their published journals in 1789. European settlers at the time gave it the name of 'Kangooroo rat.' Local Aborigines at Sydney Cove called the animal a 'Pot-o-roo.' (Claridge, Seebeck & Rose, 2007)

The Scientific name *Potorous tridactylus* is in fact a misnomer, due to a failure to note by John Hunter and also John Kerr in 1792 when describing the animal that it had syndactylus claws of the hind feet, which are two small claws within a single sheath of skin on the hind feet. In fact, if the Long-nosed Potoroo was correctly named it would be a *Potorous Quadactylus*.

Before European settlement, Long-nosed Potoroos were found widely throughout the southern half of Australia, but distribution has now become more fragmented, due to the introduction of predators, namely foxes, cats and dogs, both domestic and feral and also loss and degradation of habitat through the impact of urban development.

The Long-nosed Potoroo as with all the Potoroidae family, are described in many publications as a nocturnal species of marsupial, however, it has been noted at Potoroo Palace Native Animal Sanctuary that they are relatively diurnal in the cooler months, spending quite some time in the late morning and also the afternoon foraging for food. In the wild, they spend their time amongst thick vegetation most of the day. The Long-nosed Potoroo then becomes active and begins feeding at dusk and is rarely found far from cover.

3.1 Morphometrics

Head and Body Length: 340-400 (mm) Average 360.

Tail Length: 198-262 (mm) Average 230.

Weight range: 660-1640 (g) Average 1100.

(Claridge, Seebeck & Rose 2007)

3.1.1 Sexual Dimorphism

Sexual dimorphism, although slight, has been noted in Long-nosed potoroos (Claridge, Seebeck & Rose, 2007) as opposed to other “Rat kangaroos”, for example the Brush tailed Bettong, Rufus Bettong and the Musky rat kangaroo.

3.1.2 Distinguishing Features

The long-nosed Potoroo as noted by the author at Potoroo Palace Native Animal Sanctuary could be described as a ‘rat like’ animal, about the size of a small rabbit, having a similar looking tail to a rat, and also a long, conical shaped snout. Its eyes are set widely on either side of the snout.

The Long-nosed Potoroo is a marsupial. Individuals are brown to grey above and paler below. The female has a deep, forward opening pouch with four teats.

It has long, slightly curved claws on its front feet, its forelimbs are very short and are kept close to the chest when hopping and moving around. The back legs and feet are very strong, which assists in escaping some predators and also traveling some distances to forage for food. It has been noted, the Long-nosed Potoroo can be extremely aggressive when protecting personal territory. The Long-nosed Potoroo have been noted at Potoroo Palace to use their strong hind limbs when protecting their personal territory by kicking the unfortunate opponent, until the opponent leaves the area.

The Long-nosed Potoroo is distinguished from the Long-footed Potoroo (*Potorous longipes*) by being smaller in size and with a shorter tail. The Long-nosed Potoroo does not have a leathery pad on the sole of its foot (a hallucal pad) behind the inner toe as the Long-footed Potoroo does.

(Department of Environment and climate change, NSW, Threatened Species Viewed 31st August, 2007)

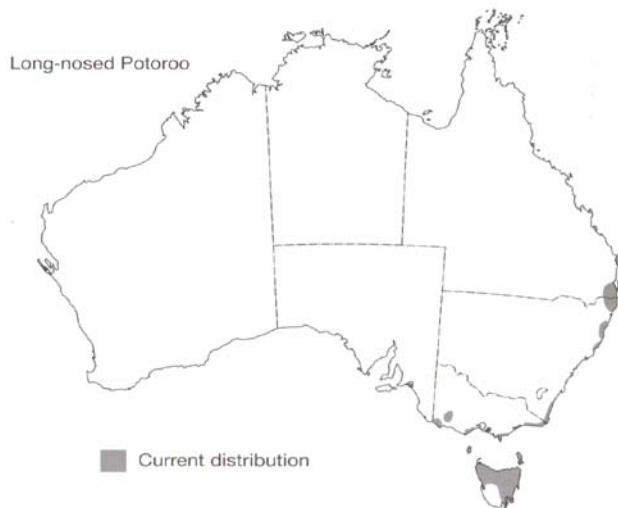
The Long-nosed Potoroo moves in a ‘potter like’ fashion on its hind feet called a slow ‘Pentapedal’ walk and uses its tail for balance. At speeds, it uses a Bipedal hop and at times uses its front feet for balance when turning quickly. Long-nosed Potoroos have

been timed at 35 metres per minute (Claridge, Seebeck & Rose 2007) and can turn very quickly making capture and restraint of the Long-nosed Potoroo difficult, if the correct techniques which will be described later are not adhered to.

3.2 Distribution and Habitat

The Long-nosed Potoroo is found on the south-eastern coast of Australia, from Queensland to eastern, south west of Victoria, South Australia and is widespread in Tasmania and is found on Flinders Island and Bruny Island. (Currumbin Sanctuary Website cited 31st August 2007). There are geographically isolated populations in western Victoria.

In NSW it is generally restricted to coastal heaths and forests east of the Great Dividing Range, with an annual rainfall exceeding 760 mm. The Long-nosed Potoroo has been found at a level near 1600 metres in north eastern NSW, which is uncommon, however, it is commonly found from sea level to about 800 metres. (Claridge, Seebeck & Rose 2007) It prefers a dense understorey to inhabit, whether it is in a dry sclerophyll forest, coastal heathland, or coastal woodland



Distribution map for *Potorous Tridactylus* (2007) Claridge Seebeck & Rose

3.3 Conservation Status

The Long nosed Potoroo has been assessed by the Australasian Marsupial & Monotreme Specialist Group, according to the IUCN red list criteria and was found to be listed as vulnerable on the South Eastern mainland of Australia

<http://www.iucnredlist.org/search/details.php/18106/all>

Under the NPWS act, they are listed as endangered in South Australia, Claridge Seebeck & Rose (2007).

Under the Threatened Species conservation act 1995 the Long-nosed Potoroo is listed as vulnerable

In Tasmania, *Tridactylus Apicalis* (a subspecies of *Potorous Tridactylus*) are listed as common.

Threats to the existence of the Long-nosed Potoroo are foxes, wild dogs, dingo's, cats owls and also human interference with the natural habitat.

3.4 Longevity

3.4.1 In the Wild

The long-nosed Potoroo may live in the wild for a period of over seven years, but longevities of four or five years are much more common (Menkhorst 1995, Walker 1975). Jackson S. (2007) states that longevity in the wild does not appear to be well known, but is generally less than that estimated for the same taxa in captivity, this could be attributed to predation and also loss of habitat due to human interference.

3.4.2 In Captivity

The maximum age noted in captivity is 14.5 years. Average age is 6-7 years http://www.genomics.senescence.info/species/entry.php?species=Potorous_tridactylus. The average age in captivity (Jackson, S. 2007) is 5-10 years.

3.4.3 Techniques Used to Determine Age in Adults

Molar eruption which is estimated by observing the proportion of molar teeth that have erupted from the gum line is one technique used to determine age in adult Long-nosed Potoroos (Jackson, S 2007)

Ageing techniques can be based on tooth wear. The sizes of the molars decrease from anterior to posterior. Old animals occasionally develop supernumerary molars that erupt through the bone, but not the cheek membrane (Jones 1924; Rose 1985) sited at <http://www.environment.gov.au/biodiversity/abrs/publications/fauna-of-australia/pubs/volume1b/30-ind.pdf>

4 Housing Requirements

4.1 Exhibit/Enclosure Design

Potoroos can climb extremely well. The enclosure design is best being fully enclosed to avoid escape of exhibited animals. Potoroos are also expert at digging, to prevent the animals digging under the enclosure sides, wire netting approximately 30 centimetres wide can be buried underground.

Due to the highly strung nature of the Long-nosed Potoroo, to avoid injury, a circular enclosure or an enclosure without sharp corners is ideal for the safety of the animal. Hessian or 70% block out shade cloth is ideal for placing in corners if the enclosure has been constructed. Wire size should be no larger than 4 centimetres so as to avoid Potoroos getting their heads caught in the fence.

Double airlock doors are an important part of any enclosure for exhibited animals, the Long-nosed Potoroo as described earlier is expert at moving very quickly and also weaving and dodging, therefore double airlock doors are essential to avoid escape. Strong padbolts and padlocks are essential to avoid illegal or unwanted entry to the enclosure.

Shelter from hot sun and also wet weather should be provided. With groups of more than two animals, two to four shelters is ideal. A windbreak with native Australian trees and bushes can be planted on the south-western side of the enclosure to avoid enclosure damage from heavy weather. Nesting material in the form of straw, dried soft browse or stringybark must be provided for the animals. Prior to placing into the enclosure, ensure that all bushes, trees and other plant and plant materials are not toxic to the animals within the enclosure.

The larger the enclosure, the better. Long-nosed Potoroos as with other exhibited animals kept in minimum size enclosures can become overweight and also destructive due to boredom. Enrichment and stimulation can be created by housing them in a larger area for exploration, foraging and exercise.

4.2 Holding Area Design

Ideally, the holding area design should be very similar to the exhibited enclosure design. Minimum spatial requirements (see below) must be adhered to. A dividing partition is particularly helpful when capturing and restraining individual animals. Nesting material and shelter should be provided. Adequate locking mechanisms and also airlocks are ideal.

