Husbandry Guidelines for

The Rainbow Lorikeet

Trichoglossus haematodus moluccanus

Aves: Psittacidae

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Disclaimer
These husbandry guidelines were produced by the compiler/author at TAFE NSW – Western Sydney Institute, Richmond College, N.S.W. Australia as part assessment for completion of Certificate III in Captive Animals, Course number 18913, ACMCAN309A. Since the husbandry guidelines are the result of student project work, care should be taken in the interpretation of information therein, - in effect, all care taken but no responsibility is assumed for any loss or damage that may result from the use of these guidelines. It is offered to the ASZK Husbandry Manuals Register for the benefit of animal welfare and care. Husbandry guidelines are utility documents and are ‘works in progress’, so enhancements to these guidelines are invited.
OCCUPATIONAL HEALTH AND SAFETY RISKS

**Bites and Scratches:** Rainbow Lorikeets have immense biting power and are capable of breaking the skin. If scratched or bitten open wounds should be thoroughly cleaned and then covered whenever interacting with the birds and cleaning in their cages.

**Ecto-parasites:** Lice, mites and ticks can often be found on birds kept in poor unhygienic conditions. Aviaries should be sprayed routinely with a suitable nontoxic insecticide e.g. Coopex.

**Zoonosis:** Are diseases that can be transferred from animals to people and vice versa. These diseases can infect keepers who handle and maintain the Rainbow Lorikeet environment.

**Chlamydia:** This was originally called "psittacosis' (parrots) and then "ornithosis" (birds in general), and is caused by the rickettsia Chlamydia psittaci. It mainly involves parrots, finches, canaries, pigeons and doves, but other species can be affected. The organism is excreted in nasal or eye discharges, or in droppings. It may also be carried by mites. Dusty confined conditions associated with transporting and pet shops, can give rise to outbreaks especially in establishments which stock trapped young parrots and galahs.

The disease is not especially common in humans. It can be contracted after direct or airborne contact with droppings and aviary dust etc. In the case of clearing roof spaces of bird droppings, workers would be advised to use airline respirators to protect themselves. Symptoms of the disease include chills, fever, headache, general aches and pains and often an irritating cough. It will be worse in the over 50s and for those with pre-existing respiratory diseases. The incubation period is 10 days and treatment entails a course of medication that lasts 7 or 8 days. Transmission to other humans is rare. Immunity after contracting the disease is short lived - you can get it again. (Birdcare)

**Ross River Virus:** A poly arthritis with painful swelling of the joints and a rash. This disease occurs in the North of Australia, but through the combination of mosquitos, water birds, and seasonal factors it can now spread right down to areas close to Adelaide. The original host animals in Carpentaria, and the carrier birds, (all of whom have been bitten by mosquitos) are not affected by the virus. But humans are.

**Influenza A:** This also is transmitted by birds; it is one of the viruses that causes influenza in man. It has been known to be carried by migratory waterfowl. Such carrier birds could fly into reserves or wildlife parks and pose a slight health risk to humans. The symptoms are typically those of influenza - headache, fever, muscular aches and pains, lassitude.

**Newcastle disease (Paramyxovirus):** Transmission amongst birds is by infected droplets. Symptoms include eye irritation, respiratory difficulties, gastric and general illness, fits and nervous disorders. The virus varies considerably in potency - only the very mild strains are found in Australia at present. The biggest source of danger to our wildlife is through illegally imported parrots. It is easily transmitted to humans as an air-
borne disease. Symptoms include severe headaches, and conjunctivitis. The incubation period is 1 or 2 days and recovery (with treatment) is spontaneous. Those strains of NVD at present found in Australia do not appear to cause disease in humans.

**Chemical:** Exposure to chemicals, pesticides, insecticides and herbicides may cause harm to the user. Anyone using chemicals in the workplace should read the MSDS and wear the appropriate PPE.

**Physical Injuries:** Repetitive strains, lifting, pushing, pulling, twisting are all part of everyday activities for people who care for birds. Care should be taken whenever doing any type of manual handling activity. Never lift beyond your means, always use two people to lift heavy items.
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1 Introduction

The Rainbow Lorikeet or *Trichoglossus haematodus moluccanus* is one of Australia’s most brightly coloured and largest lorikeet species. Its iridescent plumage, loud shrieking calls and aerial acrobatics are entertaining and a delight to watch. This species of Lorikeet is one of the most common species of bird found on the eastern side of Australia and are frequently found in suburban areas. The Rainbow lorikeet is commonly kept in private aviculture and loved by many bird enthusiasts around the country.

I have found the antics of the Rainbow Lorikeet thoroughly enjoyable, they are one of the very few species of birds that are active all day long (perhaps due to their high sugar diet) and create an enjoyable ambience to any zoo or wildlife park.

With the advancement of nutritionally prepared commercial diets, it has never been easier to keep this specialised nectar feeder in captivity. There is nothing as beautiful to see as a flock of Rainbow lorikeets going about their day chattering, feeding, calling and clowning around as they entertain their onlookers.

![Figure 1. Photo Credit: S. Williams](image-url)
1.1 **ASMP Category**  
This species is not part of the Australian Species Management Program.

1.2 **IUCN Category**  
According to the IUCN Red list status this species has been evaluated in 2009 as of least concern.

1.3 **EA Category**  
Not relevant to this species

1.4 **NZ and PNG Categories and Legislation**  
Not relevant to this species

1.5 **Wild Population Management**  
Not relevant to this species

1.6 **Species Coordinator**  
A species coordinator does not currently exist for this species of bird

1.7 **Studbook Holder**  
No Studbook holder assigned to this species

2 **Taxonomy**

2.1 **Nomenclature**

<table>
<thead>
<tr>
<th>Class:</th>
<th>Aves</th>
</tr>
</thead>
<tbody>
<tr>
<td>Order:</td>
<td>Psittaciformes</td>
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<td>Family:</td>
<td>Psittacidae</td>
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<tr>
<td>Genus:</td>
<td>Trichoglossus</td>
</tr>
<tr>
<td>Species:</td>
<td>haematodus</td>
</tr>
<tr>
<td>Sub-Species:</td>
<td>moluccanus</td>
</tr>
</tbody>
</table>

2.2 **Subspecies**  
The Australian Rainbow Lorikeet, *Trichoglossus haematodus moluccanus*, is one of Twenty one subspecies of the species *Trichoglossus haematodus* which range from Indonesia to New Guinea and the Solomon Islands, New Hebrides, New Caledonia, Loyalty Islands and Australia. (Sindel and Gill, 2007)
These sub-species consist of the nominate race:

<table>
<thead>
<tr>
<th>Sub-species</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>T. h haematodus</td>
<td>Western New Guinea</td>
</tr>
<tr>
<td>T. h rubritorquis</td>
<td>North Western Australia</td>
</tr>
<tr>
<td>T. h. mitchelli</td>
<td>Bali and Lombok</td>
</tr>
<tr>
<td>T. h. forsteni</td>
<td>Sumbawa</td>
</tr>
<tr>
<td>T. h. djampeanus</td>
<td>Tanahjampe</td>
</tr>
<tr>
<td>T. h. stresemanni</td>
<td>Kalaotoa</td>
</tr>
<tr>
<td>T. h. fortes</td>
<td>Sumba</td>
</tr>
<tr>
<td>T. h. weber</td>
<td>Flores</td>
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<tr>
<td>T. h. capistratus</td>
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<td>T. h. flavotectus</td>
<td>Weta and Roma</td>
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<tr>
<td>T. h. rosenbergii</td>
<td>Baik</td>
</tr>
<tr>
<td>T. h. intermedius</td>
<td>Sepic River to Astrolabe Bay and Manum Island in New Guinea</td>
</tr>
<tr>
<td>T. h. micropteryx</td>
<td>New Guinea east of Huon Peninsular, Whagi River and Hall Sound as well as Misima Island</td>
</tr>
<tr>
<td>T. h. caeruleiceps</td>
<td>Southern New Guinea between lower Fly River and west Frederick Islands</td>
</tr>
<tr>
<td>T. h. nigrogularis</td>
<td>Aru and eastern Kai Island</td>
</tr>
<tr>
<td>T. h. brooki</td>
<td>Spirit Island</td>
</tr>
<tr>
<td>T. h. massena</td>
<td>Bismark Archipelago through the Solomon Islands to Vanuatu</td>
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<tr>
<td>T. h. flavicans</td>
<td>New Hanover and Admiralty Islands</td>
</tr>
<tr>
<td>T. h. nesophilus</td>
<td>the islands of the Ninigo</td>
</tr>
<tr>
<td>T. h. deplanchii</td>
<td>New Caledonia and Loyalty Island</td>
</tr>
</tbody>
</table>

Adapted from (Sindel and Gill, 2007).

2.3 Recent Synonyms

The subspecific term “moluccanus” currently used to distinguish the Australian subspecies of the Rainbow Lorikeet was originally used by Johann Friedrick Gmelin to identify this Lorikeet, in error. He was of the belief the specimen originated from the Moluccan Islands. (Higgins, 1999).

2.4 Other Common Names

Swainson’s Lorikeet, Rainbow Lory, Coconut Lory, Blue Mountain Lorikeet. (Sindel and Gill, 2007).

3 Natural History

The Australian Rainbow Lorikeet was first taken to England alive by Joseph Banks in 1771 on the return voyage of the Endeavour after Captain Cook’s exploration of eastern Australia. This species was first exhibited in the London Zoological Gardens in 1868.
Rainbow Lorikeets are members of the Parrot family, Psittacidae and form part of the sub-family Loriinae. These are distinguished from other psitticines by the development of anatomical adaptions which have evolved to assist in the gathering and digesting of their main food sources: pollen, nectar and fruit. Their beaks are long and narrow while the tongue has elongated papillae which forms a brush like tip ideal for the collection of pollen and nectar. (Sindell and Gill, 2007).

