

Husbandry Manual  
For  
Squirrel Glider.  
*Petaurus norfolcensis*



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# TABLE OF CONTENTS

<b>1</b>	<b><u>INTRODUCTION</u></b> .....	<b>5</b>
<b>2</b>	<b><u>TAXONOMY</u></b> .....	<b>7</b>
2.1	<u>NOMENCLATURE</u> .....	7
2.2	<u>SUBSPECIES</u> .....	7
2.3	<u>RECENT SYNONYMS</u> .....	7
2.4	<u>OTHER COMMON NAMES</u> .....	7
<b>3</b>	<b><u>NATURAL HISTORY</u></b> .....	<b>8</b>
3.1	<u>MORPHOMETRICS</u> .....	8
3.1.1	<i>Mass And Basic Body Measurements</i> .....	8
3.1.2	<i>Sexual Dimorphism</i> .....	8
3.1.3	<i>Distinguishing Features</i> .....	9
3.2	<u>DISTRIBUTION AND HABITAT</u> .....	9
3.3	<u>CONSERVATION STATUS</u> .....	10
3.4	<u>DIET IN THE WILD</u> .....	11
3.5	<u>LONGEVITY</u> .....	13
3.5.1	<i>In the Wild</i> .....	13
3.5.2	<i>In Captivity</i> .....	13
3.5.3	<i>Techniques Used to Determine Age in Adults</i> .....	13
<b>4</b>	<b><u>HOUSING REQUIREMENTS</u></b> .....	<b>15</b>
4.1	<u>EXHIBIT/ENCLOSURE DESIGN</u> .....	15
4.2	<u>HOLDING AREA DESIGN</u> .....	15
4.3	<u>SPATIAL REQUIREMENTS</u> .....	15
4.4	<u>POSITION OF ENCLOSURES</u> .....	15
4.5	<u>WEATHER PROTECTION</u> .....	15
4.6	<u>TEMPERATURE REQUIREMENTS</u> .....	15
4.7	<u>SUBSTRATE</u> .....	15
4.8	<u>NEST BOXES AND/OR BEDDING MATERIAL</u> .....	16
4.9	<u>ENCLOSURE FURNISHINGS</u> .....	16
<b>5</b>	<b><u>GENERAL HUSBANDRY</u></b> .....	<b>17</b>
5.1	<u>HYGIENE AND CLEANING</u> .....	17
5.2	<u>RECORD KEEPING</u> .....	17
5.3	<u>METHODS OF IDENTIFICATION</u> .....	17
5.4	<u>ROUTINE DATA COLLECTION</u> .....	18
<b>6</b>	<b><u>FEEDING REQUIREMENTS</u></b> .....	<b>19</b>
6.1	<u>CAPTIVE DIET</u> .....	19
6.2	<u>SUPPLEMENTS</u> .....	20
6.3	<u>PRESENTATION OF FOOD</u> .....	21
<b>7</b>	<b><u>HANDLING AND TRANSPORT</u></b> .....	<b>22</b>

7.1	<a href="#"><u>TIMING OF CAPTURE AND HANDLING</u></a>	22
7.2	<a href="#"><u>CATCHING BAGS</u></a>	22
7.3	<a href="#"><u>CAPTURE AND RESTRAINT TECHNIQUES</u></a>	22
7.4	<a href="#"><u>WEIGHING AND EXAMINATION</u></a>	23
7.5	<a href="#"><u>RELEASE</u></a>	23
7.6	<a href="#"><u>TRANSPORT REQUIREMENTS</u></a>	23
7.6.1	<a href="#"><u>Box Design</u></a>	23
7.6.2	<a href="#"><u>Furnishings</u></a>	24
7.6.3	<a href="#"><u>Water and Food</u></a>	24
7.6.4	<a href="#"><u>Animals per Box</u></a>	24
7.6.5	<a href="#"><u>Timing of Transportation</u></a>	24
7.6.6	<a href="#"><u>Release from Box</u></a>	24
<b>8</b>	<b><a href="#"><u>HEALTH REQUIREMENTS</u></a></b>	<b>25</b>
8.1	<a href="#"><u>DAILY HEALTH CHECKS</u></a>	25
8.2	<a href="#"><u>DETAILED PHYSICAL EXAMINATION</u></a>	25
8.2.1	<a href="#"><u>Chemical Restraint</u></a>	25
8.2.2	<a href="#"><u>Physical Examination</u></a>	25
8.3	<a href="#"><u>ROUTINE TREATMENTS</u></a>	26
8.4	<a href="#"><u>KNOWN HEALTH PROBLEMS</u></a>	27
8.5	<a href="#"><u>QUARANTINE REQUIREMENTS</u></a>	29
<b>9</b>	<b><a href="#"><u>BEHAVIOUR</u></a></b>	<b>30</b>
9.1	<a href="#"><u>ACTIVITY</u></a>	30
9.2	<a href="#"><u>SOCIAL BEHAVIOUR</u></a>	30
9.3	<a href="#"><u>REPRODUCTIVE BEHAVIOUR</u></a>	30
9.4	<a href="#"><u>BATHING</u></a>	31
9.5	<a href="#"><u>BEHAVIOURAL PROBLEMS</u></a>	31
9.6	<a href="#"><u>SIGNS OF STRESS</u></a>	31
9.7	<a href="#"><u>BEHAVIOURAL ENRICHMENT</u></a>	31
9.8	<a href="#"><u>INTRODUCTIONS AND REMOVALS</u></a>	32
9.9	<a href="#"><u>INTRASPECIFIC COMPATIBILITY</u></a>	32
9.10	<a href="#"><u>INTERSPECIFIC COMPATIBILITY</u></a>	32
9.11	<a href="#"><u>SUITABILITY TO CAPTIVITY</u></a>	32
<b>10</b>	<b><a href="#"><u>BREEDING</u></a></b>	<b>34</b>
10.1	<a href="#"><u>MATING SYSTEM</u></a>	34
10.2	<a href="#"><u>EASE OF BREEDING</u></a>	34
10.3	<a href="#"><u>REPRODUCTIVE CONDITION</u></a>	34
10.3.1	<a href="#"><u>Females</u></a>	34
10.3.2	<a href="#"><u>Males</u></a>	34
10.4	<a href="#"><u>TECHNIQUES USED TO CONTROL BREEDING</u></a>	35
10.5	<a href="#"><u>OCCURRENCE OF HYBRIDS</u></a>	35
10.6	<a href="#"><u>TIMING OF BREEDING</u></a>	35
10.7	<a href="#"><u>AGE AT FIRST BREEDING AND LAST BREEDING</u></a>	35
10.8	<a href="#"><u>ABILITY TO BREED EVERY YEAR</u></a>	35
10.9	<a href="#"><u>ABILITY TO BREED MORE THAN ONCE PER YEAR</u></a>	35

10.10	<a href="#">NESTING, HOLLOW OR OTHER REQUIREMENTS</a>	35
10.11	<a href="#">BREEDING DIET</a>	35
10.12	<a href="#">OESTROUS CYCLE AND GESTATION PERIOD</a>	36
10.13	<a href="#">LITTER SIZE</a>	36
10.14	<a href="#">AGE AT WEANING</a>	36
10.15	<a href="#">AGE OF REMOVAL FROM PARENTS</a>	36
10.16	<a href="#">GROWTH AND DEVELOPMENT</a>	36
<b>11</b>	<b><a href="#">ARTIFICIAL REARING OF MAMMALS</a></b>	<b>38</b>
11.1	<a href="#">HOUSING</a>	38
11.2	<a href="#">TEMPERATURE REQUIREMENTS</a>	38
11.3	<a href="#">DIET AND FEEDING ROUTINE</a>	39
11.4	<a href="#">SPECIFIC REQUIREMENTS</a>	39
11.5	<a href="#">DATA RECORDING</a>	40
11.6	<a href="#">IDENTIFICATION METHODS</a>	40
11.7	<a href="#">HYGIENE</a>	40
11.8	<a href="#">BEHAVIOURAL CONSIDERATIONS</a>	41
11.9	<a href="#">USE OF FOSTER SPECIES</a>	41
11.10	<a href="#">WEANING</a>	41
11.11	<a href="#">REHABILITATION AND RELEASE PROCEDURES</a>	42
<b>12</b>	<b><a href="#">ACKNOWLEDGEMENTS</a></b>	<b>44</b>
<b>13</b>	<b><a href="#">REFERENCES</a></b>	<b>45</b>
<b>14</b>	<b><a href="#">BIBLIOGRAPHY</a></b>	<b>47</b>
<b>15</b>	<b><a href="#">GLOSSARY</a></b>	<b>50</b>
<b>16</b>	<b><a href="#">APPENDIX</a></b>	<b>52</b>

# 1 Introduction

## General Features

Group- The Petauridae family is a group of gliders that is restricted to the smaller furry-tailed gliders of the genus *Petaurus*, the closely related Leadbeaters possum (*Gymnobelideus*) and less certainly the striped possums.

A little more than half the species occur in New Guinea and three are restricted to that island. However many species occur in south-eastern Australia and one in Tasmania.

The gliding Petaurids resemble the Greater glider but are distinguishable in that their gliding membrane extends wrist (not elbow) to ankle. The Striped possums have several specializations for feeding on wood boring insects and in the structure and use of their incisors and forefeet. Female Petaurids have a well-developed forward facing pouch with two teats.

The Squirrel Glider is a nocturnal marsupial that is of medium size. It is similar to the Sugar glider (*Petaurus breviceps*), and is indeed closely related to it, though the Squirrel glider weighs about twice as much as the Sugar glider. (Strahan, 1995). It is grey or light grey in the upper body, with white or cream under parts and a distinctive dark mid-dorsal stripe. It also has a patagium running from the forefoot to the hind foot, and the tail is weakly prehensile (McKay, 1989).

It is a diprotodont, with a dominant, pair of larger lower incisors-used for puncturing the bark of trees to obtain sap (McKay, 1989). It moves by scaling a tree and then gliding to a distance of up to 90 meters to the base of another tree (Strahan, 1995; DSE Victoria).

Due to the difficulty in finding and observing the Squirrel glider little research has been done, and there is little public awareness. More research needs to be done to improve conservation practices and provide better management in captivity.

There is a link between “dieback” and insect attack in forest remnants, and the depletion of bird and arboreal mammal populations, including Squirrel gliders.

Squirrel gliders are eaten by the Powerful owl and barking owls; so the ability of the Squirrel glider may determine the fate of these species.

The Squirrel glider also plays a part in the pollination of plants including Banksias, Acacias (wattles) and Eucalypts.

The Squirrel glider has been made more vulnerable to pests such as foxes and cats due to land clearing and habit fragmentation

More research is needed to better manage, and improve existing habitat (Strahan, Ed. 1992)

## **OCCUPATIONAL HEALTH AND SAFETY (OH&S)**

The Squirrel glider is classed as innocuous as it will not cause serious harm to humans. Care should be taken as they can bite, and scratch with the sharp claws.

### **PEST CONTROL**

- Rats and mice can be controlled by:-
  - Keeping feeding areas clean from spent food, and faeces.
  - Laying poisons and setting traps
  - Keeping food storage areas clean and feed containers secure.

Rats can be kept out by using small gauge wire mesh on enclosures.

- Snakes: the best way to control bests is to control mice and rats as these will attract them.
- Foxes: - Keep pests such as rabbits out as these attract foxes.  
Traps can be used to catch foxes.  
Foxes can be shot (Licence needed).  
Poisoned baits can be used to control foxes.

