1. INTRODUCTION:

Squirrel Gliders *Petaurus norfolcensi.* They used to be called flying squirrels, flying phalangers. They don't fly they glide or volplane by opening a narrow membrane attached to their phalanges and the side of their body.

Colonial game pioneers ate possum (Horace Wheelwright 1861) Aboriginals used to hunt gliders by climbing trees or smoking them out, then clubbing them as they escaped their hollows. They called squirrel gliders Baua and sugar gliders Bulemba, they were Totam animals for such groups as the Ngarigo and Walgalu tribes in N.S.W, for these tribes hunting was limited or totally prohibited. (Anne Kerle 2001)

2. TAXONOMY:

Scientific name : *Petaurus norfolcensis :* Squirrel Glider :

2.1 Nomenclature

Order: Diprotodontia

Family : Petauridae

Genus Species : *Petaurus norfolcensis*

2.2 Subspecies

None:

2.3 Recent synonyms

None:

2.4 Other Common Names

Squirrel Glider, Flying Squirrel, Sugar Squirrel, Squirrel, Flying Phalanger

3. NATURAL HISTORY:

(The Marsupial Society of Australia : notes Sharron Butler) First described in 1792 the squirrel glider incorrectly with the belief that it originated in Norfolk Island when it originated in the Sydney Region, habitat ranged from Queensland through N.S.W to Victoria. They inhabit dry sclerophyll (Eucalypt) forest woodlands in Northern Queensland, in N.S.W dense coastal ranges with some wet forest areas almost bordering rainforest.

The fragmentation of the land has greatly affected the Squirrel Gliders in the wild. I know just in the area I live, the destruction is devastating, I continue to rescue wild Squirrel Glider that are injured in some way either from the felling of trees were they have broken backs, or untangling them from the barb wire that farmers continually use. I feel that in the future it is going to be up to us to re-establish the Squirrel Glider back into the wild. They are already on the Vulnerable /endangered list and to do this we need to save their woodland and forests, we need to be able to successfully breed, we need to educate people to prevent the continual destruction. I'm hoping in some way this manual will offer some information that will assist whoever is reading it because they already have a interest in the future of the squirrel glider.

3.1 Morphometrics

The possums and gliders show a very large size from 6g for the little pigmy possum to10kg for the bear cuscus. The morphometrics for the Australian species can be found in (Strahan.1995)

3.1.1 Mass and Basic Body Measurements

(David Lindenmayner) Mean Body Mass 200 – 260 mm Head and Body Length 180–230 mm Tail Length 220 – 300 mm.

Body weight 190 – 300 grams.

There are also geographic differences in body size between different populations of the same species(David Lindenmayer). This is known as the Bergmann's rule. This rule suggests that organisms tend to be larger in colder climates (at higher altitudes) to conserve energy . The size of competitors and predators and the quantity and availability of food all contribute to the difference in size. Where food is more abundant , males grow much larger in an attempt to gain competitive advantage over other males and increase their mating success. Females invest extra resorces into producing more offspring rather than body size. (David Lindenmayer)

3.1.2 Sexual Dimorphism

Sexual Dimorphism in body size may confound the latitudinal body size effect observed within species. The males are larger than the females (Smith and Lee1984; Quin 1995;) Breeding success of males varies more widely in polygynous species, associated with the frequency and intensity of competition for mates. Selection consequently favours the development of traits such as large body size of males, which enhance fighting in polygynous species (Boundrup- Neilson and Ims 1990).

3.1.3 Distinguishing Features

The squirrel glider and Sugar glider are often confused . The squirrel glider is larger than the sugar glider. Squirrel 190 – 300grams Sugar 100 -160 grams, its face is slightly pointier, the underbelly is usually a cream were as the sugar glider is more a mixture of beige (more yellow, sometimes grey) and the tail is broader at the base and then tappers, the sugar gliders tail is narrower across the base and not as much tapering . The ears of the squirrel gliders are narrower than the sugar glider. All sap feeding gliders have a black dorsal stripe of fur (for camouflage).

They are nocturnal (generally become active after dusk) their tail is moderately prehensile used mainly as a rudder, their gliding membrane(patagium) is made from skin, connective tissue and muscle. The gliding membrane reduces the need to come to ground , therefore in wet weather they stay dry and clean, they use less energy by gliding and can wrap the membrane around them for added warmth, their sent trails are broken by gliding, thereby helps prevent being followed by predators. Den swapping behaviour also reduces predation and parasite infestation. They use their dens for different purposes , larger dens for families, old rotting trees for warmth in the winter.

3.2 Distribution and Habitat

Knowledge of the home range of a threatened species is basic to their management and conservation. The Squirrel Glider Petaurus norfolcensis an arboreal marsupial that feeds on exudates, arthropods, and pollen (Dobson et. Al.2005; Menkhorst and Collier 1987; Sharpe and Goldingay 1998), and is dependent on hollow bearing trees for nesting (Trail and Lill 1997). It is listed as threatened throughout more than half of its geographic range (Kavanagh 2004; van der Ree et. Al.2004), which extends along some 3,000 km of eastern Australia. In the northern part of its range, it's status is not fully resolved (Eyre 2004; Winter et. Al. 2004). Although the home range of the squirrel glider varied, there was consistency .

The Squirrel Glider is primarily an animal of drier forests and woodlands, although they have been recoded in dry eucalypt forest , they also have been found in margins of wet forest. The highest concentrations of animals are found in forest types where the trees were characterised by high levels of foliage nutrients such as nitrogen and phosphorus.

Many gliders have a very strong affinities to their home range. This means that even if most of their home range is destroyed they will not shift to adjacent areas of forest or woodland. Rather they will often remain in the disturbed area until they die or are captured by predators,(the reason for such site tenacity are not known)(David Lindenmayer)

3.3 Conservation Status

In N.S.W they are classified as VUNERABLE,
In Victoria their classification is ENDANGERED (N.S.W Threatened Species Conservation ACT.)

Declining because of the clearing of woodland habitats

3.4 Longevity:

Females live longer in captivity compared to the wild.

3.4.1 In The Wild

The females live 5 – 6 years

3.4.2 In Captivity

5 – 8 years longest one recorded was 14 years

3.4.3 Techniques Used to Determine Age in Adults

Estimates on the age of the Squirrel Glider can be done by tooth wear, the position of the dentine and how much is exposed. The actual telling the age of gliders is quiet difficult and not always straight forward. Before they reach adult size you can calculate the age by length of body and weight. Squirrel gliders use their upper incisors to pierce the bark of sap trees. Stephen Jackson used a combination of measures to age the Mahogany Glider. These included wear of the upper incisor teeth, wear of lower incisor teeth , the colour of the gliding membranes, and the level of development of the pouch (females).

4.HOUSING REQUIREMENTS:

Photo 1. *Design for a breeding exhibit.*

Enclosures should be designed, constructed, serviced and maintained in a way that ensures the good health and well being of your animals, whilst preventing escape or injury to humans. They should be easily maintained, this can be done by using materials that are easily cleaned, durable and non-toxic. They should be protected against the weather , (wind rain, sun) predators, vermin, and harassment from other animals.

Enclosures should enable the gliders to move freely and engage in a wide range of natural behaviours, including gleaning of foliage, bark shredding, gliding, socialising, resting and sleeping. Visual barriers should be provided, allowing gliders to avoid each other or the public. All animals should have access to nesting boxes in different positions (some partly in the sun, others shaded, if possible different thicknesses of wood). They need nest boxes of different sizing to accommodate for family unites, these nest boxes should be placed securely, high in the enclosure (W.Reilly pers comm.)

4.1 Exhibit/ Enclosure Design

Photo 2. *Minimum standard holding area.*

4.2 Holding Area Design

Reason for a holding enclosure . They can be used to place gliders in safely while you are refurbishing their enclosure. You may need to isolate one or several gliders for health reasons, you may be overburden with gliders and need to prepare them to move on to another facility. You may decide to breed and need a quiet enclosure away from public view.

These enclosures need to be in a quiet part of the park away from public view.They can be a lot smaller, and more basic in design they still need to meet standards that are best suited for squirrel gliders. They can consist of natural flooring, natural lighting cycles which are important when breeding squirrel gliders. You can have a series of adjacent enclosures, they can be narrower than recommended but longer. The flooring can be concrete covered with substrate of leaf litter or sand, hollow logs and tussocks. Ideally an enclosure service area, should be provided to each enclosure to allow easier servicing during poor weather and additional security in case an animal tries to escape the enclosure. The enclosure should have about 20% weather protection this area would house nesting boxes and food containers for when weather is bad. There should be plenty of area for gliders to experience the natural elements. It should be of small gauge wire to prevent gliders from squeezing through.

4.3 Spatial Requirements

Standards for Exhibiting Australian Mammals in New South Wales (EAPA)

1) Australian mammals must be provided with an enclosure no smaller than that which is listed below. As a general rule the length and hence enclosure sizes are based on a ratio of the typical body size of the genus and their general mobility.
2) The minimum enclosure size for long term holding enclosure for a species is the same as the minimum exhibit size for that species.
3) Where enclosure contains more than one species, the minimum enclosure area is the sum of the minimum areas that would otherwise be required for each species.
4) *Petaurus* –medium- Squirrel/Mahogany Glider
   Head Body Length (cm) = 25
   Total Length (cm) = 60
   Minimum Enclosure area (m) =10.00
   Minimum Enclosure height (m) = 300
   Additional Floor area for each extra animal (m) = 1.5 x1

Each animal must be exhibited in a manner that:

- As far as possible provides a naturalistic setting which resembles the animals habitat and provides for its behavioural and physical well being;
- Provides the means for enrichment of the animal's behavioural activities in order to further its welfare, produce a more interesting educational exhibit and aid in the reduction of stereotypic behaviour;
- Provides recreational and educational opportunities which encourage an increase in public understanding of, and responsibility for, animals and their environment
- By the use of attendants and physical barriers, or both, protects the animal from abuse and harassment by public viewing,
- As far as possible, use modern display techniques.
- Each animal must be provided with shaded, cover or sheltered areas appropriate to protect it from adverse conditions attributable to the climate and any other environmental factor;
- Each animal must be provided with sufficient space in all directions to enable it ;
- To take exercise
- To be protected from undue dominance and conflict;
- To be provided with its social, breeding and husbandry needs.

- So much of an enclosure as is necessary to provide for the containment of any animal in the enclosure must be of sufficient strength to ensure that containment
- Housing in, or comprising, an enclosure must be structurally sound and must be kept in good repair;
- Electrical apparatus and other plant or fixed equipment must be installed that;
- It does not endanger the animals;
- The animals cannot disrupt its operation;
- An animal enclosure must be provided with such drainage as will quickly carry excess water away from enclosure;
- Unless it carries only surface water, an open drain must be inaccessible to the animals;
- A collection drain must be provided for the enclosure and must be fitted with baskets of wire mesh sufficiently fine to prevent animal hair and faeces from entering the drain;
- The basket must be cleaned daily.