Due to their specialised feeding habits the Rainbow Lorikeet in captivity requires a commercially made form of nectar (wet) and Pollen (dry) mixes as well as fresh fruits and veggies. Rainbow Lorikeets feed throughout the day and 70% of their time is spent feeding in order to satisfy their daily requirements. They are arboreal and can be very noisy, active and gregarious, and are often seen in the company of other birds. This active bird has a shrill call while flying and chatters while eating. Lorikeets are often seen in large flocks. Often these flocks are very noisy around sunset as they screech and fly around before roosting. They usually roost up high in tall eucalypts.

The Rainbow Lorikeet was accidentally released into the southwest of the state of Western Australia from the University of Western Australia in the 1960s and they have since been classified as a pest. Rainbow Lorikeets can also be found in New Zealand, particularly around the Auckland area. New Zealand's Department of Conservation has declared them a pest and is implementing methods to control and eradicate them.

In Western Australia, a major impact of the Rainbow Lorikeet is competition with indigenous bird species. This includes domination of feeding resources, and competition for increasingly scarce nesting hollows. Birds such as the Purple-crowned Lorikeet Glossopsitta porphyrocephala and Carnaby's Black-Cockatoo Calyptorhynchus latirostris are adversely affected or displaced.

Many fruit orchard owners consider them a pest, as they often fly in groups and strip trees containing fresh fruit. In urban areas, the birds create nuisance noise and fouling of outdoor areas and vehicles with droppings.

### 3.1 Morphometrics

#### 3.1.1 Mass And Basic Body Measurements

Length: 30cm; Wingspan: 46cm; Weight: 120-130grams

#### 3.1.2 Sexual Dimorphism

The Rainbow Lorikeet is sexually monomorphic in appearance although there is considerable colour variation, particularly in the red, orange and yellow colouring of the chest. These variations appear to have no bearing on age, sex, diet or the locality they inhabit.

#### 3.1.3 Distinguishing Features

Unmistakable large blue, green and orange lorikeet with distinctive under wing-pattern and a loud screeching call.

The Rainbow Lorikeet is Australia’s largest lorikeet about one third bigger than the Scaly-Breasted Lorikeet Trichoglossus chlorolepidotus, with a much longer tail.
In flight they appear slim, with angular backsweped and finely pointed wings combining with a long tail held tightly folded and tapering to a fine point to give a distinctive streamlined silhouette. (Higgins, 1999).

Head is violet blue with blue black shaft streaking. Abdomen is the same colour. The hind neck collar is yellowish green, breast is predominately red marked irregularly with yellow. The rest of the under parts and back is predominately bright green. Under wing coverts are orange red with a broad yellow under wing band. Legs and feet are dark grey. Iris and beak are red to orange red. (Odekerken, 2002).

3.2 Distribution and Habitat

The extensive range of the Rainbow Lorikeet now includes the whole of eastern Australia from some of the Torres Straight Islands and Cape York Peninsula in the north to the southern coastlines of Victoria and south eastern South Australia. In Queensland the range extends west to the south eastern corner of the Gulf of Carpentaria where at times it is said to meet the range of the Red collared Lorikeet, T. h. rubritorquis. In Victoria the Rainbow Lorikeet is absent only in the north western quarter of the state but at times extends along the Murray River valley to the vicinity of the Murrumbidgee River junction. A feral population exists in and around the city of Perth in Western Australia. Unfortunately this population is increasing in numbers and extending its range. The population is said to be the result of aviary escapees but recent information suggests a deliberate release that occurred many years ago after a conflict with authorities. (Sindel and Gill, 2007).

The Rainbow Lorikeet is an incredibly successful species throughout eastern and south eastern Australia where it appears to continually extend its range. An ability to adapt to suburban sprawl and a whole new variety of exotic foods together with the natural tenacity and aggressive behavior of the species has enabled a constant push into new territory. Throughout this extensive range, the Rainbow Lorikeet has adapted to an incredible variety of habitat which still includes the traditional rainforest to dry eucalypt forest and open forest, mallee scrub to mangrove swamp and more recently parklands,
suburban gardens, tree lined streets, cultivated crops and so on. Anywhere a suitable food source is available within the Rainbow Lorikeets range they will probably be there.

3.3 Conservation Status
According to the IUCN Red list status this species has been evaluated in 2009 as of least concern. This species has an extremely large range, and hence does not approach the thresholds for Vulnerable under the range size criterion (Extent of Occurrence <20,000 km² combined with a declining or fluctuating range size, habitat extent/quality, or population size and a small number of locations or severe fragmentation). Despite the fact that the population trend appears to be decreasing, the decline is not believed to be sufficiently rapid to approach the thresholds for Vulnerable under the population trend criterion (>30% decline over ten years or three generations). The population size has not been quantified, but it is not believed to approach the thresholds for Vulnerable under the population size criterion (<10,000 mature individuals with a continuing decline estimated to be >10% in ten years or three generations, or with a specified population structure). For these reasons the species is evaluated as Least Concern. (Birdlife, 2009)

3.4 Longevity
3.4.1 In the Wild
May live to a maximum of 20 years in the wild.

3.4.2 In Captivity
Lifespan of approximately 20-25 years on average. With a maximum life span of 30 years.

3.4.3 Techniques Used to Determine Age in Adults
A juvenile bird can be distinguished from an adult bird by the slightly duller plumage, they will be smaller in size, have a brown not orange beak and dark brown eyes. The beak will gradually start to lighten to orange as the bird ages.

4 Housing Requirements
4.1 Exhibit/Enclosure Design
Generally all bird aviaries should be situated in a northerly position so as to maximize sunlight and to protect the birds from bad weather. Building the enclosure as large as the area permits will allow more birds to be kept together in a colony type environment. The minimum spatial requirements for housing a single pair of Rainbow lorikeets is listed below in 4.3 spatial requirements.
It is possible to keep Rainbow lorikeets in a mixed species exhibit, however due to their specialized feeding requirements I believe they should be housed with other nectarivorous species. Ideally when designing and constructing a new aviary it is recommended that consultation be made with a person experienced in exhibit design and construction. Consultation should also be made with the local council to find out about necessary building planning approvals.

It is advisable to include a vestibule area (like an airlock) with a second door leading from the vestibule into the actual aviary. With this system in place if a bird escapes from the main section they simply fly into another enclosed area, rather than into the wild.

The exhibit would ideally be longer then it is wide to maximize flying space and encourage exercise. Branches used as perches should be positioned at either ends of the exhibit to accommodate this.

The exhibit should have an under covered section to protect the birds from the sun, wind and rain.

Fresh browse and an aviary that has been planted out with native species will also provide shelter. Suitable plant species are detailed in section 4.9 Enclosure Furnishings and 6.1 Diet in the Wild.

Use of clean, free-draining floor mediums such as fine gravels or coarse sands are ideal for maintaining a dry aviary floor. Sub-surface drainage is recommended where aviaries are not fully-roofed. (Bull)

To protect your birds from predators that dig, consider pouring a concrete footing two feet deep that can also serve as the foundation for the aviary. (Burton)

Location of taps for cleaning and watering birds should also be considered. Having a tap close to the aviary will enable ease of cleaning as well as the option of installing automatic watering systems inside the aviary.

Misting systems fixed to the roof of the aviary will provide the birds with relief from hot weather and will also water plants inside the aviary.

### 4.2 Holding Area Design

From time to time there may be a need to remove a bird off display and into a separate holding aviary or cage. Some reason for removal from display could include,

- Cleaning of enclosures
- Maintenance of enclosures
- Overnight security
- Capture of animals for transport or veterinary reasons
- Quarantine
- Social constraints
- Pre-departure
- Reproduction
- Additional housing.

As a minimum short term housing should have the following principals:

- The animal can freely stand up, stretch their wings and turn around.
- The length is at least three times the animal’s length and the breadth of the enclosure is at least one and a half times its length.
- It has adequate protection from the weather.

For medium term housing which is up to 90 days duration a bird must have enough space to fulfill its behavioral requirements, e.g. Space to be able to fly, climb and perch. All enclosures (display, treatment, holding, isolation and other) must be constructed of such
materials and be maintained in sufficiently good repair so as to ensure that they will contain the birds at all times and are safe for the birds, for the staff attending them and for the public. Sufficient shelter must be provided to allow protection from wind, rain and extremes in temperature and allow sufficient access to shade during the hot periods of the day. (EAPA)

Ideally the use of a suspended wire aviary sheltered at both ends provides a clean environment with a reduction of cleaning. It is far more hygienic and more birds can be housed in less space. It eliminates access to their own and other bird’s faeces and also simplifies the servicing of the aviary and minimises disturbances to the occupants. The minimum size of a suspended aviary is described below in 4.3 spatial requirements. If a conventional aviary is used as an off display holding area it is recommended that concrete be used as flooring. It is by far the most functional type of flooring when housing lorikeets. It is very easy to clean and maintain and also lessens the infestation of worms. (Sindel & Gill, 2007)

![Figure 3. An example of a suspended wire aviary](image)

### 4.3 Spatial Requirements

A suitable minimum aviary size for a single pair of *T.h.moluccanus* is 3m long, 0.9 wide and 2m high. When housing more than one pair of *T.h.moluccanus* space must be increased to allow protection from undue dominance and conflict and to also allow freedom of movement in all directions. (Sindel & Gill, 2007), (EAPA)

### 4.4 Position of Enclosures

The main considerations in achieving a warm and dry aviary are to maximise sunlight and exclude cool windy and wet weather. Positioning the aviary to the best aspect, facing north is crucial. However in tropical Australia other weather conditions may influence the direction that aviaries should face.

### 4.5 Weather Protection

When housing Rainbow Lorikeets we should always aim to provide dry, drought free aviaries of adequate size. They should have access to sun and shade but must also be protected from excessive heat, cold, rain and prevailing winds. Aviaries should be roofed at both ends to provide shelter and protection for front and rear perches and their nesting boxes.
In my opinion having the rear and part of the sides enclosed to the floor is not a good idea when housing lorikeets. Their messy liquid droppings will quickly foul all solid walling that is often difficult to remove. Mesh should be used wherever possible, however if there is a need for walling for protection of the weather in my opinion metal sheeting made from colour-bond that is easy to clean should only cover half of the wall leaving the bottom section meshed.

