

a guide to the  
**care of  
spinifex hopping mice**

version 1

**care guide by  
linda dennis**

**veterinary guide by  
anne fowler**



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*"Share your knowledge. It is a way to achieve immortality."*  
Dalai Lama

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## a note from Fauna First Aid

Fauna First Aid recognises the fact anybody who picks up an injured or distressed native animal is a carer and that it is very important that all carers are equipped with the knowledge on how to provide optimum care for Australian native animals.

I offer many heartfelt thanks to Dr Anne Fowler for writing **the veterinary guide** component of this resource as well as providing much valued support and assistance in all areas of my wildlife work over the years.

Thanks to my much valued vets - Judith Carney and Kim Rolls who have help me enormously with advice and discounted services over the years. Huge thanks also to Benn Bryant and Tim Portas of the Veterinary and Quarantine Centre at Western Plains Zoo, Dubbo, who have offered consultations, medications and advice free of charge.

Huge thanks to **Roz Holme** who provided most of the Spinifex Hopping Mouse photographs for this guide and for conducting a peer quality review of the guide.

Thank to Brian Yap, Robin Rotsaert and Museum Victoria for allowing me the use of their photographs.

Enormous gratitude and appreciation to:

-  the **Australian Geographic Society** for supporting my **Fauna First Aid** wildlife lecture program.
-  the **Wildlife Preservation Society of Australia** for recognising my wildlife education work and awarding me the **2006 Serventy Conservation Medal Runner Up**.
-  the **International Fund for Animal Welfare** for also recognising my work and awarding me the **2007 Animal Welfare and Education Award**.

And of course, massive thanks to my wonderful husband Todd, who has dealt admirably with my wildlife obsession..... and the crap that often goes with it.

cheers,

**Linda Dennis**  
**Fauna First Aid**

**Fourth Crossing Wildlife**  
[www.fourthcrossingwildlife.com](http://www.fourthcrossingwildlife.com)

*dedicated to the conservation of Australian native animals....*

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## **Disclaimer**

This care guide is designed to provide an overview of the care of Spinifex Hopping Mice. While every effort has been taken to include the complete data required to care for or raise Spinifex Hopping Mice the authors will not accept responsibility or liability for any error, omission or reliance upon the information or advice given.

Any involvement in caring for wildlife is done entirely at your own risk. The authors accept no liability for injuries or difficulties arising from your involvement.

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## **Remember!**

**Learning does not stop with this manual and accompanying course. You are encouraged to seek further advice and attend more courses to continually broaden your knowledge. You are also encouraged to build a support network across barriers such as regions and individual wildlife organisations.**

**And please, share your knowledge - our precious Aussie critters can only benefit from it!**

**A Guide to the Care of Spinifex Hopping Mice  
Version 1  
2008**

## biography – linda dennis

My passion for Australian native animals started over 10 years ago with my very first raptor experience at Eagle Heritage near Margaret River in Western Australia. After an up close and personal experience with a Black Kite perching on my gloved hand I vowed that I would soon work closely with these magnificent creatures.

Some years later I held true to the vow and I become licensed to raise and rehabilitate native animals that had been injured, were sick or orphaned. And, with the help of my husband Todd, I have now been experiencing the joy of wildlife care for eight years.

I have cared for many Australian native animals including several species of macropod and possum, various reptiles and many species of bird including my beloved Birds of Prey, in which I specialised in for nearly three years.

I had the immense pleasure of successfully rehabilitating and releasing many Birds of Prey including the awesome Wedge-Tailed Eagle, Nankeen Kestrel, Collared Sparrowhawk, Peregrine Falcon, Black-Shouldered Kite and more.

In later years I have had the enormous delight of raising and rehabilitating Bare-Nosed Wombats. These short and stocky bundles of energy and bravado have become my ultimate passion in life! Our first wombat Tici - with very little effort - took over a large part of my heart and I have been hooked on wombats ever since.

In 2004 I recognised that there was a gaping hole in my region in wildlife carer and public education relating to Australian wildlife and so I established **Fauna First Aid**. The programs début was to teach vet nurse students at Orange TAFE how to properly care for native animals in a veterinary care situation. The lectures have also been presented at Bathurst TAFE and I have been asked to teach at Dubbo, Mudgee and surrounding areas.

In 2005 I extended the program to include school age students - highlighting the dangers involved in handling wild animals and to show what Mum & Dad could do to rescue a native animal and to provide short term care. A community program has also been included in the lecture series teaching rescue, proper handling technique and short term care.

In June 2005 **Fauna First Aid** became a project sponsored by the **Australian Geographic Society** – a very humbling and proud moment.

Two other proud achievements are being awarded the 2006 Serventy Conservation Medal Runner Up by the **Wildlife Preservation Society of Australia** and the 2007 Animal Welfare and Education Award by the **International Fund for Animal Welfare**.

WPSA awarded me the **2006 Serventy Conservation Medal Runner Up** and this year I was awarded IFAW's **Animal Welfare and Education Award** – two very prestigious awards for which I am honoured to have received.



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**Linda Dennis & Ket**

## biography – anne fowler

Anne Fowler graduated from Veterinary Science at Sydney University after completing an Honours year investigating Vitamin D Metabolism in Marsupials.

She then worked as a veterinarian in the Hunter Valley where she became involved with wildlife through Native Animal Trust Fund.

When Anne moved to Victoria, she obtained a wildlife shelter permit and began teaching about wildlife care to foster carers and shelters. Anne teaches on wildlife care to carer groups throughout Australia while working as a veterinarian with an interest in birds, pocket pets and wildlife.

Anne is the author of **the veterinary guide**.



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# the care guide



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## **linda dennis**

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**Animal Diversity Web.**

[http://animaldiversity.ummz.umich.edu/site/accounts/information/Notomys\\_alexis.html](http://animaldiversity.ummz.umich.edu/site/accounts/information/Notomys_alexis.html)

**P&K Pets**

[www.pkpets.com/files/Info%20Sheet%2006%20-%20Hopping%20Mice.pdf](http://www.pkpets.com/files/Info%20Sheet%2006%20-%20Hopping%20Mice.pdf)

# general biology and development



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## taxonomy

### Other names:

Brown Hopping Mouse, Northern Hopping Mouse, Dargawarra (indigenous name).

### Nomenclature:

|             |                               |                                   |
|-------------|-------------------------------|-----------------------------------|
| PHYLUM      | Chordata                      |                                   |
| CLASS       | Mammalia                      |                                   |
| SUBCLASS    | Eutheria (placental mammal)   |                                   |
| ORDER       | Rodentia                      |                                   |
| FAMILY      | Muradae                       |                                   |
| GENUS       | <i>Notomys</i>                | "Alexandria Downs southern mouse" |
| SPECIES     | <i>alexis</i>                 |                                   |
| COMMON NAME | <b>Spinifex Hopping Mouse</b> |                                   |

Rodents, order rodentia, are a highly diverse group of mammals, comprising over 2000 species in 28 families (Jackson, 2003). The Australian native animals included in the rodent group are bush rats, water rats, melomys, swamp rats, tree rats, plains mice, desert mice and hopping mice.

## identification

Head and body length      95 to 112mm (average 102mm)  
Tail length                    131 to 150mm (average 137mm)  
Weight                            27 to 45 grams (average 35 grams)

Sexes are similar in appearance. Uniform light brown or chestnut coloured fur above; grey-white below. Grey coloured around muzzle and between eyes Long, narrow ears and large almond shaped eyes. Long tail sparsely furred and pink tinged, brush-tipped end. Small front limbs. The long hind feet distinguish the hopping mice from other Australian rodents. It is a little larger than the common house mouse.



**Spinifex Hopping Mouse**



**showing brush-tipped tail**

© Roz Holme(7)



**Black Rat**



**House Mouse**

© Sonya Stanvic (8)

## distribution



(9)

Prior to European settlement, there were nine species of hopping mouse living in Central Australia. Today only four remain, some of which, including the Spinifex Hopping Mouse, are still relatively common.

The Spinifex Hopping Mouse occurs throughout most of the arid zone of Central and Western Australia.

Numbers fluctuate extensively during the year; a lower number in dry conditions with population explosions after good rain. The population may also grow after fire when new shoots appear. Often after explosion periods there is a massive crash rate due to food die back when mice starve.

During population explosions, often associated with plagues, the Spinifex Hopping Mouse can become a problem for humans. During the 1975 plague several hundred were reported being seen by spotlight. It was also reported that they would enter campsites and steal scraps of food (Watts and Aslin, 1981).

There are three known subspecies of the Spinifex Hopping Mouse; *Notomys alexis alexis* is found in Western Australia and the Northern Territory; *Notomy alexis regina* is located in a small area of Queensland; and *Notomys alexis everardensis* is located in the north-west of South Australia.

## habitat

The Spinifex Hopping Mouse inhabits the arid interior among spinifex hummocks in sandy flats and stabilised sand hills, loamy mulga and melaleuca flats.

During dry seasons the mouse occupies dryer sandy land, however they do tend to branch out into other types of lush habitat after rain, coinciding with population growth.

The mouse tends to avoid the heat of the day by sheltering in deep, humid burrows, which extend around 1 metre below the sand surface. A typical burrow consists of a large nest chamber lined with leaf litter, twigs, etc. There are several vertical shafts leading to the surface. Burrow entrances are generally concealed under clumps of grass.

## activity

At dusk the Spinifex Hopping Mouse ventures out of its underground burrow to browse. Each individual moves off independently a few hundred metres from the burrow.

When in slow movement the mouse manoeuvres on all four feet, however at high speed (eg: when startled) the mouse will bound on its rear legs like a kangaroo. The body is projected forward in this motion and the tail trails behind at a horizontal angle.

An individual can migrate up to 15 kilometres during good seasons which offer greater dietary choice.

Interestingly, during the hotter seasons when temperatures rise in the burrow, the Spinifex Hopping Mouse can rise its body temperature so that the surroundings feel cooler.

The Spinifex Hopping Mouse can't sweat because it has no sweat glands so most activity is during cooler periods of the day.

## diet

The diet of the Spinifex Hopping mouse is quite varied, making it an omnivore. Its natural diet consist of new shoots of plants, seeds (interestingly, the mouse drills into the seed extracting the softer contents), leaves and invertebrates.

The mouse takes most of its water intake from the food it eats and can go for long periods without drinking fresh water.

The Spinifex Hopping Mouse is one of natures best water conversationalist. Its urine is the most concentrated of any Australian mammal and the kidneys waste very little water.

## reproduction and development

The gestation period for the Spinifex Hopping Mouse is approximately 32 days.

Reproduction can be at any time throughout the year, but more often in spring. Up to six young can be reared on four teats, however an average litter is from three to four individuals.

The Spinifex Hopping Mouse is a eutherian mammal, meaning it is a placental mammal. It does not have a pouch and therefore is not classed as a marsupial.

Male hopping mice are unusual in the fact that they have minute testes, about one tenth the average size of other mammals with equivalent body mass. The penis is also different to most mammals as it is a thin shaft with large spines. The female has a very narrow vagina with strong muscles and these two features lock male and female together during copulation. Copulation can be a violent struggle, the female sometimes biting the male.

Although females can mate with multiple partners (the species is recognized as being promiscuous), no obvious male competition occurs. In captivity, females have been observed mating with more than one male during a single estrous cycle. When the paternity of the litter was tested, all the young were found to be from the same male (Hyde and Elgar, 1992).

The young are pink and sparsely furred, the weighing about 3 grams when they are born. It takes about 15 days for the ears to open and 20 days for the eyes to open. The young are cared for and nursed in the nest by the mother until weaning occurs at about 28 days (Watts and Aslin, 1981). Both mother and father retrieve young that wonder from the nest.

As the mouse consumes very little fresh water the mothers milk is also very concentrated. To assist in milk production the mother drinks the urine of her young.

Sexual maturity is reached at 60 to 70 days.

## skeletal

The Spinifex Hopping Mouse is a vertebrate. Skeletons that define vertebrates consist of cartilage or bone, or sometimes both. Fish, amphibians, reptiles, birds and mammals are all vertebrates.

The skeleton supports the animal during growth, and for this reason vertebrates grow to much larger sizes than invertebrates. The skeleton consists of a skull, the vertebral column and in most cases, two set of limbs (forelimbs and hindlimbs). Snakes are an example of vertebrates without two sets of limbs, and whales are an example of vertebrates without one set of limbs.

*continued over page*



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Most vertebrates share common bones, for example the femur, shinbones, foot and digits in the hindlimbs and the humerus, radius, ulna, wrist, hand and fingers in the forelimbs; and a pelvis.

## teeth



© Michelle McFarlane / Museum Victoria  
(11)

The incisor teeth of rodents grow continuously throughout life, a process called *aradicular* (Wikipedia). Unlike human teeth, the rodents teeth continually produce enamel and need to be worn down by grinding and gnawing on solid surfaces such as wood.

The teeth have enamel on the outer side and exposed dentin on the inside (Wikipedia), so they self sharpen.

Rodents lack canines but have incisors to form the cutting edge and premolars to grind food. There is a large space in between and it is thought that this space is used to rearrange food in the mouth with the tongue.

## social structure

The Spinifex Hopping Mouse is thought to live in family groups, although the social structure of the mouse in the wild is not truly known.

Early observations of wild Spinifex Hopping Mouse indicate that there was a family structure, however more recent findings indicate that the species is more solitary than first thought and that group activity may be impacted by abundance of food.

## longevity

It has been recorded that in captivity the Spinifex Hopping Mouse can live as long as three years, although there are some cases of individuals living for up to five years. It is considered that they would live for a much lessor period in the wild however, maybe one year or less.

## predators

The main predators for the Spinifex Hopping Mouse are feral cats, dingoes, foxes and Birds of Prey.

## conservation status

Common, wide spread and at low risk.





© Roz Holme (12)

## golden rules of rescue

### **YOU – SAFETY FIRST** **THE MOUSE – WARMTH, DARKNESS, QUIETNESS**

Before you rescue an injured, sick or orphaned animal you need to assess the situation and ensure that YOU will be safe. For example; if there is an injured animal on the road, before you rush out to collect it assess the situation and make sure you will not be hit by a car.

Any native animal that comes into care (at any age) will be highly distressed, and it may also be in shock. Distress and shock can lead to serious illness or even death.

Keep the animal warm, but within the advisable temperature range (See **temperature** section in the **caring for spinifex hopping mice** chapter for the correct temperature.).

Enclose the animal so that it is in the dark, this will calm the animal down and stress levels should be reduced.

Place the animal somewhere quiet. While driving in the car don't play the radio and try to keep any children or domestic animals quiet. If possible it is better to leave children and domestic pets at home while you rescue any native animal.