4.4 Position of Enclosures

The enclosure (holding) should be located in a quiet area of the park if possible away from areas that are frequently used, and a good distance away from enclosures holding predatory animals. Additionally the enclosure should be facing east to north with northeast being ideal. The closed area should face west to give protection from hot afternoon sun during summer.

4.5 Weather Protection

In many cases gliders will be held in a nocturnal house, however when they are held in outdoor enclosures they should be protected from the prevailing poor weather conditions with nest boxes out of full sunlight. The nest boxes which are usually attached to the wall or secured to a branch or platform, should be under shelter away from the rain, sun, wind but still able to receive air flow. In most cases the enclosure should have 20% covered in area the rest open to the elements, as this will encourage natural behaviour .

4.6 Temperature Requirements

Heating is generally not required unless there are sustained periods of low temperatures such as a weeks ,when temperature is below approximately 5*. In most cases gliders are well adapted to low temperatures and go into torpor to conserve energy. Natural hollows are another thing that can help the gliders ,depending on the thickness and type ,age of the wood. You need to place a variety around the enclosure, provide nesting material (bark & leaves) the gliders will usually furbish them out to provide them with the level of warmth they prefer.

Cooling is just as important as heating , gliders don't like getting to hot . So you need to be aware of the position that your enclosure is structured, shrubbery can be planted in or around the enclosure as insulation against the hot weather, you can hose down the plants in the extreme heat to create a cool breeze. If you have a good assortment of hollows they will provide a stable temperature for the gliders to crawl into. If the area is subject to major heat waves you might want to attach sprinklers to the roof.

4.7 Substrate

Substrate in holding enclosure can be concrete covered in sand or leaf mulch, you may want to do a sheltered area in dolerite and the open area soil, this will allow you to plant tussocks and small shrubs. Having a concrete base to work with makes it easier to clean , helps deter vermin digging in. It is important to ensure the floor is adequately drained so that no pooling occurs after rainy periods. I would avoid just a straight dirt floor as you need to place a wire bottom on the enclosure to prevent escape or entry, then place thick substrate over the top to cover the wire, this can be a problem as the wire tends to rust, when hosing it tends to become mud, it is more difficult to see if wire is rusting under the surface. If you encounter a disease you need to dig out all the substrate and disinfect .

4.8 Nest boxes and/ or Bedding Material

Squirrel Gliders love to nest mostly with other squirrel gliders. Their favourite nests are hollowed out logs, they love to strip bark especially stringy bark and place it in their nests. Although I don't recommend that you go and collect hollow logs from the bush as most arboreal marsupials are dependant on tree hollows for den sights. It can take up to a hundred years for a eucalypt to develop suitable hollows. Clearing of forest and woodlands for agriculture has led to the Squirrel glider *Petarus norfolcencic* listed as being a threatened species. They will also nest in boxes .

Measurements for nest box:

Back height = 530mm
Front height = 480mm
Width = 200mm
Depth = 230
Hole diameter = 40mm

Boxes should be screwed together, and joints glued, you can paint the outside using a paint that dose not contain substances that cause fumes, check with the manufactures before using. Marine ply is waterproof and long lasting, you need to have holes drilled in the bottom for drainage, you need to place wood struts on the inside allowing the glider an easy exit . You need a lid or a slide that opens for easy access. You can place coconut fibre in the nest , but if you supply plenty of browse the gliders will line their own nests.

4.9 Enclosure Furnishings

- Nest boxes/ Tree hollows (secured to wall, bench, branch)a variety
- Shelter from weather
- Branches to provide climbing and gliding opportunity
- Visual barriers , must include living or freshly cut foliage of native species of plants
- Browse containers should be capped with wire to prevent gliders becoming trapped or drown
- Placement of food in different sites
- As gliders don't eat leaves you can place native plants in the enclosure this helps encourage invertebrates
- Solar or other lights to encourage moths for hunting and eating
- Natural nesting material (bark / leaves)
- Fruit suspended from roof of enclosure, on movable skewers
- Live food crickets/mealworms

Standards for nocturnal housing:

- Lighting inside indoor housing for an animal must be adequate for proper cleaning of the housing and for carrying out routine health hygiene checks;
- Indoor housing for an animal must be provided with ventilation that is sufficient to maintain the health of the animal and is so designed as to minimise undue draughts, odours and moisture condensation;

5.GENERAL HUSBANDRY:

5.1 Hygiene and Cleaning

All enclosures should be cleaned daily to remove faecal matter an uneaten food. It is very important to keep the food areas as clean as possible due to the potential for health problems that will result from bad hygiene and bacteria entering the food. Water bowls should be scrubbed and refilled with fresh water every day. Enclosures should be rested periodically .They should be scrubbed clean, old substrate removed and rested.

Daily :

- Enclosure should be raked , swept or hosed (depending on substrate)
- All faeces removed
- All feed containers washed
- All spilled food removed
- Water bowls filled browse replenished
- Drains checked

Weekly:

- wash down all permanent branches
- Wash down all tops of nest boxes (sometimes covered in faeces and urine)
- Replenish browse (may be done more frequently if available)
- Check doors /perimeter of enclosure
- Check for signs of vermin
- Wash all tools used for cleaning (buckets, rakes, brushes)

Monthly :

- all of the above
- Change all bedding material (remove and destroy old replenish)
- Wipe out all nesting boxes
- Replace all frequently used branches
- Remove and scrub food benches
- Change surface substrate and replenish
- Scrub browse containers fill with fresh water
- Flush drains

Annually:

- Remove all squirrel gliders
- All of the above
- Then completely strip enclosure, scrub every surface, and all furnishings. Return furnishings and replenish all the browse. It is important to maintain a high standard of hygiene this ensures that your gliders will stay healthy and free of disease.

Chemical agents:

Bleach is a clear, green –yellow liquid having a chlorine odour. Bleach is strongly corrosive and a moderate oxidising agent. For your personal protection, wear gloves and chemical goggles. An acid resistant respirator is recommended if spray missed are produced during use. It is recommended that a shirt with long sleeves and trousers be worn. Always wash skin and clothing after using this product.

If using this product to clean your feed dishes it is important to rinse items as to remove all traces of bleach before placing water or food. If you are cleaning their nest boxes or enclosure it is also important that you do the same, after thoroughly rinsing place in the sun (if possible) to dry.

F10 is clear colourless liquid, with a slight natural odour, it is biodegradable multi purpose disinfectant for all hard surfaces, equipment and air space. Hazardous according to criteria of work safe Australia in the pack concentrate only.

Trigene liquid green with citrus fragrance or clear with no fragrance. Disinfectant cleaner, use with care, avoid eye contact and prolonged skin contact. Gloves and safety glasses recommended if available.

Pest control

By feeding gliders in the evening and removal first thing in the morning it reduces the amount of pests. Squirrel gliders will hunt and eat most invertebrates, if you have an ant problem you can place food dishes in a shallow bowl of water, or smear Vaseline around food area (I wouldn't recommend the Vaseline unless really necessary as I think it would affect the fur of your glider) Flies you can place organic traps around enclosure, humane rat and mice traps can be set out around the enclosure.

5.2 Record Keeping

It is important to keep records; these can be very beneficial to you and other carers that follow. It creates a history were people can learn and not repeat mistakes. Records enable you to monitor the animal's health, condition and reproductive status.

- Identification numbers, all individuals should be identifiable.
- Any veterinary examination conducted.
- Treatments provided.
- Behavioural changes or problems.
- Reproductive behaviour or condition.
- Weights and measurements .
- Change in diet.
- Movements of individuals between enclosures or institutions .
- Births with dam and sire if known.
- Deaths with post mortem results.
- Unknown there is always something that fits no category .

5.3 Methods of Identification

Passive Integrated Transponder (PIT) tags. These are implanted between the scapulae of individuals, over 10 g in body weight, and can be used on squirrel gliders. This is an excellent method of identification, however it can be expensive if many animals are implanted. PIT tags are permanent methods 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 wound with tissue glue (Vetbond) or similar fast setting adhesive. The animal generally needs to be caught to confirm identification with a PIT tag reader.

Sure flap is new it is battery powered will run up to a year on 4 aa batteries it can be mounted on a door or internal wall, sure flap learns the unique number for each glider and only unlocks for them stores up to 32 individual numbers cost $135.00 . this could be beneficial as you could just chase the gliders through the door rather than catching them to identify them if you wanted to isolate a particular glider you could set the sure flap to block the particular glider you wished to capture.

Visual identification is often difficult unless you raise or spend a lot of time with them. You can use size, colouring, sex and markings, personality .

Ear tags metal ear tags can work relatively well in squirrel gliders, however they can cause sore wounds and are prone to tear out particularly in species that have thin ears, such as the petaurids. When using ear tags care is needed to avoid veins within the ear when making the hole . In some cases it may be best to use a hole punch to create a hole first, then fit the tag(S.Ward)

The squirrel gliders I have had in care are all tagged before release, I use the small metal tags I place them in the right ear for males and the left ear for females I record the number and the GPS coordinates for each glider. I have found that by placing the tag close to the head, making sure not to pierce or damage the cartilage, as this would not only be painful, but it will collapse the ear which would be detrimental in the gliders survival as it would obstruct their hearing ability. I tend to do this 5 to 10 days prior to their release as I then monitor their tags watching for any infection. (W.Reilly pers comm.)

Photo 3. *Ear Tag on a Squirrel Glider.*

5.4 Routine Data Collection

When an animal is either brought in from the wild or another facility or is brought in for hand rearing. Its sex age, weight and any identification should be recorded

6. FEEDING REQUIREMENTS:

Food preparation:

- As per the standards: part 2 nutrition and hygiene. Each animal must be offered a variety of wholesome and palatable food and water in quantities that are sufficient to provide for its good health and normal growth;
- Veterinary advice must be obtained and followed in relation to the addition of food supplements to the ordinary diet of animals;
- Food must be unspoiled and free from chemical and bacterial contamination;
- Water for animals must be either reticulated to, or changed daily in, each enclosure;
- Must not be allowed to become stagnant;
- The area in which food for animals is prepared;
- Must be indoors or completely screened;
- Must be constructed of materials that will withstand steam-cleaning and chemical disinfection;
- Thawing and preparation of the food must be done so that it retains its nutritive and wholesome qualities;
- A toxic chemical or other harmful material must not be used or stored in the area used for preparing the food;
- Subclause (3) does not apply to cleaning products or disinfectants used in cleaning the area, the food containers or the food preparation utensils.