## 2. Taxonomy

### 2.1 Nomenclature

**Class:** Mammalia

**Order:** Diprotodontia

**Family:** Petauridae

**Genus:** *Petaurus*

**Species:** *norfolcensis*

(Strahan, Ed. 1992)

### 2.2 *Subspecies*

None.

### 2.3 Recent Synonyms

*Petuarus sciurus.*

(Strahan, R Ed.1995)

### 2.4 Other Common Names

- Flying Squirrel.
- Sugar Squirrel.
- Squirrel Flying Opossum.
- Squirrel Flying Phalanger.
- Flying Possum.

(Fleay, D. (1947). Gliders of the Gum Trees. Bread and Cheese Club, Melbourne in Strahan, R. Mammals of Australia. Ed. 1995)

### 3 Natural History

#### 3.1 Morphometrics

##### 3.1.1 Mass And Basic Body Measurements

# Head and body size: - 180 to 230mm. (average 210mm).

#Tail length: - 220 to 300mm. (average 270mm).

# Body weight: - 190 to 300gm. (average 210gm).

##### 3.1.2 Sexual Dimorphism

There is sexual dimorphism in Squirrel Gliders, the male being larger than the female. Squirrel gliders are larger in the southern parts of their range where temperatures are cooler. Larger individuals metabolise somatic stores at a lower weight –specific rate (longer fasting endurance) and therefore experience higher survivorship during seasonal resource shortages (Darren. G. Quin, Andrew. P. Smith, Tony W. Norton)

**Table 1.** Mean body weights (Standard deviation (s.d), where this was previously provided) of males and females, dimorphic ratio (mass of males divided by mass of females), sex ratio and mating system of squirrel gliders.

Body mass +- s.d. (g)		Dimorphic ratio (M: F)	Mating system sex ratio (M: F)	Locality
Male	Female			
250	221	1.1	Polygynous	North-eastern Victoria.
213+-14	192+-17	1.1	Polygynous	Central-north coast of New South Wales.
197	177	1.1	Polygynous	South east Queensland.

Quin.D.G, Smith.A.P and Norton.T.W 1996; Rowston, C. 1998

### 3.1.3 Distinguishing Features

The Squirrel Glider and Sugar Glider (*Petuarus breviceps*) are very similar in appearance. They differ in that the Squirrel glider has longer narrower ears and a bushier tail and the Squirrel glider is almost twice the size. The two gliders can be reliably told apart as the squirrel glider has larger incisors.

The Squirrel glider is also similar in appearance the endangered Mahogany glider (*Petuarus gracilis*). Until 1993 the Mahogany glider was thought to be a sub species of the Squirrel glider. The Squirrel glider is smaller than the Mahogany glider (head/body 218-265mm; tail 300-380mm; weight 255-410g). The Squirrel glider also lacks the brown or honey tones of the underparts of the Mahogany glider. (Oxford University Press 2001).

### 3.2 Distribution and Habitat

The Squirrel Glider is restricted to Australia. It is sparsely distributed along the east coast and immediate inland districts from western Victoria to north Queensland. The squirrel glider inhabits dry sclerophyll forest and woodland and is generally absent from rainforests and closed forests (Menkhorst ed. al.1988, in Threatened species information NPWS. The species is found as far back as the Grampians in Victoria and the Pilliga and the Coonabarabran areas. The Squirrel glider prefers dry sclerophyll forests and dry woodlands in south eastern Australia and wet sclerophyll forests in Northern New South Wales and Queensland. In Victoria the Squirrel glider lives in the dry forest woodlands and riverine plains, but are absent from the coastal forests.

There is a gap in the distribution of the Squirrel glider where the Mahogany glider occurs. The reason for is not known though it is suspected that it may be due to the Mahogany glider being larger in size (Lindenmayer, D. Ed. 2002.).

**Figure 1.** Distribution of the Squirrel glider (Left) and distribution of Mahogany glider (Right). From Lindenmayer, D. Ed. 2002)



There is a significant drop in the abundance of Squirrel gliders when the vegetation strip width drops below 40 meters (Van der Ree 2000). In Victoria, the dry forests usually occur below 300 meters in elevation (Bennett et al, 1991, in Blue Mountains Wilderness Service). This is similar to a study carried out in South-east Queensland where no gliders were detected in altitudes higher than 240 meters above sea level (Rowston, C. 1998), suggesting that only low altitude remnants are suitable for Squirrel gliders. Squirrel gliders are least abundant in low forests and woodlands less than 17 meters in height with a high percentage of canopy cover (Smith.A.P, Murray. M, 2003), and is most widespread in forests and woodlands with an over story of winter flowering Eucalypts or an under story of Banksia or pinnate-leaved Acacias. Smooth barked Eucalypts are preferred by the Squirrel glider over other Eucalypt species as smooth barked Eucalypts grow faster forming hollows more readily, and attract a greater variety of invertebrates (Quin 1995).

### **3.3 Conservation Status**

Nationally the squirrel glider is classed as rare near threatened.

In Victoria the Squirrel glider is listed as “endangered” (Natural Resources and Environment 2000) because of the extent of decline within its geographic range and the vulnerability of surviving populations to further loss and degradation of its habitat.

In New South Wales it is classed as Vulnerable and rare on schedule 2 of the threatened species conservation act (TSC) 1995.

The squirrel glider was listed as vulnerable because: -

Its population and distribution have been severely reduced

It faces severe threatening processes.

It has poor recovery potential.

It is an ecological specialist that is dependant on specific types of food and habitat.

In Queensland under the (NCA) Nature Conservation Act 1992 the Squirrel glider is listed as common.

The Squirrel glider once occurred in isolated pockets in the South East corner of South Australia but is now presumed extinct in South Australia under the South Australian National Parks and Wildlife Act 1972

The IUCN (International Union for Conservation of Nature and Natural Resources) status for the squirrel glider is Low Risk (LR), near threatened (NT).

A recovery plan for the Squirrel glider is currently being prepared.

### 3.4 Diet in the Wild

Squirrel gliders are insectivore / exudivore that feed on exudates such as Acacia and Eucalypt sap and gum, nectar, honeydew and manna to satisfy their energy needs, and on arthropods and pollen for protein.

#### **Invertebrates**

Invertebrates are actively searched for, and consumed at all months of the year. They accounted for over 70% of feeding observations (Rowston, 1997) Arthropods consumed by the squirrel glider are of the following Orders Coleoptera (Beetles), Lepidaptera (Moths and Butterflies), Hemiptera (galls and lerps), (suborders Sternorrhycha (scale insects, aphids and mealy bugs) that are utilised for the honeydew they produce, and Heteroptera (bugs and hoppers), Diptera, Hymenoptera (wasps, beetles and ants), Isoptera (termites), and Arachnida (spiders, scorpions) (Rowton, 1997). (Lerps), galls and Thysanoptera (Thrips).

#### **Nectar and Pollen**

It is important that habitat contains at least one type of winter flowering Eucalypt with a under story of flowering shrubs such as Banksias and Acacias.

If there is an abundance of winter flowering trees such a Banksias Acacias and Eucalypts, this food source is utilised and less time is spent foraging for arthropods (Sharpe, D. and Goldingay, R. 1998)

#### **Other Exudates**

Squirrel gliders obtain sap from Eucalypts and gum from Acacia species by making and maintaining incisions in the bark of tree trunks and main branches.

See appendix for list of known food plants of the Squirrel glider.

Bottom left: Eucalyptolyma lerps on Eucalypt leaves (from Tim Low. Ed. 1989).

Bottom right: Acacia gum on the trunk of the green wattle (Photo by Matthew Trudgeon.



### **Other Dietary Components**

Squirrel gliders are known to be opportunistic feeders of vertebrates.

A Squirrel glider has been observed killing a nesting Magpie-Lark (*Grallina cyanoleuca*) and eating its eggs (winter, J.W 1966. in Holland, G.J. 2001). (Holland 2001) described an adult female squirrel glider carrying young harass, and chase a common bronze wing (*Phaps chalcoptera*) away from its nest and proceeded to eat its eggs. Eggs are high in protein and rich in fat, which assists lactating gliders in their energy demands.

Squirrel gliders have been observed to feed on the fruit of the Tree Heath (*Trochocarpa laurina*) and Mistletoe spp. Seeds and arils of Acacias are also used as a food source (Rowston, C. 1998; Menkhorst, P.W, 1987; Sharpe, D.J, Goldingay 1998).

### **3.5 Longevity**

### 3.5.1 in the Wild

Squirrel gliders life span is 5 to 6 years of age in the wild. (Lindenmayer, Ed. 2002)

### 3.5.2 in Captivity

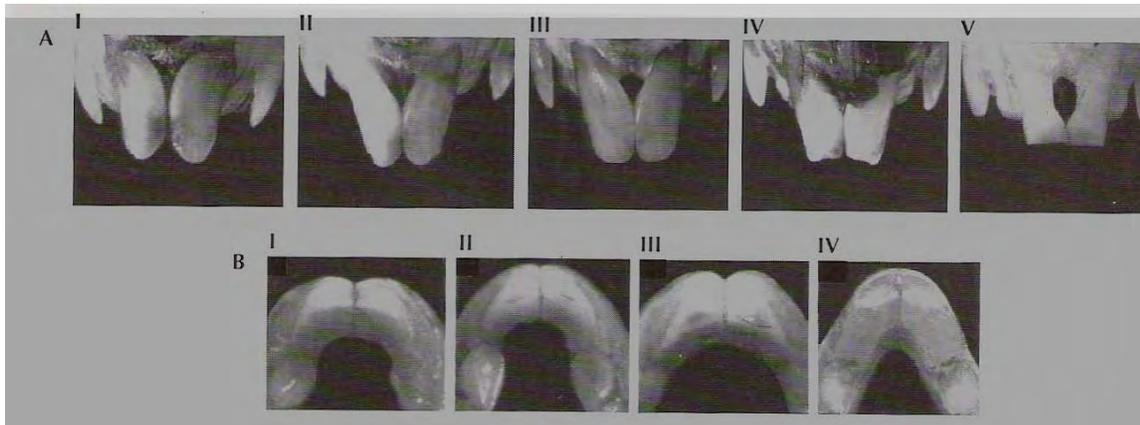
Squirrel gliders live for 5 to 6 years in captivity (David Lindenmayer, 2002) the oldest recorded at 11 years and 11 months. (Nowak 1999 in Girvin.M, Lundrigan.B. 2005).

### 3.5.3 Techniques Used to Determine Age in Adults

Patterns of growth and associated measurements such as body length and weight are used to determine age in juveniles. Once they have reached adulthood or have stopped growing this method is of limited use. In adults tooth wear of the upper and lower incisors is studied to determine age. (Lindenmayer.D). Gliders of Australia. Patagium colour, scent gland development are also used in conjunction with tooth wear to determine age

**Table 2. Estimated weight per age of squirrel gliders**

Age (yr)-	Less than 1	1 to 2	2 to 3	More than 3
Male	Less than 190 (g)	More than 190(g)	More than 210(g)	More than 210(g)
Female	Less than 170 (g)	More than 170(g)	More than 190(g)	More than 190(g)



**Figure 3.** Typical wear patterns of upper incisors of squirrel gliders, showing the front view (a) and the ventral aspect (b). See table 3. For information on the age related to each tooth wear stage. (From Steve Jackson 2003)

**Table 3.** Age –estimation parameters of squirrel gliders.  
From Jackson, S. Ed. @003).

**Wear of upper incisors.**

Less than 1(yr): -None to slight (fig.1bl).

