Macropology

A guide to raising and releasing kangaroos and wallabies

Cheryl Dooley

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Course objective

The objective of this course is to develop

your ability to rescue and rehabilitate macropods.

In particular we will discuss the

rescue, rehabilitation and release of eastern grey kangaroos, red-necked wallabies, swamp wallabies and red-necked pademelons.

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Disclaimer

This publication, the workshops and supporting material are designed to provide an overview of the subject matter covered. Whilst every care is taken in the preparation of materials, no liability is accepted for any error, omission or reliance upon information or advice.

This manual has been written from my own "hands-on" experience. This experience has developed quickly due to the dedicated work of volunteer macropod carers around Australia who have willingly shared their experiences with me. There is little science available with regard to raising orphaned macropods, so we as carers rely on the sharing of information. There are too many individual carers to be able to thank them all, however I would like to mention the work of Helen George, Peter Coote B.V.Sc, Lynda Staker, Dr Roger Cook B.V.Sc., Anne & Ray Williams, Enid Latham, Kathryn Keen, Kerry Cranney, Yvonne Mack, Paula Flack, Judy Petersen, Gemma O'Shea, Dr Rick Speare B.V.Sc., Sandra Byrne, Jennie Clowes, Sue Ulyatt and Jenifer Brindley.

Special thanks to Stephen Dooley, my better half and a great carer, proof reader and supporter!

Maximising this training

240g swamp wallaby, complete with dummy

1. This training is for YOU, and its success rests largely with you
2. Be PROMPT and regular in attendance
3. Always SAY what you think
4. Be ENTHUSIASTIC in your approach
5. Give freely of your EXPERIENCE as it may benefit others on the course
6. Be PRECISE - Confine your discussion to the problem
7. Always LISTEN alertly
8. Only ONE person should talk at a time
9. Be OPEN-MINDED of others' views
10. The only silly question is the one that remains UNASKED

Course contents

Welcome

Eastern grey female 4kg

What is a macropod? Macropodoidea is the name of a family that includes kangaroos, wallabies, potoroos and even tree and rat-kangaroos. Macro is the Greek word for big and pod means foot – therefore this training is all about "big foot"! Macropods are marsupials, that is, they carry their young in pouches and their young are "born" at an embryonic stage.

Macropods are amongst the hardest of all native animals to raise and successfully release back into the wild. Yes we have all heard the stories of when uncles and aunts raised a "roo" – but our primary aim here is to release a 100% fit joey back into the wild and for it to SURVIVE there long-term. This will not happen if the joey's health has been compromised by poor caring techniques and/or incorrect diet and it will not happen if the joey thinks domestic dogs are its best buddies and that fighting with human kids is a great game.

As with most native animal care, the contents of this manual are not proven science. It is written from personal "hands-on" experience using methods developed by myself and other macropod carers over many years. Vets are of enormous assistance as well, but often are learning too. Macropods are quite different to domestic animals, and react differently to treatments that would be standard for other animals. Two examples are the lower core body temperatures of macropods, which, like most marsupials, try to maintain a core body temperature near 36°C, lower than most placental mammals, and their lower metabolism ("…kangaroos have basal metabolic rates that are about 70% of those of comparable placental mammals"). [2] What this means is that things change over time as we gain experience and share knowledge with other groups. If you are told something by a macropod carer, or another person, which isn't contained in this manual, but may be worth further investigation, please talk to your Macropod Coordinator. It is VERY IMPORTANT to check information thoroughly. Too often a piece of information is taken as gospel when in fact it isn't correct, or has been changed along the way as people add their own translations to the original information. This can be very dangerous and may lead to serious harm to the joey. Manuals may not be totally correct as the information changes overtime. I welcome all new information and will thoroughly research it to ensure it is correct and can be safely used.

Where possible I've included stories of experiences I've been through – both positive and negative that I hope will help you to understand why I suggest you work with these methods. You'll also notice I've had some fun with some of the headings. This in no way suggests this isn't a serious business; indeed it's the opposite. Good macropod caring can be a stressful job as you battle with loose poo and illnesses you hadn't dreamed of – so the maintenance of a sense of humour will help you to survive the odds and stay outwardly calm for your joey even when your stomach is churning!

"The joey's long term welfare comes above all else". As a volunteer with WIRES (The NSW Wildlife Information and Rescue Service Inc), I work under a number of policies with regard to macropod care. This one principle is what I treasure above all else.

The Macropod Coordinator

This term is used often throughout this manual and refers to the person within your Wildlife Care Group, who is ultimately responsible for the welfare of the macropods in care. Titles will vary by

organisation and so Species Coordinator, Animal Officer, Mammal Coordinator, might all be appropriate. I have used Macropod Coordinator, as that is the title used by my local WIRES branch.

The Commitment

To foster care an animal is the same for me as foster caring a child. It comes with the same responsibility. What you do in your time with this joey determines its future – its ability to survive in the wild.

Your children may well want to play with your joey, and indeed our children are the next generation of wildlife carers and so let's educate them now. They need to understand:


Joeys are neither pets nor toys


Joeys are not to be handled by children


Joeys have only one "Mum" who does everything for them


Joeys are stressed by high-pitched shrieks, dogs barking and friends putting their heads into their pouches

Teach them to respect the needs of these creatures and you really will have a great helper on your hands.

Ask yourself who fixes it if the joey is:


underweight


desensitised to dogs


over friendly with humans


cannot recognise their natural foods


cannot recognise their natural environment

What happens to the joey when released? There will be no special foods, no TV, no hugs, no warm blanket. Raise the joey for the joey's future – not for your fun today.

Doing things well can make such a difference. When I first took on the role of Macropod Coordinator in our area, the "deaths in care" rate was almost 70% ie 7 out of every 10 joeys that survived the first 24 hours in care, died before they were able to be fully released. By making changes and instituting many of the concepts I have included in this manual, the rate is currently around 26%. I'm not sure if we can improve on this as some joeys coming in are clearly compromised, but we'll certainly be trying.

This manual has been created to assist **licensed wildlife carers**. It is illegal to raise a native animal, in most places, unless you are licensed, so please ensure you are not working outside the law. You may not care about the law, but please care about the joey – most need to be buddied and raised in very specific circumstances to ensure their successful release. They aren't pets or toys so please respect their right to a safe and fear free environment to be raised in, and the opportunity for a long life in the wild.

Using this manual

I've tried to create an easy to use manual. The Contents pages will direct you to major topics and the Index offers more detailed topics and where they are discussed. I recommend you read the manual thoroughly and then, as each joey arrives, recheck modules as you need them. It is amazing how the information disappears from our head, so dosages etc. are well worth rechecking regularly. There are one-page charts on such things as illness, diarrhoea and medications, which I hope will make life easier too. At the rear of the manual are what I have called "**Progress Charts**". These are, one page per species, reference tools that can help to keep you on track with housing needs, joey activity, feed requirements, expected weight gains, poo quality and so on. I would emphasise that they are a guide only, and you need to know the information from the relevant module to be sure you are working correctly. Each joey is individual and we need to be sure that there is a definite correlation between the joey weight and its age, to ensure we are not pushing the joey through the system too fast. Talk to your Macropod Coordinator, as you progress, to ensure everything is on track for the specific joey in your care.

TRAINERS

If you would like to use this manual as part of your training program I would be more than honoured. I have created a video of caring procedures and a PowerPoint presentation containing dozens of colour photos, that I would be more than happy to share with you at cost, (blank video tape, CD and postage), to use with your training. Please contact me via (02) 6654 3793 or email: dooleydy@ozemail.com.au. The only thing I ask is that you respect my copyright to the work and that you do not alter it in anyway.

Borrowing this manual? Further copies of this manual are available free of charge via http://www.ozemail.com.au/~dooleydy/macropology

I wish you and your joeys well.

Cheryl Dooley

The Locals

Ratty the Red-necked Pademelon (Approx. 1kg)

Module objectives

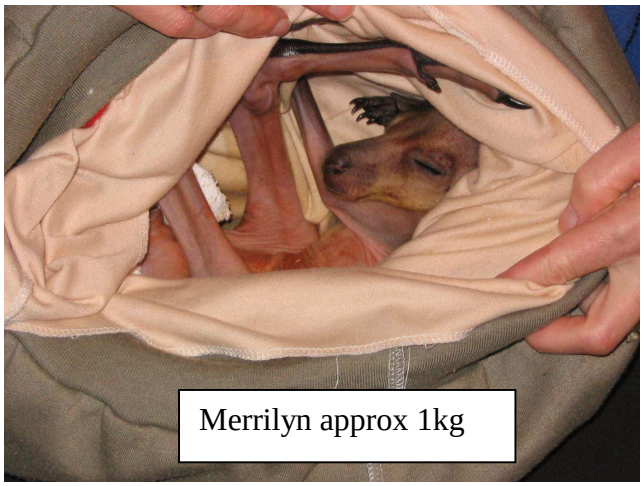
By the end of this module, you will be able to:

Identify local macropod species

Here we cover the main macropods that come into care in our area, around Coffs Harbour, mid-north coast, NSW.

The Eastern Grey Kangaroo

Macropus giganteus- 'gigantic long-foot'.



Merrilyn approx 1kg

Merrilyn – approx 1.5kg

This is our most common kangaroo, though we still only see small numbers in care here due to dwindling population levels caused by increased human habitation.

Wild eastern greys from the Idle Acres mob

Description

A uniform shade of grey, some towards a brown colour. Black tip to tail.

"Relations between an infant eastern grey kangaroo and its mother are quite intimate, involving a bond which is not broken until the juvenile is ready to fend for itself" [3]

Habitat

Woodlands and forests. Although mostly seen grazing in open areas these woodlands are crucial to the eastern grey for shelter.

Natural Food

The eastern grey is predominantly a grazer of fibrous grasses. This preference for grasses remains even through severe droughts. They will also eat herbs, bark, leaves and dirt.

Habits

They graze in the early morning and late afternoon, resting for most of the day and for a period at night.

Breeding takes place continuously though there seems to be a summer peak of births.

The eastern grey is a gregarious animal, living in small groups that combine to make up what is known as a "mob". It will not survive on its own in the way most wallabies and pademelons do.

Statistics

- Weigh approx. 740mg at birth[4]
- Males can grow to over 2 metres tall, females as much as 1.8m[5]
- Home range of 20-23 hectares [6]
- Males can weigh up to 66kg and females 32kg [7]

Buster at 3kg

- Sexually maturity – females at 18 months, males 48 months [8]
- Young start to emerge from the pouch for short periods from about 9 months [9]
- Young vacate the pouch at around 11 months [10]
- Young continue to suckle from the same teat until they are approx. 18 mths old [11]

The eastern grey is the macropod that suffers the most from stress, and in turn it therefore is the macropod that suffers from most diseases. Grouping is needed for successful release, as they are gregarious animals.

The Red-necked Wallaby

Macropus rufogriseus – 'red-grey long-foot'

This is our most common wallaby. It is under threat due to the clearing of coastal forests for housing and development.

Wilkie the red-necked wallaby approx 5kg

Description

Reddish brown to grey in colour, often more reddish colour around the neck and shoulder area. Pale cream to grey underbelly. Pale strip down jaw line.

Habitat

Eucalypt forests where there is a moderate shrub layer and in areas of tall coastal heath.

Natural Food
Grasses and herbs in the main, but as with other macropods they also consume bark, leaves and dirt. It is primarily considered a grazer.

Habits
During the day it rests in dense shrubs emerging to feed in the late afternoon and during the night. It is quite a solitary animal, often seen alone or in groups of two or three. Where large groups are seen together this usually suggests a good food source in an area of scarcity rather than the animals working as a group.

Breeding is continuous.

Statistics

- Males grow to an average of 780mm, females to 705mm [12]
- Home range of about 12 hectares for a female and 32 hectares for a male [13]
- Males weigh around 20kg and females 14 [14]
- Sexually mature between 14-19 months [15]
- Young vacate the pouch at around 9.5 months [16]
- Young continue to suckle from the same teat until they are between 12 and 17 months old[17]

Red-necked wallaby, 1kg

The Swamp Wallaby

Wallabia bicolour – 'two-coloured wallaby'
Again this wallaby is under threat due to the clearing of coastal forests for housing and development.

The swamp wallaby is so different to other wallabies that it is the sole member of the genus *wallabia*. One example is in the number of chromosomes. *Macropus* wallabies have 16 chromosomes whereas the swamp wallaby male has only eleven and the female only ten.

Female 238g

Description
Dark body, some chocolate brown to almost black, others dark grey. Orange colour behind ears and on belly. Sometimes a white tip to the tail. Pale stripe down the jaw line.

Habitat
Thick, and we emphasise the word **thick** here, undergrowth of forests, woodlands and heath. They particularly like wet areas and hills.

Natural Food

As per the red-necked wallaby food includes grasses, herbs and several shrub species and as with other macropods they also consume bark, leaves and dirt. The swamp wallaby is known as a browser as there seems to be a preference for bushes rather than grasses. It has been known to eat a wide range of both native and exotic species and will eat pine tree seedlings, bracken fern and even hemlock in times of drought and if its preferred native vegetation is unavailable. The swamp wallaby's molars differ in shape to other wallabies and it has a fourth premolar that is used to cut hard plant material.

Female 1.5kg

Habits

As with most macropods it rests during the day in dense shrubs emerging to feed very late in the afternoon and during the night. The swamp wallaby is even more solitary than the redneck and is only seen in groups when feeding. It is more nervous than the red-necked wallaby, and will generally disappear into the bush at any sign of humans. Breeding is continuous.

Statistics

- Males grow to an average of 756mm, females to 697mm [18]
- Home range of about 14 hectares up to 91 hectares [19]
- Males weigh around 17kg and females 13kg [20]
- Sexually mature between 15-18 months [21]
- Young vacate the pouch at around 9 months [22]

Female approx 2.5kg

- Young continue to suckle until they are about 15 months old [23]

Red-Necked Pademelon

Thylogale thetis "Thetis (Bougainville's ship) pouched weasel"

There are both red-necked and red-legged pademelons in this area, however it is the red-necked pademelon that comes into care more often.

Male RN pademelon 340g

Description

Greyish brown with rufous shoulders and neck. Cream under belly.

Habitat

The forest edges of rainforest and wet sclerophyll forests.

Natural Food

The red-necked Pademelon enjoys grasses and shrubs and rainforest fruits.

Habits

The pademelon is similar to most macropods in that it is often at rest in the middle of the day and around midnight. During daylight, any activity is confined to the forest so humans rarely see these animals. The red-necked pademelon can be a creature of habit, often heading to evening feeding grounds along the same well-worn paths. It is primarily a solitary animal and very timid, rarely moving far out into clearings.

Statistics

- Males grow to around 500mm, females to around 420mm [24]
- Home range 5-30 hectares [25]
- Males weigh between 5 and 7kg and females around 4kg [26]
- Sexual maturity occurs for females at about 17 months. [27]

Ratty the pademelon, approx 1kg

Joey ID

Most of the joeys coming into my local area are red-necked or swamp wallabies. The only kangaroo we have is an eastern grey. We do occasionally rescue a red-necked pademelon and very, very rarely a red-legged pademelon. You need to become familiar with the macropods of your specific region and a very useful book for this purpose is *The Mammals of Australia* Edited by Ronald Strahan. Reed New Holland 1995

Unfurred joeys:

Kangaroo or wallaby? Eastern grey kangaroos are much larger in size and remain unfurred until they are 1kg and more. If its eyes are open and it's under 500g then it's a wallaby. If it has colouring and is under 700g it's a wallaby. Eyes open but only 100g? It could well be a pademelon.

Here's an unfurred swampy. You may just see the dark ring around the cloaca.

Which wallaby? This is a bit tougher:

Swamp wallabies usually have a dark ring around their cloaca and they have a distinctive smell. They also often have two little bones, which look like lumps on their nose between their eyes. They have a fairly triangular head. Their hind legs are shorter and stockier than that of a red-neck. They also colour much faster with distinctly black tips to ears and nose from about 400g.

Red-necks don't have colour near their cloaca and tend to have long wispy hairs coming from it. Their head shape is more hourglass in shape and they have a distinctive cream stripe on the side of their face from quite early on.

Red-neck of 360g

Furred joeys:

Kangaroo or wallaby? Again weight is a telltale factor with eastern greys only starting to develop colour and fur from 1kg up. They are a uniform grey colour all over.

Swamp wallabies tend to be dark all over with an orange hue on the bottom half of their cheeks, behind their ears and on their tummies. They may have a white tip to their tail. Swamp wallabies gain colour very quickly eg a 650g swamp wallaby will be totally dark over most of its body already, whereas a red-neck will still be very light in colour.

This is a male swampy of 1.2kg

Red-necks have a large colour range but tend to reddish grey fur. Their tummies are cream coloured.

Fully furred and only 280g? It's a pademelon.

This is a 1.25kg red-necked wallaby

This is a 500g red-necked pademelon

Remember, if you have the opportunity, look closely at the adult, as this is still the faster way to identify the joey.

Stressed Out

Culeen, Kumbiri and Nurilee – all lost to Coccidiosis

Module objectives

By the end of this module, you will be able to:

- Understand stress in macropods and how to avoid as much of it as possible

Stress is a macropod's number one enemy and the thing that causes most macropods to die. Why? Stress causes changes to the joey's immune system. A compromised immune system can mean that illnesses, which would normally be easily overcome, cannot be.

Signs of Stress

Most often there is no sign at all. This can lead carers to think that things I say cause stress, don't worry their particular joey – my advice - don't take the chance. The animals that are most easily stressed are those that seem the least ie the eastern grey. Death often happens long after the stressful incident, often at release sites when the joey comes into contact with its natural environment and other animals and loses its 2nd "Mum". A compromised immune system sees disease take hold and some may take up to 18 months to manifest themselves.

Some things that may alert you to stress include:

- The joey may be completely quiet and flat
- Constant chittering sounds and/or "calling"
- Licking of forearms – which usually indicates heat stress
- Quivering or shaking
- Diarrhoea or loose poo
- Fast eating (mostly when grazing).
- Head shaking
- Failure to thrive
- Fur loss
- Teeth grinding
- Sucking on body parts or liner

What can cause stress?

There are far too many to list here and often it can be the smallest thing. Here are the main items.

- Noisy environments – especially traffic noises, loud bangs, high-pitched sounds, shrieks, slamming doors.
- Closeness to things their instincts tell them are predators eg dogs
- Closeness to strangers. Remember in the wild a joey has only one companion, it's Mum. It may come into contact with others of its own kind but these encounters may be very brief and often result in a cuff and a growl from the other animal. Joeys do not have lots of Aunts, Uncles, brothers and sisters around them.

- Being handled by children
- Changes in routine. Make any necessary changes gradually and only one at a time eg don't change milk types and milk feed number at the same time.
- Milk too hot or too cold
- Changes in clothes or shoes? Sound strange perhaps but a number of us have seen this happen. In the most recent case I realised that after weeks of generally wearing black track pants (winter wardrobe) I was in cream pants. I had to keep bending down so the joey was sure who I was. A similar thing happened to another carer with one of her joeys when she suddenly changed the shoes she normally wore outside. It may be that if the joey sees you in different clothes every day from go that it won't be a problem, but be aware of any sudden changes you may make. I have been told that joeys seem calmer with dark coloured clothes rather than bright colours – this could be true – it certainly was the day I didn't wear the black track pants! This is especially important for older joeys that come into the system – try to use navy blue or black liners to ensure they can hide in a nice dark space like Mum's pouch.
- A change of Mum. Given the nature of joeys and their care – this is the reason we try not to pass joeys through more than one carer before the release site. It is hard enough that a joey loses its original Mum but then to under go a second loss can seriously cause a problem and that is why we will often opt for animals to go straight to where they can be released from if possible.
- Pouch being removed too early. Again in the wild a joey is never alone. Mum is always there – 24 hours a day, 7 days a week – this is what nature intended. We can't be there 24x7 however their pouch can be, and in general a macropod should always have its pouch available and particularly when you are not there, up until they are of the age when they would naturally be fully emerged from the pouch.
- Transport by car. Joeys of any age should not be transported other than for vet visits and transfers to release. For an older joey that has not been in a car for some time car transport can prove to be so deadly that it may be better not to risk a Vet visit unless there is no possible alternative.
- Confinement. If a joey is used to being out and about and suddenly is kept inside
- Too many changes in environment
- Joey out on the ground pre emerging stage
- Constant handling – especially on arrival
- Changes in weather – especially long periods of rain
- Thunderstorms
- Chasing and capture.
- Stressed carers. If you know you are highly strung and talk at a hundred miles an hour you may not be the right kind of person for joey care. Macropod Mum's hardly make any noise at all.
- Angry carers. If you are cross – stay away from your joey. It will not understand that your raised voice is not meant for them. If you are frustrated with your joey – shouting at it won't help anything.
- Cigarette smoke and other air pollution eg strong perfumes and aerosol sprays

- Too many people feeding the joey. "Native animals respond better when there is only one carer who attends to their needs."[28]
- Excessive heat. In hot weather joeys need plenty of fluids.
- Excessive cold. Especially when joey is very young or for an older joey, if they have been over heated as a young joey and therefore have inadequate fur coverage
- Inappropriate housing eg pouch too loose, therefore no feeling of security. Inability to easily enter and leave pouch.
- Feeding outside the liner. Remember small joeys don't leave their Mother's pouch to feed and are not used to their legs and tail being free in the breeze. An uncovered tail can be a major problem for some joeys.
- Missed feeds or irregular feed times.

Hearts of joeys that die often show damage and Vets believe this is due to the stresses they undergo in losing their Mum originally and within our care. One example is of a joey that was autopsied after it died at its release site. Heart damage was the only thing found. This joey had lost its Mum in a motor vehicle accident, had been looked after by a member of the public for a time, went through two carers before reaching its release site and then ended up being the only joey left in a pen. All of these circumstances were beyond the branch's control for various reasons but it does leave you wondering whether one or two, or all these things combined caused the death?

Why does stress lead to disease?

Stress causes a number of physical reactions: [29]

- The pituitary gland reacts leading to the adrenal cortex releasing high levels of cortisone. This sugar boost helps the joey to cope with the immediate stress they are facing, however if stress occurs regularly then detrimental affects occur including ulcerations of the stomach that can affect nutrient absorption and thus deplete energy reserves
- The thymus and lymph nodes – key parts of the immune system – can shrink causing an inability to fight future infections. The thymus glands in a healthy joey are often prominent. (They can be found on the chest between the armpits. When a healthy joey comes into care the gland is usually quite pulpy indicating good immunity.)
- Blood pressure can rise and this in itself can prolong stress
- Leucopenia occurs (decreased white blood cells) – again leaving the animal vulnerable to future diseases.

Male red-necked pademelon 300g
See the plumb thymus gland on his chest to the left of that back leg.

"The result of stress is often not seen until days or weeks after the stressful incident, and this factor in itself confuses those trying to diagnose a problem."[30]

Sometimes all we see is a general slowing of progress caused by malabsorption.

Rescuing

Male swamp wallaby 400g

Module objectives

By the end of this module, you will be able to:

- Organise yourself in preparation for a rescue
- Conduct a safe rescue

Equipment:

Things you will need

- A hot water bottle, well wrapped, (use hot water from the tap - not boiling water) or a grain-filled heat bag (these are reusable bags filled with wheat or rice and heated in an oven or microwave. NB: See the warning on using these grain-filled bags at the end of this section.)
- Pouch liner made from natural fibre such as wool or cotton
- Sharp scissors
- Tie to tie bag up.
- Bag to carry joey in. A pillowcase is ideal for a joey, (don't forget to turn it inside out! You may need something larger for a larger joey)
- Blankets – to cover an injured adult if it needs to be subdued or larger joey
- First aid kit to address minor wounds
- Disposable gloves
- Torch (for night rescues)
- Thermometer to check pouch temperature

Please don't take dogs along for the ride on a macropod rescue.

DO NOT overheat grain-filled heat bags. Fires have occurred when wheat bags have been used as 'hot water bottles' to heat a bed. Tests suggest that the grain may deteriorate with use and then spontaneous ignition may occur. The likelihood of fire is enhanced if the bag is insulated with blankets or quilts – this may be replicated when wrapping a bag to provide warmth for a rescued animal. Fire Services provide the following recommendations:

- Do not overheat (maximum of 3 minutes)
- Use 'wheat bags' bags only as heat packs for direct application to the body – do not use them as bed warmers
- Do not reheat the 'wheat bag' until it is completely cooled – possibly 2 hours or more after initial heating
- Do not leave them in the microwave unattended. Watch for signs of over-use: an over-cooked odour, a smell of burning or, in extreme cases, smoking or charring
- Discard if you observe any problems
- Cool well before storing

Rescue safety

It is important to think of your own safety first. Be extremely careful of traffic when trying to rescue injured animals on the road. People who have stopped to rescue an animal on a country road have been killed.

Be very aware that an injured macropod can be an extremely dangerous animal. Not only do back legs pack a punch that can break human bones, the fore paws have extremely sharp claws that can rip through flesh. Keep your distance until you have properly assessed the situation and use a blanket to protect yourself.

Expect the unexpected. Even when an animal looks dead – it may not be, and even a severely injured joey can fight for its freedom when touched.

Unless it is absolutely necessary do not take children on rescues, and if you have to, please ensure they are kept well clear of the rescue activities, and quiet to minimise the stress to the joey.

Rescue of Joeys

Take note of the mother's injuries. This may help in the assessment of any injuries the joey may have sustained. With head injuries to the mother the joey is often unharmed. With body injuries, the joey may also be injured.

Also take note of what type of macropod the mother is. If you aren't sure note the colouring and any specific markings eg a white tip to the tail or a white line on the cheek. Often tiny joeys can be hard to identify and it will help to know how to care for the joey if we can identify it as soon as possible and obviously the easiest way is by identifying the mother.

In many cases a member of the public will have already rescued the joey from the mother's pouch, however you will find that you now have a new interest in road kills and that you'll be stopping the car and checking for pouches whenever you see a macropod down. Joeys can survive for several days in Mum's pouch so always stop and check.

Removing joey from mothers pouch

If the joey is attached to the teat gently try to press the sides of the joey's mouth to release it. If this doesn't work stretch the mother's teat out, (it is long and thin) and cut the teat with your sharp scissors as close to the mother's body as possible. The mother is dead and won't feel a thing. Do not pull the joey from the teat as this can cause injury to the joey's mouth.

Never try to pull the joey out by the legs. This has been known to cause dislocation and even breaks.

Rub the inside of the pillowcase on the inside of the mother's pouch to pick up the scent and then place joey inside. The exception to taking some of Mum's smell is if she has been dead some time and has developed a "dead" smell. In this case it may be better to simply pop the joey into a clean liner. Cover the joey's head to ensure it feels protected.

Beware of Over heating

When rescuing wildlife we have been taught to take a hot water bottle to ensure we can offer warmth to whatever we collect – quite correctly. However please be aware that overheating can be equally as bad as under heating and is far more likely in warmer weather. In moving a joey recently I used my

thermometer to measure the temperature that was generated using a hot water bottle and I very quickly removed the hot water bottle from the pouch. In a matter of minutes it had reached 36 degrees. Even a tiny unfurred joey only needed 32 degrees! (Overheating can cause skin to peel, poor fur development, cataracts and lethal heat stress, which causes organs to shut down.) Often it is sufficient to use your hot water bottle to warm the pouch materials and then, when you add the joey, take the bottle away, wrap the joey up well to retain the warmth and head home. If you do continue to use the hot water bottle please make sure your charge is well insulated from the bottle and only ever use tap water (not boiling water). On hot days ensure you use slightly cooler water and take a thermometer with you if you can to ensure you aren't "cooking" your rescue! Well-furred joeys don't need any additional heat.

Older Joeys

Mothers hit by cars may have had a joey at heel at the time of the accident or a joey that is old enough to emerge from the pouch. Look at the pouch – is it empty but enlarged? There are 4 teats within the pouch and any elongated teats show that a joey has been suckling. Sometimes, if you wait quietly, you may even hear the young joey calling for its Mother. If a joey is no longer living in the pouch and is old enough to be weaned, it may have a greater chance of survival by being left in the wild than by being brought into care. (Capture myopathy can result from chases. See Myopathy in *Oh My God He's Sick!*).

Older animals in the wild can be picked up by the base of the tail – as close to the body as you can to ensure you don't damage the joey's tail. (Illustration [31]) Ensure the forepaws do not come close to you as they are extremely sharp and can do a lot of damage. Pop them into a bag as soon as you can – never carry a joey by the tail base over distance.

An older joey will find the transition from the wild to hand rearing much more traumatic than a younger joey. Put them in a dark coloured liner in a dark pouch and keep them totally covered and quiet. Handle them as little as possible, talk quietly and give them plenty of time to get used to their new environment. It may be useful to put them in a dark room, with some supplementary feed and leave them to adjust as much as possible.

Transporting the joey

Hang the bag in the car if you can, from the back of the passenger seat via the headrest may be a good choice. If you have a hot water bottle within the bundle be aware that it may be heavier than the joey and could squash a tiny body. Alternatively place it on a seat – well secured in case of a sudden stop and with the joey tied into the pouch so it cannot escape whilst you are driving. Remember, warmth only – don't cook it. Turn off the music (and the talk back) and try to maintain an even temperature in the car so that the joey does not overheat or chill on the way.

Before the joey can be allocated to an appropriate foster carer it needs to be assessed, and possibly stabilised, by one of the Macropod Team. If it is possible to transport the joey directly to them, then there will be less stress for the joey. If that's not possible then take it to your home and use the following instructions until such time as you can gain the help of one of the team. We cannot stress enough the need to involve the macropod team as soon as possible to ensure the best possible outcome for the joey.

No food or drink

At this point you should not feed the joey milk. The body cannot absorb food or drink until its temperature is normal.

Check for condition and injuries

Gently check the joey with warm hands. Check for Broken Limbs/ Cuts / Blood in eyes nose ears and mouth. Look for breaks in the tail.

Look for fly eggs (look like white dots or a bit like pieces of dry rolled oats when in clumps), and maggots (may look like white worms). Look in the ears, eyes, nose, and mouth and around the cloaca and in any open wounds. Seek help for treatment.

Check hydration- pinch skin on the base of the neck. (See Dehydration section in *Oh My God He's Sick!)* Seek expert advice if in any doubt as to the treatment required.

Weigh the joey. If the joey is very tiny the Co-coordinator may decide on euthanasia, as experience has shown that these joeys are not viable without the colostrum and anti-bodies from the Mother's milk. Having these anti-bodies is absolutely vital if these small animals are to be raised to a successful release. Be assured the joey will be saved if it can be.

Warm up

Ambient temperature measured by a thermometer in the bag (not next to the Joey's skin)
Unfurred – 32 °C
Slightly furred - 30°C
Furred – 28°C

Once Warmed

Give a rehydrating fluid such as Lectade. 10% of body weight over 24 hours, or glucose and boiled water if Lectade is unavailable. Feed slowly as they can take fluid into their lungs (See *Where's My Bottle?).* Give no milk or other food until fully rehydrated and the need for veterinary treatment has been eliminated. In the past it was suggested that we should leave milk out for the first 24 hours, however this has now been changed as the electrolyte fluids do not allow for growth in the joey and so not giving the joey milk can result in weight loss. It must be stressed though that the joey must be fully warmed and rehydrated with no need for veterinary attention BEFORE milk is given.