4.3 Spatial Requirements

The minimum enclosure area for up to two Long-nosed Potoroos is 15 square metres; additional square floor area for each additional animal is approximately 6 square metres. The minimum enclosure height is 2 metres. (Exhibited animals protection act 1995, amended 27th October 2004)

4.4 Position of Enclosures

A north easterly position of the enclosure is the ideal aspect, allowing for morning sun and also some shade from the westerly sun in summer and shelter from the extremes of weather at other times of the year.

4.5 Weather Protection

Shrubs and small trees can be planted outside the enclosure, particularly on the south-western side to avoid extremes in weather. In the wild the Long-nosed Potoroo prefers microhabitats containing dense structurally complex vegetation for diurnal shelter and predator avoidance. Nest boxes should therefore be provided, ideally one nest box per one - two animals with adequate nesting material provided.

4.6 Temperature Requirements

Due to the widespread distribution of the Long-nosed Potoroo and also the different temperature ranges within that distribution, including microclimates within nesting areas, temperatures above 5 degrees Celsius and below 35 degrees Celsius with an average of 25 degrees is required for maximum good health in the animal.

4.7 Substrate

The substrate should include large grassy areas with areas of materials such as decomposed granite and also areas which include bush soil. Pine bark mulch should be kept to a minimum to avoid damage to the feet of the animals.

4.8 Nest boxes and/or Bedding Material

At Potoroo Palace, straw, soft and dry vegetation including casuarinas, black wattle and dry eucalypt leaves are provided for nest building. Nest boxes made from natural materials are provided to allow shelter for the Potoroos.

4.9 Enclosure Furnishings

Enclosure furnishings at Potoroo Palace include 15 naturally hollowed out logs, a raised walk through area with nesting material, where animals can retreat underneath to if

feeling threatened at all, many clumps of long tussocks for shelter which also form 'runways' for the animals to move between, some other long, grassy areas two ponds with a softly falling waterfall between each pond. Some piles of timber appearing to have been placed naturally. Some areas where rocks are placed appropriately to appear as a naturally formed environment.



Fig 1 Example of environment in potoroo palace

Enclosure at Potoroo Palace



Fig 2 Example of log hide at Potoroo

5 General Husbandry

5.1 Hygiene and Cleaning

The enclosure should be raked daily to ensure minimum risk of bacterial infection to the animals resulting from faeces being left in the enclosure. Fresh bush soil should be replaced in the enclosure regularly to ensure healthy gut flora is maintained in the exhibited animals.

Nesting material should be checked daily to ensure it has not been contaminated by faeces and other contaminants and changed monthly. If the nesting material has been spoiled by any extremes in the weather, it should be changed to avoid any fungal problems.

Feeding and drinking bowls should be removed from the enclosure and replaced with clean sanitized bowls when feeding. Cleaning agents such as diluted chlorhexidine should be used to sanitize all used feeding and drinking bowls. Dishes should be rinsed well after sanitizing. Caustic cleaning agents should NOT be used to clean animal feeding dishes due to the risk of the animal ingesting caustic substances and also OH&S risks to keepers using these substances.

5.2 Record Keeping

Weighing of the animals, veterinary treatment and also acquisition of new animals is recorded. Any unusual behaviour is recorded, particularly when new animals arrive, including passive and also aggressive behaviour between individual animals. This is all recorded in the daily diary at Potoroo Palace. Breeding and nesting behaviour and the arrival of pouch young is recorded. Changes in diets are recorded to ensure the proper amounts and also the proper feed is given.

5.3 Methods of Identification

All animals within the enclosure should be identifiable. Methods of identification include micro chipping, photographs of individual animals and individual differences, for example, at Potoroo Palace one animal, as well as being micro chipped has a small scar on his left ear, another has a dark mark in the middle of his snout, and these differences are recorded.

6 Feeding Requirements

6.1 Diet in the Wild

The diet of the Long-nosed potoroo includes seeds, roots, bulbs and insects. However, the main components in the diet are underground fungi which are dug up using the strong forepaws. Most of the fungi eaten are underground fruiting (hypogeous) species, commonly referred to as 'truffles'. Potoroos have a keen sense of smell which some researchers believe plays a role in the detection of food and the location of fruit-bodies of hypogeous fungi underground (Claridge, Seebeck & Rose 2007)

6.2 Captive Diet

Many institutions follow the captive diet recommended by Healesville Sanctuary (Jackson, S 2007) in Victoria, as it has been tried and true. Sydney Wildlife World and also Taronga zoo use variations of this diet. Potoroo Palace uses a variation of the diet which has proved to be successful. It is as follows:-

Daily diet and feeding regime (per animal) Long-nosed Potoroo.

40g apple – 2cm cube
30g orange
50g banana
30g corn
10 g sprouted seed
30g carrot sliced
30g pear
30g potato/sweet potato
20g pasture replacement pellets
2g silver beet
5 mealworms
Puppy kibble 10 Gms (Pal)

*The main diet is fed out between 10.30am and 11am for maximum exposure to visitors and also for regular daily health checks by keepers.

*Approx 6 pieces of sweet potato cut into cubes, 2 cms, 6 small cubes of apple or pear and 6 pieces of puppy kibble to be placed inside 'Kong' for enrichment purposes directly after am feeding.

*Occasional cob of corn with kernels cut off also given after am feed for enrichment purposes.

*4pm, bury or hide small pieces of food in different areas of enclosure (including a small amount of mealworms, puppy kibble, sultanas and peanuts) for foraging in the early to late evening.

* 10% extra diet given to females with pouched young.

6.3 SUPPLEMENTS

6g egg and cheese 3-4 times per week

2 almonds 3-4 times per week

5 mls nectar mix – 3-4 times per week

5 sultanas/sunflower seeds 2-3 times per week

Other fruit and vegetables in season can be used as supplements. (Excluding brachia's e.g. broccoli and cauliflower which can cause bloating in individual animals)

Note: Rolled oats can be used as a 'treat' along with sultanas and peanuts when educational talks are in progress which assists in allowing visitors to view the animals.

The major vitamin deficiency in macropods is Vitamin E. This is usually related to capture myopathy and it is recommended to include Vitamin E supplements whenever animals are captured or transported, and to provide diet supplements if this vitamin is low in the diet.

Another diet-related health problem is lumpy jaw (S. Jackson, 2003) Specific pathogenic bacteria invading the oral mucosa cause this and the best prevention is the emphasis of healthy chewing habits to strengthen the gums. The best way to do this is to provide high-quality browse, which could include Black wattle, Casuarina and willow. Avoid any hay or feed products that have sharp ends to avoid puncturing the gums. Prevention can also involve reducing the dependency on pellets.

6.4 Presentation of Food

Food is placed in several food bowls which are placed far enough apart to avoid any aggressive encounters between animals. Small amounts of food should also be placed amongst grass tussocks, in hollow logs and other areas of the enclosure to assist with enrichment which also helps to provide foraging and exercise opportunities for the captive animals.



Fig 1. Individual food bowl for potoroo

7 Handling and Transport

7.1 Timing of Capture and Handling

Potoroos can suffer from capture myopathy if capture and restraint techniques are sub optimal. Part of optimal planning is the time of the day, which ideally is very early morning which will avoid any heat stress which could lead to capture myopathy

7.2 Catching Bags

Due to the strength of the strong back claws of the Long-footed Potoroo it is highly recommended to use fabrics such as calico or hessian or any other thick strong natural

fabric. There should be no loose threads or holes in the bag where they could become entangled, and all seams should be reinforced.

7.3 Capture and Restraint Techniques

Using two 'drivers' and one 'catcher', with a long-handled pole net: the best results are achieved by running the Potoroo along a smooth fence line or wall and intercepting with the net. If an airlock is available, they can also be netted as they enter the airlock. If the animal has been conditioned to be 'hand friendly' it can be caught by the base of the tail and then placed into a hessian or calico bag without any further effort. Once in the bag the animal will normally settle and remain calm.

7.4 Weighing and Examination

The Potoroo can be weighed while still in the bag. Ensure the weight of the bag is written on it to ensure correct weight of the animal. Any injections, pouch checks and micro chipping can also be carried out while the animal is still in the bag.

7.5 Release

When releasing from the bag or other equipment such as a pet carrier, ensure the opening it is directed away from any obstacles, as it will take a few moments for the Potoroo to reorient itself.

7.6 Transport Requirements

7.6.1 Box Design

As with all animals, especially those sensitive to stress and likely to react adversely, transporting of the Long-nosed potoroo should be done extremely carefully. Usually only health or zoo transfer related moves are recommended. The Long-nosed Potoroo travels very well within a calico bag, tied off which can be placed into a small 'Pet Pack' transport container commonly used by many zoo's, sanctuaries and also airlines for transporting small animals. The 'Pet Pack' is easily obtainable from most pet product outlets and also easy to clean and sanitize therefore ensuring less risk of cross contamination from one animal to another.