Food storage

- High standards of cleanliness must be observed;
- By staff engaged in the preparation of food and drink for the animals;
- In relation to the utensils and equipment used, and adequate facilities must be provided to enable this to be done;
- Utensils and equipment used in preparing and distributing the food and drink must be cleaned after use and kept clean when not in use;
- Food preparation areas must be washed down daily and treated with appropriate cleaning products;
- Boots aprons and brooms used in the food preparation area must be cleaned after use and kept clean when not in use;
- Utensils and other equipment used in preparing the food and drink must not be used for any other purpose;

Food presentation

- Supplies of food for the animals must be stored in facilities in which they are adequately protected against deterioration, mould and contamination;
- Toxic substances, dead animals and discarded foodstuffs must not be kept in a storage area;
- Stocks of food supplements must be handled , stored and rotated in a way that minimises nutritional loss;
- Frozen food must be stored at a temperature that is not higher than 18 degrees below zero Celsius;
- Utensils and equipment used for offering food and drink to animals
- Must not be used for any other purpose;
- Must be easy to clean and designed to avoid risk of injury to the animals
- Must, when in an enclosure, be placed in such a position that each animal in the enclosure has easy access to sufficient food and water and the risk of contamination from soiling by the animals is minimised;
- Except in the case of a self feeder must be washed following use and kept in a sanitary condition;
- In the case of a self feeder, must be inspected daily to ensure that it is working effectively and dose not contain caked or unwholesome food;

Photo 4. *Squirrel Glider eating a wild diet of acacia gum.*

6.1 Diet in the Wild

Squirrel Gliders are Omnivores, they need plant or insect exudates to satisfy the bulk of their energy requirements, pollen, anthropoids, manna nectar and gums.

Nectar – sugary they have low concentration of protein, vitamins and minerals.

Sap - low in protein content, high in sugars.

Eucalypt sap contains 0.2 % nitrogen.

Kinos are produced by eucalypt trees and are often called gums, they differ from gums by containing large amounts of toxic polyphenolic compounds. They are astringent in taste usually red/orange Kinos are not eaten.

Gliders spend the night feeding on acacia gum sap. Licking branches for honey dew, peeling bark for anthropoids, gleaning foliage for manna. Prior to breeding they need to up their protein requirements. Gum sites generally consist of holes made by insect borers and from which gum was exuding, frequently prise open borer holes with their large incisors to access the pockets of gum which they have encouraged by damaging the tree. Changing sites is necessary not only for predatory reasons , but also the eucalypt responds by clogging the wound with Kino. The selection of sap trees is poorly understood.

Observation of Squirrel Gliders in the wild. Nectar and pollen were the most important foods, accounting for 59% of all feeding observations. *Banksia intergrifolia* was the most important source of these foods, four other species of eucalypts were also used heavily when in flower in spring and summer. Anthropoid feeding constituted 26% of all feeding observations, and was lowest in early in early winter when pollen ingestion was high. Other food resources used at some time during the year include lichen (in winter), fruit (summer), sap (autumn, winter), acacia seeds and arils (spring, summer) acacia gum (autumn), and honey dew (all seasons except winter).(Ian D Hume.1999)

Squirrel Gliders wild diet has few variables, one being seasonal as they consume nectar and pollen, arthropods (coleopteran and Lepidopterian Larvae). Wattle gum, eucalypt sap, invertebrates, native fruits. As with other species of *Petaurid* gliders they discard the hard exoskeletons of insect prey, probably to reduce trauma to the gut lining and also because they are likely to have limited nutritional value. Another variable would be habitat variations. , different states have recorded different amounts and a variety of foods consumed.

North Coast N.S.W have recorded that pollen and nectar were the key food items found in their diet, were as in Victoria N.S.W the key items were mostly invertebrates. Squirrel Glider have also been recorded killing roosting birds and then consuming their eggs. A study conducted by(Matt Dobson, Ross I Goldinglay and David Sharpe on the feeding behaviour of the Squirrel Glider in Remnant Habitat in Brisbane) has shown that feeding from flowers accounted for 48% of the diet, honey dew and lerp feeding accounted for 15% and 2% searching for arthropods accounted for 35% , overall occurred in 20 different tree species. Nectar and pollen were particularly important in the diet during winter and early spring, arthropods appear to be more favoured in the diet during Autumn. Bark shed was observed in Autumn.

6.2 Captive Diet

Photo 5. *Squirrel glider eating a captive diet (grape) for enrichment.*

To prepare food for a captive diet you need to cover all aspects of nutrition and vitamins, therefore you will need to add supplements. It is important to try to provide as much natural food as you. There are two theory's when you are preparing food for gliders , I have tried both and have found both to work well. You can prepare food to a size that is easily held by gliders, a good rule of thumb is look at their mouth, teeth and digits and cut pieces that can be easily held. The other is both an enrichment tool and a diet to provide food, you can give them full fruits and nuts and make them work for their food as this is what they would have to do in the wild. Have fun and alternate.

At least 3 to 5 varieties of browse should be provided for their captive diet, they need branches for dental care, these can also provide invertebrates amongst the foliage and give the gliders the opportunity to glean the leaves. They will also shred the branches to line their nests. At least two full branches of four to five varieties is recommended for two gliders.

Native browse, any flowering , Eucalyptus (gums and flowers), Acacia (sap, wattle), Callistemon (bottlebrush), Leptospermum (Ti tree), this also has medicinal qualities, Melaleuca (paperbark) Pittosporum (brush box) Lilly Pilly, Banksia, and many more.

SHORT TERM DIET : native browse, meal worms, insects (check they are not poison, centipedes will kill your glider)fruit sprinkled with wombaroo protein supplement,or carnivore mix, organic cereal, honey & lorikeet nectar mix, pollen grains, also I try and find lots of gum usually from acacias natural honey. (W.Reilly pers comm.)

HEALESVILLE SANCTUARY diet for gliders in long term care, pet food kibble, mixed fruit and vegetables, fly pupae, corn, sprouted seed, mealworms, pollen grains, crickets, arcacia, eucalypts, other blossoms.

Daily Diet : used by Healesville Sanctuary:

Daily Diet (per animal):

- Eukanuba pet food kibble
- 20g mixed fruit and vegetables – 10mm cub – avoid soft fruit
- 5ml nectar mix
- 2g fly pupae
- 5g corn
- 1g sprouted seed
- 2 mealworms

Supplement 0.4g pollen grains once a week, 1.5g pet health food 10mm cube once a week, crickets 3 to 4 times per week, acacia, eucalypts, other blossoms when available.

Nectar Mix Recipe :

- 900ml warm water
- 900ml honey
- 5 shelled, hard boiled eggs
- 150 g high protein baby cereal
- 6tsp sustagen (vitamin supplement)

Method :

1. add the warm water into a two litre jug and then slowly add the honey and stir till dissolved.
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 susagen and half the 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.

Dr Cathy Johnson – Delaney Diet :

- Leadbeater mix 50% of diet, major component of the diet, feed in evening, one glider portion is approximately 2 tbsp.
- 150ml warm water
- 150 ml honey
- 1 shelled boiled egg
- 25g high protein baby cereal
- 1tsp vitamin/mineral supplement
- An additional 100mg of calcium carbonate can be added

Mix warm water and honey, in a separate container, blend egg until homogenized and gradually add water/honey mixture. Then add vitamin powder and baby cereal, blending after each addition until smooth. Keep frozen in ice cube trays (one well is approximately one meal). Treat foods , fruit various, chopped. Can add bee pollen vitamin/mineral supplement, and live insects (calcium gut loaded for several days, adult insects preferred). Can also dust insects before giving them to the gliders, can give blooming eucalyptus branches when available, commercial lorikeet nectar can also be offered several times a week. Have additional calcium added to gum Arabic, mix it with fruit juice or lorikeet nectar, and use it to smear on branches as an enrichment treat.

Chicago Zoological Park Diet : (adapted from AAZK Animal Diet Notebook)

Note: *Recipe feeds one animal*

- 1 teaspoon sized piece each chopped, apple, carrot, sweet potato, banana
- 1 leaf lettuce
- ½ hard cooked egg yolk
- 1tbsp Nebraska feline diet (or other good quality zoo feline diet such as zupreem or mazuri)
- 12 mealworms

Taronga Zoo Diet :

Recipe feeds two animals:

- 3g apple
- 3g banana/corn
- 1.5g dog kibble
- 1tsp fly pupae
- 3g grapes/ kiwi fruit
- 2tsp leadbeater mix
- 4g orange with skin
- 2g pea
- 2g rockmelon/ melon/ pawpaw (papaya)
- 3g sweet potato

Once a week feed day old chick, when available, large insects or mealworms.

6.3 Supplements

There are quiet a few different supplements on the market however natural supplies are quiet easy to obtain with little work. If your enclosure is outside you can place some solar powered lights in the enclosure. This enables the gliders enrichment , as they have to work for their food. The solar lights don't get hot so the gliders won't receive burns , your enclosure needs to be in a dark section of the park for this to work well. You can also make an insect trap, leave a light on attached a large funnel under a light then attach a cotton bag under that, you will be surprised how many moths and beetles you catch . this works in well with their natural needs as the moths come in the warmer months so they can build up on the proteins they need for winter.

Commercial supplements , are available from your local pet shops, pet barns or produce stores, Veterinary Clinics.

Wombaroo Food Products

8 Oborn rd Mt Barker S.A 5251 or
Cooinda Downs Pastoral Bay 3/ 15 -17 Bellambi street Tarrawanna N.S.W 2518
Ph: 0883911713
www.wombaroo.com.au

Biolac
http://www.biolac.com.au/

Reliable Protein Products
www.zoofood.com
Ph: 7603217533.

Wombaroo supply food have a variety of supplements for wildlife

High protein supplement : that contains Whey protein, Soy protein, processed cerials, Maltodextrin, Dextrose, Lysine, Methionine vegetable oils, Omega 3 and omega 6fatty acids, vitamins A, B1, B2, B12,C D3,E,K, Nicotinamind, Pantothenic acid, Biotin, Folic acid, Choline, Inositol, Calcium, Phosphorus, Potassium, Sodium, Magnesium, Zinc, Iron, Manganese, Copper, Iodine, Selenium, Minimum, crude protein 52% minimum crude fat 12%, Maximum fibre, Maximum salt 0.8%

6.4 Presentation of Food

Food should be placed in clean bowls daily, the bowls need to be placed up high in the exhibit as its best not to encourage gliders to the floor. This practice helps discourage rodents from contaminating and steeling their food. Shallow dishes can be placed slightly lower filled with live food making it easy food gliders to spot. Fresh browse should be renewed at least every second day, depending on availability. Live food may be presented a few times a week . Bowls should be placed strategically around the enclosure (this ensures that all gliders get the chance to eat and reduces fighting over food. Position bowls in a position to reduce the amount food being spoiled from faeces and urine. I have observed gliders doing this deliberately once they have finished eating. All containers need to be secured branches or enclosure walls, if they are movable hanging bowls they also need to be secure as to withstand the weight of the gliders.

There are two theories on feeding gliders one is to cut their fruit into small cubes enabling them to hold the fruit in their hands, the other is to cut larger portions or whole fruits and make them work for their food (both work well) there food should be mixed up so they don't just eat their favourites. You can present food in shallow dishes, swinging dishes, nailed to branches, threaded on a blunt skewer or threaded on string.