Adult macropod rescue

Roads

This needs to be handled by an experienced macropod carer. Only go if you are confident you can deal with the situation. Usually two people are required. If the animal has fractures it may need to be euthanased.

Remember:

- Think of your own safety first
- Park your car well off the road
- Don't go onto a busy road
- Don't try to bring an adult kangaroo or wallaby in for rehabilitation, they will usually die from stress / capture myopathy
- If it hasn't hopped away it is probably badly injured or concussed. If it is concussed watch from a safe distance as it may regain consciousness and hop away. If it is conscious and can't get away it is very likely seriously injured. In most cases of serious injury there is little anyone can do and the animal will have to be euthanased.

Fences

Adult macropods sometimes become caught in fences. If you need to cut wires you should always do everything you can to ask permission of the owner first. Check for injuries before cutting the wire as the animal may simply escape into the bush and not be able to be treated. Sometimes you may need to try to treat small injuries before cutting the wire. Remember that the more time this takes the more stressed the animal, and the more chance of myopathy (See *Oh My God He's Sick!*) Covering the animal's head with a towel or blanket may help to keep it calm. In order to rescue a large animal with more extensive injuries you may need to see if your local Government wildlife authority, or the council ranger can tranquillise it. When the animal is sedated it can be released from the wire, checked for injuries and possibly have its wounds dressed at the site. You will need to observe the animal until it regains consciousness.

Euthanasia of larger animals

Ring a licensed shooter. If unavailable try your local Government Wildlife authority or the police.

Call the Macropod Coordinator

As soon as a new joey comes into care call your Macropod Coordinator. Yes this means the joey may have to be handed on to someone else to be buddied etc. but please remember that this is in the joey's best interest. It is certainly not good for the joey to attach itself to you for a couple of days only to be moved on – that's putting it through very unnecessary stress to satisfy your own needs. It may also need expert care and could die without it. Remember we are here for the animals, they aren't here for us.

Settling In

Male Red-necked wallaby approx 1.8kg

Module objectives

By the end of this module, you will be able to:

- Understand the process of stabilisation

Stabilisation is a process we go through when a joey first comes into care. Specific carers are nominated as Stabilisers and there may be a specialist course to complete to become a stabiliser, however I thought to include the main points here so that all can appreciate the need for stabilisation. In my wildlife care branch we have managed to bring the "deaths in care" rate down from 70% to 26% utilising methods such as stabilisation – so this step should not be taken lightly. Although new carers may find this chapter a bit confusing, as we are yet to go through the basics of feeding and toileting, I felt this was the logical place to put it, given stabilisation happens right after rescuing.

Equipment:

Things you will need

- Pouches per *Home Sweet Home*
- Equipment per *Where's my bottle?*
- Equipment per *Poo-ology*
- Equipment per *Oh My God He's Sick!*
- Patience, patience and more patience

It is up to the stabiliser to fully assess the incoming joey. To determine the species, its age, its injuries, its viability and general condition. Most importantly this is also when we orient the joey to a human environment, minimising the stress of change, and we teach it to feed and toilet.

Many of the techniques for this process are covered in other modules within this training program, so here I only cover points that are specific to a newly arrived joey.

How long does stabilisation take?

This depends on the joey itself, but hopefully the joey will move to a carer within a week. We do not want the joey to attach itself to the stabiliser, as it will then go through further trauma being moved. Once injuries are assessed and the joey is feeding and toileting reasonably well it is then moved to its longer-term carer. It is our aim for the joey to have no more than two carers to minimise stress.

Assessing age

- Use the joey ID information and photos to determine the species
- Check the footpads. If the joey has been emerging from the pouch you will be able to feel a slight roughness, rather than the softness of a pouch bound joey
- Check carefully for hydration. Joeys are some 75% water, so a dehydrated joey will weigh a lot less than a well-hydrated joey of the same size.

- Weigh the joey and measure the foot and tail
- Look at the joeys colouring and furring

Check your progress charts and talk to your Macropod Coordinator to then determine the rough age of the joey, its feed requirements etc.

Assessing Viability

This is not an easy topic and you should discuss borderline cases with your Macropod Coordinator before making a final judgement. My wildlife care branch used to make a definite call on weights, however cases came in that showed that being definite was incorrect, and improved methods are also helping to improve the odds. However this now leaves us with no definitive call and being "grey" can have its difficult moments.

Ensure you thoroughly assess the age factor first. We had an eastern grey come into care at 549g (below the old euthanase rate), that was so dehydrated that it was only via foot and tail measurements and colouring that we worked out that she should have been 900g.

Let's take the easy part first. Joeys will generally be viable if:

- their eyes are open
- they are wallabies over 200g
- they are eastern greys over 500g
- they are pademelons over 100g

Under these weights further consideration is required. Joeys that come directly into the system from Mum, warm and hydrated, stand a much better chance of survival than a joey that comes in cold and dehydrated.

- Joeys that have fused mouths and closed ear canals should generally be euthanased.
- Eastern greys under 250g and wallabies under 125g should generally be euthanased.

I believe the area between these "bottom" weights and the safer weights also carry great difficulty. Anything below the safe weights will require at least 3 hourly feeds and if we are to attempt something as small as an eastern grey of 250g then I believe it would require 2 hourly feeds. Therefore to take on such a joey we also need a dedicated carer, and we must understand that this carer will probably not be able to take on other joeys in the short term.

We must ensure we are truly giving the joey a good chance of survival and not simply shying away from the reality of euthanasia. There are many stories of joeys that have been attempted under these weights that have later died, or had to be euthanased, due to blindness, kidney failure or their succumbing to an infection they simply did not have the immunity to cope with. Round the clock feeding and products such as Impact have improved our chance of bringing smaller joeys through, but we must carefully consider the joey and the trauma we may be putting it through, and also the trauma to the initial carer, or the release site carer if the joey does not make it through. Kindness may well mean euthanasia is the correct decision.

Assessing Injury

The basics are covered in the rescue chapter and any injuries should be discussed with the Macropod Coordinator before final decisions are made.

Unfurred joeys often heal well and so a fracture may not mean euthanasia. Be very objective in fracture assessment as a badly broken hind leg can mean an animal is unreleasable and therefore has to be euthanased later down the track, even if saved initially. 100% fitness is always our aim, as a compromised animal will suffer a very cruel death when back in the wild.

Unfurred redneck joey showing swelling and bruising associated with a fracture

Fractures are usually fairly obvious, as they will be accompanied by swelling and bruising, however this isn't always the case, so check thoroughly. I usually give a new joey an overall check at first, looking for anything obvious, particularly breaks and maggots that could cause continuing pain and damage, but then at each feed I more carefully check each limb, perhaps one or two per feed, depending on how stressed the joey is. If you do find a fracture, recheck the other limb and if in the hind leg, the tail, as some problems come in 3s. If you find a fracture contact your Macropod Coordinator so
that you can jointly decide the best course of action.

Beware of very quiet older joeys – it could be a sign of problems

If a joey is very flat try popping your little finger into its mouth. If it is cold then there is probably little chance of saving it, though seek assistance to try by all means.

If the joey requires medication remember that macropods should always be given antibiotics via injection – **NOT oral**, as oral antibiotics destroy the gut flora and further compromise the joey.

Hypothermia.

If a joey comes in very cold its organs may be affected. Apparently hypothermia causes blood restriction to various organs and other parts of the body. Kidneys and liver are compromised before the heart and so they may live for a few weeks but then may succumb to organ failure.

Rehydrate First

Once the joey is warm, start them off with Lectade, both to ensure they are well hydrated and also as a mechanism to ease the move through from the mother's milk to our milk, or to cleanse the joey of cow's milk if a member of the public has given them this. There is more on rehydration in *Rescuing*. If a joey is badly dehydrated it may need sub-cutaneous fluid. Talk to your Macropod Coordinator, who will often be able to do this for you, or who will know an experienced carer who can.

Milks to use

Only move to milk if well hydrated. My preference is for unfurred joeys to move to the Divetalact regime and for furred joeys either Wombaroo or Biolac (unless they have been on Divetalact with a member of the public).

For both unfurred and furred use lots of Impact to boost the immune system.

For furred joeys also use Protexin

Teat Holes

As always this is a balance – a hole too large and hurling may be the result, but at first, a hole too small can mean they give up quickly and take longer to understand the process. Once they start to suck the milk themselves then the teat hole size can be reduced. Start with a tiny hole if using rehydration fluid, as it moves through much more easily than milk.

Feeding

Can be a fight for a day or two, and even longer in older joeys, (it took nearly two weeks with one older eastern grey that came in). The teat is made of a very foreign substance to the joey and so its reaction is to keep it out of its mouth and it will use both front and back legs to try to stop you. The trick is to ensure feeding whilst minimising the stress involved. With a smaller joey wrap the joeys body and legs up firmly, (but not too tightly), within the liner. With a larger joey an extra pair of hands is very useful. This person can gently hold the forepaws and ensure the back legs don't come into play, whilst you put your hand over the head, totally covering the eyes and carefully prise open the mouth with gentle pressure on either side of the jaw and slip in the teat. Try to ensure that the teat sits on top of the tongue. Hold the teat into the mouth as, initially, they won't understand what to do with it and it will flop out of one of the sides and you may find you've fed the liner the full milk quota! Be patient. You may have to help the process along by giving a very gentle squeeze to put a few drops of milk into the joey's mouth, but be very careful as too much can cause hurling and then aspiration pneumonia.

How often to feed?

Given the joey may be badly dehydrated and also that you may only manage to feed them a small amount at a feed, you may start out feeding as regularly as every hour. More often it is every two hours, until hydration is up and milk is started, and then you can move into the number of feeds appropriate to the joeys age. The first 24 hours is the most critical and you need to balance the need to get in sufficient fluid and giving the joey plenty of time for rest.

Between Feeds

Rest is crucial. Leave the joey alone, well secured in its pouch and in a quiet, darkened and warm place. Give it grass if it is older, within its pouch and simply leave it alone. In this way the joey can start to assimilate itself to the new sounds and odours and will settle faster.

Liners

Hopefully the liner will have gained some of Mum's scent and fluids (brown sticky substance from within the pouch.) To us this might look a bit disgusting and smell the same way, but to the joey it is its link to its world and this liner should be kept as long as is possible. Only change it if it is badly soiled by milk or poo. Cleanliness is not the main event in this process, reducing stress is and pristine materials smelling of apple bear no resemblance to what the joey is used to. Put a second liner into the pouch next to the liner the joey is in, so it can start to gain the right smell, so that if you do need to change the liner, you can pop the joey into something with a familiar smell. If the liner is soiled by wee, simply dry it out and reuse it. Any change increases stress and we've witnessed how attached

joeys get to their liners and that they do not want new ones, so minimising this change, at this stage, is crucial to minimising stress.

Also ensure the liners you use are bigger, rather than smaller, as it is crucial you keep as much of the joey covered when you feed and toilet them, as possible.

Your clothes

Again familiarity is all-important and this comes to a joey through both sight and smell. Wear the same thing every time you feed the joey if you can. Darker colours are best. Avoid perfumes and other strong scents.

Toileting

Poo colour

A joey that comes straight from Mum will often have quite dark green/black poo even if very young. This will lighten up once on our milks

A joey that comes from time with a member of the public often has lost its gut flora due to stress and will produce light yellow and even white poo even at an older age.

Quantities

Don't be surprised if you gain very little poo the first few times, then there may be a rush

The same with wee, you may not see much at first and then you may end up with a wet bag.

Don't force the issue. Just as a joey has to learn to suck the bottle, it needs to learn what we expect from a toileting perspective.

Keep in touch with your coordinator on wee/poo types and quantities.

Disease

A joey coming into the system should remain isolated from other joeys and joey pens; until it is determined they are disease free. This can be particularly important if a joey comes in that does not belong in this area. This sometimes happens when a member of the public picks up a joey when on holidays and then drops them at a wildlife care group or Vet in their hometown. Joeys from other locations may carry diseases to which our own joeys are vulnerable, and they may also catch things here that they wouldn't in their home area. A good example of this is when joeys that come from tick free areas are brought to the coast. They may not have the immunity required to withstand not just the tick, but also the diseases they commonly carry. When a joey arrives from another area, it is stabilised and then transport is organised to the nearest wildlife care group to its original home.

The main things to look for in a new joey are:

- **Breaks and bruising**. From motor vehicle collision.
- **Stress alopecia**. This is a loss of fur in furred joeys. We've seen it twice, both times in older joeys and both times starting around the middle of the back. Fur may also be lost around the head and ears. The fur will grow back over time. You will only see this in stabilisation if the joey comes from a member of the public.

- **Thrush**. Again often related to stress. See *Oh My God He's Sick!*
- **Aspiration Pneumonia**. Related to taking in milk too quickly. See Oh My God He's Sick!

Housing

Unfurred joeys go into a hospital box with a mac conversion (see design under *Home Sweet Home*). Use a dummy (see *Where's My Bottle?)*

Furred joeys need special care, as they will be especially stressed, as they know that this is a foreign environment:


Give them a dark pouch with a dark liner and make it fairly snug


Make sure his or her head is covered and that no one can see into the pouch


Put them in a very quiet place


Handle them as little as possible. Leave them alone and quiet unless feeding or toileting for the first few days. On day one don't even bother letting them out for a stretch, though from day two a quick time out of the pouch after a feed and toilet will be beneficial unless they are very wild. Only let them out in a small secure area until you know how they will react, as they may be difficult to catch again and can hurt themselves whilst trying to avoid you.


Don't ask them to self-toilet for the first couple of days


Put nibbles into the pouch with them so they can eat in total privacy.


After a couple of days, and depending how they are settling, give some outside exercise, but be with them, with their pouch and allow them back in at the first sign of stress

Worming

Joeys that have been with the public, especially older joeys, are often best wormed to ensure that they haven't developed an overload due to stress or association with domestic animals. Wait a couple of days to ensure there is some food in the tummy and then Ivomec® per the usual dosage (See *Oh My God He's Sick!*)

Where does the joey go next?

This is determined by the Macropod Coordinator and is based on whether the joey is needed as a buddy for one already in care, who is the next carer on the rotation and whether the joey needs any specialist care. Remember to hand on all paperwork and full information on how you have been caring for the joey including all treatments given. I like to leave the naming of the joey to the person who will be raising the joey after stabilisation, as they have to live with the name a lot longer and it is frustrating to always receive animals that have been previously named. Some carers feel native animals should not be named at all, however as joeys are in care for quite some time, it is simply convenient for identification, especially when you have multiple joeys in care.

Home Sweet Home

5 pouches in a row.

Module objectives

By the end of this module, you will be able to:

- Understand how to pouch a joey
- Understand their outdoor accommodation needs

Equipment

Things you will need

- Inner liners
- Middle liners
- Pouches
- Cloth nappies or similar
- Hospital box for small joeys
- A stand or somewhere to hang the pouch
- Thermometer
- A safe, enclosed sunshine and exercise area
- Bulldog clips
- Nappy pins

The various housing stages for an unfurred joey

1) In the hospital box 24 hours a day. Your joey may spend a longer time in a hospital box in winter, than in summer.
2) Rugged up in a pouch during daytime and in the hospital box at night.
3) Fulltime in the pouch inside, with lots of vegetation just outside (and some in the pouch) to start enjoying
4) Starting to emerge from the pouch. Short periods outside with the carer always present at first. Gradually extending to all day outside and time alone. Night time still spent inside. Vegetation and water available near pouch at all times.
5) 24 hours outside. Need to leave pouch to feed. For eastern greys pouches are gradually withdrawn – some abandon ship quite freely, others need a lot of persuasion.
6) No pouch available
7) Release

Pouch Basics

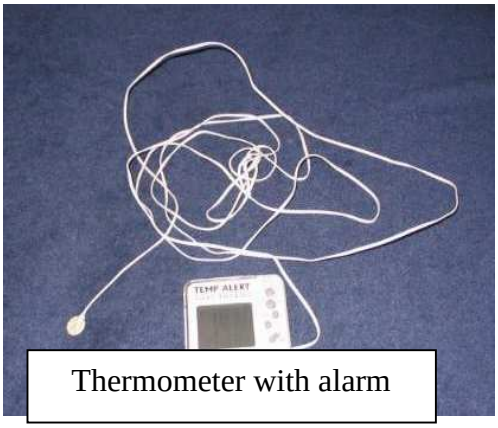
It should go without saying that a joey needs a pouch but what does it need it for?

- Warmth
- Security
- Proper development

Take a close look at how things are done in the wild. It's warm and cosy and the joey is curved with the head, tail and legs all ending up pointing in the same direction.

Warmth

The Progression Tables (*Appendix*) talk about the temperatures required during the various stages of development. A thermometer with an alarm (see photo) is a great way of ensuring that the temperature is correct. It is also important to ensure the joey isn't too warm. Overheating can certainly cause slow development in fur and may also create other longer-term problems like cataracts. Think for the joey as you think for yourself – as the day warms up remove some layers, as it cools down add a few more. As the joey develops and its fur thickens less layers are needed. If the room is warm take off some layers, if it's cold outside add a few more. Commonsense really. For the most part the pouch should be hanging and should not touch the floor.



Thermometer with alarm

The alarm is a great piece of equipment for your peace of mind. It can be set to go off if the temperature goes above or below a certain point. Be careful not to have the probe right next to the joey as the joey will start to generate its own heat and you may have the alarm going off constantly. Have it a couple of layers away from the joey. Once you don't need many layers – you don't need the thermometer.

A good way to check whether your joey is warm enough is to gently put your hand into the pouch. Does the joey's body feel pleasantly warm to your hand? Try putting your lips to the top of the joey's head. The description I have heard is that the joey should feel "toasty warm". It could take you a couple of days to work out what's exactly right for your joey. In the past we have clearly been keeping our joeys too warm. Again by observing hand-raised joeys versus joeys that come in furred, you can see the difference in the fur length and quality.

If your pouch is sitting near/on a concrete/lino floor, put a blanket or thick towel beneath it. Even if the pouch bottom is not touching the floor, (and it shouldn't be), a good deal of cold air will move up and into the pouch from a cold floor.

Remember than an older joey will find the transition from the wild to hand rearing much more traumatic than a younger joey. Put them in a dark coloured liner in a dark pouch and keep them totally covered and quiet. Handle them as little as possible, talk quietly and give them plenty of time to get used to their new environment. It may be useful to put them in a dark room, with some supplementary

feed and leave them to adjust as much as possible before moving them into larger pens or expecting them to mix with other macs.

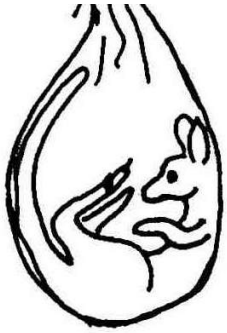
Security

A joey feels safe in Mum's pouch. In the same way the artificial pouch also needs to provide this secure feeling. This means it should be cosy comfortable and able to be closed off to exclude most of the light and sights. Sometimes joeys will fight to get between the liner and the main pouch and this is because this provides them with a much smaller opening to the world and therefore a much better feeling of security. Nice open tops help us see our joey, but don't help the joey feel secure. When joeys are first emerging you should, at least, always have a liner handy for them to jump into if something startles them and small joeys should also be fed in a liner to give them the security they require. Very small joeys hate having their liner changed and should be out of it for a very minimum of time to prevent stress – let's face it – in the wild they don't come out at all! As they start needing sun, remember that in the wild this occurs when they have their head out of Mum's pouch, not their whole body, given they are not capable of re-entering a pouch on their own.

Part of security is also easy access to the pouch when they get out of it. If the opening is too high up and the joey manages to get out but can't get back in it will become extremely stressed. Similarly if it is so deep that they cannot get out the joey may reject the pouch before they are ready to be fully emerged.

Proper Development

That curve you see in this illustration [32] is all-important for their future flexibility and so our pouches should also offer a nice comfortable curve. Small joeys should not be lying flat on the floor and even in the hospital box they should be hanging. Pouches that are too tight can also create development problems so a range of sizes is needed, with multiple liners used to pad small joeys.



Legs need to be able to stretch so make sure they aren't too confined. Good work now leads to a healthy active joey later.

This also leads to ensuring that the joey cannot injure itself getting in or out of the pouch. If the pouch is hanging from a chair, for example, you may need to cushion the legs or seat edge of the chair if there is the danger of the joey hitting them when it gets into the pouch. Watch how your joey rolls into the pouch and be sure hard objects cannot injure the back and legs.

Pouch Design

There are many pouch designs around and carers often develop their own favourites. As long as they meet all the requirements of a pouch – then it doesn't really matter which style you use. We've included a range of photos of pouches here so you can see the variety available.

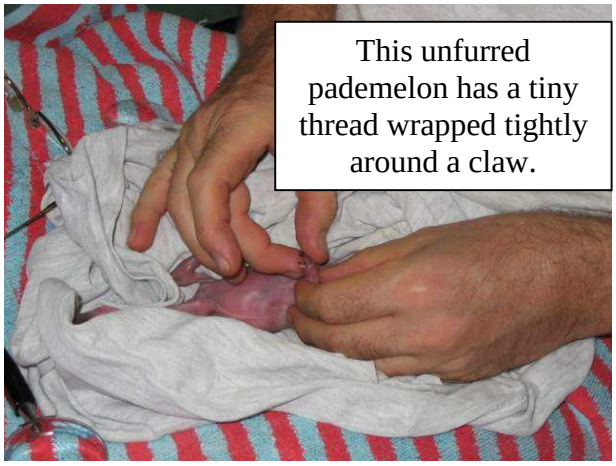

Liners

Usually you will have an inner liner that is next to the joey's skin, middle liners that provide additional warmth and the actual pouch, which provides the sturdiness and support.

Materials to Use

This is very important. Joeys need to be in natural materials

that breath but that do not give off fluff or threads that could be ingested.
For inner liners T-shirt material is ideal. Flannelette pillowcases are also popular but beware fluff balls that can become lodged in the joeys nose and inhibit breathing. All liners need to be regularly checked to ensure that they aren't becoming fluffy. Loose threads can wrap around tiny fingers, cutting off the circulation and resulting in the loss of the digit! Fluffy bits can be eaten, and these may later cause blockages that can cause the joeys death. The most recent case I have heard of is of a 4kg eastern grey kangaroo, which died a few months after coming into care. An autopsy showed that there might have been an internal injury caused when she was initially orphaned, (lost from Mum when she was chased by a group of bikers). This injury had left scar tissue, some fur had been ingested and had stuck to this scar tissue, this in turn caused an abscess, which subsequently burst, causing the joey's death.



This unfurred pademelon has a tiny thread wrapped tightly around a claw.

For the middle liners woollen jumpers are often used. Wool is a lovely natural material – its fluff is kept from the joey by the inner cotton liner. The pouch itself should still be made from something breathable. The old-fashioned school satchel used to be popular, now pouches are made from all kinds of things including old electric blankets (cords removed of course).

Pouches with straps eg the old school bag can be hung from doorknobs and other hooks, some people prefer to make stands that can be moved around and placed wherever required.

This shows a young eastern grey, Merrilyn, in the old canvas school bag arrangement. You can see a T-shirt material inner liner which her legs are sticking out from (a favourite Merrilyn pose when she was tiny – as long as her head was covered she took a "you can't see me" approach to life and loved to stretch out her legs.) The next darker layer is middle liner made from an old windcheater and before the actual pouch you can just see a layer of sheepskin. The extra strap you can see bottom right enables you to lengthen or shorten the strap depending on where you wanted to hang it and the cord to the right is the thermometer. In this photo the whole bag is sitting on a chair where it was popped on the way to picking up a bottle. (Merrilyn was incapable of getting out on her own at this stage).

The next few photos show a pouch design that was adapted from a pouch and stand used by some Clarence Valley WIRES members. It's a bit more elaborate than many pouches but it does work well to mimic mum. The photo at left shows the pouch upright – as if Mum is standing. We use bulldog clips as a quick way to keep the liner in. The back of the stand is covered in shade cloth which gives the frame support and yet is soft for the joey to roll against. The pouch is attached to the frame by hooks so that it is easy to remove.

The shot at right shows the side of the stands (there are 2 here side by side). This is the position as Mum grazes and enables the joey to put their heads out and chew on the grass.

The shot below shows a flap that can be used to close off the pouch to add more security.

The shot below shows Buster on the left and Merrilyn on the right happy in their pouches.

Designs are included at the end of this module.

This pouch has a nice rounded bottom and straps for hanging. The liner is pinned in using baby pins – the main part of the pin on the outside to prevent the joey from chewing it. This pouch is quite deep and would suit an older eastern grey kangaroo rather than a small wallaby.

Bulldog clips or nappy pins can be used to secure the liners into pouches. Pin everything from the outside so that the joey cannot chew on the pins.

Changing Liners

In the wild the joey knows only one liner – the pouch lining. Joeys hate changes and every time you put them in a new liner you are asking them to adjust to a totally new environment – this is stressful. Obviously liners do have to be changed from time to time, however there are ways we can minimize the stress:

- Only change the liner when you have to ie when there is a milk spill or poo problem. For tiny drops, clean them off with a cloth and leave the joey in the liner. Obviously

don't risk any possibility of the joey being able to consume any of its own poo, but don't jump at a tiny spot either.

Urine is actually a fairly sterile substance and will generally not hold bacteria that will harm the joey. By the same token you don't want to leave them in a wet bag. If urine is the only issue, change the liner, but simply dry the wet liner – don't wash it and re-use it next time you need a change

Always have the next liner around the joey to gain its scent in preparation for use. You might put it in the side of the pouch where it can't be soiled, or if you use a middle for feeding and toileting, put the new liner in that when it's not in use, and in the main pouch when the joey is out to be fed.

For small joeys an extra liner rolled up inside the liner they are in can be used as something to snuggle up to, as well as to keep them hidden from view.

For those of you who like everything to be sparkling clean this may go against the grain, however please think about what the joey would be in, in the wild. A pouch is a damp, sticky, icky place. Some joeys will even deliberately soil a new liner in an attempt to make it smell more like home.

Don't forget that the seams go on the outside!

Large liners are much easier to use than small ones. We prefer using an adult T-shirt size and just taking the sleeves and neck out in a u-shape with an overlocker. (See photograph P37).

If your joey is a "bed wetter" put a couple of cold-fashioned cloth nappies, or a baby blanket, beneath the liner to absorb the moisture. When you check the joey at feed time, change both the liner and the nappy to ensure you keep the joey and pouch dry. If the pouch is wet make sure you change it. A cold, wet joey can easily become sick.

As your joey gets bigger he/she may pull the liner out with them and then find the entrance blocked to return to the pouch. When this starts happening, use a nappy pin, on the outside, to pin the liners bottom into the pouch.

If the pouch starts to sag on the stand, move the hooks further down the legs to raise it up again.

As your joey starts to emerge

One of the most stressful times for a joey is when they start to emerge from the pouch. This is a time you need to be with them, encouraging them on and ensuring they don't get into trouble. Some joeys seem to understand their pouch completely and how to roll back into it, others don't seem to have a clue and chatter and fall over in their attempt to get back in.
What you need to do:

Be with your joey as much as possible, during this phase, until you are quite confident that they can get in and out of the pouch unaided. We had a pademelon who managed to get out of his pouch, but was unable to get back in. The most time he was out was 20 minutes and yet this stress was sufficient to set off a chain reaction that saw him die within a matter of hours.

Ensure the pouch can be easily exited and re-entered. If the opening is too high up your joey won't be able to get out, or may fall out and injury itself. Then it will be unable to get back in, as the entrance will be out of reach. Stands should be in the "grazing" position, and other pouches need to be leaned over so the entrance is quite near to the floor.

- Joeys are very uncoordinated when they first emerge, so make sure there are no sharp or hard objects they can bump into. Guide them if need be and help them to roll in, by tucking their head down, if they don't seem to understand this need.
- Don't insist they stay out longer than they are comfortable with. Make sure you are with them for reassurance and gently encourage them to come out every so often so they can start to build their confidence. Wallabies usually want to be out and about in the early morning and later afternoon and quickly start spending more and more time out of their pouch. Eastern grey kangaroos are a totally different proposition and need lots of support and encouragement as they slowly start to spend more time out of their pouch. We had one eastern grey kangaroo that never once came out of his pouch without our encouragement.
- Pin the base of the liner into the pouch so that it doesn't pull out as the joey emerges. Remember the main part of the pin should be on the outside.
- Remember that as your joey gets older, his activity times will move more from daytime to very early morning and late afternoon activity, resting during the main part of the day as they would in the wild.

This shopping bag made a great home for Wilkie the red-necked wallaby. When hanging from a hook the bag closed over offering the privacy and snugness required.

Where Can I Find Pouches?

Most carers find the old school bags, make their own or have others make them for them. Check with your Macropod Coordinator. The full design of the pouch and stand is included at the end of this module. There are also people who sell pouches – each has their own favoured designs, again your Macropod Coordinator will have details.

How long in the pouch?

The Progression Tables (*Appendix*) give an indication of when your joey will want to start coming out of its pouch to gain some exercise. Prior to this it is extremely important that the joey is ALWAYS kept secure in a pouch. Remember in the wild they would not be out of the pouch at all and trying to bring them out early on legs that are not ready to take the body weight can cause long-term damage to their limbs as well as considerable stress.

We try hard to mimic the wild in the way we raise our macropods and when you study wild eastern greys the joeys do, in fact, spend considerable time in the pouch. At about 3kg they may come out only twice a day, once in the morning and once in the late afternoon and then for only about 30 minutes at a time. Remember Mum spends most of day resting, joey in the pouch or lying close by her side. Having access to a pouch is crucial for security, especially if you are not with them.

A good habit to develop is, once the joey is coming out of the pouch, is to give them a short exercise spell after every bottle session. This will help them digest their milk and also prepare them for self-toileting (see *Poo-ology*). Those with a bush property will enjoy taking their charges for a walk, once they recognise you as "Mum" – though remember to always carry at least a liner with you in case something happens and remember that little legs need to be built up gradually. When we talk about taking macs for a walk – this is not on a lead!

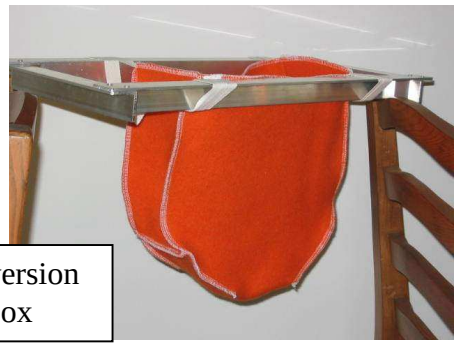
The Hospital Box

A typical hospital box, with the frame for a mac conversion.

Hospital boxes come in a variety of shapes and sizes. Members who know they will be long term carers often purchase their own boxes, others use loan boxes. Thanks should go to those who work hard to make our hospital boxes.