7.6.2 Furnishings

The Long-nosed Potoroo is a small animal which when placed in a bag which has been firmly tied, can then be placed into a small pet carrier with a soft lining such as straw and/or a soft fabric including felt or wool. Adequate ventilation on both sides is recommended and also a soft lining to the inside top of the carrier to avoid any injuries. If the animal is not in a bag, the small pet carrier should be lined with soft fabrics such as felt and straw or shredded non-toxic paper on the floor of carrier. Provide side ventilation and padding on the roof of the carrier. Ideally, the animal will feel secure in the darkness of the carrier.

7.6.3 Water and Food

Secure any water and/or food containers to the side of the pet carrier to avoid spillage.

7.6.4 Animals per Box

Transfer only one Potoroo per pet carrier to avoid any injuries to individuals caused by stress due to capture, restraint and transport.

7.6.5 Timing of Transportation

The time of the day is most important. Very early in the day (3-4am start) is optimal, which will reduce the chance of heat stress which could lead to capture myopathy and other stress related problems.

As with any animal, choose the most direct route possible and avoid any delays. Label the crate with species, sex and source and target addresses and phone numbers.

Add an obvious note to keep quiet, out of drafts and direct sunlight and not to remove the animal from the crate unless considered essential by a veterinarian or animal keeper.

7.6.6 Release from Box

When releasing from the pet carrier, ensure the opening it is directed away from any obstacles, as it will take a few moments for the Potoroo to reorient itself. Release the animal in a cool part of the day to reduce stress reactions. If necessary, leave the pet carrier opened within the enclosure to allow the Potoroo to exit when it does not feel threatened, the animal may stay within the security of the pet carrier for some time before leaving. At Potoroo palace the carrier is not removed for 1-2 days thereby allowing the animal to orient itself with minimum stress.

***Please note** When transporting animals from one state to another in Australia, import and export forms are required to be filled out and lodged with the National Parks and Wildlife service in each state and subsequently approved by NPWS before movement of the animal can take place. Acquisition and disposal forms must also be lodged and approved by the Dept of primary industries prior to the animal being transported to another facility.

When transporting a Long-nosed Potoroo to an overseas country it is a requirement to notify and seek approval from the Dept of Environment, Heritage, water and the arts (*DEWHA*) prior to any movement of the animal. Strict conditions are required prior to transporting any native Australian animal, including the Long-nosed Potoroo. The conditions provide the framework within which it is determined whether the statutory requirements of the Environment Protection and Biodiversity Conservation Act 1999 (*EPBC Act*) have been met regarding transport accommodation and care en route to and from and in overseas facilities/zoos. The *EPBC* controls all international movement of wildlife. Potoroos are not on the *CITES* (Convention on International Trade in Endangered Species) list, however, permission must be granted by the EPBC as they are an Australian native animal not listed on the *CITES* list of exempt native specimens.

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The animal must be transported individually in accordance with the International Air Transport Association (*IATA*) regulations.

A permit is required by the Australian Quarantine and inspection service (*AQIS*) prior to exporting any animal overseas. Guidelines for exporting animals overseas can be found at <http://www.daff.gov.au/aqis/import/application/how-to/live-animals#importer>.

8 Health Requirements

8.1 Daily Health Checks

During the cooler months of the year, captive Long-nosed potoroos will be quite willing to be observed at close range when being fed and also when general cleaning of enclosures is being attended to. At Potoroo Palace the long-nosed potoroos have been trained to take food from a keepers hand to ensure close observation of the health status.

During the warmer months at Potoroo Palace, including mid summer, potoroos are hesitant to leave their nests and do not eat till later in the day which makes daily health checks difficult, however, late afternoon health checks can be performed 2nd daily when there is no obvious cause for health concerns with the animals. Daily nest checks can be attended to when required or if there is any health concern. For institutions with nocturnal facilities, health checks can be attended to daily within the nocturnal enclosure.

Long-nosed potoroos have very delicate skin on their forepaws which they use for digging and holding food and nest material, it is very important to check forepaws closely for any redness or damage or sign of infection. The hind feet have a thicker skin; however, checks of the hind feet and legs are an important aspect of ensuring health and wellbeing in the animal.

Long-nosed potoroos are ravenous feeders, any sign of reluctance to feed should be recorded and veterinary assistance should be sought.

Long-nosed potoroos have large, bulbous eyes. Any discharge, evidence of injury or infection should be recorded and reported immediately.

The coat of the Long-nosed potoroo should be clean and neatly groomed. Individual potoroos at times tend to have territorial and food disputes which can result in small tufts of fur being pulled out by the aggressor, this particular behaviour should be monitored closely, however with good husbandry techniques, including enrichment procedures and feeding different animals in different areas of the enclosure there should not be a problem.

As discussed previously, Long-nosed potoroos can move at great speed and seem to delight in dodging and weaving while they forage for food etc. Any notable differences in behaviour such as a reluctance to move or eat should be recorded and reported.

The amount and consistency of faeces within the enclosure should be noted. Any evidence of diarrhoea or blood in the faeces should be recorded and reported immediately. If possible the genito-urinary area (cloaca) should be checked for any sign of redness or disease.

Female Long-nosed potoroos may have pouched young, close observation of pouched young and the female must be recorded.

8.2 Detailed Physical Examination

Chemical Restraint

The Long-nosed potoroo is a very highly strung animal as with most macropods, therefore valium (Diazepam) which is a muscle relaxant is used to prevent capture myopathy when restraint is required. The dose rate is 0.5 -2.0 mg/kg intramuscularly in the thigh muscle. (Jackson 2003). Jackson also states the injectable anesthetic drug of choice is Tiletamine/zolazepam (Zoletil) at a rate of 5-15mg/kg intramuscularly; however, he points out that recovery may be 'slow and violent.' Inhalation anesthesia using isoflurane or halothane with a pre-medication of Valium has been proven to be effective in small animals such as the Long-nosed potoroo.

The animal should be placed in a warm dark area in the recovery stage post anesthesia and monitored closely, including the heart rate and respiration rate.

Bi -annual veterinary health checks should be routinely carried out. Specific veterinary checks and procedures are as follows:-

Note: Invasive or potential stress causing procedures to be carried out by vet while animal is sedated.

- *Routine blood tests (full blood count, electrolyte balance, liver and kidney function)
- *Oral check for any cavities or abnormalities.
- *Ocular check (cataracts, damage, infection etc)
- *Urinalysis
- *Respiratory and heart rate
- *Pedal check (for any abnormalities or sign of infection)
- *Full body check, including muscle tone and strength (when animal is conscious)
- *Temperature
- *Weight

8.3 Routine Treatments

Physical Examination-Monthly health check – by keepers

As with detailed examination of all captive animals a full body assessment should be attended to. This assessment should include:

Body condition including, muscle tone and strength.

The amount of fat on the base of the tail is an indication of good or poor health in any macropod including the Long-nosed potoroo. Palpation of the area to assess health status is essential.

Body temperature, taken through the rectum via the genito-urinary opening. The average resting body temperature in the Long-nosed potoroo is 35.9 degrees celcius (Claridge et al 2007)

Weight Monthly weighing is ideal with the Long-nosed potoroo, unless the animal is ill or disease is evident. These weights should be recorded and compared to previous weights to ensure the animal is well and thriving.

Pulse rate and respiratory rate Small macropods, including the Long-nosed potoroo have an average heart rate between 80 -100 beats per minute and a respiratory rate of 30-40 breaths per minute.

(<http://www.environment.gov.au/biodiversity/abrs/publications/fauna-of-australia/pubs/volume1b/30-ind.pdf>)

As with daily health checks. Any openings including the eyes, ears, mouth and cloaca should be assessed for any abnormalities.

Pouch

Pouch condition, including any redness, areas of infection or discharges from teats should be assessed. If pouch young are present, the sex, stage of development and weight if detached from the teat should be assessed. (Jackson 2003)

Male Long-nosed potoroos

Check testes –size (Length, width and depth) and consistency (firm – not squishy)

Extrude penis and assess for any redness or signs of infection. (Jackson 2003)

8.4 Known Health Problems

The Long-nosed potoroo along with other macropods can suffer from a myriad of diseases if their environment is not kept properly and strict hygiene and feeding

techniques are not adhered to. Therefore good husbandry techniques are essential in keeping the animals disease free.

Protozoan blood parasites have been found in the Long-nosed Potoroo in the wild (Claridge et al 2007). Tapeworms and roundworms as stated by Jackson 'are probably found in all species' (potoroos, bettongs) in the wild.

Some common diseases which can be found in long nosed potoroos are as follows:

Lumpy Jaw (*Necrobacillosis*)

The bacteria such as *fusobacterium necrophorum*, *corynebacterium pyogenes* and *Bacteroides (Dichelobacter) nodosus* can penetrate the gums of macropods including the Long-nosed potoroo. These bacteria can infect the gum line in animals and in turn infect the jaw line, the *fusobacterium necrophorum* attack and 'eat away' the bones in the jaw and face.

Signs of infection are swelling in the jaw area and face of the animal, a hesitancy to feed, drooling from the mouth, general poor condition.

Diagnosis is obtained by anaerobic culture and also clinical signs.

Treatment If the animal is in the advanced stage, euthanasia is usually the best option. If detected early antibiotic treatment can be successful. Recent studies have shown that treatment with impregnated polymethylmethacrylate beads using a combination of the antibiotics Gentamycin and Clindamycin has been successful. The beads are implanted into the infected area and the antibiotics are slowly released over a long term period.