## rescue kit

- 👣 A heat source - EG: a hot water bottle (filled with hot water only – not boiling , and wrapped in a towel), grain filled bag or something similar
- 👣 Thermometer for checking temperature. Place probe near the animal and place the thermometer unit where it can be easily seen. See **temperature** section in the **caring for spinifex hopping mice** chapter for the correct temperature.
- 👣 Scissors
- 👣 Antiseptic, such as Dettol
- 👣 Pouches, liners, bags and blankets of assorted sizes
- 👣 Torch
- 👣 Milk replacer
- 👣 Electrolyte fluid, such as Vitrate or Glucodine
- 👣 Bottles and teats
- 👣 Syringes
- 👣 Disposable gloves
- 👣 Paw paw ointment (a great natural wound cleaner and healer)
- 👣 Wet Ones (alcoholic hand wipes to clean your hands after rescue)
- 👣 Safety pins (to pin pouch liners together)
- 👣 Vet wrap and assorted bandages



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## handling technique

**Beware** of teeth and claws of the Spinifex Hopping Mouse. While claws may cause surface injury only, scratches may become infected. Teeth are sharp and a distressed animal may bite very hard.

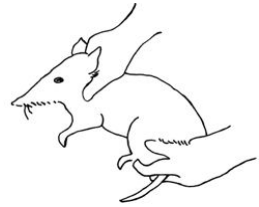
**To Capture** scoop the Spinifex Hopping Mouse inside a small bag, eg: a pillowcase.

**To Handle** a Spinifex Hopping Mouse, encircle in one hand, pinning down forelimbs with fingers.

An alternative handling method is one that can be used on any small native mammal. Hold the mouse by the back of the neck with one hand and place the other under the rump of the animal for support. This method may be difficult as Spinifex Hopping Mice are quite small, however there will be less likelihood of the mouse biting your hand.



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**To Transport** a Spinifex Hopping Mouse for short distances place it – while still inside the bag – into a box. For longer distances the mouse can be placed directly into the box, making it more comfortable for the journey. Ensure that the box is not too big. Place soft material or wood shavings on the floor of the box so the mouse doesn't slip around during transport. Water and food should be offered on long trips (over two hours).

If gloves are being worn to handle a Spinifex Hopping Mouse the handler must keep in mind that the tactile sense is greatly reduced and needs to ensure that the animal isn't being held too tightly.

Be very careful to not capture the mouse by the tail as this may result in "de-gloving" where the fur and skin will be stripped away. The tail will then die and drop off and it will not grow back.

For animal kept in permanent captivity regular gentle handling of young will enable easier handling when mature. This will also produce young that are less likely to become distressed by handling. Day time capture is often the best time as mice are generally sleeping.

## assessing injury

The first rule of assessing injuries is to look for blood and if there is any, to stop the flow. This can be done by applying pressure to the area either by pressing down with your fingers or binding the area with a bandage.

Once any blood flow is stopped then you can assess the animal for any other injuries such as open wounds, bruising or breaks to bones.

If a break is found on a limb then try to immobilise it by using a splint and bandage. Don't place the splint directly on the animal's flesh as it may cause skin injury. If you can, try to wrap the splint in cloth before placement. If a break is found on the body try to immobilise the animal as best you can and seek appropriate help.

Severe injuries on a wild native animal are often very difficult to treat, for instance a compound fracture (bone is piercing flesh). Also many adult native animals tend to become very stressed while in captivity and could die from distress. As wildlife carers we must keep in mind that we cannot save all animals, and in some situations it is kinder to humanely euthanase an animal in this condition. Most veterinarians will euthanase a wild native animal at no cost.

For information on **Small Animal Euthanasia at Home**  
please visit [www.alysion.org/euthanasia](http://www.alysion.org/euthanasia)

# hydration



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## checking hydration

It is vitally important to keep a Spinifex Hopping Mouse of any age adequately hydrated - and this means with water and not milk formula. De-hydration can cause all kinds of problems including constipation and - at the more extreme end - problems with internal organs.

There are a couple of ways to check how hydrated a mouse is. The pinch test will show if the mouse is 10% de-hydrated or over. If the mouse shows signs of being de-hydrated in this range it will require sub-cutaneous injection immediately.

To check if the mouse is dehydrated 10% or over gently pinch the skin on the back of the neck, pull the skin slightly upward (like a tent) and let go. If the skin goes back down straight away the mouse shouldn't need sub-cutaneous fluids but it will still require some oral electrolyte fluids like Vitrate, Lectate or Glucodine. If it takes a few seconds the mouse will require sub-cutaneous injection (see **sub-cutaneous injection** section in this chapter for more information).

However it is at the 10% de-hydrated mark where problems start to occur, and this is what we want to avoid. It is better management practise to *continually* check that the mouse is hydrated sufficiently and this can be done using a very simple technique.

Using your (clean) finger gently rub along the gum line. As rodents can bite hard this technique can only really be performed on a small mouse or one that is used to human contact. Remember that your safety always comes first so only perform this technique when you are confident that you can handle the mouse without being bitten.

If the gum feels tacky the mouse is approximately 5% dehydrated and will require oral re-hydration. If the gums feel slippery the mouse is adequately hydrated.

If you don't have an electrolyte fluid such as Vitrate or Lectate (both available at most vet clinics) or Glucodine (available from supermarkets and chemists) then the following recipe can be used:

1 cup of tepid water (not cold, not hot) – *use pre-boiled water*

1 teaspoon of sugar

a pinch of salt (add until you can just taste the salt)

Offer as much fluid as the mouse will take via a bottle, syringe, bowl or water dripper (depending on the age) – if using a bottle or syringe do not force the fluid into the animals mouth as it may enter the lungs. If you are offering too much the mouse may get soft poo which can turn into diarrhoea, so adjust accordingly.

It is very important to remember that you should not feed a mouse any milk replacer or solids until it has been re-hydrated appropriately and is warm (see **temperature** section in **caring for spinifex hopping mice**), as the food will not be digested properly and can cause illness or disease.

## offering water as part of a healthy diet

In the wild Spinifex Hopping Mice drink very little water. However, in captivity mice don't have the extent of resources available to them that they would normally have in the wild. For example, a thirsty wild mouse may travel some distance to find water but in captivity they don't have this luxury. Therefore it is imperative that captive Spinifex Hopping Mice have access to water at all times.

**Remember!** that milk replacer is **food** and is not considered as a hydrating substance.

For smaller mice water can be offered in a bottle between milk feeds. When offering water to a furless or just furred mouse you should always use pre-boiled warm water as their immune systems are not developed and they cannot tolerate any contact with bacteria. Once the mouse is fully furred its immune system should be properly developed and can cope with bacteria that may live in water, so the water doesn't need to be boiled. If the mouse is unwell however it may then have a



compromised immune system and you should use pre-boiled water. See **the unwell mouse** for more information.

A larger mouse should be offered fresh water in a bowl or water dripper.

Rain water is best to use – after all this is the water the mouse will be drinking when in an outside enclosure or later if released. It is a good idea to introduce rain water - or water from a dam or stream at the enclosure / release site - into the mouse's diet before you move it outside so that it can be monitored for any reactions.

As town water is chemically treated it may be advisable to continue boiling the water if you don't have a tank to collect rain water or if you cannot source water from the release site.



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Chemicals in treated water can be eliminated by leaving the water in full sun for 24 hours.

## increasing water intake during diarrhoea

Diarrhoea in any animal is often a sign that something is wrong, for example; a bacterial infection or distress. It can also mean that the animal has eaten something bad and has an upset belly.

Nevertheless, a bout of diarrhoea will compromise the animal and it should never be ignored. If diarrhoea is left unchecked the animal will lose energy and may become even sicker.

It is the job of the carer to sift through the history of the animal and this is where record keeping is so important to try and determine the reason for the diarrhoea. See **keeping accurate records** in the **caring for spinifex hopping mice** chapter for more information

The first step when an animal is suffering diarrhoea is to re-hydrate it. There are several electrolyte solutions available including Lectate and Vitrate, both available from most veterinary clinics. Alternatively, Glucodine can be used, which is available from most supermarkets. If these products are not at hand a mixture of water, sugar and salt can be used. See **checking hydration** for further information.

Peptosyl or Koamagma can be offered during bouts of diarrhoea. These products will help firm up the poo and will also line and sooth the gut. Keep in mind, however, that it is best to find the cause of the diarrhoea and not to just treat the symptoms. Some vets don't advocate diarrhoea suppressants as the poo is being hastily evacuated for a reason and it should not be suppressed. However, it is the carers choice (based on the needs of an individual animal) if these products are to be used. Peptosyl is available from vet clinics and Koamagma is available from chemists.

At the first sign of diarrhoea, the gut should be rested for around 24 hours. It is recommended that you reduce **but not cut out** any milk intake totally during this time as the animal will need energy to recover. Offer the electrolyte solution in place of a normal milk feed. Don't offer too much water though as this may flood the gut and contribute to the diarrhoea. A rough guide is to offer the animal approximately 20% of its body weight in fluid.

**Remember!** diarrhoea should never be ignored. If the animal isn't showing signs of improvement by the third day it will need veterinary attention as soon as possible. Use your judgement however; for example, if the animal is worse by the second day get it to the vet quicker.

## sub-cutaneous injection

Sub-cutaneous injection is a skill set that all wildlife carers should have, particularly if the carer lives remotely. There are occasions when this procedure is critically needed and realistically most carers do not have access to a vet 24 hours a day, 7 days a week.

**However, performing sub-cutaneous injection can be a particularly distressing procedure – for both the animal and the care giver. It is recommended that you only attempt to perform this task if you are experienced or are ultra confident that you can do the job without hurting the animal. If done incorrectly the animal may be in pain.**

**Ideally, administering sub-cutaneous fluids should only be attempted if you have assisted a veterinarian or a vet nurse, have been trained to perform an injection or have witnessed it being done on several occasions. If you do not feel confident you should not attempt the procedure and should take the animal to a vet clinic as soon as possible.**

PRACTISE, PRACTISE, PRACTISE! Before you attempt to perform sub-cutaneous injection on a live animal learn how to do it by practising on as many dead animals as you can and by assisting your vet. **Remember!** dead animals don't feel a thing – and it is better to learn and make mistakes on them rather than on a living animal.

Always listen to your vet. Your vet has been through training to learn how to perform sub-cutaneous injection. If he / she does not think you are capable of performing sub-cutaneous injection then don't! You may end up doing more damage than good.

Allow your vet to guide and train you in the procedure. Offer to help your vet perform sub-cutaneous injection as often as you can. It is also a good idea to ask your vet to critique your technique.

It is recommended that you do not try any other re-hydration techniques (for example, a drip). These methods can be very difficult and ought to be performed by a qualified veterinarian - or you should seek extensive training in the procedure.

### The procedure:

The best sites to inject sub-cutaneous fluids are the folds of skin around the base of the limbs. When giving sub-cut fluids you will need to distribute the fluid over 4 sites. Do not inject the fluid into one area as you will end up with a massive balloon of water, which will do more damage than good.

The fluid to use for sub-cutaneous injections (in most cases) is Hartmann's Solution. The general rule for the amount of sub-cutaneous fluid to be injected is 10% of the animal's body weight. The fluid must be at room temperature – not cold and not hot. Hartmann's can be purchased from veterinary clinics or alternately you can approach hospitals to see if you can have used bags, as one bag can only be used for one human procedure and is then generally discarded. If you advise what you are using it for they may give you a bag free of charge.

If the animal is very flat and has no energy then a glucose solution can be mixed with the Hartmann's. The ratio of glucose to Hartmann's is *very* specific and if given incorrectly may result in severe complications. For this type of re-hydration you ought to take the animal to a veterinarian as soon as possible.

To administer sub-cutaneous fluids you can use a syringe needle, however you need to ensure that the animal is very well restrained during the procedure. If the animal moves, the needle, being inflexible, will not move with the animal, and the needle could push further into the body and either snap off or pierce organs, etc.

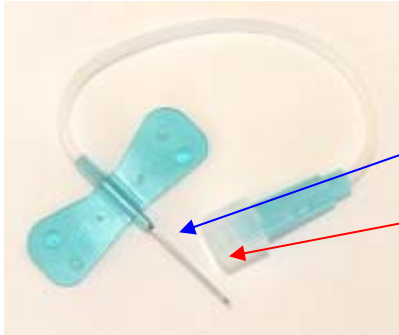


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The size of the needle used for sub-cutaneous injection is different for different species of animal. Generally, smaller needles are best. However, to find out the best sized needles to use consult your vet or an experienced carer.



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A winged infusion set is an excellent option for administering sub-cutaneous fluid.

**The needle of the set** is inserted into the appropriate area of the animal and taped to keep in place.

**The needle of the syringe**, filled with Hartmann's solution, is inserted into the plug at the other end.

This method is ideal, for if the animal moves, the tubing of the set will move with it and the needle will not be pushed in further.

Sub-cutaneous injection should not be performed on an individual more than once a day.

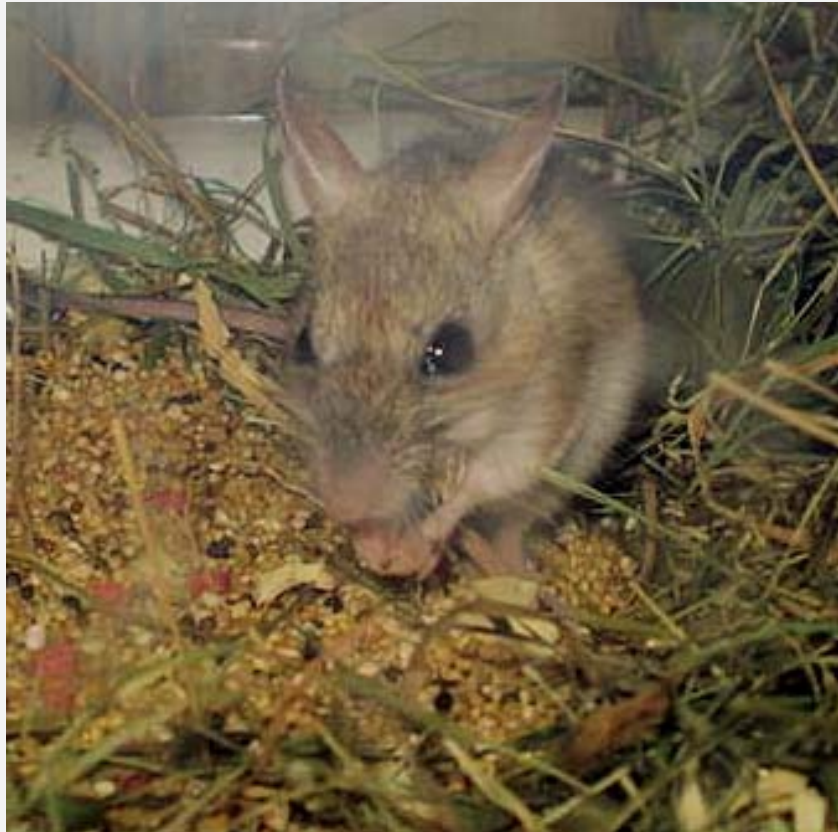
**Remember!** this procedure can be quite distressing for the animal and prolonged or continued exposure may result in severe distress.

