Husbandry Guidelines for Feathertail Gliders

*Acrobates frontalis & Acrobates pygmaeus*

*(Mammalia: Acrobatidae)*

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<td>Tom Patterson</td>
<td>WSI Richmond</td>
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(Date: 2012 by Tom Patterson from WSI Richmond, v 1)


(Photo: Luke Hogan, 1996)
DISCLAIMER

These husbandry guidelines were produced by the compiler/author at TAFE NSW Western Sydney Institute, Richmond College, N.S.W. Australia as part assessment for completion of Certificate III in Captive Animals, Course number 18913. Since the husbandry guidelines are the result of student project work, care should be taken in the interpretation of information therein. In effect, all care taken but no responsibility is assumed for any loss or damage that may result from the use of these guidelines. Care has been taken to acknowledge the correct ownership of work. Should It is offered to the ASZK Husbandry Manuals Register for the benefit of animal welfare and care. Husbandry guidelines are utility documents and are ‘works in progress’, so enhancements to these guidelines are invited.
### Annual Cycle of Maintenance

<table>
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Note: (1) Northern populations – most likely all *Acrobates frontalis*, (2) Southern populations – most likely all *Acrobates pygmaeus*.

- All maintenance cycle should be used as a guide only. These tasks are noted at a minimum, but should be done as required.
- Record keeping, weights, observations and environmental enrichment should occur all year round
OCCUPATIONAL HEALTH AND SAFETY RISKS

OH&S hazards can include anything that may be seen as a potential risk to you as a keeper or a member of the public.

Hazard identification and risk assessment are essential in all workplaces as it is important to recognise all possible situations whereby people may be exposed to injury, illness or disease. Through the identification of hazards, actions can be put into place to reduce these risks and ensure a safe working environment.

Hazards not only include direct animal risks such as bites, scratches, but also include enclosure design and maintenance, tools and procedures used when building enclosures, as well as disease. In the case of working with Feathertail Gliders (Acrobates pygmaeus and Acrobates frontalis) there are more risks with maintaining an enclosure and the use of tools than dealing with the species.

Due to its size, the Feathertail Glider does not pose any significant risk on keepers, or members of the public should an escape occur. The potential for bites and scratches from handling the gliders exist however these would only require the administering of basic First Aid practices for cuts and abrasions.

General Hygiene should be managed through the thorough washing of hands before and after handling the species and contents of enclosure to minimize transference of disease and infections between enclosure and captive facility. Enclosure hygiene should also be maintained through daily removal of faeces, cleaning of water and food apparatus, removal of old browse, regular routine substrate changes, as well as routine cleaning of nest boxes.

Keeper entrances to enclosures must be at standing height and caution should be taken of exhibit furniture positioning to minimize trip hazards and ergonomic hazards due to bending and maneuvering through the enclosure.
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## GLOSSARY

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1 Introduction

This husbandry manual serves as a source of reference on the biology, maintenance, housing, health, behaviour, diet, breeding, restraint and transporting of Feathertail Gliders held in captivity. It acts as a major source of information for the species. It presents information and experiences (both published and unpublished) together so that the knowledge of Feathertail Gliders can be passed on, which in turn allows for techniques to develop rather than be reinvented. Resulting in the overall improvement in husbandry for the Feathertail Glider and subsequently the *Acrobates spp.*

The goal of this manual is that it is to be used as a reference tool for the zoo and captive animal industry.

The following is taken from the ZAA RC&P 2011:

**Feathertail Glider (Acrobates pygmaeus)**

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<tr>
<th>Location</th>
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<th>Subadults</th>
<th>Juveniles</th>
<th>Total</th>
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ASMP Australian Mammals TAG; No Regional Program

1.1 ASMP Category

ASMP Australian Mammals TAG

1.2 IUCN Category

The IUCN category for *Acrobates pygmaeus* is “Least Concerned”

1.3 EA Category

N/A

1.4 NZ and PNG Categories and Legislation

N/A

1.5 Wild Population Management

As the Feathertail Glider is considered Least Concerned on the IUCN Categories, there is no wild population management in place. Due to the current split of the species (once findings have been published and recognized in the scientific community), numbers of the split species will have to be re evaluated. This could lead to the need for wild population management should the numbers be significantly low for one of the species.
1.6  **Species Coordinator**

There is currently no studbook holder for this species as there is no current management program for this species.

1.7  **Studbook Holder**

There is currently no studbook holder for this species as there is no current management program for this species.
2 Taxonomy

2.1 Nomenclature

Class: Mammalia
Order: Diprotodontia
Family: Acrobatidae
Genus: Acrobates
Species: pygmaeus

Scientific Name: Acrobates pygmaeus
Meaning of Scientific Name: Pygmy Acrobat

2.2 Subspecies

There are no subspecies of the Feathertail Glider. However, a supposed subspecies Acrobates pygmaeus frontalis from northern Queensland was proposed but rejected as a result of poorly described juvenile specimens of Acrobates pygmaeus (Strahan, 1983). Recent findings have led to an apparent split in the species but due to the recentness of the split and awaiting results, this is yet to be published (Parrott, 2012, pers. comm.). This will not be a sub-species but will be a separate species but same genus.

2.3 Recent Synonyms

None.

2.4 Other Common Names

Pygmy Glider, Pygmy Phalanger, Flying Mouse

Figure 2.1 Feathertail Glider with its distinctive feather-like tail. (Dick Whitford in Lindenmayer, 2002)
3 Natural History

The Feathertail Glider, *Acrobates pygmaeus*, is the smallest of the marsupial gliders and the smaller of the two species in the family Acrobatidae (Ward, 1990). The Feathertail Glider was first described in 1974 when it was named *Didelphus pygmaea*. Soon after it was joined by the pygmy-possums in the family Burmyidae. Once reclassified, it has become the Australian member of a new family, Acrobatidae, with its only relative being New Guinea’s Feathertail Glider (*Distoechurus pennatus*) (Lindenmayer, 2002).

Lindenmayer (2002) suggests that gliders evolved due to the open forest structure that was associated during the Miocene expansion of vegetation dominated by eucalypts and wattles trees, stimulating the development of gliding. This method of locomotion would have minimized contact with the ground where they would be susceptible to predation.

It has been suggested that its small size, nocturnal behaviour, as well as its reluctance to enter conventional small-mammal traps has resulted in the deficiency of knowledge of its biology in the wild (Ward, 1990:503). As such, the knowledge currently known has become available through behavioural observation methods such as spotlighting, nest box surveys, as well as being kept in captivity. Unlike most gliders that can be located by distinctive eyeshine (caused by a well-developed layer of pigment in the eye called the tapetum lucidum that allows the individual to see in limited light), the Feathertail glider rarely emits ‘eye shine’, probably due to its small size and agility (Lindenmayer, 2002).

![Figure 3.2: A phylogenetic tree showing divergences among, and evolutionary relationships between, the major groups of Australian marsupials (redrawn from Woodburne and Casse 1996, in Lindemayer, 2002)](image-url)
Over the past few decades nest boxes have been used to study hollow-using arboreal marsupials in Australia; their application aiding in the research and management of many species of gliders, including the Feathertail Glider (Goldingay et al., 2007). Recent studies focusing on the Feathertail Glider have shown a slight preferencing of particular nest box design and orientation of nest box. However further in-depth investigation involving a wider distribution and larger sample size could provide further information into Feathertail Glider nest box preferences (Goldingay et al., 2007).

Other significant studies involving the Feathertail Glider have included investigations into hibernation and daily torpor (Jones and Geiser, 1992), as well as the possibility of sex-biased ratios in births based on first or second cohort litter during each year suggesting that more males are born in the first litter, while more females are born in the second litter (Ward, 2007). The study of sex-biased births however was not found to be significantly different, suggesting perhaps a larger sample size could produce a significant difference. As such, there is plenty of scope for possible research into Feathertail Gliders particularly in regards to behaviour and reproduction both in captivity and in the wild. This is particularly important in determining just how different A. pygmaeus is to A. frontalis and questions the validity of past research.

3.1 Morphometrics

3.1.1 Mass And Basic Body Measurements

<table>
<thead>
<tr>
<th>Head and Body Length</th>
<th>65-80 mm</th>
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<tr>
<td>Tail Length</td>
<td>70-80 mm</td>
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<tr>
<td>Weight</td>
<td>10-14 g</td>
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(Lindenmayer, 2002)

3.1.2 Sexual Dimorphism

Male and female Feathertail Gliders are similar in body measurements and size, but females have been known to be slightly larger (Fourth Crossing Wildlife, 2011). Also note the presence of a pouch in the female and distinctive testes in the male.

3.1.3 Distinguishing Features

The Feathertail is the world’s smallest gliding mammal and is similar in size to that of a mouse. The Feathertail Glider is similar to other gliders in that a gliding membrane extends from elbow to knees. However, no other species of gliding possum is as small as the Feathertail Glider (Lindenmayer, 2002).

- Distinctive tail that looks like a feather, used for gripping and steering while gliding from branch to branch (Figure 3.3).
- Brown to brown-grey back and white to cream underbelly.
- Large, serrated pads on each toe (similar to frogs and geckos), which provide adhesion to smooth surfaces (Figure 3.4).
- Gliding membrane between the elbows and knees, slightly thicker than in other gliding marsupials.
Figure 3.3 (Left) Close detail of the feather-like tail (Photo courtesy of Wendy Reilly, 2009)

Figure 3.4 (Below) Electron microscopy of the footpads of the Feathertail Glider. Each digit has an enlarged pad with well-developed ridges (Herb Rosenberg in Lindenmayer, 2002)
With the latest discovery that there is possibly two species within the Acrobates genus but lack of confirmation as to the naming of the two, it is still important to be able to identify your current species. Currently they are being described as *Acrobates frontalis* and *Acrobates pygmaeus* but until published and recognized in the scientific community, they are still considered to be under the one title of “Feathertail Glider”.

Below are some photos indicating the difference between *frontalis* and *pygmaeus*. Note: I do not own these photos and they are currently unpublished. They are property of Ken Aplin (CSIRO).

**Figure 3.5** The difference in tails of the two *Acrobates spp*. Note the presence and absence of fur on the tail. This absence has sparked contemplation into whether this species used to have a prehensile tail.
Figure 3.6 Top is the “heart” shaped footpads of *Acrobates frontalis* in comparison with *Acrobates pygmaeus* at bottom (photos courtesy of Marissa Parrott, 2012)
3.2 Distribution and Habitat

The Feathertail Glider is widely distributed within Australia (refer to Figure 3.8), particularly in the tall, well watered eucalypt forests of the eastern coast and extending inland into the dryer regions of more stunted sclerophyll forest and woodland (Strahan, 1983).

Lindenmayer defines the home range of an animal as “the area traversed during food gathering, mating and caring for the young” (2002:83). For most vertebrates there is a strong correlation between body size home range usually due to larger animals having a higher metabolic rate and thus requiring more food, which typically can only be provided by a larger area. In the case of the Feathertail Glider, its home range is between 0.4 and 2.1 hectares (Lindenmayer, 2002).

As the Feathertail Glider’s diet consists of nectar, pollen and invertebrates, it is predominantly found where these resources are available.

Figure 3.7: Geographical Distribution of Feathertail Gliders (*Acrobates pygmaeus*)
(http://www.iucnredlist.org/apps/redlist/details/40584/0/rangemap)
Figure 3.8: Detailed Geographic Distribution of the Feathertail Glider (*Acrobates pygmaeus*) within Australia, including the IUCN Conservation Status
3.3 Conservation Status

The Feathertail Glider conservation is ‘secure’ and is listed under the IUCN as Least Concerned in view of its relatively wide distribution, presumed large and stable population, presence in a number of protected areas, and because there are no major threats to the species (IUCN, 2010). Once again due to the split of the species, it is difficult to say how many of each species exist. As such, more research into population numbers and distribution would be highly beneficial.

3.4 Longevity

3.4.1 In the Wild

Feathertail Gliders generally live to between 3-5 years in the wild (Jackson, 2003).

3.4.2 In Captivity

According to Jackson (2003) captive Feathertail Gliders tend to live between 2-3 years with the oldest account of a Feathertail reaching 8 years. From my experience the gliders I have come into contact with have ranged in age from less than a year to over 7 years. These have been individuals from a number of institutions with the average age of current collection specimens being 4 years.

3.4.3 Techniques Used to Determine Age in Adults

The determination of age throughout the various species of gliders is not always straightforward. In young animals, it is usually patterns of growth such as body length and weight that provide a useful indication of the age of the animal (Lindenmayer, 2002). However, once the animal has become an adult and growth has stopped, age determination can be difficult.

In possums and gliders, it is usually a combination of body weight, patagium (or gliding membrane) colour, scent gland development, pouch development and tooth wear, that is used to determine the approximate age of the individual. As Feathertail gliders do not have the same diet as some of the larger species such as brushtails, ringtails and greater gliders, the tooth wear method may not be as accurate and as such a combination of the other methods may be more precise for an approximate age.
4 Housing Requirements

4.1 Exhibit/Enclosure Design

Enclosures should be designed, constructed, serviced and maintained in a way that ensures the good health and well being of your animals. They should be easy to maintain through the use of materials that are not only durable but also easily cleaned.

Enclosures should enable and encourage the gliders to move freely whilst displaying nature behaviours. Some of these behaviours can include gliding, bark shredding, socializing, resting and sleeping. Visual barriers are a must and this will allow the animal to not only escape the view of each other, but also the members of the public.

All animals should have access to nesting boxes in various positions, a selection of nesting boxes of various shapes and sizes depending on social dynamics. These need to be placed securely, high in the enclosure.