Some hospital box tips:

- The box takes time to warm up, so put it on in advance if you know you have a joey coming into care. Keep the joey wrapped with hot water bottles, if necessary, until the box is warmed up.
- The joey still needs to be hanging from a dowel or other hanging frame
- Use the thermometer with the alarm to ensure your joey remains at the right temperature. Remember if the joey is too cold it may die or gain pneumonia, if it is too hot it may form cataracts later in its development and its fur may not develop correctly.
- Mark the thermostat dial when you do find the right temperature so that if it is moved you can easily find it again. Most thermostats have dials with them and some indicate temperatures but we find they are not accurate and that an extra thermometer is needed to ensure a good setting.
- In preference use 40w blue light bulbs. These provide good even warmth and the blue colour means the joey stays in the dark – as it would in Mum's pouch.
- Make sure the joey cannot come out of the pouch and touch the heat source
- Put a jar of water in the box, where it cannot be tipped over, to provide the necessary humidity.



This is the mac conversion for the hospital box

We particularly like the Aniwarmer thermostat. It keeps the temperature within about a degree.

A Play Pen

When your joey is first starting to emerge from the pouch, it may well still be inside your house. Given the hazards that they may find if allowed to roam freely, you may wish to start them off in a playpen type arrangement. A normal playpen has bars that a small wallaby would easily pass through, so it is necessary to line your playpen with soft material, both to stop them hopping out, and to ensure they don't hurt themselves when they make contact with the sides.

Playpen with joey and pouch in one corner and bowls with grasses, dirt and water in the other corners

Outdoor Exercise - Enclosure Specifications:

It is important to consider any outdoor exercise area you may use – even your own backyard.

In studying macropod enclosures from several organizations, we concluded that almost nothing is entirely predator proof and we have therefore tried to gain a balance to ensure maximum protection available, with the best economy. If the money were available a fully enclosed pen, including a fenced roof, would be ideal. The closer the pen is to a house, the better the protection from predators such as foxes. Pens further away from human habitation will require more protection measures. Every site has different challenges and always remember that the bigger the better to ensure adequate exercise.

Positioning (release sites only)

Gates are needed for release – see fencing section. These should lead directly into the macropod's natural terrain.

Position in or as close to the macropod's natural terrain as possible. For wallaby releases there should be no open ground for the animals to cross when released.

Habitat within the pen should mimic their natural terrain, if it is not apart of it.

Fencing

The wire netting needs to be made from a **minimum** of 1.4mm diameter wire. Thinner wire has been known to be broken through by foxes and is able to be bent by goannas. Wire hole should be a **maximum** of 50mm (chicken wire size) and can be smaller eg 40mm (rabbit fencing size). Chain mesh is reportedly the best to use, as it also has considerable give in it if a macropod hits it. However it is extremely expensive and other wires have been successfully used.

Star Pickets can be used to support the wire netting and should be placed on the **outside** of the pen (to reduce the possibility of injury) and placed at 3 metre intervals. In remote pens there is a concern that star pickets on the outside could be used as a "fox ladder".

Shade cloth should be placed to a minimum height of 600 mm around the **inside** of the pen. This allows the macropod to see, and softens any contact with, the fence. (Hessian may be eaten by some macs and can cause blockages). Wire clips are an extremely fast and effective way to attach the shade cloth to the wire. They can also be used to attach fencing to any strainer wire. Basically they are C shaped clips that are attached by means of a special pair of pliers (only a few dollars to purchase). Clip from the inside of the pen and most of the sharper edges will be outside. Be aware of, and soften, any sharp edges from construction.

Pens should be designed so that there are no corners in them. This is done by rounding any corners in the wire-fenced structure or by adding crosspieces in the corners of solid fenced structures. (Macs run the fence line if spooked and will often run straight into the facing fence rather than make the corner[33].)

When dogs are part of the family, then a solid fence construction is required. This needs to be made from timber and or roofing material, to a minimum height of 1.2 metres, so that the macropods cannot see any dogs and so the dogs cannot peer over it.

- Nursery pens should be constructed so that the length is twice that of the width. This will allow some running area.
- All gates must be covered with the same wire netting and shade cloth as the rest of the fence structure
- There are two forms of gates in macropod pens:
  1. Release gates – these are only used in the soft and pen release structures and are normally double gates fitted to allow easy exit and entry of the macropods at release stage.
  2. Entry gates – are used for our entry and exit and should be designed to ensure that the macropods don't escape and other animals (dogs) don't enter. This can be achieved by adding a step to the gate (a solid obstacle across the bottom of the gate), and or a double gate system where you have to pass through two gates to enter the pen. These gates should be self-closing.

Minimum Pen Sizes

	Just Emerging*	Nursery Pen**	Soft Release	Pen Release
Pen Height – Eastern Grey	900mm	1.2 m	1.8 m	1.8 m
Pen Height – Rest	900mm	1.2 m	1.2 m	1.8 m
Size (square metres)	3	75	300	750

* "Just emerging" is a small area used by those who raise very young joeys, to use when the joey is just emerging from the pouch. This enables the joey to gain confidence as it starts to emerge, but offers no exercise potential and so joeys must be moved to larger areas for exercise as they grow.

** "Nursery" is the typical area available to carers who do not release their macs, but who keep them to a stage where reasonable exercise is required. It can also describe the smaller pen in a larger pen release system.

Inclusions:

This 2kg swamp wallaby is just where she likes to be, in thick grass under a bush

- **Shrubs/trees.** Joeys need bushes and trees to shelter under – pens should not just be open ground. Trees and shrubs should be evergreen natives.
- **Logs and leaf litter.** Again mimic the bush as much as possible by providing areas of leaf litter; logs and dirt mounds to ensure the joeys have a variety of items to work with.
- **Grass.** Should be allowed to grow wild, joeys do not require manicured lawns and if the pen has only soft grass then the joey will have soft pads on its feet and will suffer when sent to a wild environment. A variety of grasses and weeds are needed to assist in a varied diet.

Fresh water. A good and constant supply of fresh water is required.

Shelter. This is not required in the just emerging pen but is needed for all others. Shelters can vary dramatically from being a room eg a laundry or sunroom that leads into the fenced area, to shelters made from corrugated iron and wood. A few tips to help you:

- Shelters need to protect from rain, prevailing winds and sun
- Try to ensure none of the material used can flap in the wind – this will stress the joeys
- If corrugated iron or similar is used for the roof, suspend shade cloth above it to deaden the noise of rain and to give additional shade on hot days.
- Have two ways in. In this way if a predator comes in one way the joeys can go out another.
- Ensure the floor will not hold water during rain – or a floor may be needed to ensure pouches stay dry
- You will need to provide adequate room for pouch stands, or hooks from which to hang pouches. Allow room for food and water trays too. (Food should never be put directly onto the ground).

Those who do a lot of releases long for shelters that are tall enough to stand in, big enough to ensure both they are their charges are sheltered from rain at feed times, and one that has lighting available for night time excursions to the pen.

Soft release halfway area. When you are soft releasing animals it can be useful to have a halfway area, outside the pen for the joeys who have been released, but who may still want an area for shelter and security as they move into the wider habitat. This can be a very simple shelter.

Quarantine area. This isn't a must have, but for those of us who do a lot of release work, an area that can be sectioned off when an animal if sick and needs to be isolated, and yet still needs to see it's "mates", can be extremely useful.

Additional Predator Proofing

Eagle Proofing – if the pen is in an area known to have raptors then it will require some eagle proofing. Eagles will attack quite large joeys and may carry away anything under 3kg. Coloured ropes (so they can be seen by birds who are known to be very focused on their prey) strung across the pen at 1m intervals will deter eagles from entering the pen. (They require good take off and landing clearance).

Snakes/Goannas. Carers in known snake and goanna areas often have totally snake proofed sheds for their smaller joeys. These are constructed with tiny mesh fencing that cannot be penetrated by even small snakes. Be aware of tree branches falling onto the fence that may make an easy "bridge" into the pen.

Foxes/Dogs

- Skirting wire, if used, should extend out from the fence a minimum of 500mm and be made from a minimum 1.4mm wire. It should be secured to the ground.
- If the fence wire is buried vertically it must be done to a minimum depth of 300mm
- Electric fencing – some carers have added electric fencing around the outside of their pens as an added protection.
- Lights are thought to deter foxes, as they prefer dark places. Some have them on constantly; others have installed movement sensitive lighting.

- Leaving washing on clotheslines near a pen is thought to deter foxes and wild dogs – the constant movement disturbs them.
- Unwashed work clothes hanging around may also be a deterrent.

Another problem can be black rats (rattus rattus). They can be attracted by the supplementary food and there are horror stories of joeys having their ears chewed badly and sustaining other injuries when attacked by rats in their pouch.

Cats can carry toxoplasmosis (see *Oh My God He's Sick!),* which is fatal to joeys. Even desexed cats can carry this problem. It is imperative that your joey cannot feed near or come into contact with any cat faeces or urine.

Plants to use

It is always preferable to plant native plants that grow wild in the area the joey is to be released in. By doing this you are helping the joey to recognise the food it will need to survive in the wild. The following is a list of species that wild wallabies enjoy chewing on as compiled by members of the Australian Plant Society[34] again please try to find local varieties:

- Lechenaultia
- Hemiandra pungens
- Anigozanthos
- Brachysemas
- Chorizema cordatum
- Callistemon
- Pimelea
- Scaevola
- Dichopogon
- Helichrysum
- Pea flowers
- Daisy flowers (native only)

Remember most macropods do most of their grazing around dusk and dawn. They rest during the heat of the day and again during the night for a time. It is important that your joeys be able to graze when it is most natural for them to do so, both as it is what they will want to do and also to ensure they develop the right habits for when they are released.

Why is time outside important?

Exercise and sunlight are very important for the joeys development – they need the vitamin D sunlight brings for bone development and they need to develop their leg, lung and heart muscles so that when they do have to run fast these muscles can do the job without the animal developing myopathy (See *Oh My God He's Sick!*).

Early morning and late afternoon sun are the best – as they are for humans. In the middle of the day the sun is too strong and Mum would usually be lying in the shade. As you can see from the progression tables you start with just a few minutes of sunshine a day and gradually build it. Don't forget small joeys do not come out from Mum's pouch so you just have to hold the top of the pouch open to let light enter. Make the time, as a joey with brittle bones is a major problem.

Exercise starts out with a few seconds out of the pouch and progresses through to long runs and "mad half hours" with the joeys belting around in all directions. This is one reason why we move joeys to

release sites when they may still seem quite young – they need more room than the average backyard has to offer. For example we had two eastern greys in care, Buster (at 3.7kg) and Merrilyn (at 2.6kg). Buster took long lolloping 70m sprints in one direction and then wheeled around to race back the other way. Merrilyn was often hot on his heels but pulled up more around the 50m mark. Even our largest release yards struggle to allow such exuberance. Each day you watch as the coordination and muscles improve and it is a delight to see. Without this gradual build-up – which develops heart, lungs and leg muscles – the joey is at risk of getting myopathy, (See *Oh My God He's Sick!*), the first time it has to bolt from danger when it is released. Basically the animal may end up with muscle deterioration that can cause paralysis and even death. We rescued a 10kg eastern grey that had myopathy – probably after being chased by dogs. She was almost totally paralysed from the waist down and had to be euthanased. It is crucial that we ensure our joeys are as fit as possible prior to their release and this development starts right at the earliest stages of their care.

Housing Hazards

Remember it is our duty to ensure our charges do not suffer any further unnecessary injury or stress.

Indoors

- Heaters. Emerging joeys are quite uncoordinated and also do not understand the dangers of an unprotected heater or open fire. Make sure you have a barrier that keeps the joey safe from heaters.
- Vinyl, tile and wooden floors. The are very slippery surfaces so don't cross them quickly with your joey following you or you'll find they lose footing and risk doing damage
- Windows. Joeys don't know what glass is and, very much like a bird, they will try to go through it if they aren't aware of it. They learn fast and one collision is often enough, but try to avoid that collision by showing your joey the window up close before it can bolt into it.
- Carpets. Can be eaten! Wallabies in particular are renowned for eating anything they can. Carpet fibres can cause blockages many months after they are consumed as pieces slowly attach until a full blockage occurs. Make sure you supervise well.
- TV and stereo noise. We know it's a TV program – not an outbreak of WW3 or a real lion roaring in the lounge room, but does your joey know that? Often joeys stay with us in the lounge room where it is warm and they can see us, but think about what is happening if the TV is on and adjust the volume accordingly. The stereo is the same – if you have a 16 year old who loves rap at full volume, they may have to forego the volume whilst the joey is in care.
- Unsupervised children. Poked eyes, crushed ribs by incorrectly picking them up, and stress from high-pitched shrieks or handling.
- Domestic pets – see separate section in this Module.
- Fumes. From high powered chemicals, perfumes or cigarette smoking. Think about what they would smell in nature and remember that if it's affecting your eyes and health it will be affecting theirs.
- Staying indoors too long. Joeys that have the run of the house at a later age can become a nightmare for release sites. Joeys have been known to come through fly screen doors and even try to come through glass if they think their rightful place is inside the house. We have had a couple of examples of joeys who were kept inside too long and were therefore very stressed when they came face-to-face with the natural environment. Natural noises

and the feel of grass can be quite stressful if not introduced gradually and from an early age. As soon as a joey can pop its head out to look around make sure you allow it to sniff at the ground. When it starts to emerge from the pouch make sure some of the time is outside and increase that time gradually. Similarly a joey needs to understand what a fence is. An older joey suddenly introduced into a pen can end up with a bloody nose and worse if it is unsure what a fence is all about. These things can be introduced by the carer, walking a fence with the joey and showing them what it is all about.

Insecticide. Can cause extreme illness. I once found a carer about to spray an ant trail right behind a hanging pouch. She was rightly concerned that she didn't want the ants to get into the joey pouch, however she was a bout to spray where the joey could reach and lick. Find non-toxic alternatives eg peppermint oil and remove the joey from the vicinity until the insect problem has been removed.

Outdoors

We've talked through most of the outdoor hazards in the section on *Outdoor Exercise* but there are a couple more to cover:

Utilising old chook pens, or even existing chook pens. These can harbour disease within them and should have been well rested before being used as an exercise area.

Toxic Plants.

Sadly many every day plants are toxic to macropods and can cause anything from loose poo to liver function issues to death. Make sure the following plants are not within reach of your joeys:

Azaleas	Irises
Blue-green algae	Indigo Bush (indigofera spp)
Camellias	Jasmine – night flowering variety
Capsicums	Kikuyu grass (*Special times only – see *Kikuyu Poisoning* Section in *Oh My God He's Sick!*)
Carnations	Oleander
Cotoneaster	Madonna Lilies
Crab Apple	Passionfruit
Daphne	Phalaris Grass
Daffodil bulbs	Potatoes
Glory Lily	Rhubarb
Grass trees	Rhododendrons
Guava	Roses (Some species)
Hibiscus	Wandering Jew
Holly	Wisteria
Hydrangeas	Yesterday, Today and Tomorrow

We have covered only the main problem plants likely to be in the suburban garden here, there are others on rural properties eg bracken fern, fireweed and crofton.

See also the *Issues with Supplementary Foods* Section in *Where's My Bottle?*

Domestic Pets – why do I need to keep them separated?

Very often wildlife carers will also have domestic pets – their love of animals is often what has lead them to WIRES in the first place – however there are some very good reasons why domestic pets should be kept TOTALLY SEPARATED from joeys in care.

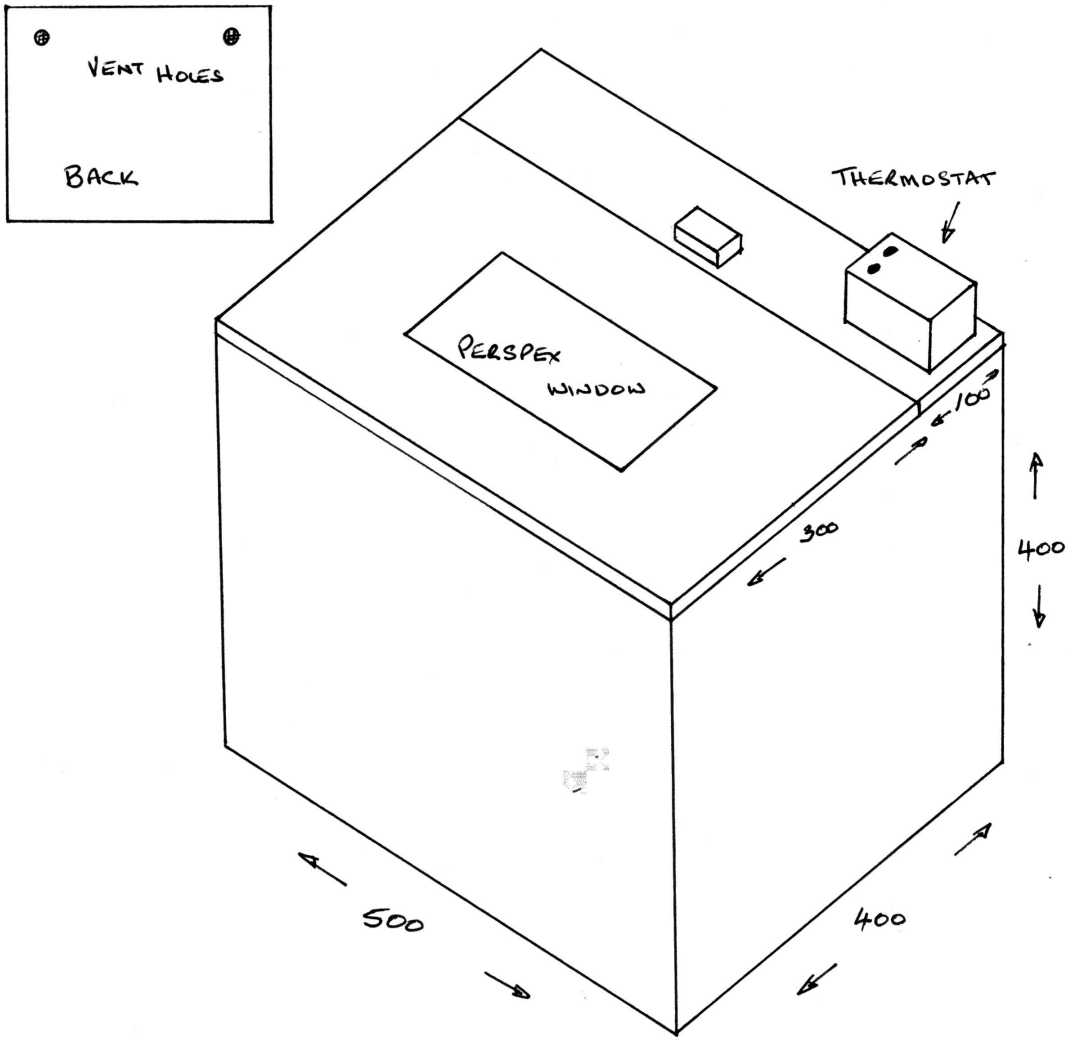
- Parasites. No one really likes to talk about it but our domestic pets are prone to intestinal worms, fleas and mites. None of which belong anywhere near a macropod and all of which may cause harm
- Desensitisation. In other words the joey no longer recognises the immediate danger that foxes, wild dogs or roaming domestic dogs are to them in the wild. When a joey sees you, its Mum, fussing with a dog, it believes the dog is an accepted part of the group. It may never warm to the dog, or it may become best buddies with it. It's also true that it may remain wary of other dogs, but wary is not the same as scared and those few seconds of hesitation may be the difference between life and death in the wild. Your dog may be the softest thing in the world, but allowing it to have a relationship with your joey could be condemning the joey to a shortened life and a very unpleasant death.
- Toxoplasmosis. Cats can carry toxoplasmosis (see *Oh My God He's Sick!*), which is fatal to joeys. Even desexed cats can carry this problem. Many wildlife carers have cats and have never experienced toxoplasmosis (yes people can catch it too.) They therefore feel there is little risk to their joey. The difference is that humans don't usually graze, (we hope), where cats may have defecated. If you have house cats that use a litter box that the joeys could not possibly have access to then the risk is minimal. It is very important that your joey cannot feed near or come into contact with any cat faeces or urine.

Summer Heat

When you hunker down in a cool house think of your charges out in the heat:

- Offer joeys cool boiled water by bottle between feeds.
- Always ensure animals have plenty of fresh, cool water available to drink. Offering several dishes and sizes of dishes ensures at least one may stay cool. Adding ice cubes may help. Change water often.
- Drape hessian over shelters and wet it down. This adds shade and cool air, as air moves past the damp hessian
- Cover tin roofs with shade cloth, cardboard or even branches to reduce heat. **DON'T** hose tin roofs down unless you plan to leave the sprinkler on all day – as the sun dries the water it heats the inside of the roof up like an oven
- Ensure that the sun is not shining directly on joeys in pouches at any time of the day. They may be under a shelter but does the sun reach them as it moves in different seasons?
- Plan Vet trips, releases etc so the joey isn't travelling in the heat of the day.

Macropod Hospital Box

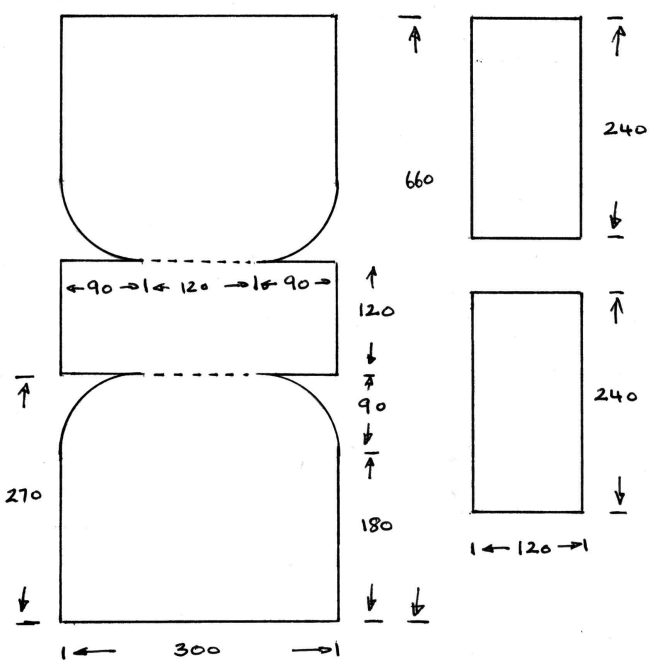


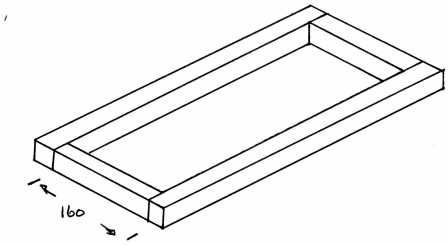
The hospital box requires the following:

- 2 Incandescent blue 40 watt light bulbs
- 2 Kitchen vent holes located in the top of the rear panel
- A Perspex window centered in the lid measuring 120mm by 240mm
- Box materials should be at least 15mm thick for insulation
- Thermostat recommended is an “Aniwarmer”
  Aniwarmers can be obtained from Susanne Ulyatt, WIRES Northern Rivers.
  Email: katweet@byrononline.net

Original hospital box designer unknown

Hot Box Pouch

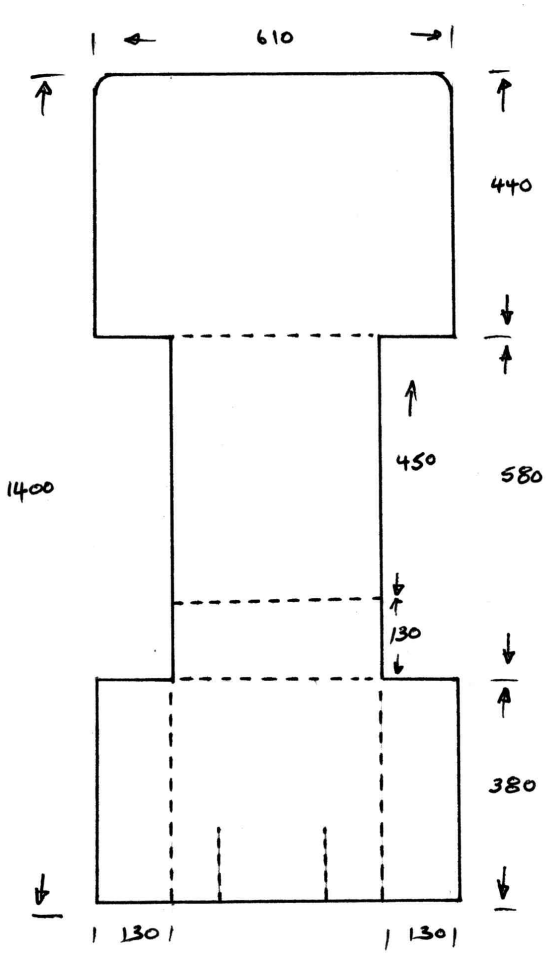


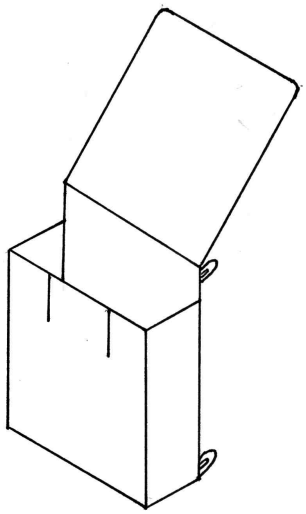


1. Straps 500mm long and sewn into each of the larger side corners
2. The frames internal width is 160mm and a recess is cut into the hospital box to allow the lid to close completely.
3. The one shown is made of aluminium, however it can be made of any material that is strong enough to hold the joeys weight.

Designed by Stephen Dooley, 2003

Pouch For Macropod Stand

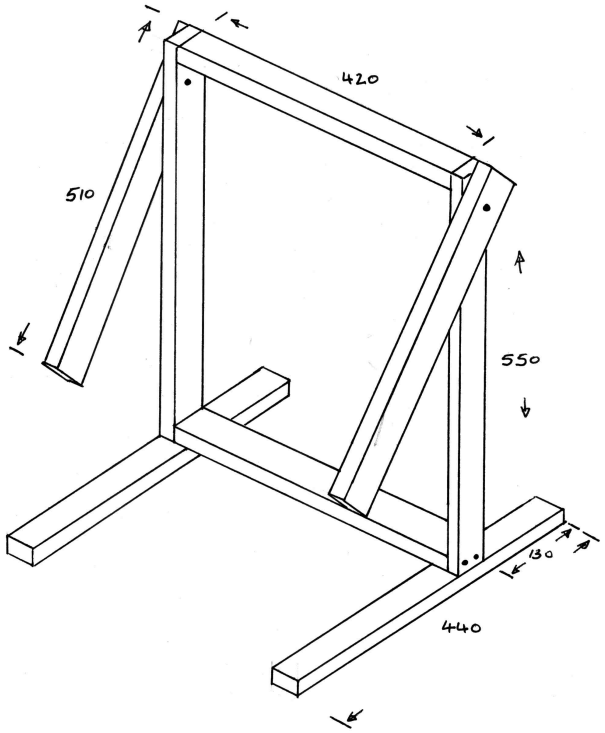




Make 4 straps 25mm x 160mm from off cuts and attach to back of pouch to make the 4 loops needed to hang from the hooks attached to the stand.

Adapted by Stephen Dooley from an original design by Clarence Valley WIRES

Macropod Stand Design



Qty	**Item**
2	440 x 42 x 19 Legs
2	420 x 42 x 19 Top & Bottom Rails
2	550 x 42 x 19 Uprights
2	510 x 42 x 19 Arms
2	65 x 65 Brackets
2	¼” x 50mm Bolts
2	¼” Wing Nuts
2	¼” Flat Washers
2	¼” Spring Washers
6	32mm Cup Hooks
1	460 x 460 Shade Cloth
12	8 x 35 Screws
	Staples to attach shade cloth

Adapted by Stephen Dooley from an original design by Clarence Valley WIRES

Where’s My Bottle?

Eastern grey approx 1.5kg

Module objectives

By the end of this module, you will be able to:

- Understand the macropod milks available
- Understand how to make up milk formulas
- Understand how to feed a joey

Equipment

Things you will need:

- Bottles
- Teats
- Milk
- Cloth to wipe up spills
- Container to warm bottle in
- Cooled boiled water
- Hot water for warming
- Bottle brush and other bottle washing equipment
- Measuring cup
- A towel for your knee (in case the liner is wet)
- Bowl of bush dirt
- Two alarm clocks (Two make life easier, one set to 2am and one to make sure you get up again at 6am!)
- Protexin
- Impact

Macropod Milks

Macropod Milks

Since the 1st Edition of this manual was created in September 2003, I have revised my preferences with regard to milks. Though still using Wombaroo and Biolac milks, I have also adopted a regime that incorporates Divetalact for unfurred joeys that has proven to be highly successful. The formula and transition varies by joey so talk to your Macropod Coordinator regarding the precise regime for your specific joey.

Making Up the Milk Formulas

Biolac

Biolac M100g	16g of formula made up to 100mls
Biolac M150	18g of formula made up to 100mls
Biolac M200	24g of formula made up to 100mls

"Made up to", means adding the powder to a measuring cup and then adding sufficient water to make a quantity of X mls. Rather than adding the specific amount of water.

The Biolac manufacturers also recommends that for young joeys, particularly pinkies, that 1 or 2 drops of fish oil (with omega 3 fatty acids) is added to every 100mls of M100g and M150. This is purchased in capsules which each hold around 2mls. There has been research done on premature human babies suggesting this oil can be of benefit in the development of certain tissues, particularly the brain and eye, although there has been no similar research on macropods it is hopeful such additions may be of assistance.

The manufacturers instructions say 10-15% of body weight is to be given. We find that for unfurred and just furred joeys 15% is fine, however as they grow this must be reduced back to 10% or loose poos are the result.

Wombaroo

Wombaroo <0.4	14g of formula made up to 100mls
Wombaroo 0.4	18g of formula made up to 100mls
Wombaroo 0.6	22g of formula made up to 100mls
Wombaroo 0.7	25g of formula made up to 100mls

Closely follow your Wombaroo feeding charts with regard to quantities and remember to properly transition between milks. Transition instructions are in the Wombaroo booklet or talk to your Mac Coordinator.

Divetalact

Divetalact is used in combination with Impact and Heinz High Protein baby cereal. The regime will change, dependent on what stage the joey comes in at eg a 220g unfurred wallaby will move far more slowly through the transition than would a finely furred joey. We don't use the baby cereal until a wallaby is at least 400g and an eastern grey 800g. The following example is for a 300g wallaby. As joeys come into care your Macropod Coordinator will discuss the exact transition program you should use.

For the entire time:

- Add ¼ teaspoon of Impact **to every bottle** to begin with, gradually increasing to ½ teaspoon by 400g for a wallaby and 1 teaspoon by 800g for an Eastern grey, and shake well before warming.

Once the wallaby reaches 400g or eastern grey reaches 800g

- Start adding Heinz High Protein Baby Cereal very gradually building up over 7 days to 1 flat teaspoon **to every 300mls of formula**

Divetalact scoop = one scoop, firmly packed down and levelled off. (We measure this at 12g)
With water – add the full amount noted. (Biolac and Wombaroo are "made up to", Divetalact is not.)

Day 1 - 1 scoop to 100ml water (Water should be boiled water at all times).