**Remember! to never rush sub-cutaneous injection.** Make sure your work area is quiet, that the animal is securely wrapped and not stressed and then take your time.

#### **The bottom line:**

**If you are not confident, are inexperienced or rush a sub-cutaneous injection damage can be done and may be severe.**

## caring for spinifex hopping mice



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## keeping accurate records

Keeping accurate records is an essential management tool when caring for any native animal.

**There are several reasons for this:**

**Keeping a well documented history will help you if anything goes wrong with the animal while it is in care.** If an animal becomes unwell you can go back through your notes to find out if there is a change in diet, sleep patterns, poo, etc.

**Vets appreciate a good history of any animal that is brought in for a consult** – the more you can tell them the easier it is to diagnose an illness, disease or problem.

**You can ascertain that the animal is gaining weight according to progression charts.** Although progression charts are an indicator only (each animal is individual and there may be healthy variations from the chart), they give you an excellent idea of where an animal should be at a particular age.

**Keep as much detail as you can. Examples of information that can be included in your records are:**

**Date of entry** so that you know when an unusual occurrence or a change has happened.

**Type of entry** – eg: **MEDICATION, WEIGHT, POO CHANGE, MILK INCREASE.** Entries are colour coded as it is much easier to retrieve relevant information when needed quickly.

**A description of what the occurrence is** – eg: *mouse has soft poo today. Soft and "toothpasty" although not watery. May be due to increased fruit intake?*

Milk intake, poo and mood changes are probably the most important record to keep and should be noted daily. Consider keeping a daily record of this information even if you are a bit forgetful to record other information regularly – this alone will be able to help a veterinarian make a diagnosis if the animal becomes ill. The table on the next page is a good example of a daily record.

**How to use the POO & MOOD section:**

Circle the appropriate entry after each poo.

**Yellow**      **Brown.** Poo Colour is important when trying to identify some illnesses. Green poo can be marked in between the other entries.

**Scours**      **Firm.** If the animal is scouring you know that something may not be right with it. On one extreme it could tell you that the animal is sick, or on the other extreme the formula is too watery or too much of one food type (not so serious, but still requiring changes to the animal's care / routine). Soft poo can be marked between the two other entries.

😊      😐      ☹️. This is the mood indicator. Smiley face is good – the animal is happy. The second would show that the animal is so-so, not in a great mood, but not distressed. The unhappy face would be used if the animal is distressed or lethargic.

*So, if the animal has yellow poo, has the scours and is in an unhappy mood you know to get it to the vet ASAP!*



## equipment for feeding young

You will need to have the following equipment to feed a baby Spinifex Hopping Mouse:

**Milk formula** of carer's choice (see **milk formula** in this chapter for more information).

**Teats** (see **teats and holes** in this chapter for more information).

**Syringes and droppers.** Spinifex Hopping Mouse babies are very tiny may not take a teat. Syringes or droppers can be used successfully.

**Catheters** (in replacement of teats). These can be placed on the end of a syringe and placed into the mouth (remove needle and cut catheter plastic to size).

**Probiotics and Impact.** See **probiotics** in this chapter for more information.

**Cloths** to wipe up spills. Chux clothes are ideal as they are soft and ultra absorbent. Cut one Chux into four for handy sized wipe cloths. Soft toilet paper or tissues can also be used (but are not so environmentally friendly). Don't use paper towel as it is too abrasive on fragile cloaca's. (See **toileting** in this chapter for more information on how to toilet an animal after feeding).

**A container with warm water.** Some animals take a long time to drink (and this is the way it should be) and the milk can cool, use the warm water to warm up the milk again.

**A towel to place over your lap.** Feeding baby animals can be messy – they can also wee and poo while drinking!

## milk formula

There are several good milk formulas that can be used for Spinifex Hopping Mice. The formulas are all low in lactose and have the required vitamins and minerals for a growing animal. Most carers have a favourite milk formula, however it is up to each individual carer to find out which product works best for them and the animals in their care.

**Remember!** that Spinifex Hopping Mice are lactose intolerant so cow's milk should not be offered, and this includes powdered and skim milk. Offering a mouse cow's milk, even for short term periods, can make the animal ill.

A baby Spinifex Hopping Mouse will continue to take milk until it is approximately 30 to 40 days old. Of course, each individual animal is different, some may wean earlier than others, but it is important not to forcefully wean too soon (see **weaning** in this chapter for more information).

It is important to remember that milk replacers are **food** and not used to keep an animal hydrated. Always have water available for older animals to drink and offer water in a bottle or syringe to smaller animals (see the **hydration** chapter for more information).

Available milk formulas and distributors are listed on the next page (in alphabetical order of product name). Formulas can be purchased at most veterinary clinics and farm produce stores.

## Biolac

Biolac has three milk formulas that can be used for Spinifex Hopping Mice.

**M-100** is used on furless animals.

**M-150** is a transitional milk and used on animals when dense fur has developed.

**M-200**, which contains elevated lipids in the form of canola oil, is used on animals that are producing solid, dark pellets (poo).

Manufacturers for Biolac

Biolac  
PO Box 93  
BONNYRIGG NSW 2177  
Phone / Fax: (02) 9823 9874  
Website: [www.biolac.com.au](http://www.biolac.com.au)

## Di-Vetelact

Di-Vetelact milk, made by Sharpe Laboratories, is a universal milk formula and can be offered to all Australian mammals and also to farm animals and domestic pets.

Di-Vetelact is offered according to the weight of an animal. The general rule when offering Di-Vetelact to a native animal is 10% of body weight to survive and between 15% and 20% to thrive. This is, of course, while the animal is totally dependent on milk (furless and just furred) – once the animal is eating solids the quantity should be slowly reduced (see **weaning** in this chapter for more information).

Start on Dilution A and increase consistency slowly. Not all animals will tolerate Dilution B and it may cause constipation or diarrhoea – so adjust accordingly.

Manufacturer details for Di-Vetelact

Sharpe Laboratories  
Animal Health Division  
12 Hope Street  
ERMINGTON NSW 2115  
Phone: (02) 9858 5622  
Fax: (02) 9858 5957

## Wombaroo

Wombaroo Food Products make two milk formulas that can be used on Spinifex Hopping Mice.

**Stage <.4 (under point 4) Kangaroo Milk** can be used on mice that are completely furless with pink skin, eyes closed and ears drooped to erect.

**Stage .4 (point 4) Kangaroo Milk** can be used on mice from furless to fine fur, eyes are open and ears are erect through to weaning. Stage >.6 (greater than point 6) Kangaroo Milk is not recommended as it may cause constipation in Spinifex Hopping Mice.

**Passwell Formula One** is a universal milk supplement that can be offered to all Australian mammals and to domestic pets such as kitten and puppies. This formula is offered at 5% of body weight. The manufacturer suggests the total milk required be fed over 4 feeds a day.

Manufacturer details for Wombaroo

Wombaroo Food Products  
8 Oborn Road  
MT BARKER SA 5251  
Phone (08) 8391 1713  
Website: [www.wombaroo.com.au](http://www.wombaroo.com.au)

## Considerations when choosing milk formulas:

**To date there is no published data on changes in milk composition in Spinifex Hopping Mice.**

**Cow's milk** is not recommended for feeding native mammals as the milk has too much lactose, which many native mammals are intolerant to. Lactose is poorly digested in native mammals and feeding cow's milk results in diarrhoea and other symptoms. See **Australian Mammals Biology and Captive Management** for scientific research into the use of milk formulas for mammals.

**When using the Wombaroo formula** it is important to follow the manufacturers recommendations regarding mixing up the formula. A too strong consistency may cause constipation and a too water consistency may cause diarrhoea.

**With Wombaroo** you must ensure that you are giving extra water in between milk feeds. Wombaroo is a very thick formula and little hydration is received from the product. By not offering water problems may occur, like cystitis.

**Wombaroo gives better growth rate and hair quality** than any other milk formula (Jackson, 2003).

**Biolac and Di-Vetelact offers more freedom** for the milk quantity offered to an animal. It is considered by many that these may be better products for new time carers who haven't quite got the gist of the importance of Wombaroo accuracy. The quantity offered to animals can be increased or decreased without problem.

**If using Di-Vetelact** you may not need to offer as much water in between milk feeds, as with Wombaroo. The formula is watery and adequate hydration may be received from the milk formula alone. Ensure that you constantly keep checking on hydration, however, and offer water appropriately. See the **hydration** chapter for information on how to assess an animals hydration status.

**As Di-Vetelact is a very watery formula** it can sometimes cause diarrhoea in an animal, especially when Formula A is being used. Adjust the mixture accordingly.

**Di-Vetelact should not be mixed to a stronger consistency than Dilution B** as this may cause constipation in the animal.

**If using Di-Vetelact**, buying a 5kg tin direct from the manufacturer will save you considerably. A 375g tin from stores costs around \$15. Buying in bulk will cost the equivalent of \$7 to \$8 for a 375g tin.

**Biolac is offered based on a combination of age and weight and Di-Vetelact is offered based on weight.** It is important to remember however, that the recommended quantity to offer is for an animal that is totally dependent on milk (furless or just furred). As an animal starts to eat solids the quantity should be slowly reduced (see **weaning** in this chapter for more information).

**According to CSIRO research, Biolac milk contains more lipid concentrations** (higher energy) and is closer to that of natural milk. Late lactation animals receive more "total energy" from Biolac milk than any other formula. (CSIRO. Jackson, 2003).

**Biolac is more readily digested** than any another milk formula due to the ingredient galacto-oligosaccharides (special sugars) which are similar to the sugars found in natural marsupial milk. Therefore, using Biolac is likely to result in fewer problems such as diarrhoea. (CSIRO. Jackson, 2003).

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**Remember!** to always *transition* between milk formulas. This includes when moving through the different composition formulas of Biolac and Wombaroo, or if swapping an animal from one product to another.

**An example of a transitioning** (from Di-Vetelact to Wombaroo):

**80%** of Di-Vetelact to **20%** of Wombaroo

Offer for approximately 3 days \*

*eg – if the animal was taking approximately 10mls per day you would mix 0.8mls of the Di-Vetelact formula to 0.2ml of the Wombaroo formula.*

**50%** of Di-Vetelact to **50%** of Wombaroo

Offer for approximately 3 days

**20%** of Di-Vetelact to **80%** of Wombaroo

Offer for approximately 3 days

**On the tenth day**, and until the animal is weaned, you would offer 100% of Wombaroo.

\* 3 days is a guide only, it is up to the carer to determine transition period based on the animals needs – some may require more time on each transitional stage.

## probiotics

Regardless of the milk formula you choose it is recommended that probiotics be used as a general management tool every day - this is advice offered by Dr Anne Fowler BVSc, MACVSc (Wildlife Health and Conservation Centre).

Dr Fowler, who is experienced in the care of wildlife, suggests that probiotics, such as those listed below, should be added to milk formulas daily and not just when the animal is ill. Using probiotics daily will *reduce* the chances of the animal becoming ill with a bacterial infection. **Remember!** that each animal is different and a probiotic that works well on one mouse may cause problems with another – so adjust accordingly.

**There are several good probiotics formulas to choose from:**

**Protexin** is wonderful mixture that increases gut flora. It comes in a liquid or powder form which can be added to milk (after the milk has been heated) or the liquid can be given directly by squirting into the mouth. It is very pricey however – approximately \$60 for a 125ml bottle with a pump.

**Inner Health** and **Inner Health Plus** are “human” probiotics that have been used very successfully in native mammals. There are dairy free options (no lactose) that come in powder form in a 50g jar, costing around \$30. A tiny pinch is all that is required in each milk feed (add after milk has been heated). Inner Health and Inner Health Plus can be purchased from most chemists and health food shops.

**Yoghurt** is a probiotic derived from cow’s milk. Quantities depend on carers preference and the animals age. Use natural un-flavoured yoghurt only **Remember!** that native mammals are lactose *intolerant* not lactose *resistant*, so the low levels an animal will receive from yoghurt or other probiotics derived from cow’s milk will not affect it.

**Yakult**, is another “human” probiotic that can be used successfully. Quantities depend on carer’s preference and the animals age. A recommended mixture is 1 bottle of Yakult per litre of milk, alternatively ½ a bottle of Yakult can be mixed with one litre of milk.

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**Acidophilus powder** is another good source of probiotic which is not derived from cow's milk. Again, quantities depend on individual carer's preference and the animal's needs. For a furless or just furred mouse a tiny pinch is all that is required per milk feed. For a furred mouse around 1/8 of a teaspoon can be added to the milk. Acidophilus can be purchased from most chemists and health food stores.

## milk additives

Generally, other milk additives are not required if using milk formulas correctly, although some carers do like to add different elements for extra nutrition, vitamins or minerals. This is a personal choice for each carer.

### Some additives include:

**Wombaroo Impact** is a colostrum powder that is considered by many as an essential milk additive for furless or just furred native animals to boost the immune system. It can also be used for an unwell animal that may have a compromised immune system. See the leaflet included in bottles of Impact for directions.

**Heinz Baby Cereal Powder** or **Farex** can be added to Di-Vetelact formula for added nutrition but should only be started once the animal has its eyes open and ears are starting to detach from head. Spinifex Hopping Mice are rather fond of Farex.

**Olive or Canola Oil** is used to keep the coat shiny and in good quality. Only a drop per bottle is needed.

## water used for making milk formula

When mixing up milk formula you need water. Simple? Well, did you know there is water, and then there is water?

When mixing formula for a furless or just furred mouse you will need to use pre-boiled warm water. Pre-boiling is essential as animals of this size have no immune system, or a weak immune system. The bugs that normally live in water - which humans are used to - can cause illness in a furless or just furred mouse as their immune systems are not strong enough to cope. It is for this reason that you must use pre-boiled water when making up formula.

As the mouse grows older, usually when a good covering of fur is coating the body - and its immune system grows stronger - you may not need to continue boiling the water before use. It depends on the animal however, if you have a mouse that seems a little fragile and is experiencing soft poo then you should continue boiling the water before use.