Dense shrubs planted around the perimeter of aviaries, either inside or out, will also provide protection from prevailing winds and the cold. (Sindel & Gill, 2007)

4.6 Temperature Requirements

*T.h. moluccanus* is a hardy parrot that is quite adaptable and can easily tolerate a large variant in temperature. I have witnessed Rainbow Lorikeets roosting in a nest box that is left in the aviary year round. This offers them protection on cold winter nights. When temperatures exceed 35deg and in excess of 40deg it is possible deaths may occur in adult birds and almost certainly in nestlings. Cooling of the aviary and the birds using a sprinkler system mounted on the roof of the aviary is a cheap and simple method in helping to lower temperatures. (Sindel & Gill, 2007) Also the placing of a bird bath inside the aviary will allow the birds to cool themselves, they will often spend hours bathing and then preening themselves during hot weather.

4.7 Substrate

Types of flooring used in Australian aviaries include the following:
- Natural earth floor,
- Sand filled flooring,
- pebble flooring,
- woodchip,
- Concrete and a combination of anything previously mentioned.

These types of flooring all provide an aesthetically pleasing presentation of an exhibited aviary.

As previously mentioned the nature of the Rainbow Lorikeets liquid droppings and messy eating habits should be taken into consideration when deciding on a suitable substrate.

A natural Earth floor provides a pleasing appearance and can also be planted out with grasses and shrubs providing a more naturalistic environment.

However this type of flooring will quickly become damp and polluted from the lorikeets liquid droppings.

Lorikeets housed in aviaries on earthen floors are often worm infested and will require worming every three months. Bacteria will thrive in damp earth floors leaving the occupants vulnerable to infection and rodent infestation is common. (Sindel & Gill, 2007)

Sand filled floors will also provide a pleasing appearance for conventional aviaries, it is essential that regular skimming and cleaning is undertaken to remove all discarded food items as well as the large amounts of the lorikeets liquid droppings.
Efficient drainage of sand filled floors is necessary, either by subsurface agricultural drainage or by elevating the sand filled flooring to at least 10cm above the surrounding ground level and providing suitable seepage weep holes.

Regular worming is also essential when housed on sand filled flooring. (Sindel & Gill, 2007)

Pebble filled flooring also provides a pleasing appearance, particularly for exhibition aviaries, and if constructed with an efficient subsurface drainage system may be easily cleaned using a high pressure hose.

If pebble floors are not provided with an efficient drainage system the surface becomes difficult to clean and silting up is inevitable.

Even adequately drained floors are subject to silting up after several years of use, necessitating the removal and renewal of the pebbles.

Regular worming of the occupants is also essential. (Sindel & Gill, 2007)

Wood chip flooring has many of the pros and cons of the earth and sand type flooring, this flooring is hard to keep clean and will often house parasites and bacteria and is really not recommended for the substrate when housing Lorikeets.

Concrete flooring as previously mentioned is easy to clean and maintain and is by far the most functional type of floor in a conventional aviary.

Cleaning of these floors can be simplified by a liberal sprinkling of dry sand which helps to prevent the liquid droppings and dropped foodstuffs from adhering to the floors surface.

A broom and shovel is usually all that is required to remove the bulk of the waste. Suitably drained floors can then be cleaned with a high pressure water hose. (Sindel & Gill, 2007)

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**Figure 4. Watering and sub-surface drainage**

4.8 Nestboxes and/or Bedding Material

*T.h. moluccanus* will successfully breed in a variety of nest boxes. They will accept hollow logs, either horizontal or vertical and nest boxes of any design.

In captivity they have often nested on the floor of their aviary, sometimes in a corner or behind some object which provides privacy. Some have even dug a burrow in an earth floor when a suitable nesting site wasn’t available.

Hollow logs are not always a good choice for Lorikeets as they are hard to obtain, difficult to access and hard to keep clean during the nesting period. As such, a large
horizontal wooden nestbox with a full access lift off lid to provide easy cleaning is the ideal nest box for this species. A suitable horizontal nest box for this species is about 45cm long, 22cm wide, 25cm deep with an 8cm diameter entrance hole and perch near the top and to one end of the long side of the nest box. (Sindel & Gill, 2007)

It is recommended that nest boxes be constructed from marine grade plywood with a minimum thickness of 12.5mm. On the inside of the box fix a weldmesh ladder to allow the parents to be able to clamber in and out without jumping on and damaging eggs. All sharp wire cuts must be filled smooth so that no damage can occur to the chicks or the parent birds. (Odekerken, 2002) The box should be hung with a slight fall away from the entrance hole to keep the eggs at the rear of the box. (Sindel & Gill, 2007)

Prior to the breeding season (June-January) nest boxes should be thoroughly cleaned and the bedding renewed. Suitable bedding to use in their nest boxes must be clean and relatively dust free. Untreated wood shavings without fine particles are suitable. Replenish the wood shavings when the nest becomes fouled. (Odekerken, 2002)

4.9 Enclosure Furnishings

I have noted that Rainbow lorikeets particularly enjoy fresh eucalyptus browse placed inside their aviary. They will excitedly jump from tip to tip investigating every leaf and flower on each branch. This keeps them occupied for hours on end and the public is delighted by their comical antics. Other native species suitable as browse that lorikeets particularly enjoy are flowering Grevillea sp, Callistemon sp, Banksia sp and Melalueca sp.

Figure 5. Nest boxes suitable for Rainbow lorikeets

Figure 6. Example of a weldmesh ladder

Figure 7. Lorikeet feeding on a grevillea

Figure 8. Lorikeet on flowering gum tree
Natural Eucalyptus branches of various diameters used as perches should be positioned at either end of the aviary to provide maximum flying space, exercise their feet and to encourage them to perch under the sheltered areas. Rainbow lorikeets usually prefer to perch on the highest branches in the aviary. They will also chew the bark of fresh branches; make sure branches placed inside the aviary are not poisonous. (Odekerken, 2002) Most Australian Native Species are suitable for use in aviaries. Browse pots made from PVC piping placed around the aviary make ideal browse holders. Place these up high as lorikeets love to sit up on the highest branches. Any type of flowering Australian native will be devoured readily. Browse should be replaced as often as possible. Weekly at the very least.

If at all possible an aviary planted out with native species of plants will provide enrichment for the birds throughout the day. Plants that also flower will have the added bonus of providing additional nutrients and encourage natural foraging behavior. A large shallow container or a natural style concrete pond of water should be placed away from perches to prevent fouling. Supply fresh clean water as frequently as possible as lorikeets love to bathe daily. The depth of the water should be such that it covers the lower abdomen of the bird and can be fluffed over the upper body by the bird’s wings. If the water is too deep the bird will be afraid to enter and will not fulfill its bathing requirements. (Odekerken, 2002) Concrete style ponds must be cleaned out regularly to prevent any buildup of bacteria.

I have provided lorikeets with glass jars filled with their wet and dry mixes; this is suspended from various branches throughout their exhibit. It offers the rainbow lorikeets a slight challenge as they hang from different angles trying to get their food from out of the jar. This also eliminates the lorikeets fouling their food with their messy liquid droppings. These jars should be replaced daily and always placed in a different location around their exhibit.

A nesting box as described earlier should be provided year round as they tend to roost in their nest boxes during the night.

5 General Husbandry

5.1 Hygiene and Cleaning

The most important aspect of captive management of all livestock is cleanliness. In the case of T.h. moluccanus it is absolutely essential due to the squirting liquid nature of their droppings.

- Aviaries should be raked over daily to remove fallen leaves, discarded fruit and vegetables and to dry out the substrate. (Sindel & Gill, 2007)
- Water dishes must be hosed out and cleaned daily. Fresh clean water should always be available. Water dishes should never be hosed out within the aviary;
this unnecessarily wets the substrate providing an ideal environment for bacteria to thrive.

- All food fed to lorikeets must be fresh. Do not top up the food dishes. These must be thoroughly cleaned before placing them back into the aviary. Dirty feeding bowls and old food left in the aviary will encourage fungal growth. Fungal growths in the crop are fatal unless treated without delay. (Fuller, 2000)
- Regular washing and scrubbing of walls, floors, wire mesh, perches food and water containers etc. with an iodine or chlorhexidine based disinfectant detergent will assist in the control of disease outbreaks. (Sindel & Gill, 2007)
- Regular sweeping, raking or scraping of floors particularly under perches, feeding stations and nest boxes is very important to keep disease at bay.
- High pressure hosing is a good option where floors are suitably drained and water use is not restricted. (Sindel & Gill, 2007)
- Fresh flowering browse where possible should be placed into the aviary in browse pots, at least weekly. Any dried browse needs to be removed during routine cleaning.
- Nesting boxes will need cleaning during the year. Remove the nest box, dispose of the soiled bedding, hose out and clean using a suitable detergent and disinfectant. The nest box must be allowed to dry completely in the sun before being reintroduced into the aviary. Having a clean spare nest box on hand makes for an easy change over.
- Pest control should be carried out frequently. Rat and mouse baiting stations should be placed in and around the aviary. These bait stations need to be checked and replenished routinely. It is recommended that a poison with a different active ingredient be rotated every three months. An example of products containing a different active ingredient would be Generation Block with the active ingredient Difethialone and Ditrac Blox with the active ingredient Brodifacoum. This prevents the rodents from developing any type of resistance. Feeders and left over food if possible should also be removed from the aviary in the afternoon this lesson the chance of rodents having a regular food supply.
- Substrate should be topped up as needed, and completely replaced at six monthly intervals.
### Cleaning Regime for Rainbow Lorikeets