Browse containers need to have a protective wire cap, to prevent gliders crawling down amongst the browse and either getting stuck or drown. There are many ways of presenting food you can present natural food, this can be in the way of the browse that is picked. Blossoms provide the gliders with the proteins they need and the activity , leaves also provide the opportunity to carry out the gleaning process which occupies a great deal of their time in the wild. Galls are insect incubators which are full of pupae or larvae, you can also place solar lighting around to attract insects

7. HANDLING AND TRANSPORT:

The main precautions that need to be taken would be their sharp teeth and claws. A bite from a squirrel glider can be painful as they have large incisors these are used for tearing bark from tree trunks looking for sap and invertebrates , they tend to clamp on and then bite down and grind and then bite down and grind again they can continually add pressure quiet a few times before they decide to let go. Their nails are like needles, for grasping on to trees, you need to protect your eyes and your skin as it's a delicate process removing them from your skin.

Photo 6. *The incisors of a Squirrel Glider.*

7.1 Timing of Capture and Handling

Squirrel Gliders are best caught during the day while they are asleep in their nest boxes. This can be done early morning, if they are housed in a nocturnal house, before the lights go out for the next day. They can also be netted or trapped within their enclosure. Nest boxes placed in a pet carry basket, secured and placed in a well ventilated area works well for transporting over long distances. Logs can have material placed in each end and used in the same manor making sure to secure them to prevent them from rolling over and maybe squashing your glider. They will need adequate nesting material to provide comfort and cushioning, this reduces stress for the glider, they will feel more secure with familiar smells, and it reduces the need to handle the animal.

Photo 7. *Removing Squirrel Gliders from a nesting box.*

7.2 Catching Bag

Calico cloth bags, small, medium money bags, natural fibre pillow cases are good they must be of good quality and turned inside out. There should be no lose edges that the glider may damage their sharp needle like claws or wrap around their phalanges and cut off circulation. A dark fabric is beneficial as it helps making your gliders feel secure. The size of your bag should be large enough to place two hands into the bag. At least 25cm by 25 cm up to 39cm by 68cm.

7.3 Capture and Restraint Techniques

Photo 8. *Plugging both holes of a natural nest box, ready for transportation.*

If your gliders are nesting in natural wooden hollows, you can approach the nest in the day plug both holes at the same time with some sort of cloth (I just use cotton pouches) you can then place the whole nest in a secure box, cage or bag. When you arrive at the new enclosure, secure the nest and wait till the evening and remove the material, and let the gliders explore at their own will.

Sometimes you may need to remove gliders from a box or carry basket . these pictures demonstrate this method. You have a thick small bag, you place both hands inside the bag, you reach down securing the neck and tail. You then gently but swiftly turn the bag over, at the same time turning the bag inside out, you can then tie the bag. Then place back in the carry basket, this enables you to then take glider to the vets for a vet check knowing when you arrive you can open the lid bring your glider out. You then can present different parts of the anatomy to the vet safely and securely. If your glider is very stressed but needs to be gassed down, you can do this by cutting one of the corners off the bag, poking their nose through then placing on the mask, you will feel the glider go limp and then remove from the bag.

Photo's 9, 10 & 11. *Three steps in securing your glider for health check.*

There are other ways of catching gliders you can use netting, set traps or use a net attach to a pole. These can be dangerous methods. You need to be aware of your gliders at all times, to prevent injuries such as wounds, fractures, ruptured organs or concussion, suffocation and sometimes death . You need to eliminate the risk of injury, know your flight distance, remove as many obstacles as possible, make sure all the possible equipment is ready and close at hand. Temperature is very important, you don't want the gliders you are chasing to overheat, you need to be aware of where you place the bag or box (don't leave in the sun, don't leave locked in your car) keep noise and people activity to a minimum.

7.4 Weighing and Examination

A useful technique for examining the pouches of gliders is to place them in a transparent plastic tube and an otoscope (Roberts & Kohn 1991) this allows a clear view of the glider through the tube and confines the front limbs for examination. A confident person may restrain the glider by manipulating relevant body parts out of the bag whilst keeping the rest of the glider secure within the bag, both the examiner and the holder need confidence in each other. Weighing is best undertaken by placing the glider in a catching bag and using digital or hanging scales, its best to weigh the bag prior so that it can be deducted from the total. If weighing to monitor health or weight gain you need to weigh at the same time every day, you can weigh before feeding, after feeding or both.

7.5 Release

Photo 12. *Release of a Squirrel Glider.*

If transporting to another park the glider would have to spend time in quarantine, if moving to a new enclosure within the park or temporary enclosure while existing enclosure is being cleaned/ refurbished or on returning from a veterinary visit. Before dusk, is an ideal time as squirrel gliders will normally stay in their nesting box , if they do come out they will run to the highest point of the enclosure. If it's on dusk they will be able to get their bearings quickly and return to their nest box. If the middle of the day they will be disorientated and may take longer to find their nest box leaving the out in the elements this will add to the stress they will already be feeling , and may cause injuries. Their nest boxes should be secured to the branches before gliders are returned.

7.6 Transport Requirements

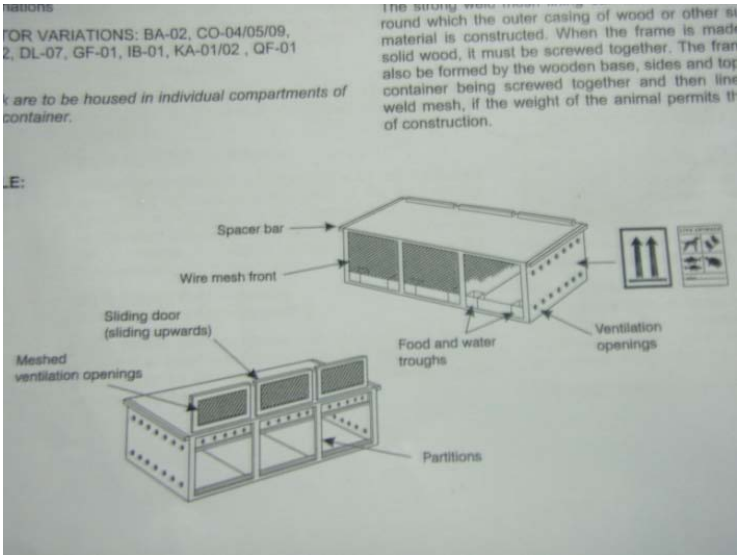

Photo 13. *Dimentions for a transport box*

Materials, wood, fibreglass, rigid plastic, lined with wire mesh strong enough to contain the glider(s) and resist gnawing at all times. There should be enough height and width for the animal to stand in a natural position, turn around and lie down comfortably. The floor should be made non-slip before being covered with absorbent bedding. The grill door and all ventilation openings must be covered with fine mesh, if this is fixed on the inside all edges must be protected and made smooth. The door must be fixed shut at both the top and the bottom in such a manor that it cannot easily come open. Food and water containers must be fixed inside the container and have outside access for replenishment. The container must be correctly labelled. If container has wheels, they must be removed or rendered inoperable.

7.6.1 Box Design

Photo 14. *Plastic carry basket for short term transportation of Gliders.*

Short term transportation – Plastic carry baskets are a good alternative to the wooden fret boxes. Especially for day trips you can place the nesting log straight into the basket, with minimum disturbance to your gliders, or you can place them into cotton pouches . there is plenty of ventilation and the air is able to circulate through the whole basket, you need to maintain correct temperatures while you are travelling, be conscious of the temperature in your car make sure they are not placed in the sun or in a draught caused form an open window. It's a good idea to strap the basket into the seat belt to avoid being thrown around, if their nest log is small you need to pack around the log to prevent it rolling. Nesting material must be provided even if transporting in the cotton bag, this can be in the way of shredded paper, square of woollen material or in their log stringy bark.

7.6.2 Furnishings

Floor covered with absorbent material, such as wood shavings, gliders may be given their bag with which they can curl up and hide. Metal food and water containers must be provided, they must be fitted into the wood/plywood at the front of the container and be fixed to the uprights of the framework so that they cannot be moved by the animal, there must be a means of outside access for replenishment. Soldered tin must not be used. All gliders must be provided with some sort of nesting material (shredded newspaper)

7.6.3 Water and Food

Squirrel Gliders do not normally require additional feeding or watering during 24 hours following dispatch. If feeding is required due to unforseen delay, they can be provided fruit and water without the need to open the transport box as there is outside access to the permanently attached dishes. They would be emptied before transport commencement.

7.6.4 Animals per Box

Normally one animal per compartment unless the animals are used to co-habiting. Squirrel gliders usually live in family units . so it would be best to move them as a family unite. I would not recommend placing unfamiliar gliders together . They need to be introduced and then monitored for a time.

7.6.5 Timing of Transportation

The best time to transport gliders would be the early morning or evening avoiding the heat of the middle of the day, if there is no choice care must be taken to not overheat gliders or leave them in the cold. If long term transportation is not avoidable food and water must be offered.

7.6.6 Release from Box

If they are going straight into quarantine depending on the facility they may be placed into a nest box with their familiar bedding, with the opening blocked until dusk. If they are being placed in an enclosure with other squirrel gliders it may be beneficial to leave them in their transport container for 24hours until they can familiarize themselves with other sounds, smells and gliders. What I have done , and have found that it works well is , I place them in a bag altogether in the daytime , then I rub them all together (this confuses them as they have different sent all over them) they are slightly aggressive at first , once they are confused by the sent they settle down all together. Their transport containers if being left in enclosure for any amount of time need to be secured in a position high in the enclosure, gliders tend to stress if left down low.

8. HEALTH REQUIREMENTS:

As per Standards:

- Arrangements must be made for the health of each animal to be checked each day;
- For the person checking the health of the animals to provide the exhibitor of the animals with an appropriate report on any distressed, sick or injured animal;
- In particular, a report must be made in relation to an animal suffering from;
- Obvious under – nourishment or weakness
- Bare spots in fur or fur covering
- Persistent diarrhoea
- Unusual nasal discharge
- Sores or open wound, broken bones or other physical injury
- Arrangements must be made for regular veterinary inspection and care of each animal

8.1 Daily Health Checks

Gliders should be observed every day , or night depending on enclosure or nocturnal house. Daily checks can be carried out visually by observation only. Getting to know the dynamics of the group is a great help in picking up problems within the group.

- **Coat condition :** fur dull and listless, health problem (diet /illness) fur on enclosure floor or elsewhere indicates fighting/mating .
- **Discharge :** from eyes, ears, nose, mouth. Cloaca.
- **Appetite :** leaving food, or consuming to quickly.
- **Faeces :** colour, consistency, amount.
- **Change in demeanour :** aggressive/ withdrawn/ isolated.
- **Injuries :** including abrasions, swelling, lameness and any asymmetry.

Presence and development of pouch young by observation of enlarged pouch, aggressive behaviour, food consumption.

8.2 Detailed Physical Examination

Things to look for to gauge the health of a squirrel glider, observation and assessment . Their behaviour, movement, sleeping, grooming, eating excreting and socialisation behaviour are all beneficial to the history before you start to look at the health.