It also depends on where you live as to when you should stop pre-boiling water. If you live in town where the water is normally heavily treated for human consumption then it may be better to continue boiling water until the mouse is fully furred and has a strong immune system. However, if you live out of town and are using tank water - rain water - then you may be able to stop pre-boiling water sooner.

However, use your common sense. If you are experiencing any problems with your mouse and you think it may be caused by the water you're using, continue pre-boiling until the animal is settled.

**Handy Hint!** - chemically treated town water can be left outside in a bucket for a period of 24 hours which will break down any additives and leave the water fresh and chemical free.

## teats and holes

### Different types of teats:

When choosing a teat keep in mind that the length of the latex teat should be a similar length to that of the animals mouth. A teat that resembles the mother's teat should be used for the animals comfort, fit and tooth eruption. However, it is up to each carer to assess what is best for each individual animal.

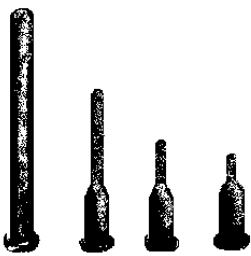
**There are several companies that make good quality teats for native animals, including the following** (in alphabetical order):

**Biolac** recommends the T4 teat for very small native mammals.

To see the range of latex teats by Biolac go to their website [www.biolac.com.au](http://www.biolac.com.au).



© Biolac (21)



Syringe Teats  
SK VSM SVSM ESP  
Fit snugly on the end of a syringe. Ideal for turtles.

© Australian Wildlife Supplies (22)  
**Bush Baby teats**

**Bush Baby Teats** also make teats that can be used for Spinifex Hopping Mice which fit nicely over syringes or droppers. Bush Baby teats are available from Australian Wildlife Supplies. [wildlifesupplies@bigpond.com](mailto:wildlifesupplies@bigpond.com).

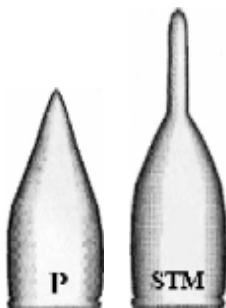
**Wild Baby Teats** provide a range of teats with some being suitable for feeding Spinifex Hopping Mice. For more information, contact Desleigh at [WildBabyTeats@bigpond.com](mailto:WildBabyTeats@bigpond.com).

**Wombaroo Food Products** make a range of special teats for native animals and there are two that could be used successfully on Spinifex Hopping Mice.

The "P" teat is for small mammals and the "STM" is for small in pouched marsupials but could also be used for Spinifex Hopping Mice.

Each individual animal is different however, and some may not take to a particular type of teat.

To see the range of latex teats by Wombaroo go to their website [www.wombaroo.com.au](http://www.wombaroo.com.au)



© Wombaroo (23)

### Making the hole in a teat:

Latex teats do not come with the hole already in them, so you will need to carefully make a hole in a teat before you use it. The hole needs to be very small so that the animal does not get the milk flow too fast which can cause inhalation pneumonia.

However, if the hole is *too* small, excessive sucking will quickly weaken the tip and the end will blow out. The hole should be large enough for milk to drip out slowly, when the bottle is held upside down.

With a sharp pair of nail scissors snip the top of the teat, about this size - .

Push a match stick up through the teat. The teat will stretch and snap to accommodate the match; push match all the way through. Ensure you are using normal sized matches and not the jumbo ones!

Use a very hot needle and push it through the top of the teat.

## Changing teats:

Teats should be changed regularly as animals often chew on the teat and holes become too big. Also, after time, the latex starts to break down and the teat becomes soft and squishy. Ensure that you are continually replacing old or damaged teats.

To prolong the life of latex teats store them in a dry place, away from light. An air-tight container is a good place to store teats.

Teats can be purchased through most veterinary clinics and produce shops.

## syringes and droppers

There are two types of syringes that can be used to feed small native animals – plastic and glass. Droppers can also be used and come in both plastic and glass as well.

The best types of syringe to use are made of glass. Plastic syringes are prone to sticking and this often results in an influx of milk flooding into the mouth as the syringe stem is pushed through the canister. This can result in inhalation pneumonia.

Glass syringes flow very smoothly, and you will often find that the gently sucking from the animal will be enough to move the stem of the syringe through the canister without having to push it.

The syringes come in a range of sizes which is great for different sized animals. The syringes shown at right are 20ml and 2ml.



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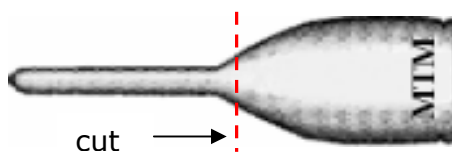
**Bush Baby** syringe teats are ideal to use when syringe feeding. They are made specifically for this purpose. The chance of the teat slipping off the syringe nozzle is greatly reduced.

A normal latex teat can be placed over the syringe nozzle as shown in the photo at right (wombat photographed). Push the long part of the teat over the nozzle; the remaining part that would normally be fitted over a bottle can be pulled up over the canister of the syringe.



© Carol Pullar (25)

Using this method is ideal as it will ensure that the teat does not slip off the syringe and become lodged in the throat of the animal.



© Wombaroo (26)

Alternatively, cut the teat end from the portion that you would normally fit over a bottle. You need to ensure a tight fit over the nozzle so that the teat does not slip off and get caught in the animals throat. You will also need to make sure there is enough teat left to get into the mouth of the animal.

## feeding young

There is definitely an art to feeding a native animal - it isn't always as easy as you may think. Not all animals take to feeding easily and it may take a while to get the mouse used to the new "human mum" feeding technique.

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The best way to feed a new animal is while it is still safe and snug in a pouch or blanket – this will give the animal a sense of security while feeding.

To feed a furless or just furred you will need to keep the whole body enclosed in the pouch with only its snout exposed. Cover the animals eyes by keeping the pouch material over its eyes or by wrapping your fingers around its face - this will help to keep the animal calm. You will find that as the animal gets comfortable and gets to know you as its new “mum” you will not have to cover them up as much.

There is no strict feeding positioning for an animal once it has been accustomed to being in care, as each animal is totally unique and each has a preferred feeding position. Experiment different feeding position with the animal until you can see which position is favoured by the individual in your care.

**Remember!** do not place an animal directly on its back while feeding as the milk may end up being inhaled, causing inhalation pneumonia.

Feeding an animal should never be rushed. The action of sucking not only feeds the animal, but also gives it a feeling of security.

## milk feeds a day

**Furless** .....every 3 to 4 hours around the clock.

**Just Furred** .....every 4 to 5 hours around the clock.

Spinifex Hopping Mouse develop very quickly and as such they tend to wean very quickly as well. Once fully furred milk can still be offered in a bowl for the mouse to lap at. A Spinifex Hopping Mouse is usually weaned at about 28 days.

**Remember!** do not feed a animal that has just been received into care directly from a rescue until it has been warmed first (see **temperature** in this chapter for more information). Ensure that you warm the animal slowly – it should take approximately 3 hours for the animal to reach the desired temperature.

**Remember!** to clean up any milk spills from animal and bedding. If the bedding becomes soiled with milk, wee or poo you should change it immediately. Soiled bedding and fur may cause bacterial infection.

The information listed above is a guide only. Keep in mind that each individual animal is different and you should adjust your feeding regime accordingly.

## utensil hygiene

A good hygiene system - for animals of all sizes – will help keep the animal disease or illness free. If good hygiene practices aren't adopted an animal can quickly become ill with bacteria infections; for example, thrush, which can do nasty stuff to the animals gut.

It is important that you always ensure you have good hygiene practices and thoroughly clean syringes, teats and other utensils after every feed.

**Following are recommended steps for a properly cleaned equipment, etc.**

**Rinse syringes, etc, under cold water first.** Cold water stops the protein setting and results in a cleaner syringe (Dooley, 2004).

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**Wash syringes, etc, using hot soapy water** - a simple washing up detergent will do, however Dettol Hand Wash has very good results. Hot water is recommended as it breaks down the fat component and bacteria that builds up on the syringes walls. (Dooley, 2004). Wombaroo milk formulas are particularly thick and bottle cleaning will need extra attention if this product is used.

**Thoroughly rinse after washing to remove detergent.** If using antibacterial agents, such as Dettol Hand Wash, any left over residue may build up and result in loss of gut flora (which may cause diarrhoea).

**Allow bottle to air dry before using again.** Utensils that are still wet may result in bacteria growth.

**When feeding a furless or just furred animal** it is essential to ensure your utensils are spotlessly clean. As mentioned in other sections in this chapter animals of this size have weak immune system and the gut cannot tolerate introduced bacteria. It is recommended that you sterilise utensils after each feed.

Sterilisation is easy - all you need is salt and water. Place the salt in a large heat proof bowl and add water. You want enough salt to be able to taste it without being too overpowering.

Place the utensils into the bowl and place in the microwave. Heat on the highest setting for 15 to 20 minutes. You can also sterilise utensils with just plain boiling water, however you will need to boil the equipment for at least 30 minutes at 100° Celsius to kill stubborn bacteria. If you don't have a microwave you can sterilise equipment using the same technique on the stove top.

The use of chemical sterilisation is not recommended for use in wildlife care so much any more - however, it is a personal choice for each carer. The reason it isn't used as frequently as in the past is that many carers believe that a build-up of the sterilisation formula can result in loss of gut flora in the animals gut - which of course is not good and may cause illness.

If you are going to use a sterilisation mixture, such as Milton's, ensure that you rinse thoroughly after sterilisation.

## weaning

The weaning process begins when an animal starts to take solid food. Contrary to popular belief, weaning is not the act of cutting out the milk formula *altogether*, but is a slow process that begins when the animal becomes more and more interested in solid food stuffs.

### **The Macquarie Dictionary describes weaning as:**

*To accustom (a child or animal) to food other than its mother's milk.*

In most (not all!) situations you will find that an animal will begin to wean itself off milk. For example:

*You are feeding a furred mouse four times a day. The mouse is becoming more interested in fruit and bugs and nibbles regularly at the offerings you supply. Every morning the mouse readily accepts its first milk feed and then tucks into solid food. The mouse used to also love its second milk feed of the day, but over the last few days it has become disinterested and only takes a few drops of it.....*

This is an ideal weaning process. Instead of giving the mouse the full quantity it normally would take, cut that second milk feed down to the amount it has been interested in over the last days. Follow this process until the mouse is fully weaned, which should be roughly between 30 to 40 days old.

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When the weaning process has started fresh, non-toxic native braches will need to be supplied. The teeth of native rodents grow continuously and chewing items are required to ensure that overgrowth of teeth does not occur. (Jackson, 2003).

It is recommended that animals be weighed regularly throughout the weaning process to ensure that individuals are not losing weight as milk is reduced. (Jackson, 2003).

**Remember!** that each animal is individual and you will need to use unique weaning processes for each one.

Not all animals will wean themselves – some are just far too fond of milk! For animals like this, use a similar weaning process to the self-weaning-animal, but be very gentle. In other words, do not enforce a strict weaning regime or it is likely that you will end up with a distressed animal.

## toileting

There is little known on how a Spinifex Hopping Mouse mum toilets its young. A macropod, for example, will bend over and lick the cloaca of an in-pouch joey which stimulates the joey to pass wee or poo (which the mother consumes). It is thought that a Spinifex Hopping Mouse will also lick the cloaca to stimulate the young to toilet.

However, even without the knowledge of how a mouse mum toilets its young, it is still recommended that you toilet a furless mouse before *or* after each bottle feed - purely for hygiene reasons. A mouse that is allowed to lie in its wee or poo may develop illness or disease.

To toilet a mouse you need to move it into a position where its bottom is poking out of the pouch or bedding material (to prevent soiling the bedding) and gently stimulate the cloaca with a soft, preferably damp, cloth.

Not all mice will tolerate this technique however, and some carers have found that it isn't necessary to stimulate the mouse into toileting, so it is up to each carer to determine the need for stimulation for each animal.

### **There are several methods that can be used to toilet a native animal:**

**Chux wipes are ideal** as they are ultra absorbent and soft on fragile cloaca's. Cut one chux (or equivalent product) into four pieces for a handy sized cloth. Have a bowl of warm water at hand to rinse any wee or poo off the cloth. Chux clothes are the environmentally friendly option!

**Toilet paper or tissues** can also be used, however you need to ensure that the product you choose is soft so not to cause irritation to the skin in and around the cloaca.

**It is not recommended that you use paper towels** as they are too rough and may cause irritation to the skin in and around the cloaca.

**Remember!** you only need soft, gentle rubbing to stimulate the mouse into toileting. Do not over stimulate the area as this may result in a bowel prolapse\*. If the mouse has not passed wee or poo within 30 seconds - or is not showing signs that it is about too (cloaca opening and closing) - cease toileting.

\* *Prolapse, as described by the Macquarie Dictionary – a falling down of an organ or part, ie: the uterus, from its normal position.*

**Remember!** to immediately clean up faeces and urine from the animal and the makeshift pouch. If left, the animal may become ill with a bacterial infection.

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Spinifex Hopping Mouse have been known to easily toilet train. This technique can begin once the mouse is begin to grow fur.

### **Toilet training:**

**Place a layer of newspaper or a box of kitty litter** in the area you would like the mouse to toilet. Hide the spot with leafy branches, enclose it in a box (open at one end) or place a "lean-too" over the area as the mouse will want to be hidden while toileting.

**After each feed place the mouse in the toilet spot** and gently stimulate the cloaca using a warm, wet button bud for easy access to the cloaca. You may need to do this a few times before the mouse starts to use the spot on its own.

**When the mouse smells wee or poo in the toilet spot it will continue to use that area.**

**If you are using newspaper, once it is wet remove the top** wetter layers and place at the bottom. This will keep the smell in the spot which will encourage the mouse to use it.

**Regularly change the newspaper or kitty litter** so that bacterial infection does not occur. Always leave a few pellets of poo to encourage the mouse to continue using the spot.

## **temperature**

Furless and just furred native animals cannot regulate their own body temperature and therefore a heat source will need to be provided. Temperatures should be strictly monitored to ensure the animal doesn't over or under heat. The use of a thermometer that is placed close to the animal and heat source is required.

As the animal grows fur it begins to regulate its own temperature and the heat source should be placed at one end of the enclosure so the mouse is able to move onto it and off it as required.

### **Temperature requirements are:**

**Furless or just furred mice – 32 to 33° Celsius.**

**Furred mice – 28 to 32° Celsius.** *Animals of this size are just starting to regulate their own temperature, however there should still be a heat source available. Place the heat source so that the mouse can move away from it if it wants to.*

**Enclosures for native mice should be maintained at around 15 to 25°C.** Avoid draughts and lower temperatures as hopping mice are prone to respiratory problems. If heating is not available ensure that there is ample bedding material and keep several mice together so they can huddle together for warmth.