<table>
<thead>
<tr>
<th><strong>DAILY</strong></th>
<th><strong>WEEKLY</strong></th>
<th><strong>MONTHLY</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Rake entire aviary removing fallen leaves, uneaten fruit and vegetables and soiled substrate.</td>
<td>Thoroughly rake entire floor surface paying particular attention to under perches, nest boxes and feeding stations.</td>
<td>Remove the top 10% of the substrate, top up with fresh substrate</td>
</tr>
<tr>
<td>Empty and thoroughly clean out water dishes and bird baths</td>
<td>Remove water dishes and soak in a bleach solution for 30min. rinse thoroughly.</td>
<td>Service any locking mechanisms, gate hinges, sprinkler systems and water pumps</td>
</tr>
<tr>
<td>Remove dirty wet/dry mix bowls, thoroughly clean and replace with fresh wet/dry mix</td>
<td>Remove dirty wet/dry mix bowls. Soak in Bleach solution, rinse thoroughly before adding fresh wet/dry mix.</td>
<td>Thoroughly check aviary structure looking for any evidence of rodents entering, leaks, broken and rusting wire.</td>
</tr>
<tr>
<td>Remove any dried browse and replace if needed</td>
<td>Remove all browse, replace with fresh flowering specimens if possible. Water vegetation growing in the aviary.</td>
<td>Service any vegetation that may be growing within the aviary, water, prune and fertilise if needed.</td>
</tr>
<tr>
<td>Spot clean any perches, wall panels, nest boxes etc. that may be soiled. Use detergent and warm water to help loosen droppings, hose clean.</td>
<td>Using detergent in warm water completely clean all perches in the aviary as well as wire mesh and metal sheeting. A high pressure hose may be used on metal sheeting and wire to help remove droppings. Rinse thoroughly.</td>
<td>Check perches for signs of wear and replace them if needed.</td>
</tr>
<tr>
<td>Remove nest box if not breeding and completely clean out, use detergent and disinfectant, allow to completely dry before returning to aviary. Add some fresh bedding material</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check baiting stations and replace baits if needed</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Replace all rodent bait stations with alternate poison

Completely remove all substrate, if concrete use detergent and scrub slab, hose off using high pressure cleaner, allow to dry

Replace old nest boxes with new boxes at the start of the breeding season (June). Place in some fresh bedding

All birds should be wormed using an appropriate worming solution e.g. Wormout Gel

High pressure clean all walls and wire mesh, scrub with detergent removing all traces of droppings

Replace any vegetation that may be old or failing to thrive.

Remove and dispose of all perches and branches within the aviary. Replace with fresh branches of various diameters.

Do a complete inspection of the structure of the aviary, fix any repairs if needed.

Figure 9. Yearly cleaning regime, produced by R.Klarich

**Bird safe cleaning detergents and disinfectants**

**CHLORINE** (regular household bleach) is a very effective disinfectant, and one of the few that can kill protozoans such as giardia. It should be used in a dilution of 1 part bleach to 32 parts water. It must stay in contact for about 10 minutes to assure disinfection. It is the least expensive disinfectant available. There are two major problems with chlorine. It is harmful to the respiratory system to a certain degree, so it must be used with adequate ventilation. It is very corrosive to metal surfaces. Routine use of chlorine will seriously decrease the life expectancy of metal cages and cups, so should be used with caution.

**CHLORHEXADINE** (Nolvasan) is one of the best products to use routinely. Although more expensive than chlorine, it does not harm metal surfaces and is very safe for your birds. When applied, it must remain in contact for about 5 minutes. It is not effective against giardia, and does not work well against some viruses and bacteria (e.g. pseudomonas). It is particularly good to be used when disinfecting bedding, syringes, bowls, and food processing equipment.

**FORMALDEHYDE PRODUCTS**, such as Wavicide, are the most effective products, and can even kill bacterial spores which are often resistant to other products. They are very effective against viruses and bacteria that are often resistant to other products. Their use is limited, however, because they are extremely toxic to birds, both when ingested or inhaled. I recommend that their use be limited to situations when other products are known to be ineffective (e.g., chronic pseudomonas infections).

**QUARTERMY AMMONIUM** compounds are excellent for routine use. A typical product is called Roccal-D. Roccal is intended to be a one-step clean and disinfectant product. Thus its major advantage is that you do not need to clean the surface prior to disinfecting. After cleaning and disinfecting with Roccal, you must thoroughly rinse the surface, since this product is toxic to birds. It is also fairly harsh to your hands when used habitually. It tends to be more effective than Nolvasan, and is a good one step clean and disinfecting product. (McCluggage, 2008)
Unsafe chemicals
Lyso1, hydrogen peroxide, and most of the grocery store bought household disinfectants that are intended to clean up kitchens and bathrooms. (McCluggage, 2008)

5.2 Record Keeping
Keeping accurate and up-to-date animal records ensures a complete history of each animal that can be easily accessed to provide important information for identification, transaction history, breeding, medical history, husbandry practices, behavior, dietary patterns, deaths and future research.
The General standards for exhibiting animals in NSW states that “Exhibitors are encouraged to maintain records that include the following information for each individual or group:
- Species (common and scientific name).
- Given name of animal and its sex.
- Date of birth.
- Name of breeder, place of birth, sire and dam (if known).
- Previous ownership - names and dates.
- Breeding history - mating dates, mating partners, number and sex of any offspring, and the fate of those offspring.
- Medical History (including diagnoses of diseases, medical treatments, surgical procedures, vaccinations). Dates are essential.
- Any noteworthy incidents involving this animal.
- Identification - e.g. leg band, ear tag, microchip, tattoo number, distinguishing marks or appropriate photograph.
- Dietary preferences.” (General Standards for Exhibiting Animals in New South Wales, viewed March 2011).

5.3 Methods of Identification
There are a number of reasons why identification of a bird is important. These include proof of ownership, governmental requirements, identification of lost or stolen birds, and tracking of birds for breeding purposes. The ability to identify a bird also acts as a deterrent to smugglers and the illegal bird trade. Therefore it has a positive impact on saving birds in their natural environments.
The most widely accepted means of identification of birds today is the leg band. Micro chipping and DNA fingerprinting are alternative methods which are gaining in popularity. Many people prefer these newer methods for a variety of reasons. However at this time, the leg band is required by many governmental organisations.
Leg bands can be closed or split.
- Closed bands are normally placed on young birds whilst still in the nest and split bands are generally placed on birds at an older age, when a closed band cannot fit over the foot. This provides a permanent method of identification as they are very difficult to remove.
• Split bands allow both juvenile and mature birds to be banded. Once the band is placed on the bird's leg, the ends are pinched together, which allows the band to remain in place. Coloured bands are most commonly used with open bands, especially for identifying multiple birds in a single aviary. These are easier to remove.

• Micro chipping: This is a small implantable transponder that contains a unique code. This code can be read using a scanner. A microchip should be implanted by a qualified avian veterinarian, whilst the bird is under anaesthetic. The best location for implanting a microchip will depend on the species and the size of the bird. Generally, they can be implanted into the breast muscle or collarbone cavity of a bird.

• DNA analysis is most commonly used in exotic birds to determine the sex of a specimen or to prove the parentage of a bird. DNA can be a valuable tool if you want to keep a record of the birds you keep or trade. A blood sample can be retained and analysed in the future if necessary, for example, to confirm a specimen’s identification. This method of individual identification is generally used in conjunction with either a leg band or a microchip as this will relate the blood sample to the specimen.

It is recommended that two methods are used when permanently identifying a bird. That way if a band is cut off there is a microchip that can still positively identify the bird.

5.4 Routine Data Collection

Information should be collected when the opportunity arises in an adult bird. When a bird is captured to be moved or if it needs medical treatments the birds weight should be recorded at the very least. Chicks being hand raised should be weighed every day, usually before the first feed. Chicks that are being raised by their parents should be checked on daily when hatched and any notable information recorded. Daily nest inspections allow potential problems to be rectified before they become disasters. (Cannon, 2002)
6 Feeding Requirements

6.1 Diet in the Wild

To harvest food in the wild, lorikeets possess a very special adaptation; papillae on the tongue. Papillae can be retracted from their extended form to be folded back in a protected position. In this position, the tongue looks similar to that of most other forms of parrot. (Odekerken, 2002)

In the wild, *T. h. moluccanus* feed from a large variety of native flora. Predominately in the form of nectar and pollen harvested from the blossom of trees and shrubs. They also take fruit, seeds, vegetable matter, and insects. Rainbow lorikeets have a varied diet which also extends to some introduced foods such as orchard fruits, ripening grains, and introduced plant species. (Sindel & Gill, 2007)

In a detailed study in South East Queensland and North East New South Wales, 87% of food was taken from flowers (mainly nectar, less often pollen), 5% fruit, 4% leaf buds, 4% bark, and insects. (Higgins, 1999)

Some examples of plants favoured by *T.h. moluccanus* (pollen or nectar unless stated) include: *Syragus romzoffianum*, *Schefflera actinophylla*, fruit of *Schinus molle*, seeds of *Casuarina sp.*, fruit of *Ficus microcarpa*, *Angophora costata*, *Eucalyptus ficifolia*, *E. maculata*, *E. pilularis*, *E. sideroxylon*, *Melaleuca quinquenervia*, *Banksia integrifolia*, *B. serrata*, and *Grevillea robusta*. (Higgins, 1999)

![Figure 11. Flowering Angophora costata](butterflyhouse.com)

![Figure 12. Flowers of Eucalyptus ficifolia](ianpercym.jpg)

![Figure 13. Flowering Eucalyptus maculate](yallaroo.com.au)

![Figure 14. Flowering Banksia serrata](quiki.com)
6.2 Captive Diet

*T.h moluccanus* is a nectarivore and does not eat seed unlike most of Australia’s native parrots. Lorikeets require a specialised diet of a nectar mix, fruit and vegetables. There are many nutritionally balanced commercial dry feed and wet feed mixes available through avian suppliers. Eg. Shep’s Lori-dry and Lori-wet mixes, Avione Lorikeet dry food, Passwell Lorikeet dry food, Avian science wet and dry mixes and Wombaroo lorikeet and honey eater food.

It is also possible to make your own lorikeet wet and dry mixes. These however may need supplementation to provide a balanced diet. Vetafarm now make a nectar pellet that is a complete diet; no additional dietary supplementation is necessary.

A commercially available liquid nectar is also available from Vetafarm and Wombaroo. This can be offered as a treat or sprayed onto the foliage of browse for enrichment.