From my experience, housing Feathertail Gliders is best achieved in the utilization of a nocturnal house. By doing this, the animals can be observed at “night time” and are provided with UV light on an opposite “day/night” setting. The enclosure should include but is not limited to the following:

- Glass to allow and encourage climbing on smooth surfaces
- A fan to encourage natural gliding behaviour
- Enough room to be able to jump and glide from perch to perch
- An airlock to prevent the accidental escaping of individuals

Precautions

- Ensure that there are no gaps through which they can escape – exhibit security is important. These little guys are escape artists

Try to avoid

- Large water bodies
- Open browse pots
- Furniture that could fall

Following is a plan for the current Feathertail Glider exhibit at Wild Life Sydney. Included is a proposed plan of a “Blossom Garden” I have designed to supply the Feathertail Gliders with flowering browse for food and enrichment all year round.
4.2 Holding Area Design

The holding area or enclosure is an off-exhibit area that members of the public do not see. These are often located behind or near the exhibit enclosure or staff only areas.

The following are possible reasons for holding area usage:

- Maintenance routines such as browse changes or substrate changes
- The cleaning of exhibit
- Placing food in the exhibit
- Replacing furnishings
- Quarantine purposes
- Rehabilitation or recovery of an animal
- Vet checks
- Conditioning or training of an animal
- Breeding purposes

This list is far from being exhausted and there are many other reasons that animals will require being transferred into the holding area.

It is important to note that the design of the holding area will be dependent on the purpose for transference and the longevity of the placement within the holding area.

SHORT-TERM HOLDING

The need for short-term holding could be due to many of the aforementioned situations. From my experience, short term holding scenarios utilise small plastic terrariums that can be bought from pet or hobby stores. These plastic containers are suitable for short term housing such as during maintenance routines, changing browse, changing substrate and short-term exhibit upgrades such as replacing furniture etc.

These containers are easy to clean and maintain, the small vents provide sufficient ventilation while preventing escapes and are also easily stored when not in use. The containers need to be big enough that the nest box can fit, along with some fresh browse, water dish and enough room for the Feathertail to move around. If it is an extended short term, shredded paper will suffice as a substrate to minimize stress (pers. obs.).

Generally, the nest box entrance is blocked off (a small cloth bag, towel, or specifically made sliding door should suffice), and the entire box is placed within the container. As the maintenance tasks are undergone during the day, the Feathertail Gliders should be asleep in the nest box allowing easy transference from exhibit to holding container. These containers can also be contained within the nocturnal house during short-term holding periods to reduce stress by maintaining the animal’s living in reverse-cycle lighting.

If simply moving to obtain weights, the gliders can be caught up and placed within the terrarium without the nest boxes. If this is the case, shredded paper should be added to provide the animals with a safe and secure environment.
Figure 4.1   A mockup of a plastic terrarium used for short-term holding purposes. Note the box is placed inside the terrarium and browse is always present when placed in holding.

LONGER-TERM HOLDING
These types of holding areas are generally used during processes of quarantine or the recovery and rehabilitation of an animal. These types of holding areas are larger than simple plastic containers and need to be suitable for the Feathertail Glider to live in long term with appropriate furnishings.

Noegal cages or small bird aviaries are appropriate sizes for longer-term holding. The wire mesh needs to be rodent proof (6mmX6mm or less) and ideally an airlock if housed externally to prevent escapes. Appropriate nest boxes (multiple) should be placed undercover and out of direct sunlight, along with food and water dispensers. Deep, water bowls should be avoided as accidental drowning can occur. Shallow dishes or water dispensers are favorable to prevent spillage and drowning from occurring. Branches and browse should also be available to provide the glider with a means to meet their physical and behavioural requirements.

Medium sized glass terrariums are also suitable from my experience in housing individuals and small groups off exhibit.
4.3 Spatial Requirements
Minimum standards for the housing of animals in captivity are enforced through State law and legislation. It is important to know what legislation applies to you and your park in the exhibition of captive animals. In New South Wales, Australia, the requirements for housing Feathertail Gliders (*Acrobates pygmaeus*) can be found under the Standards for Exhibiting Australian Mammals in New South Wales as part of the Exhibited Animals Protection Act, 1986 (EAPA).

These standards have been developed to maximize the psychological and physical welfare of the animal in captivity, ensuring the safety of animals, staff, and visitors through providing a suitable living environment.

The spatial requirements as stated by the EAPA (1986) for up to two animals are as follows:

<table>
<thead>
<tr>
<th>Genus:</th>
<th>Acrobates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Common Name:</td>
<td>Feathertail Glider</td>
</tr>
<tr>
<td>Minimum Enclosure Area (m$^2$):</td>
<td>1.00</td>
</tr>
<tr>
<td>Minimum Enclosure Height (cm):</td>
<td>100</td>
</tr>
</tbody>
</table>

(N.B. An extra 0.3m X 0.3m floor area is required for each additional animal housed.)

Clause 10 of the Mammal Exhibition Standards (EAPA, 1986) is specific to Possums and Gliders, stating that:

1) Enclosures must contain visual barriers. This must include living or freshly cut foliage of native species of plants.
2) A variety of appropriately sized nest boxes and/or tree hollows must be provided to offer a refuge for the animals and allow them to nest away from other aggressive individuals. If held outdoors nest boxes and tree hollows must be placed in a position of the enclosure where they are protected from inclement weather.
3) Adequate climbing and gliding opportunities must be provided.
4) Some species such as *Petaurus* gliders, Leadbeater’s possum and honey possums generally live in family groups, or in the case of Feathertail Gliders, in large extended groups, so this social structure must be provided for.

The EAPA (1986) also makes a specific note that “behavioural enrichment should be provided in the form of flowers, foliage and branches (eg stringybark) of native species to provide additional food and nesting material.”

4.4 Position of Enclosures
In many cases, the Feathertail Glider is housed in the zoo’s or park’s nocturnal house. This allows the animals to be displayed during the day in what would appear to be “night”, when the animal is most active. The Nocturnal houses are set to reverse cycle lighting. As such, the position of the enclosure is not limited as it is fully enclosed (Tom Patterson, pers. obs of Taronga Park Zoo and Wildlife Sydney).
If the enclosure is located outside, it should be partially covered, allowing the animal to experience the weather. This being said, it should be positioned in a way that prevents strong winds and poor weather from causing harm or stress on the Feathertail Glider. Nest boxes, food bowls and water should be placed in an area within the enclosure that is not directly in the sun or out in the open where they can be spoiled by rain. Nest boxes must be out of full sunlight. I suggest that these animals should be housed indoors to prevent accidental escapes, control temperatures better, but also to control photoperiods throughout the day/night.

4.5 Weather Protection

As previously mentioned, in many cases Feathertail Gliders are internally housed within nocturnal houses and as such weather protection is not an issue. In this case, protection from weather refers to individuals housed externally, and that are exposed to the elements in any way, shape or form.

The enclosure, as mentioned in section 4.4, should be partially covered, allowing free airflow and the animal to experience natural weather conditions. Stanvic (2006) suggests that only about 20% of the aviary requires weather protection. This includes shelter from above and half the length of the height of the enclosure.

4.6 Temperature Requirements

Heating is generally not required unless there are sustained periods of low temperatures, such as weeks when the temperature is below approximately 5 °C (41 °F). Because of their small size, Feathertail Gliders have difficulty maintaining a high body temperature in cold surroundings or when food intake is insufficient. In most cases gliders are well adapted to low temperatures and are found to enter states of torpor to conserve energy.

Torpor, which is sometimes referred to as temporary hibernation, is a state of decreased physiological activity of an animal, usually characterized by a reduced body temperature and rate of metabolism. In the case of the Feathertail Glider, their body temperature falls almost to that of the surrounds, breathing slows down, and the animal is usually unresponsive to normal stimuli (Strahan, 1983). Strahan suggests that periods of torpidity usually extend overnight but can last up for several days, but for no more than two weeks. Torpor should not be confused with hibernation, which is much longer lasting and unknown among marsupials.

During torpor, these animals should not be overheated and as a rule of thumb generally do not require a lot of additional heating. In captivity, heat lamps may be provided to encourage normal behaviour all year round, but is generally not recommended, as torpor may be a breeding trigger in small possums and gliders.

Similar to the pygmy possum (Cercartetus spp. and Barramys sp.), southern populations or those that are held in cooler climates require ambient temperatures to be maintained below 25 °C (77 °F), preferably between 10-20 °C (50-68 °F). Species obtained from northern populations or are held and adapted to tropical areas in the wild may require additional heat to mimic the wild conditions. Heating may also increase their activity
during winter, as they are less likely to go into torpor, however, as mentioned above, the effect this has on reproduction is not definitely known.

4.7 Substrate

Animal exhibits within modern zoos and wildlife parks aim to portray their animals in as close as possible to their natural environment. As such, a suitable substrate should be chosen to reflect the environment that is being portrayed. Generally sand, dirt or leaf litter, or even a combination may be utilised to aid in the portrayal of the natural setting. Sand can easily be sifted to removed faeces or left over food, as well as allowing for ease of spot cleaning with a dustpan and brush. Dirt is also easy to maintain as it allows for ease of raking and spot cleans. Providing leaf litter encourages natural smells and foraging. Although Feathertail Gliders are arboreal, spending most of their time in the trees, they will often come down to the ground to forage (Tom Patterson, pers. obs.). In my experience, leaf litter aids in aesthetic presentation, allowing different naturalistic settings (eg. Eucalypt forests, casuarina woodlands etc.), as well as ease of cleaning as it can easily be removed and replaced as required. Leaf litter can, however, impact on finding your animals. If you have done a daily head count and find you are missing an individual, it can take some effort to search the leaf litter (pers. obs. and Blount, 2012).

From my experience, in short term holding containers such as the plastic terrariums, newspaper may be placed as a ‘substrate’ to aid in cleaning and hygiene maintenance, particularly for sick or injured individuals. This is used instead of leaf litter as this may act as a contaminant. If the individual is not sick or recovering, leaf litter from the enclosure may be used as a substrate in the terrarium to minimize stress. In both scenarios, fresh browse must be placed within the terrarium along with the nest box for the animal (Tom Patterson, pers. obs).

4.8 Nest boxes and/or Bedding Material

Nest Boxes

In the wild, the Feathertail Gliders typically make egg-shaped nests with leaves such as eucalypt and casuarina, bark and tree fern fibre. It is then usually lined with feathers and other soft flexible materials. These are often found in a number of places such as tree hollows, deserted ringtail dreys, telephone interchange boxes, old birds’ nests and even power boxes.

Nest boxes are extremely important for all species of gliders, providing protection from the elements of weather, a place to feel secure and hide, sleep, as well as raise their young.

The nest box needs to be large enough to house multiple individuals comfortably, and the entrance should be as small as possible while allowing the Feathertail Glider to move in and out without discomfort or injury. As Feathertail Gliders exist in highly social family structures, the nest box needs to comfortably house as many individuals as are in the
Husbandry Manual for the Feathertail Glider

However, providing a single nest box with enough room for all individuals is not encouraged so instead multiple boxes should be supplied throughout the exhibit. From my experience, the number of nest boxes required is dependent on how comfortable and successful the animals can be housed together. If animals are found to spend an unusual amount of time outside of the nest box, there could be a problem socially. As such, extra nest boxes should be made available as soon as possible.

Figure 4.2 Feathertail Glider nest box as suggested by Gould League, in The Nestbox Book (1997).

Special instructions
Entrance size is all important.
Drill three well-spread 5mm drainage holes into the base of the box.

Gould’s nest boxes are designed for supplying additional housing for wild native birds, possums and gliders, as well as used as release boxes’ for rehabilitated animals released back into the wild. The depth of the box is required in the wild to provide a certain level of protection for the Feathertail Gliders from predators that may reach and pull out the individuals. As animals in captivity do not experience predation to the same extent as their wild counterparts, these nest box designs should be used as a guideline.

Jackson (2007) suggests a nest box with dimensions 15cm length X 20cm breadth X 30cm height with an entrance diameter of 3cm. In my experience, the boxes can be much
Husbandry Manual for the Feathertail Glider

less deep (approx 15-20cm) with a sliding roof allowing for easy observation during daily health checks whilst the gliders are ‘asleep’ in the box.

Another design that works well is PVC piping with holes drilled for ventilation, capped at both ends with a secondary pipe of smaller diameter (30mm) attached as entrance to ‘drey’. As the box is made of piping, it can be thoroughly cleaned without having to be concerned about bacterial or fungal growth of wooden nestboxes.

If box is to be used for release, another option is similar to the nest boxe for microbats (refer to Section 11.11)

**NOTE**: if wooden nestboxes are used, they should be treated with anon-toxic waterproof paint to ensure that cleaning can be done, and minimize swelling of timber from moisture and humidity (pers. obs.).