1 to 2 (yrs): - Slight to moderate sometimes cracked. (fig.1bll).

2 to 3 (yrs): - Moderate to heavy. Often cracked. (fig.1blll).

More than 3 (yrs): -Heavy to very heavy. Usually cracked. (fig. 1blV).

**Wear of lower incisors.**

Less than 1 (yr): - White no cracks.

1 to 2 (yrs): - Slight discoloration. Lateral cracks slight.

2 to 3 (yrs): - Orange discoloration, lateral cracks obvious.

Occasionally Chipped teeth in older animals.

Greater than 3 (yrs): - Orange discoloration, lateral cracks obvious.

Occasionally chipped teeth in older animals.

**Patagium colour.**

Less than 1 (yr): - White.

1 to 2 (yrs): - Cream-yellow.

2 to 3 (yrs): - yellow.

Greater than 3(yrs): - Yellow-orange.

**Frontal gland (males).**

Less than 1 (yr): - Not developed.

1 to 2 (yrs): - Partially to well develop

2 to 3 (yrs): - As above.

Greater than 3 (yrs): - As above.

**Pouch.**

Less than 1 (yrs): - Small and shallow with fine white hairs; teats 1mm long.

1 to 2 (yrs): - Larger and deeper than in females that had not bred.

Yellow/orange hairs with black scale. Teats greater than 1mm.

## **4 Housing Requirements**

### **4.1 Exhibit/Enclosure Design**

The Exhibit should be designed allowing the public to view the Squirrel gliders while still

allowing them to feel safe, secure and exhibit natural behaviour. The Exhibit should have an air lock included into the design to allow movement in and out of the exhibit while preventing the escape of animals. The Enclosure should be designed in such a way that any furnishings can be easily moved around and replaced.

The exhibit should also allow the keeper to perform good husbandry techniques with ease.

The Squirrel glider needs to be displayed in a nocturnal house for public due to their nocturnal behaviour.

## **4.2 Holding Area Design**

A suspended cage 4x4x10 meters in size. The floor is to be 3 foot off the floor (concrete). This is to allow waste to fall through to the floor reducing the risk of rotten food being eaten, help stop the spread of disease, and make it less likely to attract vermin. (Butler.S)

## **4.3 Spatial Requirements**

An enclosure that is to house a pair of squirrel gliders should be a minimum size of 3.7m long x 3.5m wide x 3m in height. An additional 1.5x1.5 meters should be added for each additional animal. (Jackson.S, Ed. 2003)

## **4.4 Position of Enclosures**

Squirrel gliders are often held in a nocturnal house. Outdoor enclosures should be built to face away from prevailing winds and poor weather. Nest boxes should be hung in a dark area of the enclosure.

## **4.5 Weather Protection**

Nest boxes should be positioned on wall in an area safe from wind and rain. The rest of the enclosure can be opened to allow good air circulation.

## **4.6 Temperature Requirements**

Squirrel gliders don't generally need heating unless low temperatures are sustained for weeks under five degrees Celsius (S.M. Jackson Ed.). Heat lamps can be used to stop them from going into torpor.

## **4.7 Substrate**

### **Nocturnal House.**

Pine bark 15mm in size (Annette Gifford) is then used as the substrate due to its durability, and aesthetic value

### **Holding Enclosure.**

Dolerite can be used as substrate in holding enclosures that are not suspended (Taronga Zoo).

## **4.8 Nest boxes and/or Bedding Material**

Dimensions of the nest boxes for the Squirrel glider are as follows.

Entrance- 7 to 9cm in diameter.

Depth- 15+cm

Floor- 20x30cm

½ inch plywood is used to build the nest box.

The roof the nest box should be made into a sliding door for easy access to allow keepers for to observe, catching and observe the gliders.

Grooves are made in the plywood on the inside at the front of the nest box so young gliders are able to climb out (University of Ballarat). Dry seagrass can be used for nesting material as it is easily cleaned and can be reused many times (Taronga Zoo). Eucalypt, Casuarina, and Leptospermum leaves should be supplied for use as nesting material. Jackson. S. Ed. 2003, Lindenmayer.D. Ed. 2002)

## **4.9 Enclosure Furnishings**

Squirrel gliders are very good climbers and rarely venture to the ground so an array of branches should be supplied. Sufficient space should be maintained to allow for gliding. It is highly recommended that fresh branches be supplied for the gliders to feel secure (Jackson 2003). Ropes made from natural fibres can be for climbing can be added to the enclosure (Butler, Sharon).

## **5 General Husbandry**

### **5.1 Hygiene and Cleaning**

# Every morning feed dishes should be collected. Food scraps and faecal remains should be picked up using a dustpan and brush. Clean water bowls and fill up with fresh drinking water (daily).

# Scrub down platforms and nest boxes as required.

# Replace browse weekly or when fresh browse is required.

# Every six months or as required undertake a complete substrate change. Before adding new substrate the enclosure is scrubbed out and disinfected. Gliders are to be removed by this is being done. (Per's obs).

### **5.2 Record Keeping**

It is important to keep records of health, condition and reproductive status of captive squirrel gliders.

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

Keeping records can contribute greatly to the husbandry of the species. It also allows the history of individuals to be transferred to other institutions and greatly facilitate a cooperative approach to data collection amongst institutions. In larger institutions ARKS (for general information on births, transfers and deaths), SPARKS (Breeding studbook for species) and MedARKS (veterinary information) are used. These systems have been developed by the International Species Information System (ISIS). (Jackson .S. Ed. 2003)

### **5.3 Methods of Identification**

# Passive integrated transponder (PIT). This is implanted between the scapulae of individuals, over 10g in body weight. This is an excellent method of identification but can be expensive if many animals are to be implanted.

This is a permanent method though care should be taken when they are implanted as they can track out. This can be avoided by sealing the entrance with tissue glue. (Vet bond) or similar fast setting adhesive. With this method of identification the glider will have to be captured.

# Tattoos. This has been used and is placed on the ears or behind the hind leg, but tends to fade with time. The ears of the squirrel glider are not that large so there is not much space to fit identification, and may still need to be caught for correct identification. (Jackson.S.Ed. 2003).

# Ear tags may be used but they can get caught on branches and tear ears. Ear tags can also be seen by the public.

# Visual identification is often difficult; however it is possible size, colour, sex and markings.

#### **5.4 Routine Data Collection**

Records that may be required to be kept as a part of research

And long-term studies are: - Growth rates.

Weights of gliders.

Blood biochemistry

Fertility and breeding

Changes in diet.

## 6 Feeding Requirements

### 6.1 Captive Diet

#### Healesville Sanctuary: Victoria

Ad Lib:

Water

Daily Diet (per animal)

1 piece of Eukanuba Pet food kibble

20g mixed fruit and vegetables – 10mm cube - avoid soft

Fruits

5ml Nectar mix

2g fly pupae

5g corn

1g sprouted seed

2 mealworms

- Nectar mix.
  - 900 ml warm water
  - 900 ml honey
  - 6 shelled hard-boiled eggs
  - 150 g of high protein baby cereal
  - 5 tsp Sustagen (vitamin supplement)

#### METHOD

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

#### Taronga Zoo: Sydney, New South Wales

Add Lib: Water

Daily diet:-

Banana/corn: 3grams

Apple 3 grams

Dog kibble: 1.5 grams

Grapes/kiwi fruit: 3 grams

Leadbeater's mix: 15 millilitres

Orange with skin 4 grams

Pear 2 grams

Papaya: 2 grams

Sweet potato: 3 grams

- Leadbeater's mix
  - 150 millilitres of warm water
  - 150 millilitres honey
  - 1 shelled boiled egg
  - 25 grams high protein baby cereal
  - 1 teaspoon vitamin/mineral supplement

**METHOD:**

Mix warm water and honey. Blend egg, and then gradually add water/honey mixture. Then blend in vitamin powder until smooth. Keep refrigerated until served.

Grevillea sp. (right) and Callistemon (right). Blossoms used as for gliders. Photos by Matthew Trudgeon.

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## 6.2 Supplements

### **Healesville Sanctuary: Victoria**

0.4g pollen grains - once per week

1.5g pet health food-10mm-cube-once per week

Cricket – 3-4 times per week

Acacia, eucalypts, other blossoms when available.

### **Taronga Zoo: Sydney, New South Wales**

Insects (mealworms, crickets)

### **6.3 Presentation of Food**

As Squirrel gliders do not like descending to the ground to feed they should be fed in stainless steel bowls, either on platforms or attached to branches. The bowls are 10cm in diameter and 5cm deep. (Taronga Zoo, Australian Native Mammals Division.). Instead of the fruit and vegetables being cut up into cubes, the same amount can be placed on nails or branches around the enclosure for increased activity and enrichment as gliders will look around the enclosure for the spiked food instead of just eating at the food bowls.

## 7 Handling and Transport

### 7.1 Timing of Capture and Handling

It is best not to handle squirrel gliders as it stresses the animals, and they can be difficult to handle. (Pers. Com. Wendy Gleen.)

Squirrel gliders are best transported while asleep in nest boxes. The entrance to the nest box can be covered and the whole nest box transported to the new location. (Pers com. Wendy Gleen).

### 7.2 Catching Bags

The larger sized calico bank bags are used in the capture of squirrel gliders. These catching bags are to be used inside out to prevent the animal from getting caught up in the stitching. Once in the bag they can be easily weighed and transported.

### 7.3 Capture and Restraint Techniques

Gliders can be transported from one enclosure to another by blocking the entrance to the nest box with a catching bag placing in the new enclosure. This method is used, as it is less stressful on the animal.

Squirrel gliders are best caught by first plugging the entrance to the nest box. Once the entrance is blocked place the nest box on the ground in a well-lit area. While carefully opening the lid reach and place the catching bag over the glider. Once caught squirrel gliders can be restrained by grasping the head and shoulders with one hand and the feet



Once caught Squirrel gliders can be restrained by grasping the head and shoulders with one hand and the feet and tail with the other. The photo opposite shows a Ringtail possum (*Psuedocheirus peregrinus*) being restrained. Squirrel gliders can be restrained in the same way. Photo by Steve Jackson in Jackson, S. Ed. 2003). Care should be taken when handling Squirrel gliders as they can bite and scratch. Leather gloves can be used though they can make it difficult to grasp the glider securely (Butler, S).

If the squirrel glider is free in the enclosure a hand net can be used.

It is best not to handle squirrel gliders as they will get aggressive and will stress easily.

The squirrel glider should be caught using a catching bag, and then manoeuvred so that the part of the animal to be studied is exposed while still covering its head. This will make the glider secure.

If necessary to restrain outside the bag they can be held spread out against a flat surface such as a table. While doing this head should be held firmly between two fingers to prevent being bitten (pers com. Paul Davies). This method is good as it is a more natural position for gliders

#### **7.4 Weighing and examination**

A useful technique for examining the squirrel glider involves using a transparent plastic tube and an otoscope (Roberts and Kohn 1991 In Steven Jackson, Ed.2003). This allows a clear view of the animals through the tube and confines the front limbs for examination. (Steve Jackson Ed. 2003).

The squirrel glider should be weighed using a catching bag that is hung by the scales. (Pers com. Wendy Gleen)

#### **7.5 Release**

Squirrel gliders are best released in a nest box if that is where they were first found. Alternatively they are released on the ground, branches or tree trunk.