Day 2 - 1 scoop to 100ml water
Day 3 - 1 scoop to 95ml water
Day 4 - 1 scoop to 95ml water
Day 5 - 1 scoop to 90ml water
Day 6 - 1 scoop to 90ml water
Day 7 - 1 scoop to 85ml water
Day 8 - 1 scoop to 85ml water
Day 9 - 1 scoop to 80ml water
Day 10 - 1 scoop to 80ml water
Day 11 - 1 scoop to 75ml water
Day 12 - 1 scoop to 75ml water
Day 13 through to fine fur – 1 scoop to 70ml

At fine fur transition down again:
First 4 days - 1 scoop to 65ml water
Next 7 days - 1 scoop to 60ml water
Next 4 days - 1 scoop to 55ml water
Then 1 scoop to 50mls with 1 rounded dessertspoon of Heinz High Protein Baby Cereal to every 1 litre of milk. If the joey is doing well the Impact can now gradually be discontinued.

Start at 6 feeds per day – feeding at least 20% of body weight per day. Remember to increase the milk volume as her weight increases. The % fed will reduce down eg by around 1kg a wallaby will be on 4 feeds a day of 30-35mls (roughly 15%) and the maximum a wallaby joey will ever be fed is 180mls in a day, (250mls for an eastern grey).

Our thanks to Jenifer Brindley of Clarence Valley WIRES for sharing this formula with us and allowing it to be reproduced here.

Don't forget to increase the milk quantity as the joey's weight increases and also when you reduce feeds, you increase the milk so that total volume remains the same ie if you go from 5 feeds of 40 mls of milk, you move to 4 feeds of 50mls of milk – total volume still 200mls a day.

Milk quantities also reduce once supplementary foods are included in the diet. DO NOT simply keep increasing the milk quantity once your joey is on supplementary foods or loose poos will result.

Milk Storage

Powder can be stored in your refrigerator or in a freezer, when not in use. Milk that is made up should be kept in a clean jar in the fridge and should never be polluted with leftovers from bottles. Any leftover milk from a bottle should always be thrown out – never reheated.

Transitioning

With both Wombaroo and the Divetalact regime we have been using, you need to transition the joey through stages when moving from one strength to another. This is very important and any shortcutting can cause diarrhoea, loss of gut flora and stress to the joey. The transition amounts are included in the Wombaroo booklet, an example being:
Moving a red-necked wallaby from 0.4 through to 0.6 milk
Days 161 to 163 50ml 0.4 plus 20ml of 0.6
Days 164 to 166 35ml 0.4 plus 35ml 0.6
Days 167 to 169 20 mls 0.4 plus 50ml 0.6

The days relate to age. In other words you create a milk mix that is part 0.4 and part 0.6, its strength increasing every four days until you move from totally 0.4 to totally 0.6. Each transition may be different, so check your Wombaroo chart for the specific mixes.

We use the Wombaroo transitions as our guide if transitioning from Divetalact to either Wombaroo, or Biolac, ie check for the equivalent Wombaroo milk to where you are with Divetalact eg it may be equivalent to 0.4 going to 0.6, so you use the appropriate transition sequence to move from the Divetalact to the actual Wombaroo 0.6.

Which milk for what?

Milk choice can be a very emotive subject. What we have found works best to date is the following:

- All unfurred joeys – use the Divetalact regime with Impact and cereal.
- Eastern greys – transition to Wombaroo when furring. Use a dessertspoon of Impact to every 1 litre of milk right through lactation.
- Pademelons – transition to Wombaroo when furring.
- Furred wallabies. Once furring the choice is yours we've had successes with all three formulas.

Do not mix the milks together. This could cause an overload of specific ingredients eg sugars.

Don't add anything to milk formulas unless you have discussed it with the Macropod Coordinator.

The Value of Bottle Feeding

In some care groups, where there are many macropods coming through the system and time and carers are short, macropod joeys are encouraged to lap from a fairly early age. We are lucky to have a lot less joeys and therefore to have carers who have the time to use a bottle, as there are several important reasons to do so.

- Joeys need to suckle for their lung development
- Joeys need to suckle for their security – this is when they are most at ease
- Joeys need to suckle to create the saliva needed for digestion
- A joey with pneumonia will not suckle, however it will lap – so those lapping do not see the signs until the pneumonia is well developed.
- Many mammals need to suckle for their mouth/jaw development. Though I could not find this specifically documented, it could also be the case for macropods.

Plastic versus glass bottles

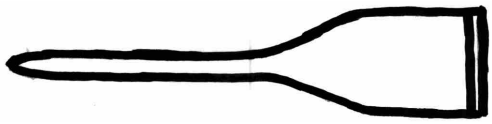
There is no doubt that glass is easier to keep clean than plastic and that plastic bottles should be discarded if they show signs of scratching and wear as these will harbour bacteria. Plastic bottles should also be used for one joey only and then discarded. Other than that it's probably a matter of personal preference.

Teats

There are four main teat sizes we use with macropods. (Teats shown here are not actual size)

A small teat – called STM by Wombaroo – used for small in-pouch kangaroos and wallabies

A medium teat – called MTM by Wombaroo – used for in-pouch kangaroos and wallabies



A large teat – called TM by Wombaroo – used for larger kangaroos and wallabies

An extra large teat – called FM by Wombaroo – used for larger kangaroos

eg an eastern grey pinkie may start on a small teat at 600g, progress to a medium teat by the time they reach a kilo and move to a large teat at about 4kg

The hole in the teat

This is an important topic. Firstly your teat will come without a hole and so you need to make a hole before you start feeding. A large hole means fast feeding, but it also means an unsatisfied joey and possibly a dead joey if the milk is taken in too quickly and the joey can't cope with it – it then goes into the wind system, either appearing out of the nose or going straight into the lungs – this is known as hurling. This creates obvious problems with breathing and the joey may suffocate or it could lead to pneumonia.

The smaller the hole the better – though it is not easy to gain the balance between a hole that allows a thick milk formula through to one that is too large. (If it is too small the joey may give up before they have sufficient milk and excessive sucking can also cause the end to blow out.) Some people suggest using a wooden skewer or matchstick or a tiny nick with a pair of scissors. The smaller the better – just a drip coming through is enough, then the joey needs to work its lungs to suck the milk through and will suck long enough (at least 5-10 minutes) to ensure it feels the satisfaction of the milk. Joeys that feed too quickly can end up being overfed, as they seem to be still hungry – overfeeding is a sure way to diarrhoea or loose poo.

The hole in the teat will grow with use, so keep your eye on it and replace the teat when it becomes too big. If you want to slow things down, and you haven't a new teat on hand, a bobbie pin or paper clip can help temporarily.

How many feeds per day?

This is covered in the Progression Tables however we would recommend you err on the side of more, rather than less feeds (ensuring you split the amount of milk required evenly across all feeds – less feeds doesn't mean less milk). Again in the wild the joey has access to its mother's teat when it needs it and this is an important part of the security it feels.

Hypoglycaemia

Some animals cope well even if they don't receive a feed during the night – this is not the case with young macropods. Just as with human babies, a young joey's brain needs glucose for energy but cannot store it – regular feeding ensures this regular supply of glucose. If regular feeding doesn't take place the brain may starve of glucose causing several possible side effects: weakness, ataxia (inability to coordinate muscles), muscle twitching, seizures, convulsions, visual problems, neurological disturbances leading to paralysis and even death.

Unfurred eyes open joeys should be fed 3 hourly to begin with and no less than 4 hourly. A just furring joey should be fed no less than 5 hourly. This means day and night. Even a young furred animal that has been injured or has come in quite debilitated should be fed every 3 hours to give it the very best chance for survival. Yes this takes a lot of time and dedication.

How much to feed?

When your joey comes to you it will have been checked by an experienced carer who will tell you what it is, recommend the right food and the quantities to start off with. The manufacturers instructions, along with guidance from the macropod coordinator will assist you in increasing or decreasing the volumes as necessary.

How do we know how much?

The quantity is based on a "guesstimate" of the joey's age. Usually weight, and an understanding of the joey's growth stage, (ie 0.4 etc.), are the main tools used to determine quantity. Weight alone is not always accurate and changes may be needed once the animal's development can be ascertained. Think of it this way – with humans not everyone aged 10 weighs the same do they? Animals are the same as humans - some are smaller than others. There are tail and foot measurements available from Wombaroo, however these have often proved inaccurate for our local macropods as animal size varies depending on where you are in Australia. As a general rule, animals are smaller the further north you travel and this has been demonstrated in both koalas and possums. More research is required to enable us to be more accurate and we would encourage you to measure the tail and hind foot and see how they correlate to each other and to the weight of your joey. We collect all these measurements and will try to develop our own measurement charts for this area.

What do the numbers mean?

For those who use Wombaroo products you'll hear the description "point 4" or "point 7" used a lot and this can be confusing at first. Think of it this way – a "1" is a fully emerged joey, that is it no longer resides in a pouch, and for macropods there are 5 main stages:

<0.4 = eyes-closed and unfurred joeys
0.4 = eyes open, ears free, unfurred macropods – may have some colouring appearing
0.6 = just furred joeys – ears up – nice fine fur
0.7 = fully furred joeys
1 = fully emerged from pouch

From a photographic viewpoint the photo of Merrilyn at 1.1kg in *The Locals* Module would cover 0.4 and at 1.5kg she was just beginning the 0.6 stage, with a very fine covering of fur. For 0.7 see the photo of the joey near the "Pouch Basics" section of *Home Sweet Home*.

Preparing to Feed

- Wash your hands in hot, soapy water. This is as much about not transferring our germs to the joey as worrying about their germs coming our way. Don't want to bother? Apparently 1 in 20 humans carry salmonella – bacteria that kills joeys – we have more than 20 possible macropod carers in this branch….
- Find a nice, quiet place for your feeding station
- Make sure your feeding station is organised with your needs for both feeding and toileting (see *Poo-ology*) – it's tough to stop once you are started.
- Prepare the milk per the manufacturers instructions using cooled boiled water. (Never use very hot water as it can deplete vitamin and mineral contents) You may find making up 24 hours worth of milk at a time a good time saver, but never make up more than you would use within 48 hours. Putting it through a sieve helps with smoothness. Keep it in a spotlessly clean, sealed jar or bottle in the fridge between feeds. (Storage jars should go through the same cleaning process as the bottles and teats. Make sure any lips of jars are thoroughly cleaned of the milk that accumulates there).

These bottles are marked with tape so that we know which belongs to which.

- Shake the jar of milk before decanting. Put the required amount of milk in the bottle, adding a ml or two for testing.
- Warm the milk using hot water in a container ie a mug of hot water. Do not warm milk in a microwave. There are 2 concerns with regard to using microwaves to heat milk:
  1) That it may change the constitution of the milk. This is yet to be proven and tests to date show that vegetables and meat cooked in microwaves may even retain more vitamin and protein quality than those cooked by more conventional methods. However "Far less information is currently available on the effect of microwave cooking on other food components such as carbohydrates, lipids and fat-soluble vitamins." [35] .
  2) Microwaves do heat substances unevenly and this has led to severe scalding. Three web sites checked say DO NOT use a microwave to heat milk for this very reason. "Don't heat baby bottles of milk in the microwave. The bottle may feel to be at a safe temperature when in fact the contents are dangerously hot." [36] "It is possible to raise water temperature greater than the normal boiling point; when this occurs, any disturbance of the liquid can trigger violent boiling that could result in severe burns." [37]

  The milk should be 30°C - that's a fairly neutral temperature and will feel neither too hot nor too cold on your wrist when you test it. Use your thermometer and check out what 30°C feels like – you may be surprised. Always give the bottle a shake to ensure the heat is distributed evenly and then test the milk on your wrist to ensure you won't burn the joey's mouth – also overheated milk can start to break down. Never test the temperature in your mouth – putting your mouth anywhere near the joeys teat or the joeys mouth or nose could transfer germs to the joey.
- Relax and take your time in feeding – this is a time for total relaxation and enjoyment for your joey, if done well, so both of you enjoy it – it is not a time to rush. Don't forget to keep the joey in at least a liner so they feel secure, even a tail that is uncovered can cause distress.
- Make sure your joey is more in a sitting position, than lying flat on its back. In this way you are not tipping the milk straight down its throat, which increases the chances of milk entering

the respiratory system. In other words the joeys nose should be pointed across the room, not up into the air.


Make sure you wipe any milk from around the joey's mouth (or anywhere on the joey it found its way to.). Spilt milk is a great breeding ground for bacteria.


Never smoke around a joey – at feed time or anytime.

A First Feed

Will be a nervous time for you. Make sure you have plenty of time.

Remember a joey feeds inside a warm, dark pouch, so try to imitate this environment by having them inside snug liners and by gently covering the head with your hand so that they are feeding in the dark. After a while you may find that the joey is quite happy to feed in the light but initially it is best to use your hand.

Putting a few drops of milk on the front of the mouth may encourage the joey to open its mouth and lick, enabling you to slip in the teat. Try this a few times first, but if necessary you may need to gently, but firmly prise the mouth open by putting pressure on either side of the mouth. When the mouth comes open pop in the teat. Sounds simple – right. Wrong!

You need plenty of patience for this – it can take many attempts to get that teat in and you need to stay calm and relaxed, but be firm and confident in what you are doing. Make sure the teat is on top of the tongue. You may have to prise the mouth open many times over many feeds before the joey eventually understands what is required of it. We had an eastern grey joey of almost 3kg come into care and for the first few days it took two of us to feed him. One to hold the bottle and mouth and the other to control the fore paws that were waving around everywhere – not understanding we were trying to help. It took a few days before it only needed one of us to feed him and nearly two weeks before he happily opened his mouth himself for the teat.

Look for small bubbles of air moving up into the bottle to show the joey is taking the milk.

This is one of the reasons why joeys are often stabilised by an experienced carer before coming to a newer carer, an experienced hand means a lot less stress all round.

What are those hands doing?

Joeys in a pouch knead their Mum to facilitate milk flow and that habit of pushing out with their forepaws often continues. They aren't trying to push you away; it's simply a reflex action. Let them hold the bottle if they can or push against your hand – it's all part of the process.

Feeding Too Quickly

A joey, which feeds too quickly, is at risk of colic and worse, aspiration pneumonia – caused by milk entering the respiratory system. How can you slow your joey down?


Small hole in teat


Glass bottle


Bobby pin or paper clip on the top half of the teat


Bending the teat over as you feed to reduce the flow

- Restricting milk flow by tipping the contents backwards slightly – ensuring only small amounts enter the teat at a time
- Taking the teat from the mouth when you realize the joey is having difficulty swallowing the amount it has taken into its mouth

Remember to sit your joey up a bit, so that the bottle is going into its mouth from the side, not above. See the photo at the front of this module.

Cleaning up

Toileting takes place after the feed but that's covered in the next Module. When toileting is completed then comes the clean up!

- Pop the joey back into its full pouch, and re-hang the pouch. Change the liner if you've spilt any milk on it – it will breed bacteria quickly.
- Wash your hands – yes again
- Throw away any milk not consumed – reheating milk can multiply bacteria
- Rinse the bottles and teats in cold water first. This could be a new step for some and may even sound illogical. Try putting milk into two glass containers – rinse one in hot water and one in cold and see the difference. Cold water stops the protein setting and therefore gives you a much better clean
- Then wash in hot soapy water and use bottlebrushes (tiny bottlebrushes are available that are quite good for teats too). Why? Well it takes hot water and detergent to dissolve fat, and bacteria are killed in water over 60°C. Detergent can also break down bacterial walls.
- Now bottle cleaning is a controversial subject as some carers still believe in sterilising solution and others don't due to evidence of build-ups that can cause the loss of gut flora and the fact that even hospitals now seem to be going away from sterilising solutions. I personally do not use sterilising solutions. If you wish to use a sterilising solution do so at this point but please ensure you follow the instructions carefully and rinse every last drop from the bottle before using it again. Don't forget to soak everything for 12 hours in cold water. You can also sterilise in a babies sterilisation unit (steamer) available at supermarkets. If you think boiling will sterilise remember you may have to boil for 30 minutes at >100°C to kill E coli and clostridium.
- Rinse everything in boiling water very well to make sure every trace of detergent and sterilising solution are removed (The bleach in the sterilising solution is inactivated in boiling water.)
- Store your equipment safely between feeds to ensure it remains clean. I keep my bottles in the fridge.
- Enter what happened into your joey's record sheet. (See *So What's Left?)*

Reducing Feeds

The progression tables will help you to decide when feeds can be reduced. Some points to help you:

- Don't forget to increase the quantity of milk per feed as the number of feeds decreases to ensure the joey still receives the quantity it requires

- Don't rush the process – more feeds are better than less feeds. In the wild it is available as required and you're really not making a small joey tougher by denying it regular feeds, you're simply creating stress
- Don't change anything else when you are changing feed numbers – remember one change at a time
- Even the times out as you change things so that no one time slot is greatly bigger than another. Once you get down to 4 feeds a day you will be able to enjoy some unbroken sleep – but don't make that night time stretch too long for the joey.
- Change times gradually to the new time slot
- Make sure the joey is eating other foods as you move them down in bottles and that these foods are available between feeds, or you'll have a stressed and hungry joey.

Some people have asked what time should they feed. An even spread is the most preferred option ie if 6 feeds then feeding exactly every 4 hours, 2am, 6am, 10am, 2pm, 6pm, 10pm. I'm often asked if we can be more flexible to enable a little more sleep. The general rule should be – the younger the joey, the less flexible you can be and remember that constantly changing times are a real stressor so decide what you'll do and stick with it. Here are some slightly uneven times that have been used by others to give you some ideas:

6 feeds a day: Frankly every four hours is what is needed for these small joeys.
5 feeds a day: 2.00am, 7.00am, 12 noon, 4.30pm, 9.00pm. Shortest 4.5, longest 5
4 feeds a day: 6.00am, 11.30am, 5.00pm, 10.00pm. Shortest 5, longest 8. Something like 8am, 2pm, 8pm and 2am is the ideal of every 6 hours and I find gives me more sleep than the first.
3 feeds a day: 6.00am, 2pm, 9.30pm. Shortest 7.5, longest 8.5
2 feeds a day: 7.00am, 7pm. An even 12 hours should be easy at this point.
Remember that by 4 feeds a day your joey should also be eating other foods – and plenty of them by 3 feeds a day.

Be aware that joeys need their milk, even when growing older. A study completed by the University of NSW [38] on red kangaroos found that young at foot joeys, (ie permanently emerged from the pouch), had a total energy requirement of 60-70% of those of an adult female. An adult female being three times their size! Macropods complete their weaning when outside the pouch and typically this takes half the time again as pouch time ie if they are in the pouch for 12 months, they will continue to suckle for a further 6 months out of the pouch.

Several joeys in care

It can be difficult if you have several joeys in care, all on different feed times. If you can, work each joey individually, but if this becomes too difficult give both the larger number of feeds. Better to go slowly than to rush – remember macropods aren't weaned until they are between 12 and 18 months old in the wild.

Make sure each joey has a separate bottle and teat. Coloured electrical tape stands up to the washing process for a reasonable time and makes identification easy.

Once your joeys are confident out of the pouch then you may wish to feed them on their feet. This can help time wise, as you can easily bottle-feed two joeys at once. However please be sure your joey is confident out of the pouch and with standing for the time it takes to drink their bottle first.

Supplementary Foods

Once a joey reaches a certain age (see the Progression Charts) it starts to feed on things other than its regular milk. When a joey travels around in its Mum's pouch it has the ability to graze on a variety of grasses as mum feeds and also as it starts to emerge from its pouch. When it reaches this age we should be providing supplementary foods too.

Ideally these will be the foods the joey will be living on once it is released into the wild. These are the best for its digestion and also help it to recognise food sources once released. If a joey has only ever seen oats or goat pellets it may struggle to live when these food sources are removed.

Native Foods


Native grasses. Some of our local species include Hedgehog grass (echinopogon caespitosus), Love grass, (eragrostis brownii), Three awned spear grass (arista vagans) and Blady grass (Imperata cylindrical).


Native herbs


Native shrubs


Leaves and bark – dead and alive


Native fruits and flowers

Dried leaves and bark may be especially useful when the joey is first starting to learn to chew, and should be used along side the clumps of grass with roots and dirt. They may be used to assist the teething process. Make sure they are always from native trees.

Get into the habit of adding some fresh grasses or other native foods after every feed. Firstly on the tummy in the pouch and then just outside the pouch where the joey can reach them. Even when joeys are out grazing most of the time, the browsers eg swamp wallabies may still need supplementation with branches from natives of their release area, so they can clearly identify the foods they will be consuming.

Non-Native foods

It isn't always possible to provide all a joeys needs with native foods alone if you live in a suburban area. The following are non-native foods that can be used sparingly:


Alpaca-llama/Goat/kangaroo pellets (many other pellets eg rabbit are not formulated correctly for macropods and may cause loose poos. Some also contain additives, which may have an adverse affect on gut flora. The protein content should be no more than 16% and preferably less).


Grasses. Try to have a variety of grasses, even if non-native to give them a wide range of vitamins and minerals. Be wary of kikuyu (See *Oh My God He's Sick!*). even when not toxic this grass can result in green and loose poos.


Dandelions


Gota kola


Flat leaved weeds (Check Toxic plant table in *Home Sweet Home*)


Lucerne chaff


Grated carrot

- Grated sweet potato
- Grated apple
- Corn
- Some fruits for swamp wallabies and pademelons
- Rolled oats (never whole oats as they are sharp and could cause injury and the development of lumpy jaw – see *Oh My God He's Sick!*)

Please don't feed your joey sugary foods and things not on this list.

Issues with Supplementary food:

- Attracting rats, mice, birds and possums. This is sometimes difficult to avoid. Put them in protected areas where birds may not go or be able to see them. When your joey is outside fulltime and can graze it may be better to remove the supplementary feeds during the night.
- Putting supplementary food on the ground. If your joeys can urinate or defecate on their feed and then eat it you may have problems with illnesses such as coccidiosis and e coli (see *Oh My God He's Sick!*) Use dishes.
- Not enough variety of grass types causing possible nutritional deficiencies and the possibility of enterotoxaemia (bacterial infection sometimes known as "pulpy kidney") upon release.
- Grasses that are very lush in dry times. Again this could see enterotoxaemia develop.
- Toxic plants – see section in *Home Sweet Home*
- Incorrect foods that cause illness eg cauliflower, cabbage, broccoli
- Polluted grasses. Often we need to cut grasses for our joeys to eat and this can also be a hazard to the joey:
  - Septic systems. Often lush green grasses will grow where there are septic overflows and drains. Sadly these grasses are usually loaded with bacteria like e coli and they should be totally avoided
  - Car emissions. The cars passing by may pollute grasses on roadsides. If it is absolutely necessary to use such grasses wash them thoroughly first.
  - Chemical pollution (pesticides and herbicides, including snail baits)
  - Where dogs/cats have toileted (fence lines and bases of trees and poles can be a major problem for this)
  - Kikuyu Poisoning – see *Oh My God He's Sick!*
- Non-recognition of natural foods
- Too much soft food – see Lumpy Jaw in *Oh My God He's Sick!*
- Food such as goat pellets being allowed to become damp and mouldy. Any mouldy food should be immediately discarded.
- Dust from pellets can cause sore eyes – be careful when you are coming to the end of the packet.
- Dirty food dishes. All food and water dishes should be washed regularly.

 Leaving supplementary food in liners when they may have been soiled.

What's that waving in the wind?
When a male joey starts to graze – they really gain a lot of enjoyment from the process. So much so that you will often see their little red penis wave like a happy flag as they walk along chewing on the grass. This is quite normal and nothing to be concerned about.

Dirt and Roots

Yes you read the Progression Tables correctly – you do need to start adding roots with dirt attached to your joey's pouch at a certain age. This is very important. Tiny joeys use enzymes to digest their food (a good reason to ensure you are using the correct milk formula for the correct age). As they age their gut starts to change and gut flora builds up and takes over the role of digestion. In the early days of macropod care this was not known and many joeys were lost, as they were not helped to establish a good gut flora base with dirt and roots.

All you need to do is take a gardening tool out and dig out a small clump of grass. Shake off the excess soil, (but not all of it), and pop in the pouch on your joey's tummy after a feed. At first the joey will simply suck at the roots, then after a while they eat the roots too and eventually the grass part becomes of interest. It is the microbes in the dirt that help to establish the gut flora. Progress through from quite dry grasses to greener grasses as the interest in grass increases. (Too much green grass initially can cause diarrhoea.)

Yes it means that pouches (and often the floor around them) can become quite messy. Live with it – the mess is one of the most important things we can do to ensure the good health of our joeys.

We keep a bowl of dirt near all our joeys – right through and including at release. Even older joeys can be seen nuzzling in the dirt when their tummies don't feel quite right. NB: Potting mix is not dirt. It contains many chemicals and should not be offered to your joey. You'll find more on gut flora in the next Module.

The best dirt to use is dirt that comes direct from a bush area. Often domestic gardens contain chemical additives and they do not seem to have the essential ingredients to spark the gut flora into action. Talk to a carer with a bush block, I'm sure they would readily offer you a bag full of natural dirt.

Don't remove uneaten grass as the joey may well eat it when it is drier.

Take care that soil does not become damp and grow mould that could cause disease. Keep areas around water bowls dry.

Water

The Progression Tables mention when to start making sure that a bowl of water is available. Some joeys take more readily to water than others and at earlier times. The main thing to consider is heat – if it's warm and you need to drink more so does your joey – the same thing applies after exercise.

We used to think that adding a little water to the joeys milk was fine, and possibly a very small amount is fine, however it is better to offer water between feeds. Why? Apparently if the milk is too

diluted it will not do what it is supposed to do in the gut and therefore the joey will not receive the nutrition it needs. I am told that gastric acids cause the milk to curdle becoming a solid mass and passing into the intestines to be absorbed. Diluted milk does not curdle as readily and thus the absorption process is affected. If your joey will not lap water and will not take water from a bottle on a hot day, try very weak lectade – the extra flavour may tip the balance in your favour.

Impact

Impact is a food supplement made from bovine colostrum powder and it contains whey protein, omega-3 and omega-6 fatty acids, vitamins and minerals. Many carers swear by its ability to produce a healthy immune system in their joeys. Joeys coming into care are given Impact with their milk as per the manufacturers instructions and then, once healthy and stabilised, a heaped tablespoon of Impact is used per litre of formula.

Why use Impact? "In marsupials there is probably no colostrum as such. Intestinal closure occurs later in pouch life so antibodies are present in the milk throughout much of lactation." [39]

The following uses have been confirmed with the manufacturer, our distributor and carers elsewhere who have been using it for some years with great success.

1) With unfurred joeys to boost immunity.

2) For older joeys who are not progressing to expectation eg joeys that are not adding the expected amount of weight – when other causes have been eliminated. "The high protein, low fat composition of Impact facilitates the absorption from the intestine while providing a high level of nutrients."

3) For older joeys who have been ill or have been through a stressful situation. It helps to speed recovery.

4) Just before and after moving joeys to release sites to help boost immunity to prevent diseases associated with the stress of changing carers and environments.

It's a great product to keep on hand in case it's needed. Please talk to your Mac Coordinator before using it on any joey.

This use of colostrum/immunoglobins has also been confirmed in humans. An ABC *Catalyst* program in early 2004 documented the use of colostrum in athletes and found the following benefits: muscle growth, improved immunity, greater absorption of nutrients, increased endurance and an improved recovery rate.

Protexin

Protexin is a multi strained probiotic, which improves a joey's intestinal microbial balance. It is a must for stressed joeys and those who have been on antibiotics or wormed. Joeys go through two types of digestion. An unfurred joey uses enzymes to digest its food, whereas a furred joey uses gut flora. Protexin works to assist gut flora. Given this, it may be of little use to unfurred joeys.

The liquid form mixes into the milk well and is therefore the recommend form to use.

Using a Dummy

Joeys, and especially small joeys, spend a good deal of their time in the pouch attached to their Mother's teat. This is not available to us in the usual way, however a substitute teat can be made using a teat WITHOUT the hole made in it. This last point is important – your dummy must not have a hole in it or the joey will suck in air causing colic. Select a teat of the same size you are using to feed your joey and soak it for a while in boiling water to cleanse and soften it. Then as you remove the bottle from the joey's mouth, insert the dummy for them to continue sucking on. This may take perseverance given the teat is nothing like Mum's. Simply pop it back in gently as you see it come out. After a few days most joeys will take to the dummy and this helps both from a stress perspective and from the alleviation of problems caused when joeys decide to suck on other areas of their bodies. Males are especially prone to suck on their testicles and this can cause severe, and lasting injury, if allowed to go on. (And it's very difficult to stop once it is started. See Body Sucking under "*Oh my God he's Sick!").*

Keep the dummy clean. When feeding take the dummy out and pop it into clean water to soak. Wash it off and pop it back in after feeding.

Swamp wallaby with dummy

Poo-ology

Young eastern grey ready for toileting action

Module objectives

By the end of this module, you will be able to:

- Know how to toilet your joey
- Define the poo you are seeing
- Know when to worry about poo

Why Poo-ology? My husband dubbed me the Poo-ologist when we first started caring for macropods due to my following joeys around to see what they deposited. In *Oh My God He's Sick!* you'll learn just how vital it is for you to know your joey's poo, it's smell and current consistency – it's a good indicator that something may be very wrong.

Equipment

Things you will need

- A bowl of warm water
- Cloths to collect the wee and poo with (see options below)
- Clean liners – in case of accidents*
- A bowl to collect the dirty cloths in (an old ice cream container works well)
- Cream for skin care – see *So What's Left?*

* If it is cold then use a hot water bottle to warm the liner before transferring the joey to it.

Cloth Options

- Chux cloths. Cut a Chux Superwipe into 4 pieces.
- Other old cloth pieces.
- Toilet paper – create pads of 2-4 pieces
- Tissues

Again what you use is a matter of preference, though I prefer the Chux cloths, both for their gentleness on the joeys and also their gentleness on the environment. The Chux superwipes can be reused (soak them in a nappy bucket and then wash when you have a quantity) and they also become very soft and so are very gentle on the cloaca if you have periods of diarrhoea or for tiny joeys.

What's a cloaca?

Cloaca – pronounced Clow (as in glow)-akk-ahhh. This is that rounded piece just up from the tail at the front. It's an all-in-one job – you'll notice when you toilet that the poo comes out of a hole at the rear whilst the wee comes out nearer the middle. This also houses the "bits" for reproduction so all in all it's a valuable part of the joey's anatomy.

As you raise different types of macropods you will realize that cloacas can look quite different eg an eastern grey cloaca is a very large, raised affair, whereas a pademelon doesn't seem to have much of one at all! A red-neck wallaby develops quite long hair on its cloaca, and a swampy often has a dark ring surrounding theirs.

The Toileting Process

Most people toilet their joey directly after feeding, some toilet before, it's a matter of preference. The main thing is to develop the habit so that you minimise the possibility of soiled liners between feeds.

Again we are trying to mimic the wild where, we are told, Mum's lick their joey's cloaca in order to stimulate them to go to the toilet. We certainly don't expect you to use your tongue! (See section on cloth options!) This is the general process

- Lift the joey's legs up towards its head – as illustrated here by Merrilyn (fast asleep as always!)
- Dip the cloth into warm water and squeeze out the excess moisture
- Gently stroke the cloth over the cloaca – the emphasis here is **gently** – with tiny joeys it's more of a wave over the top and it's never a rub with any joey or you'll find your joey sucking in their breath with pain and you could end up with a prolapsed cloaca. This is a very delicate area so be gentle. A gentle wipe up the rear of the cloaca can help stimulate the poo process and once the joey starts to pellet you'll even be able to feel the pellets there. NEVER try to stimulate a male joey with his penis out.