(Staker 2006)

Prevention: Strong teeth and gums are essential in any healthy animal. Fibrous and hard food must be part of the Long-nosed potoroo diet. Soft foods such as apple should be kept to a minimum. Dog kibble, fibrous grass and bark and other foods that are hard are important to keep the teeth and gums healthy and to avoid the entry of any bacteria. Strict hygiene techniques must be followed, all faeces and old food debris should be removed from the enclosure daily. The enclosure should have at least 5-6 feeding stations for 3-4 potoroos. Food should be kept off the ground. As previously stated, good husbandry techniques are essential.

Toxoplasmosis (*Toxoplasma gondii*)

Toxoplasmosis is a protozoa. The animal can contract the disease by a keeper not using proper hand washing techniques after handling raw meat. The other main cause of toxoplasmosis is when the animal eats from an area where a cat has defecated. The protozoan lodges in the main organs of the body and has many symptoms.

(Claridge 2007) found that toxoplasmosis has been recorded in the Long-nosed potoroo in wild populations.

Signs of infection are:

Lethargy

Anorexia

Liz Piipari

Lack of coordination
Arching of the neck
Discharge from the nose
Retinitis
Scouring
Convulsions
Exophthalmoses (bulging eyes)
Respiratory distress for example laboured breathing

Diagnosis of toxoplasmosis

Based on clinical signs and serological testing to detect rising *Toxoplasma gondii* titres.

Treatment of Toxoplasmosis

Toxoplasmosis is a difficult disease to treat, the disease can progress very quickly in any species of macropod and result in death before any treatment is effective. Studies have shown that using sulfadimethoxine and pyrimethamine or clindamycin has been somewhat successful in a few cases (Staker 2006 and Jackson 2003). It has been noted that the disease can be inevitably fatal and that animals that are still alive in the later stages should be euthanased because of the pain of encephalitis which is associated with the disease.

Prevention of Toxoplasmosis

Strict hand washing techniques to be used when feeding and handling animals.
Prevent feline access to enclosures, including feral cat populations.

Coccidiosis

Coccidiosis is caused by a protozoan called *Eimeria arundeli*. The Long-nosed potoroo is not as susceptible to this disease as other macropods such as Eastern grey kangaroos, *Macropus giganteus* and Western grey kangaroos, *Macropus fuliginosus*; however, it is possible for the Long-nosed potoroo to contract this disease when they are new to an exhibit and also the pouched young of the Long-nosed potoroo are susceptible if proper husbandry measures are not adhered to.

Signs of infection are:

Anorexia
Lethargy
Weakness
Dehydration
Weight loss
Fur is rough and unkempt
Anaemia
Black, foul smelling diarrhoea

Diagnosis of Coccidiosis.

The presence of oocysts in the faeces may not be noted because during the asexual stages of the coccidian life cycle they will not be present. (Staker 2006) Post mortem results can be used to confirm the diagnosis of Coccidiosis.

Treatment

Anti-protozoal medication including sulphonamides, Trimethaprin and sulfadiazine are the drugs of choice to treat coccidiosis (for doses see Jackson 2003) Sub-cutaneous or intravenous fluid therapy can be used to treat dehydration in combination with Baycox (Toltrazuril) used orally for 3 days, using a nasogastric tube if necessary has also been found to have some effect in the early stages of the disease.

Prevention

Employing strict hygiene techniques within enclosures is essential to ensure there are no cases of coccidiosis.

Raking, sweeping and cleaning away faeces from near and around eating areas and drinking troughs.

Providing food in containers off the ground..

It has been noted that overcrowding of macropods in enclosures can increase stress which in turn can increase the chances of the animals developing coccidiosis.

Capture myopathy

Capture myopathy is a syndrome found in macropods after periods of increased stress. The muscles including the heart muscle degenerate and become necrosed due to a build up of lactic acid in those muscles. The animal is unable to metabolize the build up of lactic acid within the body. Capture myopathy can be likened to Rhabdomyolysis which has been diagnosed in humans after running marathon races.

Stressors which can contribute to an animal developing capture myopathy are:

Being chased excessively by a human or another predatory animal.

Physical restraint.

Prolonged struggle after being captured.

Being caught in a trap or netting and attempting to escape.

Overheating after being captured.

Signs of capture myopathy

Immediate signs: Rapid heart rate, obvious overheating (the animal is hot to touch)

Tintibulation (shaking of the head or body) Please note, Tintibulation can also be a normal phenomena within some macropod species...It can be a form of greeting between animals which are unfamiliar with each other.

Neck spasms.

Excessive salivation (with a strong odour).

Liz Piipari

Respiratory or cardiac failure progressing to death of the animal.

Further signs (between 24 hours to up to 3 weeks)

Twitching of muscles.

Stiffness

Obvious signs of pain (Grinding teeth and clenching claws)

Very dark to brown urine which can be the result of myoglobin (muscle product) being released in the urine.

Diagnosis of capture myopathy

Obvious clinical signs of capture myopathy after increased stress to the animal.

Dark Brown urine

Blood tests for levels of creatinine phosphokinase which is an enzyme released into the blood after muscle damage has occurred, particularly heart muscle.

Treatment of capture myopathy

Unfortunately, treatment of capture myopathy can be generally unsuccessful.

If the animal is treated immediately after being chased or stressed, Valium, 0.25 ml/kg intramuscularly, combined with cooling of the animal in cold water and an injection of vitamin E/selenium (68 i.u./ml) @ 0.02 ml per kilogram has been found to have some positive result. (Staker 2006).

Other measures to treat capture myopathy include intravenous sodium bicarbonate to counteract the acidosis (Booth 1999 cited in Jackson 2003). Corticosteroids, intravenous fluids and diuretics can be given to prevent renal damage (Blyde 1999 cited in Jackson 2003).

Prevention of capture myopathy

Capture and restraint of the animal should be attended to in the early morning at the coolest part of the day. Capture should be planned carefully to assure minimal stress to the animal. Animals which are conditioned to being handled should not require any sedative medication. However, animals which have not been conditioned may require an intramuscular injection of Valium at 0.5-2.0mg/kg immediately after capture which will reduce stress.

Ectoparasites

Known parasites of Potoroos are:

Fleas (*Acanthopsylla* & *Pygiopsylla*)

Ticks and mites (*Amblyomma*, *Haaemaphysalis* and *Ixodes*)
(Claridge et al 2007)

Signs of Ectoparasites

The animal scratches itself more than normally (Pruritis)

Fur loss (alopecia)

Inflamed, reddened skin (erythema)

Mites or fleas may be seen in and around the ear and also on the abdomen of the animal as well as around the cloaca.

Diagnosis of ectoparasites

Clinical signs as described.

Skin scrapings or skin biopsies which can show microscopic signs of mites. (Jackson 2003)

Treatment of ectoparasites

Ivermectin injectable and/or oral is used in many zoos and sanctuaries for the treatment of ectoparasites with effective results. Doses of Ivermectin are to be prescribed for each animal by a veterinarian.

Prevention

Regular inspection and treatment of exhibited potoroos.
Quarantine and treatment of infected animals.

Endoparasites

Endoparasitic worms including tapeworms or roundworms may be found in most animals, including the Long-nosed potaroo, although, most animals can handle relatively large burdens of gastrointestinal parasites (Jackson 2003)

Signs

Signs of endoparasitic burden should not be evident in captive animals. Good husbandry techniques including regular worming should be in place in all zoos, sanctuaries and wildlife parks, however, some signs of endoparasitic burden can be:

Weight loss

Dull fur

Evidence of endoparasites found in fecal samples.

Treatment

Anthelmintics (worming treatment)

Ivermectin 200ug/kg and Cydectin (moxidectin) 200-500ug/kg – orally, topically and by injection.

Prevention

Strict cleaning routines within exhibits.

Strict hygiene techniques in food preparation areas and regular cleaning and sanitizing of utensils, food preparation equipment, feeding bowls and troughs.

Regular worming treatments.

Cryptococcosis

Cryptococcus gattii, also known as *Cryptococcus neoformans* var *gattii*, is a yeast-like fungus found in tropical and subtropical climates. If an animal breathes in spores or cells, it causes a lung infection called cryptococcosis which can be fatal if it spreads to the central nervous system and causes Meningitis

(http://en.wikipedia.org/wiki/Cryptococcus_gattii)

A case of *Cryptococcus* was found in a female Long-nosed potaroo at the Perth Zoo, other cases have been found in different species of potoroos and other small mammals, including domestic cats. Some eucalyptus browse given to potoroos can be contaminated

with the cryptococcus spores from birds and other animals. The spores can also be found in fecal material; on the ground or substrate of some enclosures. In mammals, inhalation of *Cryptococcus* from the environment usually results in sub clinical disease that is rapidly resolved in the healthy animal. However, clinical disease may be seen.

(Vaughan et al 2005, cited

at http://www.wildlifedisease.org/Documents/Proceedings/Australia_2005.pdf

Even though the likelihood of captive Long-nosed potoroos contracting cryptococcus is very remote, keepers must be aware of the possibility.

Signs

Nasal disease

Pneumonia

Disseminated disease including **meningitis**.)