**Bedding Materials**
The most common material used in the building of nests by Feathertail Gliders is the bark from any of the Stringybark eucalyptus species (*Eucalyptus spp.*). The inner bark of this tree is rough, fibrous and stringy, and is often found in strips or small pieces that have been carried into the nest from outside. The bark is soft, provides warmth, and is flexible, allowing individuals to bend and maneuver pieces to best suit the individual. The following is a list of a number of specific Eucalypts that this bark can be sourced from:

- Blue-leaved Stringybark (*Eucalyptus agglomerata*)
- Brown Stringybark (*Eucalyptus baxteri* (*Eucalyptus laeovinea*)
- Mealy Stringybark (*Eucalyptus cephalocarpa*)
- Messmate Stringybark (*Eucalyptus obliqua*)
- Privet-leaved Stringybark (*Eucalyptus ligustrina*)
- Red Stringybark (*Eucalyptus macrorhyncha*)
- Tindale's Stringybark (*Eucalyptus tindalae*)
- Yellow Stringybark (*Eucalyptus acmenoides* (*Eucalyptus muelleriana* (*Eucalyptus umbra* (*Eucalyptus umbrina*)
- Thin-leaved Stringybark (*Eucalyptus eugenioides*)
- White Stringybark (*Eucalyptus globoidea*)
- Stringybark or Narrow-leaved Stringybark (*Eucalyptus oblanga*)

(Leonard, 1993)

From my experience I have found that dried rehydrated peat moss, coconut fibre and casuarina needles can be used in conjunction with, or alternatively to, stringy bark in the building of nests when supplied within the enclosure or nest boxes. Dried shredded seaweed can also be utilised. An easy and more hygienic alternative is shredded paper that can be easily discarded when soiled.
Other nesting materials found in wild Feathertail Glider nests that can be used in captivity can include soft feathers that can supply extra warmth, as well as fresh green eucalypt leaves. The leaves also provide environmental enrichment through smells and textures available in the wild. (Refer to appendix 2 for a list of flowering Eucalypts that you can utilise for nesting materials.)

### 4.9 Enclosure Furnishings

Important to any glider enclosure are a number of branches spread throughout the enclosure. As Feathertail Gliders are naturally arboreal, jumping from tree to tree, these should be placed around the enclosure to allow natural jumping and gliding behaviours. By supplying a network of branches positioned vertically and horizontally, both the physical and behavioural needs of the Feathertail Glider can be met.

It is important to note the positioning and placement of the branches to ensure maximum use of the enclosure, as well as addressing any OHS issues that could arise from the positioning of branches.

Other important furnishings are as follows:

- Multiple nest boxes or hollows
- Visual barriers either as living or freshly cut foliage
- Natural nesting materials such as stringy bark or leaves

As gliders do not eat leaves, Native plants can be planted or placed within the exhibit to encourage invertebrates. Rocks can also be added to the bottom of the enclosure to add to the naturalistic presentation.

If browse pots are used, they should be capped with wire to prevent gliders from drowning or becoming trapped. Where possible, use simple plumper’s pipe without a bottom to hold browse, or alternative intertwine fresh browse into older branches or cable tie supports. If this method is used, the browse will not be supplied with water, and new browse will be required more frequently.

In the case of nocturnal houses, sufficient lighting is required to aid in not only cleaning maintenance and health checks, but also to present itself as ‘sun’ and encourage the glider to retreat back into their nest boxes to sleep during the ‘day’. Adequate ventilation is also important in nocturnal houses to minimize draughts, unwanted odours and moisture condensation.
5 General Husbandry

5.1 Hygiene and Cleaning

In general, all enclosures should be cleaned daily to remove faecal matter and uneaten food. It is very important to keep the feed area as clean as possible due to the potential for health problems that can result in poor hygiene and bacteria entering the food. Drinking water should be cleaned and refilled daily. When all individuals permanently leave an enclosure, all nest boxes, bowls, perches, platforms, walls and wire need to be scrubbed down and cleaned using an appropriate disinfectant before new animals enter. Doing this minimizes possible transfer of potential disease or the growth of bacteria or fungus that may cause problems to the health of your animals.

Nest materials should only be changed when flat, dry and rigid, usually once a month for dried seaweed. If using shredded paper, dispose of more frequently as Feathertail Gliders tend to sweat and urinate quite often (pers. obs). This may need to be changed more regularly if there are more animals using the nest boxes, or if there are pest infestations or other outbreaks.

Substrate should be changed according to what is used. This may only require a complete change annually, or in the preparation of new animals to be housed in the enclosure after previously inhabitants are transferred. If sand is used for substrate, it should be completely replaced at least bi-anually (Forsdick, 2010).

Browse should be replaced every couple of days for on exhibit enclosures to ensure aesthetic qualities are maintained. These should be sourced from Australian native species. These could include Eucalypts, tea trees, acacia, banksia, grevillia etc. In my workplace, off exhibit natives are grown especially for use as browse for animals within each division. This ensures a constant fresh supply of browse for feeding and enrichment purposes all year round.

Leaf litter can easily be replaced as required for aesthetic purposes or during spot cleans. The old leaves can be easily collected and removed, being replaced by new dead leaves collected from the grounds. It is important to source leaf litter effectively to ensure that you do not contaminate your exhibit with harmful chemicals, harmful bacteria or pest species faeces. From my experience, sourcing a clean reliable source for leaf litter can be tricky, particularly when your workplace is known for brushtail possum and rodent pest species. As such, storing old used browse from the exhibit in a spare room, browse collection pile, or even off exhibit tool shed can allow used browse to dry off and be easily broken off the branch to produce leaf litter. By using old browse from the same exhibit, introducing and cross contamination from other species is reduced (pers. obs.) Mulching from old browse can also be used.
**Chemicals**

The most commonly used chemicals to clean animal exhibits in zoos and parks are **F10 SC Veterinary Disinfectant** and **Animal House**. **Neutra-san** is also used as a deodorizer during major schedule cleans. Chemicals such as bleach or chlorine should be avoided in the hygiene and cleaning maintenance of Feathertail Glider housing as these chemicals are not suitable for animal use.

**F10 SC Veterinary Disinfectant** is one of the only strong disinfectants on that market that is approved by the APVMA (Australian Pesticides and Veterinary Medicines Authority) as there are no negative side effects on people, animals, or equipment or surfaces. It is also ecologically friendly and biodegradable.

**Animal House** is a great multipurpose disinfectant, although it foams up quite easily. It is more suited for exhibits and housing that can easily be hosed and rinsed such as those with concrete floors, or during full substrate changes. It is however useful in small volumes as it disinfects without the chemical smell of F10, particularly for use in nest boxes where gliders rely heavily on their own smells for comfort.

**Pest Control**

There are a number of pests that affect gliders and these are broken down into two categories; **ectoparasites** can be found on the skin and in the fur, and **endoparasites**, that occur internally such as in the intestinal tract, the heart or the lungs.

**Ectoparasites** affecting possums and gliders include fleas, ticks and mites. A number of species of fleas have been collected from Feathertail Gliders and are listed as follows:

- **Choristopsylla ochi**
- **Choristopsylla tristis**
- **Choristopsylla thomansi**
- **Anathopsylla pavida**

Jackson recognises that the *Petaurus* genus is parasitised by mites of the *Guntheria* and *Petauralges* genera. As such, there is a possibility these mites could also affect the *Acrobates pygmaeus*.

Ticks also have the potential to affect Feathertail Gliders. However, due to their small size, this is likely to be detrimental to the life of the glider and as such, there have not been any records of ticks on wild specimens (Lindenmayer, 2002). Ticks can cause paralysis, anaemia, skin irritation as well as transmitting diseases. Stanvic (1992: 43) suggests that many native marsupials appear to be immune to the paralysing effects of ticks, however, an injection of tick anti-serum may be given by vets in very severe cases.

In captive populations, it is very unlikely for these parasites to affect gliders, particularly if adequate husbandry and hygiene routines and techniques are implemented. When housed within a nocturnal house, the chance of fleas can be minimised.

**Endoparasites** include roundworms or nematodes, tapeworms and flukes. Lindenmayer notes that due to the complexity of parasitic life cycles, some parasites require a number
of hosts depending on their stage: “This can mean that gliders might be the final host for some parasite taxa and an intermediate host for others” (Lindenmayer, 2002: 103).

Excessive worm infestations can be identified through unexplained weight loss as well as evidence of diarrhoea.

I feel that the implementation of good husbandry techniques and hygiene practices are best to prevent pests, particularly relating to the *Acrobates* species. Cleaning regimes for daily, weekly and monthly basis can help to minimise pest activity. Routine hand washing both before and after handling each animal can minimise and prevent the spread of infection and parasites. Daily health checks of the animals ensure that any fleas, mites and ticks are detected and treated. Other signs that the glider may have fleas/mites include excessive grooming, hair loss or inflamed skin. Endoparasites are more difficult to detect but may be recognised through weight loss, the condition of faeces (loose, diarrhoea etc.) or non-normal behaviour (lethargy, not eating as per usual – over time you will recognise what is normal behaviour for your animals). These are noted and reported at first sign, confirmed through a recently as possible collected faecal sample, and treated accordingly. Mites and fleas can be successfully removed manually or treated with Revolution flea and mite control (Reilly, 2009).

Reilly (2009) suggests feeding gliders late afternoon to early evening, and removing excess food during morning clean and checks to reduce the amount of flies and ants that may act as pests.

**Cleaning Summary**

**Daily**

- Enclosure should be raked, swept or hosed (depending on substrate to remove faeces and excess food). [NOTE: in nocturnal enclosures, usually spot cleans are enough due to the sheer size of the animal]
- All excess or spilled food must be removed.
- All feed containers must be washed.
- Water bowls must be refilled.
- Browse pots (if used) must have water changed and check cover to prevent accidental drowning.
- In the case of glass displays in nocturnal houses, the outside of glass needs to be wiped and dried with a squeegee or paper towel in the morning to remove visitor fingerprints from the previous day.
- Distant and close examinations of animals.
- Record keeping and observations (any noteworthy changes in behaviour need to be recorded).
- Every couple of days replace browse (or as needed if browse water pots are not used).
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Weekly
- Scrub and disinfect water bowls.
- Scrub and wipe down all permanent branches.
- Check doors close securely and lubricate padlocks.
- Check security of enclosure and perimeter.
- Wash all tools used for cleaning (buckets, rakes, brushes etc).

Monthly
- Every three months do a full scrub of the enclosure.
- Every three months replace leaf litter (or as needed)
- Every four months clean nest boxes and replace nesting materials.
- Minimum every 6 months collect faeces for faecal examination to detect parasites.

Annually
- Replace soil substrate (Bi-annually if using sand)

5.2 Record Keeping
Keeping detailed records is important in order to establish a system whereby the health, condition and reproductive status of captive Feathertail Gliders are routinely monitored. In keeping detailed records on each individual, the records as a collective can contribute greatly to the husbandry of the species based on physical and behavioural patterns (Jackson, 2003).

It also allows the history of each individual to be transferred to other institutions if required and greatly facilitates a cooperative approach to data collection amongst institutions. In most of the larger institutions ARKS (for general information on births, transfers and deaths), SPARKS (breeding studbooks for species) and MedARKS (veterinary information) are used. The International Species Information System (ISIS) has developed these systems, providing a high degree of efficiency in transferring information between institutions (Jackson, 2003).
5.3 Methods of Identification

There are a number of different methods of identification that can be used on individuals. These could include the following:

**Passive Integrated Transponder (PIT) tags**

These are implanted between the scapulae of individuals and can be used on most species of possums and gliders. This method requires the individual to be over 10 g in body weight, and as such is only suitable for adult Feathertail Gliders that are above the 10 g weight. This is an excellent method of identification; however it can be expensive if many animals are implanted. PIT tags are a permanent method of identification but care must be taken when they are implanted as they may track out along the injection site. This may be avoided by sealing the entry site using tissue glue such as Vetbond, or a similar fast setting adhesive. This method requires the animal to be caught up and scanned using a PIT tag reader.

While microchips are an easy and permanent method of identification, it is not recommended on Feathertail Gliders if another option can be utilised. Recently it has been found that these chips can cause tumors after several years that can be quite debilitating (Johnson and Hemsley, 2008:427)

**Tattoos**

These can be used on many possums and gliders. Many texts state that due to the sheer size of the Feathertail Glider, tattooing is not recommended. However, from my experience, blacklight ink can be used on the tail in different spot combinations and colours for easy, non-visible to the naked eye identification. This method of identification in individual works well.

**Visual identification**

Often difficult, especially in the smaller species, natural variation of colour or features can sometimes be used to identify a particular individual.

**Ear tags**

While ear tags are often used as an identification method for many possums and gliders, I would not recommend ear tagging in Feathertail Gliders, once again due to the small size and weight of the species.
5.4 **Routine Data Collection**

Animal records form the permanent history of an institution’s animal collection and are indispensable in the population management of zoo animals. Internally, the records are vital to daily husbandry practices, veterinary treatments and on analysis over time, allow monitoring of any potential welfare problems. Externally records are required for sharing the information with other Zoological parks.

These records are used for cooperative breeding programs and play an important role for studbook keepers. This includes any records which may be required as part of a long-term study such as reproduction and growth and developmental stages. These are vital for future breeding successes for captive animal facilities. These would include any of the following:

- Weights / growths for development charts
- Contraception / genes/ parenting behaviours
- Blood biochemistry

Routine data collection suggests that, as much information regarding the animal should be kept as often and routinely as possible. As such, the following information should be noted:

- Identification numbers; all individuals should be identifiable
- Any veterinary examination conducted
- Treatments provided
- Behavioural changes or problems
- Reproductive behaviour or condition
- Weights and measurements
- Changes in diet
- Movements of individuals between enclosures or institutions
- Births with dam and sire if known
- Deaths with post mortem results
6 Feeding Requirements

The dietary niches of possums and gliders limit their body size, with larger species being folivorous and small species, that have a higher energy requirements on a mass-specific basis, being limited to energy-rich food items such as nectar, sap and arthropods (Jackson, 2007: 206). Lindenmayer (2002) suggests that most information about the diet of all gliders has come from four main sources:

- Direct observations of animals feeding. Searching for food is one of the major forms of activity outside the nest. For example, about 90 per cent of the active time of the Yellow-bellied Glider is spent foraging.
- Laboratory analysis of scats left by animals in traps or at the base of trees.
- Feeding trials on captive animals to determine their preferences for certain types of food.
- The analysis of the stomach contents of dead animals or animals sacrificed for scientific study.