Their diet must also be supplemented daily with a variety of fruits and vegetables such as apple, mango, grapes, cherries, banana and pear. These fruits are crushed in the beak and the juice is consumed and the non-fluid portion discarded. Vegetables such as silverbeet, endive, celery, cucumber and sweet potato can be offered.

The flowers and leaves from native trees and shrubs as described above in 6.1, as well as Callistemon, Hibiscus, and Bottlebrush can be placed in the aviary for the birds to play with and chew up and obtain some nutritional value. The fruits, vegetables, and flowering plants should be varied from day to day to give the birds a wide as possible variation in daily food intake.

A dry mix must be provided daily and on an unlimited basis. (Sindel & Gill, 2007) A wet mix can be provided daily or every other day. It must be mixed fresh and removed after a few hours to avoid the growth of bacteria. (Fuller, 2000)
A variety of fresh fruits and vegetables suitable for lorikeets
Photo credit: mylot.com

Vetafarm Blossom Nectar
Wombaroo Nectar
Shake n make

Figure 15. Variety of suitable food

Figure 16. *T.h moluccanus* enjoying an apple treat.
Photo credit: Rebecca Klarich

Dry mix recipe as detailed by Sindel
10 cups of finely ground rice flower
3 cups of dextrose powder
1 cup of full cream milk powder
½ cup of malt powder (optional)
2 slightly heaped teaspoons of calcium powder
2 slightly heaped teaspoons of a multi vitamin and mineral supplement.
Store this mix in an airtight container in a cool, dry place. Refrigeration is not advisable.

During the approach and throughout the breeding season add ½ cup of whole egg powder to the mix and increase to a full cup when young are being parent reared.
This dry food mix should be available at all times plus all the fresh apples and or pears they can eat daily, as well as silverbeet and a 2cm cube of plain madeira cake per bird.
When young are being parent reared a full slice of madeira cake is fed daily to the parents while *T.h moluccanus* will often relish sprouted sunflower seeds when rearing young—but feed it sparingly; one heaped dessert spoonful per day is plenty.

**Wet mix recipe as detailed by Odekerken**

1 cup of Farex baby cereal  
1 cup of finely blended plain biscuit eg Arnott’s Nice  
½ cup of wheat germ cereal  
1 tablespoon malt powder  
A pinch of table salt  
The ingredients are thoroughly mixed and placed in an airtight container.  
Each morning a fresh mix is made as follows:  
1 ½ cups of the above mixture  
4 dessertspoons of blended vegetable mix (can of Edgells vegetable mix which contains potato, corn, carrot and peas)  
2 dessertspoons of honey alternated with 4 dessertspoons of brown sugar on alternate days.  
Add 400ml of boiled water to help disperse the honey and then add cold water to make up 1.5 litres. The farex and biscuit combination is added and stirred. 1.5 liters serves about 14 lorikeets. *T.h moluccanus* will require 200ml per day per pair. At certain times of the year it may be necessary to increase or decrease the amounts offered. For example during winter pairs will consume more.

A variety of fresh fruits and vegetables should also be offered; Apple, pawpaw, grapes, pears and melons as well as celery, sweet corn and silverbeet.  
Each evening when young are in the nest feed sponge cake that has been slightly moistened with sugar and water. This is also given on occasion once every 2 to 3 weeks outside of the breeding season.

### 6.3 Supplements

Veterinary advice should be obtained to ascertain if your birds require mineral and / or vitamin supplements, and this includes calcium, as excess levels can be detrimental to a bird’s health. (birdcare, 1996)  

Some signs that your lorikeet’s diet is just not right:

- An excess loss of feathers outside molting time  
- Any change in feather colouration, this includes if the colours of your lorikeet are different from the norm. Feather colour can evolve from aberrations in dietary vitamins A, C and E, carotenoids, selenium, zinc and amino acids  
- Reduced movement  
- Variation in vocalization (Hume, 2011)

The availability of calcium to the diet is important, particularly prior to egg laying and when young are being parent reared. Most lorikeet diets have calcium included but the availability of cuttlefish bone in each aviary ensures a deficiency does not occur.
Charcoal is appreciated by some lorikeets and should be available to breeding pairs. (Sindel & Gill, 2007)

**Supplements formulated specifically for birds.**
- Vetafarm Calcivet - Liquid calcium and vitamin D3 supplement.
- Vetafarm D'Nutrical - Powdered calcium, vitamin and mineral supplement for use in food. Ideal as an addition to home-made hand rearing formulas.
- Vetafarm Poly Aid Plus - Powder first aid supplement for sick and injured birds and animals.
- Vetafarm Soluvet - Vitamin supplement for use in water or added to foods.

### 6.4 Presentation of Food

Lorikeet feeding facilities must be protected from all adverse weather conditions and always be located so as to avoid the possibility of contamination from above by the lorikeets own droppings but must also be positioned and designed to protect solid wall surfaces and surrounding areas. (Sindel & Gill, 2007)

Wet/dry mixes and fruit and vegetables should be positioned up high in the aviary or at least elevated off the ground. Lorikeets are arboreal and rarely come to the ground to feed.

Stainless steel food bowls are durable and easy to clean. Fresh clean bowls must be provided every day to prevent any possibility of infection. There should always be one food bowl per bird plus one extra to ensure all individuals can access a feed station.

Water bowls must also be cleaned daily and topped up throughout the day; Lorikeets can be unpredictable with their water use. (Odekerken, 2002)

Weldmesh wire trays of a suitable size provide an easy to clean, hygienic area to feed fruit and vegetables as well as wet and dry feed in bowls. Overhead protection from the sun, rain and the occupant’s droppings is essential. (Sindel & Gill, 2007)

I have successfully used glass jars placed on an angle and suspended from perches inside the aviary. Both wet and dry mixes can be placed inside. This system completely eliminates fouling from droppings and can be moved around into different locations daily providing enrichment. The birds must also “work” for their food as they balance on them sticking their heads in and out of the jars opening.

Enrichment feeding can be provided with different types of fruit and vegetables placed around the aviary daily. Fruit and vegetables spiked on branches and also hidden in different locations will keep the lorikeets busy for hours searching for their hidden treats.

Flowering browse placed inside the aviary in browse pots will encourage natural foraging behaviours, they will also chew leaves and strip branches of bark. Liquid nectar sprayed onto the leaves of branches is also another good enrichment tool.

Lorikeets love to bathe so separate large dish should be provided for bathing, this also needs to be cleaned out daily.
### Daily Feeding and Enrichment Table.

<table>
<thead>
<tr>
<th>Monday</th>
<th>Tuesday</th>
<th>Wednesday</th>
<th>Thursday</th>
<th>Friday</th>
<th>Saturday</th>
<th>Sunday</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fresh Lori wet/dry mix</td>
<td>Fresh Lori wet/dry mix</td>
<td>Fresh Lori wet/dry mix</td>
<td>Fresh Lori wet/dry mix</td>
<td>Fresh Lori wet/dry mix</td>
<td>Fresh Lori wet/dry mix</td>
<td>Fresh Lori wet/dry mix</td>
</tr>
<tr>
<td>Clean water provided</td>
<td>Clean water provided</td>
<td>Clean water provided</td>
<td>Clean water provided</td>
<td>Clean water provided</td>
<td>Clean water provided</td>
<td>Clean water provided</td>
</tr>
<tr>
<td>Fresh flowering browse</td>
<td>Fresh flowering browse</td>
<td>Fresh flowering browse</td>
<td>Fresh flowering browse</td>
<td>Fresh flowering browse</td>
<td>Fresh flowering browse</td>
<td>Fresh flowering browse</td>
</tr>
<tr>
<td>Apples, pears and corn spiked, chopped variety of veggies.</td>
<td>Passion fruit, Melons and Silverbeet chopped into bowls</td>
<td>Orange, apple and pear spiked Chopped variety of veggies</td>
<td>Grapes, apple pieces and passion fruit hidden around aviary</td>
<td>Apples, pears and corn spiked, chopped variety of veggies</td>
<td>Passion fruit, Melons and Silverbeet chopped into bowls</td>
<td>Orange, apple and pear spiked, Chopped variety of veggies.</td>
</tr>
<tr>
<td>Liquid nectar sprayed onto browse</td>
<td>Liquid nectar sprayed onto browse</td>
<td>Liquid nectar sprayed onto browse</td>
<td>Liquid nectar sprayed onto browse</td>
<td>Liquid nectar sprayed onto browse</td>
<td>Liquid nectar sprayed onto browse</td>
<td>Liquid nectar sprayed onto browse</td>
</tr>
<tr>
<td>Turn on sprinklers or spray birds with hose</td>
<td>Turn on sprinklers or spray birds with hose</td>
<td>Turn on sprinklers or spray birds with hose</td>
<td>Turn on sprinklers or spray birds with hose</td>
<td>Turn on sprinklers or spray birds with hose</td>
<td>Turn on sprinklers or spray birds with hose</td>
<td>Turn on sprinklers or spray birds with hose</td>
</tr>
<tr>
<td>Plain madeira cake</td>
<td>Plain madeira cake</td>
<td>Plain madeira cake</td>
<td>Plain madeira cake</td>
<td>Plain madeira cake</td>
<td>Plain madeira cake</td>
<td>Plain madeira cake</td>
</tr>
</tbody>
</table>

*Figure 17. Enrichment and feeding table. Produced by R. Klarich*

*Note: fruit and vegetables may change depending on availability.*

Rainbow Lorikeet feeding from stainless steel bowl.

Lorikeet using the suspended glass feeder jars.

The feeder jars are practical as well as a form of enrichment.