- Start at the head – notice the position (tilting to one side)
- Eyes – pupils reacting, sunken or glazed
- Discharge - eyes, ears, nose, cloaca, ears erect and firm
- Mouth – teeth clean /length /colour, gums pink,
- Skeletal – palpation is beneficial for allocating condition scores, feel down spine for irregularities,
- Limbs – expose each limb and inspect claws and pads, run your fingers along the gliding membrane (patagium)
- Body – cover the head and gently blow fur in an opposite direction working your way over the whole body looking for any puncture wounds, alopecia, ectoparasites, fungal infections
- Sent glands – mature gliders sent glands are located , centre forehead, front of their chest
- Pouch – check for pouch young, lactation, condition of pouch
- Testes – size, length, width, depth, hard or soft, extrude penis and assess
- Temperature - is usually 35* to 36*
- Pulse – rate 200 – 300 beats per minute, taken from the femoral artery or heart beat
- Respiratory rate – 16 to 40 breaths per minute

The overall condition should be a clean cloaca, fir should be thick and healthy , eyes should be glassy in appearance , whiskers should be straight, tail fluffy and well groomed, gliders should be well covered but not fat(average body weight for an adult is 220 grams)

8.2.1 Chemical Restraint


Photo 15 Gassing down with Isofluren.

Chemical restraints, Diazepam (0.5 – 1mg/kg IM) or Butorphanol tartrate (0.4 – 1mg/kg –SC or IM) have been used A Olsson & J Roffey *pers,comm.*) Tiltetamine/ Zolazepam (4 – 10mg/kg IM) The induction is usually smooth with good muscle relaxation. Reported adverse effects include tachycardia, ptyalism, respiratory depression, apnoea and muscle rigidity (Volgelnest 1999, Holz 2002, Viggers & Lindermayer 1995). Three deaths have been reported in Squirrel Gliders (Holz 19920) I personally have seen two deaths in Squirrel Gliders and one near death. One was inappropriate placement in a bag after procedure, the second one was dead after it was handed to me, the mucous membrane and nose were blue, the near death was being removed from barb wire and stopped breathing after the injection. With repositioning and massage recommenced breathing and fully recovered. (Wendy Reilly 2008 *pers comm.*). Darting would not be recommend due to the size of the glider.

8.2.2 Physical Examination

Knowing how to handle a Squirrel Glider is essential, keep it wrapped in a towel, or a bag handle the glider firmly but gently. Quieten your voice tone and others around you, loud noise and fast movements stress the gliders. Be careful when restraining gliders that you are not squashing them (squeezing their chest so they cannot breath) . Try not to approach them from above, as this can be very threatening to them they may see this as a predator swooping down, keeping eyes covered has a calming effect. Squirrel Gliders may bite and will attempt to escape, they will hiss and grunt especially if they are not routinely handled. If you are confident you can restrain the glider in a cotton bag or towel and expose parts of the anatomy that need to be inspected or treated, this works well, making sure to keep the eyes

(except on examination) covered. You can manipulate every part of your glider with minimum stress to the glider.


photo restraining glider in pillow slip whilst examining his swollen leg, injury from barb wire.

8.3 Routine Treatments

- **Worming** – endoparasitic worms, cause a number of cestodes, trematodes and nematodes that have been found in or on various species of possums and gliders. Parastrongyloids, Paraustrostrongyloides and potentially Paraustroxyuris have been found in the gut of gliders (Spratt et al. 1990)
- **Signs** - not obvious unless diagnosed, may cause diarrhoea or ill thrift (Booth 1990)
- **Diagnosis** - faecal floatation and the presence and the presence of eggs or proglottids (segments that make up worms).
- **Treatment** - Anthelmintics can be used without apparent side effects in gliders and include Fenbendazole at a dose of 20-50mg/kg sid (once a day) for three days, Oxfendazole at a dose of 200 ug /kg PO or SC only once (Booth 1999)
- **Prevention** – Good hygiene by the removal of faeces and quarantining new animals.
- **Ectoparasites** - cause numerous species of ectoparasites including ticks and fleas, have been found on gliders, mites of the Guntheria and Petauralges and Atopomelid (Booth 1999)
- **Signs** – generally seen on the animal when captured , by excessive grooming, hair loss or inflamed skin.
- **Diagnosis** – visual observation or skin scraping and microscope examination to identify the parasites.
- **Treatment** , treated with acaricides, carbaryl powder 50g/kg has been used topically and in the nest box to control mites (Booth 1999). Injectable ivermectin also controls a range of ectoparasites.
- **Prevention** by maintaining good hygiene and routine examination of fur. Quarantine of new arrivals helps prevent the introduction of ectoparasites.

8.4 Known Health Problems

Dermatological Disease – a variety of skin conditions have been diagnosed in possums and gliders.

Alopecia – occurs frequently in most species and may be discrete patches, **cause** – include epilation after attack by predator, stress , nutrition, hormones, pouch young maintained at too high a temperature or infectious.
Diagnosis – investigation to rule out infectious cause should occur in all cases, but in many cases no specific aetiology is determined. Underlying causes frequently result, Bacterial and fungi skin disease is common. Accompanying disease often include pneumonia, pleuritis and sinusitis, (RWH 2007)

Dental disease –tooth root abscesses and periodontal disease. The primary pathogens involved in gliders has not been identified. Periodontal disease may be associated with sinusitis in gliders, **signs –** decreased appetite and weight loss. **Treatment** - is based on cleaning of affected but essentially sound teeth, extraction of more severely affected teeth and the administration of systemic antibiotics, Clindamycin 11mg/kg Bid (twice a day) for 2 – 3 weeks or until signs resolve, server tooth wear may lead to emaciation in elderly animals (K Bodley pers comm.). **Prevention** –of periodontal disease is largely based on feeding a Diet based on natural feedstuffs, and avoid abrasive material.

Ophthalmologic diseases – Lenticular cataracts occur in gliders. Cataracts are commonly seen in captive and free ranging gliders. In most cases the aetiology is not known, except when associated with Toxoplasmosis. Previously it was thought that diet – induced galactosemia led to osmotic changes in the lens, but has been disproved (Sphere 1988)

Toxoplasmosis – infection is most likely due to ingestion of oocysts in food contaminated with cat faeces, or ingestion of raw meat containing cysts might also be possible as these are known to occur in other species (Fenkel 1990, Rose 1999). Disease is more common in animals that are immunosuppressed or hand reared. Deaths due to toxoplasmosis in free ranging urban and captive gliders (Presidente 1982a, Canfeild et.al. 1990a, Hemsley 1992, Rose 1999). **Clinical signs** –include sudden death malaise, respiratory distress and neurological dysfunction (Canfield et. Al. 1990) **Treatment** –most cases of toxoplasmosis are diagnosed post mortem and the effective treatment regimes have not been determined. Clindamycin 10 – 15 mg/kg Bid Po for up to 4weeks may be effective in early stages of the disease.

Abscessation – retrobulbar abscess associated with adreanal adenoma in a squirrel glider has been recorded (ARWH2007), abscess formation appears to occur commonly as a sequel to trauma and immunosuppression.

Wound infections –a range of bacteria have been isolated from infected wounds in gliders and bacterial infections should be anticipated as sequel to traumatic injury staphylococcus aureus, b haemolytic streptococcus and corynebacterium spp. From infected wounds (Presidente 1978 Munday 1988). As septicaemia and death can result, local wound treatment and prophylactic antibiotics are recommended.septicaemia associated with cat bites (Woods 1999). **Treatment** – appropriate antibiotics such as enrofloxacin, doxycycline or amoxicillin / clavulanic acid should be administered prophlactically to bitten gliders as p, multocida infections often become systemic (Cunningham 1994)

Hypothermia – the subnormal body temperature, server disease / shock sedation, anaesthesia, prolonged exposure to low environmental temperatures. **Signs** –shivering , depression, slow breathing rate, cardiac arrhythmias, coma , death. **Treatment** –warmed intravenous fluids, rewarming should only start once cardiovascular support has been initiated (fluids) passive rewarming maintain ambient environment, surface rewarming warm wter bottle, care should be taken with glider that they don't get cooked on the water bottle , use warm water and wrap it in a towel, check temperature constantly especially if glider is unable to move, don't warm glider up to quickly if they are in shock this will worsen the situation.

Hyperthermia – elevated body temperature, causes overexposure to a hot environment that the glider cannot remove itself from excessive seizures, **Signs** –restlessness, tachypnoea, tachycardia, poor pulse quality, red mucous membranes, vomiting and diarrhoea, ataxia, collapse, coma, death, elevated body temperature. **Treatment** –rapid rate intravenous fluid therapy, cool fan, wet fur preferably with running water, lay ice pack wrapped in a towel, check temperature to make sure glider does not become to cold. Once cooled animal should be monitored closely for the development of disseminated intravascular coagulation, hypoglycaemia, shock gut with sloughing of the GI tract mucosa and development of haemorrhagic vomiting and diarrhoea, acute renal failure, cardiac dysrhythmias, pulmonary dysfunction.

Obesity – can become a problem, in the states sugar gliders are kept as pets and are fed yogurt balls, this has created a large health problem for the gliders as they are not only becoming obese,they are also becoming diabetics. You need to closely monitor your gliders closely, provide plenty of opportunity for them to exercise, and make sure their food is mixed together to prevent them from only eating one particular thing.Several dishes need to be placed around the enclosure to give every glider the opportunity to eat

Ectoparasites –fleas, ticks and mites of numerous species infest gliders. The *Petaurus* genus is parasitised by mites of the *Guntheria* and *Petauralges* genara (Jackson 2003)

These can safely be treated with Revolution.

Leptospirosis - Transmission is by direct contact between animals through urine or during mating activity. Infections are associated with interstitial nephritis but are often subclinical or mild (Durfee &Presidente 1979, Rose 1999).

These are just two examples of transformation there are other ways, stress caused from other animals will contribute for an illness to present itself, that would normally lay dormant. Injury is another, so these are diseases that have been indirectly cause from or to another species.

8.5 Quarantine Requirements

A newly –acquired animal must be kept in isolation for as long as may be necessary to provide for its examination, acclimatisation and , if necessary restoration to good health before being placed in the company of other animals.

The quarantine period is anything up to 60 days depending on the circumstances. Squirrel gliders should be kept in a cat, fox and rodent free enclosure.
Faecal examinations, faeces should be cultured for Yersinia pseudotuberculosis. It may be appropriate to test for Cryptococcus sp if it has been seen within the group and /or if it has been isolated from the environment , food tree or browse. Serum should be tested for Herpes virus, Toxoplasma gondii, and leptospira sp. Infection. Faces should be submitted for complete bacteriologic examination including routine culture, Salmonella culture, Campylobacter culture and ZN staining for acid fast bacilli, there should be three negative faecal floatations. Heavy infections of coccidian, nematodes or cestodes should be treated appropriately. Any strongyloides spp should be treated. Treat with praziquantel at 5mg/kg Bid (twice) at beginning and end of quarantine. Test for Cryptococcus spp. Infection use latex cryptococcal antigen test (LCAT) on serum. Greater than 1.2 is considered positive. Two negative test or non rising titres are needed. Test the recipient and departing population for toxoplasma gondii infection using a modified direct agglutination test forantibodies. Release only negative animals into negative populations. Test for leptospira interogans antibodies using a microscope agglutination test.