On the basis of collated information from the various diet studies, Lindenmayer (2002) conveys that gliders have been classified into three broad groups:

1. Specialist arboreal folivores (the Greater Glider).
2. Intermediate-sized omnivores that eat a combination of insects, plant and animal exudates (comprising the Sugar Glider, Squirrel Glider, Mahogany Glider and Yellow-bellied Glider).
3. Small omnivores that consume fewer plant exudates than intermediate-sized omnivores and concentrate more on insects and pollen (the Feathertail Glider).

6.1 Diet in the Wild

The wild diet of the Feathertail Glider includes arthropods, insect and plant exudates such as nectar, honeydew, pollen, as well as seeds and fruit. Honeydew is a carbohydrate-rich secretion produced by sap-feeding, lerp-forming insects. As these substances are very low in protein, dietary protein requirements are supplied through the consumption of arthropods, pollen and, occasionally, small vertebrates (Jackson 2007). Pollen is high in protein, and although a tough, exine coat, protects it the nitrogenous cell contents are large components of the diet for the Feathertail Glider. The Feathertail Glider has a long brushed tongue to assist in gathering pollen and nectar, and will visit many flowers each night grooming itself for additional pollen grains adhering to its fur. (Lindenmayer 2002).
Figure 6.1 Examples of *Eucalyptus spp.* present in Sydney that can be fed to Feathertail Gliders. A) Red Bloodwood (*Eucalyptus gummifera*), B) Blackbutt (*Eucalyptus pilularis*), C) Swamp Mahogany (*Eucalyptus robusta*) (photos from Holliday and Watton, 2002).
Below are examples of other plants that flowers are consumed by Feathertail Gliders in the wild.

**Banksia**

**Heath Banksia**

*(Banksia ericifolia)*

Medium compact ornamental shrub with large orange-red flowers appearing in fall-winter. In its native habitat it grows in deep sand, sandy loam or sand over sandstone in shrub land & woodland, sometimes in semi-swampy places. It frequently extends to very exposed cliffs and bluffs near the ocean. It is a common plant among Hawkesbury Sandstone - Blue Mountains west of Sydney -where the average rainfall is usually 32-35" per year (Australian Native Plant Nursery, 2011). *(Figure 6.2 own photo).*

**Coast Banksia**

*(Banksia integrifolia)*

Medium tree suitable coastal or inland, erosion control, frost and wind tolerant, cut flower. Yellow flowers autumn-spring. Interesting foliage and seed pods, dries well. Rare pink form sometimes available B. integrifolia subsp. Monticola (Australian Native Plant Nursery, 2011, *Figure 6.3* photo from Sainty, Abell and Jacobs 1989).
**Silver Banksia**  
*(*Banksia marginata*)  
Variable shrub to small tree with yellow flower heads in spring and summer. Hardy adaptable banksia for most soils and positions, inland or coastal. Tolerant of frost, salt winds and extended dry periods once established. (Australian Native Plant Nursery, 2011)  
(Figure 6.3 Photo from Sainty, Abell and Jacobs, 1989)

**Hairpin Banksia**  
*(*Banksia spinulosa*)  
Medium to tall shrub with large bright golden flowers with black styles or orange/red or yellow/gold- depending on seedling grown. Most grow true to seed but great variability of flower colour and size of plant. Flowers summer-fall through to winter-spring. Hardy in well-drained neutral soils. Excellent for under eucalyptus. (Figure 6.4 photo and description from Australian Native Plant Nursery, 2011)

Figure 6.5 Leaves from a variety of Banksia spp.. From Left to Right  
*Banksia ericifolia*; *Banksia spinulosa* (2 leaves); *Banksia integrifolia* (2 leaves); *Banksia serrata* “Old Man Banksia” (2 leaves), (photo from Sainty, Abell and Jacobs 1989).
Bottlebrush

*Bottlebrush* (*Callistemon citrinus*)
Shrub to 3m tall. Widespread in moist places. Leaves lanceolate (Figure 6.6 photo from Sainty, Abell and Jacobs, 1989).

Grevillea

*Molongolo* (*Grevillea juniperina*)
Compact prostrate shrub with sulphur yellow apricot flowers appearing in winter-spring-summer and deep green needle-like leaves. It prefers well-drained soils in full sun or partial shade position. Tolerant of heavy frost and extended dry periods once established. (Figure 6.7 and info from Australian Native Plants Nursery, 2011, Figure 6.8 “red-apricot” variation in colour, from Sainty, Abell and Jacobs, 1989)

6.2 Captive Diet
The following is a number of different diets as prepared by various institutions:
Husbandry Manual for the Feathertail Glider

Taronga Zoo Education Centre Feathertail Glider Diet

Daily Diet (per individual)
- 3ml Leadbeaters Mix (pre made by Food Prep Department)
- 1 large chunk of fruit or vegetable (10 x 5 cm for spiking – can be sweet potato, sweet corn, apple, pear, rock melon, cantaloupe, or any other fruit or vegetable available except citrus)
- Water ad lib.

Sydney Wildlife World Feathertail Glider Exhibit Group
(Now Wildlife Sydney)

Daily Diet (approx 15 individuals)
- 15ml nectar (Healesville Sanctuary Nectar Mix)
- 40g fruit and veg
- Water ad lib

Feathertail Glider Diet from Jackson 2007

Ad Lib
Water

Daily Diet (per animal)
- 3ml Nectar Mix (as used by Healesville Sanctuary)
- 1g Mixed fruit – (sweet potato, melon, sweet corn, apple, pear, orange, banana) (Can be in large chunks 10X5 cm spiked on a branch or nail)

Healesville Sanctuary Nectar Mix

Ingredients
900m warm water
900ml honey
6 shelled hard-boiled eggs
150g High-protein baby cereal
6 tsp Sustagen (vitamin supplement)

Method
- Add the warm water into a two litre jug and then slowly add the honey and stir so that it dissolves.
- Blend the eggs (no shells) until mushy.
- Add half the honey/water mix and blend. Add the remainder of the mix ad blend.
- Add Sustagen and half the baby cereal and blend.
- Add remainder of baby cereal. Blend for 1.5 minutes to make lump free
- Can be stored for up to two weeks.

Fresh flowers from eucalypts, bloodwoods, melaleucas, banksias and callistemons should be provided wherever possible. After several days the flowers can be sprayed with a fine mist of nectar to increase glider activity (Jackson, 2007). Following is a list of species that can be used as freshly cut blossoms for the Feathertail. See appendix for yearly blossoming times.

<table>
<thead>
<tr>
<th>Botanical Name</th>
<th>Common Name</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Grevillea asparagoides</strong></td>
<td>N/A</td>
</tr>
<tr>
<td>---------------------------</td>
<td>-----</td>
</tr>
<tr>
<td><strong>Height</strong></td>
<td>0.5 – 2 m</td>
</tr>
<tr>
<td><strong>Water Usage</strong></td>
<td>LOW</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Grevillea banksii</strong></th>
<th>Bank’s Grevillea</th>
<th><img src="image5.png" alt="Image" /></th>
<th><img src="image6.png" alt="Image" /></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Height</strong></td>
<td>2.5 – 4 m</td>
<td><strong>Spread</strong></td>
<td>3 m</td>
</tr>
<tr>
<td><strong>Water Usage</strong></td>
<td>MEDIUM</td>
<td><img src="image7.png" alt="Image" /></td>
<td><img src="image8.png" alt="Image" /></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Callistemon citrinus</strong></th>
<th>“Lemon Scented Bottlebrush” “Red Bottlebrush”</th>
<th><img src="image9.png" alt="Image" /></th>
<th><img src="image10.png" alt="Image" /></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Height</strong></td>
<td>5 – 8 m</td>
<td><strong>Spread</strong></td>
<td>5 m</td>
</tr>
<tr>
<td><strong>Water Usage</strong></td>
<td>LOW</td>
<td><img src="image11.png" alt="Image" /></td>
<td><img src="image12.png" alt="Image" /></td>
</tr>
</tbody>
</table>
### Banksia integrifolia

- **Name**: “Coastal Banksia”
- **Height**: 15 - 25 m
- **Spread**: 5 m
- **Water Usage**: LOW

### Banksia ericifolia

- **Name**: “Heath Banksia”
- **Height**: 4 – 6 m
- **Spread**: 3 m
- **Water Usage**: LOW

### Grevillea longifolia

- **Name**: N/A
- **Height**: 2 - 3 m
- **Spread**: 4 m
- **Water Usage**: LOW
### Corymbia gummifera

- **Height**: 20 - 35 m
- **Spread**: 6 m
- **Water Usage**: LOW

### Eucalyptus robusta

- **Height**: 28 – 22 m
- **Spread**: 8 m
- **Water Usage**: MEDIUM

### Eucalyptus pilularis

- **Height**: 40 – 60 m
- **Spread**: 25 m
- **Water Usage**: LOW
<table>
<thead>
<tr>
<th>Eucalyptus albens</th>
<th>White Box</th>
<th>Juvenile Leaf</th>
<th>Adult Leaf</th>
</tr>
</thead>
<tbody>
<tr>
<td>Height</td>
<td>18 – 22 m</td>
<td>Spread</td>
<td>5 m</td>
</tr>
<tr>
<td>Water Usage</td>
<td>LOW</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

All plant information in tables, flowering times, spreads, heights, and photos obtained from PlantFile (2012). www.Plantfileonline.net

### 6.3 Supplements

Jackson (2007) suggests the following may be offered as a supplement:
- Mealworms once a week
- 1 insect (including crickets and moths) once a week
- 1g of pollen grain once a week.

From my experience, the nectar mix (Healesville recipe) and mixed fruit/chunks is sufficient for supplying dietary requirements and as such supplements are not necessary but can be useful for enrichment. Crickets are also added ad lib as an enrichment feed (pers. obs.).
6.4 Presentation of Food

Figure 6.1    A Feathertail Glider feeding on Leadbeaters Mix from a dispenser (own photo, 2011).

Nectar mix (leadbeaters mix) is supplied in hanging dispensers. Mixed fruit may be placed in a single small dish on a shelf or holder within the exhibit. Large chunks are to be spiked on nails on branches around the enclosure. The placement of food encourages natural foraging behaviours and maximizes use of the entire exhibit. If mixed fruit mix is used, separating mixture into multiple containers to be placed around the enclosure encourages the Feathertail Gliders to search for all of the food. Similarly, the use of multiple dispensers for the nectar mix can be presented for this same reason.

Remember, if housed in a Nocturnal house with glass walls, the Feathertail Glider can climb and jump from smooth surfaces so the placement of food in odd and hard to reach places away from the majority of the networks of branches encourages activity and exercise (pers. obs.).
7 **Handling and Transport**

There is no OHS risk to keepers or handlers when handling Feathertail Gliders.

7.1 **Timing of Capture and Handling**

The Feathertail Glider is, like many other possums and gliders, nocturnal. As such it is easiest to capture and handle these mammals during the day when they are asleep in their nest box. If held in a nocturnal house, the best time for capture would be early in the morning before the lights switch to “night” and the gliders awaken.

During the warmer months of spring and summer, the Feathertail Gliders become more active and can sometimes be found awake for short periods throughout the day. In the hottest months, morning is the best time for capture, even if the glider is awake, to prevent overheating and stress that could be detrimental to the individual. In winter and cooler months, the Feathertail Glider can often be found in states of torpor or deep sleep, resulting in an easy capture.

7.2 **Catching Bags**

Small calico cloth bags can easily hold Feathertail Gliders. Jackson (2007) suggests that using plastic bags (that are not sealed or have several small holes at the top to allow plenty of air to enter) can be used when weighing Feathertail Gliders using a fine scale spring balance. This is because the weights will be more accurate and the animals will be easier to see and handle than in a calico cloth bag (Jackson, 2007).

7.3 **Capture and Restraint Techniques**

Small gliders such as Feathertail Gliders can be easily picked up and held in the hand. They generally do not bite but, if they do, it is not painful (Jackson, 2007). It is highly recommended that you gently but firmly hold the base of its tail in between two of your fingers to prevent the glider from possibly escaping. These marsupials are very quick and can EASILY slip out of your hands (Forsdick, 2010). Cupping the glider in one hand and holding fingers closed firmly without

7.4 **Weighing and Examination**

Weighing is best undertaken by placing the glider in a catching bag as described above in 7.2 and using either hanging or digital scales if available (Jackson, 2007). From my experience, taring a plastic takeaway container and placing glider inside allows easy and accurate weights to be obtained.

7.5 **Release**

Possums and gliders are generally best released directly into the nest box, if that is where they were first caught, on the ground or onto a branch or tree trunk. In the case of Feathertail Gliders, it is important to ensure that the door to the enclosure is closed and secure as upon release back into the aviary/enclosure, these little gliders will run away quickly leading to the possibility of escape if not monitored (pers. obs.)
7.6 Transport Requirements

Appropriate preparation needs to be made when transporting any animals. The following is a list of actions that should be made before transportation can occur:

- **Contact ZAA** (Zoo and Aquaria Association) if your facility is a member and fill out necessary forms.
- **Contact the Zoo or Park** receiving the animal, ensuring that adequate housing and requirements are available for the Feathertail Glider *before* it arrives.
- **Veterinary Checks** need to be completed prior to the animal leaving the institution. This includes recording all information such as weights, observations and individual identification (ARKS, SPARKS and MEDARKS profiles).
- **Conditioning the animal** to a transport box or pack a few months prior to transportation may be appropriate to familiarize the animal with the box, and effectively reducing the stress endured on the day of transportation.
- **Climatic conditions and local weather** at the destination should be looked into, as animals should not be exposed to extreme temperatures during transportation or during the settling in period upon arrival into their new enclosure.