### **7.6 Transport Requirements**

#### **7.6.1 Box Design**

Squirrel gliders can be transported short distances (several hours) in a nest box or catching bag (Jackson S.M. Ed 2003)

Whenever transporting by air they should be transported in a wooden box that complies with the International Air and Transport Association (IATA 1999) See Appendix 4 for IATA regulations.

Materials to be used are wood, metal, wire mesh and muslin or other light material.

Frame: Solid wood, screwed or nailed and glued with none toxic glue, metal or none 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.

#### **7.6.2 Furnishings**

Adequate clean soft nesting material should be supplied for insulation and to stop the gliders from rolling around excessively.

### **7.6.3 Water and Food**

When transporting in a box water can be supplied in a water container that has no sharp edges. Water can be supplied by placing a piece of clean sponge or rag and soaking it with fresh water (Jackson, S. Ed 2003).

### **7.6.4 Animals per Box**

Squirrel gliders are best transported separately.

Females with young should not be transported unless young have only just been recently born and are permanently attached to the teat.

When transporting squirrel gliders by air IATA regulations state that pregnant females or females suckling young are not to be transported.

### **7.6.5 Timing of Transportation**

Transportation is best carried out at the time when the gliders are sleeping.

### **7.6.6 Release from Box**

Once in the enclosure, open the bag or box, uncover the glider's head so it can see outside, and then leave it to exit when it is ready. The bag and box are then removed when the glider has fully emerged (Jackson. S.M. Ed. 2003).

## **8 Health Requirements**

### **8.1 Daily Health Checks**

Animals should be observed daily to spot any signs of ill health. It is important to know the normal behaviour of each group or individual, as deviation from this pattern will assist in identifying if there is a potential problem. The most appropriate time to do health checks is at feeding or when the enclosure is being cleaned. During these times, each animal in the enclosure should be checked and the following assessed

- Coat condition
- Fur on the enclosure floor or elsewhere suggesting fighting or mating
- Discharge from eyes, ears, nose or cloaca
- Appetite
- Faeces – number of pellets and consistency
- Changes in demeanour
- Injuries – including abrasions, swellings around the face, lameness and any asymmetry
- Presence and development of pouch young by observation of the bulge in the pouch (Jackson.S.M, Ed. 2003)

### **8.2 Detailed Physical Examination**

#### **8.2.1 Chemical Restraint**

If the squirrel glider is being hand reared it should be fasted for one hour prior to anaesthesia to prevent the potential for regurgitation of the formula. Sedation can be undertaken with diazepam (Valium) at 0.5 – 1.0 mg/kg given intramuscularly in thigh muscle area for minor procedures and handling (Volgenest, L. (1999); in Bryden, D.I, ed). Tiletamine/zolazepam (zoletil) is not recommended for squirrel gliders as it has implicated in the death of three healthy gliders. (Holtz 1992; Booth 1999 in Jackson S. Ed 2003). Inhalation via mask induction is preferred in squirrel gliders. Isoflurane is preferred for inhalation anaesthesia, although halothane in oxygen can also be used.

#### **8.2.2 Physical Examination**

Physical examination may include the following

- Body condition can be assessed by muscle palpation in the area over the scapular, spine, and temporal fossa or by examining the base of the tail.
- Temperature – usually 35 – 36 deg celcius, taken via the cloaca.
- Weight record and compare to previous weights. Trends in body weight give a good general indication of an 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.

- Pulse rate – normally 200 – 300 beats per minute at rest
  - Respiratory rate – normally 16 – 40 breaths per minute, monitored via auscultation of the lungs.
  - Fur – check for alopecia, ectoparasites, fungal infections or trauma.
  - Eyes – should be clean, bright and alert
    - Normally bilateral papillary light response
    - Normal corneal reflex
    - Should not have any discharge
  - Also check for the presence of lumps over the body and auscultation of lungs
  - Cloaca – Should be clean
    - Check for faeces around cloaca
  - \* Pouch – 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 teat and measure to determine age from growth curves, if available
  - \*Males – Check testes – size (length, width, depth) and consistency (firm, not soft)
    - Extrude penis and assess
    - Check the size and activity of the sternal gland and forehead gland.
- (Jackson. S, Ed. 2003)

### **8.3 Routine Treatments**

Treat when needed

Faecal floats are taken every six months to test for diseases (pers. com. Annette Gifford.)

### **8.4 Known Health Problems**

#### **# Ectoparasites**

**Cause: -**

\*Mites of the genera *Guntheria* and *Petauralges*

\*The flea - *Choristophylla tristis*

\*Trematode - *Athesmia sp.*

\* Ticks – *Ixodes sp.*

**Signs:** -

Generally seen on animal when captured, by excessive grooming, hair loss or inflamed skin.

**Diagnosis:** - Visual observations or a skin scraping and microscope examination to identify the parasites.

**Treatment:** - Treated with acaricides, carbaryl powder (50 g/kg has been used topically and in the nest boxes to control mites. Injectable ivermectin is also used.

**Prevention:** - Routine examination of the fur.

**# Endoparasites (worms)**

**Cause:** - *Parastongyloides sp.* (Nematoda)

- *Parastrongylus sp.* (Nematoda)

- *Parastrongylus sp.* (Nematoda)

- *Athesmia sp.* (Trematoda)

**Signs:** Not obvious unless diagnosed. May cause diarrhoea or ill thrift.

**Diagnosis:** Faecal floatation and the presence of eggs or proglottides (segments that make up the worms).

**Treatment:** Anthelmintics can be used without apparent side effects and include fenbendazole at a dose of 20- 50 mg/kg PO s.i.d. For 3 days, oxfendazole at a dose of 5 mg/ kg PO once only, and ivermectin at a dose of 200 ug/kg PO or subcutaneously once only.

**# Protozoans**

**Toxoplasmosis**

**Cause:** - The protozoan *Toxoplasma gondii* causes Toxoplasmosis after the ingestion of felid faecal material containing sporulated co cysts.

**Signs:** - Infection often apparent with clinical illness often in animals that are immunosuppressed or hand reared. The illness ranges from mild malaise to peracute mortality with other signs including depression, weakness, anorexia, pyrexia, dyspnoea, ataxia, hemiplegia, quadriplegia, coma, convulsions, muscle stiffness, diarrhoea, emesis, uveitis, and retinitis or cataract formation

**Diagnosis:** - Antemortem diagnosis of Toxoplasmosis is confirmed by serological testing to detect rising IgG *Toxoplasma gondii* titres. Direct Agglutination Test using a commercial kit Antigene Toxo-AD and microtiter plate reagents (bioMeriex SA, Marcy l’Etiol, France) are useful. Most commercial veterinary laboratories offer indirect hemagglutination inhibition for the detection of IgG. Indirect Fluorescent antibody tests may be used to determine serum IgM concentrations.

**Treatment:** - Drugs used to stop the replication of the parasite. Clindamycin

**# Fungus**

**Candida / Thrush**

**Cause:** - The fungus *Candida albicans*. It can result from antibiotic therapy causing candidiasis or thrush it also results less than adequate hygiene or stress in hand reared joeys.

**Signs:** - Diarrhoea which often has a foul yeast-like smell with a yellowish green and sometimes

frothy or curdled appearance.

- With oral thrush it can result in the mouth becoming sore, ulcers, and/or white plaques or crusting around the mouth and rust coloured crusty discharge.

**Diagnosis:** - Diagnosis is made through Gram stains of the faeces or oral cavity with high numbers of budding yeasts being used to confirm the diagnosis. The organisms are about half the size of a red blood cell and stain blue-purple. It should be noted that *Candida* is normally present in the gastrointestinal tract. Low numbers in faecal smears does not necessarily indicate a problem

**Treatment:** -Can be given Nilstat Oral Drops (Wyeth Ayerst for Woman's Health) or Mycostatin Oral Drops (Bristol-Myers squib Pharmaceuticals) at 0.1 – 0.5 ml/kg orally 3 times a day for over 3 – 5 days. Failure of a *Candida* associated diarrhoea to resolve nystatin provides an alert to concurrent diseases such as salmonellosis.

**Prevention:** - Frequently clean the glider so that excess milk formula or urine and faeces do not build up. It is also important to minimize stress, which reduces the animal's ability to fight infection. Refer to section 9.6 for signs of stress.

**Note:** To prevent the spread of disease high levels of hygiene should be maintained by picking up faeces and spent food. New arrivals should be placed in quarantine before entering the collection. Gliders that are sick or suspected to be sick are to be removed and placed in quarantine.

#### # Nutritional Osteodystrophy (hind limb paralysis)

**Cause:** Appears to be due to a calcium deficient diet that often only contains fruit and meat. Nocturnal animals are known to rely on gut absorption of Vitamin D3, rather than skin absorption of ultraviolet light to convert Vitamin D1 to D3. Diets should contain approximately 1% calcium, 0.5% phosphorous and 1500 IU/Kg of Vitamin D3 on a dry weight basis.

**Signs:** - Sudden onset of hind limb weakness or paralysis (Jackson.S.M.Ed.2003).

- Fractured bones, Tremors, Lethargy (ISGA, 28/2/2004)

**Diagnosis:** - Radiography of vertebral, pelvic, and long bones demonstrating osteoporosis. Spinal trauma is a differential diagnosis.

**Treatment:** - Cases identified early may respond to a high calcium, additional vitamin D3 diet and strict cage rest.

**Prevention:** - providing adequate calcium in the diet can prevent Hind limb paralysis. Insects fed out should be supplemented with calcium. Dusting the insects with calcium is less reliable than feeding (gut loading) high calcium diet 48 hours before they are fed out.

#### # Obesity

**Cause:** - Excess food consumption and the wrong diet that is too high in fat.

**Signs:** - weight gain and lethargy.

**Treatment:** - Difficult because they live in family groups. Feed a diet lower in nutrient and encourage the glider to exercise.

**Prevention:** - Feed a correct and balanced diet.

- Daily observations of animals and their feeding behaviour.

-Design enclosures to comply with EAPA standards and promote appropriate amount of exercise. Separation of obese animals from group is not a good option as it difficult to reintroduce gliders because of aggression, and when the glider reenters the group the problem will recur. (Pers com. Wendy Gleen).

(Jackson.S.M, Ed. 2003; ISGA 2004; Lindenmayer.D, Ed. 2002)

## **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.S.M, Ed. 2003).

## **9 Behaviour**

### **9.1 Activity**

The squirrel glider is nocturnal and is generally active from dusk until dawn. During the day gliders reside in their dens. Sixty percent of the gliders nocturnal activities are taken up with feeding/foraging. Squirrel gliders will forage in the middle and lower strata of the forest. Many observations occur between 25 – 35 meters above the ground (Blue Mountains Wilderness Service Pty Ltd). Squirrel gliders go into torpor when temperatures are low and in periods where food is scarce.

## 9.2 Social Behaviour

Squirrel gliders are colonial living in groups consisting of 2 to 9 individuals. They are polygynous with a dominant male, several females and their offspring. Sub dominant males may also be present.

The home range of the squirrel glider covers an area from 0.65- 8.55 ha. And movements tend to be greater for males than females as males are required to defend the group's home range. The home range of a family group is likely to vary with the availability of resources. Density as been estimated to average 0.43+/- 0.1 animals per hectare (Smith 1998) and 0.95 – 1.54 animals per hectare (Van der Ree, 2000).

Squirrel gliders are den swappers and the mean number of den trees used per individual was 5.3. Gliders averaged 4.9 days per den tree. (Van der Ree, 2000).

Squirrel gliders are territorial although their home range may overlap with other squirrel glider and or sugar glider home ranges.