- Catch what comes out
- Pop the dirty cloth into the dirty cloth container
- Start over again quickly!

It may take quite a few cloths to complete a toileting. Sometimes wee will come first, sometimes poo, sometimes they come together (a bit tricky) and sometimes they alternate. When you think you are finished, wait awhile – there's usually more to come (especially with eastern greys who seem to create a lot more than goes in!)

It can also be useful to put a cloth behind the cloaca before you start to catch anything that may come out too fast to catch.

After a couple of goes you'll find you get less on yourself and the joey and more on the cloths and the whole exercise becomes a lot easier. It's also a good incentive to minimise stress (which often causes diarrhoea) and to ensure the correct amount of feed is used (over feeding also leads to lots of loose poos and/or diarrhoea)

Bed wetters

If your joey is a "bed wetter" put a couple of old-fashioned cloth nappies, or a baby blanket, beneath the liner to absorb the moisture. When you check the joey at feed time, change both the liner and the nappy to ensure you keep the joey and pouch dry. If the pouch is wet make sure you change it. A cold, wet joey can easily become sick.

Older joeys

As your joeys start to emerge from their pouches and spend more time outside exercising you may find they start to toilet themselves on the lawn. This is certainly easier when the joey starts to pellet.

Self-toileting often starts as morning exercise increases. You'll see the joey concentrating hard and a nice wee may be the result. At the next feed you won't obtain a wee and so the process begins. It's a good habit to pop a joey that does come out of its pouch, out onto grass after a feed and toilet so that it gains some exercise which helps in digestion, and this will then develop a habit for the self-toileting process in the longer term. When you start self-toileting pop the joey out of the pouch after feeding and stimulate the cloaca with a cloth whilst they stand on the ground. Some joeys will pick up what you want very quickly and will wee quite readily when popped on the ground after a feed. Others take a bit more patience.

Poo Definitions

It's useful for us all to have a common language when discussing poo – which is a major indicator when something is wrong and also a good indicator of development. You'll note in the Progression Tables that we use common household items to help define what we are seeing.

Watery poo is a flowing liquid, often watery with some solids, but very fluid.

Thick custard is gaining consistency but does not create any shape as it emerges ie it still flows.

Toothpaste poo comes out in the same way toothpaste comes out of a tube – in a nice rounded line.

Pellets. Here we have some variety but generally pellets have a good solid form about them. They may be soft or long or rounded but they are firmer and a shorter more definite shape than toothpaste.

Loose poos. A general term for poos that are softer in consistency than they should be.

Your joey will go through all these stages as it develops and may even go through several in one day if it is stressed, eats the wrong thing, is overfed and so on.

Diarrhoea

Also known as scouring and is the fear of every carer, but often confused with loose poos. The essence of diarrhoea is that it is **uncontrolled.** That is the joey has no control over when it emerges from its body. If the joey has loose poo when you toilet, but remains clean the rest of the time, then it's not diarrhoea. Diarrhoea can often mean illness – see *Oh My God He's Sick!* for full descriptions and some solutions.

When to worry about poo

When it is clearly diarrhoea – don't waste any time – TAKE ACTION

- When it is inconsistent with what is expected for the joey's age
- When the smell changes – again take action – see *Oh My God He's Sick!*
- When the colour changes dramatically – see section below
- When there isn't any – see constipation in *Oh My God He's Sick!*

Poo Colours

The Progression charts (*Appendix*) take you through the colour changes you can expect. Sometimes the colour may change several times during the day – observe what is happening between toileting sessions so you can determine why changes are happening eg lots of wet green grass can cause loose green poo, eating some weeds can also cause loose green poos. Generally speaking the darker the poo, the better. Good dark poo is a good indication of good gut flora. Colour change can also be an indication of disease, see the section on diarrhoea in *Oh My God He's Sick!*

Toileting Problems

Over Stimulation

This is the main concern with toileting. If you over stimulate your joey you will certainly cause it pain and in the worst case a prolapsed cloaca where the intestinal lining starts to come out from the body. (See *Oh My God He's Sick!* for the solution if this happens)

Constant loose poos

What's causing it?

- Lack of gut flora? Make sure they are eating sufficient dirt and if that's still not picking it up try Protexin
- Too much milk? Check the manufacturers recommendations versus what you are giving your joey. With Biolac saying 10-15% sometimes it is possible to over do the feeds. Try reducing the amount and see if things improve. Also remember that the more milk the less likely they are to take to dirt, roots and grasses and the more of these they consume the firmer the poo.
- Supplementary problems? Are they eating plants that may have some low toxicity? Are the plants polluted in some way?
- Hygiene. Could your cleaning program be leaving bacteria to build up in the bottle or on the teat or perhaps via storage bottles? Review the suggested steps in *Where's My Bottle?*
- Is the joey constantly in a stressful situation eg around noisy children or dogs?
- Could illness be a factor? Check for other symptoms – see *Oh My God He's Sick!*

Diarrhoea

- See the section above and in *Oh My God He's Sick!*
- To help keep the joey dry between feeds use several layers. An old fashioned nappy between the layers can help draw any excess moisture away from the joey so it's not constantly in a wet liner.
- Don't leave it too long between changes to ensure the joey cannot ingest its own faeces.

Wind

Is a regular event for some joeys when toileting and is often nothing to worry about. Be aware of your joey and if the tummy is distended and there are signs of pain then your joey may be experiencing Colic. (See *"Oh my God he's sick!"*) Try to minimize the time your joey spends sucking on an empty bottle as this can increase the air intake. If you have any concerns contact your Macropod Coordinator.

Gut Flora

When the gut flora of your joey is affected by stress or illness then loose poos and also light coloured poos can be the result. The worst case I have seen was in Buster – the eastern grey in some of the photos in this manual. Buster had been found by a young family who thought their young son, (perhaps 10), might have fun raising a joey. The joey was put in his care totally, and although he was a caring boy he obviously had no knowledge of raising a macropod. He kept Buster out of his pouch for most of the day (Buster was less than 3kg) and tried to feed him skim milk via a syringe. Fortunately the family realised within a few days that things weren't working and so we were able to collect him. He wasn't being fed much and so he was dehydrated and the stress had so depleted his gut flora that all we saw for the first couple of days were some very small, almost pure white pellets. The whiteness told us that Buster's gut flora had been destroyed. (He also lost a patch of fur on his back as a result of the stress.)

I use a product called Protexin – which is a probiotic to help re-establish gut flora. It is often used in times of stress eg the first week or so after a joey comes into care and it can also help with loose poos. Though it should not be used with antibiotics, it is a must to use after them, as many antibiotics destroy the gut flora. The liquid form mixes well with milk. If you use the powder form, use the brown packet, which is much finer and again mixes better with the milk than the larger granules.

Wee

A small joey's urine should be practically clear. Look out for signs of any pain on urination or any blood or flecks in the urine. Check *Oh My God He's Sick!* for causes and cures.

Bright orange urine can occur once your joey is eating solid food. It can be caused by a number of things including the level of concentration. Some suggest the joey is not drinking enough water. Sometimes it is so red that you think it's a pool of blood. Don't panic – use a cloth to check that it's really a deep orange. Of course if blood is suspected seek help immediately, better to be left feeling a little foolish than to have a joey die.

If any pain is shown on urination then you may be seeing a urinary tract infection, see *Oh My God He's Sick!*

Remember urine can scald so be sure not to leave it on the cloaca or around the base of the tail.

Oh My God He's Sick!

Malcolm the eastern grey with blood parasite infection

Module objectives

By the end of this module, you will be able to:

- Understand the main illnesses in macropods
- Understand what action to take when an illness occurs

Equipment

Things you will need

- Syringes (to administer some medications orally)
- Peptosyl
- Lectade
- Protexin
- Impact
- Infacol®
- Towels
- Cloth nappies or similar absorbent cloth

This list could be unlimited, however you will not know what is likely to happen before it does and medications go out of date. The list above is a good kit to keep on hand and your Macropod Coordinator will probably have far more that they can bring to you if needed.

Animals in the wild show few signs of disease – indeed of over 200,000 carcases of red, eastern grey and western grey kangaroos, taken for human consumption from 1980, less than 0.7% were found to have some kind of pathological condition, and mortality in young animals in the wild is usually caused by lack of nutrition and predation.[40] It's a sad fact that we cannot mimic the wild environment. The stresses we cause, and a lack of early access to the immunities found in the wild environment, can take a large toll on the joeys that come into our care. I hope the following information can help you to prevent and cure as many as possible.

Remember that many wild animals have an ability to mask their illnesses (It's called a Preservation Reflex – a sick looking animal soon comes to the attention of predators), so an illness may be well advanced before we see the signs.

This is a basic macropod course and so we have included here information about the most common problems you will see. There are many more and so you will need the help of your Macropod Coordinator and possibly a Vet when illnesses occur. Whenever you need to seek veterinary advice let your Macropod Coordinator know about the problem.

Most diseases manifest themselves slightly differently in each joey, so your joey may only exhibit some of the symptoms mentioned in each section, not all of them. Where Veterinary help is required we haven't included all the treatment information as products change over time.

Stress

Firstly make sure you read and thoroughly understand the Module on stress, *Stressed Out*. Stress is often the thing that leads to the problems we will discuss in this Module.

Look for change

Every macropod is different. Some drink every drop of milk every time; some leave some on and off. Some have slightly different coloured poo, different shapes, and more solid. You need to know your joey and therefore to know when a change is occurring. For example we had two eastern grey joeys in care. One drank every drop in her bottle every time; the other left some at least once per day. If the first left some in her bottle even once I'd immediately be concerned that something was wrong. With the second, a small amount left is usual and therefore causes no great concern, though again if his pattern changed we'd be alerted.

Speed

Whilst you shouldn't panic at the first sign of trouble, neither should you delay seeking help and providing treatment. Just a few hours can be the difference between life and death for a joey. If you think something maybe wrong ring the Macropod Coordinator to discuss it straight away. You can then agree on further action and you should take that action immediately. It doesn't matter that you might be embarrassed that you have done something wrong, don't compound it by not seeking expert advice.

Prevention

As you read through the diseases we are covering here you will note that many can be prevented by good management eg myopathy. A joey that is confined in a small pen too long cannot build its heart and leg muscles. Once released it may have a heart attack the first time it is asked to run fast, though more likely the deterioration will be more gradual with death occurring within 18 months of release. Coccidiosis seems certainly to be exacerbated by having a lot of eastern greys in pens over a long period of time – especially if poo is not cleaned up several times a day – this is one reason we prefer to soft release our eastern greys with minimal pen time. Sharp items in supplementary feed can cause lumpy jaw. Minimising stress, which depletes the immune system, is another obvious area. Make sure you understand the areas where you can make a real difference in the prevention of disease.

Pouches

When an animal is sick it will often seek the kind of comfort it had as a youngster. Most of you will only have young animals, but for those who are involved at the release end, we advise you to have some larger pouches so that joeys who are ill can be placed in a pouch even though they may long since have completed emerged from them.

Vets

We could not do what we do without our Vets. At all times Vets need to be treated with respect and their many time constraints need to be understood – after all they do most of our work for free. A couple of points need to be made here:

Call ahead for an appointment if possible to ensure the waiting room will be free of dogs and not too crowded when you arrive and that a Vet will be available.

When you arrive, check the waiting room before taking the joey in and if need be alert the receptionist to your presence and wait with the joey in the car to be called.

- Never leave the joey at a Vet's if it can be avoided. The sights, sounds and smells will cause great stress.
- If you suspect a particular disease, take any written information you have on this disease with you to the Vet so he/she can see what others have done before. Talk to your Macropod Coordinator before going to a Vet as they may have more advanced material that may be of value to you and to the Vet.
- Most Vets will not charge you for their time, but you will have to pay for any medications and processes eg faecal floats, x-rays.
- In the case of a high expense treatment that you wish to be reimbursed for, it is usual to speak to your Macropod Coordinator for permission BEFORE treatment takes place.

Vet Prescribed Medicines

Veterinary medications eg antibiotics should only be given under Vet supervision. You may end up with medications left over from a joey's treatment. We suggest you find out how they can be kept and for how long, as they may well be useful in the future. However they MUST NOT be administered without discussion with the Macropod Coordinator and the Vet. Joeys have become ill when carers have administered medications they were given for other joeys that may be inappropriate for the new condition and size of joey or may have gone out of date. Different antibiotics are used for different problems. Out of date medications can kill. One particular tick treatment can cause neurological damage if used after it has expired.

The Main Indicators

Every disease has different symptoms; however there are 3 main indicators, changes in which, should alert you that something may be wrong:

Loss of Appetite

This is where keeping records of feed quantities is very useful. Occasionally joeys don't drink all of their milk, however if the pattern suddenly changes then you should be looking for other signs that may indicate a problem

Lethargy

The Macquarie Office Manual describes lethargy as "a state of drowsy dullness or suspension of the faculties and energies; apathetic or sluggish inactivity"
You should know your joey well – does he have less energy today? The "hang dog" look that is illustrated on the front page of this Module is typical of a very lethargic animal.

If an animal is very weak we need to keep their head propped up away from their chest to prevent asphyxiation. If they are unable to exercise at all then roll them over regularly to prevent a fluid build-up in the lungs.

Poo Changes

Watch for any changes in poo and particularly diarrhoea, which we cover in more detail in this module

Key Treatments

Each illness may have different specific medications that should be used, but just about all illnesses require the following action to be taken:

Minimise Stress
(See *Stressed Out*)

Keep the joey warm
This may mean extra middles for a furred joey or even a hospital box, depending on the extent of the problem and the size of the joey. For some reason, when joeys become ill, even with infection, they seem less able to maintain their own body temperature.[41]

Hydration
This third item is probably the most important of all. On occasion even joeys that have received vet treatment have almost succumbed because they were not kept sufficiently hydrated after treatment. When a joey goes off their milk, immediately contact your Macropod Coordinator, and also try them with a rehydration fluid such as Lectade. Small amounts and often are the key. We once brought a joey through an illness by offering him fluids every 15 mins. He would only take a very small amount, and that's why we tried so often. Aim to ensure your joey receives at least 10% of it's body weight in fluid every 24 hours, but remember that some illnesses cause dehydration and so even 10% may not be enough. Sub-cutaneous delivery of fluid may be necessary for joeys that won't take anything orally, and they can deliver large quantities of fluid quickly to a debilitated joey. When your joey is ill you may have to work around the clock delivering fluid. Leaving them overnight whilst you sleep may mean a dead joey by morning.

Signs of Health

- Growing per expectations. Joeys that grow slowly are known as "at risk" joeys, and have a higher probability of dying.
- Taking an interest in the world (After a certain age, see Progress Charts)
- Grooming. (Again after a certain age.)
- Plump thymus glands – found just below neck, either side (almost like small breasts, see photo P20), should be visible in unfurred joeys and palpable in furred.
- Thick tail base. There is a 6-point condition score developed by M.A Austin, I believe.[42] Basically a gauge is taken of how well covered the bones are by muscle at the tail base. Condition 1, where the bones can be obviously felt, offers a very poor prognosis, through to Condition 6, which is considered excellent as the bones cannot be felt at all even with some pressure.
- Pink gums
- Coat shiny and well groomed

The joey on the left is in excellent health, with a thick tail base, the joey on the right is older and yet, due to poor treatment is not as fit. It is difficult to show in a photo but his tail base is significantly thinner.

Do you think your joey is sick?

Answer these questions for your Macropod Coordinator and Vet:

You might want to make some copies of this form. It's a useful form to keep with all your notes on each joey.

Species: Sex: Age: Weight:

What's happening with his appetite?	
What's happening with his energy levels?	
How has his weight changed recently?	
How has his poo changed?	
Describe his eyes	
What are his thymus glands like?	
Are his ears hot?	
What colour are his gums?	
Does he feel warm?	
Is he dehydrated?	
Is his tummy swollen?	
Is he showing any signs of pain?	
Has anything unusual happened in the past few days? For the joey? In the household?	
Any other symptoms/unusual signs?	

Medications

Medications should only be given after consultation with your Macropod Coordinator. The following table offers some dosage rates for the more regularly used substances. Please ensure you have an up to date weight for your joey.

Name	Used For	Dosage per kg of body weight	Comments
Baycox® (Piglet)	Precautionary use against Coccidiosis for Eastern Grey kangaroos Treatment of coccidiosis	0.4ml/kg at times of wet weather and high stress eg give just prior to relocation 0.4ml/kg once per day for 3 days. Re-dose every 5 days for a further 15 days.	Chicken Baycox is very harsh and unpalatable. If it is the only thing available the dosage rate is 0.8ml/kg
Baytril®	Antibiotic	Baytril®50 0.1ml/kg Via injection only	Some anecdotal evidence of joint issues at a later age after use.
Incremin®	To build joey up during and after some illnesses	Two drops per bottle	This is basically vitamin C
Infacol®	For Colic	0.2ml initially, either in the bottle or via mouth. An additional couple of drops per bottle if Colic continues.	Any persistence in symptoms should be checked out.
Imizol®	Treatment for Blood Parasite disease	0.024ml/kg	See paper at the end of this manual
Ivomec®	Worming	0.1ml/kg	
Koagulin	Used to control bleeding in coccidiosis	0.25ml/kg once per day	This is vitamin K
Modecate	Used to sedate older joeys for transport	5mg/kg IM	
Nilstat®	For thrush	Unfurred joeys 0.25ml/kg Furred joeys 0.5ml/kg 3 times per day between feeds. (Recent debate suggests a dosage as low as 0.1ml/kg may be preferable as higher doses cause excess diarrhoea.)	Do not use mycostatin – it has had severe side effects in macs.
Pentavite®	To build joey up during and after some illnesses	Two drops per bottle	
Peptosyl	Anti diarrhoeal	0.25-0.5ml/kg 3 times a day for 2 days, then twice a day for 3 days	Excellent product, soothing to tummy.
Protexin	This is a pro-biotic used to improve gut flora	Usually 1/8th teaspoon per bottle.	You cannot overdose and higher amounts can be used after antibiotics and for loose poos.
Swipe-a-fly	External parasites	External use only. Dilute 1:100 with water and spray on.	

Some medications are known to create problems, even death, in macropods and should therefore be avoided. These include:

- Mycostatin - used for thrush. Use Nystatin instead.
- Phenylbutazone – non-steroidal anti-inflammatory. Has, apparently, caused ulcers and sudden death. Use metacam (meloxicam) instead.
- Oral antibiotics. These destroy the gut flora. Antibiotics should be administered via injection only.

Signs of Pain

- Grinding Teeth. Some joeys grind when they are hungry and you'll know if this is true of your joey. In most cases grinding teeth is a sign of pain or discomfort of some kind and action needs to be taken to alleviate the problem.
- Clenched forepaws
- Out stretched fore paws
- Hunching over

Pain Relief:

Talk to your Vet. Different medications are used for different forms of pain ie what you use for stomach spasms is different to what you would use for a fracture.

Allergies

This topic is huge with an infinite number of things that an animal can be allergic to and many symptoms. Fortunately allergies appear to be rare and so I have covered only the basics here.

Causes:

- Milk products
- Skin creams
- Materials
- Toxic plants (See *Home Sweet Home*)

Symptoms:

- Skin rash
- Red forepaws and hind pads
- Skin of digits stretched tight
- Swelling

Treatment:

Will vary dependent on the specific allergy, the following covers a milk product allergy

- Take the joey off the milk product and feed lectade or similar for 24 hours
- Change milk type as long as symptoms have disappeared in 24 hours

We found one joey quite ill in the pen one day. Hunched over and obviously in pain from the grinding teeth. We think she had eaten something that had caused the pain, and the following treatment worked:

- We administered Infacol®, immediately and before each bottle that day
- We administered Peptosyl 3 times that day
- We popped her in a warm pouch
- We administered some Lectade as she would take it.

Having found her at 6am in pain, she refused the first bottle of the day, but by 2pm was drinking her milk and by evening she was out and eating normally again.

Bacterial Infections

There are several of these, including salmonella and E Coli, which we detail separately.

Cause:

- Poor hygiene
- Dietary change
- Polluted food source

Symptoms:

- Change in the colour of the poo – may be yellow
- Smelly, very loose poo, or diarrhoea
- Lethargy

Treatment:

- Accurate diagnosis by a Vet is required and may need antibiotic attention
- In two recent cases a course of the antibiotic Leotrox®, combined with an anti-diarrhoeal was successful

Bleeding

Again a complex topic of an advanced nature, however a few tips:

- Bleeding from the ear – especially when accompanied by a watery substance and a foul smell will usually indicate brain damage. Have a Vet confirm.
- Small bleeds – a few drops of blood, from anywhere on the body could be an indicator of the blood parasite – see the detailed section this module.
- Frothy blood around the mouth and nostrils could mean a punctured lung if it is accompanied by laboured breathing. Have a Vet confirm.
- First aid for bleeding in macropods is identical to that of other animals. Strap the area, be sure not to cut off the circulation, seek expert advice.

Blood Parasite

This is a relatively new disease. It has been proven to occur in eastern grey kangaroos and is strongly suspected in red-necked wallabies. So little is known about it that the parasite and the insect that carries it, are yet to be finally identified. It does appear that this particular parasite may be a normal part of the parasite load carried by an eastern grey and that something triggers a parasite multiplication that the joey cannot cope with. We are actively involved in the research needed to take our understanding further. It is a very interesting situation and I'd encourage you to read the paper in the Appendix: "Blood Parasite seen in Young Eastern Grey Kangaroos" January 2003 to increase your understanding.

Cause:

- Parasitic overload potentially triggered by stress
- It has been suggested that a lack of immunity caused by no or low exposure to insects such as ticks, flat flies and mosquitoes whilst in human care in suburban environments, contributes to a joeys susceptibility to this disease.

Symptoms:

- Anaemia (white or very pale pink gums and conjunctival membrane around the eye)
- Lethargy, weakness
- Fluid may build up in lungs and abdominal cavities.
- Tendency to bleed from tick attachment sites, or veins after blood sampling.
- Increased consumption of water and frequent urination
- Loss of appetite (though we have one confirmed case where eating remained normal)
- Hot ears
- Misshapen and desiccated pellets (I have some examples)

Treatment:

- If you suspect this disease contact your Macropod Coordinator immediately
- Veterinary assistance will be required with treatment and to collect a blood sample for future testing. (Please read the paper on this subject in the Appendix if you have an animal suspected of having this disease.)
- Keep the animal in a stress free environment – preferably in a pouch. This disease can leave the joey vulnerable to internal bleeding and to spontaneous blood vessel eruption, therefore ensuring they cannot bump themselves is important
- Imizol® sub-cutaneously, using the dosage rate of 0.024ml/kg. So a 5kg joey would receive 0.12ml.
- Antibiotics do not affect the parasite and are only used if there are signs of fluid build-ups or chest infections.
- Provide plenty of fluid using Lectade or by administering Hartmann's sub-cutaneously.
- Add Pentavite® with iron, and/or Incremin® to any milk taken to assist the rebuilding process.

- Keep the animal in a fairly quiet, contained environment for a few weeks after the disease has passed as there has been considerable strain on the heart during this time and a gradual build up of fitness is required. Too much too soon can cause sudden death.
- Add a liberal amount of Impact per bottle
- Add Protexin to the bottles after any antibiotic treatment is completed.

Speed is VERY important with this disease. If the parasite travels to the heart or brain then death is the result.

Body Sucking

This isn't something to take lightly. Jaws have been misaligned and significant injuries to testicles have taken place.

Causes:

- Stress

Symptoms:

- Specific areas of the body may be reddened or, in the case of the testes, swollen or sucked flat.
- Cloaca may be swollen and even bleeding.
- If cloaca is being sucked, liner will contain faeces on a regular basis.
- Orange colouration of the area

This 660g swampy has his testicles entirely in his mouth. Caused by babysitting one weekend.

Treatment:

- Use a dummy (see *"Where's my Bottle?"*)
- Cover the area until sucking stops. Though be careful that covering the area does not cause even more stress. A nappy type arrangement can be fashioned to cover the cloaca and testicles.

We have seen a red-necked wallaby that sucked his scrotum so much that his testes ascended back into his body. (See photograph) An example given by Dr Rick Speare in his work *Clinical Assessment, Diseases and Management of the Orphaned Macropod Joey* talks of an eastern grey joey that sucked his scrotum so much that it became ulcerated and the testis were fibrosed.

Empty sacs on this red-neck. As at 3.5kg the testes had not redescended.

Cataracts

Causes:

- Over heating
- Injury

- Nutritional deficiency
- Dehydration
- Genetic defects

Symptoms:

- White circular disks within the eye

Treatments:

- Vary dependent on cause and timing. Talk to your Macropod Coordinator immediately if you have even the slightest concern that your joey may have cataracts, as if left and the joey becomes blind, euthanasia may be the only option.

Coccidiosis

Coccidia are protozoal parasites that live in the lining of the small intestine in many animals. Several types of coccidian species occur in macropods. In the wild, healthy animals don't appear to be affected. This is probably due to the fact they do not face the same stresses that a hand-raised joey does. A wild macropod also has a wide territory, which prevents the build-up of oocysts.

This disease is the most common killer of the eastern grey kangaroo and does affect and kill other macropods. Stress, as with most diseases, plays a fundamental role in the development of this disease. A joey with a depleted immune system may develop a build up of coccidiosis oocysts. If there is also faecal build-up in a pen and warm, wet weather arrives the joey is at high risk of dying from this disease.

Cause:

- Stress – any lowering of immunity
- Transportation to a new location.
- High risk at certain ages for eastern greys, 4.5 – 5kg and 6.5 – 8kg [43]
- Contamination of grazing areas – this disease is one of the main reasons we stress the need to PICK UP THE POO. The coccidian oocysts are deposited in the faeces and then consumed by the joey.
- Supplementary food on ground
- Warm, wet weather (enabling oocysts to become infective)
- No previous exposure to coccidia ie no immunity [44]
- Poor nutrition and/or changes in diet

Symptoms:

- "Doey" eyed look
- Lethargy
- Lack of appetite
- Smelly green to brown diarrhoea leading to bloody diarrhoea
- Hunched up look

- Often become very "sooky"

Treatment:

Speed is critical – and even with it success is very limited. 24 hour a day care is needed.

- Talk to your Macropod Coordinator and seek veterinary help immediately
- Keep the joey pouched and warm
- Baycox® orally. There are 2 types available Poultry (Toltrazuril 25g/l) and Piglet (Toltrazuril 50g/l). The piglet Baycox® is much more palatable to a joey and therefore much the preferred option, but either can be used in an emergency. Be sure to check which you are given, as the dosage is different. Poultry Baycox® is at a dose rate of 0.8ml/kg, the piglet would be 0.4ml/kg, once per day for 3 days. Some people suggest re-dosing with Baycox® every 5 days for a further 15 days to try to defeat the whole coccidia cycle – others say this is unnecessary, including the manufacturer. Your Macropod Coordinator may have Piglet Baycox on hand.
- Antibiotics (injections) - Baytril® 50 at 0.1ml/kg body weight (ie 0.5ml for a 5kg joey) for 3 – 5 days
- Elecrolyte fluids eg Lectade or if insufficient fluids are being taken sub-cutaneous Hartmann's solution. Give them often and keep a bowl near them that they can drink from.
- Vitamin K (injection from Vet), koagulin 0.25ml/kg once per day (helps to control bleeding)
- Peptosyl (orally) 0.25 – 0.5ml/kg 3 times a day for 2 days and then twice a day for 3 days (helps to sooth the tummy and works on the diarrhoea)
- Buscopan® injections may help with the pain. (Check with your vet as painkillers have recently been updated.)
- Add a liberal amount of Impact per bottle
- Add Protexin to the bottles after any antibiotic treatment is completed.

Do not allow a joey to suffer unnecessarily. If mucosal lining is seen in the faeces, ie almost black blood, then full recovery is almost impossible with animals succumbing to other diseases eg bowel infections and pneumonia some time after recovery. Euthanasia may be the kindest option.

Be aware that pneumonia and salmonella can be complications of this disease and a prolapse of the bowel can occur with the constant diarrhoea.

Prevention:

There is much discussion about prevention of this disease and as with many aspects of macropod care there seems no clear direction to take. Many carers I have spoken to do not use any preventative medications on a regular basis, others use a variety of methods. We need to ensure that any preventative treatments do not cause either a loss of immunity or a possible growth of a "super bug".

We would recommend the following for eastern greys:

- Joeys never be moved in the critical weight zones

- Joeys never be moved in wet weather
- That a dose of Baycox® be given in adverse weather conditions, at points of high stress and if joeys need to be moved to a release site at a weight above 3kgs.
- Follow the policies and Progression Charts ie avoid any stressors, move at the correct age and PICK UP THE POO.

We are continuing our research into this disease and it is a disease that it is important to know about before it happens. Eastern greys do not seem to fair well with a change of carers and so our recommendation is to try to locate them at their intended release site from the first. Further information/papers on this subject can be obtained from your Macropod Coordinator.

Colic

Basically this is wind.

Causes:

- Over feeding
- Incorrect food eg cauliflower, cabbage, broccoli, toxic plants
- Allowing the joey to suck in air through an empty bottle
- Hole in teat too big, allowing more air to be sucked in and an unsatisfied joey that continues sucking on an empty bottle.

Symptoms:

- Distended tummy
- Clutching at tummy
- Back legs hugged into tummy
- Moving around in obvious discomfort

Treatment:

- Infacol® (baby colic preparation available from the chemist). 0.2mls initially, either in the bottle or orally. An additional couple of drops per bottle can be used if the colic continues.

If symptoms don't disappear fairly quickly then seek expert advice, as it may be a more severe problem.

Constipation

This is usually an indication of a lack of water so try offering more water to the joey – even adding a small amount, start with one or two mls, to the next couple of bottles. In hot weather joeys should be offered water bottles between feeds. If this fails to work try a few drops of olive oil in the next couple of bottles. If this doesn't work seek expert advice, as it could be an indication of a serious blockage.

Dehydration

Fluid is critical to the joey's survival "About 75% by weight of a kangaroo's body is water, which is a high proportion compared to most mammals." But by the same token "Kangaroos can withstand losses of body water that would be fatal to a human." [45]

Causes:

- Lack of fluids due to death of Mother
- Lack of fluids due to poor care
- Diarrhoea
- Disease

Symptoms:

- Lethargy, weakness
- The usual test for dehydration is the pinch test. Take a pinch of skin around the shoulder blade area. The slower the skin goes back into place the greater the dehydration.
- Dry or tacky mouth
- Limbs and ears may be cold
- Weight loss

Treatment:

- If the skin moves slowly back into place then oral fluids may be enough to restore the joey's hydration. Use Lectade.
- If the joey's skin stays up then it is severely dehydrated and you need to call on expert advice, as sub-cutaneous fluids will be required. A Vet, or an experienced carer should administer these.

Again, if in doubt seek some help. If Lectade is used for a prolonged period and with milk being given also, then there is a concern that a glucose overdose could occur. This causes acidosis, which in turn can affect the kidneys and lungs.