7.6.1 Box Design

Nest boxes should be placed securely into a transporting box to reduce stress and provide the glider with a warm comfortable area to rest. Ideally, for both long-term and short-term transportation, boxes need to be large enough to fit a nest box inside as well as room to move and for a water container and possibly a food container (Forsdick, 2010).

The design of the box will depend heavily on the duration of the transportation, as well as method of transportation. If short term transportation by foot or car is required, simply placing the Feathertail Glider within its nest box, inside a rigid plastic container such as a terrarium (similar to that used in the short-term holding enclosure in section 4.2 of this manual, refer to Figure 7.1).

![Figure 7.1 Plastic terrarium suitable for short distance transportation of Feathertail Gliders (own photo, 2011).](image)

If transportation is over a longer period of time, interstate, international, or by air, the following is the box design as required by the International Air Transport Association (IATA):
Materials
Wood, metal, wire mesh and muslin or other light material

Frame
Solid wood, screwed or nailed and glued with a non-toxic glue, metal or non-toxic plastic.

Sides
Wood, metal or plastic. The front must consist of a 2/3 solid panel with ventilation openings above a 1/3 wire mesh.

Floor
The base of the container must be solid and leakproof. A slatted floor made of 2.5cm x 2.5cm (1 x 1 inch) battens spaced at 0.5-1cm (1/5-2/5 inch) intervals and covered with absorbent bedding must be placed over a droppings tray, with a locking device, fitted into the base of the container. If a droppings tray is not provided then there must be sills at both the front and rear of the container to prevent excreta escaping.

Roof
Solid but with meshed ventilation openings optional.

Door
Either the front of the container can be constructed as a vertical sliding door or a rear hinged or sliding door, extending the whole height of the container, must be provided. In either case, the door must be fastened with tamper proof fastenings.

Figure 7.1  Appropriate box design for transporting Possum and Glider species as described by IATA standards (2009)
**Ventilation**

Meshed ventilation openings, approximately 2.5cm (1 inch) in diameter must be provided along the base of the two long sides and in the upper 1/3 of the sides and front of the container. Whenever openings are covered by mesh, care must be taken that there are no sharp edges present within the container. All edges must be covered with a smooth material that is tamper-proof. A muslin, or similar material, curtain must cover all ventilation opening including the front.

Alternatively, IATA also states that *rigid pet containers* can also be used with the following modifications:

- A slatted floor must be firmly fixed to the bottom of the container, covered with an absorbent material
- A low resting shelf must be firmly fixed to the back of the container. (In the case of Feathertail Gliders, their nest box can be firmly attached to the base of the container, with or without a shelf.)
- Container should be securely locked and tamper-proof.
- Fine wire mesh must be securely fastened over the door grill and all ventilation openings; these must also be covered in muslin or a similar material.

![Figure 7.2](image)

**Figure 7.2** Alternative ‘rigid pet container’ for use of transporting Feathertail Gliders. Note the above-mentioned modifications required as well as the appropriate furnishings as listed in 7.6.2 (IATA, 2009)

The transport box must be clearly labelled. The following information must be visible on the outer packaging at all times. “Live Animal” signage should be clearly visible with the “dog” picture marked, indicating a mammal. “This way up” arrows and “DO NOT TIP” should be visible on all sides.
Figures 7.3, 7.4, 7.5 Examples of labels that must be visible on transportation box (IATA, 2009).
7.6.2 Furnishings
A resting shelf of 1/3 the length of the container must be provided in the rear of the container.

Branch-like timber must be provided and firmly attached within the container so that the animal can climb and rest safely. Clean, soft, and comfortable nesting material should be provided inside nest boxes to provide insulation and to stop the glider from potentially rolling around during transportation. If transportation occurs at night, when a Feathertail Glider is awake, a couple of thin branches or twigs can be easily secured inside containers for them to climb and grip on (adapted from Forsdick, 2010).

7.6.3 Water and Food
Animals do not usually require additional feeding or watering during 24 hours following the time of dispatch. If feeding or watering is required due to an unforeseen delay, appropriate food must be provided but care must be taken not to overfeed (IATA).

Separate food and water containers, with outside access, must be fixed to the upper part of the door grill in order that the animal cannot sit on them. Water must only be offered when required and must not remain in the container after use but must be siphoned out (IATA).

In the case of Feathertail Gliders, water can be supplied either through a damp cloth or sponge in a container that is securely fastened to the wall of the transport box. The glider can easily lick off the moisture required, minimizing the potential for accidental drowning from water dishes (adapted from Forsdick, 2010). Alternatively, a small dripper bottle may be fastened to the side of the transport box. This method is only recommended if the animal has been introduced to this method of drinking prior to transportation.

7.6.4 Animals per Box
IATA (2009) regulations state “Animals of the same species and size may be shipped together in the same container only if they have previously been housed together. Otherwise, they must be carried completely separately”.

In the case of Feathertail Gliders, a highly social species, many individuals may be transported in the same container, but similarly as the IATA standards have stated, “only if they have previously been housed together”. Generally it would be best to transport multiple individuals together to reduce stress on the animals during transportation. The size of the transport container must therefore be big enough to house the appropriate number of individuals being transported.

7.6.5 Timing of Transportation
Like any species of possum or glider, transporting during the day is the best time as it is when the animal is less active which may minimize stress levels. By transporting in the
morning, time is allowed for any unforeseen circumstances or problems that may arise during travel.

As mentioned before in Section 7.1 of this manual, Feathertail Gliders become more active and can sometimes be found awake for short periods throughout the day during the warmer months of spring and summer. In the hottest months, morning is the best time for capture, even if the glider is awake, to prevent overheating and stress that could be detrimental to the individual. Transporting in winter and cooler months is usually best as the Feathertail Glider can often be found in states of torpor or deep sleep. This often means that the Glider will remain asleep and stress can be minimized when transported during this period.

7.6.6 Release from Box

Once in the new enclosure, open the bag or box, uncover the animal’s head so that it can see outside, and then leave it to emerge from the bag or box when it is ready. The bag and box are then removed once the animals have fully emerged (Jackson, 2007).

Alternatively, by simply transferring the nest box into the new enclosure, the animal can vacate the old box when they are ready. This reduces the stress placed on an animal after the transportation period as the glider has something familiar to them in their new enclosure. Once vacated, the older box may be removed.
8 Health Requirements

8.1 Daily Health Checks

Daily health checks are carried out visually and are often referred to as a “D.E” or distant examination. Gliders should be observed daily for any signs of injury or illness. It is important as a keeper to familiarize yourself with your animals, identifying group dynamics and all individual’s behaviours. In doing so, any abnormal behaviours or physical changes as a result of potential problems the individual may be facing can be identified early.

The most appropriate time to do this is generally when the enclosure is being cleaned out or during feeding to minimise disturbance. During these times, each animal in the enclosure should be checked and the following assessed in a Distant Examination:

- **Coat Condition**
- **Fur** on the enclosure floor or elsewhere – may be an indication of fighting or mating
- **Discharges** – from the eyes, ears, nose, mouth or cloaca
- **Appetite** – was the food consumed too quickly? Was there any food left over?
- **Faeces** – number or pellets and consistency, colour and smell of faeces
- **Changes in behaviour** – aggressive/withdrawn/isolated from the group. This requires the keeper to know the animal’s normal behaviour in order to detect a divergence.
- **Injuries** – abrasions, swelling around the face, lameness and any asymmetry
- **Reproduction** – the presence and development of pouch young can be detected by observation by an enlarged or bulging pouch in the female.

8.2 Detailed Physical Examination

8.2.1 Chemical Restraint

**Sedation**

Sedation may be useful prior to inhalation anaesthesia or for minor procedures and transport. Diazepam (0.5-1mg/kg IM) or butorphanol tartrate (0.4-1 mg/kg SC or IM) have been used (A Olsson & J Roffet pers. comm. in R. Johnson and S. Hemsley, 2008)

**Anaesthesia**

Pre-anaesthetic fasting for 1-2 hours prior to anaesthesia is adequate as regurgitation under anaesthesia is uncommon in possums and gliders. Pre-anaesthesia handling should be minimised in order to decrease common complications of anaesthesia, such as breath-holding or apnoea. It can be difficult to assess the anaesthetic risk of a patient prior to induction but the body mass and demeanor of the individual may aid in assessing potential risk.
Inhalation anaesthesia using isoflurane in oxygen delivered via a face mask and Ayre’s T-piece provides rapid induction in most cases and is the method of choice for induction and maintenance of anaesthesia (Vogelnest 1999; Holz 2002; Booth 1994). Induction with 4–5% isoflurane and oxygen flow rate of at least 1 L/min (200 mL/kg body weight) reducing to 2% isoflurane for maintenance is recommended. In smaller species such as the feather-tailed glider and the eastern pygmy possum an induction chamber may be used with a mask used for maintenance. However, most clinicians prefer masking as animals may become distressed in induction chambers (A Olsson pers. comm. in R. Johnson and S. Hemsley, 2008).

8.2.2 Physical Examination

The physical examination may include any of the following:

<table>
<thead>
<tr>
<th>Body Condition</th>
<th>This can be assessed by muscle palpation in the area over the scapula, spine and temporal fossa or by examining the base of the tail and allocating a condition score (Jackson, 2007).</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature</td>
<td>this is usually between 35 – 36° C taken via the cloaca</td>
</tr>
<tr>
<td>Weight</td>
<td>Record and compare to previous weights. Trends in weight are a good general indication of the animal’s state of health, provided age, sex and geographical location are taken into account. Animals in captivity should be weighed monthly to indicate trends.</td>
</tr>
<tr>
<td>Pulse Rate</td>
<td>The rate varies greatly with species, decreasing with the increasing body size. The rate is taken over the femoral artery or direct heart rate.</td>
</tr>
<tr>
<td>Respiratory Rate</td>
<td>Monitor via auscultation of the lungs. Rate will vary greatly among species of gliders, with rate increasing with decreasing body size.</td>
</tr>
<tr>
<td></td>
<td>Normally 16-40 breaths per minute at rest in sugar gliders (Booth, 1999), so expect more breaths per minute in Feathertail Gliders.</td>
</tr>
<tr>
<td>-----------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
</tbody>
</table>
| **Eyes**  | Should be clear, bright and alert  
Normal bilateral papillary light response  
Normal corneal reflex  
Should not have any discharges |
| **Cloaca**| Should be clean, check for faeces around the cloaca.                                                                 |
| **Pouch** | Check the condition of the pouch  
Check whether lactation is occurring by milking teats  
If pouch young are present, record sex, stage of development, weight if detached from the teat and measure to determine age from growth curves if available. |
| **Males** | Check testes – size (length, width, depth) and consistency (firm but not soft)  
Extrude the penis and assess |

**Figure 8.2**  
Feathertail Glider pouch during a physical examination (Photo courtesy of W Reilly, 2011)
8.3 Routine Treatments

There are a number of routine treatments and procedures that can be utilised to maintain your animal’s health and well-being. These can be broken down into Daily, Weekly, Monthly and even Yearly.

Daily
- Head Counts and record numbers
- Distant Examinations during cleaning or feeding (see section 8.1 for detail). If loose or unusual faeces is present, collect sample and send to vet for a faecal test (Be sure to note any unusual faeces or behaviour in the daily records).

Weekly
- Physical examinations of each individual

Monthly
- Weighing each individual and recording

Half Yearly*
- Faecal samples of individual or as a group are collected and tested for potential endoparasites

* Faecal samples should be collected at a MINIMUM of every 6 months. In larger collections 6 months is easiest to ensure all individuals in the collection are monitored for internal parasites. The more frequent faecal samples are collected and tested, the more closely the collection can be monitored for internal health.

8.4 Known Health Problems

Gliders can suffer from a number of problems both in the wild and in captivity. The majority of parasites and diseases that have been recorded as listed below.

Ectoparasites
Ectoparasites such as fleas, ticks and mites do not seem to be a problem with captive populations of Feathertail Gliders, particularly if housed in a nocturnal house. This being said, there are a number of ectoparasites that could potentially affect the Feathertail Glider (particularly if you as the keeper come into contact with a number of possum and glider species) and as such deserve mentioning.

- The stick-fast flea *Echidnophagia myrmecobii* frequently infests common brushtails and ringtails; heavy infestations may cause anaemia in juveniles.
- The paralysis tick *Ixodes holocyclus* is a frequent parasite of the common brushtail. Fleas and ticks are treated with selamectin (6 mg/kg topically once). Ticks can be removed physically.
- The Petaurus genus is parasitised by mites of the *Guntheria* and *Petauralges* Genera (Jackson 2007).
- *Sarcoptes scabei* has been known to cause mange in common brushtails and common ringtails (Munday 1988; Skerrat et al. 1998).
- The mite *Trichosurolaelaps crassipes* causes irritation and alopecia of the lower back of common brushtails but can also be found on normal possums. Hair loss around the head, ears and extremities also occurs.
Visible observation or a skin scraping followed by a microscope examination is the best method of identifying parasites. Once determined, the appropriate treatment may be administered. Gliders and possums can be treated with acaricides, carbaryl powder (50g/kg) topically and in the nest box to control mites. Injectable ivermectin also controls a range of ectoparasites.

Ensuring good hygiene protocols and routine examinations of your animals best prevents ectoparasites. Also, by quarantining new arrivals, you can help to prevent potential introduction of ectoparasites.