Dominant males continually patrol territorial borders and scent mark to warn off rival males and other intruders.

Vocalisations used by Squirrel gliders are a throaty gurgle that is produced with an agonistic encounter (threat). Other vocalisations are a “squir” and a repeated “Nwarr”, and soft nasal grunts (Lyndenmayer.D. Ed.2002; Gervin.M, Lundrigan.B, in Suckling 1995). Juveniles hiss when separated from parents (Wood, L 2005).

## 9.3 Reproductive Behaviour

The mating season for the squirrel glider is from May till January. The mating behaviour for the squirrel glider is not known. Information is available on the sugar glider. It is the female glider that chooses witch male she will mate with and this is not always the dominant male. First the male approaches the female and rubs his forehead scent gland on her belly, if she accepts him, she then rubs her forehead on his belly, and they mate over a period of three days (Smith, E. 2004).

The ovulatory behaviour of the Mahogany glider (*Petaurus gracilis*) has been described by VanDyck, 1993. In Jackson. S.M, Ed. 2003). During this event the male produced a soft “chew-chew-chew” at which the female made immediate efforts to join him. The female sniffed the male's rump and then followed him up the tree to rest with him in the canopy. The two glided to a nearby tree where they curled up around one another. The male then lunged at the female and they copulated for approximately 23 minutes, during which time they both adopted a vertical head-down position on the trunk, with the male thrusting intermitted. The male grasped the female's dorsum in a similar fashion to that adopted by young back riding gliders that newly emerged from the pouch and he bit her on the neck until they separated. As the Mahogany and Squirrel gliders are closely related similar behaviour may occur.

## 9.4 Bathing

Squirrel gliders are not known to bathe (Jackson. S.M, Ed. 2003).

## **9.5 Behavioural Problems**

Squirrel gliders suffer little from behavioural problems.

## **9.6 Signs of Stress**

Acute stress can be associated with loud vocalisations, threats and attacks or excess urination or defecation Spielman 1994, in Jackson, S 2003 Ed). Gliders under stress may also be unusually active, moving around their enclosure (pers. Com. Paul Davies). Gliders suffering from heat stress lick their forelimbs to cool down, as they lack sweat glands over most of their body (Jackson, S.M. Ed. 2003)

## **9.7 Behavioural Enrichment**

Behavioural enrichment of squirrel gliders can include:

- Providing browse such as leaves flowers or gums.
- Providing live food, such as mealworms or crickets as activity feeds at times throughout the day. Insects can be placed in a short length of bamboo that has holes drilled in it to allow glider access. These are then placed on branches (Pers com. Annette Gifford)
- Placing food on branches (fruit spiked on branches) throughout the enclosure rather in one location in a feed tray.
- Provide nesting material such as stringy bark to promote nesting behaviour.
- Provide enough room in enclosure for gliding.
- House them with other terrestrial species as appropriate

## **9.8 Introductions and Removals**

When introducing new gliders to an established population all gliders can be moved to an entirely different enclosure, or talcum powder rubbed on all gliders to neutralise the scent of the group (pers com. Paul Davies).

## **9.9 Intraspecific Compatibility**

Male squirrel gliders can be housed together without any problems. If a female glider is introduced there will be aggression between the males. Female gliders can be housed together with no problems. Young gliders may have to be removed as there may be aggression towards them and they cannot disperse from the group.

### **9.10 Interspecific Compatibility thrush included.**

As squirrel gliders are arboreal and require large exhibits, they can be housed with other species in captivity. These species include short-beaked echidna *Tachyglossus aculeatus*, long-beaked echidna *Zaglossus bruijnii*, long-nosed bandicoots *Permeles nasuta*, eastern –barred bandicoot *Permeles gunnii*, long-footed potoroos *Potorous longipes*, long-nosed potoroos *Potorous triactylus* and brush-tailed bettongs *Bettongia penicillata*. Nocturnal birds such as Nightjars and Tawny frogmouths are generally not recommended to be housed with squirrel gliders as there likely to be aggression between them with is likely to the birds being preyed upon. (Jackson, S. Ed. 2003) Squirrel gliders have been known to attack and kill Australian magpie-larks *Grallina cyanolueca* Half -grown Guinea-fowl *Numida meleagris* in captivity.

Squirrel gliders and sugar gliders *Petaurus breviceps* have been successfully housed together, and it is probable that other *Petaurus species* could also (Jackson, S. Ed. 2003).

### **9.11 Suitability to Captivity**

Squirrel gliders can be easily kept in captivity despite being specialist feeders. They are moderately long lived and breed easily which makes them easier to manage. As they are nocturnal a nocturnal house with reverse cycle lighting is required for daytime public viewing. As long good husbandry is maintained the gliders should be relatively disease free.

Endoparasites can be transmitted between other species of gliders along with other diseases.

## **10 Breeding**

### **10.1 Mating System**

Squirrel gliders are polygynous, with a single male mating with more than one female per season

### **10.2 Ease of Breeding**

Squirrel gliders generally breed well in captivity and may breed at any time of the year.

### **10.3 Reproductive Condition**

#### **10.3.1 Females**

The female squirrel glider has four teats and the pouch opens anteriorly (Lundrigan, B. Givin, M. 2000)

- Nulliparous: no extension of teats, pouch muscles tight, few if any guard hairs, usually shorter and white in colour; no mammary gland activity.
- Non-parous female: teats extended, light pink in colour, but no milk produced; some guard hairs, deep red in colour remain in pouch area; pouch deep and muscles relaxed relative to nulliparous females; mammary glands not active.
- Pregnant females: pouch deepening with growth of deep Red Guard hairs, teats enlarged, deep pink in colour; mammary glands enlarged; no pouched young.
- Fixed lactation: young attached to teat; Pouch deep, much growth of deep Red Guard hairs.
- Free/late lactation: young not permanently attached to teat, deposited in nest while female forages.

#### **10.3.2 Males**

Males have a small scent gland in the middle of the forehead and on the sternum that becomes increasingly developed with age. The activity of the glands can be measured in the following scale:

- Little or no activity: little or no staining of the surrounding hair; little or no hair loss over the gland area; no obvious gland product.
- Medium level activity: some staining of the surrounding hair; some loss of hair over the gland area; waxy glandular products visible.
- High activity: much staining of surrounding hair; total loss over gland area; waxy glandular product prominent.

The male's testes can increase in size during the breeding season.  
(Millis, A.L. Bradley, A.J. 2001)

## **10.4 Techniques Used to Control Breeding**

Separation of sexes is main method used to control the breeding of squirrel gliders (Jackson, S Ed. 2003).

## **10.5 Occurrence of Hybrids.**

Hybrids have been observed between squirrel gliders and sugar gliders. A male Squirrel glider from Queensland and a female Victorian sugar glider have produced a fertile hybrid (Fleay 1947. in ed. Jackson S. 2003 Aust captive animal management). Zuckerman (1953) also reported a hybrid between a Squirrel glider and Sugar glider.

## **10.6 Timing of Breeding**

Breeding occurs from May to January. And can occur at any time of the year depending on the availability of food and other resources. Breeding normally coincides with an abundance of food.

## **10.7 Age at First Breeding and Last Breeding**

Both males and females are sexually mature at 12 months of age.

Gliders are able to breed throughout their life, peaking in gliders 2 to 3 years of age. (Quin, D.G. 1995).

## **10.8 Ability to Breed Every Year**

Squirrel gliders generally produce one litter per year with a mean litter size of 1.8-1.9 (Quin, D.J. 1995)

## **10.9 Ability to Breed More than Once Per Year**

Squirrel gliders are polyestrus and can breed twice a year if there is an abundance of food. The Breeding can take place twice a year as long as an abundance of high protein food is available. The annual natal rate per female is 2.3-2.4 young (Quin 1995)

## **10.10 Nesting, Hollow or Other Requirements**

A hollow in with an entrance of 7-9cm is required for young to be raised. Nesting material includes Eucalypt, casuarinas and leptospermum leaves should be supplied.

## **10.11 Breeding Diet**

No change in diet is required for breeding. (Pers comm... Annette Gifford)

## 10.12 Oestrous Cycle and Gestation Period

Squirrel glider has a gestation period of 20 days. Oestrous cycle is not accurately known. (Jackson, M. Ed.2003). In the closely related Sugar glider (*P. breviceps*) the gestation period is 16 days and the oestrous cycle 29 days. (Pasatta, J. 1999)

## 10.13 Litter Size

1 to 2 offspring per litter. The average litter size is 1.8 (Quinn 1995)

## 10.14 Age at Weaning

Young are weaned at 4 months of age.

## 10.15 Age of Removal from Parents

The mean dispersal age for juvenile squirrel gliders was 12.5 months of age (Quinn 1995)

This dispersal is a result of adult aggression towards the juveniles. Dispersal is enforced to keep the population at the correct carrying capacity. Females may show aggression to juveniles to disperse them early so a second litter can be produced.

## 10.16 Growth and Development

### Developmental stages

- Pouch or scrotum discernable: 12-20 days.
- Eyes are open: 84-85 days.
- Fur on muzzle: 27-34 days.
- Fur on shoulders: 48-69 days.
- Fully furred: 76 days.
- Papillae of mystacial vibrissae: 6-27 days.
- Appearance of teeth:
- First release teat: 48-82 days.
- Partly out of pouch: 69 days
- After emerging from the pouch the young will stay in the nest for a further 40-50 days. The mother glider and other female gliders of the group may come back to baby sit the young (Butler, S. 2005)
- At the age of 110-120 days, the young begin to venture out and forage with their mother (Suckling 1995)
- Sexual maturity: 12 months for both females and males.

### Measurements

- Crown-rump length: 5 days = 13.5-14.2mm; 28 days = 26mm. (Smith, M.J.1979)
- See table on page 38 for Growth equations, head lengths and weights of Squirrel gliders (Reproduced from Bach Carol, ed. 1998).