NB: a joey may still urinate when dehydrated, so please don't see urination as a positive sign

"If a joey becomes dehydrated, even mildly, the cornea often ulcerates" [46] Cataracts can form as a result of dehydration.

Diarrhoea

Diarrhoea is often the precursor to something much worse and to be on the safe side you should always inform your Macropod Coordinator when diarrhoea is suspected.
The essence of diarrhoea is that it is **uncontrolled.** That is the joey is not controlling when it releases the faecal matter. In some cases the same culprits that cause loose poo can cause diarrhoea, and the same remedies will apply ie:

- Lack of gut flora? Make sure they are eating sufficient dirt and if that's still not picking it up try Protexin
- Too much milk? Check the manufacturers recommendations versus what you are giving your joey. Be exact with Wombaroo or loose poos may well be the result. With Biolac saying 10-15% sometimes it is possible to over do the feeds. Try reducing the

amount and see if things improve. Also remember that the more milk the less likely they are to take to dirt, roots and grasses and the more of these they consume the firmer the poo.

Supplementary problems? Are they eating plants that may have some low toxicity? Are the plants polluted in some way?

Hygiene. Could your cleaning program be leaving bacteria to build up in the bottle or on the teat or perhaps via storage bottles (make sure any lips of jars are thoroughly cleaned of the milk that accumulates there)? Review the suggested steps in *Where's My Bottle?*

Is the joey constantly in a stressful situation eg around noisy children or dogs?

However if these are not considered the problem and the diarrhoea does not seem to indicate a disease (See the following table) then the following treatments may help:

Resting the gut for 24 hours. Substitute Lectade for the milk usually given – **DO NOT** starve the joey – it requires fluid intake. Don't do this too often as an electrolyte replacer such as Lectade, only allows the joey to "hold its own". During the time it is used the joey will be using its own energy reserves.

Peptosyl. (Available from your Vet, this is an excellent product that not only has anti-diarrhoeal properties but also lines the bowel surface, so it is very useful as a soothing agent, it may absorb toxic compounds and has antiseptic properties). Dose rate of 0.25ml – 0.5ml/kg 3 times a day for 2 days and then twice per day for 3 days. [47]

Specific types of diarrhoea

Most of these problems are detailed elsewhere in this module. Call in expert assistance as required.

Description	Possible Problem
Smelly Green to brown diarrhoea leading to bloody diarrhoea, joey won't drink and is lethargic.	Coccidiosis
Very smelly and green lumpy faeces that becomes more and more runny. Also drinking lots of water	E-Coli
Runny light to dark brown. Appetite still good	Enteritis - Bacteria overgrowth
Light coloured to light brown faeces when they should be passing pellets	Loss of gut flora
Diarrhoea of any colour in combination with obvious pain and possibly breathing problems	Poisoning – possibly toxic plants
Runny brown to black faeces and not eating usual amounts	Salmonella, septicaemia
Pea soup style with sweet and sour smell	Thrush
Yellowy coloured with bubbles of wind and sweet and sour smell	Thrush
With lack of coordination, convulsions and a runny nose or respiratory problems	Toxoplasmosis
Green and runny	Wet and new grass

These problems all have specific treatments, some dealt with elsewhere in this module, others require immediate veterinary attention.

NB: If diarrhoea persists then dehydration will quickly become an issue, be aware of this and seek expert advice should sub-cutaneous fluid replacement be required.

Scourban

Scourban is an anti-diarrhoeal favoured by some vets. It has been used successfully where the diarrhoea is extreme eg in some bacterial infections, however it is not the first choice for use to control diarrhoea where alternatives are available. The reason being that Scourban contains oral antibiotics, which we always try to avoid with macropods. Oral antibiotics can cause even greater problems with gut flora than do injectable antibiotics. Antibiotics should always be followed with a course of Protexin and plenty of bush dirt.

Using Poo

In the past, one treatment for diarrhoea used by some carers was to mash up the faeces of a healthy joey of the same species and add these to the joey's milk. The problem, of course, is in knowing if the poo you are using is disease free and some Vets feel this might also lead to an increased risk of salmonellosis.[48] As we have many alternatives available this method should be left to a situation when all else has failed.

E Coli

An overgrowth of escherichia bacteria

Cause:

- Poor hygiene
- Dirt or grasses taken from near septic or drainage systems
- Food contamination

Symptoms:

- Smelly, green diarrhoea
- An increased thirst for water
- Lethargy
- Dull eyes

Treatment:

- Antibiotics – seek veterinary advice

Eye Injuries/Issues

Are not always obvious and can have many causes and conclusions. Seek expert advice if an eye problem is suspected.

A bluish tinge to the eyes is very normal for young macropod joeys. See also Cataracts.

Fleas

Are not normally found on macropods.

Cause:

- Proximity to domestic animals

Symptoms:

- Considerable scratching due to the irritation
- Anaemia

Treatment:

- Neem pet spray or
- Cat parasitical treatments

NB Do not use dog medications or other chemicals on macropods. PLEASE NOTE – some flea powders may be lethal to joeys.

Fractures

Are best covered at an advanced course. Suffice to say here that compound fractures of the rear legs generally require euthanasia. Do not condemn an animal to a slow painful death in its older years.

Lumpy Jaw

Bacteria infect the bone, lips and/or tongue primarily. It occurs when a sharp piece of vegetation pierces the joeys gums and infection occurs. The primary bacteria are usually fusobacterium necrophorum, though other bacteria can be involved.

Cause:

- A soft, unnatural diet can cause the gums to soften – don't feed a joey bread, or only grated foods – make sure they gain a high percentage of their natural grasses that include the fibre required.
- Don't include sharp things in supplementary foods – some mixes include oats and sharp pieces of chaff – avoid these
- Passing of the organism on via faecal contamination of foods (again don't put supplementary food on bare ground and pick up poos in gardens and pens)
- Stress caused by overcrowding, unhygienic conditions and poor nutrition can contribute to the extent of this problem

Symptoms:

- Swelling of the jaw, gums or palate and in severe cases deformity
- Weeping sores
- Nasal discharge
- Refusal to eat
- Pneumonia is often an associated factor

Treatment:

- Sadly in most cases euthanasia is the only option. (Removing the affected tissue and antibiotic treatment have been tried but to date the infection usually reoccurs some time later)
- Clindamycin may be worth trying.

Death can occur within 2-3 days or may take as long as three weeks after the symptoms are first noted.

This should not be confused with an external abscess. An abscess is usually spongy, whereas lumpy jaw is usually hard.

Myopathy

Sometimes called capture myopathy as it can sometimes be seen in animals that are stressed by capture. It can be a degenerative disease as well as being seen almost immediately in some instances. I have seen it described as "a severe form of stress" [49]. The same article went on to say that because of myopathy - "As a general rule a high percentage of adult 'roos that are moved will be dead within 18 months, (maybe even up to a couple of years) of the move."

Causes:

- Insufficient exercise as a young joey (pens too small and kept in them too long)
- Severe stress ie being chased by dogs, thunderstorm, being relocated
- Dehydration
- Hypoglycaemia
- Moving joeys from a large to a small pen

Symptoms:

- Lethargy
- Coffee coloured urine
- "Floppy neck" – an inability to hold the head erect
- Stiffness
- Convulsions or muscle spasms
- Paralysis

Treatment:

- If the cause is stress ie being chased by dogs, remove the stress immediately
- Even older joeys will benefit from being bagged as discussed under pouches
- If dehydration is the cause then fluid therapy should be started
- Seek veterinary advice.

Some joeys may initially survive, only to die several weeks later from heart failure or progressive paralysis.

Open Wounds

Major damage may need veterinary attention. Talk to your Macropod Coordinator to be sure of how to proceed eg a tetanus shot may be required and stitches may be needed.
Some small scratches may be best left to heal themselves. Somewhere in the middle you may need to cleanse the wound and use something like manuka honey, which is a great healing agent. We have also found Chloromide antiseptic, in a pump spray, (from the Vet), to be very useful.

Generally macropod skin heals quickly, and as long as the wound is kept clean it will only rarely become infected. In areas where tetanus is a possibility, wounds should not be dressed. Tetanus does not survive well in an oxygenated environment. See also *Tetanus,* this module.

Poisoning

Cause:

- Toxic plants (see *Home Sweet Home*)
- Pesticides, herbicides, insecticides
- Artificial fertilisers
- Baits – even snail baits can kill

Symptoms:

- Abdominal pain
- Depression
- Lack of coordination
- Aimless wandering
- Drooling and/or frothing at the mouth
- Wanting to stand in or near water but not drinking it

Treatment:

- Try to identify the cause
- Talk to your Macropod Coordinator first as treatments depend on causes
- Seek Vet advice

Kikuyu poisoning

When this area received good rains in early 2003, after the prolonged drought, cattle and horses were being affected by, and dying from, what is called “Kikuyu poisoning”. Kikuyu grass is not normally poisonous, however the lush growth after a period of dry weather can be, and can kill animals. An eastern grey in the care of a local WIRES branch came down with all the classic symptoms of kikuyu poisoning and died. As no autopsy was undertaken, kikuyu poisoning cannot be proven, however it would be sensible for us to avoid giving our animals lush kikuyu growth after rain for a period of at least two weeks.

Pneumonia

Cause:

- Hurling – milk entering the lungs. "Aspiration" pneumonia. See *Where's My Bottle?*
- Other illnesses that cause a joey to be lethargic. Fluid can build up in the lungs and cause pneumonia
- Bacterial infections – sometimes caused by poor hygiene
- Insufficient warmth
- Stress
- E Coli (joeys often seem to develop pneumonia after a bout of E Coli)
- Often associated with lumpy jaw

Symptoms:

- Reluctance to suck
- Breathing noises (unlike domestic animals, a joey's breathing should be very difficult to hear.)
- Redness on the chest of very young joeys
- May have a runny nose
- Coughing. Joeys don't cough often and even a single cough could be an indication of some kind of respiratory disease.

Treatment:

- Seek veterinary advice

Prolapsed Cloaca

Cause:

- Over stimulation when toileting
- Constipation
- Diarrhoea

Symptoms:

- The mucosal lining of the bowel protrudes outside the cloaca
- Red and swollen cloaca

Treatment:

- Bring joey into a clean environment (You don't want twigs and dirt attaching to the bowel lining or fly strike)
- Wait for an hour to see if the problem corrects itself
- Try sprinkling a little sugar on the bowel lining

- In severe cases a Vet may have to place a stitch in the cloaca to prevent a reoccurrence.

Sadly I saw a prolapsed cloaca when we experienced coccidiosis in a number of animals early in 2003. It was on a Vet's advice that I undertook these steps. Leaving it alone did work, and when it didn't the sugar did, (as strange an idea as it might seem).

Skin Disorders

Kangaroo Pox

Causes:

- A virus

Symptoms:

- Wart like growths often on the legs, paws, face and tail

Treatment:

- None – they will grow and spread for a month or two and will then fall off. Larger scabs may leave a scar.
- Humans do not catch this disease. However it would seem to be quite contagious in macropods so if you have an outbreak **isolate the joey.**

Fur loss or lack of development

Causes:

- Over heating
- Stress
- Poor nutrition
- Parasites ie mites, fleas

Symptoms:

- Fur not developing properly, thin and patchy
- Fur loss – may be in patches in different areas

Treatment:

- Ensure joey is not kept too hot – remove layers during the day, add them on colder nights, though once fully furred and emerged let the joey maintain their own temperature.
- Will depend on cause – talk to your Macropod Coordinator

Ring Worm

Causes:

- Fungal infection – probably gained by contact with domestic animals or small children

Symptoms:

- Roundish areas of hair loss
- Skin appears rough or greasy looking

Treatment:

- Antifungal creams such as Conofite® Cream or Deltaderm® lotion. NB Not Whitfield's ointment as it may be toxic.[50]

It is thought that ringworm can be transmitted to humans from macropods. There is speculation that treatments do not alter the duration of the disease.

Tetanus

This particular bacteria remains in the soil and is prevalent where livestock have been kept.

Cause:

- A cut infected by the bacteria clostridium tetani

Symptoms:

- Locked jaw
- Rigid legs and then eventually whole body
- Convulsions – caused by movement, bright light or sounds
- Drooling/excessive saliva

Treatment:

- Treat for tetanus if an injury occurs, especially in a suspect area.
- Seek immediate veterinary assistance. Survival rate is very poor.

Thrush

Thrush is relatively common in young joeys. This is a fungal infection (*candida albicans)* that may affect the mouth only, but can also affect the entire intestinal tract.

Causes:

- Post antibiotics
- Teething
- Stress eg change in carers, change in milk
- Poor hygiene – especially milk left around mouth and on liners

Symptoms:

- Chewing on the teat – obvious discomfort and a reluctance to suck
- Lesions in mouth

- Rusty colouring appearing around mouth and on chest area from saliva. (Not always thrush, can be common in swampys as they fur and in joeys that are over heating.)
- Refusing to take the teat
- Irritation of the cloaca – joey scratches at the cloaca
- Irritation on pooing
- Pea soup looking poo – may contain white flakes
- Poo has a strong "sweet and sour" smell

Treatment:

- Impact.
- Nilstat® drops (from the chemist) between feeds, three times a day. Continue until 2 days after all symptoms disappear.[51]
  - Unfurred joeys 0.25ml/kg
  - Furred joeys 0.5ml/kg

  The reason the treatment is between meals is that the Nilstat® needs to come into contact with the fungus to be effective – milk would prevent this.
  Again there is some debate as to dosage rates with some recent work suggesting that a smaller dose of 0.1ml/kg can be as effective and may produce less diarrhoea. In a recent case we experienced, a small dose did not prove effective and the thrush returned. On the higher dose when all other symptoms had disappeared except the diarrhoea, we stopped the Nilstat® treatment and after a few days the diarrhoea also cleared up.
- Add a very small pinch of ground ginger to each bottle. This apparently helps reduce the fungus and is also very soothing on the tummy
- Use Protexin and lots of dirt for two weeks to help re-establish the gut flora

Nilstat® – with the active ingredient nystatin is the medication to use. Mycostatin is sometimes suggested as an alternative, and carers are told it is exactly the same, it is not. It may have the same active ingredient, but it also has additives. DO NOT USE MYCOSTATIN. There is anecdotal evidence that it has caused deaths in joeys. Of recent times there have been shortages of Nilstat® liquid, so here are some alternatives: Go to your Pharmacist or GP and ask them to prescribe Nilstat® tablets then crush 3 tablets with a mortar and pestle and suspend it in 15 ml of Heinz® apple and blackcurrant gel then dose at 1ml/kg. If you let your Pharmacist know the usual dosage you use, they may even make a solution up for you, from the tablets.

Toxoplasmosis

This is another disease caused by a protozoal parasite – this time *toxoplasma gondii*. This parasite is carried by cats, which can be infected with it at any age. "Cats acquire Toxoplasma infection by eating any of the three infective stages of the parasite…" [52] Even neutered cats can carry toxoplasmosis and cats can infect more than once. Cats should be excluded from all macropod enclosures and anywhere macropod food is stored. In a zoological situation it is suggested that "cats, including all wild cats, should be housed in a building separate from, and at least 15 metres away

from, other animals, particularly macropods." [53] Be cautious of purchasing supplementary foods that may have been contaminated by cats living in produce stores.

Causes:

- Faeces of cats infecting the grazing area or supplementary food.

Symptoms:

Can be many and very varied

- Lethargy
- Glazed eyes
- Weight loss
- Lack of coordination, head tilted
- Progressive weakness
- Diarrhoea
- Convulsions – often associated with bulging eyes
- Respiratory problems eg laboured breathing, runny nose
- Blindness
- Sudden death

Treatments:

- Nothing effective at this point, though a number of things are being tested. Seek veterinary advice – sulphonamides may be helpful [54] though generally this disease is fatal
- Clindamycin may be worth trying.

NB: This is another Zoonotic disease. Pregnant women need to avoid toxoplasmosis as if infection occurs during pregnancy it can be transferred to the foetus. The child may subsequently have permanent damage to its nervous system. [55] [56]

Urinary Tract Infections

Causes:

- Insufficient water consumed
- Dehydration – possibly from a recent bout of diarrhoea
- E Coli

Symptoms:

- Joey has a strong "urine" smell
- Cloudy urine, dark urine or urine with white flakes in it
- Joey urinates in droplets, rather than a steady stream
- Pain when animal tries to urinate

- Rusty coloured cloaca (may even see a black ring which can be from dried blood)
- Ulcerations on cloaca

Treatment:

- As the urine is usually found to be extremely alkaline, (this can be confirmed by a Vet or by using a urine testing kit), vitamin C tablets (1/2 a tablet to 50mls water) can be used – dissolve them in water and offer to the joey between feeds. If the urine is found to be acidic use Ural® powder.
- Make sure they are drinking plenty of water
- Bath the cloaca to reduce any ulceration problems caused by scalding from the strong urine.
- If there is a bladder infection (this must be confirmed by a Vet) then a course of antibiotics may be necessary.

Don't take this problem lightly – in severe cases such blockages can cause a bladder to burst, leading to death.

Worms

Macropods do carry a number of parasites and a healthy animal should not need any treatment for these. However joeys that are compromised can gain a heavy build up and treatment may be necessary:

Symptoms:

- Dull, scruffy looking coat
- A failure to thrive
- Rash
- Mucousy poo
- Seeing worms in the faeces

Treatment:

- Ivomectin (Sheep Ivomec® not cattle) dosage rate is 0.1mg/kg once and then again 3 days later.
- Use Protexin after the Ivomectin course to assist the reestablishment of gut flora.

So What's Left?

Joe the red-necked wallaby sharing a secret with Pepe

Module objectives

By the end of this module, you will be able to:

- Understand the important bits and pieces that don't fit in other Modules

Approaching a joey

For those of us who've been raised with domestic pets, our usual approach is to pat the head or stroke the back of an animal presented to us. You need to change this thinking with macropods. An approach from the head or back is usually an approach from a predator and so it can make a joey jump severely.

Approach from the front, touching the chest between the forepaws. Of course once the joey is familiar with you, you can move your hand around to the back – they often love a good scratch!

It is better that your joey is not handled by other people, but if it's unavoidable, make sure the approach is from the front so as not to cause undue stress.

Bathing

In days gone by some macropod carers have suggested joeys should receive a daily bath, (and even a blow dry). We do not believe this to be necessary, and in fact feel it could be harmful. Putting a blow dryer anywhere near a joey would cause incredible stress, and washing your joey daily could well deplete oils that are naturally needed for their skin and fur development. Certainly if you spill milk on your joey, or if they have poo, or urine on them, you need to clean them. A nice soft cloth and clean, warm water is usually all that is necessary. Make sure all the muck is cleaned off and use a soft dry towel to remove excess moisture. When unfurred joeys come into care they sometimes have the brown substance on them that is usual in their mother's pouch. Resist the temptation to clean this off, as the smell will bring comfort to the joey, as well as protecting their skin.

Between Feeds

What should you be doing between feeds? Leave the joey alone. Small joeys – pre the emerging stage need their sleep and a contented joey should simply snuggle down and go back to sleep between feeds. If they are disturbed, their energy will go on the disturbance, rather than their growth. They do of course need daily sunshine and this should be done directly after early morning and late afternoon feeds. Older joeys need stimulation between feeds but this should come from a buddy, food sources and their pen, not from humans wherever possible. The exception comes in a soft release situation when some joeys are taken for walks to familiarise the joeys with the area. See also *Stimulation*, in this module.

Buddying

We make it a rule to try to buddy all our macropods and you may be wondering why.

- Stimulation. Unlike a macropod Mum we are not with our joeys 24 hours per day. They need 24-hour company if it is possible and the "buddy" provides that company. Even the

more solitary species like swamp wallabies are not solitary until they are much older and weaned.

The issue of strong attachments. Given our joeys see so much of us they naturally think of us as "Mum". When they are moved to a release site they lose "Mum" for the 2nd time in their life (isn't once bad enough…). Having a buddy to whom they are attached helps to ease the stress of this changeover. At least one "person" in their life doesn't change

Humanising. There are macropods out there that think sleeping on the couch – or even in bed – is natural. It's not and having a fellow macropod helps to ensure the natural instincts come to the fore. Each will give the other confidence and also the ability to learn by watching each other. Merrilyn and Buster were buddies, Buster being a kilo heavier. With Buster to follow Merrilyn started to graze and lay down on the grass at a much earlier age than Buster did.

Boxing. Some joeys, even at quite a young age, like to have the occasional boxing match. It is best this takes place with another joey rather than a human. Humans who think it's fun to box may be setting their joey up for later euthanasia and another carer up for severe injury. Think of it in the same way as you might for a small child. It may be amusing if an 18 month old throws a playful punch; it's far less amusing when it's a 10 year old. There are documented cases of macropods having to be destroyed because they tried to fight with humans. Try Mare Carter's "A Wild Life" [57] Her description of her husband's near death experience, (including photos), at the hands of a male kangaroo which had been in their care for several years, brings it home. That particular kangaroo had originally been with a family with small boys who'd had a great time playing and fighting with the kangaroo. The kangaroo was shot dead – it could have killed one of its carers.

When introducing a second joey to your first please keep the following in mind:

Keep the new joey isolated until you can be sure it is disease free.

Take things slowly and be with the joeys as they are introduced to ensure they don't fight and cause each other damage or stress overload. We have seen even a tiny joey hiss and claw at a larger joey that it felt was coming too close too soon.

Remember the rule of changing only one thing at a time – that is, don't change anything else when a new joey first arrives.

Be aware that if a larger joey jumps on top of a small joey eg into its bag with it, it can cause damage and even death.

Dreaming

It seems some joeys dream. Well this is the explanation given when joeys sometimes jerk in their pouches. The joey seems to be fast asleep and all of a sudden the legs kick out and sometimes the head jerks around and yet the joey still seems fast asleep. Sometimes all you see is a quick movement of the pouch. We had one eastern grey who we would find part out of her pouch at times after she'd had a particularly energetic romp in the field of her dreams!

Keeping Records

Yes paperwork, but you'll find this is the kind of paperwork that can save your joey and certainly your sanity. You don't need much and you can set it up anyway you want to, but please keep these records as when something goes wrong (and it will at some point) you'll have the ability to find out what quite quickly.

Set yourself up an exercise book, or similar, per joey and keep the following records:

Weights

When your joey first comes to you take their weight every couple of days to ensure they are heading in the right direction – a week of weight loss for a small joey can mean death. Once things are stabilised then once a week is fine. This weight must be called through to the Macropod Coordinator. This weekly check lets us know how the joey is progressing – is it gaining weight? Is the weight gain fast enough or even too fast? The amount will vary, especially as your joey matures – when they move to a different formula, or when they start doing lots of exercise. It is simply a good check to make sure there is upward progress and that nothing is going wrong. See *Weighing Your Joey*, later in this Module.

Whilst keeping a weekly eye on weights, do not lose sight of the age of the joey either. A joey that is growing slowly may be ready to move outside prior to the time indicated by the joey's actual weight. Holding him back could cause frustration. A joey that is gaining weight quickly will become very distressed if we expect them to be ready to leave the pouch before they are psychologically ready to do so. It is important to look at both the age and the weight on the progress chart before taking the next steps.

Foot and Tail measurements

The foot measurement is the foot of the hind limb from the heel to the end of the toe, not including the toenail. The tail is measured on the bottom, from the base of the tail near the cloaca to the tip.

Don't forget to keep the joey in a liner when doing these measurements, to minimize stress.

Feed Times

Sometimes these may vary, if you are running late for some reason, and this can make a difference to what happens and may also be useful if Vet attention is required.

Milk amounts

Make a note of how much milk is consumed at every meal. This not only ensures you are feeding the correct amount per day but any loss of appetite can be immediately noticed and this is one of the three most important indicators of illness. (See *Oh My God He's Sick!*). We keep a simple box for each day; like this one and it is easily seen as we look down the pages of notes. This example is for an eastern grey joey on 4 feeds per day aiming to feed it 160mls a day:

40	40	35	40	155

Poo and Wee Types

Note down wee volume (roughly – small, med, loads) and colour and poo colour and rough quantities whenever you toilet joey and once they start to pellet outside. In this way you'll know when changes occur and also with loose poos how long it is going on for. If there's not much poo is constipation a problem? *Oh My God He's Sick!* discusses this in more detail but again this is an area, poo in particular, that is one of the first indicators of illness and if you don't know how long, or how much then there is more guess work involved in diagnosis.

Things that happen

Stress has been covered in a previous Module, and you should now understand that many things may stress your joey and it isn't always obvious at the time, so note down things that happen so that if the poos change over the next few days you can look back and know the possible cause. It might be a car

back firing in the street that causes your joey to jump, an accidental meeting with the dog, the introduction of a new macropod to the group, rain, absolutely anything that isn't strictly routine.

Eastern Greys

For the most part the way you raise eastern grey kangaroos is similar to the way you raise wallabies ie the way you feed and toilet, house etc. However wallabies move through the various growth stages fairly easily, making their own pace fairly well known, whereas eastern grey kangaroos are quite different and will remain in their pouches 24 hours a day until they are 30kg if allowed to, so I have added some additional notes here that may help you in the raising of eastern greys. Again none of the rough weights/ages are absolute, the individual joey must be taken into consideration – we have had an eastern grey that jumped out of her pouch herself from about 2kg and another who never once left his pouch unaided. Remember that the following advice is for healthy, stabilised joeys only. Even large joeys will benefit from a pouch when ill, and older joeys coming into the system will need several days of pouch confinement as they settle in. (See the relevant sections of *Oh My God He's Sick!* and *Stabilisation*.)

Some carers may argue that this regime is too soft, that in the wild the joeys may be out of their pouches for longer and earlier. Perhaps I have a particularly lazy mob of wild eastern grey kangaroos that reside on my property, but I have video of large joeys still leaping back into pouches when alarmed and this raises the main point. In the wild "Mum" is with them 24 hours a day. This is impractical for us and so the pouch plays a surrogate Mum role and is used for longer than may be the case in the wild. Those of us using this method seem to attract less disease and have joeys that do enter the wild more confidently. Time is needed for joeys to understand many aspects that they would learn more readily with a wild mum who would be spending her time listening for trouble, showing the joey the best hiding and feeding places etc. and taking off at the first sign of danger. Though we wish to mimic the wild as much as possible, we must also understand that unless we are prepared to live in the bush 24 hours a day, the process may take a little longer from the pouch perspective.

- Follow your progress tables carefully – an eastern grey of 3kg is a lot less confident and mature than a wallaby of 1.5kg
- Eastern greys are far less confident, much more stressy and far more prone to diseases – so be sure to read the module on stress and about diseases such as coccidiosis and the blood parasite.
- You need more time available to raise eastern greys. They often do not start to emerge until 2kg or more. (Some will come out earlier). Do not push them as damage can occur to those spindly legs if they are not yet ready to take the weight of the body.
- Once they do start to emerge, give them time outside of the pouch a few times a day, starting with just a few seconds and lengthening it out. Be with them and have their liner ready for them to hop back into.
- As they don't come out of their pouches as readily, always put a handful of cut grass on their tummies to ensure they have plenty to chew on. In the wild they would be chewing from Mum's pouch as she moves around the paddocks.
- By about 3kg they should be getting two good "out of pouch" times a day, around 30 minutes at least. We take ours for a walk. No not on a lead, they follow us. Always taking their liners for them to hop into if disturbed at all. You need to be with them whenever they are out until about the 4kg mark. Walks only take place on bush properties.

You need space for Eastern Greys. A 3.5kg eastern grey joey will run flat out for 100m in one direction without hesitation, so keeping them in a small pen or backyard will restrict their development considerably.

At 4kg you can start leaving them for short periods without you or their pouch. Stay close and listen for the bleats of alarm and if they continue, go back to the pen, reassure the joey and leave them again. Day by day the amount of time they can be left will increase until you can leave them out most of the morning, give them a rest in their pouch until late afternoon and then let them out for a few hours of grazing again until bedtime.

By 5kg they will hopefully be without their bags all day long. You will need to remove the bags to stop them getting back in. Be aware that you cannot have mixed size joeys going and expect the older joeys to stay out of pouches whilst younger ones are in them – the older joeys will simply hop in on top of the younger joeys – sometimes causing their death. So progress is usually determined by the youngest of the group.

By 7-8kg they should be out of their bags altogether. Some think it should be even younger, however I have certainly observed very large wild joeys still getting back into their Mum's pouches and I feel that our joeys are already compromised, and so a little extra TLC will do them no harm. As you start to finally remove their pouches you might pop them on the ground so they can stand near them or lie on them until they do wander away readily and then you know the pouches can be removed altogether.

Licking

Why is my joey licking at his forepaws? He is too hot. This is the normal way macropods cool themselves down. Just under the skin of the underside of the forepaws is a network of fine blood vessels. When it's hot the blood flow to this area increases and water (from water-secreting glands in the nose) is used to lick over the area of the blood vessels, thus providing a cooling effect. [58] Move your joey out of the sun if this is happening.

Merycism

Ever seen a kangaroo or wallaby that you thought was about to choke? They cough and contort and seem to be in trouble and then suddenly they stop, have a chew or swallow and everything is calm again. This coughing up of previously eaten material is known as merycism and is quite normal. There is some debate over whether the material brought up is always re-chewed – some say it is never re-chewed however we have observed kangaroos re-chewing food, so although no one is quite sure on this one, at least we know that this is a normal part of their behaviour and not something to worry about. (Though it's normal to be alarmed the first time you see it happen.)

Pademelons heave for a while and then may throw up a little green pile. This they devour with relish. Those who have reared them say they do this quite regularly.

Please be careful though as something genuinely caught in the throat can also seem a bit like merycism. Usually a joey doesn't do this coughing up routine very often, so if you're hearing something similar over a few times in reasonably quick succession make sure the animal doesn't have something stuck and isn't choking. Buster seemed to have something caught on one occasion and went through a coughing fit every couple of minutes. We ended up giving him a solution that eased the coughing and cleared the blockage. In another case, an eastern grey had been released and went missing for a few days. He was found in the middle of a lantana thicket and when given milk was

struggling to get it down. He dribbled milk out and almost seemed to be foaming at the mouth. A Vet had to put him under anaesthetic to remove a blockage from his throat that would probably have killed him.

Native Habitat

This section is not so much care of your current joey perhaps, but care for its future. In reality what we do by raising and releasing a small number of macropods each year does nothing for macropods long term. (Though we are sure the particular joey prefers it to the alternative…) They are not an endangered species and so our contributions would not be missed in even our dwindling local populations. What is really needed is a concerted effort to save their habitat. Our local area is under great pressure by developers and we must try to ensure that large areas are retained that enable these beautiful creatures to survive. We also need corridors between the areas to ensure catastrophic events in one "patch" don't see that area devoid of macropods forever.

Natural behaviour

This is a topic we are only just beginning to scratch the surface of it may take us many more years to truly understand what is and isn't appropriate behaviour and how to encourage the correct behaviour.

In most cases, a hand-raised joey will not behave the same way as a wild joey and the extent of the differences between them can be the difference between life and death. The easiest way for a carer to understand the differences is when we are able to observe an older wild joey versus a hand-raised joey. In one case we had a female swamp wallaby that had been hand raised from just over 300g. Her buddy came in at 1100g – furred and worldly wise. When both were taken out to a new pen, the female leapt out of her pouch in a fairly eager, unobservant way, whereas the joey who came in at the older age was very cautious to come out and checked every sound out before emerging with great caution and staying close to the pouch, widening his circle as he understood the territory and its possible dangers.