Hind limb weakness

Muscle atrophy

Weight loss

Inappetence (Lack of appetite)

(Vaughan et al 2005, cited at

http://www.wildlifedisease.org/Documents/Proceedings/Australia_2005.pdf)

Diagnosis

Clinical signs are significant indicators of the disease. Examination of the discharge from the nose or skin lesions can reveal *Cryptococcus* in high numbers and can be identified under the microscope. A blood test is also available to identify the fungus. The latex agglutination test is the most widely used and accurate of the blood tests and can be performed by a veterinarian. Identification of the organism through cultures or biopsies can also be used.

(<http://www.peteducation.com/article.cfm?cls=1&cat=1317&articleid=254>)

The disease has been found to be almost always fatal unless diagnosed and treated in the very early stages.

Post mortem examination of the cerebral tissue can confirm the diagnosis.

Treatment

In the early stages the animal may be treated with oral antifungal medications including fluconazole and amphotericin B. Treatment of animals usually involves the use of oral itraconazole, fluconazole, or ketoconazole. These drugs have some potential side effects and must be used for several months or longer to be effective. Intravenous treatments of the drug Amphotericin B can also be used but must be used with caution in small animals.

Prevention

Strict hygiene techniques should be used when cleaning and raking enclosures. Eucalypt and other browse should be checked carefully for fecal contamination before being given to animals. All nesting material should be checked daily and changed weekly. Regular examination of exhibited animals.

8.5 Quarantine Requirements

The purpose of quarantine is to allow the detection of those animals, which may be incubating a disease with a short incubation period and also to detect the clinical signs of diseases with a longer incubation period. (Woodford 2000)

Quarantine measures are essential for:

Prevention of transmission of diseases within institutions

Prevention of transmission of diseases between institutions

Prevention of disease transmission between countries- import/export of animals (Phipps 2007, 3409A4.0 QT study notes)

Whenever a disease, injury or abnormality is discovered in an exhibited Long-nosed potoroo the animal should be placed in quarantine. The animal should remain in quarantine until any evidence of disease is ruled out by a veterinarian.

When a new animal arrives at the facility strict quarantine measures should be put into place.

Quarantine for all species should be under the supervision of a veterinarian and consist of a minimum of 30 days (unless otherwise directed by the veterinarian).

Mammals: If during the 30-day quarantine period, additional mammals of the same order are introduced into a designated quarantine area, the 30-day period must begin over again. However, the addition of mammals of a different order to those already in quarantine will not have an adverse impact on the originally quarantined mammals. (Association of Zoos and aquariums, Accreditation standards and related policies, 2008).

9 Behaviour

9.1 Habits

Activity: As noted previously, the Long-nosed Potoroo is partially diurnal, however, it has been noted at Potoroo Palace that the Long-nosed potoroos are more nocturnal than diurnal in the hot summer months and prefer to emerge in the early evening when the temperature of the day has cooled somewhat. During the cooler months of autumn and winter, the exhibited potoroos at Potoroo Palace are quite at ease feeding and coming out to be viewed by the visiting public. Claridge 2007, found that 'daytime captures of the Long-nosed potoroo at Cabbage Tree in East Gippsland mainly occurred in the cooler autumn and winter months.' It has been noted that the Long-nosed Potoroos are definitely

more active after dark, they have been found actively foraging from the hours of approximately 9pm in the summer months and from 7pm in the cooler months.

Social behaviour

The Long-nosed potoroo is essentially a solitary animal, however, it has been noted at Potoroo Palace that some animals appear to ‘buddy up’ and feed in pairs, this may be a phenomena only found in captive populations. Further studies would confirm this theory. The only other times that the Long-nosed Potoroos have been observed together, particularly in the wild, are when courtship and mating is taking place and when a female has a young at heel. (Claridge et al 2007)

Example approximate daily activity chart for the Long-nosed Potoroo

Dusk to early morning	10.30-12.00pm	12pm-4pm	4pm-10pm	10pm-Dusk
Digging in enclosure, foraging for insects, & buried food items (which were buried the pm before)	Captive diet given. See example diet. Enrichment in the form of ‘Kong’ filled with dog kibble, sweet potato etc.	Resting in nests, occasionally coming out to forage. (Foraging during the day more in the winter months)	Food items buried in strategic areas of enclosure to encourage natural behaviour	Resting in nests, occasional foraging behaviour. Some mutual grooming behaviour.

9.2 Reproductive Behaviour

Courtship

Mating systems of wild Long-nosed potoroos are poorly understood due to the limitations that small body size, secretive behaviour and dense habitat impose on observational studies of these species. (Long 2001) Long-nosed potoroos are **asynchronous, continuous breeders**, although a period of anoestrus has been observed from March to June (Hughes 1962 sited in Long 2001). Wild Long-nosed potoroos shelter in shallow depressions called ‘squats’ amongst thick undergrowth. Up to seven ‘squats’ have been observed being used by individual animals.

Home ranges of males and females overlap. Mean home-range size of male potoroos, 4.0 ha, was larger than that of females, 1.9 ha. Male home ranges overlapped the ranges of 1–4 females, and ranges of females were overlapped by those of 2–3 males. Intersexual overlap was higher than intrasexual overlap.

In captivity, it has been noted that due to close proximity of exhibited animals to others of the same species, male & female animals may be found courting and mating at any time during the day and night. As with most other macropod species, the Long-nosed potoroo have a post-partum oestrus and experience embryonic diapause.

Courtship rituals can be a display of tails ‘slapping against the ground’ (male & female) whilst keeping close contact with each other, and making sounds similar to the sound of the call of a swamp wallaby *Wallabia Bicolour* calling to its mate.(Chee Chee)

9.3 Bathing

Potoroos generally do not bathe.

9.4 Behavioural Problems

Fortunately, the Long-nosed potoroos do not display any obvious behavioural problems, at Potoroo Palace. I believe this is due to the large size and overall design of the enclosure, effective furniture which is in place and also enrichment techniques being used. It may be possible to find behavioural problems in a smaller enclosure with more animals within that enclosure and a lack of enrichment techniques.

9.5 Behavioural Enrichment

Tussocks for hiding in and moving between are essential, especially if the animals are in a large enclosure.

Nest building material must be provided in the form of straw, dried black wattle browse and used koala browse. (Ensure nest material is not contaminated, and change nest material frequently to prevent disease.)

Food is scattered in and around tussock areas. Food can be buried which can assist with foraging behaviour.

If truffles (hypogeous fungi) are available, this could be provided.

A ‘Kong’ has been designed out of a dried coconut shell with holes drilled in it. Food treats (peanuts, corn etc) are placed into the ‘Kong’ for the potoroos to discover and eat. The Long-nosed potoroos at Potoroo Palace are encouraged to be on display by using food treats such as small pieces of sweet potato and also small pieces of corn on the cob.



Fig 1 Potoroos with coconut ‘Kong’



Fig 2 Potoroo with corn cob.

9.6 Introductions and Removals

New introductions to a display must be 'softly' introduced and observed closely. Some animals may show some aggression to new arrivals. The new arrival can be housed in a small enclosure (Demountable aviary with protection from inclement weather) within the large enclosure for a short time whilst getting to know the original inhabitants. Then when there is no sign of aggression between animals the new animal can be release into the large enclosure.

Jackson 2003 states that 'when animals are taken out and returned later there are generally few problems'

9.7 Intraspecific Compatibility

The suggested intraspecific compatibility according to Jackson 2003 is 1:1:2, however it has been found at Potoroo Palace larger and different intraspecific compatibilities can be found to cohabit very well together, however, again, this may be due to the size of the enclosure.

9.8 Interspecific Compatibility

The Long-nosed potoroo appears to be interspecifically compatible with most birds (excluding raptors) and also other Australian mammals (excluding predatory mammals) including sugar gliders, yellow-bellied gliders, koalas, different species of potoroos and Bettongs, echidnas, ring tailed possums, tawny frogmouths. (L.Andrews pers.comm; H.Guy pers.comm.; pers obs. Sited in Jackson 2003)

9.9 Suitability to Captivity

It has been noted that the Long-nosed potoroo adjusts very well to a captive situation. Aggression between animals is minimal.

They are not aggressive towards humans. They can be trained to be hand fed and behave comfortably within a small distance from members of the public. The Long-nosed potoroo is a low maintenance animal from an animal keeper's perspective as long as regular physical checks are attended to, enrichment techniques are in place and proper diet is given.

10. Breeding

10.1 Mating System

The long- nosed potoroo is polygynous, which is where a male has more than one female partner, during a single breeding season.

10.2 Ease of Breeding

The Long-nosed potoroo breeds easily in captivity. However, females must be observed closely when they have pouched young if there is more than one male in the enclosure as the males can tend to harass the female to breed again and therefore cause stress which could result in the loss of pouched young, (observed at Potoroo Palace 2007)

The Long-nosed potoroo breeds easily and there appears to be no obvious triggers to breeding.

10.3 Techniques Used to Control Breeding

The most non invasive method to control breeding in the Long-nosed potoroo is to separate the sexes into different enclosures.

Another method is to have same sex populations.

Castration of the male has been an effective way of controlling contraception in the Long-nosed potoroo and other Potoroidae species according to Taronga Park zoo veterinary staff.

Other methods of controlling populations can be immuno-contraception, however, this method must be attended to at correct intervals to ensure efficacy.