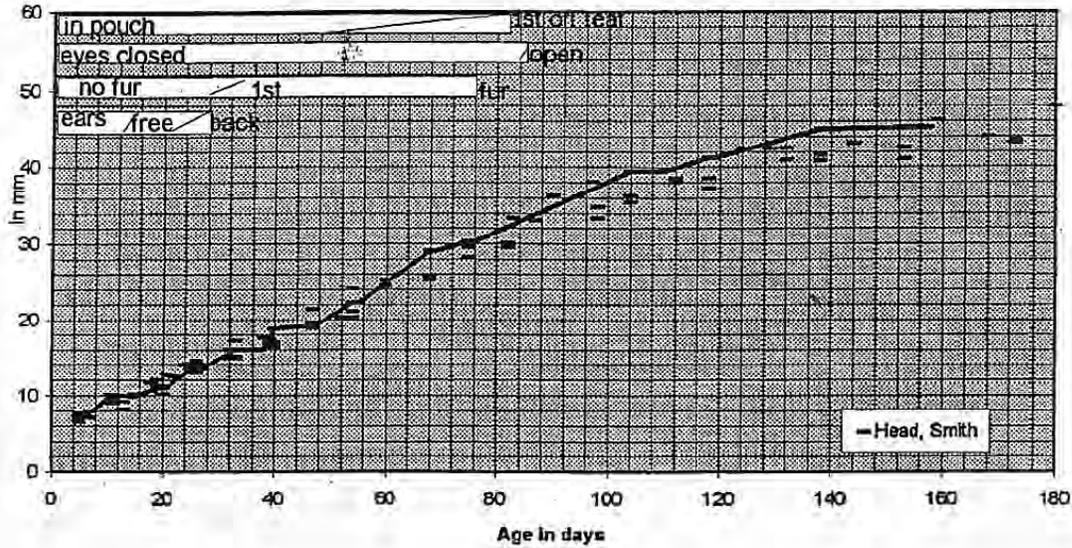
Growth equations, head lengths and weights of Squirrel gliders. Reproduced from

**SQUIRREL GLIDER**  
*Petaurus norfolcensis*

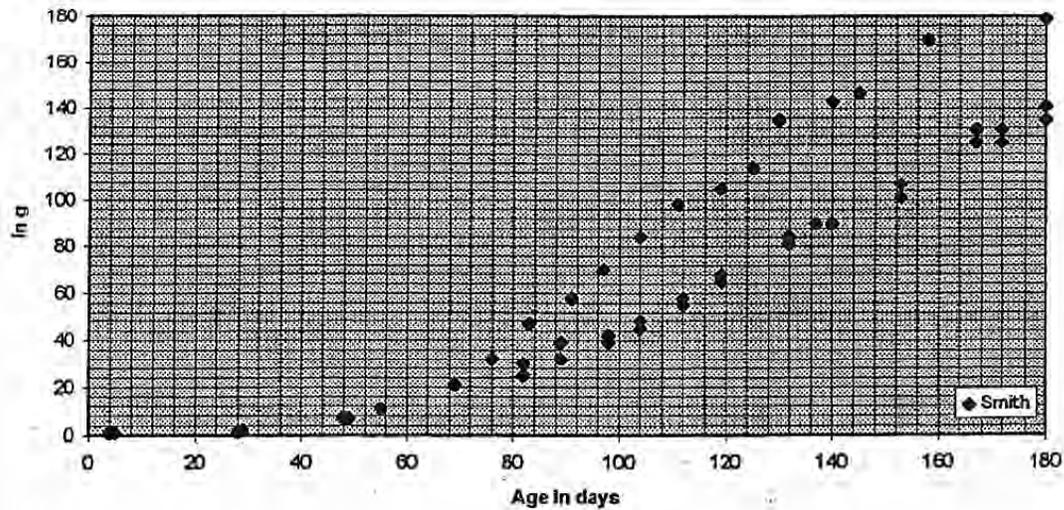
Size adults  
 males 190-244 mm HB  
 294 g  
 females 193-230 mm HB  
 173-230 g

**Measures**

Growth Equation <135d: Head len.(mm) = 6.169 + 0.291xAge



**Weights - Use with caution**



**Table 2:** Head lengths, and body weights in joeys. Reproduced from Bach, C. Ed.1998

## 11 Artificial Rearing of Mammals



Squirrel glider joeys that are to artificially reared should be placed in an artificial pouch. Only natural fibres such as cotton and wool should be used. Synthetic material should not be used as they are often too hot or too cold. A woollen sock or sleeve of a fleecy sweatshirt sewn up with a cotton liner can be used (Walraven, Ed. 2004. Jackson, S. Ed. 2003 ). Photo opposite: Juvenile Squirrel glider in artificial pouch (NATF).

### 11.2 Temperature Requirements

Unfurred Joeys should be kept at a temperature of 34 to 35 degrees Celsius. Once furred the temperature should be reduced to 28 degrees Celsius. The Temperature can be maintained using a heat pad that is thermostatically controlled. (Walraven, E. Ed. 2004.)

### 11.3 Diet and Feeding Routine

There are several formulas which are satisfactory for raising gliders. Biolac, Divetalact /

Digestalact and Wombaroo are all used. The formula use to start rearing a glider must be used throughout the raising period.

**Table 3:** Wombaroo milk formula feeding chart. Reproduced from Burgmann, Rees, A. (NATF) B.

SQUIRREL GLIDER					
MILK TYPE	AGE Days	HEAD mm	LEG mm	WEIGHT g	FEED ml/day
<0.8	20	12	6	1.1	0.8
	30	15	8	2.2	1.4
	40	16	11	4.2	2.2
	50	21	15	8.1	3.6
	60	24	18	16	6.0
Transition Milk Mixtures <0.8 to >0.8			<0.8 Milk	>0.8 Milk	
	61 to 63		3ml	1ml	4
	64 to 65		2ml	2ml	4
	67 to 69		1ml	3ml	4
>0.8	Emerging from pouch	70	27	29	5
		80	30	43	7
		90	33	57	8
		100	36	71	9
	Emerging from nest	110	39	85	11
			(1)	(2)	

(1) Growth rate estimate is 1g - 3g/day

(2) Milk volume now depends on other food consumed. If uncertain about feeding or weaning procedure consult your Wombaroo supplier.

(3) Provide fresh drinking water between feeds on hot days and once joey begins to emerge from pouch.

## 11.4 Specific Requirements

When first brought in for hand rearing young are often dehydrated. To check for dehydration pinch the skin at the shoulders. If the skin stays “peaked” for several seconds the animal may be dehydrated. If dehydrated the glider can be given boiled water, with 5 grams (one teaspoon) of glucose to 100 millilitres of water or 1 gram of electrolyte replacer. Alternatively fluids such as Lectade or Pentalyte, an electrolyte replacer (if the animal has diarrhea), or Glcoden can be given for a period of up to 24 – 48 hours. Unfurred Joeys should be kept moist using sorbelene cream (not with added glycerine) to prevent the skin becoming dry and cracked.

## 11.5 Data Recording

As many records as possible should be kept including the area the animal was found who found it and the condition the animal was in when found.

The following information should be recorded on a daily basis:

- Date
- Time when the information is recorded
- Body weight to the nearest gram if possible
- General activity and demeanour
- Characteristics and frequency of defecation and urination
- Amount in grams of different types of food offered
- Food consumption at each feed
- Veterinary examinations and results
- The developmental stages and measurements on a weekly basis.

## **11.6 Identification Methods**

Small quantities of fluorescent pigments can be tattooed into the pinnae of pouch young. These pigments are visible for a minimum of six months under UV light (Soderquist, T.R, Dickerman, C.R. 1988)

Once furred and a minimum of ten grams gliders can be implanted and identified with an implant chip (Jackson, S. 2003).

## **11.7 Hygiene**

Hygiene in artificial rearing of gliders is very important for the health of the animal in care and the carer. Emphasis needs to be placed on the following:

- Carers should wash and disinfect their hands before and after each animal is handled.
- Use antibacterial solution for washing hands with furless joeys.
- Maintain clean pouch lining at all times.
- If furless, cover the joey's body with sorbeline cream after each feed until fur appears.
- The glider must be thoroughly cleaned after each feed. Spilt milk must be washed off the fur with moist cotton wool and dried off with tissue or a soft towel.
- Bottles, teats, syringes and other feeding implements must be washed and sterilised after each use. First wash in warm soapy water and then sterilize in a suitable anti-bacterial solution such as Halasept or Milton, or boil for 10 minutes.
- Only heat up milk once and then discard leftovers.

- Refrigerated milk should be thrown out after 24 hours or frozen for longer.
- Contact with other animals should be avoided unless you are sure they pose no health risk.
- Stimulate the Joey to go to the toilet before and after feeding by gently wiping the cloaca using cotton wool dampened with warm water.
- Change pouch liner as soon as it is soiled.

## **11.8 Behavioural Considerations**

Care should be taken not to over handle gliders in care as they bond easily and this will make them harder to release. It is best if multiple gliders are raised together to form a group that can be released together.

## **11.9 Use of Foster Species**

No foster species are used.

## **11.10 Weaning**

Squirrel glider joeys being artificially reared are weaned at 150 days of age and weighing 90 to 100 grams (pers com. Amanda Boardman). Generally the milk formula should be reduced by 5% per week as long as long as the Joey continues to gain weight at a rate of 5 – 10% of its body weight per day (Jackson, S. Ed. 2003). As milk formula is being reduced solids should be introduced into the diet. Foods include nectar mix, finely cut up soft fruit and freshly cut flowers of Eucalypts (Gum trees), Callistemon (Bottle brush), Lilly pilly, Leptospermum (tea tree) and Melaleuca (paperbark).

## **11.11 Rehabilitation and Release Procedures**

### **RELEASE SITE CRITERIA. ADULTS**

- Must be as close to capture site as possible.
- Must be some dense vegetation into which to put the nest box.

### **JOEYS**

- Squirrel gliders must be known to inhabit that area.
- As close as possible to the joeys mother's area. It must be within the same gene pool. No natural barriers such as mountains or large rivers should have been crossed.
- It cannot be released in a National Park without written permission from the Department of Environment and Conservation (DEC).
- It can be released in State Forests, but assurance needs to be found that the area is not due to be logged in the next 2 years.
- Ideally it needs to be an area with no cats and dogs.
- The property of a wildlife carer is preferred, with an aviary in a secluded section of bush to attain a monitored soft release.
- As far away from human habitation as possible.
- It should not be the same site into which a number of individuals had been released the previous year.
- Two years should be given before stressing the local population with extras.
- There needs to be good shelter available, and good food sources

### **RELEASE CRITEREA FOR GLIDERS**

- Weight must be appropriate.
- Fur conditions perfect
- Able to hear.
- Sharp claws
- Own nest box
- Not addicted to unnatural food.
- Must be self reliant on native foods, with only minimal supplement
- It must be dehumanised.

### **PRE-RELEASE AVAIRY.**

A predator proof aviary 1.8 x 5 x 3m in size enclosed at one end for protection.

Furnish the aviary with live or not long dead branches. Ropes preferably natural fibres can be slung between branches.

Place the small cage that the glider is in off the ground on a bench or table in the covered section of the aviary. Leave the cage door closed for three nights still feeding its current diet of foliage, flowers, lorikeet mix and fruit.

Add extra nest boxes lined with paper bark in different areas of the aviary that are under shelter and hidden by foliage. Affix door of cage open so gliders have free run of the aviary.

At least four vases with water and large amounts of foliage should be added to the aviary. Shallow bowl of water should be placed on the floor of the aviary. In the morning check to make sure all gliders have gone back into nest boxes. If not return to the nest box they are most used to. Weigh gliders once a week until reached release weight. Squirrel gliders should be 150 grams and 6 to 7 months of age before release.

(Pers com. Amanda Boardman.; Jackson, S. Ed. 2003; Walraven, E. Ed. 2004).

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## 15 Glossary

- Acaricides: - A preparation for destroying mites.
- Agglutination:- The clumping of Bacteria or red blood cells when held together by antibodies (Agglutinins)
- Anteriorly: - Situated near or towards the head.
- Alopecia: - Regular episodes of hair loss.
- Antemortem: - Before death.
- Anthelmintics: - Any drug or agent used to destroy parasitic worms.
- Arils: - An extra seed covering, often coloured hairy or fleshy.
- Arthropods: - Invertebrates (animals with no backbone) with a segmented body, jointed limbs, and an exoskeleton, eg. Insects and spiders.
- Ataxia: - The loss of full control of bodily movements.
- Carbaryl powder: - A chemical used for the control of ectoparasites (mites, lice, fleas).
- Cataract: - A condition in which the eye lens becomes progressively opaque resulting in blurred vision.
- Dieback: - Decay of a plant from the tip towards the root as a result of disease or unfavourable conditions.
- Diazepam: - An antianxiety and sedative drug.
- Dolerite: - A mix made mainly of sand with other ingredients that he it compact while being well drained.
- Dorsal: - On or near the back.
- Dyspnoea: - Difficult or laboured breathing.
- Emesis: - The act of vomiting.
- Exudate: - Liquid that oozes from an animals or plants pores eg. Sap, nectar and honeydew.
- Exudivore: - An animal that diet mainly of exudates.
- Galls: - A growth on plants, often bulbus, caused by the irritation of the young stages of insects.
- Gestation: - The duration of pregnancy.
- Halothane: - A volatile liquid used as a general anaesthetic (Halogen + Ethane).
- Hemagglutination: - The Agglutination of red blood cells.
- Hemiplegia: - Paralysis of one side of the body.
- Honeydew: - The sugary waste excreted by Psyllids on the leaves and other parts of the plant.
- Hybrid: - An offspring of parents of different strains, variations subspecies or species.
- Ill thrift: - Failure to thrive.
- Insectivore: - Diet consists mostly of insects.
- Interspecific: - Between species.
- Intramuscularly:- Directly into the muscle
- Intraspecific:- Within species
- Invertebrate: - Without a backbone.
- Isoflurane: - A halogenated ether used for inhalation anaesthesia.