9. BEHAVIOUR:

9.1 Activity

Observations of captive sugar gliders who are very similar to squirrel gliders , showed that although the amount of time utilized increased with increasing night length, the proportion of the night utilized decreased(Goldingay 1984). Activity within different night lengths increased from 9.7 hours at 14:10 to 10.3 hours at 12:12, to18.8 hours at 9:15. The mean percentage of the night spent active decreased from 51.7% at 14:10 to45.7% at 12:12 to46.3% at 9:15.The peak period of activity was also shortly after the lights went out(Goldingay 1984). These results suggest that night/day lengths of 12:12, or slightly shorter nights, are preferable, although the change in day length may be important for initiating reproduction.

The diet can also be important for the activity of gliders spending more time foraging, which increases with increasing body size. There are predictable limitations to the activity and therefore visibility to the public that can be achieved, even with activity feeds, when attempting to display gliders in nocturnal houses.

9.2 Social Behaviour

Squirrel Gliders live communally in groups of between two and nine individuals, with at least one male and several females , suggesting a polygynous mating system (Quin 1995). A family group typically comprises one mature male (more than two years old), and one or more adult females and their offspring (Suckling 1995). Up to two adult males may be present in the nest (with a single male more than three years old),(Van der Ree 2001). The presence of multiple adult males both sexes within a social group suggests the mating system is polygamous or polygynous (Van der Ree 2002) . Sent marking plays an important role in their social activity .They have an anal gland that exudes a very strong musty odour that is rubbed onto branches by the animal performing a cloacal drag (Biggins 1984, Carmicael 2000). Upon meeting they raise their tails over and parallel to their backs with their tails standing on end and they move their tail from side to side (Carmicael 2000) . Other behaviours include a chatter challenge call, attacking each other, grappling sniffing and an alarm hiss when held against their will. Females are more socially aggressive than males and readily attack and pursue animals of either sex from another colony (Smith 1995).

Similar observations have been observed in captivity suggest that captive colonies do not like the introduction of females and will fiercely attack them. Juvenile females should also be removed prior to sexual maturity to avoid being attacked. The male has a well developed sent gland on the top of his head that is used to mark other members of the group. Other glands on the chest and the underside of the tail are also used to mark their territory and each other (Russell 1995). When gliders are held in a colony, members are regularly sent-marked by mature males and animals not bearing this scent are often attacked(Dunn 1982). Therefore, the introduction of unfamiliar animals should be attempted with great caution.

This is where I have found the rolling them around in a pillow case works well, it confuses them as all the sent glands rub on each other, you can monitor the level of aggression between the group and if you feel it's getting a bit rough you can separate the whilst they are still in the bag. Once they have settled you can rub them all again, when you feel comfortable place them in their bag into the nest box, always monitor closely.

9.3 Reproductive Behaviour

Courtship behaviour is not well understood for the glider species. The copulatory behaviour of the mahogany glider which has many similarities to the squirrel glider has been described (Van Dyck 1993). During this event ,the male produce a soft 'chew – chew – chew – chew' at which the female made immediate efforts to join him. The female sniffed the males 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 for 23minutes, during which time they both adopted a vertical head down position on the trunk ,with the male thrusting intermittedly. The male grasped the female's dorsum in a similar fashion to that adopted by young back riding gliders newly emerged from the pouch and he bit her neck until they separated (Van Dyck 1993)

The timing of breeding is linked to the times of the year when additional protein is available to assist in lactation. Breeding success will typically vary from year to year and also between different locations. Reproductive success can be severely impaired in drought years when food is in limited supply. Similarly, rates of reproduction can vary significantly between populations in different parts of a landscape. The influence of stands of different tree and species and their associated foliage nutrients on the density of populations.

9.4 Bathing

Bathing is not normally observed in any of the possums and gliders, I personally have noticed mammals that are not exposed to the elements, such as rain, dew, tend to build up a film of scunge on their coat which prevents the natural oils from travelling down the shaft. This can be a problem especially in older mammals when grooming becomes a chore. It can cause your glider to stress, encourages parasite build up.

Making sure your gliders are exposed to the elements would be the best solution. If this is not possible , depending on the disposition of the gliders in your care, you can wipe them down with a damp warm cloth. Natural non scented products work best. As this usually encourages your animal to naturally groom, you don't want the glider ingesting chemicals. The one time when you can bath your glider is if it has been brought into care and you are having trouble warming them up this is usually furless or you have a glider that is covered with a hard to remove substance.(W.Reilly pers comm.)

9.5 Behavioural Problems

They appear to suffer little from behavioural problems. The only problems I have had encountered is that they are very intelligent and great little escape artists. I have had five in an enclosure . I had been feeding them at the same time of day (just before they emerge from their hollows). This particular day they were waiting. One glider was sitting on the log in front of the door, the others were placed strategically above my head hiding on the door frame. I think this was a very cleaver plan because if I opened the door focused on the glider in front, the others would try to escape. I have had others held in a hospital box (wooden) it had a wire door and a wire back there were also holes drilled in the wood for ventilation, I was placed in an enclosure. They worked on the ventilation holes and chewed until it was big enough for them to chew out. (W. Reilly pers comm.)

Dominance hierarchies have been identified in Squirrel Gliders both males and females. One investigation found that in comparison with subordinate males, the dominant male sugar glider in a group was heavier, won more social encounters and sent marked more frequently. There also were significant physiological differences between such males in their levels of hormones such as testosterone. When dominant males were translocated to another colony, levels of testosterone decreased substantially as did body weight.

Accompanying the loss in weight was a loss in social status including a reduction in sent marking and lack of success in aggressive interactions. A dominance hierarchy also has been recorded among females of captive colonies of sugar gliders. Aggressive interactions between females was to be believed to be the reason why only dominant ones successfully reared their young. However, care is needed in extrapolating these findings to wild populations as captive animals do not have the opportunities to disperse as they do in the wild.

9.6 Signs of Stress

Stress contributes to a number of underlying illnesses to present themselves, that would normally lay dormant. Acute stress can be associated with loud vocalization, threats, and attacks or excess urination or defecation (Spielman 1994) I have noticed with males of both gliders and possums especially the very young they will give up they get this look and its like they just give up. Females will tend to fight to survive. I have found when I see this look in a male young glider or possum I place them down my top and carry them around for a few days and it seems to make a difference unfortunately I have resisted the look and the glider/possums have died . So now I don't hesitate, the only thing I can put it down to is the heartbeat makes them feel safe. (W.Reilly pers comm.)

9.7 Behavioural Enrichment

- provide browse such as leaves, flowers and gums
- providing live food such as meal worms or crickets, (these can be placed in enclosure to encourage activity)
- placing food on branches (fruit spiked on branches) strategically placed
- provide branches of stringy bark, this will encourage nest building behaviour, they will spend great amounts of time shredding the bark and taking it back to their hollows
- provide opportunities to glide, this can be done by having branches placed up high in the enclosure these branches should be placed at large distances apart and be secure but not fixed (a live branch will move)
- providing gums you can purchase Gum Arabic Powder food grade by swift Ltd. Place the gum in gum feeders
- find rotting wood filled with lots of invertebrates , suspend these logs from the enclosure roof, this provides natural food and stimulates foraging and hunting instincts

As Squirrel Gliders *Petaurus norfolcensis* are nocturnal and usually held in a nocturnal enclosure ,they are usually behind glass so it is important to provide activities that will keep them active , this will keep the public interested and give you the opportunity to educate them on the gliders natural behaviour and the important role they play in the eco system .

9.8 Introductions and Removals

Most introductions and removals can be undertaken with few problems. Squirrel gliders live in family groups, they use their sent to maintain social structure. They need to be carefully observed to assess if there are any problems of aggression. I have found one way to eliminate problems and speed up the integrations of others , is in their sleeping hours I gather them up and place the old group with the new one (ones) I then put them all into a strong cotton bag. I continually roll them around rubbing the bag keeping a feel for aggression that could be detrimental to the gliders, I have found if you continually move and rub it confuses them very quickly as their sent glands are intermingling over every glider. And they are focused on what's happening outside the bag that they forget to defend their territory .When I feel they have settled I then place them in the bag into a nest box that hasn't been used before. I have already removed all original nest boxes and hollows and replaced them with new ones. So when they emerge they are so busy exploring and confused they accept the new members without too much of a drama. This also works well if one of the gliders has been away for a short while (vet visit) you only need to roll them around there is usually no need to replace nest boxes. (W.Reilly pers comm..)

9.9 Intraspecific Compatibility

The Squirrel Glider *Perarurus norfolcensis* is highly territorial, it will fight of other males to protect his females. He will also chase off sugar gliders from their favourite sap/pollen locations (tap trees). There have been observations of interactions between flying foxes and gliders . competition has been studied in populations of the sugar glider and the squirrel glider. The work there showed that there was considerable overlap in the use of tree hollows and artificial cavities in nest boxes . the squirrel glider was found to monopolise the best hollows and precluded their use by the smaller sugar glider. Gliders have been known to use hollows previously occupied by the laughing kookaburra. The squirrel glider has been observed eating birds eggs, and on a few occasions steeling young birds from

9.10 Interspecific Compatatibility

As long as the enclosure you are keeping more than one male squirrel glider in is large enough, with plenty of hollows and food, food placement with plenty of screening you should not have any problems. Daily observations should indicate a problem. Occasionally you will encounter a really aggressive glider this could be male or female, that you will need to remove. As for other mammals they interact in the wild with many species around them all the time, so there should not be a problem. Brad Walker has housed them with Bettongs, Bandicoots and yellow bellied gliders. Without a problem.

9.11 Suitability to Captivity

Squirrel Gliders tend to breed well in captivity if not better than in the wild ,provided they are eating the right diet.

10. BREEDING:

10.1 Mating System

The mating system of the squirrel glider is dependent on a number of factors. * Body size, the male being larger than the female. * Availability of food is another factor, squirrel gliders like many other mammals need a particular diet to give them the protein levels to see them through the breeding season. It is particularly important for females that are lactating. Generally they breed well in captivity, although there may be a problem with obesity (over weight gliders tend to be lazy). A halt in breeding may be due to increased breeding.

10.2 Ease of Breeding

Providing the right environment is an important factor. Large outdoor enclosures, with natural lighting, multiple nesting boxes, nesting materials and a good diet, one male with several females, will increase the amount of neonates.

10.3 Reproductive Condition

Reproductive condition, they need to be reproductively viable, healthy, of a good weight to carry them through the act of mating, then to provide the nutrients during development of the neonate and lactation. You can place squirrel glider in a plastic tube and examine the pouch with a otoscope (Roberts and Kohn 1991). Squirrel gliders when only have access to foliage and trees containing nitrogen and phosphorus, low nutrient forest , low density populations will maintain a monogamous breeding system whereas a polygamous system would be typical of forest with high levels of foliage nutrients located on high nutritional soil (observed by Wayne Braithwaite).