**Endoparasites**

Endoparasites rarely cause clinical disease in possums and gliders (ARWH 2005). *Bertiella trichosuri*, an anoplocephalid cestode parasitising the intestine of common brushtails is often an incidental finding at necropsy. There appears to be increased susceptibility to infection with this parasite in suboptimal habitats (Booth 1994). Parasites from the *Bertiella* genus have also been detected in the common ringtail (Beveridge 1985). Infestation with the liver fluke *Fasciola hepatica* has been reported in common brushtails (Whittington, 1982). A variety of nematode parasites including *Marsupiostrongylus minesi*, *Trichostrongylus axei* and *T. colubriformis* inhabit the gut of possums and gliders and rarely cause disease. Although routine worming of captive and rehabilitating animals is not generally required, regular faecal checks and worming as indicated is a useful control strategy. A range of anthelmintics can be used if indicated.

**Dental Disease**

Tooth root abscesses and periodontal disease occur in captive and pet gliders and possums, more commonly when young are in the transition stage from milk to solid food. They are also common in adult sugar gliders, and some clinicians believe that the disease is associated with poor husbandry, overcrowding and stress (R Woods pers. comm). In possums and gliders the processes do not usually extend beyond periodontal disease, unlike the more extensive condition of lumpy jaw (necrobacillosis) seen in macropods (L Vogelnest pers. comm). The primary pathogens involved in possums have not been identified. Periodontal disease may be associated with sinusitis in gliders, leading to a decreased appetite and weight loss. Prevention of periodontal disease is largely based on feeding a diet based on natural feedstuffs, but avoiding abrasive material. Treatment is based on cleaning of affected but essentially sound teeth, extraction of more severely affected teeth and the administration of systemic antibiotics, e.g. clindamycin 11 mg/kg bid for 2–3 wk or until signs resolve. Severe tooth wear may lead to emaciation in elderly animals, particularly common ringtails (K Bodley pers. comm.) (Vogelnest and Woods, 2008).

**OBESITY**

Obesity can be a problem with gliders, particularly with high sugar diets or overfeeding of leadbeaters mix. Routine weight checks and dietary monitoring can prevent this from occurring.
**Dermatological Diseases**

Bacterial and fungal skin disease is common. Mycotic dermatopathy involving yeasts (*Candida spp.*) and mixed bacterial infections, often including *Pseudomonas aeruginosa*, has been seen in feather-tailed gliders. Gastric yeast overgrowth is not uncommon in debilitated feather-tailed gliders (Vogelnest and Woods, 2008) and hand-reared possums and gliders, particularly under suboptimal husbandry conditions or while on antibiotic therapy. *Candida spp.* predominately invade squamous epithelium, consequently, in the gastrointestinal tract the oral cavity, oesophagus, stomach and cloaca are mainly affected. Animals affected ranged from juveniles to adults of both sexes. Accompanying disease conditions included pneumonia, pleuritis and sinusitis. Dermatitis, epidermitis, cellulitis, pyoderma, panniculitis and severe ulceration of the skin have been recorded in common ringtails, sometimes in association with fungal infection.

**Respiratory Diseases**

**Pneumonia**

Primary acute pneumonia has been diagnosed in juvenile and adult common ringtails. Acute aspiration pneumonia is a frequent finding in hand reared animals. Pulmonary infections occur frequently in Feathertail Gliders (Vogelnest and Woods, 2008). Johnson and Hemsley (2008) describe two Feathertail Gliders that also suffered concomitant sinusitis.

**Sinusitis**

Sinusitis occurs frequently in some glider species, predominantly in captive animals. It is more frequent in older animals and in conjunction with other disease processes. Dental attrition, periodontal disease and lower respiratory tract disease are also common findings.

Often the best medicine is prevention, so in order to maintain the health and well being of your animals it is best to maintain simple hygiene and day-to-day procedures. From my experience, by doing this you can minimise the potential problems before they occur. If they do occur, by maintaining a detailed routine inspection of all your animals, you can often fix the problem before it becomes untreatable.
8.5 **Quarantine Requirements**

Newly received animals should be quarantined to prevent contact with existing animals until their health has been evaluated. Veterinary staff should perform the following procedures if appropriate:

- Physical examination
- Clinical and laboratory tests for disease
- Treatment for internal and external parasites
- Evaluation of age, sex, and teeth.
- Marking for permanent identification

Animals already in the exhibit may need to be isolated from time to time if they are known to be, or suspected of, carrying a disease. Separate quarantine facilities will be necessary for these animals. Quarantine should be at least 30 days and this varies depending on the disease and severity of it (Jackson, 2003). Individuals should remain in quarantine until they have passed three consecutive clean faeces.
9 Behaviour

9.1 Activity

All *Acrobates* spp. are nocturnal, meaning they spend most of the day asleep and are active at night.
Both species are arboreal, meaning they live off the ground in trees. They will spend a large amount of their time gathering nesting material such as feathers and bark, particularly in summer and autumn, just before they enter torpor. Eastern Pygmy-possums will spend a large part of their active time foraging for nectar, seeds, and fruits.

**TORPOR**

Torpor is the state of decreased physical activity in an animal and is usually characterised by the reduced body temperature and rate of metabolism in the individual. It is sometimes known as temporary hibernation.

Torpor is only a state of hibernation, and is usually only short-term. This means that a Feathertail Glider will sleep for most of the day, maybe only waking up for only an hour or so. In this state the gliders body temperature drops to almost the same temperature as the air around it, therefore conserving energy. The body does not shut down completely - metabolism, heart rate, and body temperatures are only reduced. The complete psychological state of the animal is only slowed down. The Feathertail Glider curls up in a tight ball with its nose tucked into its chest.

Torpor is often used to help animals survive during periods of colder temperatures, as it allows it to save the amount of energy that would normally be used to maintain a high body temperature. Whilst Feathertail Gliders are in this state of hibernation, no food or water is required. However in a captive environment, a bowl of fresh water should always be available to gliders. These gliders may wake up every day for a very short period of time, or may sleep for a couple of days.

Keepers should be constantly monitoring the time it spends sleeping and when it becomes active. An increase in diet is needed in autumn in preparation for torpor. A very small bowl of food should be placed inside the enclosure, not necessarily everyday though, just for when he wakes up every now and then. It is a natural instinct for a glider to eat more before the winter months. It will put on a lot of weight and this is sufficient enough to keep him going throughout winter. By observing the body condition and size of a Feathertail Glider, keepers should be able to decide how much food to place in enclosures, and when.
9.2 Social Behaviour
The Feathertail Glider is a highly social animal and can be kept in a number of groupings. From my experience, bachelor groups and female groups work well if breeding is required to be monitored/prevented. I have also observed large social groups of mixed sexes being housed successfully. In these cases there were at least 3-4 females to males to reduce aggression towards one another through sexual competition. In all cases, plenty of nest boxes were provided so that should an individual be singled out, they still have a box they can seek refuge.

9.3 Reproductive Behaviour
Not much is known in terms of the actual courtship of Feathertail Gliders. However, it is known that these species are highly polygamous and in many cases numerous males can father a single litter. It has been found that for reproduction to occur, correct numbers and ratios must be met. From my observations, reproduction occurs more often and successfully when the species are kept in high group numbers, with the ratio favouring females (usually at least 3-4 females per males).

9.4 Bathing
In the wild, Feathertail Gliders will not bath or swim. As such there is no need for any body of water to be provided in a captive environment for this purpose. Drinking water should be provided in a shallow bowl or drip bottle. It is recommended that browse pots should not contain water as Feathertail Gliders are likely to drown if they fall in. Alternatively, a browse pot cap, or simply ensuring that the browse pot is never left full of water without browse whilst present in the exhibit can minimise and prevent potential death from drowning.

9.5 Behavioural Problems
Generally speaking, Feathertail Gliders in captivity do not show any undesirable or stereotypic behaviours.

While it can be said that there are no common behavioural problems or negative stereotypic behaviours in the Feathertail Glider, it is important for keepers to learn the behaviours of individual animals within their collection. Individuals can develop problems due to boredom, changes in the environment, or changes to their social group.

**Stereotypic Behaviour**: a behaviour that is repeated and possibly negative. For example, excessive self-grooming, howling, barking, pacing, squawking, and unusual movements such as swaying or head bopping (not the case in some species i.e. lizards).

**N.B. It is important to be sure it is not a natural behaviour or characteristic to that particular species.**
Feathertail Gliders are capable of a variety of vocalisations, just like other possums and gliders. They can vocalise loudly when provoked, but show little to no aggression towards individuals or keepers. There has been recent thought that the vocalisations of *A. pygmaeus* may vary greatly from that of *A. frontalis*, with recording and study currently being researched (pers. comm.).

Feathertail Gliders are capable of biting when placed under stress, are uncomfortable, or are in pain while being handled. This, however, rarely occurs and it is not normally painful to the recipient of the bite.

9.6 Signs of Stress

Signs of stress are not easily seen within the *Acrobates* spp.. As a small animal, they have an already high heart rate and respiratory rate. Knowing the ‘normal’ respiratory rate of your animals is important, as an increased rate may be a signifier of stress.

If an animal has fallen ill, it is often as a result of stress that will reduce the animal’s immune system. A sick glider with no obvious cause of infection or illness may be a result of a stress-related incident. It is important to isolate any possible causes of stress to minimise potential ill health. Other signs of stress could be identified as a stereotypic or undesirable behaviour such as any of the aforementioned behaviours (e.g. excessive self-grooming).

9.7 Behavioural Enrichment

Before an animal may be exhibited, it is important to ensure that both the physical and behavioural requirements of the animal are addressed.

Environmental enrichment can be described as a mean of enhancing the environment of captive animals to provide more stimuli through alterations in the physical environment. Through the implementation of enrichment items and toys, as well as other various activities, we as keepers can encourage natural behaviours that satisfy both an animal's physical and psychological requirements (Forsdick, 2010).

When providing environmental enrichment items or activities the following questions regarding safety must first be considered:

- Can the animal be caught, entangled, or trapped inside the item?
- Can the item be used as a weapon to hurt conjoining animals?
- Will the item aid in the animals escape?
- Can the item fall on the animal?
- If the item is eaten or chewed, will it harm the animal?
- Can the animal be cut, pinched or otherwise injured by the item?
Included below are the instructions to make a HANGING MOBILE FEEDER that could be used for Feathertail Gliders (or any possums/gliders for that matter). The hanging mobile feeder should be hung from the ceiling of the enclosure away from perches and branches. The aim of the enrichment item is to encourage gliders to jump or glider from their perches to the feeder. As the mobile is suspended and light in weight, the branches should sway and move even with the smallest touch.

**Materials**
- Assorted branches – 3 branches
- 5 M of rope (not synthetic as it may be chewed)
- Screws with eyelets.
- Small nails.

N.B. A dead Elder branch was used, as it is very light weight and non-toxic should it be consumed.

**Instructions**
- Cut the branches to the appropriate size (in this example the branches were approximately 600mm in length, the longest branch is cut in half).
- Drill holes in both ends of the two longest branches.
- Drill holes in the middle of the two shortest branches.
- Smaller holes are drilled at even intervals along the length of all branches (this will allow browse and blossoms to be pokes in during feeds).
- Thread the rope through the hole at the end of the big branch, through the middle of the the smaller branch, and finally through the end of the bottom branch, ensuring that as the rope is past through each hole a knot is tied to prevent the branch from moving.
- Repeat the threading of the rope through the other branches at the other end, ensuring a knot is tied after passing through each branch.
- Screw eyelets into the end of two of the smaller middle branches (these allow you to attach the nectar feeders, as well as hang any enrichment items from).
- Nails can be hammered in at any location to allow fruit to be spiked.
Figure 9.1 The completed Hanging Mobile Feeder. Note that if the two ends of the rope are used and threaded through, you can remove the need to cut the rope into multiple lengths (All photos regarding enrichment feeder are own photos).

9.8 *Introductions and Removals*

The most important thing to remember when introducing any animal is to take it slowly. For some species, introductions may take a long time and may be potentially dangerous for either the new comer, or the existing individuals. In some cases you may find this the case for both.

When a new individual is received at a captive facility, remember to always put in place your institutions quarantine procedures and protocols before it comes into contact with any individuals. This can minimise and prevent the spread of disease and is important to all good animal husbandry.

The Feathertail Glider can be quite flighty but is generally a calm animal that is tolerant of others sharing its space, food, and next box. The introduction of a new individual to the group is not a difficult task, but care should be taken when introducing a new animal into an environment or group. Individuals may initiate a fight at first, but generally they will settle relatively quickly and easily without aggression involved.

When an animal is removed from an enclosure but aimed to be reintroduced (such as during a vet check or treatment) there should not be any problems with aggression upon reintroduction to the group. If there are problems between individuals there are two solutions offered by Forsdick (2010) that may fix the issue:

- remove the 'problem' animal from the group for a period of time and then reintroduce again. In doing this, the social dynamics will mostly likely change. eg. The male may not be dominant when reintroduced.
Husbandry Manual for the Feathertail Glider

- Remove ALL animals, change the exhibit and furnishings, and reintroduce again. This principle applies to most, if not all species of animals.

To reintroduce individuals to a group, all members should be collected up and given a light sprinkling and covering of talcum powder to provide a neutral smell. Nest boxes and furniture should also be new so as to provide a clean slate during the reintroduction.