Note that native rodents are prone to chewing just about everything they can so as the mouse grows and becomes more adventurous any potentially dangerous items, like electrical cables, should be removed from the enclosure.

## **heat source**

There are several good options for keeping a Spinifex Hopping Mouse at the appropriate temperature. Most options create a dry heat however, so a furless or just furred mouse will need to be lubricated daily (see **lubrication** for more information).

**A heat pad** is one of the best and most easily accessible options. There are many heat pads available on the market that are made specifically for animals. Check your local pet supply store for options. Alternatively, a head pad for a water bed can be used.

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To create a snug bed for a furless or just furred mouse, partially fill a wine bladder with warm water and place on top of the heat pad (George et al, 1995). As the animal becomes more adventurous make sure that you remove the wine bladder as it may develop holes from curious scratching or biting – electric heat pads and water don't mix!

**Hot water bottles** can be used for emergency situations, however as the bottle does not hold the required temperature for long periods it must be constantly checked. Only hot water from the tap can be used - water from a boiled kettle may scald the animal or cause heat stress. Hot water bottles must be wrapped in a towel or piece of cloth and placed between bedding material.

**Wheat bags** can also be used for emergency or short periods. Ensure that you do not overheat the bag; wheat bags have been known to combust if too hot. Tests of wheat bags suggest that combustion may occur as the wheat content breaks down and deteriorate (Dooley, 2004). Cheryl Dooley in Macropology recommends:

Heat the bag for a maximum of three minutes.

Do not reheat the bag until it has completely cooled (around 2 hours or more after initial heating).

Discard the bag if you observe problems, ie: burn marks, weird smells, etc.

Cool the bag well before storing.

As with a hot water bottle, wrap the bag in a towel or cloth (do not make the wrapping too thick – such as, with a blanket) and place between the inner and outer liners of the makeshift pouch.

**A humidicrib** is another option to heat a furless or just furred mouse. A humidicrib keeps an animal at the correct temperature, but also creates a humid environment.

However, humidicribs are designed to be used in a room that has constant temperature (ie: is air conditioned) and therefore are often difficult to manage in a normal care situation.

If a humidicrib is being used an animal should be removed at just after the just-furred stage as the animal is growing more fur. Keeping an animal in this environment too long may cause delays in growth.



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Humidicribs are difficult to source. If you choose to use this method try contacting your local hospital and tell them you are looking for a humidicrib to raise orphaned Australian native animals. Hospital often discard humidicribs that may have slight problems that make them illegal for human use, but may only require a small fix to work efficiently.

**Remember!** that under heating an animal is as detrimental as over heating. Over heating can cause severe heat stress and can kill an animal - under heating could cause pneumonia and this can also kill an animal.

**Remember!** a mouse that is being raised on Biolac 100-G can begins to regulate its own body temperature a lot younger and therefore may not require a heat source. Use a thermometer to ascertain the animals temperature and use a heat source only if the pup is not sitting comfortably at the desire temperature.

## skin lubrication

A furless or just furred pup will need to be lubricated daily so that skin does not dry out.

There are several options available and it is up to each individual carer to find the right product for them and their animals.

### Some topical options are:

**Eucerin cream** is a wool fat cream that has no additives. It is a lot easier to spread than the other wool fats. You only really need to use it once a day at the most and sometimes every second day. Obviously don't use it too thick or the animal may get blocked pores. (pers. comms. C. Letica, 2005).

**Olive Oil** is another all natural alternative to use as a topical application. Although this can work it does tend to leave a sticky residue bedding material which results in them needing to be washed more often.

**Paw Paw Ointment and Paw Paw Cream** are ideal topical applications as they are totally natural products and will not harm the animal if it is licked off. Paw Paw Ointment is very thick however and is only needed sparingly. Heating the ointment before applying (being sure not to overheat and cause burns) makes the ointment easier to spread.

**Sorbolene Cream** can be a bit gluggy on the skin and doesn't always absorb well, especially in cold climates, but does work efficiently if warmed first.

**Sorbolene and Glycerine Cream** has always been considered as a no-no as it was thought that glycerine was used as a heart starter in human medicine (after cardiac arrest, etc). However, Anne Fowler has recently advised that it is **Nitroglycerine** cream that is the heart starter which is only available on prescription.

### Topical applications that should be avoided:

**Baby oil** is a real no-no. The mineral content of this application can make an animal very ill when absorbed through the skin or if it is licked off.

**Petroleum Jelly** is a petrol based product and the use of this ointment can make an animal very ill if absorbed through the skin or if it is licked off.

### Oral treatments that can be mixed with normal milk bottles:

**Canola Oil** is an oil that has been used for many years, especially for constipation. It can also be used as an additive to milk feeds for skin lubrication. Only a few millilitres per feed is needed.

**Megaderm** is an exceptional product and if used according to instructions (on the bottle) an animal may not need as much topical lubrication as with any other oral treatment.

**Olive oil** is used on domestic pets with great success. Olive oil is (normally) chemical free and is gentle on the gut system. Olive oil, when given internally, can also add sheen and quality to the animals coat. Only a few millilitres per milk feed is needed.

## stress – or *distress*

Many people associate a “freaked out” animal with stress, however stress responses can also be a good thing. For example, a stressor of pain can have the stress response of a limp, which helps the body part heal (Bryant, 2004).

The word to better describe an anxious or “freaked out” animal is ***distress***. Distress is otherwise described as anguish, agony, grief and misery – all things we want to avoid at all costs.

The Spinifex Hopping Mouse tends to be a very secretive animal and therefore signs of distress are not really understood.

One well known indication however to show that a mouse may be distressed or anxious is when it runs at lightening speed up and down its enclosure.

Another indicator of distress is teeth grinding. Keep in mind though that rodents teeth grow continuously and teeth grinding is a way for a mouse to keep the teeth at a healthy length. Excessive and prolonged teeth grinding, however, can indicate distress

If a mouse shows signs of being distressed it is important for the carer to determine the reason why and to remove the stressor.

## stressors

There are many things that can distress a native animal, and unfortunately they are often things that normally occur in our day to day lives.

### Stressors include:

**Loud children** even if they’re playing happily and aren’t intentionally being frightening, the loud noises that children often make can distress a native animal.

**Over handling**, especially by other people (including children).

**A change in carers.** It is advisable - wherever possible - for a native animal to be raised by one carer throughout its whole time in care.

**Dogs and cats** are the natural predators of most native animals and the fear of these animals is usually instinctive in natives. Keeping a native animal near a cat can frighten it so much that it can die instantly or over a prolonged period.

**Loud music and noises.** The deep booming of music and the slamming of doors, etc, can reverberate right through a animal which could lead to severe distress.

**Heat stress** can lead to severe distress. Keeping an animal too warm or too cold can cause major illness.

**Strong unnatural smells** such as air fresheners, strong fabric softeners, cigarette smoke, etc. An animals sense of smell is highly advanced and one of the primary senses used.

**Enforced abnormal biological rhythms.** For example, forcing a nocturnal animal into a diurnal lifestyle (Bryant, 2004).

**Overcrowding can cause distress** and can also lead to aggressive / submissive behaviour. Carers need to set limits on how many animals are in care at one time. Limits need to be placed on carer capability and area capacity.

**Raised blood pressure** in a severely distressed animal can lead to prolonged distress and can be fatal if you cannot pull the animal out of its distressed condition quickly.

When stressors are severe and not remedied immediately, stress responses can be detrimental. Raising a native animal may require a total shift in the way you would normally live. It takes dedication for you to be able to make these changes in your life.

## importance of sunlight

Most living things on this planet need sunlight in order to grow. Access to *filtered* sunlight is an essential component to the care of any native animal. Direct sunlight during the hottest parts of the day should be avoided.

Early morning and late afternoon are the best time to get an animal out into the sun, but only if the temperature is suitable (see **temperature** section in this chapter for more information).

An animal does not necessarily need to be in direct sunlight to benefit from the UV rays. A shady spot, say under a tree or beneath a verandah roof, is perfectly acceptable and the animal will receive enough UV to stay healthy.

A furless or just furred animal will also benefit from sunlight, however you should only expose the head of the animal and for short periods at a time. Spinifex Hopping Mouse in the wild are used to living in a dark warm nest - if you leave the mouse exposed for too long it will become distressed.

Ensure that you monitor the animal constantly while being in the sunlight - any sign of discomfort in the mouse and it should be moved into a more shaded area or returned to the pouch. If you keep the mouse in the sun too long it may develop a skin allergy - red raised skin or swollen eyes may need an antihistamine injection to remedy.

## natural food and supplements while in care

A Spinifex Hopping Mouse will begin to nibble at solid food when it is nearly fully furred. The mouse is an omnivore, which means it is a fruit, vegetable and meat eater. The healthy captive diet should be varied and include both fruit, seeds and meat.

### Solid food stuffs can include:

**Fruit**, but nothing too exotic. Pear and apple are good examples. Don't offer citrus fruit.

**Vegetables** such as sweet corn, sweet potato peas and carrot.

**Dog biscuit** can also be offered. Ensure it is a good quality brand with lots of vitamins and minerals.

**Small parrot mix** can be offered for the seed component of the diet.

**Wombaroo Small Carnivore Mix** is a great supplement to offer. It has lots of added minerals and vitamins for a healthy mouse.

**Natural muesli**, steer clear of the sweetened variety

**Rat or mouse cubes**

**Lucerne pellets**

**Natural diet** should make up a large portion of the captive diet. These include bugs (eg: crickets, native cockroaches, moths and worms), native seeds, fungi, pollen, flowers such as callistemon and acacia, roots, grass, grass seed and leaves. One mouse may eat one to three insects per day.



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Approximately one tablespoon of seed and one tablespoon of fruit / vegetables should be offered per individual per day rotational basis (P&K Pets).

Spinifex Hopping Mice are not strictly nocturnal and there may be some day time foraging so food should be made available 24 hours a day.

## water

In the wild Spinifex Hopping Mice drink very little water and are very efficient users of water. However, in captivity mice don't have the extent of resources available to them that they would normally have in the wild.

For example, a thirsty wild mouse may travel some distance to find water but in captivity they don't have this luxury. Therefore it is imperative that captive Spinifex Hopping Mice have access to water at all times.

### There are a couple of options for this:

**A small dish**, shallow enough so that mice cannot drown. If a small dish is not available place a large rock or branch in the water so mice can climb out.

**A water dripper** installed in a corner of the enclosure, these are a much safer option.

Water should be checked daily and changed if dirty. The roller balls in water drippers should be tested to ensure that they haven't seized.



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# the unwell mouse a carer's perspective



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Native animals can become unwell for many reasons including unclean feeding utensils, bad food, too much food, distress, allergic reaction, etc.

Small mammals have poor recovery rates and when symptoms show it is often too late to save the animal. It is highly recommended to keep mice in a clean environment and to continually monitor individuals to ensure that illness doesn't occur in the first place.

This section covers what a carer *can* do to alleviate or treat a minor illness.

**Remember!** if you are unsure of what to do with an unwell native animal seek veterinary advice immediately. This is one area where your record keeping will come in handy. By recognising symptoms and then looking through your daily records you may be able to determine what is happening with your animal (see **keeping accurate records** for more information).

## signs of an unwell mouse

### Some signs to look for in an unwell mouse:

**Lethargy.** Take care that you don't confuse a sleepy mouse with a lethargic one. The Macquarie Dictionary describes *lethargy* as a state of drowsy dullness or suspension of the faculties and energies; apathetic or sluggish inactivity.

**Loss of appetite.** If your mouse seems to be eating healthily one day but is disinterested the next, or over a prolonged period, it may indicate illness or distress.

**Diarrhoea or any change in faeces.** Keep a record of what your animal's poo is normally like. A change in faeces consistency or colour may indicate either illness or distress. Your records may be able to give you a clue as to what is happening with the mouse. See **increasing water intake during diarrhoea** in the **hydration** chapter and **constipation** in this chapter for more information.

**White gums.** Gums should be a healthy pink.

**Cold mouth.** When you place a (clean) finger in the mouse's mouth it should feel body temperature – neither hot nor cold.

**Dull coat.** A mouse's coat should have a sheen to it.

**Wind.** Some wind is normal – we all pass wind from time to time! Excess wind, however, can indicate diseases such as gut thrush.

**Teeth grinding.** Rodents teeth grow continuously and teeth grinding is a way of keeping teeth healthy and the right length. Excessive and prolonged teeth grinding, however, can indicate distress.

**Signs of pain** (contorted, hunched over or clenched or outstretched paws.)

***It is most important for you to remember that diarrhoea should not be ignored. If the diarrhoea has not shown signs of improvement on the third day the mouse should be taken to a vet immediately.***

You will need to try and work out what is causing the mouse to feel unwell. Go over your daily records for the days just prior to the signs manifesting - there may be hints in behavioural change, decrease in milk intake, faeces change, etc.

A mouse that is unwell may not be able to regulate its own body temperature so it is important to keep the mouse warm, always keeping in mind the temperature requirements (see **temperature in raising orphans** for more information).







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When a mouse is unwell, keep fluids up. Unless the mouse is refusing its milk do not reduce the amount as it needs the food to keep its strength. Increase the mouse's water intake - or better still offer an electrolyte fluid such as Vitrate or Glucodine for added minerals. Aim to offer at least 10% of the animals weight in fluids over a 24 hour period.

## signs of a recuperating mouse

**The signs that show a sick mouse is recuperating are:**

-  **Grooming.** A healthy mouse will groom daily.
-  **Interest in surroundings.** The mouse may seem to perk up and become interested in you and its surroundings again.
-  **Pink gums** are a good indicator of a healthy animal.
-  **A shiny coat,** without oral treatments (such as olive oil).
-  **Increased appetite.** If a mouse is interested in food again you know that is on the improve.
-  **Weight gain.** This is a fantastic sign - a healthy mouse should increase in weight weekly.

## allergies

There are many things in our human world that those living in the wild world would not normally come across. So, it stands to reason that a native animal may develop an allergic reaction while in care.

**Signs of allergies can include:**

- Red or hot paws.
- A rash on the body.
- Hot ears.
- Swelling around eyes (this can be a reaction to sun exposure).
- Sore mouth (this can also indicate thrush).

Use your records (see **keeping accurate records** in **raising orphans** for more information) to ascertain what may have caused the allergy and adjust your care regime.

**Some causes may include:**

- Skin creams.
- Bedding material.
- Laundry liquids and softeners.
- Toxic plants (see toxic plants for more information).
- Milk product.
- Sun exposure. Many native animals cannot tolerate prolonged exposure to direct hot sun and skin swelling may occur.