*Figure 18, 19, 20 Photo credit: Rebecca Klarich.*
7 Handling and Transport

7.1 Timing of Capture and Handling

Birds should never be moved or captured during heat wave conditions. When planning a capture they should be caught early in the morning (unless a bird is unwell and requires treatment) preferably before the public arrives and then transported during the cool of the evening or in an air-conditioned vehicle. Australian Rainbow Lorikeets like most psittacines, can become aggressive when placed in stressful situations. They are capable of inflicting a very powerful bite that can easily break the skin. Correct handling and restraining techniques must be applied to avoid being bitten. See 7.3 and 7.4. (Sindel & Gill, 2007), (Odekerken, 2002)

7.2 Catching Bags

The blue net that is pictured below is made of a hoop that is padded to prevent any injuries that may occur during capture. Breathable cotton material is sewn over the hoop, forming about a 90cm drop from the hoop to the tip. The reason it has to be so long is that you want there to be enough extra room so that when you catch the bird and he falls to the bottom of the net, you can flip the net over and have the body weight of the bird hold the upper material against the hoop so he can't fly back out. The net is turned inside out so there is no chance a bird’s leg could be caught on any loose threads. I find these types of catching bags far easier to use then nylon net also pictured below. Breathable cotton or calico bags are also useful when weighing birds or transporting them short distances. I have found that most birds settle quickly when dark coloured catching nets and bags are used during capture.

Figure 21. Examples of a padded catching net and a nylon bird net.
Photo credit: Rebecca Klarich
7.3 Capture and Restraint Techniques

The health and well-being of captured birds should be the primary concern during all phases of handling. Proper handing techniques will minimise stress and maximise the chances that the bird can returns to its pre-capture state with a minimum alteration in its behavior.

Handling and restraint of all birds should:

a) Be safe and comfortable for the bird as well as the handler: Avoid the temptation to use gloves with all birds. Gloves reduce the sensitivity you have in feeling the bird and they are clumsy and awkward.

b) Consider the behavior of the bird: The age of the bird will determine how it will respond to capture. Young birds may not have learned to be fearful of people. Older birds may have been caught many times before and be aware of the means to make the task more difficult. Breeding status may complicate the issue. Birds that are handled and are incubating or feeding young may abandon the nest if captured and handled. Observe the bird to determine which methods of escape or defense it is likely to use.

c) Consider the physical characteristics of the bird: The anatomy of birds makes capture a problem. They have air sacks and lack a diaphragm which makes them prone to problems if their chest movements are restricted.

d) Minimise stress: Before you attempt to restrain a bird have all your equipment prepared for any tests or medications you suspect you might need. This ensures the bird is restrained for the minimum time possible. To minimise injuries remove any perches or obstacles before you start the capture process. (Cannon, 2002)

- A general guideline is to work at catching the bird for no more than 5 minutes at a time so that you don't unduly stress out your birds.
- Catching birds in an aviary is much easier if there are two people.
- Try to enlist the help of another, even if that other person does nothing other than usher the bird back to your end.

Catching process

- Single out the bird you want to catch.
- Using your catching bag watch the birds movements and try to predict their flight path.
- Swiftly pull up the net catching the bird in mid-flight.
- Twist the top of the hoop while dropping the net to the ground. This will secure the bird in the net using the birds own body weight.
- Aim to grasp the head and upper surface of the body, including the wings and gently press the bird into the floor.

Restraining process

- Adjust your grip using the ‘three fingered hold’ as pictured below in picture 1.
- Slide your other hand in under the net and behind the hand restraining the bird, carefully swap hands and adjust your grip.
- When the head is held with the correct amount of tension with the neck stretched and extended, most birds will settle down
- An alternative grip commonly used is termed the ‘universal grip’. The thumb is inserted into the gap underneath the lower beak. The index finger encircles the
back of the neck placing downward pressure on both of the wings. This then allows the neck to be extended. Picture 2. (Cannon, 2002)

- A physical examination can then be performed if required.

![Figure 22: Example of the three fingered hold](image)

Photo credit: Rebecca Klarich.

![Figure 23: Example of the ‘Universal’ grip.](image)

7.4 Weighing and Examination

**Weighing Birds:**

It is best to get a good scale (e.g. a bird scale, postal scale, or any other scale that weighs in grams) and periodically monitor the weight of your bird. Birds are experts at hiding signs of illness, so noticing weight loss is often the best way to detect a potential health problem early.

- Birds should be weighed before transport with the weight being recorded for reference.
- Place bird in a cotton bag secured at the top and then in a box (these items should be weighed empty and then deducted from the birds weight).
- Place onto the scales and record the bird’s weight in grams deducting the weight of the bag and the box, it should be recorded along with the bird’s leg band number, colour and or microchip number.
- The bird’s weight and other health records should accompany the bird to its new destination.
- The bird should be weighed on arrival and monitored for any signs of stress after travel.

![Figure 24. Digital scales are extremely accurate for weighing birds](image)

Photo credit: birdscales.com
Examination:
Once the bird has been captured and is correctly restrained and identified a physical examination must be conducted starting from the head to the tip of the tail. Only healthy birds should ever be transported unless they are being captured to be taken to a vet.

- A healthy bird will have bright, sparkling eyes that are wide open and free of any discharge. Eyes that are runny, squinty, or discolored can be an indication of disease of infection.
- Check the bird's nares and cere for signs of infection. Many birds with respiratory problems will exhibit a runny, crusty, or inflamed cere as a symptom. Avoid birds that show any sign of obstructed nares or any discharge whatsoever coming from the nasal area.
- Check the birds ears, they should be clean and free from any discharges.
- The top and bottom parts of the beak should meet evenly, without gaps, and in good alignment. The top part of the beak should not be overgrown or overly pointy, and the edges of the beak should be smooth.
- Breathing should be regular, quiet and not strained. Wheezing, clicking, shorting, or heavy, labored breathing can be a sign of respiratory problems.
- Extend the birds wings checking for bruising, dislocation or fractures.
- In a bird in good condition, the keel can be felt but its edge is nearly even with the muscles on the chest. In an underweight bird, the keel bone is very prominent and in an obese bird it is very difficult to feel.
- The vent is the area around the combined opening of the urinary, digestive, and reproductive systems (just in front of the tail on the underside of the bird). This area should be clean and dry, free of matted feathers or fecal material.
- Check the bird's plumage to make sure that it is bright and clean. Dull, dirty, or scruffy looking feathers can be a sign of abnormal preening behaviors. Matting of feathers around the top of the head or face may indicate the bird has been vomiting. (Williamson, 2000), (McLeod, 2011)

Figure 25. Example of how to extend the bird's wing during an examination.
Photo credit: Rebecca Klarich
7.5 Release
Release should occur as soon as possible. Turn the bird into the correct orientation and release them onto the ground so that they can adjust to new bearings and are less likely to panic or flutter.
When releasing a bird from its box, the box should be placed on the ground then the door opened to allow the bird to exit the box at its own accord.
If the bird has received or is undergoing treatment releasing the bird into a smaller cage or aviary will enable easier observation and monitoring by staff.
The bird may need to be restrained inside the catching bag and then released into the smaller cage by hand. Above all, do not release birds into midair. This is dangerous and stressful for the patient. (Cannon, 2002)

7.6 Transport Requirements
If transporting single birds short distances e.g. to another enclosure on the same premises a cotton holding bag or even the cotton net which the bird was caught in will be sufficient. Always keep in mind that Lorikeets have powerful beaks and may be able to chew and bite through bags.
For short trips to the vet etc. a small sized pet pack covered over with a cloth to keep the bird in the dark would be sufficient.
For long journeys, interstate and international flights the following guidelines must be adhered to.
For general transport purposes, birds will be carried only in closed containers. The container must be well constructed and be able to withstand other freight damaging it or causing the structure to buckle or collapse. It must be constructed of non-toxic materials. Chemically impregnated wood may be poisonous and must not be used. (IATA)
The container must be suitable to keep the bird inside at all times and protect the bird from unauthorised access.

7.6.1 Box Design
Ridged plastic pet containers
To transport individual birds a modified ridged plastic pet containers are suitable for use. The following modifications must be made:
- Perches, fixed foothold blocks or non-slip floor lining must be fixed appropriately to the floor of the container.
- Non-destructible padding must be fixed to the roof; the doors and ventilation openings must be covered with a fine mesh to prevent any part of the birds protruding. A light curtain must cover the door and ventilation openings to reduce the amount of light within the container; this must be suitably adjusted for those birds that need very dim light.
- The amount of space per bird must comply with the species carried.
- Food and suitable water containers must be fixed inside the container with a means of being refilled.
- Labeling must conform to IATA standards for live animals.
**Wooden containers**

The container must not cause the bird to damage itself. All inside edges must be smooth or rounded. There must be no sharp projections, such as nails, upon which the bird can injure itself. Joints of a wooden container must be made so that they cannot be damaged by a bird’s beak or claw from the inside.

A wooden perch must be provided for *T.h moluccanus* to rest by perching as well as sufficient head height for the bird to perch upright and its tail clear of the floor. The diameter of the perch must be large enough to permit the bird to maintain a firm, comfortable grip with its claws. The perches must be placed so that droppings do not fall into the food or water troughs. The container must be clean and leak proof. If it is being reused it must be thoroughly disinfected or sterilized.

When constructing containers for the shipment of birds, the normal habits and necessary freedom of movement must be considered. It is recommended that the material for the sides, frame, roof and floor be standardized as follows:

- Sides- 0.6cm (1/4in) plywood;
- Frame- 2x4cm (3/4x1½in) solid wood;
- Roof, floor- 1.2cm (1/2in) plywood.
Container construction
Materials used include: wire mesh, non-toxic wood, non-toxic plastic, fiberglass, synthetics and muslin or other light material.

- **Size** - The normal habits and necessary freedom of movement of the bird species involved will determine the size.
- **Frame** - Solid wood of a minimum of 2x4cm (3/4x1½in) either screwed or nailed and glued with non-toxic glue.
- **Sides** - Plywood or solid wood with a minimum thickness of 0.6cm (1/4in) 75% of the front must consist of wire mesh or metal bars.
- **Floor** - Solid wood of 1.2cm (1/2in) thickness. A false wire floor for lories can be provided so that excreta can pass through onto the floor beneath.
- **Roof** - The roof must be solid, however ventilation holes are permitted.
- **Perches** - No more than 3 parallel perches for the species that perch.
- **Door** - There must be a door, made of solid wood of 1.2cm (1/2in) thickness. Either sliding or hinged, to each container or compartment of container. There must be a secure means of fastening each door.
- **Ventilation** - Meshed ventilation openings, approximately 2.5cm (1in) in diameter must be provided at approximately 5cm (2in) distance apart along three sides of the container. Whenever openings are covered by mesh care must be taken that there are no sharp edges present within the container, all meshed openings must be covered with a light material that allows good airflow.
- **Handling Spacer Bars/Handles** - Must be provided as shown in the illustration on three sides of the container.