10.3.1 Females

The categories for females are,

- Non – Parous (females that have never bred) pouch small with no skin folds, clean, dry teats.
- parous (females that have bred previously but not presently) pouch small but distinct, dry and dirty, the teats are slightly elongated.
- pregnant pouch is pink in colour and glandular in appearance, skin folds may be observed on lateral margins.
- Pouch young present attached to teat.

10.3.2 Males

Male Squirrel Gliders have sent glands in the middle of their forehead and on their sternum.

- 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 of activity – some staining of the surrounding hair, some loss of hair over the gland area, waxy glandular products visible.
- High activity – much staining of the surrounding hair, total loss over the gland area, waxy glandular product prominent.

In males of seasonally breeding species, the testes can increase in size during the breeding season. The testes should be measured by measuring the length, width and depth in mm.

10.4 Techniques Used to Control Breeding

The altered day/ night can be used to manipulate breeding as the photoperiod plays an important role in the initiation of breeding. Separation of the sexes, Vasectomy or Castration of males, Removal of pouch young, Immuno contraception, Tubal ligation in females, Culling.

10.5 Occurrence of Hybrids

The occurrence of hybrids is thought to happen in the wild between sugar gliders and squirrel glider. When the numbers of one particular species is not available, however no DNA tests have been conducted (due to the cost). It is mealy an observation that myself and other wildlife carers , that have had the opportunity to care for both species in large numbers have documented. I have heard of one carer that had a squirrel glider housed with an injured sugar glider, they bread whilst in her care. A female Victorian sugar glider and male squirrel glider have produced a fertile hybrid (Fleay 1947) (Zuckerman 1953) also reported a hybrid between a squirrel glider and a sugar glider.

10.6 Timing of Breeding

There is a large variation in the start and duration of the breeding in gliders depending on the season and food availability. Breeding can be seasonal or continuous. Season they give birth are June to January.

10.7 Age at First Breeding and Last Breeding

The female squirrel gliders are ready to mate at 12months. Oestrus can be determined by examining the urine for the presence of non – keratinised and keratinised epithelial cells, polymorpho – nuclear leucocytes and the presence of sperm (Duckworth et al. 1998) at the time of oestrus there is a massive increase in the number of epithelial cells and leucocytes in the urine. It is thought that the female can breed up until her death.

10.8 Ability to Breed Every Year

Squirrel Gliders appear to be able to breed at least once per year. More in captive environment.

10.9 Ability to Breed More than Once Per Year

Squirrel Gliders are able to have two litters per year even three in captivity.

10.10 Nest Hollow or other Requirements

Squirrel Gliders should be provided with several nesting hollows, if they are not available they will nest in wooden boxes. In the wild the size of the entrance cavity is an important factor influencing were they live. It needs to be large enough for them to entire but small enough to preclude potential predators or large competitors. Gliders use higher hollows than other possums, this limits energy expenditure when they glide for food. And more difficult for predators. Changing nests helps reduce parasites (ticks, fleas, mites)they use different tree hollows for different seasons, dead trees provide warmth in the winter as they are composting, other tree hollows provide cooling , with pools of water that build up in the hollows. They also need to be provided with fresh branches of eucalypts, casurinas and leptospermum, they should be provided with branches of stringy bark with which they line their nests. Other materials that can be included are, sea grass, hay and shredded paper.

10.11 Breeding Diet

The squirrel glider needs an increase in protein this is very important in their diet .When female gliders are lactating or when they are increasing their body condition prior to breeding. These requirements may even lead to differences in the foraging strategies, between the sexes. Reproduction increases energy requirements for several reasons, nutrients have to be transferred to the growing young (particularly via lactation). More energy expenditure is required by the mother to find extra food. Movement by the mother requires more energy by the mother to cope with pouch young or back babies. A natural or as close to natural diet is best also (refer to diets in section 6.1 to 6.4)

Banksia pollen is high in protein (36 – 42%) (Turner 1984). Honey dew found in live eucalypts. Invertebrate material, nectar. Early winter pollen ingestion is highest, other food resources used at some time during the year included lichen (winter), fruit (summer), sap (autumn/winter), acacia seeds and arils (spring/summer), acacia gum (autumn) and honeydew (all seasons except winter)

10.12 Oestrus Cycle and Gestation Period

At the moment I have not been able to find any actual data on the gestation period of the Squirrel Glider. The closest data I have found, which is related to gliders in general. Ovulation occurs on the first 1 – 2 days of the oestrus cycle. Ovulation is usually suppressed by lactation, but females will return to oestrus 8 – 9 days after losing a PY. Length of gestation is usually less than 60% of the oestrus cycle.

10.13 Litter Size

Litter size would usually be one but occasionally they have two. They have four teats.

10.14 Age at Weaning

Age of weaning has been documented as being 120 days, if hand raising you would keep the neonate on milk a lot longer (depending on the individual, as some will wean themselves.)

10.15 Age of Removal from Parents

Once weaned, the young should be removed to stop aggression between the parents and offspring . However as Squirrel Gliders usually live in family groups they may be left together until they reach the age of breeding.

10.16 Growth and Development

Photo 15. *5 gram Glider (survived)*

Age	Head	Leg	Weight
20 days	12 mm	6 mm	1.1 grams
30 days	15 mm	8 mm	2.2 grams
40 days	18 mm	11 mm	4.2 grams
50 days	21 mm	15 mm	8.1 grams
60 days	24 mm	18 mm	16 grams

- Emerging from pouch 70 days 29grams
- Fully out of pouch 90days 57grams
- Emerging from nest 110days 85grams
- Growth rate 1gram to 3gram per day

11. ARTIFICIAL REARING OF MAMMALS:

11.1 Housing

As with all native mammals that have been taken into care stress is a major consideration. choosing suitable housing can help to create a stress free environment. To achieve this, several factors should be considered. Stress can kill a young animal and the first place they feel it is through you if you are stress you furless will sense it. They are being exposed to change of milk, change of feeding pattern, change of smells , sounds and have been taken away from the security of a warm pouch and being constantly attached to a teat and their mothers heartbeat.

- Securing a quiet area away from children or animals
- Maintaining the area in a hygienic manor
- Escape proofing the area
- Making sure it is safe from obstacles

Gliders can be placed in a cotton sock or sleeve of a fleecy sweatshirt (Booth1999) just furred young require a temperature in the range of 30* to 34* c which can be decreased gradually to ambient temperature at about 100days of age (Booth 1999)

I have successfully raised many gliders(sugar and squirrel) the smallest sugar glider was 5grams, the smallest squirrel glider was 17grams. I have them in what I call a heat box ,it is a styrofoam fruit box with a heat pad placed at the bottom and one down the side I then line the box with a woollen blanket I have a sheep skin pouch that has 2 material sides the rest sheep skin, I then have a pouch made of feather down, then a cotton pouch which can be changed daily or if necessary after every feed.

I place the neonate into the pouch and tie it off with a rubber band.(the blood of a furless is different to that of a furred neonate it requires less oxygen, this is so it may survive sealed in the mothers pouch) therefore you are quiet safe completely covering your furless I then cover the lid with skinless sheep wool then a light woollen blanket. It is tight in the mothers pouch not much room to move around and as they are attached to the teat they remain pretty still. You need to create that feeling of security by having your neonate packed nicely in the heat box.

I have the two heat pads attached to Anny warmers and a thermostat which I place between the cotton bag and the feather down bag, it maintains a temperature of 30 to 32*

11.2 Temperature Requirements

Photo 16. *Vetario intensive care unit design for neonates.*

The temperature of the bag should be at 34* - 36*c if the joey is furless. As the joey grows fur the temperature can be reduced to 28*-30*c (Bellamy1992). Different temperatures are suggested for different species of possum, 32*c feathertail gliders (Caton1995) and 28*c for ringtail possums(Smith1995). Brushtail possums should be kept at 30* -32*c for individuals less than 250g and 28*c for new individuals brought in until settled(Smith1995). Use a minimum/maximum temperature gauge with plastic coated probe that can be placed next to the joey, as this will ensure that the temperature can be monitored (j.Cowey pers comm..)

I keep all my furless at 30* 32*c I keep my furless macropods higher, unless they are having trouble warming up. (you want your joey warm not hot) I only take heat up 1*c at a time. As you need to take your furless out of the heat box to feed and toilet, (always keep them in their cotton liner) and they are usually born in the colder months, I place a heat bag under a towel on my lap, this helps to maintain some warmth whilst out of the box. When using a heat pad you need to constantly observe your joey for dehydration. You need to keep their skin supple, I use paw paw cream there are a few good creams on the market but if you think natural with no perfumes they are usually ok.

Thermometers are great they stop you going insane, worrying about temperatures. They are available at dick smiths, Tandy , BIG W, and many other places . the ones I use have IN and OUT reading they are digital (great they glow in the dark) I attach it to the probe on the Anny warmer and then place in the bag not touching your furless but between the cotton pouch and the next layer.(W.Reilly pers comm..)

Photo 17. *The heat box, that houses my furless.*

11.3 Diet and Feeding Routine

The three main formulas for hand –rearing possums and gliders are.

Biolac the M100 formula is recommended for the entire hand –rearing process, they should be fed 10-15% of their body weight per day.

Di Vetelact A widely used low lactose milk formula. Animals should be fed at approximately 20% body weight except for very small joeys (less than 100g). Squirrel gliders have been raised on one scoop with 70mil water, two drops pentavite and one teaspoon of high protein baby cerial (A. Gifford pers.comm)

Wombaroo possum milk. Different formulas are used for different stages of development to mimic the changes that occur in the female during lactation. The two formulas are the < 0.8 for pouch young prior to emerging from the pouch and the >0.8 milk that is used with possums and gliders after pouch emergence. Charts are provided to assist in determining the volume to be fed.

Feeding utensils , very small joeys can be fed using a syringe fitted with a bicycle tyre valve rubber, plasticintravenous catheter or 1-inch length of infant gastric feeding tube(Bellamy1992). Small possums can be fed by fitting the teat onto a 10ml syringe from which it will lap(Austin 1997) T4 teats from Biolac are also useful (J.Cowey pers. Comm.)

When feeding, it is important not to feed the milk formula too quickly, the rate at which the milk is squeezed should not be faster than the rate that it is swallowed. Ensuring the hole in the teat is not too large will help (it should only be the size of a pinhole). Too much milk results in an accumulation in the pharynx, which is suddenly sneezed or coughed out the nostrils. To avoid this, be very careful of the rate at which milk is released to the joey and use a smaller hole on the tear if required.(Bellamy1992)

Photo 18. *Squirrel Glider still attached to the mothers teat. (notice the granular pouch)*

Don't feed your Joey if it's cold or dehydrated (warm first then rehydrate then feed)

Remember when Joey first comes into your care they are used to having a teat in their mouth constantly, and take a drop at a time .This is where the first few days are critical. Don't expect your Joey to drink great amounts; you may need to provide more feeds than recommended until their little tummy has become used larger amounts.