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**Remember!** that a product such as a lubricant or milk formula may be used without problem in one animal but may adversely affect another – each animal is individual! Therefore it may be difficult to find the cause of the allergy and you may need to become a pseudo-investigator and delve deeply into your care routine. Once you have found the source of the allergy you need to try and eliminate the cause.

**Remember!** if symptoms do not subside in a couple of days the mouse may need an antihistamine injection administered by your vet.

## **bacterial dermatitis**

All animals – including humans - have bacteria living on the surface of the skin and on the mucous membranes of the nose and in the mouth. These bacteria do not normally cause problems, however if the skin is damaged (scratch, bite, etc) the bacteria can cause an infection leading to bacterial dermatitis.

Rodents can be rough and tough little critters and normal activity it is not uncommon for them to bite and scratch one another. Usually play bites and scratches do not penetrate the skin, but as they grow older play time can become rougher and minor scratches may occur. Minor scratches can also be received from enclosure furniture such as logs and sticks. If the skin has been broken it may lead to bacterial dermatitis.

### **Signs of bacterial dermatitis include:**

- development of reddened skin
- sores, sometimes weeping or crusty
- increased itchiness
- dry skin, which is often thickened in the areas that have been scratched
- pimples
- lumps, blisters or ulcers on the body
- fur loss

Bacterial dermatitis can be very itchy and the symptoms will need to be eased. Paraderm Plus has been used successfully to treat the condition. It has a mild antibiotic which will help treat the bacterial outbreak, along with an antiseptic, anaesthetic and anti-inflammatory. Prednoderma has also been used with success. See **treatments for minor condition** for more information.

## **colic**

Colic, also known as gas, wind or bloat, is a condition that all animal can develop. It is a build up of gas in the gastro-intestinal tract that can be quite painful if left untreated. It can also cause major problems, such as a twisted bowel or bacterial infection, if the condition is severe.

### **There are many causes for colic and these include:**

**Sucking air** – allowing an animal to suck air through the teat can cause colic.

**Incorrect food** – such as cabbage.

**Little or no exercise** – particularly after a milk feed, furred mice should be encouraged to exercise daily.

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**Symptoms of colic include:**

- Distended belly.**
- Hunching.**
- Stretching body.**
- Contorting body.**

As with human babies it is better to prevent colic than to continually treat it. Use your daily records (see **keeping accurate records** in **caring for spinifex hopping mice** for more information) to ascertain why the animal has developed colic in the first place and amend your care regime to eliminate the cause.

See **treatments for minor conditions** for more information on basic treatments.

**Remember!** if the animals condition appears severe it is recommended that you seek veterinary advice.

## constipation

**At times mice may develop constipation and there are several factors for this, including:**

- Not enough water** in the diet.
- Milk formula** is too thick.
- Introduction of solid food** into the diet.
- An obstruction.**

Constipation can be quite painful for the mouse and it is important that the condition is treated quickly. If left untreated severe complications may occur, for example: a twisted bowel.

**Following are some recommended treatments for constipation:**

- Ensure plenty of fluid is offered at all times** – prevention is better than cure.
- Add canola or olive oil to the bottle**, only 2 to 3mls is needed per bottle. The bowel and the poo will be coated with the oil making the poo easier to pass. The oral route does take some time to reach the bowel however, so use this option at the onset of constipation.
- Give the mouse an oil enema** using any of the oils listed above mixed with warm water. The water will absorb into the poo making it softer and the oil will coat the poo and the bowel making the poo easier to pass. Make sure that you are inserting the enema into the right orifice, the anus is to the rear of the cloaca.

See **treatments for minor conditions** for more information on basic remedies.

**Remember!** if the constipation is severe it is recommended that you seek veterinary advice.

## cystitis

Cystitis, also known as Urinary Tract Disease, is inflammation of the bladder caused by a bacterial infection. Animals in care often get the condition when they are not offered enough water in the diet.

**Symptoms of this condition are:**

- Dark coloured wee** - dark yellow to orange / red

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**Highly concentrated wee** with a strong smell

**Wee is in a broken flow** – an animal should wee in a continual stream, dribbles or spurts of wee may indicate cystitis.

**Pain during urination** -shown by hunching over, hissing, etc

To clinically identify this condition a dip stick test can be performed to test the alkalinity levels within the wee. Catch the urine mid flow and using a dip stick test the pH.

To help ease this condition water intake should be increased. Vitamin C can also be offered, which reduces alkalinity.

Severe cases will need to be treated with antibiotics and penicillin. If left untreated cystitis can cause major problems with the kidneys.

See **treatments for minor conditions** for information on basic remedies.

**Remember!** if the mouse's condition appears severe it is recommended that you seek veterinary advice.

## diarrhoea

Diarrhoea in any animal is often a sign that something is wrong, for example: a bacterial infection or distress. It can also mean that the animal has eaten something bad, eg: a weed or rich grass, and has an upset belly.

Nevertheless, a bout of diarrhoea will compromise an animal and it should never be ignored. If diarrhoea is left unchecked the animal will lose energy and may become even sicker.

Many carers are confused about diarrhoea and are unsure exactly what is classed as diarrhoea – or scouring – and what is not.

Diarrhoea is when the poo is very watery and is **uncontrolled**. Soft poo – or Mr Whippy poo - although still a concern, is not strictly diarrhoea.

It is the job of the carer to ascertain why the animal has diarrhoea, and this is when your daily records come in very useful (see **keeping accurate records** in **caring for Spinifex hopping mice** for more information).

**Some of the causes are:**

**Lack of gut flora.**

**Too much milk.**

**Milk formula is too watery.**

**Poor hygiene.**

**The animal has eaten something which has upset the gut** (ie: a weed or rich grass).

**Distress.**

When an animal has diarrhoea the first thing to do is re-hydrate it. See **increasing water intake during diarrhoea** in the **hydration** chapter for more information.

See **treatments for minor conditions** for information on basic remedies.

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**Remember!** diarrhoea should never be ignored. If the animal isn't showing signs of improvement by the third day it will need veterinary attention as soon as possible. Use your judgement however; for example, if the animal is much worse by the second day get it to the vet quicker.

## fighting

Fighting is a frequent cause of death in rodents but severe injuries can also be sustained. These may lead to abscesses and septicaemia.

### Signs are easily observed:

**Wounds** to the head, body and tail leading to ulcerations. Wounds can be hidden under fur so regular inspection is required.

Wounds should be treated with antibiotics, however it is better to prevent wounds in the first place.

### Prevention:

**Gain an understanding** of the mouse's social structure.

**Take caution when placing animals together.**

**Socialise individuals in a neutral area.**

**Provide adequate burrows and nests** so that individuals can retreat from each other.

See **treatments for minor conditions** for information on basic remedies.

## ringworm

Ringworm is not an internal parasite (worm) but a fungal infection of the skin. In humans it presents itself as round raised welts (see photo below), however in animals it can present itself in varied forms – not just in rings.

There are different types of ringworm and each appear on the skin differently and therefore ringworm is often difficult to identify without a biopsy.

Ringworm in native animals does not show up under UV lamps, as it does with cats and dogs.

### Ringworm symptoms include:

**Hair loss.**

**Lesions may appear crusty.**

**Slight orange colour** (but not always).

**Fur covering infected area feels hard.**

**Matted and dull fur.**

**Nasty looking rash.**

### Causes for ringworm in marsupials include:

**Distress.**

**Contaminated soil.**

**Close proximity to cats, dogs and small children** while in care (hosts for ringworm).

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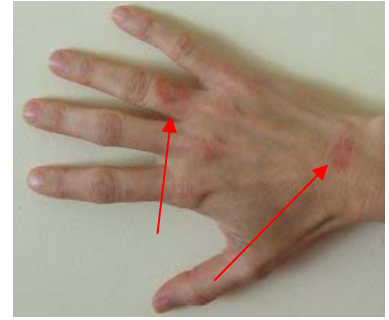
As ringworm is difficult to diagnose visually it should be formally diagnosed with a skin biopsy which is tested in a laboratory for fungal cultures.

**Remember!** this is a highly contagious condition and infected animals should be isolated.

**Remember!** ringworm is also a zoonosis, meaning that it can be transferred from animal to human.

See **treatments for minor conditions** for information on basic remedies.

**Remember!** if the animals condition appears severe it is recommended that you seek veterinary advice.



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## thrush

Thrush is quite common with hand reared animals. It is a yeast infection that can affect the mouth, the gut or both.

### Causes for thrush include:

**The stress of being in care** – being in close proximity to humans can be pretty frightening.

**Unhygienic conditions** – ie: not washing feeding equipment or pouches properly.

**After antibiotics** – particularly if oral antibiotics are used.

**Distress** – including a change in routine, carers, introduction of solid food, etc.

**Teething.**

### Signs of thrush include:

**Very mouthy when taking a milk feed** – the animal may seem interested in the milk but will “mouth” the teat when in the mouth.

**White build up in and around the mouth.**

**Saliva may appear rusty in colour (when mouth is wiped).**

**Mouth and gums are inflamed.**

**Yellow diarrhoea with bubbles, can be smelly (sweet & sour).**

**Excessive wind.**

**Cloaca becomes sore and itchy.**

See **treatments for minor conditions** for information on basic remedies.

**Remember!** if the animals condition appears severe it is recommended that you seek veterinary advice.

## ticks

There is some thought that native animals are not affected by ticks as humans and domestic animals are, and there is suggestion that there is some immunity to tick related conditions. However, there are some cases of native animals being affected by the paralysis tick.

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If a tick is found attached to the body, chemicals such as methylated spirits should not be applied to the tick as it may inject more saliva into the flesh. Frontline Plus and insect repellents containing pyrethrin can be applied directly to the tick which will cause the tick to dislodge from the flesh (after about 24 hours). Pyrethrin will also prevent the tick from injecting more saliva into the flesh. Creams and sprays with pyrethroid or permethrin are also fine to use.

Tweezers can also be used to pull out a tick. Place the tweezers as close to the animals flesh as possible and pull out in one clean motion. The head should dislodge with the body, but if not, the bodies natural defence mechanism will reject it in time.

**Note:** a diet high in sugar will increase the chance of biting insects such as ticks, fleas, etc.

See **treatments for minor conditions** on the following page for more information on tick removal.

## treatments for minor conditions

**There are some good medications / applications to have on hand for an unwell or injured animal. These include:**

| Medication           | Used for                             | Dosage  | Comments   |
|----------------------|--------------------------------------|---|--|
| Apex                 | Maggots                              | Clean wound liberally   | Apex is a chemist brought ear cleaner which works very well at eradicating maggots from wounds.  |
| Frontline Plus       | Ticks                                | Spot on.  | Frontline Plus kills a range of fleas and ticks, including the Paralysis Tick. Many native animals can usually carry (some) types of tick with no problems, but should be treated if burdened by the parasite. There is a range of Frontline Plus for different animals – consult your vet for the right product to use for each case. |
| Ilium Neocort        | Topical treatment for skin condition | Apply thin layer twice daily to affected area. Treat for a maximum of 14 days only.   | Antibiotic, anti-inflammatory, anaesthetic skin emollient cream.   |
| Incremin             | A booster                            | Two drops per bottle  | Incremin is essentially Vitamin C.   |
| Infacol              | Colic (wind)                         | 0.2ml initially. A couple of drops can be given if colic continues.   | Can be given in the bottle or directly in the mouth. Seek veterinary advice if colic persists.   |
| Ivomec Oral          | Worming                              | 0.1ml per kg.   | Administered orally.   |
| Ivomec Pour on       | Ticks                                | Spot on (for external parasites such as ticks) or for a drench (external and internal parasites) use 1ml per 10kgs of bodyweight. | Many native animals can carry (some) types of tick with no problems, but should be treated if burdened by the parasite. Ivomec Pour On will also eliminate internal parasites, part fur and apply drench to skin on back of neck.  |
| Kaomagma with Pectin | Diarrhoea                            | Furless – ¼ml daily.<br>Furred – ½ml daily.   | Do not ignore diarrhoea. If it persists into the 3rd day seek veterinary advice ASAP.  |

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| Medication    | Used for                                      | Dosage   | Comments  |
|---------------|---|--|---|
| Malaseb       | Ringworm and other fungal diseases            | Wash once a week until signs of fungal infection have gone.                    | This treatment is used twice weekly for domestic pets, however it is not recommended that a native animal be washed this regularly. Pay particular attention to mouth, feet and under tail area when washing. |
| Mylanta       | Bloat.  | 1ml per kg, orally.  | No more than twice a day.   |
| Nilstat       | Oral treatment for thrush, both oral and gut. | Furless - .25ml per kg.<br>Furred - 0.5ml per kg. 3 doses a day for 5 days.    | Nilstat can be purchased from chemists. DO NOT use Mycostatin as it has added ingredients that adversely effect Australian marsupials.  |
| Nutrigel      | Energy boost (calorie and vitamin supplement) | 10g per 5kg (during convalescence)   | Can be mixed with milk (after milk has been heated) or apply to clean finger and mouse should lick it off (very palatable!)   |
| Paraderm Plus | Cuts, bites, rashes, dermatitis.              | Apply cream generously to affected areas.                                      | Paraderm Plus is a mild antibiotic, antiseptic, anaesthetic and anti-inflammatory. It works very well to alleviate symptoms of bacterial dermatitis.  |
| Pentavite     | A booster - essentially multi-vitamins.       | A drop or two per milk feed  | Pentavite is used to build up an animal after it has been unwell. Purchase the <b>Infant</b> formula – available at chemists.   |
| Peroxide      | Cleaning necrotic wounds.                     | Apply un-diluted to the affected area.   | Peroxide can also be used as a powerful bleach for cleaning cages, etc.   |
| Peptosyl      | Diarrhoea                                     | 2.5-.5ml per kg. 3 times a day for 2 days. Reduce to 2 times a day for 3 days. | Lines and soothes the gut. Do not ignore diarrhoea. If it persists into the 3 <sup>rd</sup> day seek veterinary advice ASAP.  |
| Prednoderm    | Cuts, bites, rashes, dermatitis.              | Clean area of crust and debris. Apply 3 times daily.                           | For the treatment of acute and chronic dermatitis. It is an anti-inflammatory and antibacterial ointment. It is a thick, green ointment which can be quite messy although very effective.                     |
| Protexin      | A pro-biotic used to increase gut flora       |  | Can be used in the first instances of diarrhoea or daily. Add to milk. See <b>milk additives</b> for further information.   |
| Repel-X       | External parasites                            | External use only.   | Repel-X is an insecticidal and repellent spray. Can also be sprayed onto bedding material.  |

Table adapted from "Medications". Macropology. **Cheryl Dooley**.