![Figure 28. Transport Container Suitable for Rainbow lorikeets (IATA)](image-url)
7.6.2 Furnishings

- Wooden perches of a suitable diameter that are fixed and cannot move must be supplied for *T.h moluccanus* to perch on for the duration of the trip.
- A false wire floor for lories can be provided so that excreta can pass through onto the floor beneath.
- Absorbent bedding must be provided by the shipper that is suitable for the species; Artificial turf, shredded paper, sawdust etc. Straw is unacceptable as many countries prohibit its importation.

7.6.3 Water and Food

Separate food and water containers must be provided, they must be accessible for refilling and the sides of the water containers must be flanged to prevent spillage. It may be necessary to have a float or sponge of similar material, on top of the water to prevent excess spillage and drowning. Soldered tin must never be used. (IATA) Lorikeet dry food provided in a fixed container as well as half an apple on the floor of the box will always be relished. (Sindel & Gill, 2007)

Shippers instructions for feeding and watering must be given in writing at the time of acceptance. Feeding and watering instructions must be affixed to the container and a copy of the instruction must accompany the shipping documents. Any feed or water given must be recorded on the container instructions with the date and time of supply.

Birds do not usually need additional feeding during the 24 hours following the time of dispatch.

Fruit may also be given to provide moisture, but it must be checked that it does not contravene any regulations of the country of transit or importation. (IATA)
7.6.4 Animals per Box
It should be noted that *T.h moluccanus* is an aggressive species; they must not be transported with other species of birds. (IATA) All lorikeets should be transported in individual compartment boxes, regardless of the duration of the trip. (Sindel & Gill, 2007)

7.6.5 Timing of Transportation
- The transportation of birds in temperatures exceeding 32 degrees Celsius is not recommended.
- They must not be left in vehicles in hot weather or parked in the sun.
- The preferred time for transportation is during the cooler parts of the day preferably at night.
- Take direct routes when transporting birds and try to minimise transport times
- Establish an ETA (estimated time of arrival) before setting off and notify relevant parties of your plans. (Delain, 2007)

7.6.6 Release from Box
New birds should undergo a physical examination before release and should then be quarantined for a minimum of 6 weeks before being released into an aviary with resident birds. Birds being introduced to an outside aviary should be released early in the day to allow for acclimatisation. Birds should never be introduced to an outside aviary during extreme weather conditions. Wait until early the next morning when the weather is cooler.
When releasing a bird from its box, the box should be placed on the ground then the door opened to allow the bird to exit the box at its own accord. Releasing a bird in the morning allows for observations during the day by staff and allows the bird plenty of time to explore its new surroundings, locate feeding and watering stations and find a place to roost during the night.

8 Health Requirements

8.1 Daily Health Checks
Distant examinations can be carried out during routine feeding and cleaning procedures. Spend some time observing the birds from a distance preferably where the birds cannot see you. If you are too close sick birds will often respond with the preservation reflex by hiding any subtle signs of illness. After observing from a distance quietly approach the bird and see how it responds to you.
A normal bird should display the following:
- Bright and alert behavior
- Both eyes wide open and clear with no swelling or discharges
- Both nostrils open and clear
- No darkening or stains on the feathers around the nostrils
- The bird should look at you and respond to your approach
• Wings folded against the body in the normal position
• Standing erect with its weight evenly distributed on both feet
• All feathers are in good condition
• Singing and calling normally
• Moving around actively
• Its breathing should be barely detectable
• No abnormal swellings anywhere on the body

A distant examination of the environment should also be conducted while servicing the aviaries. Look around the bird’s environment and make note of anything that may be unusual.

• Are there any signs of vomiting?
• Has the bird eaten any of its seed or is the bird eating more of one seed type rather than another?
• Pay particular attention to the birds droppings, are they runny, whole seeds passed and a change in quantity?
• Have the other foods like fruits and vegetables been eaten?
• Has the bird been chewing on the wire or metal components of the cage?
• Are there any other changes to the environment? E.g. rodents entering the aviary.

8.2 Detailed Physical Examination

8.2.1 Chemical Restraint
Inhalation agents are the preferred methods of anesthesia in most parrots. Isoflurane is the anesthetic of choice for the avian patient. In some circumstances, short anesthetic periods are safer and impose less physiological compromise and stress than physical restraint. Other gases used are: Halothane and sevoflurane. These drugs though do have some negative side effects. (Girling, 2003)
While under anesthetic some procedures that can be carried out could be micro-chipping, surgical sexing, x-rays, removing an egg from an egg bound hen and many types of surgical procedures.

8.2.2 Physical Examination
Once the bird has been captured and is correctly restrained and identified a physical examination must be conducted starting from the head to the tip of the tail. Only healthy birds should ever be transported unless they are being captured to be taken to a vet.

• A healthy bird will have bright, sparkling eyes that are wide open and free of any discharge. Eyes that are runny, squinty, or discolored can be an indication of disease of infection.
• Check the bird's nares and cere for signs of infection. Many birds with respiratory problems will exhibit a runny, crusty, or inflamed cere as a symptom. Avoid birds that show any sign of obstructed nares or any discharge whatsoever coming from the nasal area.
• Open the mouth and check the tongue and throat, note any abnormal odours
• Palpate the crop. It may contain food but rarely any fluids. In an aviary bird the crop should be emptying during the day as they prefer to eat in the morning and
the afternoon. In a young bird a delay in crop emptying is often the first sign of disease.

- Check the birds ears, they should be clean and free from any discharges.
- The top and bottom parts of the beak should meet evenly, without gaps, and in good alignment. The top part of the beak should not be overgrown or overly pointy, and the edges of the beak should be smooth.
- Breathing should be regular, quiet and not strained. Wheezing, clicking, shorting, or heavy, labored breathing can be a sign of respiratory problems.
- Extend the birds wings checking for bruising, dislocation or fractures.
- In a bird in good condition, the keel can be felt but its edge is nearly even with the muscles on the chest. In an underweight bird, the keel bone is very prominent and in an obese bird it is very difficult to feel.
- The vent is the area around the combined opening of the urinary, digestive, and reproductive systems (just in front of the tail on the underside of the bird). This area should be clean and dry, free of matted feathers or fecal material.
- Check the bird's plumage to make sure that it is bright and clean. Dull, dirty, or scruffy looking feathers can be a sign of abnormal preening behaviors. Matting of feathers around the top of the head or face may indicate the bird has been vomiting.

If the bird looks obviously stressed or is breathing heavily after an examination assume it is ill and seek further tests and treatments from a veterinarian. (Williamson, 2000) (McLeod, 2011)

8.3 Routine Treatments

To insure your birds are kept in optimal health worming all your birds every three months is a must. A soluble wormer can be diluted into the drinking water. Wormers are bitter and the rainbow lorikeet will often avoid drinking the water if it can gain moisture from other sources e.g. fruit, vegetables and even rainwater running off the aviary.

When worming your bird it is recommended that all liquids be removed from your birds diet during the worming process (usually 3-4 days). Supply your bird with only a lori-dry mix during this time.

Birds should never be wormed when temperatures exceed 27 degrees and when rain is predicted.

I have found Wormout gel by Vetafarm an excellent and easy to use product that is very safe to use as a water soluble wormer or as a crop needle wormer.

Recommended dose for use as a water soluble wormer is 2ml of Wormout Gel to 160ml of drinking water.

Recommended dose for use as a crop needle wormer: dilute 1ml of Wormout Gel to 9ml of water. The dose rate is 0.5ml of diluted wormer per 100grams of body weight. The correct weight of the bird is important in ensuring the correct dose in being given.

An avian insecticide should be used as a preventative for mites and lice

Spray for mites every 6-12 weeks. Spray Perches, nest boxes, flights and aviary floors regularly to control and prevent a mite or lice infestation. Avian insect liquidator is safe
and effective insecticide that kills pests on contact. It is safe to spray directly onto birds and will penetrate the feathers to kill lice and mites instantly. There are no vaccinations available for Rainbow Lorikeets.

### 8.4 Known Health Problems

The following is a brief summary of the most significant diseases of Lorikeets in Australia.

#### Parasitic Diseases

**Intestinal Worms**

Internal parasites are relatively uncommon in lorikeets, due to their arboreal nature. However aviary birds that have contact with wild Lorikeets may be exposed to parasites.

- **Cause** - Proventricular worms, Tapeworms.
- **Signs** - Anemic, sudden death, weight loss, Depression, diarrhea, tapeworm segments in droppings.
- **Treatment** - Intestinal worms can be treated with a drug called praziquantel (Droncit, Virbac, Tapewormer, Wormout Gel.)
- **Prevention** - If lorikeets are kept in a multi species display a regular worming program should be implemented. I have found that worming the birds every 3 months with Wormout Gel keeps them healthy and relatively worm free. This has been confirmed by our vet conducting regular fecal examinations. When worming Lorikeets it is recommended that they are not fed any fruit or nectar mix as they will be reluctant to drink the worming solution. This solution should be supplied in the drinking water for 3 days in a row and again 2 weeks later for another 3 days. Then worm again in 3 months time.

**Coccidiosis**

- **Cause** - Protozoal parasite, birds are unable to absorb nutrients from their food. This can eventually lead to death.
- **Signs** - Bloody diarrhea, rapid weight loss, loss of appetite and lethargy. Diagnosed by fecal examination off egg-like structures called oocysts.
- **Treatment** - The most efficient treatment is by a drug called toltrazuril (Baycox).
- **Prevention** - Parasites are spread via droppings often from wild Lorikeets that contaminate the food or water source. Prevent an onset of coccidia by restricting wild bird access to the aviary and also by cleaning your birds food and water containers regularly. Poor hygiene and overcrowded aviaries provided the perfect environment for coccidiosis.