Other more invasive methods are removal of pouch young and also culling of excess stock, both of these methods can be described as 'ethically questionable' (Jackson 2003, p282) and also can give a negative public image of the captive animal facility.

10.4 Occurrence of Hybrids

Hybridization has not been documented as occurring between the Long-nosed Potoroo and other members of the Potoroidae family at the time of writing.

10.5 Timing of Breeding

The Long-nosed potoroo is a continuous and asynchronous breeder. Claridge, 2007 P 91, states that the continuous reproduction cycle of the Long-nosed Potoroo in the wild, could allow them to 'maintain populations in habitats that are naturally patchy in distribution' Andrew Bennett cited in Claridge 2007, states that 90% of all Long-nosed potoroos are carrying pouched young throughout the year. The peak birth season (Jackson 2003) is June until August.

10.6 Age at First Breeding and Last Breeding

The age at first breeding of the Long-nosed Potoroo is 12 months. Most species of macropods will breed up until they die (Jackson 2003, P284).

Sterneberg, B.2005 discusses 'cross fostering' the pouched young of endangered and vulnerable species. The Tasmanian bettong (*Bettongia gaimardi*) and the Long-nosed Potoroo (*Potorous tridactylus*) were used as model species in a study at the School of Zoology, University of Tasmania, 2004-2005. A total of 32 young were transferred from

the pouches of the Tasmanian Bettong to the pouches of the Long-nosed potoroos. Evidently the young transferees developed species specific behaviour after vacating the pouch of the foster mother, which was some evidence of success, however, the cross fostering did appear to have an impact on the actual growth of the pouched young. Further studies in the future targeting milk composition and age of transferring may rectify the problem with low growth patterns in cross-fostered pouched young.

10.7 Ability to Breed Every Year

Due to the Long-nosed Potoroo being a continuous breeder, it has the ability to breed each year.

10.8 Ability to Breed More than Once Per Year

The Long nosed Potoroo has the ability to breed twice per year. Population management strategies would be required to avoid large populations. Long-nosed potoroos are asynchronous, continuous breeders, although a period of anoestrus has been observed from March to June (Hughes 1962), sited in Long, 2001, p17.

10.9 Nesting, Hollow or Other Requirements

The Long-nosed Potoroo as with most small macropod species, require hollow logs, stands of tussocks where they make their nests. Sheltered areas for wet and also hot weather. Native browse including black wattle and Casuarina can be supplied for nest building. If native browse is not available grass hay is suitable for nest building, see Figures 1 and 2 in housing requirement section of this manual. An annual cycle of maintenance is essential to ensure optimum breeding conditions. See Fig 1. (Page 35)

ANNUAL CYCLE OF MAINTENANCE ACTIVITIES
Long-nosed Potoroo *Potorous Tridactylous*

Figure 1

	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Breeding season												
Peak Breeding season												
Major enclosure repairs												
Minor enclosure repairs if required												
Enclosure renovations												
Full cleaning of enclosure												
Routine health checks (monthly)												
Bi Annual vet checks												

Figure 1.

- Breeding season continuous
- Peak breeding season, June till August
- Routine health checks monthly
- Bi Annual Vet checks (pre peak breeding season and post breeding season)
- Full cleaning of enclosure after young have left the mother ensuring less chance of stress to mother & young
- Enclosure renovations when young have left the mother and when peak breeding season has not yet begun ensuring less stress.
- Major enclosure repairs when young can be removed from parent and be moved to another enclosure or institution.
- Minor enclosure repairs in November when young are still in pouch prior to when the young are ready to leave the mothers pouch

10.10 Breeding Diet

There is no specific diet required for breeding with the Long-nosed Potoroo, however, correct hygiene, correct foods and amount of food must always be used for individual animals at all times for optimal health of that animal.

10.11 Oestrus Cycle and Gestation Period

The female Long-nosed Potoroo comes into Oestrus at approximately 6 weekly intervals or 42 days. The gestation period is 38 days. (Claridge, 2007, P89)

10.12 Litter Size

The Long-nosed potoroo gives birth to only one young at a time. The young is born at an embryonic stage and is approximately 15.5 mm long at birth.

10.13 Age at Weaning

The Long-nosed potoroo young leave the pouch at approximately 130 days and are weaned at approximately 147 days.

The Long-nosed Potoroo is a continuous breeder and also experiences embryonic diapause. She may have one young at foot, one small pouched young and also one embryo awaiting birth at any time after her first breeding, similar to most other macropod and potoroid species.

10.14 Age of Removal from Parents

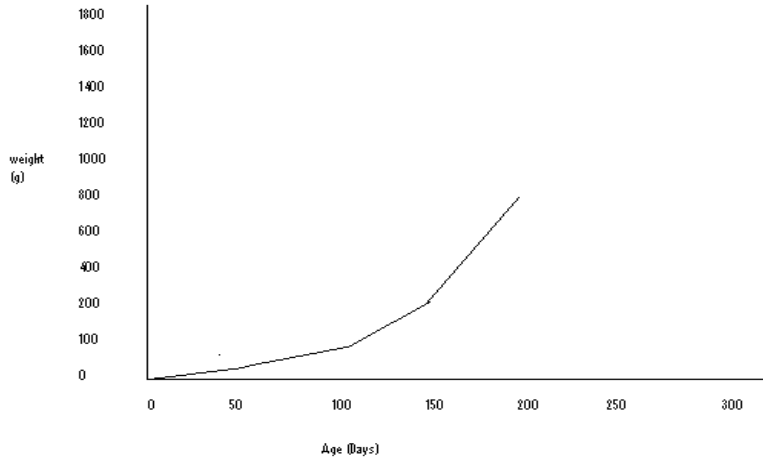
It has been noted by Jackson, 2003 that some female potoroids, including the Long-nosed potoroo can become 'intolerant' of their young at weaning, unlike other macropod species including kangaroos when the young generally remain part of the 'mob' and suggests that the young should be removed at weaning due to this intolerance and likely aggression.

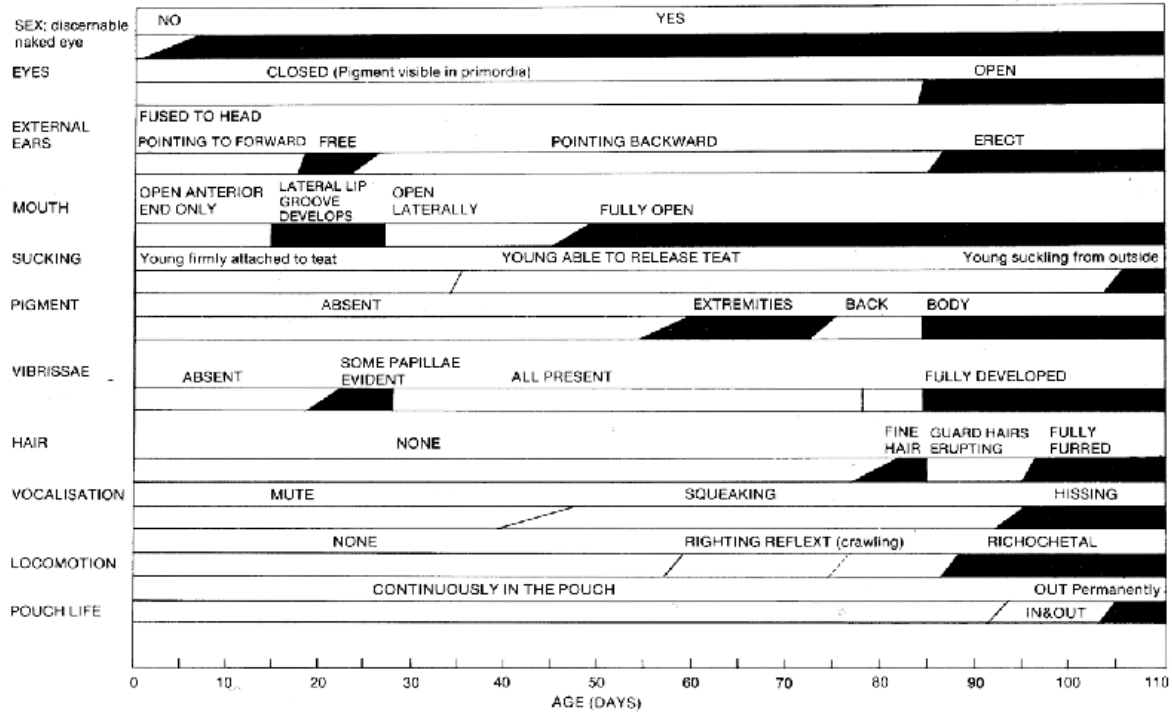
10.15 Growth and Development

The Long-nosed Potoroo enters the pouch after approximately 38 days of gestation. It weighs approximately 0.5 gms and measures 15-20mm.

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Growth in body weight of the long-nosed Potoroo from birth until 200days.





Unfortunately, at this time there is no data available for maturity/growth approximations in the Long-nosed Potoroo, however, the maturity/growth approximations have been found for the Tasmanian Bettong, which is very similar to the long nosed Potoroo. As noted previously, the Long-nosed Potoroo has been used as a cross-fostering species with the Tasmanian Bettong.