**ALWAYS CONSULT YOUR VET IF YOUR ARE UNSURE ABOUT TREATING A NATIVE ANIMAL.**

**NOTE: this is a guide only. It is recommended that you consult your vet before proceeding with treatment.**



**Some natural remedies include:**

| Remedy                         | Used for   | Dosage  | Comments  |
|--------------------------------|--|---|---|
| Acidophilus Powder             | Probiotic used to increase gut flora                                   | Use your judgement – depends on size of animal. Recommended dosage is ⅛ teaspoon per bottle for furless and just furred and ¼ teaspoon per bottle for furred. | Can be used in the first instances of diarrhoea or daily. Add to milk. See <b>probiotics</b> for further information. Do not ignore diarrhoea. If it persists into the 3 <sup>rd</sup> day seek veterinary advice ASAP.   |
| Bach Flower                    | Stress & shock   | 4 drops, 4 times daily.   | Can be administered directly into the mouth or mixed into milk.   |
| Charcoal                       | Removing toxins from the gut.  | Use your judgement for dosage amounts – depends on size of animal. Crush charcoal and add to bottle.  | Ensure that you are using charcoal from non poisonous native trees. Alternatively, you can buy charcoal tablets from health food shops.   |
| Citronella Spray               | External parasites   | 5ml of citronella dissolved in 10ml of methylated spirits then mixed with ½ litre of water. Use in a spray bottle.  | An alternative recipe is 2.5mls each of lavender oil and citronella oil. The method is used to break down the oil in the water, without it there will be clumps of oil floating in the water and it will be ineffective.  |
| Medihoney Antibacterial Honey  | Topical application for the treatment of cuts, abrasions and wounds.   | Spread honey on an absorbent dressing and place with the honey contacting the whole of the affected area.   | Change dressing daily.  |
| Medihoney Eczema Cream         | Topical application for the treatment of cuts, abrasions and wounds.   | Apply directly to wound.  | The Eczema cream is much creamier than the straight antibacterial cream and can be rubbed in to skin.   |
| Metamucil                      | Constipation   | Just a few drops  | Mix into every other bottle for 1-2 days or until symptoms ease.  |
| Nads' Foaming Foot Wash        | Ringworm   | Apply foam to area and massage. Rinse thoroughly with water.  |   |
| Olive Oil                      | Constipation   | Guestimate!   | Olive oil can be mixed into the bottle but it is a long process until it reaches the blockage. Alternatively, mix the oil with some warm water and draw up 1-2ml in a syringe and insert into the anus. This can be done every few hours until the hard faeces is passed. |
| Olive oil and bicarbonate soda | Colic  | Furless - ¼ml<br>Just Furred – ½ml<br>Furred – 2ml  | Bicarbonate soda unites air bubbles into one mass making it easier to pass, olive oil acts as a mild laxative helping to empty the bowel.   |
| Paw Paw Ointment               | Topical application for treatment of minor cuts, abrasions and wounds. | Apply generously to affected area.  | Paw Paw is a totally natural product so there is no worry if the animal licks at the ointment.  |
| Weak Tea                       | Soothing for a upset tummy.  | Use your judgement for dosage amounts – depends on size of animal.  | Use plain tea. Add the tea to milk or give between milk feeds. Alternatively make up the milk formula using the tea.  |

| Remedy                                | Used for                                | Dosage  | Comments  |
|---------------------------------------|---|---|---|
| Yakult                                | A pro-biotic used to increase gut flora | Use your judgement for dosage amounts. Recommended dosage is either 1 bottle or ½ a bottle of Yakult mixed to one litre of milk.                    | Can be used in the first instances of diarrhoea or daily. Add to milk. See <b>probiotics</b> for further information. Do not ignore diarrhoea. If it persists into the 3 <sup>rd</sup> day seek veterinary advice ASAP. |
| Yoghurt - natural, non flavoured only | A pro-biotic used to increase gut flora | Use you judgement for dosage amounts. Recommended dosage is ⅛ teaspoon per bottle for furless and just furred and ¼ teaspoon per bottle for furred. | Can be used in the first instances of diarrhoea or daily. Add to milk. See <b>probiotics</b> for further information. Do not ignore diarrhoea. If it persists into the 3 <sup>rd</sup> day seek veterinary advice ASAP. |

## toxic plants

There are many plants that are commonly found in gardens or vegetable patches that are toxic to native animals. There is a fairly large list of toxic plants; listed below are some of the more common ones may affect Spinifex Hopping Mice.

### Avocado

The flesh and seed of the avocado can be poisonous if consumed. Symptoms include diarrhoea, vomiting and laboured breathing.

### Azalea

See Rhododendron.

### Blue Green Algae

This algae is a food source for complex organisms, however under particular environmental conditions, for example hot temperatures, warm still water, drought and reduced water flows, the algae undergoes an enormous population explosion resulting in algal blooms which can kill an animal if consumed.

If Blue Green Algae contacts skin, the skin can become itchy and rashes may form. Lips can swell and eyes and ears can become irritated. If the infected water is swallowed, nausea, vomiting, abdominal pain and diarrhoea may be experienced. Liver problems can occur as can muscle weakness. The more Blue Green Algae swallowed the sicker the host becomes. Toxins from Blue Green Algae can be lethal.

### Buttercup

The entire plant is poisonous if consumed. If the juice from the buttercup (ie: from the stem) is consumed it may severely injure the digestive system. The plant may also cause dermatitis.

### English Ivy

Berries and leaves are poisonous if consumed. Signs of poisoning include gastro-intestinal problems. The plant may also cause dermatitis if touched.

### Daffodil

The bulbs of the daffodil are poisonous if consumed. Symptoms include nausea, vomiting, diarrhoea caused by the alkaloid toxins. The plant also causes dermatitis if touched.

### Daphne

All parts, particularly the berries and seeds are poisonous. Symptoms include gastro-intestinal and kidney upset. The plant may also cause dermatitis if touched.

## **Holly**

The berries in Holly are poisonous if consumed. Symptoms include an upset stomach, tremors, seizures and loss of balance.

## **Honeysuckle**

The plant and berries of the Honeysuckle bush are poisonous if consumed, although they are considered minimally toxic. Symptoms include vomiting, diarrhoea and lethargy.

## **Hyacinth**

The bulb is the main toxic part of the plant. Hyacinth poisoning is reported to cause vomiting and abdominal discomfort. Treatment includes emptying the stomach.

## **Hydrangea**

Affected animals may experience painful gastroenteritis, and diarrhoea which may be bloody.

Hydrangea may contain *cyanogenic glycoside hydrangin*, but poisonings do not generally involve effects or clinical signs of typical cyanide poisoning. It should be noted that Hydrangea poisoning is rare, but it has been recorded that a horse was seriously poisoned after eating a single potted hydrangea.

## **Kikuyu Grass**

Kikuyu poisoning is a severe and sometimes fatal condition of cattle, but the condition can also affect native animals. Outbreaks occur when animals graze kikuyu which is growing rapidly after recent rain or irrigation. These outbreaks appear more likely to occur after a prolonged dry spell and in paddocks which have been unstocked for some time.

Signs of kikuyu poisoning include abdominal pain, depression, incoordination, aimless wandering, recumbency and eventual death. Drooling of saliva is also a characteristic feature of the condition. In the early stages or in mildly-affected animals, small quantities of thin, clear saliva are often drooled. Drooling becomes more pronounced as the disease progresses.

## **Lantana**

The major clinical effect of Lantana toxicosis is photosensitization, the onset of which often takes place in 1 to 2 days after consumption of a toxic dose (1% or more of animal's body weight).

Jaundice is usually prominent and the animal can suffer from constipation. Other signs may include: sluggishness, weakness, and transient diarrhoea, which can sometimes be bloody. In acute cases, death occurs in 2 to 4 days. Subacute poisoning is more common and may result in death after 1 to 3 weeks of illness and weight loss.

Raw photosensitised surface areas are susceptible to invasions by blowfly maggots and bacteria. In severely affected cattle, lesions may appear at the muzzle, mouth, and nostrils. Ulceration may be present in the cheeks, tongue, and gums, while swelling, hardening, peeling of mucous membranes, and deeper tissues occur in the nostrils.

## **Lilly of the Valley**

All parts of the plant are poisonous. Symptoms from poisoning include irregular heart beat and pulse accompanied by digestive upset and mental confusion.

## **Oleander**

All parts of the oleander shrub are extremely poisonous and can cause death. Even a small amount of the plant being eaten or sucked can be fatal.

Oleander poisoning affects the heart and produces severe digestive upset. The cardiovascular system can be affected causing seizures. Other signs of poisoning include abdominal pain, salivation, gum irritation, drowsiness, dilated pupils and slow, irregular pulse.

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Treatment can rarely be given in time (before coma and death) and involves emptying the stomach.

### **Onion (and garlic)**

All parts of the onion plant are considered poisonous. The poisoning occurs a few days after the pet has eaten the onion.

Poisoning causes haemolytic anaemia where the animal's red blood cells burst while circulating in the body resulting in red urine. Kidneys can become enlarged and liver will degenerate. Other signs are diarrhoea, no interest in food and a dull and weak lethargic appearance.

While garlic also contains the toxic ingredient found in potatoes (thiosulphate), it seems that garlic is less toxic and large amounts would need to be eaten to cause illness.

### **Philodendron**

All parts of the Philodendron shrub is poisonous if consumed.

If any part of the Philodendron shrub is consumed it can cause diarrhoea. The plant can cause a burning sensation in the mouth when eaten, so the poison rating is low.. It can also cause dermatitis reaction when touched.

### **Poinsettia**

The leaves, stem and sap are the poisonous parts of the Poinsettia, which is also known as the Christmas Bush, however the toxic rating is low.

Symptoms of poisoning include diarrhoea, abdominal cramps and delirium. The sap can cause irritation, and if rubbed in eyes - blindness. The plant can also cause dermatitis.

### **Potato**

The leaves and immature fruit are considered toxic. Potatoes that have turned green can cause severe illness if consumed.

Potatoes have a high GI rating (see below) so the digestive throughput is very quick. Therefore potatoes have very little nutritional value for native animals. Consequently food that is rated with a lower GI (and carbohydrate level) are better choices.

*Glycemic index*, abbreviated to GI, is a way of classifying carbohydrate foods according to their effect on blood glucose. Food with a high GI produces a quicker response in digestion and therefore food is stored (made into fat) or evacuated quickly. Foods with a low GI produce a lower response in digestion and therefore more nutrition and energy will be gained from the food.

### **Privet**

Both the leaves and berries of Privet are toxic, however it is not a common poisoning.

Symptoms of poisoning include vomiting and diarrhoea with blood, collapse and convulsions. Kidney failure and death have also been reported.

### **Rhododendron**

All parts of this plant contain toxic resins with the leaves being the most potent. Poisoning from consuming Rhododendron produces gastro-intestinal irritation with some haemorrhage, secondary aspiration pneumonia, and sometimes renal tubular damage and mild liver degeneration.

Clinical signs usually appear within 6 hours of ingestion. Affected animals may experience anorexia, depression, acute digestive upset, hypersalivation, nasal discharge, epiphora, projectile vomiting, frequent defecation, and repeated attempts to swallow.

There also may be weakness, incoordination, paralysis of the limbs, stupor, and depression. Aspiration of vomit is common in ruminants and results in dyspnea and often death. Coma precedes death. Animals may remain sick for more than 2 days and gradually recover.

## **Rhubarb**

The leaves of rhubarb are the toxic part of the plant, although the toxic level is classified as low. If large amounts of raw or cooked leaves are consumed it can cause convulsions, coma and in extreme cases, death.

Other signs of mild poisoning are staggering, trembling, breathing difficulties, weakness, diarrhoea, increased drinking and urinating.

## **Sorghum**

Although Cyanide (Prussic Acid) is present in **forage** sorghum at low levels most of the time, acute poisoning is more likely to occur when the plant is growing fast, such as when it rains after a dry spell; or when the plant is suffering under hot, dry conditions; or in damp and overcast conditions.

However, cyanide poisoning may be an overrated problem as the number of (stock) deaths due to poisoning is very small compared to the number of animals grazing sorghums. However by observing a few simple rules, you can prevent serious loss.

- Avoid grazing stressed plants and avoid regrowth crops ratooning as a result of storm rain.
- Delay grazing until plants are over 45 cm high for shorter varieties or over 75 cm high for tall varieties. This greatly reduces the risk of cyanide poisoning. Plants forming flowers or grain are least likely to cause poisoning.
- Don't graze hungry animals on sorghum crops, particularly if the crop is wilted or stressed.
- Supplement animals on sorghum crops with sulphur (10% sulphur in a salt lick).

Cyanide poisoning generally affects a group of animals, not just an occasional one. Sudden death occurs, often within one hour of eating the plants, but may be as fast as 15 minutes. Sickness is rarely seen, however difficulty breathing, restlessness, and moaning might be noticed before the animal lies down and dies. Sometimes there is a convulsion just as the animal dies.

## **Wisteria**

All parts of this plant are poisonous. Poisoning from consuming any part of the Wisteria bush causes digestive upset caused by alkaloid toxins.

Symptoms include nausea, repeated vomiting, stomach pains, severe diarrhoea, dehydration. Severe poisoning can result in collapse.

**PLEASE NOTE: This is not a complete list of poisonous plants.**

chapter five

# housing



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## the furless or just furred mouse

A baby Spinifex Hopping Mouse will need to be housed in a warm, lined and snug makeshift nest.

### There are a few options for lining material:

**Soft cloth**, polarfleece material is ideal as it holds the warmth even if it becomes wet.

**Wood shavings**, avoid saw dust as the dust particles can be inhaled causing respiratory infection.

**Soft straw and leaf litter**, placing the straw which acts as insulation at the bottom and the leaf litter on the top.

As furless mice cannot regulate their own body temperature a heat source will be required. See **heat source** in **caring for spinifex hopping mice** chapter for further information. As the mice grow they begin to regulate their own temperature and the heat source can be removed. See **temperature** in **caring for spinifex hopping mice** chapter for further information

Once the mice are furred and become active they can be moved into an enclosure.

## the fully furred mouse

Aquariums make excellent indoor enclosures for Spinifex Hopping Mice. Alternatively metal walled and floor enclosure can also be used. Wood, soft ply or cardboard enclosures are not recommended as the mice may chew through the walls and escape. As with other small mammals species it is important to ensure that there are no small cracks or crevices in the enclosure where the mice may become trapped.

Ensure that enclosure are placed in a cool area, avoiding areas in front of windows as temperatures could rise detrimentally due to direct sunlight. An area with lots of natural light is ideal.