- Lactation: - Production of milk by the female.
- Malaise: - Non-specific bodily discomfort not associated with the development of a disease.
- Manna: - White, carbonate-rich criptaline substance that occurs on Eucalypt leaves.
- Morphometric: - The measurement of body parts.
- Nectar: - Sweet liquid produced by the flowers of plants.
- Nocturnal: - Active at night.
- Non-parous:- A state of physical and physiological inactivity, especially in excessive heat or cold.
- Nulliparous: - Never given birth.
- Nystatin: - An antibacterial and antibiotic. Trade names (Mycostatin and Nystan).
- Oestrous: - The regular interval between periods during witch the female is sexually active.
- Opportunistic feeder: - Feeds when the occasion arrises.
- Osteoporosis: - Paralysis of the hind limbs.
- Patagium:- Gliding membrane
- Peracute immuniosupressed:-
- Polygynous: - Where a male has more than one female partner in any one given season.
- Polyestrus: - When a species has more than one oestrous cycle per year.
- Prehensile: - Capable of grasping.
- Prexia: - Fever.
- Quadriplegia: Paralysis of all four limbs
- Retinitis: - Inflammation of the retina.
- Scapular:- The shoulder or shoulder blade
- Sclerophyll forest: - Forest that are characterised by woody plants with leathery leaves that retain water.
- Serological: - Study or diagnostic examination of blood serum, especially with regard to the response of the immune system to pathogens or introduced substances.
- Sporulated: - To produce or release spores.
- Strata: - Layer or layers.
- Sub dominant: - Not in control.
- Substrate:- Material laid used to cover the floor of an exhibit such as Pine bark or sand
- Subcutaneously: - Underneath the skin.
- Temporal fossa:-
- Tiletamine/zolazepam: - An injectable aesthetic.
- Torpor: - A state of physical and physiological inactivity, especially in excessive heat or cold.
- Uveitis: - Inflammation of the uvea (the iris, ciliary and choroid together).

## 16 Appendix

### Appendix 1. Timeline for Maintenance and other activities.

Activity	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Breeding season Wild Captivity	##				##	##	##	##	##	##	##	##
General health checks												
Pouch checks	#	#			#	#	#	#	#	#	#	#
Faecal Float tests carried out					#						#	
Peak zoo visitation	#			#		#	#			#		#
Renovations			#									
Replace substrate		#						#				
Clean exhibit enclosure wire/glass	#	#	#	#	#	#	#	#	#	#	#	#

## **Appendix 2. Suppliers and Wildlife Agencies.**

### **Computer Software.**

#### **International Species Information System (ISIS)**

12101 Johnny Cake Ridge Road  
Apple Valley, Minneapolis 55124, U.S.A.  
Ph: +1 952 997 9510  
Fax: +1 952 432 2757  
Email: [isis@isis.org](mailto:isis@isis.org)  
Internet: [www.isis.org](http://www.isis.org)

- Animal Record Keeping System (ARKS)
- Single Population and Record Keeping System (SPARKS)
- Medical Animal Record Keeping System (MedARKS)

#### **Conservation Breeding Specialist Group**

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Email: [office@cbsg.org](mailto:office@cbsg.org)  
Internet: [www.cbsg.org](http://www.cbsg.org)

- Vortex – Population Viability Analysis program
- Training Courses and Workshops
- Global Zoo Directory

### **Identification Equipment.**

#### **Animal Electronics I.D. Systems**

PO Box 189  
Kiama, New South Wales 2533, Australia  
Ph: +61 2 4232 3444  
Fax: +61 2 4232 3350  
Email: [aeids@bigpond.com](mailto:aeids@bigpond.com)  
Internet: [www.animal-id.com.au](http://www.animal-id.com.au)

- Implant chips and scanners

### **Central Animal Records**

22 Fiveways Boulevard  
Keysborough, Victoria 3173, Australia  
Ph: +61 3 9706 3100  
Fax: +61 3 9706 3198  
Email: [info@car.com.au](mailto:info@car.com.au)  
Internet: [www.car.com.au](http://www.car.com.au)

- PIT tags and scanners

### **DLC Aust Pty Ltd**

17-19 Horne Street  
Hoppers crossing, Victoria 3029, Australia

Fax: +61 3 99360 9994  
Email: [info@dlc.com.au](mailto:info@dlc.com.au)  
Internet: [www.dlc.com.au](http://www.dlc.com.au)

- Tattoo equipment

## **Food Products**

### **Australia's Own**

127 Main Road  
Toukley, New South Wales 2263, Australia  
Ph: +61 2 4397 1444  
Fax: +61 2 4397 2666  
Email: [info@australiasown.com.au](mailto:info@australiasown.com.au)  
Internet: [www.australiasown.com.au/beepollen.htm](http://www.australiasown.com.au/beepollen.htm)

- Bee Pollen

### **Biolac**

Geoff and Christine Smith  
PO Box 93  
Bonnyrigg Plaza, New South Wales 2177, Australia  
Ph: +61 2 9823 9874  
Fax: +61 2 9823 9874  
Internet: [www.biolac.com.au](http://www.biolac.com.au)

- Biolac milk for Marsupials
- Marsupial Feeding Teats

**Biotech Pharmaceuticals**

100 Antimony Street

Carole Park, Queensland 4300, Australia

Ph: +61 7 3271 9600 or +61 1800 620 898

Fax: +61 7 3271 1315

Email: [biotech@bit.net.au](mailto:biotech@bit.net.au)

Internet: [www.biotechpharmacueticals.com.au](http://www.biotechpharmacueticals.com.au)

- Milton – sterilizing milk feeding apparatus

**Darling Bee Products**

325 Anthony Place

Sawyers Valley, Western Australia 6074, Australia

Ph: +61 8 9295 1534

Fax: +61 8 9295 1592

Email: [darlingbeehoney@bigpond.com](mailto:darlingbeehoney@bigpond.com)

Internet: [www.darlingbeeproducts.com](http://www.darlingbeeproducts.com)

- Banksia Honey

**Iams Australia New Zealand**

PO Box 6116 or Unit A2 1-3 Rodborough Road

French's Forest, New South Wales 2086

Ph: +61 2 8977 2500

Fax: +61 2 8977 2588

Email: [kim.mouret@iams.com](mailto:kim.mouret@iams.com)

Internet: [www.iams.com](http://www.iams.com)

- Eukenuba Premium kibble

**Sharpe Laboratories Pty Ltd**

16 Hope Street

Ermington, New South Wales 2115, Australia

Ph: +61 2 9858 5622

Fax: +61 2 9858 5957

Email: [sharpe@myoffice.net.au](mailto:sharpe@myoffice.net.au)

- Di – Vetelact and Digestalac low lactose animal milk formula

### **Wombaroo Food Products**

PO Box 151

Glen Osmond, South Australia 5064, Australia

Ph: +61 8 8379 1339

Fax: +61 8 8379 1339

Email: [wombaro@adelaide.on.net](mailto:wombaro@adelaide.on.net)

Internet: [www.wombaroo.com.au](http://www.wombaroo.com.au)

- Wombaroo milk formulas
- Teats

## **Catching and handling Equipment**

### **Wildlife and Animal Capture and handling Equipment Services**

PO Box 334

Warwick, Queensland 4370, Australia

Ph: +61 7 4661 7066

Fax: +61 7 4661 9179

- Animal Capture and handling equipment

## **Other Suppliers of Products.**

### **Australian Native Landscapes Pty Ltd.**

Baulkham Hills division

Old Windsor Road, Baulkham Hills

New South Wales, 2153, Australia.

Ph: +61 02 9629 2588.

Fax: +61 02 9629 1285.

Internet: [www.austnativelandscapes.com.au](http://www.austnativelandscapes.com.au)

- Dolerite.
- Sand
- Pine bark.

## **State and other Wildlife Agencies**

### **New South Wales**

National Parks and Wildlife Service  
PO Box 1967 or Bridge Street  
Hurstville, New South Wales 2220, Australia  
Ph: +61 2 9585 6444  
Fax: +61 2 9585 6555  
Email: [info@npws.nsw.gov.au](mailto:info@npws.nsw.gov.au)  
Internet: [www.npws.nsw.gov.au](http://www.npws.nsw.gov.au)

### **Queensland**

Queensland Parks and Wildlife Service  
PO Box 155  
Brisbane Albert Street, Queensland 4002, Australia  
Ph: +61 7 3202 0200  
Fax: +61 7 3202 6844  
Email: [nqic@env.qld.gov.au](mailto:nqic@env.qld.gov.au)  
Internet: [www.env.qld.gov.au](http://www.env.qld.gov.au)

## **South Australia**

Department of Environment and Heritage  
GPO Box 1047  
Adelaide, South Australia 5001, Australia  
Ph: +61 8 8204 8888  
Fax: +61 8 8204 8889  
Email: [environmentshop@saugov.sa.gov.au](mailto:environmentshop@saugov.sa.gov.au)  
Internet: [www.deh.sa.gov.au](http://www.deh.sa.gov.au)

## **Victoria**

Department of Sustainability and Environment  
PO Box 500  
East Melbourne, Victoria 3002, Australia  
Ph: +61 3 9412 4011  
Fax: +61 3 9637 8100  
Email: [customer.service@nre.vic.gov.au](mailto:customer.service@nre.vic.gov.au)  
Internet: [www.nre.vic.gov.au](http://www.nre.vic.gov.au)

## **Native Animal Trust Fund (NATF)**

Ph: (NSW) 05002294  
Internet: [www.users.bigpond.com/natf/index.html](http://www.users.bigpond.com/natf/index.html)

- Wildlife care and rescue agency

## **Wildlife Information and Rescue Service (WIRES)**

Ph: (NSW) 1800641188  
Internet: <http://www.wires.org.au/index.html>

- Wildlife care and rescue agency

**Appendix 3. Known food trees of the Squirrel glider: Type of food used, time of year used and plants distribution. (Sharpe, D.J, Goldingay, R.L. 1998; Rowston, C. 1998; Menkhorst, P.W, Collier, M. 1987; Van der Ree 2000)**

<b>Scientific name</b>	<b>Common name</b>	<b>Food utilized</b>	<b>Time of year used</b>	<b>Distribution in Australia</b>
Acacia Concurens	Currah	Nectar/pollen. Seed arils.	Autumn/winter. Spring	NSW / QLD
Acacia Irrorata	Green wattle	Gum	Autumn/winter	NSW / QLD
Acacia Pycnantha	Golden wattle	Nectar/pollen. Gum.	Winter/spring. Autumn/winter.	NSW / VIC
Angophora	Smooth barked apple	Nectar/pollen. Sap.	Summer. Autumn/winter.	NSW / QLD.
Banksia integrifolia	Coast banksia	Nectar.	Summer/autumn	NSW / QLD.
Banksia serrata	Saw banksias	Nectar.	Spring/summer	NSW / VIC.
Banksia spinulosa	Hairpin banksias	Nectar	Autumn/Winter and Spring.	NSW / QLD / VIC.
Corymbia glommifera	Red bloodwood	Nectar/pollen. Sap.	Summer. Winter.	NSW / VIC / QLD.
Corymbia maculata	Spotted gum	Nectar/pollen. Sap.	Winter/Spring. Autumn/Winter.	NSW / QLD / VIC.
Eucalyptus amplifolia	Cabbage gum	Nectar/Pollen. Sap.	Summer. Autumn/Winter.	NSW / QLD.
Eucalyptus camaldulensis	River red gum	Nectar/pollen. Sap.	Variable. Autumn/Winter.	NSW / QLD / VIC.
Eucalyptus Melliodora	Yellow box	Nectar/pollen.	Summer.	NSW.
Eucalyptus paniculata	Grey ironbark	Nectar/pollen	Autumn/Spring	NSW.
Eucalyptus pilularis Blackbutt		Nectar/pollen. Sap.	Winter. Winter.	NSW / QLD.