In another case a swampy was raised from pinkie stage to just over 1kg in a suburban situation. Traffic noise and even planes overhead didn't seem to worry him at all, but when he went out to release he was terrified of the normal night noises of the bush. We soft release eastern grey joeys on our property and the slightest noise will send them into flight into the safety of the bush. Our instinct is to call out and stop their flight and to reassure them that all is well, however they need those high strung instincts to survive a predator attack, so even when the noise that sends them fleeing is not a threat we don't try to dissuade them from their instincts to head for the bush and safety.

In the wild an unfurred joey knows only a dark pouch and its mother by sound and smell only. As it starts to emerge it starts to recognise its mother by sight, and to ensure this period goes smoothly, even an eastern grey mother, (usually more social), will segregate itself from the mob. This may help to explain why strangers looking and touching can cause great stress and why joeys do best that are managed as closely as we can to what they might experience in the wild.
It is also important to remember that macropods move around most from mid afternoon until early morning. This is also what your joey should be doing.

We all must try to observe nature as it happens in reality and to try to provide as close as possible an upbringing for our joeys and to ensure we don't desensitise them to any possible dangers, including that of humans, who sadly may present the greatest danger of all.

Number of Carers

Macropod joeys are one Mum animals. In the wild this one Mum is all they know and will be the only animal they have any real kind of physical contact with until they are sparing males or breeding females. The stress of changing carers is high. If there were enough release sites with carers able to take the joey right through from orphaning to release, then ideally this is where all joeys should go. Sadly it isn't an ideal world and there are simply not enough carers of this type, so once a joey is stabilized, it often has to go to a Mum who will only take it through until it is ready for a release site. With this in mind it is extremely important that when you take on a macropod joey, that you realize the commitment you are making and make the commitment for the time the mac should be with you. Macs don't baby sit well – the increased stress reduces immunity and makes them vulnerable to illness. One joey we baby sat, who had been stabilized with us only a few weeks before, became a rampant testicle sucker and even sucked at his cloaca when with us. Some seem to role easily through it, but many others will not and it is not worth the risk. This means you cannot travel away from home from the time you receive your joey, until they move to release.

Picking up a joey

Joeys can be easily damaged – especially the rib area and so should never be picked up by the top half or by grabbing hold of a leg. Always make sure the heavy bottom end is well supported.

The best way to pick them up is to offer them a liner or pouch to jump into and scoop them up in that. This isn't stressful to them at all.

Older animals in the wild can be picked up by the base of the tail – as close to the body as you can to ensure you don't damage the joey's tail. Ensure the forepaws do not come close to you as they are extremely sharp and can do a lot of damage. Pop them into a bag as soon as possible. Never carry a joey by the tail base over distance.

Q Fever

Is an infectious disease that **you** can catch from macropods – it doesn't affect the joey itself; the joey is simply the carrier, (as cats are the carrier with toxoplasmosis). It is caused by a microbe, *coxiella burnetii*. This microbe can survive for years in dust or soil. Other animals, as well as macropods, carry Q Fever, including cattle, sheep and goats. In NSW it is a "notifiable disease". In other words, if you contract it your Doctor will notify the health authorities. Professional workers in areas such as the meat industry and veterinary practices are inoculated against Q Fever.

People usually catch Q Fever by breathing in the microbes that are deposited in faeces, urine and other bodily fluids. The microbes become airborne with dust from the animals themselves, from pens, bedding and from the clothes of other carers. This makes the job of sweeping out macropod areas particularly hazardous if you are not inoculated and reinforces the need for strict hygiene.

Symptoms may include:

 Fever

 Chills

 Headache

 Muscle pain

 Loss of appetite

- Dry cough
- Jaundice – yellowing of the skin and darkening of urine

You may simply think you have the flu. You may remain ill for several weeks. In severe cases heart and liver damage can result. You will need blood tests to confirm Q fever and there are antibiotic treatments.

Vaccination:
A vaccination is available that prevents Q Fever that you can have – talk to your GP.
Further information is available on the Internet and via the Government Departments that cover Health and Agriculture.

Skin Care

With the Divetalact regime we are now using for unfurred joeys, we are finding that the use of creams is minimal. We might use some on the heel area occasionally, as the joey develops, however they no longer need the daily creaming of old. This is a great improvement both for the joey and carer, both of whom could find this addition of creams quite stressful. When creams are needed, the following information may be valuable:

There are a variety of creams that can be used, but don't use oils as they can clog the skin and even creams must be used sparingly as they too can clog the skin when they build up. A couple of popular creams include:

- Paw Paw Ointment – a favourite with many, as it is a natural product as opposed to the petroleum-based alternatives
- Ungvita – nice to use as melts down to oil when a small bowl is placed over hot water
- Sorbolene (plain, no fragrances)

If you feel the cream you are using is building up and clogging pores, use a warm damp cloth to remove it before any further applications.

Make sure your joey is kept in a humid environment that is not too hot. Over heating can cause cracked and damaged skin and in severe cases may result in constriction bands around the tail, finger joints and toe joints. These constriction bands can cause the restriction of blood flow and deformity.

Be on the look out for bites and injuries that could develop into something more serious if not treated.

Stimulation

A joey in the wild is with its Mum 24 hours a day. Mum may not spend the same amount of time "fussing" with a joey that a human mum does, but nevertheless she is there – warm and alive next to the joey. For a good deal of the day she is also moving. Once a joey is old enough to pop its head from the pouch there's always something to look at, and as mum bends down, something to nuzzle at, and once it's grazing, it will graze from within the pouch as mum feeds as well as when it is out of the pouch. It is impossible for us to replicate the life a wild joey leads, but there are things that can help:

- Having a buddy – this, along with reducing the trauma of moving to a release site, is one of the most important reasons to buddy. The two joeys keep each other company.

- Dirt bowls, food on hand. Never leave a joey for long periods without something to nuzzle into and chew on. Even from quite small they are looking for things to suck on even if they don't eat them
- Exercise. Once they are at an appropriate age (See the Progression Tables in the Appendix), they should be gaining more and more time out of the pouch to develop and stretch. This helps fill their time, increases their appetite and helps them sleep well

Teeth Grinding

Joeys can grind their teeth for any number of reasons and the important thing is to get to know your joey and whether this is a regular habit, or a one off occurrence that might be a sign of pain or other difficulty. A joey may grind its teeth when:

- It is in pain
- It is hungry
- It has a gastrointestinal problem
- It is stressed
- It is teething

Ticks

Ticks are a normal part of a joey's life. In the wild they would be getting ticks from a very young age as they crawl up Mum and into the pouch. One of the theories for the loss of joeys to diseases such as the blood parasite (see *Oh My God He's Sick!*) is that joeys being raised in suburbia don't see ticks at an early age and therefore do not build up an immunity to the diseases they carry. When they are then introduced to a natural environment containing ticks they then fall prey to their diseases. This is also true of flat flies and mosquitoes.

One way to overcome this problem, if you are in suburbia, is to gather vegetation from wilder areas for your joeys. Hopefully in this way you'll bring a few "nasties" home for them. Please note: "Ticks are…common in ground and shrub layers…contrary to popular belief ticks do not fall out of trees." [59]

If your joey does get a tick, don't panic. A healthy joey with a healthy immune system should not have a problem. Keep your eye on the joey and what happens. With many diseases it is the tiny ticks that carry the diseases and so these should certainly be left on. Removing ticks can be stressful, may mean your joey doesn't develop any immunity, and can be dangerous if the ticks are close to the eye.

If there is any major infestation (which would usually suggest an unhealthy joey that isn't grooming and that is lying around too much), or any tick that you feel may be a problem, talk to the Macropod Coordinator immediately. An infestation can cause anaemia.
Get to know the two types of ticks we see in our area (I'm told the cattle tick has been eliminated here and if you do see it you need to call the Department of Agriculture at once. The cattle tick has cream legs and the first pair of legs are not close to the nose). What you should see are:

- Bush ticks – the legs are dark red-brown and the first pair are close to the nose with 3 more pairs spreading out around the first 3rd of the tick body
- Paralysis tick – all the legs are close to the nose, the first and last pair are brown, and the 2nd and 3rd pair are pale.

The Department of Agriculture has a handy card that illustrates all three ticks.

Tintibulation

This is a normal part of behaviour and is usually seen when macropods greet each other – especially for the first few times. It is a quivering, sometimes only of the head, but at other times of the whole body.

Washing pouches etc.

We would make the following recommendations:

- Joeys are like people and can have allergies, so although there are no recommended washing powders, keep your eye on your joey and make a change if you think there could be a problem.
- Rinse everything thoroughly. Especially if you use any strong bleaching type substances like nappy soakers
- Hang everything out in the sun rather than using dryers – the sun is one of the best cleansers around
- Wash your joey's things separately from your own
- If you have an animal in care with an illness make sure you wash their things totally separately. There are cases where diseases have been passed between joeys by washing things in the same water and even between different species.

Weighing Your Joey

When your joey first comes in we recommend you weigh them every couple of days for the first week, to ensure things are moving in the right direction, and from then on once per week. These weights must be called through to your macropod coordinator.
Here are some tips for weighing your joey:

- We recommend digital scales – these will give you the highest degree of accuracy and a few grams can make a difference to a small joey
- Find yourself a basket that fits on top of the scales and that will hold your joey comfortably. Most digital scales allow you to zero the scale with things on top of it.
- Weigh the joey in its pouch, or at least in a liner – a small joey that hasn't emerged will be over stressed by being removed from its liner for the time it takes to weigh.
- When the joey is transferred to a new pouch/liner – weigh the pouch/liner you weighed him/her in and subtract that from the total weight to gain the weight of the joey. The liner weight can be marked on the liner using a laundry marker.
- Try to weigh the joey at the same time of day, on the same day each week so that your results are consistent

Zoonotic Disease:

This is a term used to describe diseases that can be passed from animals to humans. Q Fever, discussed elsewhere in this module, is such a disease. There are others that it is thought can be transmitted from macropods to humans including salmonella and ringworms. You should be aware of this and take the obvious precautions:

- Consider a Q fever vaccination
- Wash your hands in hot, soapy water, after every contact with a joey
- Avoid breathing in dust from faeces or urine
- Keep small children away from joeys. They may be more susceptible to some diseases.

Saying Goodbye

A wild female eastern grey kangaroo

Module objectives

By the end of this module, you will be able to:

- Understand the various release methods
- Understand the steps to release
- Conduct a smooth transfer to a release site
- Determine if your property may be a possible release site.

This is a basic care course and so we will not go through all the elements of release that are needed to be understood by people who are actually conducting releases, however we would like you to understand the basics so that you can consider, if you live on property, whether your property may be a possible release site, and we would also like you to understand why joeys are moved out when they are and what you can do to make the movement to the release site less stressful for your joey.

What makes a good release site?

- Macropods must live there. You may have only one type or several, but it must be confirmed that they live on and around your property and which types they are.
- As you have seen, from *The Locals*, macropods roam over a large area. There must be this size area, at least, available to them and preferably more to enable males to move into their own areas. This may include your property and surrounding properties.
- There should not be any imminent danger of habitat destruction in this area
- Unless your property is so large that release and subsequent life can take place totally within your boundaries, then neighbouring properties must be taken into consideration. Is there agricultural work nearby that could see the owners wishing to cull macropods? (They may have a licence to shoot already). Do they use chemicals that could cause poisoning? Do they grow plants that could poison? Are there trail bike riders belting through the bush on weekends or in school holidays?
- Is the habitat close to your home? The further away the more difficult soft release and the harder for pen release as you will have to build the pens within the habitat area. Would building pens lock local wild macropods out of their usual feeding and resting areas?
- Do possible pen areas contain appropriate food sources as well as resting areas?
- Do you have dogs roaming free on your property?
- Do you have cats roaming free on your property?
- Do you have horses or other livestock? Tetanus is a consideration with livestock, as is the possibly of joeys being kicked.


Is the property fenced? Is it macropod friendly fencing? (Not barbed wire and with bottom wire removed). Macropods need to be able to disperse into the natural environment, not be trapped on your property.


Is permanent water available?


How close is the main road?


How close are other dwellings? Do they have fences, dogs etc.


How much time can you give to macropod release. Soft release requires a lot of time, pen release not as much.

There are three main methods for macropod release across NSW. Different groups use different terms so these are simply my definitions.

Hard release

In this system animals are raised to an appropriate hard release age (usually much older than soft and pen release) and are then transported in groups to a suitable release area and are released and left in the bush. Where possible hard release sites are where someone can keep an eye on the released animals to see if they are surviving, but this is not always possible. I don't favour this type of release, if it can be avoided.

Soft release

This is a time consuming method however it allows the joey to really understand its new environment before it is totally released and allows the joey to move back to the wild at its own pace. Joeys are like people, some are slower than others.

Joeys arriving at the release site are kept in an enclosure for what may be only a few days and would be no more than a month to bond with the new carer and then, if they are old enough, they are given supervised day freedom. This starts with walks with the new carer, and more and more time out of the pen, at first with the carer constantly there to ensure a stress free transition and then without the carer as the joey gains confidence in the new surrounds. Obviously joeys still vulnerable to eagle attacks would not be left unsupervised outside a protected environment.

At an appropriate weight and age – roughly around 12 months old the joeys are given 24-hour freedom. If they have come to the release site at the right age they will usually stay in the area and be fed regularly until they are fully weaned and fully confident to head off on their own.

For soft release eastern grey joeys are moved to the site by 3kg and wallabies by 2.5kg. They will obviously still be in their pouches and taking bottles. At this age they generally find the changeover in environment and carers less stressful and so are less prone to disease. Some ages are critical for diseases, as you will have seen if you read the section on coccidiosis. When joeys are too old, not only are they prone to disease but also to frustration that can cause them to become aggressive (especially wallabies). Often the day the gate is first opened they will bolt for freedom and never be seen again – usually not the best thing for the joey.

Another key to soft release is to have native vegetation quite close to the home/release pen. If the bush is too far away then the joeys are far less likely to return regularly as their instincts will keep them in the wild areas.

Pen Releases

Pen release occurs where joeys go initially to a nursery yard where they will be weaned from milk and their pouches and are then transitioned to the major release yard of at least ¾ acre (preferably larger) in size to ensure adequate heart and leg muscle development from exercise prior to final release. They stay in this larger yard for several months becoming totally dehumanised and learning to fend for themselves food wise within a reasonably protected environment. With total freedom given by 18 months of age.

Pen releases work best for groups of wallabies. Individual animals can stress badly, and penning eastern greys increases the risk of coccidiosis. Wallabies come to the nursery pen by 3.5kg. As joeys need to become very quickly independent of humans in this method we transfer them in groups to pen release sites, never as lone animals.

What you can do to help

- First and foremost follow your groups macropod care policies and make sure your joey is raised as closely as you can to the way it would be raised in the wild. Policies are aimed at getting healthy joeys, that can still recognise predators, and their natural foods, to the release site and back out into the wild. The release site is where non-compliance will show through ie the joey who thinks dogs are its mate, the joey who thinks the couch is the bed, the joey whose compromised immune system leaves it open to disease and so on.
- Make sure you move your joey to the release site at the appropriate weight. This is important and keeping your joey too long can leave it vulnerable to diseases as well as additional stress and the possibility that the joey will simply bolt from the release site.
- Go and see the release site and understand what the release site carer needs of you ie number of feeds etc. An important point here is whether the joey needs to be used to being outside 24 hours a day by the time they move to the release site. It wouldn't be good for a joey that always sleeps in a pouch near the fire watching the TV to suddenly find themselves outside in the wild overnight.
- If the fencing is different at the release site ensure you orient your joeys to the new style. This is particularly important when your pen is fully enclosed with a sight barrier and the joey is moving to an open fenced pen. Joeys that don't understand wire fencing can harm themselves as they run into it – thinking they can go right through it, as they would thick grass. Simply having a small amount of fencing in their pen with them before they move will enable them to check it out and understand it.
- Take the joey to the release site on your own. There may be other joeys already there and you and your joey will cause them some stress and they certainly don't need extra people, children and dogs to add to this. A number of release sites are dog and cat free zones.
- Make sure you have plenty of time to be with your joey at the release site. It is good to arrange to spend several hours, even most of the day, helping your joey to settle in and to get to know the new carer. You need to try to be hands off, as the new carer becomes hands on, but to be there so the joey knows this new carer is OK eg be there when the new carer gives it a bottle. The time you spend now will ensure your joey settles into their new home with far less stress.
- Possibly call in for the first couple of days to help with the settling in but then take yourself out of their lives as your occasional reappearance may cause distress.

- Take the joeys teat, pouches and anything else that they are used to having around constantly. All the familiar things will help the joey settle in and the release site will return them to you once the release is complete.
- Take a supply of milk with you. The release process can be a long and expensive one, eg taking a wallaby from 220g to 2.5kg costs around $130. To take them from 2.5kg to release costs another $165 in food, plus the ongoing costs of keeping the facilities in good repair, (let alone its initial cost). Everything you can do to help the release site is much appreciated.
- Make sure the release site knows your joey's history – anything and everything that will help the new carer pick up and maintain the routine your joey is used to. Take your detailed notes with you to refer to. Here's a checklist:
  - Call number
  - Date into care
  - Weight when first arrived
  - Reason for coming into care and original location
  - Number of foster carers, names and dates of transfers
  - Current weight - though the release site will re-weigh the joey as scales vary
  - Number of feeds per day, quantities, bottle or lapping
  - Type of supplementary feed they are used to – including lushness of grass. Animals moved from fairly dry grass to lush pasture are susceptible to enterotoxaemia
  - Toileting habits and poo quality
  - Previous illnesses or injury
  - Recent upsets
  - Housing ie indoors/outdoors. It's a big shock to a joey if left outside 24 hours a day when they are used to being inside overnight.
  - Current exercise regime
  - Anything else you can think of!

The Week Before

- Add 1/8th teaspoon of Protexin and ¼ teaspoon of Impact to each of their bottles. This will help boost their immune system and should act as a buffer against the stress of moving. The release site will continue this process for some days after they arrive, to again assist the transition process.

Settling into the new environment

Losing yet another "Mum" and moving into a strange location is a very stressful thing for a joey. Here are a few things the release site carer can do to help the joey settle in:

- When they first arrive spend time with them, with their old "mum". He or she should be hands-off, just talking quietly, and you should start being hands on. Feeding any bottles and offering some nibbles by hand. Several hours will really help the joey to settle quickly.

Put lots of fresh nibbles at the pouch entrance so the joey can simply lean out to eat as it starts to take in the sights and sounds of its new environment. Wallabies love the tippy bits from native trees, the occasional callistemon or grevillea. Eastern greys will enjoy fresh picked grass.

Sit near and talk to them quietly so they start to know your voice

Make sure their environment is at least as good as, if not better than, their previous habitat eg **NEVER** move a joey into an area that is smaller than they are used to – they can end up with stress induced myopathy if they don't have the room to move in they are used to and may also try to jump the fence looking for more room to move. Similarly make sure the ground cover is similar ie don't move joeys that are used to lush growth and good overhead cover into a bare paddock. Don't lock joeys up inside if they are used to being out in a pen at night

Add Impact and Protexin to their bottles for up to a week to help their immune system cope with the stress of the change.

Weaning

When do you wean?

Weaning occurs at the release site and varies depending on the species of macropod, the release style and the individual joey. We tend to wean hand-raised joeys earlier than they would be weaned in the wild. This is mainly to ensure they can become properly independent before they are finally released, and before they become sexually mature. Eg eastern greys don't totally wean in the wild until they are 18 months old. In practice this can make them 15-20kgs in weight and for the males they are starting to heavily spar, which can be dangerous for the carer, and therefore dangerous for the joey. Some joeys are ready much earlier than others and some will wean themselves, not arriving at bottle time and letting you know they are ready to move on. Weaning generally happens around 12 – 14 months, pademelons perhaps a bit earlier. Treat each joey as an individual, don't hold them back when they are telling you they are ready to move on, but don't wean if the joey is not emotionally and physically able to cope with it. Again eastern greys can be the most difficult to judge, as some will happily take a bottle forever!

Weaning is a difficult time for both joey and carer, as you finally remove the milk food altogether. There are several weaning methods in use by carers around Australia. The following is the one we have used and found to be gentle and, so far, without incident.

We add a buffer to the joey's immunity by adding both Impact, (about ¼ teasp per bottle), and Protexin, (about 1/8th teasp per bottle), for a few days before commencing weaning and right through the weaning process.

As we do not need to hard release our joeys, we keep them on two bottles until the weaning age and then the weaning process takes place over several weeks. As most macropods do most of their feeding from late afternoon through to early morning, the evening bottle is the first to go. (This encourages more night feeding).

Simply reduce the amount given by 10mls every two days, down to 40mls, and then you offer water, (cooled, boiled), so that the joey makes up its own mind that it no longer wants a bottle. Eg if you have a joey on 100mls and you start on Sunday, the amounts would be:

Sunday 90mls

Monday	90mls
Tuesday	80mls
Wednesday	80mls
Thursday	70mls
Friday	70mls
Saturday	60mls
Sunday	60mls
Monday	50mls
Tuesday	50mls
Wednesday	40mls
Thursday	40mls
Friday	Water
Saturday	Water

You can use smaller increments when you are dealing with smaller species on lower amounts. Depending on your situation, ie whether the animals are still penned, availability of natural feed in the pen and surrounds, you would also increase the amount of supplementary food offered, as the milk decreases. We offer the supplementary food before the bottle and then they don't seem to miss the milk as much.

We then leave things as they are ie supplementary foods and a full morning bottle for a week to observe how the joeys are handling the change. If you feel there is a problem, or illness occurs, seek assistance from your Macropod Coordinator. Then when you are sure they are settled, follow this same process for the morning bottle. Again offering water to finish. A couple of days of water are usually sufficient and then you can stop altogether. In some cases the water is unnecessary. Some wallabies make up their own minds about weaning and will stop coming regularly for their bottle as you start to reduce the quantities. When this happens you may simply stop offering a bottle.

It is sad when they look up at you with those big brown eyes, wanting that bottle, however you must be strong for them – keeping them too long is detrimental to their health and the development of the natural instincts they need to survive.

Is the joey ready for release?

- Is the joey fit and healthy with no sign of illness or injury?
- Is the joey acclimatized to outside weather?
- Can the joey recognise its natural diet?
- Is the joey at an appropriate age and weight?
- Is the joey mentally able to cope?
- Is the joey afraid of predators, including humans? (If they are friends with the family dog, or will go up to strangers, the answer to this one is a resounding NO.)
- Is it an appropriate time of year? (Going into winter is a time of scarcity so not a good time for releases unless done softly).
- Are the weather conditions appropriate? (No major drought, on-going storms and wet weather, which might add to the stress of release)

If you can answer YES to all of these questions, the joey is ready to go. Answer NO to any – rethink the timing and what is needed to reach 100% YES!

What is an appropriate age for release?

This is a subject that many carers disagree on and so you'll find a wide spread of weights used to determine release size eg with eastern greys some advocate that they should be penned until at least 15kg, whereas in a soft release situation they are more likely to be free 24 hours a day, (though not weaned), from anywhere around 5kg. The concern in keeping eastern greys penned so long is their vulnerability to diseases such as coccidiosis. The concern in having them free earlier is whether they are more vulnerable to predators and, for young females, early sexual advances. The final answer is a complex mix of the individual joey, the carer's availability, the proximity of pens to habitation, the size of the pen and so on. We personally soft release eastern greys, taking them for walks outside their pen from a very early age, allowing them day freedom almost immediately because we are home most of the time, are within sight and sound of the joeys and have no dogs or children to interfere with them. Most of the eastern grey carers I know would have their eastern grey joeys 24 hours free by about 8kg and probably totally weaned by 10-12kg.

Wallabies are mush faster developers. In my situation I may have wallabies free during the day from around 3kg, depending on the joey, and 24 hours free by 5kg, though still on a bottle for a while. Again most soft release sites would have their wallaby joeys 24 hours free by 5-6kg. Pen release occurs around 7kg and even hard release around 8kg. The oldest I have read about are wallaby joeys of 24 months and 13kg in size. However I believe this to be far too old, with these joeys possibly reaching sexual maturity before release, and unless they are in a huge pen of at least several acres, they would probably be extraordinarily frustrated by the confinement.

An excellent carer I know talks about "them letting you know" and when you have released for a while you know this to be true. Some joeys need more time and security and others are raring to go and may suffer from being held back. Go through the checklist and be honest with yourself. Your first joeys you will probably hold back, for fear something will happen to them, ask yourself if you are holding them back for them or for you? There are dangers in being free, but not being given the ability to grow and learn their environment properly is a greater danger. A very humanised joey that is used to artificial foods and warm cosy pouches, that suddenly finds itself in the wild has less chance of survival than a young joey that has had the opportunity to build their strength and knowledge early.

When is the joey officially released?

This can vary, depending on the organisation, however a good rule of thumb may be:
Hard release – when joey is left at the release site
Pen Release – once the pen is left open, even though supplementary feed may continue for a short time afterwards
Soft release – once the joey is not only 24 hours free, but also fully weaned, though supplementary feed may continue for a short time afterwards.

Resting Pens

There is sometimes discussion about the need/or otherwise to rest pens. There is no doubt that the vegetation is benefited from a period of rest from animals grazing on it, however there we have found no concrete evidence to date, that resting a pen reduces disease. Coccidiosis for example, seems to

survive most things ie liming the pen will not kill it and may cause skin irritation for future resident joeys.

ALWAYS pick up poo from your pens. Poo build up is associated with an increased risk of disease.

If you can rest your pen for periods to enable the vegetation to build up, that's great. If not perhaps you could section off an area every now and again to restore the vegetation section by section.

Appendix

Wilkie the Red-necked Wallaby

Eastern Grey Kangaroo Progression Chart

Weight Range	Approx. Age	Joey's appearance	Expected Behaviour	Housing	Food	Weight gain	Faeces	Other Requirements
13g to 550g	20 days to 4 mths	Eyes closed, ears down. Furless pink skin,	May still be attached to teat. Moving but, unable to stand.		Requires feeds every 2-3 hours around the clock. Divetalact regime.			Viability to be determined by Coordinator
550g to 950g	4 to 5 mths	Eyes will open, ears up. Furless.	Detached from teat. Active in pouch at times but needs plenty of sleep.	In a hospital box. 31- 32° C required. Do not over heat. Use a thermometer.	Divetalact regime, 0.4 Wombaroo or Biolac 100g.4 hourly (6 feeds/day)	Av 13g per day	Thick yellow custard.	Cream may be required – see manual for details
950g to 1380g	5 to 6 mths	Colour deepening and very fine hair appearing.	Active in pouch but still sleeping a considerable amount.	In a hospital box. 30-31° C. Do not over heat. Daily exposure to around 15 minutes of filtered sunlight early morning or late afternoon within the pouch	Divetalact regime, 0.4 then transition to 0.6 Wombaroo or Biolac M100g. 4 hourly (6 feeds/day)	Av 13g per day	Mustard custard	Cream may be required – see manual for details
1380g to 1700g	6 to 7 mths	Very fine covering of fur.	Very active in pouch, can stand in pouch. Starting to groom. Sticking head out of pouch.	Joey still housed inside. 28-29°C required. Starting to maintain own temperature. Do not over heat. Daily filtered sunlight, keep warm while outside	0.6 Wombaroo or Biolac M150 5 hourly (5 feeds/day) Establish gut flora with dirt and roots in pouch	Av. 16g per day	Mustard toothpaste.	Cream may be required – see manual for details
1700g to 2240g	7 to 8 mths	Short to long sleek fur.	May get out of pouch, very awkward. Will hang head out of pouch to graze.	Will self regulate own body temp. Do not over heat Outside most of day – access to grassy area Still inside at night, give an extra middle for warmth if needed.	Transition 0.6 to 0.7 Wombaroo. Biolac M150 to M200. 6 hourly (4 feeds/day) Supplementary feed can be introduced. Water available for lapping	Av. 18g per day	Olive green toothpaste forming soft pellets. Clean up all faeces from grazing area.	Skin care as required.
2240g to 3340g	8 to 9 mths	Long sleek fur, becoming dense and waterproof. Toughened pads on feet.	Becoming confident out of pouch, well coordinated. Grazing during the day – starting to graze at night.	Able to house joey outside day and night in a protected area with shed for night. Give an extra middle for warmth if needed at night.	0.7 Wombaroo. Biolac M200 6 hourly (4 feeds/day) Plenty of native browse available from now on.	Av. 36g per day	Soft to firm dark green pellets. Self-toileting starts once pelleting. Clean up all faeces at least twice a day.	
3340g to 5kg	9 to 10 mths	Long sleek fur, becoming dense and waterproof.	Grazing during the day – starting to graze at night.	Able to house joey outside day and night in a protected area with shelter for night	0.7 Wombaroo. Biolac M200 8 hourly (3 feeds/day) Native browse.	Av. 57g per day	Soft to firm dark green pellets. Clean up all faeces at least twice a day.	
5kg to 10kg	10 to 13 mths	Fur dense and waterproof, pads tough.	Grazes day and night Sleeps during the day under natural shelter	Able to house joey outside day and night. Pouch night only from approx. 5kg. Pouches removed by 8kg	0.7 Wombaroo Biolac M200 12 hourly (2 feeds per day until weaned).	Av. 60g per day	Firm pellets Clean up all faeces at least twice a day.	Wean at approx. 12-14 months. Soft release preferred