The size of the enclosure depends on the number of individuals being housed. A good size for a pair of mice is approximately 90cm long, 40cm wide and 50cm deep.

**Remember!** that Spinifex Hopping Mice can jump and they are known to escape so a well fitting lid should be installed. The lid should be ventilated for air flow.

As Spinifex Hopping Mice are ground dwellers there must be suitable substrate and furniture to keep the mice happy in their environment.

### Good non-toxic substrate material can include:

**Wood shavings**, preferably from native wood and changed regularly. Saw dust is not recommended as the dust particles can be inhaled and cause respiratory infection.

**Shredded paper**, also changed regularly – paper can become soiled with urine and faeces very quickly and if left may cause bacterial infection.

**Dirt or sand**, these are good options as they simulate the mouse's natural environment. Use fine sand as coarse sand may be abrasive to the skin on feet.

**Leaf litter, twigs, grass** etc to make soft bedding material.



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**a substrate of wood shavings and grass with PVC pipe for the makeshift burrow.**

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## Furniture:

As the Spinifex Hopping Mouse uses tunnels to nest in it is essential that a make-shift burrow is offered. More burrows will need to be offered for more than two mice. Ensure that any item offered as a burrow is placed directly on the enclosure floor and substrate is placed on top of that. Spinifex Hopping Mice regularly dig through the substrate and this will prevent the mice being hurt should their tunnels collapse and the burrows falls.

### Other furniture includes:

**Grass tussocks**

**Rocks**

**Branches**

**Hollow logs**



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### There are several options for burrows or nest boxes:

**PVC pipe**, cut into long length so the mice can hide deep within the burrow.

**Clay or concrete pipe**, also cut into long lengths. Keep in mind however the weight of concrete or clay and ensure that the burrow isn't too heavy for the enclosure floor.

**Hollowed out logs**, this is a good option as it is natural material.

**A small parrot breeding box** is an alternative to a long burrow-type nest.

Ensure that there is plenty of substrate on the enclosure floor. The mice will shovel the substrate into the burrow to create a soft nest. The substrate will also be used to block the entrance of the burrow during the day when the mouse rests.



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## outside enclosure

If a Spinifex Hopping Mouse is to be released back into the wild then it will need to be moved into an outside enclosure several weeks prior to release. The mouse needs time to adapt to an outside environment so that it will survive once released.

A mouse that is moved into an outside enclosure must have reached a stage where it is totally independent. Moving young mice into an outside enclosure may result in severe distress for the animal.

As Spinifex Hopping Mice can dig and can also jump it is essential that the walls of the enclosure are high enough so mice can't escape but also dug deeply into the ground so that the mice can't dig underneath.

If walls cannot be dug into the ground the floor of the enclosure needs to be made impenetrable.

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### **There are a few options:**

**Concrete floors** can be used but must have a thick layer of dirt over the top so the mice can dig.

**Mesh or fencing** wire can be laid under the dirt, either throughout the whole enclosure or around the enclosure walls only.

The enclosure needs to mimic the Spinifex Hopping Mouse natural habitat.

### **Suggestions for an enclosure habitat are:**

**Sandy soils.**

**Spinifex and melaleuca shrubs and other trees and shrubs.**

**Substrate such as leaf litter and twigs.**

**Hollow logs for hiding under.**

**A nest for burrowing in.**

## **enclosure hygiene**

It is recommended that enclosures be cleaned regularly to maintain a healthy environment for the mice. An enclosure housing two individuals should be thoroughly cleaned weekly, or more often if the substrate is getting dirty quickly. Obviously, the more mice housed in one enclosure the more often it will need to be cleaned.

Ensure that all faeces is removed weekly, however uneaten food matter should be removed daily.

If using fine sand as substrate it can be easily cleaned by using a sieve to sift through the sand and remove debris.

Spinifex Hopping Mice are small and delicate and may be injured during enclosure cleaning so it is recommended that mice be transferred into a holding facility while the enclosure is being cleaned. A good way to trap a mouse in the enclosure is to place a sturdy wooden box in the corner of the enclosure and herd the mouse into it.

## **introducing new members to the enclosure**

Although the Spinifex Hopping Mouse is thought to live in family groups, introducing a new member to the mix may cause some distress to all animals involved.

It is recommended that new members be introduced in a neutral environment on several occasions before moving the new individual into the enclosure. This will prevent any aggressive behaviour from the dominant mouse in the enclosure.

It may take several hours for the mice to become accustomed to one another. Once all individuals seem to be content in the group then all can be moved into the enclosure.

## **overcrowding**

It is important that an enclosure is not overcrowded as this may encourage submissive and dominant behaviours (see the **fully furred mouse** for more information on appropriate enclosure size).

Overcrowding may result in the death of surplus males, also individuals may be subject to chewed ears and tail. Fur loss from distress is also a concern.

## scientific observing

The Spinifex Hopping Mouse is not strictly nocturnal however most activity does occur after dusk and before dawn.

For mice that are being kept in captivity for scientific purposes (eg: breeding, activity monitoring), day and night patterns can be reversed so that activity can be viewed in daylight (work) hours. Enclose the aquarium in black material (eg: paper or plastic) with viewing holes can be cut into the material. Ensure that there is adequate ventilation to the enclosure. A UV light should be installed to simulate a day pattern during night time hours. This type of activity will also require temperature control to mimic the normal day and night temperatures.

Alternatively, a red or blue light can be installed so that night time activity can be viewed at night. Red and blue light does not appear to trouble the mice.

*P&K Pets – Hopping Mice Care.*

# release



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## essential components of a release site

There are several essential components required for a good release site for Spinifex Hopping Mice.

### These are:

**The area must be the correct habitat** for the Spinifex Hopping Mouse, which is among the spinifex hummocks in sandy flats and stabilised sand hills, loamy mulga and melaleuca flats.

**There must be wild Spinifex Hopping Mice already living in the area.** If there are none already living in the area you must ask yourself: Why? Is the habitat suitable? Have they been eradicated and if so, why?

**There must have been wild Spinifex Hopping Mice living successfully in the area until human interruption** (ie: being purposely eradicated). Of course, you would only ever consider releasing mice in this type of area if you know for certain that the reason they were eradicated has gone. You also must ensure that the area remains prime habitat for Spinifex Hopping Mice and that mice can live successfully in that area. It is recommended that you contact your local National Parks and Wildlife Service for their approval before you release mice in this type of area.

**Neighbouring land owners are supportive of mice being released in the area.** There is no point releasing mice into an area where they may be unwanted - and even eradicated - by neighbours.

**Surrounding land at release point must also be suitable for Spinifex Hopping Mice.** The range for an adult mouse can extend to 15 kilometres in a good season, so you must ensure there is enough space for mice to roam freely.

**The release site is not overcrowded.** If you release mice into an area that is already heavily populated then they may not survive.

**The release point, ideally, should be away from major roads (and train lines)** to eliminate road kills.

## is the mouse ready for release?

Any native animal needs to be in prime condition before it can be released into the wild. It needs to be strong and healthy with absolutely no sign of weakness. Weaknesses would include illness, injury or a mentally immature animal that may not be ready for life in the wild.

### Factors indicating a mouse is ready for release are:

**Size and weight are vitally important.** A releasable mouse should weigh around the 35 grams - (27 to 45 grams). Each animal is different however, so other factors should be used to determine release viability.

**The mouse should be accustomed to living outside.** The mouse needs to have experienced all weather conditions, including hot days, cold days, storms, etc.

**The mouse should be able to identify its natural food.** For several weeks before release any "un-natural" food should be slowly withdrawn and natural food (including crickets, seeds and roots) should be increased.

**The mouse should be afraid of predators.** This includes people and other animals. A animal that is not afraid should not be released as it is unlikely to survive in the wild.

**The weather conditions must be fine.** If a mouse is released during prolonged rainy periods then it may be unable to dig a suitable burrow and may be exposed to the weather. It will also be vulnerable to attack by predators as it will not have safe shelter to escape to.

## soft releasing

A soft release method is normally used when a carer releases a hand raised animal from their home and supports it for some time after release.

Soft releasing takes longer time than a hard release. The soft release process allows the animal to become familiar with the area and it also gives the animal confidence to move away from the enclosure at its own pace.

Food and water is made available to animals that are soft released. As the animal becomes more self sufficient food and water is slowly withdrawn.

A stress free transition to the wild is what we want for any hand raised animal and therefore in most situations a soft release is the preferred method.

## hard releasing

Hard releasing is commonly used for adult animals that have come into care and are released back into the area they originated from. It is also sometimes used to release hand raised animals if a soft release method can't be used. There is little to no support for the animal when using this technique and for that reason it is not a preferred methods.

You will need to have done your homework in finding a suitable release site well in advance of releasing an animal. This will involve not only finding a suitable location, but surveilling the area for a number of weeks to ensure that there are no threats in the area. It is a good idea to talk to your local National Parks and Wildlife Service for help finding a suitable release site for the animal. See **essential components of a release site** for further information.

# the veterinary guide



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## diseases of spinifex hopping mice (*notomys alexis*)

This species is now kept in Australia as a laboratory species.

Note: All treatments in the text are empirical and derived from treatment regimes for laboratory mice. These dose rates represent a 'best guess' as no pharmacokinetics have been performed with this species.

## traumatic conditions

### Predation (cat predation)

Cause: Cats are a significant predator of this species in the wild.

Clinical signs: Wounds are often found around the head and thorax  
Extensive internal damage may be present

Treatment: Address shock with warmth and fluids  
Start antibiotics:

- Enrofloxacin (Baytril, Bayer) 5 – 10mg/kg bid 5 days
- Metronidazole (Flagyl, Aventis) 20mg/kg bid

Pain relief: meloxicam (Metacam, Boehringer-Ingelheim) at 0.2mg/kg sid

Prognosis: Guarded – cats have been a cause of local extinctions!

## diseases

### Viral Diseases

The house mouse has brought many viruses into Australia when it arrived on the continent. Native mouse populations have not been monitored for the presence of these viruses. However, it may be expected that these novel viruses may impact heavily upon naïve native species. This has not been documented.

### Bacterial Diseases

#### Respiratory tract disease

Cause: A variety of bacteria can be involved. These include:

- *Pasturella*,
- *Streptococcus* and
- Cilia-associated respiratory (CAR) bacillus.
- *Mycoplasma* has also been isolated. (Mackie et al)

Clinical signs Progressive difficulty breathing, snuffles, rough coat, chattering teeth, weight loss, head tilt, lethargy, sudden death of individuals.

Diagnosis Submit animal for necropsy.

Treatment: Broad-spectrum antibiotics based on bacteria present  
**Enrofloxacin** at 10mg/kg bid, **doxycycline** at 5mg/kg bid

Prevention: Keep stocking rates low  
Provide good ventilation  
Use an all-in-out system – do not add new animals to a group that is already established.

### **Tyzzler's Disease** (Breed)

Cause: A bacterium, *Clostridium piliformis*

Transmission: Faecal-oral route

Clinical signs: Asymptomatic in some individuals  
Sudden death in weak or stressed animals  
Weanlings may have a mucoid bloody diarrhoea

Treatment: Supportive care  
Antibiotic therapy may be successful with one of either **oxytetracycline, penicillins, or cephalosporins**

## **parasitic diseases**

### **A. Internal parasites**

#### **Tapeworm**

Cause: *Rodentolepis fraterna* (Hill et al)

Clinical signs Sudden death,  
enteritis, diarrhoea,  
No clinical signs seen.

Diagnosis Faecal floatation

Treatment: **Praziquantel** 30mg/kg once a fortnight for 6 weeks

#### **Nematodes**

Cause: Oxyurid pinworm, *Aspicularis tetraptera*

Clinical signs: None.

Diagnosis: Faecal floatation will show presence of eggs.

Treatment: Treatment may not be required as these are normal parasites  
Antiparasitic agents have been used

- **Ivermectin:** 25mg.L drinking water for 4 days a week over 5 weeks
- **Piprazine citrate** 4mg/ml drinking water for 10 days
- **Fenbendazole** 20mg/kg PO once daily for 5 days

#### **Toxoplasmosis**

- Cause: A protozoan parasite, *Toxoplasma gondii* whose primary host is the cat.
- Transmission Ingestion of an infective life stage of the protozoa.  
The natural cycle is from cat to mouse to cat.
- Clinical signs Unlike European rats and mice, native mice have not evolved with *Toxoplasma*. Thus it is possible that disease may result. Clinical signs, seen in other naïve Australian mammal species may include: sudden death, lethargy, convulsions, lameness, diarrhoea.
- Treatment: None likely to be effective.

## **B. External Parasites**

### **Ascarid Mites**

*N. alexis* hosts 3 species of *Murichirus sp*, a small slender mite belonging to the ascarid family:

- *M alatus*,
- *M dorsoscutatus*,
- *M dorsostriatus*

Clinical signs: Commensal parasite on the fur,  
Rarely causes lesions.

Treatment: None required.

### **Fur-clasping mite**

Cause: *Myocoptes musculinus*

Clinical signs: Fur loss between shoulder blades, pruritis,  
Weight loss.

Treatment: Selemectin at 2 – 6mg/kg (0.01ml of pup/kit revolution).

## **husbandry conditions**

### **Mass Mortalities**

Cause: Several different agents have been implicated (Jackson)

- *Clostridium piliforme*
- *Streptobacillus moniliformis*

Clinical signs: As this species is a laboratory animal, mortalities have been noted in the past.

Diagnosis: Submit freshly dead animals for necropsy.

Prevention: Have low stocking rates,  
House animals from different ages and areas separately.

### **Tail Skin Shedding**(Jackson)

- Cause Hopping mouse is picked up by the tail.  
Also called 'tail slip'.
- Clinical signs: Tail skin sloughs off and the tail then suffers dry gangrene and falls off.
- Treatment: Antibiotics may be of assistance. However, the tail is still likely to fall off.  
Amputation of the tail may be required by a veterinarian.
- Prevention: A cupped hand can be used to catch hopping mice.  
Catch this species in a calico bag.  
They can be restrained for examination by scruffing.

### **Con-specific Fighting**

- Cause: A communal animal, but a high density can lead to fighting.
- Clinical signs: Fur loss,  
Damage to tail with resultant scarring,  
Death.
- Treatment: If minor, clean with antiseptic (Chlorhexidine) and dry well.
- Prevention: Reduce stocking rates.

### **Diarrhoea due to overfeeding**

- Cause: Small animals are often overfed during hand rearing.
- Clinical signs Greatly distended stomach filled with milk,  
Diarrhoea found in the bedding
- Treatment: Reduce the amount fed but increase the frequency if required.  
Wean early onto solid foods.  
Examination of the faeces may be required to direct therapy.