9.9 Intraspecific Compatibility

In the wild, Feathertail Gliders are community animals and are very social, especially around the breeding seasons. This can be seen in captivity also in regards to the *A. frontalis* that are housed at Taronga Zoo. The education centre currently houses 3 males as a bachelor group, while the nocturnal house currently keeps 3 males and 14 females in a breeding group. Males show little to no aggression when females are around or if housed in same sex groupings. Bachelor groups were made up of individuals that were previously housed together and as such are used to each other. The presence of multiple nest boxes with the males also helps to minimise the potential of aggression over resting spots.

9.10 Interspecific Compatibility

Feathertail Gliders are very social and until recently were believed to be a single species. Housing *A. pygmaeus* with *A. frontalis* should not cause too much harm among the species (due to the fact that in many facilities, individuals from this species could have very well have been housed together without realising – this could also explain why some institutions have had difficulty in breeding Feathertail Gliders). It is however difficult to distinguish between the two species without a keen eye. As such, housing single species is recommended.

Many zoos and wildlife parks are moving towards multi-special exhibits to achieve an ecosystem rather than habitat display. As such, there are a number of species that could potentially be housed with Feathertail Gliders. It is important to note that you should not house other arboreal species with the Feathertail gliders as competition for trees, food and nesting boxes could cause potential harm to your animals (particularly as the Feathertail Glider is the smallest of the possum and glider species). Non-arboreal species such as echidnas, and other small macropods could be utilised with caution. Feathertail Gliders are known escape artists and as such care would need to be taken when servicing the exhibit and other species that are housed.

9.11 Suitability to Captivity

The Feathertail Glider is commonly kept in captivity. It is a common species in the wild throughout the east coast of Australia. When housed in correct conditions, these animals are easily suited to a captive life. As they are nocturnal, they should be displayed in a reverse day/night cycle exhibit, otherwise viewing during the day can be difficult and stressful to the animal.
10 Breeding

Figure 10.1 Twin joeys of a Feathertail Glider. These joeys were thrown by the mother after coming into care as a rescue animal. They were then returned to the pouch. Photo courtesy of W. Reilly (2011)

10.1 Mating System

The social organisation of Feathertail Gliders has been known to be ‘colonial’ (with up to 40 individuals within an area). They are not known to be territorial as is prevalent in other possum and glider species as evident by up to 29 individuals have been observed to share a den site (Lindenmayer, 2002). Mating systems have been noted in reference to group structures of individuals and not from genetic methods such as DNA fingerprinting. As such, these are not ‘set in concrete’ and may change due to the availability and quality of food resources. Feathertail Gliders have been known to portray evidence of promiscuity, in which members of one and often both sexes have multiple mates, polygynous in which a male mates with two or more females per breeding season, as well as portraying monogamy in which individuals have been known to have only one mate per breeding season (Lindenmayer, 2002).
10.2 Ease of Breeding

The Feathertail Glider breeds well at Taronga Zoo in large indoor enclosures (the Nocturnal House), however it has not bred very well anywhere else according to Jackson (2007: pg 234). The trigger appears to be having large enclosures with a large number of animals, i.e. more than 12-15 individuals. They then appear to breed until they reach the carrying capacity of the enclosure. Following the reach of carrying capacity, either breeding is reduced or natural mortality will increase.

10.3 Reproductive Condition

Possums and Gliders are generally placed in several categories depending on their reproductive status. The examination of reproductive status in medium to large species can be facilitated by putting them inside a transparent plastic tube and examining the pouch with an otoscope (Jackson, 2007).

10.3.1 Females

For females, the categories are as follows as per Jackson 2007.

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-parous</td>
<td>(Females that have never bred) – the pouch is small with no skin folds, and is clean and dry. The teats are very small</td>
</tr>
<tr>
<td>Parous</td>
<td>(Females that have bred previously but not presently) – the pouch is small but distinct, dry and dirty. The teats are slightly elongated</td>
</tr>
<tr>
<td>Pregnant</td>
<td>The pouch is pink in colour and glandular in appearance. Skin folds may be observed on the lateral margins.</td>
</tr>
<tr>
<td>Pouch young present</td>
<td>Pouch young are attached to the teat</td>
</tr>
<tr>
<td>Lactating</td>
<td>(Young absent from the pouch but are still suckling) – pouch area is large. Skin folds are flaccid and hair is sparse and stained. The skin is smooth and a dark pink, and the teats are elongated.</td>
</tr>
<tr>
<td>Post Lactation</td>
<td>Teats expressing only clear liquid and/or are regressing</td>
</tr>
</tbody>
</table>
Figure 10.2 A female Feathertail Glider’s pouch. Two joeys were thrown from the pouch and subsequently returned. Photo courtesy of W. Reilly (2011).

10.3.2 Males

In some species of glider, the males have a scent gland in the middle of their forehead and on their sternum (also found in brushtail possums) that becomes increasingly developed with age. The activity of the gland can be measured using the following scale from Millis and Bradley, 2001 in Jackson (2007)

<table>
<thead>
<tr>
<th>Activity</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Little or no activity</td>
<td>Little or no staining of the surrounding hair. Little or no hair loss over the gland area. No obvious gland product</td>
</tr>
<tr>
<td>Medium level activity</td>
<td>Some staining of the surrounding hair. Some loss of hair over the gland area. Waxy glandular products visible.</td>
</tr>
<tr>
<td>High activity</td>
<td>Much staining of the surrounding hair. Total loss of hair over the gland area. Glandular product prominent.</td>
</tr>
</tbody>
</table>

Testes can also increase in size during the breeding season. The testes should be measured by measuring the length, width and depth in millimetres. Testis volume can be calculated by using the equation $v = \pi/6 \times (\text{length}) \times (\text{width})^2$ (Jackson, 2007)
Figure 10.3 A male Feathertail Glider’s testes. Note this is normal size during non breeding season (own photo, 2012).

10.4 Techniques Used to Control Breeding
Some methods to control breeding could include but not limited to any of the following:
- the separation of the sexes
- regular pouch checking and subsequent pouch pulling

10.5 Occurrence of Hybrids
Due to the recent discovery of the split species into Acrobates pygmaeus and Acrobates frontalis, the occurrence of hybrids is unknown at this current point in time.

10.6 Timing of Breeding
Season of Birth: July-Jan (In northern populations breeding can occur at anytime of the year.)

10.7 Age at First Breeding and Last Breeding
- Females will become sexually mature at 12 months.
- Males will become sexually mature at 6-8 months.
  (Jackson, 2007)
10.8 *Ability to Breed Every Year*

The female Feathertail Glider can produce up to two litters a year.

10.9 *Ability to Breed More than Once Per Year*

The female Feathertail Glider can produce up to two litters a year.

10.10 *Nesting, Hollow or Other Requirements*

It is important to ensure enough nest boxes to house and facilitate the number of individuals housed. When gliders are required to breed, it is important to provide extra nest boxes than you would usually house within the exhibit.

As mentioned previously, population numbers within the exhibit appears to be key to the success of breeding, requiring more that 12-15 individuals. As previously mentioned, the number of nest boxes that should be supplied depends on the social dynamic of the group. Knowing your animals is key to ensuring there are enough nest boxes for your animals.

10.11 *Breeding Diet*

The introduction and increase in blossoming flowers appears to be a trigger to induce breeding (pers comm. Formerly Sydney Wildlife World Keeper 2011). No specific changes are required to the diet during breeding. An increase food may be required for lactating females.

10.12 *Oestrous Cycle and Gestation Period*

The oestrous cycle and gestation period for the Feathertail Glider is not known in full. For the species of gliders that are known, the oestrous cycle typically lasts between 21-30 days. Gestation length is remarkably similar and does not appear to follow any pattern between taxonomic group or body size, and therefore generally ranges between 15-30 days. Feathertail Gliders are capable of embryonic diapauses and as such, their cycle will change depending on whether the pregnancy is following a second cycle and as such will be ‘paused’. The extended duration of the gestation period will be based on lactation cycle as well as the presence or absence of trigger food such as blossoms.

10.13 *Litter Size*

The Feathertail Glider is known to have 2-4 joeys.

10.14 *Age at Weaning*

Feathertail joeys are usually weaned at age 3-4 months.
10.15 **Age of Removal from Parents**

Once the joeys have been weaned they can be removed from their parents. Removal from parents is not necessary for either species as the social structure permits large numbers of individuals.

10.16 **Growth and Development**

Developmental Stages as listed in Lindenmayer (2002).

<table>
<thead>
<tr>
<th>Developmental Stage</th>
<th>Days after birth</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>First detachment from teat</td>
<td>n/a</td>
<td>-</td>
</tr>
<tr>
<td>Left in the nest</td>
<td>50-60</td>
<td>-</td>
</tr>
<tr>
<td>Eyes Open</td>
<td>70</td>
<td>-</td>
</tr>
<tr>
<td>Weened</td>
<td>95-110</td>
<td>-</td>
</tr>
<tr>
<td>Adult Size at sexual maturity (grams)</td>
<td>110 +</td>
<td>110-240 g</td>
</tr>
</tbody>
</table>

**NOTE:** weight of joeys prior to weaning is unknown due to the fact that if pouch checked, the mother is highly likely to throw her joeys (Parrott, 2012, pers. comm.).
Figure 10.4 Growth Charts for the Feathertail Glider (Acrobates pygmaeus) in Birth Date Determination in Australasian Marsupials (Bach, 1998). Note this may include *A. frontalis* due to date of publication.
Figure 10.5 Feathertail joeys that were found in the pouch of a dead mother. These joeys would not be viable for hand rearing. Photo courtesy of W. Reilly (2011).
Artificial Rearing of Mammals

Artificial rearing of an animal is not just limited to a keeper hand rearing an animal. There are various scenarios in which this would take place and as such, various considerations that need to be addressed before deciding which path to take. Some of these different methods can be outlined in the following depending on the various reasons.

An animal may require assistance in rearing if the animal:
- is orphaned
- is rejected by the mother
- is inexperienced
- is to be used for educational purposes
- is injured
- has some form of sickness or deformity
- was rescued from the wild
- is experiencing bullying from others

If any of these scenarios arise, there are a number of techniques that can be utilized and are preferred BEFORE attempting to hand rear the animal entirely on your own. For example:

1. Let the parents do it. Don’t be tempted to interfere. Monitor the situation and provide anything extra they may need.
2. Help the parents (e.g. doing some of the feedings)
3. Foster the young (to another member of the same species, e.g. aunt or sister.)
4. Cross fostering (Different species)

What ever is decided, keepers must be certain that it is in the animal’s best interest for survival. As such, a care program should be developed and researched to include:

- The nutritional requirements, such as food dictated by breeding and growth patterns,
- appropriate environment,
- The teaching of animals to catch their own food,
- providing socialisation opportunities with other animals and
- providing animals with materials to create their own living environment.

Housing

When housing any animals for artificial rearing it is important to keep a sterile and quiet environment to provide the best possible upbringing of the young. For Australian marsupials, stress is a major factor that can often lead to death. As such it is important that you have a special room for hand rearing. This room should:
Husbandry Manual for the Feathertail Glider

- Be a secure, quiet area away from children and other animals,
- Be able to maintain a hygiene regime easily,
- Be escape proof,
- Be safe from potential dangers that may injure the animal.

As most possums and gliders are born in pairs or trios, it is best to replicate what occurs in the wild. As such, most possums and gliders are best raised in groups. If you only have the individual, a surrogate should be used for it to feel secure and safe.

Most possums are best raised in groups. This replicates the wild where there will normally be around 3 other young in the pouch. It may also help with the ‘lack of socialisation’ risk that may appear later on if not correctly socialised.

11.2 Temperature Requirements

Pouch young are unable to thermoregulate adequately and require supplementary heating at earlier stages of rearing. Furless young should be kept at 34 – 36°C and then gradually lowered to 30°C. Temperature is important for Feathertails as they enter torpor during the cooler months. Heaters should be thermostatically controlled to avoid hyperthermia and hypothermia (Vogelnest, 2008).

Temperature and humidity should be regulated with the use of a humidicrib or alternately, commercially available bird hot boxes with a thermostatically controlled heat source and humidity provided via an open container of water in the box (Vogelnest, & Woods, 2008).

11.3 Diet and Feeding Routine

Low lactose formulas available for possums and gliders in Australia include:

- Di-Vetelact (Sharpe Laboratories)
- Wombaroo (Wombaroo Food Products) and
- Biolac (Biolac Milk products)

Biolac offers several formulas within the one brand, increasing the total solids (fat and protein) content as dietary requirements change as they develop and come out of the pouch. Biolac M100 is recommended. M150 and M200 should not be used on possums. (http://www.biolac.com.au/possum.htm)

Two stages of Wombaroo possum milk are available, <0.8 and >0.8. <0.8 is for young that have not yet emerged from the pouch. >0.8 is for young that have exited the pouch and it is higher in fat and lower in protein. (Vogelnest, L; Woods, R 2008)

The formula required depends on the stage of development. According to the manufacturer, the possum milk replacers are suitable for all species of possums and gliders (Vogelnest, L; Woods, R 2008). Milk powder/ formulas should be kept in seal proof containers in the fridge to avoid bugs gaining access and potentially ruining the...
entire bag.

### 11.4 Specific Requirements

The skin of unfurred and slightly furred young should be kept moist by using Sorbelene cream (not with added glycerine). This will ensure that the skin does not become dry and cracked. Baby oil does not appear to be absorbed. It tends to stay on the skin surface where it rubs off and is absorbed by the liner bag fabric (Jackson, 2003). Another product that I have found to be very successful and low irritant is Papaw ointment such as Lucas’ Papaw Ointment (pictured right [http://www.lucaspapaw.com.au/]).

It is important to warm the joey before feeding otherwise there is a greater risk of inhalation pneumonia. If the joey is really cold, place it in a warm water bath and dry off rather than putting in a hot box (Jackson, 2003).