When your joey first comes into care it can be very frustrating for both you and the joey. The joey just wants to be fed and you just want it to survive. Joeys are all the same but different, some will adjust straight away, others are just difficult . The mouth of a furless has not properly developed, it is usually shaped, as to accommodate the mothers teat. You can purchase very small teats that attach to a 1ml syringe, soft tubing, I use Terumo winged infusion set (ask your vet) the tubing is soft I cut the needle of, then cut to the length required, then attach to a 1ml glass syringe. Some joeys are so small you need to just place a drop on their lips and it will just soak in through the opening. For these joeys I have a large magnified glass on a stand with a flouressent light , this enables me to see if the milk is being consumed, (another way is by weighing before and after you feed you need small increment scales, or you can actually see the milk in the neonates stomach) this is helpful as you can monitor at what rate the food is being digested.

Photo 19. *Squirrel Glider, ready to have the milk wiped from his face.*

Always wipe over the face to remove milk as this can be a breeding ground for bacteria, I use a warm damp soft cloth I gently wipe the whole face as the mother would be keeping the neonate clean in the pouch. Times to feed your furless will vary depending on what milk you are using and what weight of your neonate.

Photo 20. *Squirrel Glider wrapped in a tissue, ready to feed.*

Before removing your furless make sure everything is ready, leave furless in cotton pouch, with head poking out , wrap it up like you would a baby with arms securely tucked in (they tend to pad , this is done in the mothers pouch to stimulate the milk to come down) allow for movement under your wrap. I feel this contact with you is important especially as now, its living in a warm box with no movement or heartbeat. I also feel it's an important time to massage and stimulate your furless. This helps with digestion (by stimulating the internal systems) helps reduce the chances of phenomena and replicas the movement, it would be encountering in the mothers pouch.

The first few days can be unpredictable, it is important that your joey feeds even if it means you get 1 drop in every hour until it settles (this won't go on forever) if you notice your joey dehydrating you must get help you may need to SC some fluids either yourself, vet or an experienced keeper. (I have found the insulin needles to be best as they have a very fine needle attached) if you don't your furless will probably die or damage their kidneys. Your neonate might just let the fluid run out of its mouth this is where you must be vigilant about getting milk into it, you can lay them back lift their lip trying anything to get the milk to run into their mouth.

I use IMPACT with every neonate that comes into care. It is a wombaroo product that you can add to your milk it is Bovine colestrum powder, protein, whey protein, vitamins and minerals, omega three and omega six fatty acids. I

11.4 Specific Requirements

When first brought into care , the young animal may be dehydrated. If so it can be given plain boiled water with 5g (one teaspoon) of glucose to 100ml or 1g of electrolyte replacer if available (Austin1997) Vytrate can also be used at a ratio of 20ml Vytrate to 250ml water(J.Cowey pers.comm.) . Alternately, fluids such as lectade or pedialye

Stimulating / Toileting, your joey . This needs to be done very gently especially with your furless. Gently lay your joey on its back, cupped in your hand, hold its tail away with your finger wet a soft tissue with warm water and gently brush across the cloaca this will stimulate your glider to urinate if you brush from the tail towards the head this will stimulate faeces. Over stimulation can cause a prolapsed this often happens when you have been handed a neonate that a member of the public has been looking after for a while. Sheriproct ointment can be applied once a day (you will need a script from your vet).

Faecal colour, will change once you have changed the milk, when with the mother it is usually dark, once you have your neonate on commercial milks it will lighten , the consistence should be that of toothpaste, if smelly (sweet or sour or runny like water seek help). Constipation can be another problem, you need to make sure your furless has some amount of water, milk is a food. Urine should be odourless and clear. (W.Reilly pers comm..)

11.5 Data Recording

When an animal is first brought in for hand rearing, you should check the sex, weight and measurements then using charts work out an approximate age. All this information should be recorded, and then continually record on a daily basis. The best way to record weight is at the same time of day and before a feed, if you are concerned that your neonate is drinking enough(as they drink a tiny amount they can dribble a lot out the side of their mouth) you can weigh them after their feed as well making sure to record both weights.

All this information is important as it creates a history, which will help the veterinary if neonate becomes ill or is not thriving.

- Date time information is recorded (try to keep to the same time this helps to keep your records accurate)
- Body weight to the nearest gram (or you can purchase scales that will record up to a gram)
- General demeanour and activity
- Characteristics and frequency of defecation and urination
- Food consumption at each feed
- When and what different types of food that are offered
- Veterinary examinations and results
- Development stages and measurements

11.6 Identification Methods

Once furred, they can be identified with a implant chip. A general rule is not to chip individuals that weigh less than 10grams.

11.7 Hygiene

You should be scrupulous with your hygiene as neonates are usually depending on antibodies provided in mother's milk. Spilt milk can harbour bacteria. Change pouches regularly you might not see the milk but it will be there, wipe neonates face with a warm cloth, rinse bottles and teats with cold water first then wash in hot soapy water, I then pop them all into a baby bottle steriliser you can purchase these at places like Big W , or you can pick them up at garage sales, there are other products on the market like Milton if you use these I would highly recommend that you rinse well before using.(W.Reilly pers comm..)

11.8 Behavioural Considerations

Take care that the joey being hand reared does not become too attached to the raiser, as this will make the weaning process much more difficult. Raising several individuals together and not over handling them will help them to socialized properly and reduce these problems.

I find that when it's time to move the possum to the next stage, which is an outside undercover cage is where I start the weening of stage, they are usually so busy being scared, wanting to explore their new dwelling they forget about me. I limit my visits to the day were I clean ,place fresh browse and leave their food.(W.Reilly pers.comm.)

11.8 OH&S

Squirrel Glider *Petarus norfolcensis*

Wild squirrel gliders should be approached with care as they have very sharp incisors (they use to pierce bark) and nails that have needle points (which are use to grip the bark on landing). Approach slowly and quietly speaking in a slow soft tone, not talking your eyes of the glider, you need to be able to anticipate its next move, you may need to use leather gloves . I have found it difficult to get a true grip when using gloves. A thick towel is very useful with a pillow case close by, speed and accuracy is needed (don't hesitate) once bagged and tied off the squirrel glider will usually settle down (be aware they can still bite through the bag).

Hand reared squirrel gliders are very gentle and will usually come to the keeper without hesitation, in doing this they can cause injury to the keeper. They need to wear protective clothing as their sharp nails will scratch, long sleeves, hat and some sort of protection for your eyes. They tend to become excited thinking they may get a treat and will launch of a branch and glide straight to you. (I have walked into the enclosure, and have had my face covered with an out spread glider grasping on to whatever it could e.g. my face)

Protection of the handler is paramount for two reasons, it prevents injuries to the handler and prevents injuries to the squirrel glider, if the handler gets bitten or scratched there is a chance the glider may be dropped or escape.(W.Reilly pers comm.)

Zoo noses – (M.Bovis) reports infection associated with handling possums and gliders is rare. Infection is commonly reported in veterinarians and other workers performing necropsies on common brush-tails in New Zealand. These primarily involve infections that result from contamination of cuts and abrasions on the hands. (Cookeet al. 2002) other diseases of gliders such as Leptospirosis, yersiniosis, Dermatophytosis and Salmonellosis are all positional zoonoses (Steven & Hughes 1980, Blyde 1999) the role or possums and gliders is in the Epidemiology of other diseases that have been known to affect humans such as Ross river fever, Murray valley encephalitis and Rickellsial disease is unknown.

GLOSSARY

Cloaca - A common chamber reviving the discharge of the digestive, excretory and reproductive systems.
Incissors - Teeth that are found at the front of a mammals mouth. Incisors are used for cutting food.

IV intravenously, into a vein, within the lumen of the vein.

PO Orally, into mouth

SC subcutaneously, the area below the dermis or skin layer, composed of adipose and loose connective tissue.

Sid once a day

Bid twice a day

Tid three times a day

Qid four times a day

Prn as needed

Q every

Behavioural enrichment, food or devices provided to captive animals to enhance natural behaviours and activity patterns.

Crepuscular, of the twilight , applied to animals that are active dusk and dawn.

Dehydration, an excessive loss of water from the body it can be tested by pinching the skin and letting it go. If it does not fall back in a few seconds it may be servery dehydrated.

Dentine, one of the hard tissues of the teeth that constitutes most of its bulk. It lies between the pulp cavity and the enamel and where it is not covered by enamel is covered by cementum, the third hard substance of the tooth.

Distribution, the area or range that is occupied by a species.

Gestation period, the duration of pregnancy.

Habitat, the natural environment occupied by a particular organism.

Hibernation, a type of deep and prolonged torpor where the minimum body temperatures decrease to within several degrees of the ambient temperature and can decrease to 16degrees and can last several weeks or more.

Hierarchy, a form of social organization in which there is an order and each individual has rank or status from the top ranked most dominant animal to leased ranked and most subordinate individual. The rank turn reflects the individual priority to feeding and mating success.

Home range, the area in which an individual travels in order to fulfil nightly feeding requirements, social behaviour, reproduction and nests.

Honeydew, the sugary waste excreted by psyllids on the leaves and other parts of the plant on which they feed. The presence of honeydew can be recognized by the growth of a black fungus called sooty mould.

Hybrid, an offspring of parents of different strains, variations, species or subspecies.

Illthrift, failure to grow, increase in weight or maintain weight in the presence of apparently adequate food supplies and the absence of recognizable disease.

Interspecific, between species

Intraspecific, within species

Lerps, the covering or testa excreted by the nymphs of psyllids, under which they shelter and feed and which enlarge as they develop. The adult then emerges from the lerp and lives a free existence.

Longevity, age until which an individual lives.

Mating system,

Neonate, a newly born animal.

Nocturnal, active during the night.

Photoperiod, the length of time between consecutive light or dark phases.

Reproductive status, condition of males and females with respect to reproduction. Eg non breeding, pregnant or lactating.

Reverse cycle lighting, the use of artificial lighting such as white, blue or red lighting during the day to simulate night time so that nocturnal animals are more active. During the night, bright lights are lit to simulate day time and the nocturnal species retreat to their nests.

Quarantine, restrictions placed on entering or leaving premises where a case of communicable disease exists or is suspected.

Salmonellosis, a highly contagious disease of all animal species caused by salmonella.

Sedation, method of preparing an animal for surgery or helping it relax during a time of excitement by the use of medication.

Sedentary, of inactive habits.

Sexual dimorphism, when there is a difference in body size between the two sexes.

Social behaviour, behaviour between individuals within a species.

Solitary, individuals that avoid the company of others.

Stereotypic behaviour, constant and repetitive actions, such as vocalizations, grooming, walking or weaving, which would otherwise be seen as normally in the species.

Stress, an individual under pressure or tension.

Subspecies, the rank below the species level.

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 generally ranges from 11-28 degrees). Compare with hibernation.

Toxoplasmosis a contagious disease of all species caused by the sporozoan parasite *toxoplasma gondii*. It can cause pneumonia and central nervous system disease.

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Squirrel Glider

Petarus norfolcensis

Petauridae

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