11. Artificial Rearing of Mammals



**Long-nosed Potoroo joey
(anonymous photographer)**

11.1. Housing

Stress is one of the main causes of disease and illness in any young marsupial joey. The most important aspects of caring for a joey is warmth, a quiet safe area and an area which is not brightly lit, which is away from any predatory animals and curious children and adults. The housing area should be safe and sheltered and escape proof for larger potoroo joeys, who as described previously, are very fast, love dodging and weaving and also very good 'escape artists' if given the chance.

The area must be predator proof (Foxes, goannas, dogs, humans). The area must provide hiding areas with tussocks and hollow logs for the joey to hide and fresh water must be provided daily. The enclosure must be cleaned of faeces daily to ensure good health.

11.2 Temperature Requirements

Unfurred joeys are unable to produce their own heat, therefore artificial warming must be put into place to maintain the correct temperature. An unfurred potoroo joey will require a constant ambient temperature of 32-36degrees celcius (Jackson, 2003)

When the joey has developed a very light covering of fur (velvet), the temperature can be decreased to between 30 – 32 degrees celcius.

When the joey has developed thicker fur, the temperature can be decreased to between 28-30 degrees celcius.

A home made hospital box is a handy requirement for any facility if a humidicrib is not available. Pictures and a diagram of dimensions of a simple home made hospital box are illustrated below. The hospital box requires 2x blue or green 40 watt globes to maintain adequate warmth and also a thermostat which can control the heat. A cup of warm water

will provide some humidity. A humidity probe can also be used to assist with ensuring a necessary amount of humidity.



Figure 1.
Home made hospital box



Figure 2.
Pouch within hospital box

The original designer of this hospital box is unknown. (Cited in Dooley, 2004)

HOSPITAL BOX FOR MARSUPIAL JOEYS

The hospital box requires the following:

- ◆ 2 Incandescent blue 40 watt light bulbs
- ◆ 2 Kitchen vent holes located in the top of the rear panel
- ◆ A Perspex window centered in the lid measuring 120mm by 240mm
- ◆ Box materials should be at least 15mm thick for insulation
- ◆ Thermostat. An Aniwarmer thermostat is used with the hospital box used by Potoroo Palace. Contact author for details.

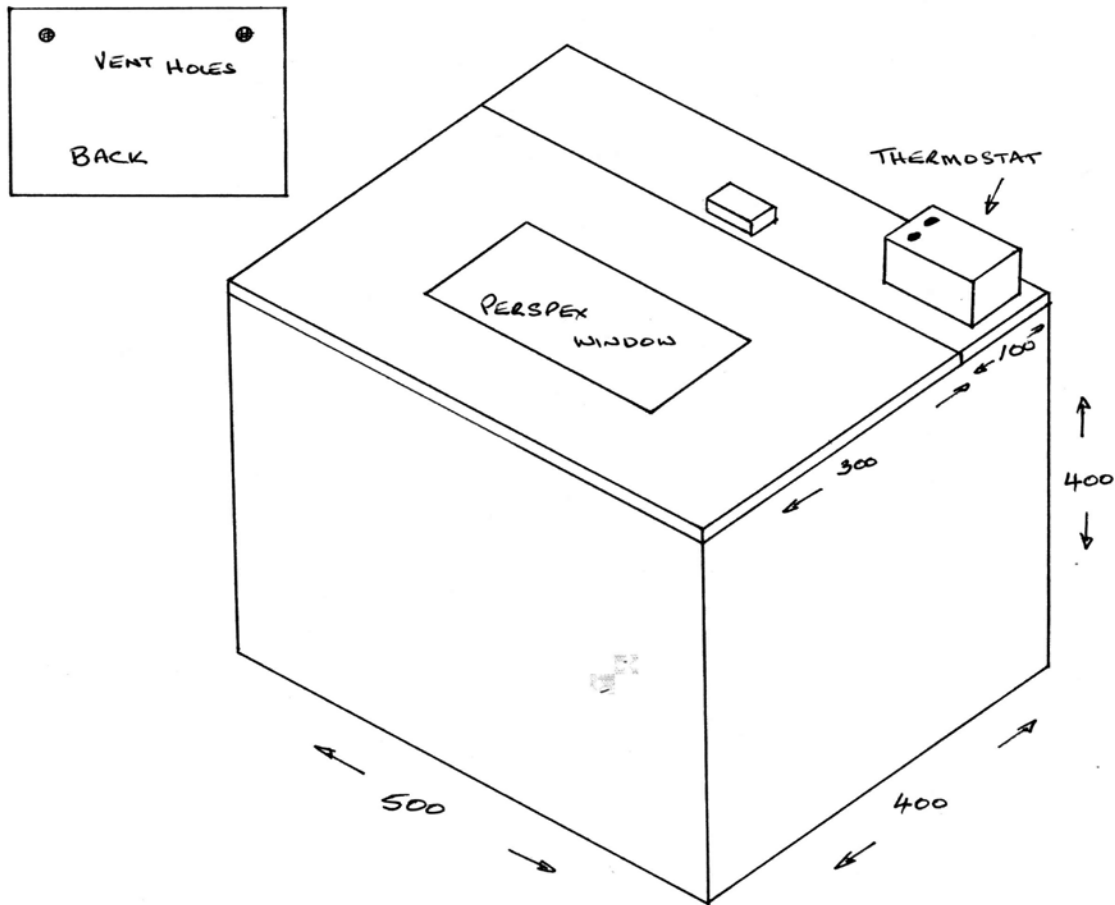


Figure 3. Hospital box dimensions. If a humidicrib or hospital box is not available, a number of hot water bottles (with warm water) can be placed next to an artificial pouch made from natural fibres. Pieces of lambswool can cover the hotwater bottles which surround the artificial pouch to maintain an even temperature. A probe thermometer with a minimum/maximum alarm is helpful to ensure correct temperature of the joey. A fish tank thermometer can be used to check a temperature if a probe thermometer is not available. Regular checking of the pouch temperature is essential.

11.3 Diet and Feeding Routine

The potoroo mother, as with other marsupials, has the ability to produce milk with different energy requirements to its joey at all stages of pouch life.

The most important part of the diet and feeding regime for marsupial joeys is **STRICT HYGIENE**. When strict hygiene techniques are not followed the joey may suffer from

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disease which could have been avoided by simple hand washing techniques, sterilization of feeding utensils and proper washing and sanitization of the joeys' living area.

'Wombaroo' dietary formula is the formula of choice for young marsupial joeys. Wombaroo formula is specifically designed for major growth stages in marsupial joeys.

Another dietary formula used for handraising marsupial joeys is 'Biolac'. Biolac has three formulations, M100, M150 and M200. These formulations are used for furless joeys, joeys with short fur and joeys which have matured and close to weaning stage.

'Divetelact' is a low lactose milk formula which is used with marsupial joeys and also eutherian young. 'Divetelact is readily available from veterinary practices and has proven to be an effective formula short term for marsupial joeys.

The joey must be at a correct temperature prior to feeding to reduce the risk of inhaling the formula. Do not feed a joey formula until it is warm enough. A good rule of thumb is to give the joey warm rehydration fluid for 24 hours before commencing formula feeds.

Many times a potoroo joey is dehydrated when it has been 'thrown' from the pouch or has been rescued from the wild. The joey may have to be rehydrated. An effective oral rehydration fluid can be used, including 'Lectade' and 'Vytrate' which are available from veterinary practices without a veterinary prescription. If these are not available when the joey arrives, it can be given warm pre-boiled water with a teaspoon of glucose powder added.

Cow's milk causes diarrhoea in all marsupial joeys and should not be used under any circumstances. If all Dietary formulas described above are not available, diluted 50/50 soy milk formula can be used for 24 hours until other formula can be obtained. (Anecdotal, but proven by trial and need by author) Low lactose baby formula and also ½ strength canned evaporated milk are other alternative formulas which can be used short term (24 hours)

Unfurred Potoroo joeys can be very small (50grams – 200grams) A glass syringe (10 ml) with a small marsupial teat will be required to feed the correct amount of formula. A small STM teat available from Wombaroo can be placed over the syringe to feed the young joey (See diagram) The teat should have a small hole (about the size of a pin) to avoid the joey inhaling milk and developing aspiration pneumonia, which will result in the joey requiring antibiotics.



STM teat (place teat over the end of 10 ml syringe)

Small animal feeding bottles which can be obtained from veterinary practices and also from suppliers of 'Wombaroo' can be used when the joey is furred and further developed. Unfurred joeys must be fed a required amount of formula 2-3 hourly over each 24 hour period. The frequency of feeding is decreased as the joey matures. Reference guides for

amounts and further facts about diet and feeding regimes can be found in Staker, L.2006, Dooley, C. 2006, WIRES (Rescue, rehabilitation and release of macropods) 2006. Inexperienced keepers and animal carers should not attempt to raise a Potoroo joey without expert guidance, training and/or information.

11.4 Specific Requirements

Unfurred joeys live in a warm humid environment when they are in their mothers pouch. Artificial environments cannot replicate that environment. The joeys' skin will require moistening when it is being artificially raised; Sorbolene cream (without glycerine), Ungvita cream, Alpha Keri oil and other natural creams and oils can be used. The preferred product used at Potoroo Palace is either Sorbolene or Ungvita. These lotions, oils or creams must be applied to the entire body of the unfurred joey 3-4 times daily. When the joey has developed 'velvet' fur the product can be applied to the feet, paws and tail twice per day.