You must stimulate or toilet your joey before and after each feed so as to ensure the joey is ready for the feed. Care needs to be taken particularly with unfurred joeys. Gently lay the joey on its back, cupped in your hand and hold the tail away with your finger. Wet a soft tissue or cotton swab with warm water and gently brush across the cloaca. Brushing across will generally stimulate the joey to urinate, while brushing from the tail towards the head will encourage and stimulate faeces (Reilly, 2010) Be careful not to over stimulate the cloaca as this may result in a prolapsed cloaca and may require hemorrhoid cream as treatment (Reilly, pers comm. 2012).

As stress is a major issue in regards to hand rearing any animal, it is important the following is address:

- Keep noise to a minimum
- Don’t over handle the animal and
- Maintain high standards of hygiene. (Jackson, 2003)
11.5 Data Recording

When any animal is brought into a collection or for hand-rearing, its sex and approximate age according to growth charts needs to be recorded.

ANY INFORMATION YOU RECEIVE SHOULD BE RECORDED!

During the hand-rearing process, it is important to regularly record information and observations that could become vital down the line. This information serves several purposes including providing important background information such as food consumption which will assist veterinarians reach a diagnosis if the animal becomes sick or fails to grow or gain weight. It also allows a comparison with growth curves to assess progress and to establish other growth curves that do not exist for other measurements. (Jackson, 2003)

The following information should be recorded on a daily basis:

- Date
- Time when the information is recorded
- Body weight to the nearest 1g (prior to feeding and after)
- General activity and demeanor
- Characteristics and frequency of defecation and urination
- Amount (g) of different food types offered (mL if on milk feed)
- Food consumption at each feed
- Veterinary examinations and results (if and when obtained)

The developmental stages and measurements should also be recorded on a weekly basis if possible (Jackson, 2003; refer to growth chart in Fig 10.3 from previous chapter).

11.6 Identification Methods

Again, it is up to your personal opinion as to which method of identification should be used. Jackson (2003) suggests that Feathertail Gliders should not be microchipped until they are full-grown and as a general rule, should not be microchipped if under 10g in weight. As such, diagnostic features of the individuals should be noted to compare if raising more than one individual.
11.7 Hygiene
Maintaining a high level of hygiene is critical to the survival of a young possum.

The following was taken from Stephen Jackson (2008), *Australian Mammals: Biology and Captive Management*:

“Emphasis needs to be placed on the following:

- Maintain a clean pouch lining at all times. Older joeys can be trained to urinate on newspaper by keeping a piece with the smell of urine on it.
- Maintain personal hygiene by washing and disinfecting hands before and after handling the joey. Use antibacterial solution for washing hands with furless joeys, as their immune system is not well developed.
- Wash hands between feeding different joeys.
- Use boiled water when making up formulas for very young joeys.
- Clean spilt milk formula, faeces and urine from the joey’s skin and fur as soon as possible, and then dry the animal. If the fur becomes hard from milk, wash it under warm tap water and dry thoroughly.
- Wash all feeding equipment in warm soapy water and sterilize it in a suitable antibacterial solution such as Halasept or Milton, or boil it for 10 minutes. Once sterilized, the equipment should be rinsed in cold water.
- Many carers store teats and bottles in the fridge after they have been disinfected.
- Only heat up milk once and then discard the leftovers.
- Contact with other animals should be avoided unless you are sure they pose no health risk.
- Stimulate to toilet before or after feeding. As with other marsupials, toileting can be done by the application of warm water to the cloaca using cotton wool to stimulate urination and defecation, which allows the animal to keep drier and warmer in its pouch.
- If furless, cover the joey’s pouch after each feed.”

11.8 Behavioural Considerations
Behavioural considerations are important to think about when hand rearing most species. Some particular groups of animals, for example primates are more likely to develop various behavioural problems.

Some of the risks associated with the hand rearing of young include:

- Imprinting,
- Lack of socialization,
- Infection and low immune system, and
- Acquisition of abnormal behaviours for the species.

Take care that the joey that is being hand reared does not become too attached to the raiser. This will make the weaning process much more difficult and could result in
problems later in life. Raising several individuals together and minimalising handling of
them will help them to socialise properly and reduce these problems. (Jackson, 2003)

From my experience, Feathertail Gliders are not known to become too attached or
develop behavioural problems relating to imprinting.

11.9 Use of Foster Species

Foster species have not been readily used to date with any species of possums. However, brushtail possums have been transferred to other mothers of the same species
of similar age (Jackson, 2003).

Feathertail Gliders can be quite finicky in regards to their young and will quite often
pouch pull and throw their own young as a result of stress. This has been the case with
numerous individuals involved in WIRES rescues (Reilly, 2011, pers. comm.) and as
such cross fostering within the species is not suggested at the risk of the joey dying. If
considered viable, hand rearing should take place to ensure the survival of the individual.

11.10 Weaning

When ready for weaning, the Feathertail Gliders should be provided with an increase in
solid foods. If slow to wean, it can be encouraged by slightly reducing the amount of milk
while providing the solid food. It is important to keep a close eye on weight to ensure
weight is not being lost to quickly.

| General rule for weaning: decrease formula by 5% each week (providing the joey is
gaining weight at a minimum of 5-10% per day) |
<table>
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<td>(Jackson, 2003)</td>
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Feathertail Gliders are usually weaned around 3-4 months of age and should be given
flowers plants, finely chopped up soft fruits such as watermelon, grapes, rock melon etc
as well as several milliliters of leadbeaters mix. At 3 months of age, start to introduce the
solid food and access to flowering plants and monitor their activity and feeding closely. Once solids are being readily taken, start reducing the milk by the recommendation listed
above.

NB Water should be provided at all times during the weaning process to prevent
dehydration. Water supplied could contain supplements such a lectade.
Leadbeaters mix (Forsdick, 2010)

- 2/3 cup warm water
- 1 boiled egg (no shell)
- 2/3 cup honey
- 1/2 cup high protein baby cereal.

Method:
- Mix honey and water together
- Mix egg in with blender
- Add baby cereal and blend until smooth.
11.11 Rehabilitation and Release Procedures

Animals may come into your care at any stage of their life. For joeys and juvenile, the aforementioned section in hand rearing may be relevant. In some cases however, the animal may be anywhere in age from a young adult to a senior. In any case, a plan of release needs to be addressed prior to any rehabilitation taking place. There is no point in rehabilitating an animal if you have not considered the options for the animal.

Rescue → Release options → Rehabilitation → Release

The rehabilitation options for the animal should be based on the release options available.

Rescue

The actual rescue of the glider could involve a number of situations. Generally when an animal comes into care it has already had initial contact with a member of the public. In the case of Feathertail Gliders, these rescue calls are usually in response to a “native mouse” or “rat rescue”. In my experience, cases have involved the animal already being contained in a shoe box or similar holding container as a result of direction by the wildlife rescue phone coordinator.

Release Options

Before an animal can be rehabilitated, you must decide what you want for the animal: is the animal going to be release, or will it become part of the collection.

If you decide the animal is to be released back into the wild, there are a number of considerations that must be made:

- Is the initial site of contact suitable for the animal to be re-released into?
- Is the animal likely to come back into care if released into the same environment?
- Is there an alternative site in which you can release the animal into (that complies with your local National Parks legislations and policies)?

The following needs to be considered in regards to the release site:

- What is the animal’s home range and social hierarchy within the release site?
- Are there already established populations and whether this will impact on the release of your animal into the already existing populations?
- Are there already established populations of possible predatory species?
- Is there access to food and water?
- Are there enough tree hollows or other nesting areas available in the area?

There are also a number of hazards that need to be addressed in relation to potential release sites and whether a site is deemed suitable.
The rehabilitation of the animal might also include hand-rearing depending on the situation the animal is in. If this is the case, all of chapter 11 needs to be considered. In most cases, however, rehabilitation will refer to an adult, or sub-adult preparing itself for its final release.

Jackson states “if an animal to be hand reared is to be maintained in captivity there is not as much need to rehabilitate it except in some species where it may affect their effectiveness of breeding. If breeding is not an issue, then the presence of a highly manageable, calm animal is generally of great benefit in captivity and generally results in better displays as they are more active”.

In *Australian Mammals: Biology and Captive Management*, Jackson (2003) writes:

*If a possum or glider is to be released back into the wild it is important to take every measure to maximize its chances of survival. Measures include:*

- **Minimise the amount of handling by proving milk in a bowl as soon as the animal can lap and leaving solid food for it to consume while you are not there. It is very important that the possum does not associate you with food; rather, encourage it to explore its enclosure to find the food that you have left there.**
- **Make as little fuss as possible over the possum or glider to reduce the bonding it males with you. Placing the food in the enclosure at dusk before the animal emerges for the evening can facilitate this as they will not associate food with humans.**
- **Provide as much native food as possible, after dark, so that it becomes used to eating natural food items**
- **Provide lots of climbing opportunities to allow the animals to increase their climbing skills and fitness.**
- **Do not place the food on the enclosure floor as this encourages them to come to the ground where they are more likely to be taken by predators.**
- **Do not rear them near to domestic animals as this habituates them to predators, which they need to be wary of in the wild.**
- **Pair them up, if possible, when they are young with another possum of the same species and approximately the same age.**

Prior to release, the possum should be introduced to other possums so that they can learn socialisation skills. More nest boxes than individuals should be supplied as well as natural nesting material to allow them to practise nest building (Jackson, 2003).
There are a number of final considerations that need to be addressed prior to the final release of the animal. This includes pre release conditioning as well as the decision of how the animal should be released. These can be broken down into two categories; hard release and soft release.

**Pre-release Conditioning**

This involves anything that you deem necessary to provide the animal with a fighting chance of survival in the wild once they are released. The following are some forms of pre-release conditioning:

- Minimising human contact
- Providing food that would be found at the release site
- Encourage physical fitness by supplying plenty of opportunity to climb and glide
- Play predator sounds and ensure the animal is reacting correctly
- Supply the animal with numerous nestboxes that are to be released with the animal
- Buddy up the animal prior to release to ensure animal socializes with own species

**Hard Release**

This refers to releasing the animal back into the wild straight away after rehabilitation has been completed. Usually this involves the possum being released back to the initial point of contact with a nest box to provide initial shelter and housing until the animal has successfully re-entered the territory.

Unfortunately in a lot of cases, survivorship of hard releases is relatively low with many individuals falling prey to cats and foxes. This is evident in a number of studies involving the release of 100 hand raised ringtail possums (Jackson, 2007)

**Soft Release**

This method of release is preferable when possible as it provides the animal with the best chance of survival following rehabilitation. In this situation the animal is provided with shelter not just in the form of a nest box, but also a retreat from predators, as well as a supply of food. An example of a soft release could be moving an aviary to the release site and supplying the animal with food from the surrounding trees. Once the animal is accustomed to the new area, simply open up a chute allowing them to come and go as they please.

In many situations, soft releases are deemed successful when the animal is no longer returning to the aviary for assistant feeds. This however, should not be deemed the case as it could easily be evident of an unsuccessful release. As such, animals should be monitored where possible to ensure that the animal is living well in the area. Monitoring in Feathertail Gliders could include tattooing the tail of the animal to ensure that if the animal was to come back into care it can be identified. Routine nest box checks in the area is a good way of finding out if the Glider is still in the area.

**NOTE: Due to the sheer size of the animal, visual monitoring can be difficult.**
Release Nest boxes
It has been suggested that rather than the typical nest box (as described earlier), they seem to favour wedge-shaped boxes, similar to that of a microbat, with a bottom entry (Franks and Franks, 2003: 19). As such, following is a nest box design suitable for either soft or hard release (Franks and Franks, 2003:44-45). Always remember to be considerate of the placement of the box, as well as the method of attachment when placing in tree for release.
FEATHERTAIL GLIDER
Acrobates pygmaeus

Size adults
males 66-71 mm HB
8-9 g
females 67-75 mm HB
9-12 g

Measures

Weights - Use with caution

- HB, Males, F & W
- HB, Females, F & W
- Head, Ward
- Tail, Males, F & W
- Tail, Females, F & W
- CR, Fleming & Frey

Males, Fanning and Watkins
Females, Fanning and Watkins
12 Acknowledgements

This list highlights the important people who have assisted me in the compilation of this manual. It is not a complete list, and for those I have not mentioned, know your help has not gone unseen.

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13 References


14 Bibliography


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15 Glossary

Alopecia  
a condition in which some or all of the hair is lost from certain areas of the body. This can be a result of stress in some cases.

Arboreal  
living in the trees

Cloaca  
posterior opening that serves as the only opening for the intestinal, reproductive and urinary tracts

Drey  
nesting material collected and formed into a ball shape nest

Embryonic Diapause  
the ability to prolong and pause a pregnancy at the blastula level when conditions are not considered adequate. As reproduction uses a large level of energy, it is more beneficial to have ideal conditions in the form of food availability, weather conditions, and even the lack of competition from previous offspring.

Exudate  
any fluid that filters from the circulatory system into lesions or areas of inflammation. This can include sap from plants

Non-parous  
relating to animals that have not given birth yet

Papillary  
relating to the nipple or teat

Parous  
having given birth one or more times

Potagium  
membrane of skin, in gliders this is the gliding membrane

Tapetum lucidum  
layer of tissue within the eye reflecting back visible light, e.g. eye shine

Torpor  
a state of physical and physiological inactivity, especially in excessive heat or cold. Usually involves daily torpor with minimum body temperatures that are metabolically defended (body temperature ranges from 11-28 °C)
APPENDIX 3 – Animal House MSDS
APPENDIX 4 – Neutrasan MSDS