Eucalyptus punctata		Nectar/pollen.	Summer/Autumn.	NSW.
Grey gum				
Eucalyptus seeana	Narrow-leaved red gum	Nectar/pollen. Sap.	Spring/Summer. Autumn/Winter.	NSW / QLD
Eucalyptus siderophloia	Grey ironbark	Nectar/pollen.	Spring and Autumn	NSW / QLD.
Lophostemon confertus	Brushbox	Nectar/pollen.	Spring/summer	NSW / QLD.
Lophostemon suaveolens	Swamp terpine	Nectar/pollen.	Spring/Summer.	NSW / QLD.
Melaleuca nodosa	Tea tree	Nectar/pollen.	Winter/Spring and Summer	NSW / QLD.
Melaleuca alternifolia	Tea tree	Nectar/pollen.	Spring/Summer	NSW / QLD.
Melaleuca styphloides	Prickly leaved paperback	Nectar/pollen.	Summer.	NSW / QLD.
Nototthixos species	Mistletoe	Fruit.	Summer.	NSW / QLD / VIC.
Xanthorhea Species	Grass tree	Nectar/pollen.	Winter/Spring.	NSW / QLD / VIC.

## Appendix 4. IATA Transport requirements for the Squirrel glider.



**IATA**

### Container Requirements

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**CONTAINER REQUIREMENT 31**

□ The illustrations shown in this Container Requirement are examples only. Containers that conform to the principle of written guidelines for the species but look slightly different will still meet the IATA standards.

Applicable to primates of size and weight of an adult vervet/African green monkey or smaller.

<p><i>Multiple Container Species</i></p> <ul style="list-style-type: none"> <li>Capuchin monkey</li> <li>Guenon</li> <li>Howler monkey</li> <li>Langur</li> <li>Leaf monkey</li> <li>Lemur species (large)</li> <li>Macaque</li> <li>Marmoset species</li> <li>Patas monkey</li> <li>Rhesus monkey</li> <li>Spider monkey species</li> <li>Squirrel monkey</li> <li>Swamp monkey</li> <li>Tamarin species</li> <li>Tarsier</li> <li>Titi monkey</li> <li>Vervet/African green monkey</li> <li>Woolly monkey</li> </ul>	<p><i>Single Container Species</i></p> <ul style="list-style-type: none"> <li>Aye-Aye</li> <li>Colobus monkey</li> <li>Drill</li> <li>Indri</li> <li>Mandrill</li> <li>Mangabey</li> <li>Proboscis monkey</li> <li>Saki</li> <li>Sifaka</li> <li>Uakari species</li> <li>Wanderoo</li> </ul> <p><i>Multiple/Single Container Species (Nocturnal species)</i></p> <ul style="list-style-type: none"> <li>Bush-baby</li> <li>Douroucoul</li> <li>Galago</li> <li>Lemur (small)</li> <li>Loris</li> <li>Opossum species</li> <li>Phalanger</li> <li>Potto species</li> </ul>
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**1. CONTAINER CONSTRUCTION**

(see Exception QF-01 in Chapter 3)

**Materials**  
Wood, metal, wire mesh and muslin or other light material.

**Principles of Design**  
The following principles of design must be met in addition to the General Container Requirements outlined at the beginning of this chapter.

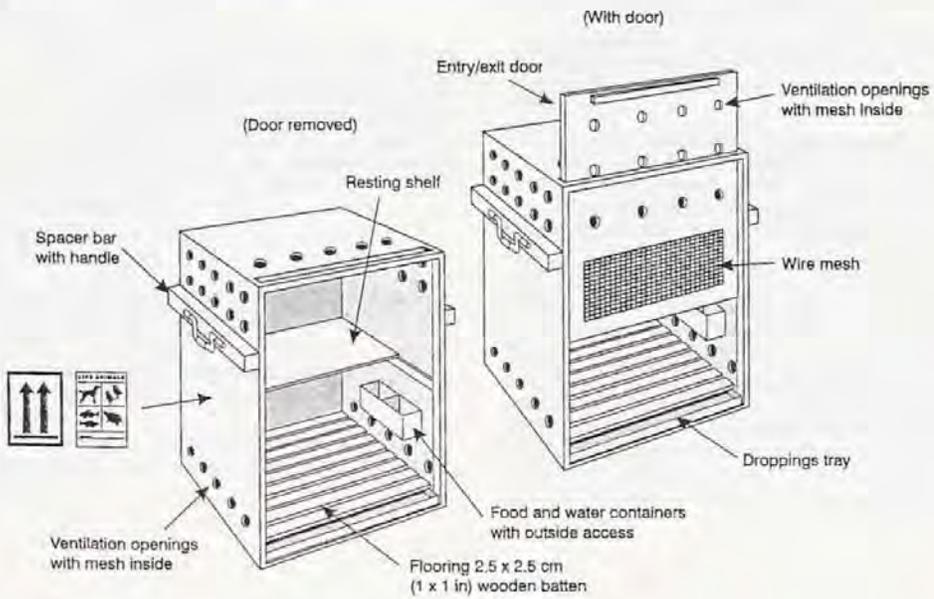
Certain countries have government regulations controlling container dimensions and the quantity of monkeys that can be carried. The following design specifications, in principle, comply with such regulations but are primarily intended for use where detailed national regulations do not exist.

**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.

**Handling Spacer Bars/Handles**  
Must be provided as shown in the illustration on three sides of the container.

**EXAMPLE:**





**CONTAINER REQUIREMENT 31 (cont'd)**

**Floor**

- △ The base of the container must be solid and leak-proof. A slatted floor made of 2.5 x 2.5 cm (1 x 1 in) battens spaced at 0.5 – 1 cm (1/2 – 2/4 in) 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.

**Interior**

- △ For some species 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 for bush baby and lemur species, it must be firmly attached within the container so that the animal can climb and rest safely.

**Ventilation**

Meshed ventilation openings, approximately 2.5 cm (1 in) 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.

**Feed and Water Containers**

- △ Separate food and water containers must be provided, either revolving or fixed. If fixed inside the container they must be placed at a height that does not allow the animal to sit upon it and there must be an outside access for filling and emptying which does not allow the animal any chance of escape. Water containers should only be filled to demand and must be emptied after use as monkeys will splash themselves and become wet and chilled.

**Rigid Plastic Pet Containers**

(see *Container Requirement 1*)

These containers are suitable for transport of lemur, bush baby and small monkeys. The following modifications must be undertaken:

- a slatted floor must be firmly fixed to the base of the container which must be covered with absorbent material;
- a low resting shelf or a branch-like structure for lemurs and bush babies must be firmly fixed in the back of the container;

the method of closing the container must be completely tamper-proof. When monkeys are being shipped the use of padlocks at the top and bottom of the door rather than clasps or clips is the method of choice;

fine wire mesh must be securely fixed over the door grill and all ventilation openings, these must also be covered with a muslin, or similar material, curtain;

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; the container must be correctly labelled.

- If a container has wheels, they must be removed or rendered inoperable.

**2. PREPARATIONS BEFORE DISPATCH**

(see *Chapter 5*)

These animals instinctively fear the strange environment encountered during transportation. Therefore, in transporting these animals, there are a number of basic principles with which the shipper and the carrier must comply as these affect the welfare and comfort of the animal. This, in turn, has a bearing on the animal's behaviour during air transportation as the strain may cause the necessary stimulus for the animal to become difficult. Therefore, the container must be constructed to adequately contain and restrain the animal.

Adult monkeys must be crated individually or separated by partitions, unless they are used to each other.

Mature males will become upset by the presence of females in heat. Therefore, accepting females in this condition for shipment must be avoided whenever possible. If it is necessary to accept male and female monkeys, each sex must be in its own container and the containers separated from each other as far as possible.

- △ **Pregnant females and females with suckling young must not be accepted for air transport.**

Young animals must not be separated from one another as this increases stress. They must be in partitioned containers or in separate containers loaded adjacent to each other in the aircraft.

Animals of the same species and size may be shipped together in the same container *only* if they have previously been contained together. Otherwise, they must be carried completely separately. Care must be taken to prevent any possibility of snapping and disturbing one another.

It is natural for these animals to investigate their surroundings and try to escape. With very few exceptions, these animals do not willingly accept confinement. They become frustrated and will often make determined efforts to escape.

These animals are affected by temperature changes and severely affected by temperature extremes. Care must be taken to ensure that they are not subjected to drafts. Most species can withstand reasonable variations in temperature but exposure to the wind or to a draft can be fatal. Therefore, consideration must be given not only to the temperature changes but also to the chill factors involved. On the other

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31

**CONTAINER REQUIREMENT 31 (cont'd)**

hand, these animals must not be exposed to direct heat, such as placing them in sunlight or against hot radiators. Monkeys unavoidably subjected to extreme heat must be cooled so as to prevent dehydration or heat prostration. During prolonged transit stops, when the ramp temperature exceeds approximately 20°C (68°F), the aircraft compartment doors must be opened and, in extreme temperatures, ground equipment must be used to ventilate the compartments. The different climatic factors prevailing during a journey must always be considered when arranging the routing and carriage of these animals.

**3. FEEDING AND WATERING GUIDE**  
*(for emergency use only)*

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, cereal or appropriate primate food, bread and non-citrus fruits, must be provided but care must be taken not to over-feed. After offering water, the water container must be emptied or removed.

**4. GENERAL CARE AND LOADING**  
*(see Chapters 5 and 10)*

See 5.3 for special segregation of animals known to be for laboratory use.

There are a number of contagious diseases carried by monkeys communicable to man, consequently, care must be taken to avoid physical contact with the animal and full personal hygiene precautions must always be taken.

Monkey container ventilation openings must be covered with muslin or other light material that does not occlude ventilation to prevent possible inhaling of infectious droplets by handlers.

Monkeys from different continents must not be shipped together nor come in airborne contact with each other in aircraft holds, airport cargo warehouses, animal holding facilities, and during all phases of ground transportation.

**5. CONSIGNMENTS OF LABORATORY MONKEYS**

Laboratory monkey consignments must be kept isolated from any other consignments of primates at all times (see 5.3).