The minimization of stress is paramount in raising a marsupial joey, in particular any species of macropodiae joey. Therefore reduction of noise and not overhandling the joey is a very important aspect of handraising. The joey must be able to display species specific behaviour whether it is to be placed with other exhibited animals of that species or released back into the wild, overhandling and over 'humanizing' can actually be detrimental to the future of the animal. In other words it will not 'assimilate' with animals of the same species.

11.5 Data Recording

Specific information should be recorded when a joey first arrives.

Weight, sex, age using growth charts should be measured. When these measurements are obtained, correct temperature, housing and feeding can be implemented. Also, whether the animal is of a viable age can be determined. (A furless Potoroo joey with ears flat to its head and eyes closed and a weight of 25 grams is of an unviable age to be handraised.) Euthanasia, in that case, would then be the most appropriate option.

Daily records should include:-

Date & time

Formula given & amount taken

Urine /faeces and consistency of faeces (watery, thick & pasty, pellets etc.)

Temperature

Is behaviour normal and age specific?

Skin moisture

Any abnormalities noted.

Weekly records should include whether the animal has reached correct developmental and behavioural stages for its age. (Bach, 1988)

11.6 Identification Methods

Microchip implants when the joey has furred are a useful method of identifying individual Long-nosed Potoroo joeys. The microchip can be implanted by a qualified animal keeper or a veterinarian. Microchip courses can be attended by animal keepers and are available at Richmond College of TAFE in Richmond, Sydney. The course is run over a 2 day period.

11.7 Hygiene

As stated previously, strict hygiene is one of the most important aspects of raising any marsupial joey to avoid disease.

Some aspects are listed below:-

- Strict hand washing before and after handling joey and any equipment used for that joey. If there is more than one joey, strict hand washing between joeys, s.
- Sterilization of all utensils and equipment used for feeding.
- Change pouch liners frequently (each feed), soak in napsan or boil in a large boiler for at least 10 minutes. Ideally pouch liners should be dried in the sun to avoid any cross contamination. Change pouch liners also if they are soiled between feeds.
- Always use pre-boiled water when mixing formula.
- Do not reheat milk.
- Store formula no longer than 48 hours in a refrigerated area < 4 degrees celcius.
- Clean the joeys face and chest for any spilt formula after feeding with a warm damp cloth
- Toilet the joey after each feed by stimulating the cloaca with a warm damp cloth. (Cloaca cloths can be Chux cloths or old towels cut into 10-15 cm squares)
Change cloaca cleaning cloths frequently. (Do not use facial tissues as they can tend to irritate the joeys, skin)
- Discourage well meaning people who want to touch the joey. (contamination)
- Maintain good skin integrity by applying Sorbolene or Ungvita cream to unfurred joeys, body. (avoid eyes and mouth)

11.8 Behavioural Considerations

One important aspect of hand raising a joey is to ensure that it will be a healthy adult and survive with animals of the same species whether it is in the wild or in a captive situation. When the joey is furred and leaving its pouch for short amounts of time, it must be allowed to use its species specific behaviours, including foraging, hiding in tussocks and behind log and rocks etc. Food items can be hidden and covered lightly with soil to allow that joey to forage. The joey can be observed from a distance to allow it to behave 'normally'.

Avoid having predatory animals close by; the joey will not have a natural fear of these animals when released.

Avoid having more than one carer raising the animal for the same reason as with predatory animals.

11.9 Use of Foster Species

As stated previously the Long-nosed Potoroo has been used as a foster parent for the Tasmanian Bettong (*Bettongia gaimardi*) with some success.

11.10 Weaning

When the joey is fully furred and is beginning to leave its pouch for short periods, supplementary foods should be given, including fresh vegetables, such as carrot & sweet potato. Other supplementary foods include mushrooms, 'puppy' kibble, peanuts in the shell (buried), kangaroo cubes and natural browse. A fresh supply of dirt, preferably 'bush dirt' should be available to assist the joey form its natural gut flora. Fresh bowls of water should be available for the joey to drink from. Long-nosed Potoroo joeys can generally be weaned from their formula at approximately 147 days (Jackson, 2003) The feeds are gradually decreased from approximately 6-8 feeds per day to two feeds per day, then one feed per day, then complete weaning. During the weaning period the animal should be observed for proper growth and weight patterns.

11.11 Rehabilitation and Release Procedures

If an animal has not been raised and prepared properly for release it will surely perish. This will result from the inability to access proper food, shelter and the inability to recognise predators. Preparation for release or assimilation begins the minute the young joey arrives into care.

Points which are essential for effective release of the animal discussed by Booth, 1999 sited in Jackson 2003 are:-

- Should be fit & healthy (mentally and physically)
- Should maintain condition on natural foods.
- Is able to recognise its own species.
- Should be familiar with the social behaviour of its species.
- The animal should show appropriate fear of humans and predators.
- It should show no evidence of being imprinted on humans.
- The animal should be able to seek and find shelter.

5 Acknowledgements

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<http://www.aza.org/Accreditation/Documents/AccredStandPol.pdf> (Association of Zoos & Aquariums, Accreditation Standards and Related Policies Significant Additions & Changes 2005-2009)

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Glossary

(of terms used that may not be easily understood without explanation/definition)

Joey - Young/immature marsupial.

Syndactylus – Having webbed digits or claws

Sexual Dimorphism – Any difference in characteristics or behaviour of animals from the same species.

Diurnal – Normally awake and active during daylight hours

Nocturnal – Normally awake and active during the night.

Ectoparasite – External parasite

Endoparasite – Internal parasite

Crepuscular is a term used for describing animals which are most active during dawn and dusk

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Appendix

Wombaroo Native animal formula can be obtained from:-

Wombaroo Food Products

Ph / fax: (08) 8391 1713

PO Box 151
Glen Osmond
South Australia 5064

email: wombaroo@adelaide.on.net
web: www.wombaroo.com.au

Biolac native animal formula can be obtained from:-

Biolac

15 O'Shannassy St, Mt Pritchard
NSW 2170

Phone(s): 02 9823 9874 Email: biolac@optusnet.com.au

Web: <http://www.biolac.com.au/>

Divetelact animal formula can be obtained from:-

Veterinary supply outlets in Australia including **Vet Products direct** at 1/116 Crockford Street Northgate, Brisbane. Phone: 1300720453.

Email: help@vetproductsdirect.com

Web: <http://www.vetproductsdirect.com.au/vetprods/contact.asp?url=CT>

Nectar mix

110 mls of warm pre-boiled water

110 mls honey

1 hard boiled egg (Boiled for 1t least 10 minutes to reduce any chance of salmonella being transferred to the animal)

25 grams of high-protein baby cereal

1 Teaspoon of Sustagen (1 Vitamin supplement obtainable in small quantities from supermarkets or pharmacies.)

Add the honey to warm pre-boiled water

Blend the eggs until very soft

Add the egg, sustagen and high protein baby cereal to the honey/water mix and blend for about 2 minutes or until free of lumps.

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Kangaroo cubes and Pasteur replacement pellets

Young stock feeds Pty Ltd
Young, NSW Australia
Ph: 02 6382 1666
Email: ymgroup@bigpond.com.au

Drugs

Gentamycin is an antibiotic which is effective against gram –ve and also gram +ve bacteria including Pseudomonas and staphylococcus. It should be used with caution when renal function is compromised. Used for infection including ‘Lumpy Jaw’ in marsupials

Clindamycin, (Similar to Gentamycin)

Sulfadimethoxine is an antibiotic and also used to treat coccidial infections in many species

Diazepam is used in animals as a sedative, anticonvulsant, and to treat certain behavior disorders, such as anxiety. It may also be used for its effect of relaxing both skeletal muscles (muscles used in movement) and smooth muscles (muscles of the digestive system and urinary bladder). It can assist when transporting animals and also when veterinary procedures which could potentially cause stress are being attended to.

Ivermectin injectable and/or oral is used in many zoos and sanctuaries for the treatment of ectoparasites with effective results. Doses of Ivermectin are to be prescribed for each animal by a veterinarian

Pyrimethamine is an antiprotozoal medicine. Antiprotozoals work by killing protozoa (tiny, one-celled animals) or preventing their growth. Some protozoa are parasites that can cause many different kinds of infections in animals. It can be used in conjunction with other drugs to assist with combating diseases including toxoplasmosis

Lectade can be used to reverse the effects of mild to moderate dehydration and loss of electrolytes due to procedures including surgery to an animal whereby the animal loses fluids and also electrolytes. It also may be used when young rescued orphaned animals require rehydration due to shock and/ or exposure

Vytrate Can be used instead of or to replace Lectade.

Sorbolene Pure Sorbolene without glycerine is recommended for moisturizing the skin of young unfurred marsupials. Glycerine has a drying effect therefore is not recommended

Ungvita is used for the effective treatment of dry skin conditions in young unfurred marsupials, similar to Sorbolene cream, one of the ingredients it Vitamin A which can

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assist healing when the unfurred or short furred marsupial has a skin injury (skin grazes etc)

Napisan is a germicidal and also a stain remover, used to soak cloth pouches when a young orphaned marsupial is being fostered.