Red-necked Wallaby Progression Chart

Weight Range	Approx. Age	Joey's appearance	Expected Behaviour	Housing	Food	Weight gain	Faeces	Other Requirements
8g to 210g	10 days to 4 mths	Eyes closed, ears down. Furless pink skin,	May still be attached to teat. Wriggles, unable to stand.		Requires feeds every 2-3 hours around the clock. Divetalact regime.			Viability to be determined by Coordinator
210g to 360g	4 to 4.5 mths	Eyes will open, ears up. Furless.	Detached from teat. Active in pouch at times but needs plenty of sleep.	In a hospital box. 31- 32° C required. Do not over heat. Use a thermometer.	Divetalact regime, 0.4 Wombaroo or Biolac M100g. 4 hourly (6 feeds/day)	Av 10g per day	Thick yellow custard.	Cream may be required – see manual for details
360g to 730g	4.5 to 5.5 mths	Colour deepening and very fine hair appearing.	Active in pouch but still sleeping a considerable amount.	In a hospital box. 30-31° C. Do not over heat. Daily exposure to around 15 minutes of filtered sunlight early morning or late afternoon within the pouch	Divetalact regime, 0.4 then transition to 0.6 Wombaroo or Biolac M100g. 4 hourly (6 feeds/day)	Av 10g per day	Mustard custard	Cream may be required – see manual for details
730g to 1080g	5.5 to 6.5 mths	Very fine covering of fur.	Very active in pouch, can stand in pouch. Starting to groom. Sticking head out of pouch.	Joey still housed inside. 28-29°C required. Starting to maintain own temperature. Do not over heat. Daily filtered sunlight, keep warm.	0.6 Wombaroo or Biolac M150. 5 hourly (5 feeds/day). Establish gut flora with dirt and roots in pouch	Av. 11g per day	Mustard toothpaste.	Cream may be required – see manual for details
1080g to 1330g	6.5 to 7.3 mths	Short to long sleek fur.	May get out of pouch, very awkward. Will hang head out of pouch to graze.	Will self regulate own body temp. Outside most of day – access to grass and shrubs. Still inside at night, give an extra middle for warmth if needed.	Transition 0.6 to 0.7 Wombaroo. Biolac M150 to M200. 6 hourly (4 feeds/day). Supplementary feed can be introduced. Water available for lapping	Av. 12g per day	Olive green toothpaste forming soft pellets. Clean up all faeces from grazing area.	Skin care as required.
1330g to 1790g	7.3 to 8 mths	Long sleek fur, becoming dense and waterproof. Toughened pads on feet.	Becoming confident out of pouch, well coordinated. Grazing during the day – starting to graze at night.	Able to house joey outside day and night in a protected area with shed for night. Give an extra middle for warmth if needed at night.	0.7 Wombaroo or Biolac M200. 6 hourly (4 feeds/day). Plenty of native browse available from now on	Av. 23g per day	Soft to firm dark green pellets. Start self-toileting once pelleting. Clean up all faeces at least twice a day if penned.	
1790g to 2540g	8 to 9 mths	Long sleek fur, becoming dense and waterproof.	Grazing during the day – starting to graze at night.	Able to house joey outside day and night in a protected area with shelter for night	0.7 Wombaroo, Biolac M200. 8 hourly (3 feeds/day) Native browse.	Av. 25g per day	Soft to firm dark green pellets. Clean up all faeces at least twice a day if penned.	
2540g to 5kg	9 to 12 mths	Fur dense and waterproof, pads tough.	Grazes day and night Sleeps during the day under natural shelter	Able to house joey outside day and night	0.7 Wombaroo Biolac M200 12 hourly (2 feeds/ day) until weaned.	Av. 30g per day	Firm pellets Clean up all faeces at least twice a day if penned.	Wean from 12 mths Release from 5kg depending on style

Swamp Wallaby Progression Chart

Weight Range	Approx. Age	Joey's appearance	Expected Behaviour	Housing	Food	Weight gain	Faeces	Other Requirements
8g to 210g	10 days to 4 mths	Eyes closed, ears down. Furless pink skin,	May still be attached to teat. Wriggles, unable to stand.		Requires feeds every 2-3 hours around the clock. Divetalact regime.			Viability to be determined by Coordinator
210g to 400g	4 to 4.6 mths	Eyes will open, ears up. Furless.	Detached from teat. Active in pouch at times but needs plenty of sleep.	In a hospital box. 31- 32° C required. Do not over heat. Use a thermometer.	Divetalact regime, 0.4 Wombaroo or Biolac M100g. 4 hourly (6 feeds/day)	Av 9g per day	Thick yellow custard.	Cream may be required – see manual for details
400g to 670g	4.6 to 5.6 mths	Colour deepening and very fine hair appearing.	Active in pouch but still sleeping a considerable amount.	In a hospital box. 30-31° C. Do not over heat. Daily exposure to around 15 minutes of filtered sunlight early morning or late afternoon within the pouch	Divetalact regime, 0.4 then transition to 0.6 Wombaroo or Biolac M100g. 4 hourly (6 feeds/day)	Av 9g a day	Mustard custard	Cream may be required – see manual for details
670g to 1110g	5.6 to 6.6 mths	Very fine covering of fur.	Very active in pouch, can stand in pouch. Starting to groom. Sticking head out of pouch.	Joey still housed inside. 28-29°C required. Starting to maintain own temperature. Do not over heat. Daily filtered sunlight, keep warm while outside.	0.6 Wombaroo or Biolac M150. 5 hourly (5 feeds/day) Establish gut flora with dirt and roots in pouch	Av. 14g per day	Mustard toothpaste.	Cream may be required – see manual for details
1110g to 1470g	6.6 to 7.3 mths	Short to long sleek fur.	May get out of pouch, very awkward. Will hang head out of pouch to graze.	Will self regulate own body temp. Outside most of day – access to lots of shrubs and tall grasses for security. Still inside at night, give an extra middle for warmth if needed.	Transition 0.6 to 0.7 Wombaroo. Biolac M150 to M200. 6 hourly (4 feeds/day). Supplementary feed can be introduced. Water available for lapping	Av. 18g per day	Olive green toothpaste forming soft pellets. Clean up all faeces from grazing area.	Skin care as required.
1470g to 1890g	7.3 to 8 mths	Long sleek fur, becoming dense and waterproof. Toughened pads on feet.	Becoming confident out of pouch, well coordinated. Grazing during the day – starting to graze at night.	Able to house joey outside day and night in a protected area with shed for night. Give an extra middle for warmth if needed at night.	0.7 Wombaroo. Biolac M200. 6 hourly (4 feeds/day). Plenty of native browse available from now on	Av. 21g per day	Soft to firm dark green pellets. Start self-toileting once pelleting. Clean up all faeces at least twice a day if penned.	
1890g to 2560g	8 to 9 mths	Long sleek fur, becoming dense and waterproof.	Grazing during the day – starting to graze at night.	Able to house joey outside day and night in a protected area with shelter for night	0.7 Wombaroo. Biolac M200. 8 hourly (3 feeds/day). Native browse.	Av. 21g per day	Soft to firm dark green pellets. Clean up all faeces at least twice a day if penned.	
2560g to 5kg	9 to 13 mths	Fur dense and waterproof, pads tough.	Grazes day and night Sleeps during the day under natural shelter	Able to house joey outside day and night	0.7 Wombaroo or Biolac M200. 12 hourly (2 feeds per day until weaned).	Av. 22g per day	Firm pellets. Clean up all faeces at least twice a day if penned.	Wean from approx.12 mths Release from 5kg depending on style

Red-necked Pademelon Progression Chart

Weight Range	Approx. Age	Joey's appearance	Expected Behaviour	Housing	Food	Weight gain	Faeces	Other Requirements
9g to 100g	20 days to 2.5 mths	Eyes closed, ears down. Furless pink skin,	May still be attached to teat. Wriggles, unable to stand.		Requires feeds every 2-3 hours around the clock. Divetalact regime.			Viability to be determined by Coordinator
100g to 150g	2.5 to 3 mths	Eyes will open. Furless.	Detached from teat. Active in pouch at times but needs plenty of sleep.	In a hospital box. 31- 32° C required. Do not over heat. Use a thermometer.	Divetalact regime, 0.4 Wombaroo or Biolac M100g. 4 hourly (6 feeds/day)	Av 2.7g per day	Thick yellow custard.	Cream may be required – see manual for details
150g to 210g	3 to 4 mths	Colour deepening and very fine hair appearing.	Active in pouch but still sleeping a considerable amount.	In a hospital box. 30-31° C. Do not over heat. Daily exposure to around 15 minutes of filtered sunlight early morning or late afternoon within the pouch	Divetalact regime, 0.4 then transition to 0.6 Wombaroo or Biolac M100g. 4 hourly (6 feeds/day)	Av 2.7g per day	Mustard custard.	Cream may be required – see manual for details
210g to 280g	4 to 4.6 mths	Very fine covering of fur.	Very active in pouch, can stand in pouch. Starting to groom. Sticking head out of pouch.	Joey still housed inside. 28-29°C required. Starting to maintain own temperature. Do not over heat. Daily filtered sunlight, keep warm while outside.	0.6 Wombaroo or Biolac M150. 5 hourly (5 feeds/day) Establish gut flora with dirt and roots in pouch	Av. 3.5g per day	Mustard toothpaste.	Cream may be required – see manual for details
280g to 425g	4.6 to 5.3 mths	Short to long sleek fur.	May get out of pouch, very awkward. Will hang head out of pouch to graze.	Will self regulate own body temp. Outside most of day – access to simulated rainforest area. Still inside at night, give an extra middle for warmth if needed.	Transition 0.6 to 0.7 Wombaroo. Biolac M150 to M200. 6 hourly (4 feeds/day). Supplementary feed can be introduced. Water available for lapping	Av 7.2g per day	Olive green toothpaste forming soft pellets. Clean up all faeces from grazing area.	Skin care as required.
425g to 650g	5.3 to 6 mths	Long sleek fur, becoming dense and waterproof. Toughened pads on feet.	Becoming confident out of pouch, well coordinated. Grazing during the day – starting to graze at night.	Able to house joey outside day and night in a protected area with shed for night. Give an extra middle for warmth if needed at night.	0.7 Wombaroo. Biolac M200. 6 hourly (4 feeds/day). Plenty of native browse available from now on	Av.11g per day	Soft to firm dark green pellets. Start self-toileting once pelleting. Clean up all faeces at least twice a day if penned.	
650g to 900g	6 to 6.6 mths	Long sleek fur, becoming dense and waterproof.	Grazing during the day – starting to graze at night.	Able to house joey outside day and night in a protected area with shelter for night	0.7 Wombaroo. Biolac M200. 8 hourly (3 feeds/day). Native browse	Av.13g per day	Soft to firm dark green pellets. Clean up all faeces at least twice a day if penned.	
900g to 3.5kg	6.6 to 12 mths	Fur dense and waterproof, pads tough.	Grazes day and night Sleeps during the day under natural shelter	Able to house joey outside day and night	0.7 Wombaroo or Biolac M200. 12 hourly (2 feeds/day until weaned).	Av.15g per day	Firm pellets. Clean up all faeces at least twice a day if penned.	Wean at from approx. 9 mths Release from 2kg depending on style.

Blood Parasite seen in Young Eastern Grey Kangaroos

Compiled by Cheryl Dooley January 2003

The purpose of this paper is:

- To communicate information about a blood parasite, identified in macropods, to carers, vets and all those interested in the care and rehabilitation of macropods.
- To ask for cooperation from all wildlife groups to enable further work to identify the parasite and study cases of the disease as a basis for its control and thereafter its causes and possible cures.

Background:

This paper continues investigative work started in 1994. I have attached a copy of a paper presented at the Australian Veterinary Association Pathology Meeting in 1996 by the NSW Agriculture, Regional Veterinary Laboratory at Wollongbar (RVL Wollongbar) and a paper written in July 1998 by Liz Drinkwater (FAWNA). These papers could be read first as a background to my paper. Many things have changed since these papers were written, and things will continue to change. I expect to update this paper as this work continues.

I am not a veterinarian, and the information provided here should not be seen as scientifically proven nor should it replace advice from your own vet. I am a wildlife carer of some 2.5 years and a member of Coffs Harbour WIRES. I have provided footnotes to show the sources of documented information wherever possible, and I have worked to sort the suspected from the confirmed, and the anecdotal from the clearly tested and documented. This in no way reflects on those people who have provided information that is anecdotal, indeed at times it is all we have as the basis to develop theories. We need to use words such as "theory" and "could" and "may", and should avoid passing on information that we do not know to be entirely proven, as "this is the way it definitely is". The other constant danger when information passes from person to person in an ad hoc way is that old story that "Send reinforcements we're going to advance" becomes "Send three and four pence we're going to a dance". When I say, "confirmed" in this paper please be assured that this means confirmed by blood tests and/or necropsy (post-mortem examination).

Some of the information in this paper may challenge things that some carers have come to believe as "facts". This simply shows that "facts" often change as information grows and that any changes to treatment today should in no way suggest we did the wrong thing in the past. The treatment of native animals is far from being an exact science and we are all learning together. Every person I have spoken to has wanted only the best for the animals in their care and no one should take anything in this document as personal criticism. I trust this paper will be of some benefit to you, and that it may inspire you to become a part of the program to investigate this disease further.

What to look for:

The parasite infects and causes destruction (haemolysis) of the red cells circulating in the blood. The result is a **haemolytic anaemia**. Necropsies have shown that the parasite localises in massive numbers in the blood vessels of the kidney and brain.

Signs of anaemia:
- White or light pink gums and conjunctival membranes of the eyes.
- Lethargy, weakness.
- Fluid build-up in lungs and thoracic and abdominal cavities.

Other signs reported from suspected cases in Eastern Greys are:
- Tendency to bleed from tick attachment sites or veins after blood sampling.
- Increased consumption of water and frequent urination (polydipsia and polyuria).
- Loss of appetite (though we have one confirmed case where eating remained normal)
- Hot ears
- Misshapen and desiccated pellets

Many of these signs occur in other diseases, so it is desirable to seek veterinary advice for diagnosis before treatment is given. Coccidiosis in macropods also causes anaemia, due to blood loss into the gut. In blood loss anaemia a blood sample will have a low number of red cells (anaemia) and a low concentration of plasma protein. In the haemolytic anaemia produced by the blood parasite there is anaemia but also a **normal** concentration of blood plasma protein. A blood sample collected in EDTA anticoagulant is useful for differentiating these two types of anaemia.

(This is the "hang dog" look that may be seen in some animals)

Of course each animal will react individually and there are probably a wide range of signs possible.

Could this parasite be the reason for other "unexplained" deaths where animals have simply "faded away"?

Prognosis:
At initial examination, it is difficult to determine whether an animal will live or die. Animals with a slower onset of the disease seem to have a better chance of survival than those that go down rapidly. (That was certainly seen in my two cases and has been the case for others.) It would seem that in the cases of a slower onset, the animal's bone marrow has a chance to react to the parasite and start to fight back. These animals also respond to the use of Imizol® (see treatment section). Where the onset is fast, the immune system does not appear to be able to cope and Imizol® may also not be affective. (Again I saw this in one of my joeys).

The parasite seems to leave them vulnerable to internal bleeding and to spontaneous blood vessel eruption. If a bleed occurs in the brain the joey may go a bit "lop-sided" or develop eye

ticks/movements. Generally if this happens the animal cannot be saved. This happened to one of my joeys, she was found going round in circles. Within seconds she was down and lost all coordination and had to be euthanased.

It is important that carers record their cases in a standard format (see Macropod Examination sheet) so that we can develop more reliable information on prognosis and likely response to treatment.

Which animals are affected and why?
All confirmed cases so far have been from northern and mid-north coast NSW. This localisation of cases may simply reflect a greater awareness of the disease in this area.

Not all kangaroos in a group seem to be affected. In one group of 8, only 3 were affected and the first to die was the healthiest of the group. The majority of cases seem to be from 5kg upwards, though one anecdotal case is suspected in a 2kg joey. Both males and females are affected. Both sick and healthy animals are affected.

Stress is always a concern in reducing an animals immunity however in several cases stress does not appear to have been a factor eg 3 x 12kg males that had been in one location for six months i.e. they had not been moved or changed handlers and nothing else significant appears to have happened. Cases also seem to appear at varied times of the year. With confirmed cases occurring in all seasons. There is a theory that perhaps more cases occur during drier years but this cannot be proven at this point.

There are only a couple of reports of this parasite in wild eastern greys, however they are not confirmed cases.

In general outbreaks seem to be confined to hand-reared orphans and in “wild” release areas i.e. not in suburban situations.

Are other macropods affected?
The disease has been seen almost exclusively in eastern grey kangaroos. There have been several suspected cases reported in redneck wallabies with blood analysis confirming anaemia though unable to specify this particular parasite without further testing. In several of these cases Vets diagnosed a blood parasite and treated accordingly. In 2002, two cases were suspected in swamp wallabies. Necropsy (post mortem) confirmation is required to demonstrate the organism in these other macropod species.

Could we be assisting this cross over of this parasite into other species by mixing species at our release sites? There is not enough information available to determine this.

Detecting the parasite:
This is difficult in the live animal. Only a very small percentage of red cells in the peripheral blood (rarely more than 5%) contain the parasite even in severely affected animals. The parasite is concentrated mainly in the blood vessels of the brain and kidney of affected animals. Therefore a negative blood examination result from an animal with a haemolytic anaemia does not rule out the disease.

It is certainly worthwhile making smears of blood taken from the tip of the tail or ears and sending these smears to a laboratory for staining and examination under a microscope to try and detect the parasite.

A blood sample in EDTA anticoagulant is useful for two reasons:

- Testing for severity of anaemia and plasma protein concentration.
- Remainder held frozen for research to identify the parasite. (See section – what can you do to help?)

One thing that sets this parasite apart is that it causes an haemalytic anaemia, i.e. only the red blood cells are affected, and the plasma protein concentration is normal. (This is not the case in all anaemias eg; in anaemia related to coccidiosis plasma protein is affected). When red blood cells are broken down from plasma they usually constitute 30% of the total, 20% is considered low and in these cases animals are seen with as low as 10%.

What is this parasite?

The following brief layman's guide to microbes lists them from largest to smallest:

Helminth parasites (eg worms).
Protozoan parasites (eg coccidia, and many blood parasites)
Rickettsia
BacteriaViruses (smallest).

The protozoa are Eurcaryotes and have 18S ribosomal DNA. Preliminary electron microscopic examination of the parasite in affected Eastern Grey kangaroos could not confirm its identity as a Eucaryote. It is therefore possible that it belongs to another group of microbes such as the Rickettsia (Prokaryotes with 16S ribosomal DNA). To investigate this question of the identity of the parasites we need to collect and freeze samples of blood in EDTA anticoagulant from all cases.

How is the parasite spread?

It is not known how this blood parasite spreads. It could be one of many biting insects including ticks, flies or even mosquitoes. Scientists I have questioned seem to favour ticks as the most likely vector. As an example, with the *Babesia* sp blood parasites, (two types that cause cattle tick fever), the parasite is taken from infected cattle when female ticks engorge with blood and transfer the parasite through tick eggs to the larvae. The disease spreads when larval ticks attach to a new host, infecting it by injecting saliva carrying the organisms.[1] A larval tick is the tiniest tick seen and it is doubtful whether a tick of this size would even be detected on some animals.

In the areas in NSW where this parasite has been confirmed, *Boophilus microplus* (the cattle tick) does not exist, (or at least it should not), and cattle ticks do not attach to native animals. The common ticks seen are *Haemaphysalis longicornis* (the bush tick, also known as the grass or bottle tick), which make up about 90% of ticks in NSW, and *Ixodes holocyclus* (the paralysis tick, also known as the dog, scrub and shell-back tick), which make up about 10%.[2] I have not included detailed information about ticks in this paper, however I would encourage all carers to gain further information via websites (eg http://medent.usyd.edu.au is a website created by the joint work of the University of Sydney and Westmead Hospital, or

[1] Dept. Agric. WA - Farm note 37/93: Cattle tick and tick fever
[2] Tick Note No 13 1st Edition Nov 1998, NSW Department of Agriculture

www.ozemail.com.au/norbertf - which is a very detailed site) or from relevant authorities eg NSW Agriculture, so they can clearly identify the different species of common ticks.

Could young joeys in the wild be immune?
Let me use cattle tick fever as an example, (and again I would stress that we are not dealing with one of the 3 cattle tick fevers here, I simply use it as an example where we do know how the organism works), "calves younger than nine months do not become sick when infected, but do develop immunity to the organisms." "Complete eradication of cattle tick is not recommended because some ticks are needed to reinfest cattle continually to help them develop an immunity to the diseases carried by the ticks." "Calves from immune mothers receive temporary protection (maternal antibody) from the colostrums which prevents babesiosis. This protection lasts about 3 months and, in most cases, is followed by an age resistance, which lasts until the animals are about nine months old. Calves exposed to infection when the maternal or age resistance is high rarely show clinical symptoms but develop a solid, long-lasting immunity. It is therefore possible to have both babesia organisms and cattle ticks present on a property without animal losses or clinical disease. This situation is known as endemic stability."[3]

At this point we don't know whether this is true of macropods as well, however as previously stated there are no confirmed cases of wild kangaroos only suspected cases. Also this problem does not seem to happen to carers of young joeys in what we might call "suburbia" it only manifests itself in "wild" areas.

In my own situation, I have a mob of some twenty plus wild eastern grey kangaroos that move freely around my house and property. They have come into close contact with the two affected joeys we have had recently and yet I have seen no evidence of the problem in the wild mob. There are also cases where only a few joeys of those in care developed the problem – could it be the others had developed an immunity somewhere in their development – either coming into care at a later age, or having gained some bites whilst in care? I also had a red neck wallaby joey undergoing release that also had contact with the two eastern grey joeys. He too showed no signs of the illness, however he had been exposed to many ticks and flat flies (and probably mosquitoes) for a calendar month before their arrival. Could he have built immunity prior to their arrival?

RVL Wollongbar have seen this parasite in the kidney of a wild kangaroo (brought in for testing for another reason). This animal showed no signs of anaemia so it is possible that, as is the case with coccidia, animals carry this parasite but have a natural immunity to it.

This then raises the question - could this problem be as a result of joeys being raised in care, not being exposed to the range and number of ticks and other biting insects that would be a normal part of their wild world? This question is also raised in the report by Cook, Fraser and Hartley and the Liz Drinkwater Paper.

Although it is natural for carers to want to protect joeys from such biting insects, perhaps some exposure to bites at an early age is as necessary to develop immunities, as dirt is in developing good gut flora?

[3] Dept. Agric. WA - Farm note 37/93: Cattle tick and tick fever

How would we solve this problem, given we need our suburban carers? One suggestion may be to cut grasses and bushes from the wild and to take them into suburban carers to enable exposure. (Ticks are…common in ground and shrub layers…. contrary to popular belief ticks do not fall out of trees).[4] This may not solve the problem though given such things as flat flies seem to be a very rare event in suburbia and may not travel on branches or in grasses? Also what degree of exposure is needed? Is one tick enough? Probably not.

It is easy to forget that we should be thinking and acting like eastern grey kangaroos rather than letting our own motherly instincts take over – this could be fatal to our charges eg I have heard of carers who test milk warmth by popping the teat into their own mouths before popping it into the joeys mouth. This may be fine for human babies, but what diseases might we pass on to a kangaroo joey via our saliva? In the same way too sterile an environment might set animals up for later failure. It is a sad fact that we often do not know what happens to our joeys once they are released but we must try to ensure they have the same chance as wild joeys and that may mean treating them like wild joeys and exposing them to wild elements from an early age.

Treatment

Two things must always be considered when treating eastern grey kangaroos:

- They have a lower body temperature than domestic animals "Kangaroos, like most marsupials, try to maintain their core body temperatures near 36ºC, slightly lower than most placental mammals."[5]
- They have a lower metabolism than domestic animals. "As a general characteristic, kangaroos have basal metabolic rates that are about 70% of those of comparable placental mammals."[6]

This means there can be the risk of prescribing too much medication, which could do immediate or long-term damage.

The following are treatments being used by four different groups who have seen this infection.

Group 1 – Gives one shot of Imizol® sub-cutaneously (no specific location for shot), using the dosage rate of 0.12ml per 5kg (0.024ml per kg). Vets sometimes also prescribe antibiotics if there are signs of fluid build-ups or chest infections. They keep fluids up, using Lectade or by administering Hartmann's sub-cutaneously. They use Pentavite with iron or Incremin. Prior to the use of Imizol® this group managed to save about half of the joeys that suffered from this problem using various treatments including vitamin supplements such as Pentavite, Cellvite E and also antibiotics.

Group 2 – Two shots of Imizol®. One shot and then a second given 24 hours later. Dosage rate 0.1ml per 2 kg (0.05ml per 1kg). Shot is given in the back of the neck. Antibiotics are given on the 1st and 3rd days into the muscle. Anabolic steroids were given to one animal, as it was very debilitated. They sometimes also use a natural tonic (similar to Pentavite) and Vytrate (similar to Lectade) to keep fluids up.

[4] Department of Medical Entomology, University of Sydney/Westmead Hospital website on Ticks.
[5] Kangaroos, Biology of the Largest Marsupials, Terence J Dawson, Uni. NSW Press Australia Natural History Series 1995
[6] Kangaroos, Biology of the Largest Marsupials, Terence J Dawson, Uni. NSW Press Australia Natural History Series 1995

Group 3 – Pentavite with iron, Incremin, keep them well fed and watered. This group has lost 2 out of 5 joeys in the past 10 years that have presented with the problem.

Group 4 – Two shots of Imizol®, one day one, the second one-week later. Dosage rate is 0.2ml per 4kg (0.05ml per kg). Given sub-cutaneously, no specific location.

The use of Imizol®

When this drug was initially used, the main concern was its possible toxic effect on macropods. Given the number of animals that have now been treated with the drug, and in varying amounts, it could probably be safely concluded that it does no short-term damage to the animal being treated. (Group 2 has seen side effects of localized swelling and a scab that falls off).

In the 3 groups using it, all believe that a majority of the animals recover with the use of Imizol®, though some confirmed cases did die and a greater number of cases are "suspected" rather than confirmed and so some recovering animals may not have had the parasite. As previously stated, those with a regenerative anaemia (even with haemocrits as low as 0.11 and 0.12 L/L) do seem to improve clinically with the use of Imizol®[7]. Anecdotally it would seem that those that are going to die usually do so within a few days and those that will recover respond to the Imizol® within 24 hours.

A single dose sterilizes *Babesia* spp infections and is effective, though less so against *Anaplasma* spp. Therefore if the drug is active against the kangaroo organism a single dose may be sufficient treatment. One Vet I discussed this with said in some cases where a second dose was given it appeared that the animal was probably going to recover anyway and that the 2nd dose probably had little effect. This may be confirmed by the Department of Agriculture (WA), which states "Imidocarb (the active ingredient in Imizol®) is highly effective for treating tick fever. However a single dose sterilises the bloodstream for up to 12 weeks, negating the development of immunity"[8] This then raises the question of immunity in those cases that have survived. So far there have been no cases reported of second infections, however given surviving animals are released to the wild, not all animals can be tracked for the duration of their life. One Vet I spoke to felt if their immune systems have started to fight the problem then they should gain a degree of immunity despite the use of Imizol®.

The Department of Primary Industry Queensland states the recommended dosage of Imizol® when used for the treatment of vaccine reactions in cattle as follows:
For the two babesia strains:
"Imizol® dose rate: 1ml/100kg (0.01ml/1kg) live weight (treatment). Imizol® must be given under the skin, preferably in the neck. Depending on the volume given, it may cause some tissue damage and it is advisable to split the dose into two inoculations if it exceeds 5mls."
For anaplasma reactions and if using it as a short-term preventative:
"Imizol® dose rate 2.5ml/100kg (0.025ml/1kg) live weight" [9]

[7] RW Cook, GC Fraser and WJ Hartley, "Haematozoan infection in young eastern grey kangaroos" presented at Australian Veterinary Association Pathology Meeting, Brisbane, 1996.
[8] Dept. Agric. WA - Farm note 37/93: Cattle tick and tick fever
[9] www.dpi.qld.gov.au/tickfever/

With regard to where the dose should be given, the scientific consensus seemed to be it probably doesn't matter where it is given but it should certainly be sub-cutaneous and not intravenous.

Because of the difficulty of obtaining Imizol® in the affected area, sometimes it may have been used when passed its use by date. The manufacturers advice is that this should not happen. I have been unable to ascertain, at this point, what changes may occur in the product after it expires. There are drugs whose properties change post expiry and may create neurological problems. It is probably safest not to use Imizol® past its use by date if possible.

The use of Antibiotics
The use of antibiotics will not kill the parasite, but could be helpful if there are secondary problems such as fluid build-up (oedema) within the lungs, which can predispose to pneumonia. Antibiotic use is the same in animals as in humans in that most may have some toxic effects, and over use may reduce future resistance. Whether antibiotics should be given sub-cutaneously or intra-muscularly depends on the type of antibiotic used.

Is Imizol® the only drug?
At this point it would seem so. In some of my research I came across reference to quinuronium sulphate (Ludobal®)[10]. This drug is an old babesiacide developed in the 1930s and no longer available. It is, however, very stable and old stock of this product has still worked for cattle tick fever.

Recovery:
May takes two weeks or longer, with the animal slowly gaining energy. Meanwhile, their heart may be under strain, as it is working so much harder to pump the blood around. Rest with plenty of fluids and food is recommended. Some animals are so lethargic that they cannot move themselves out of the sun and this obviously needs to be monitored.

Preventative Measures:
Imizol® is only used as a preventative on cattle as a temporary measure (eg the cattle tick vaccine can create problems for pregnant cows and therefore Imizol® may be used as a temporary measure, but does wear off after a short time.) It is registered with the claim of providing protection for 4 weeks. The conclusion seems to be that it should only be given to macropods as a treatment and not as a preventative.

Where to from here?
There is a need to:

- Identify the organism (from DNA studies using EDTA blood samples collected from cases and frozen for future testing. For this work we need to collect samples from a substantial number of cases.
- Collect clinical and treatment data in a standard format for ease of collation.

Inhibitors to further progress in this area include:

- Sometimes poor documentation of cases by carers
- Information not shared between wildlife groups
- Unclear definition of cases (anecdotal versus confirmed cases). It is important to have laboratory tests done to support the diagnosis and be sure of what the problem is. If we

[10] Dept. Agric. WA - Farm note 37/93: Cattle tick and tick fever

are tempted to see this parasite as the possible cause of all ills and Imizol® as the cure we run the risk of losing animals to other diseases as well as being unable to come to scientific conclusions.

- Lack of funding for research for native animals

What can you do to help?

1. **When you have a LIVE suspected case**, you are encouraged to collect the following information in a standardised format and samples for diagnosis and research:
   - **Air-dried blood smears** from tip of tail or ear (for staining and detection of the organism).
   - **EDTA blood sample**. A blood sample in EDTA anticoagulant is useful for two reasons:
     a. Test immediately to assess severity of anaemia and plasma protein concentration
     b. Freeze remainder for research to identify the organism.
   - **Collect any ticks from affected animals** and hold them in a 70% by volume alcohol mix. (This can be pure alcohol, or even mentholated spirits can be used, but in a 70% alcohol/30%water mix). In a clean jar. These do not require freezing.
   - Complete the **Macropod Exam Sheet** attached so we can gain consistent information from all sources
   - Arrange for these **frozen EDTA blood samples, ticks in 70% alcohol, and Macropod Exam Sheets** and any other details to be sent to or collected by:
     Cheryl Dooley, 1647 Orara Way, Glenreagh NSW 2450
     Ph: (02) 6654 3793
     Email: dooleydy@ozemail.com.au

2. **When you have a DEAD suspected case**, you are encouraged to arrange necropsy (a post-mortem examination)
   Bodies for necropsy should be **chilled NOT FROZEN** (i.e. use the fridge not the freezer). The approximate cost is $100 (current January 2003). Post mortem examination can be by a local veterinarian who can collect specimens to send to the laboratory, (these should include fresh and formalin-fixed kidney and brain at minimum. Fresh faeces and a range of other formalin-fixed tissues – heart, lung, liver, intestines, bone marrow – should also be collected to diagnose other possible diseases such as coccidiosis), or the chilled carcass can be sent directly to the laboratory, eg:
   NSW Agriculture Regional Veterinary Laboratory
   Bruxner Highway. Wollongbar NSW 2477
   Ph: (02) 6626 1261
   Fax: (02) 6626 1276

3. Send all information to Cheryl Dooley (contact details above). This will enable us to have a central [11]contact point so that this paper can be updated.

4. Distribute this paper to all known macropod carers and vets who may be involved in macropod care.

Acknowledgments:

[11] www.dpi.qld.gov.au/tickfever/

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