**Trichomaniasis**

- **Cause** - Protozoal parasite (*Trichomonas gallinae*) that lives in the crop and intestine. The organism burrows into the tissue lining and causes a large white cheesy reaction. If left untreated 50% of infected birds will die.
- **Signs** - Vomiting crop contents, green diarrhea, white cheesy material in the mouth or throat, Dry retching or neck stretching, depressed and listless, weight loss and death.
Treatment- Diagnosed by a crop wash and examination of the mobile organisms. Treatment requires the use of drugs such as ronidazole or metronidazole.

Prevention- Very contagious, this disease is passed on by a bird eating food and drinking water that has been contaminated by vomit or saliva from an infected bird. Quarantine new birds and have them health checked by your vet. High levels of hygiene within the aviary should be adhered to.

Bacterial and Fungal Infections

Crop Infections:
One of the most common ailments affecting Lorikeets.

- **Cause**- bacterial or fungal infections. Because lorikeets have specialised diets (part of which is liquid) and a very short gut-passage rate (and hence produce large volumes of liquid faeces) they are very susceptible indeed to bacterial and fungal infections of the digestive tract.

- **Signs**- Dull, listless, vomiting sticky mucus and food or have copious food and mucus around the facial feathering. The crop may either be empty from persistent vomiting or full and spongy to feel. Despite being quite ill, these birds will often continue to eat ravenously but often vomit immediately after.

- **Treatment**- Bacterial infections require acute diagnosis by a veterinarian to determine the antibiotics which are most likely to work. Fungal infections will require crop samples taken by a veterinarian to identify the organism. Medication may then be needed to stop the vomiting, treat the initial organism and to possible prevent secondary organisms.

- **Prevention**- In order to avoid fungal and bacterial infections a high standard of hygiene is essential. Similarly, aviaries and feeding stations should be constructed in such a way as to minimise the opportunity for birds to foul their foods.

Viral Infections

Psittacosis:
Psittacosis is a very common infectious disease that will often be carried by a bird with no clinical signs being observed.

- **Cause**- Caused by an organism called *Chlamydophila psittaci*.

- **Signs**- Ruffled feathers/huddled posture, depression, weight loss, conjunctivitis, feather loss around one or two eyes, sneezing, heavy breathing (tail bobbing), soiled vent, diarrhea- often lime green in colour, excessive urine in droppings and sudden death.

- **Treatment**- Diagnosis is best made by your veterinarian on the basis of clinical signs and testing of appropriate smears for the presence of the organism. Treatment is time consuming. The drug doxycycline is considered to be the drug of choice and needs to be used continuously for a minimum of seven weeks. Birds may clinically improve quickly but if the medication is withdrawn to early relapses are common. A bird that has been treated for Psittacosis develops no immunity to the disease and can be infected repeatedly. The treatment is given either as weekly injection or as a daily medication in the water of nectar.
- **Prevention**- Take all new birds to a qualified avian veterinarian immediately after purchase for chlamydiosis screening tests. Purchase or acquire birds from reputable suppliers who screen for the presence of chlamydia, isolate and quarantine all newly acquired birds for a period of at least six weeks. Periodically monitor breeding flocks for chlamydiosis and maintain a clean and healthy environment at all times to prevent any future outbreaks.

**Psittacine Circovirus (Psittacine Beak and Feather Disease, PBFD):**
This virus affects both wild and captive lorikeets, it is caused by a circovirus and infects rapidly dividing cells within the body, this means that the cell population that will be most affected are the feather and skin cells which are constantly growing. Liver spleen and bone marrow cells are also damaged by this virus.

- **Cause**- A viral infection caused by the circovirus.
- **Signs**- More common in young birds, usually under one year of age, abnormal feather growth particularly primary flight feathers and tail feathers, dirty plumage, patches of yellow feathers appear in green birds, bald patches anywhere on the body, sneezing, conjunctivitis.
- **Treatment**- Blood tests and examination of the feathers will help detect the virus. There is no treatment available; however there may be a vaccination available in the future. Many affected birds will invariably die of secondary complications and euthanasia of these birds may be a more responsible approach. If a bird with circovirus is diagnosed within your collection then the aviary should be completely disinfected with appropriate disinfectants (Avisafe, Parvocide, f-10). Nest boxes and perches should be discarded and the aviary substrate should be completely replaced.

- **Prevention**- Prevention involves screening all incoming susceptible birds for the virus or buying your birds from circovirus free collections. The virus is found in feather dust and any discharge (Saliva, droppings and crop contents) shed from infected birds. Cleaning the birds environment regularly to minimize dust present is a useful tool in reducing the amount of viral particles that can be passed to other birds.

![Figure 30. A Rainbow Lorikeet showing PBFD](image)

**Polyoma Virus of Nestlings:**
This is a cause of death in young birds before they have fledged.
➢ **Cause** - This pathogen is considered one of the most significant threats to cage birds around the world. This highly infectious disease effects most if not all parrot species. Polyoma seems to be most problematic among neonates (young birds) between the ages 14-56 days. Young birds often die, while adult birds can develop a certain level of immunity. Polyoma is believed to have an incubation period of approximately two weeks or less.

➢ **Signs** - In young birds: Enlarged abdomen, crop emptying slowly or not at all, bruising under the skin, death within 2-3 days.
In older birds: Abnormal flight and tail feathers, weight loss, poor growth. Some birds die without any clinical symptoms. Adult birds may die of secondary infection from bacterial, viral, fungal or parasitic pathogen.

➢ **Treatment** - There is no treatment for this disease. In a breeding situation the best control measure is to cease breeding for up to one year.

➢ **Prevention** - Isolate all birds shedding the disease. Disinfect all contaminated surfaces with an oxidizer such as chlorine bleach (Polyoma virus is resistant to many disinfectants).

**Lorikeet Paralysis Syndrome:**
LPS is a syndrome seen in lorikeets as a sudden onset of paralysis in both legs (bilateral) and/or clenched feet. The syndrome is also often called Clenched Foot Syndrome.

➢ **Cause** - The cause is unknown. In some cases an encephalomyelitis of possible viral origin has been suspected. Other suspected causes are vitamin deficiencies with some suggestions that vitamin E deficiency is involved.

➢ **Signs** - Trembling, wobbly gait, incoordination, reluctant to walk, lying on the floor of the cage, abnormal head movements. Birds will often have clenched feet and the inability to stand as a result of leg paralysis. This is sometimes seen in combination with wing paralysis and or wing convolutions.

➢ **Treatment** - Many of these birds die within the first few days, some recover in the same time frame, others gradually improve over a period of weeks to months and some remain the same. There is no specific treatment for LPS. The secondary infections, nutritional deficiencies and inflammation need to be treated. This may include antibiotics, corticosteroids and vitamin injections. Fluid therapy is normally necessary in the first 24 - 48 hours either by crop tube or by injection. Exercising the clenched foot by opening it to its normal shape and then “bicycling” the legs 2 - 3 times daily may be beneficial.

➢ **Prevention** - While the exact cause of LPS is unclear, many affected birds show spinal cord damage or stroke-like damage to the brain, but not all affected birds show these changes. It is now thought that a deficiency in calcium and/or vitamins A, B1,2&6, D and E may be involved, especially as a dry seed diet is notoriously lacking in these ingredients. the long term diet of both the affected bird and any aviary mates needs to be modified to include more fruit, green vegetables such as spinach and other vitamin and mineral supplements.

**Non-infectious Diseases**

**Egg Binding:**
Most common in Lorikeets who are obese and on calcium deficient diets. Although an infection of the oviduct can also lead to egg binding.

- **Cause**- Calcium deficient diets, obesity, chilling lack of exercise and infection of the oviduct.
- **Signs**- Birds with egg binding are usually depressed, fail to perch, often sit on the bottom of the cage, and may strain as if trying to lay an egg. If the egg is putting pressure on the nerves that control the legs, paralysis may result.
- **Treatment**- Treatment varies with how sick the bird is when presented to the veterinarian as well as the location of the egg and the length of time the bird has been egg bound. Critically ill birds are first treated for shock and then attempts are made to treat the egg binding. Mildly affected birds may respond to supplemental heat, calcium, vitamin E, selenium, and vitamin D-3. Other injectable drugs may help cause the oviduct to contract and expel the egg. If the egg is near the cloacal opening, the veterinarian may be able to gently extract it. Eggs that do not pass with drug therapy require more aggressive treatment. The veterinarian may need to place a needle through the abdomen into the egg shell and aspirate the contents of the egg, causing the shell to collapse. The shell will usually pass out of the bird within a few days. Failing this, surgery may be performed to remove the egg or shell fragments.
- **Prevention**- Birds on a poor diet should have the diet changed following instructions from your veterinarian. Calcium, phosphorus, vitamin and mineral supplementation may be recommended. Obesity should also be corrected. Birds that are chronic egg layers might respond to hormonal drug therapy, although this can be associated with severe side effects. A hysterectomy can also be performed to prevent egg laying and egg binding.

### 8.5 Quarantine Requirements

Quarantine comes from the word "quarantina", which means around forty. In other words, 40 days in isolation for the bird/s, or is it forty lashes for the bird keeper who doesn’t use a quarantine program? (Hunter valley Avicultural society).

Quarantine is the separation and isolation of all new birds from all other birds. All new birds are quarantined to prevent the introduction of new infections to the other birds already in the collection.

In my opinion, placing birds in a quarantine program is like taking out an insurance policy. In both cases, you should assess the risks. That is, what will happen if you don’t? How much will it cost you if a problem arises? Can you afford the loss if it occurs?

Quarantine is used to monitor the bird during its settling time as this is the time when any disease it may be carrying is most likely to break out.

The recommended quarantine time is a **minimum of six weeks**. Even if you have veterinary examination prior to purchase and the bird is deemed healthy, a quarantine period should still be carried out.
• The quarantine area should be isolated from the other aviaries and the birds fed and watered after the other birds in the collection have been serviced.
• Quarantined birds should have separate food and water dishes, as well as separate cleaning items. These items should never be taken over to or used within the aviaries holding the resident collections.
• Introduce the new bird into the aviary or cage as early as possible in the day. This gives the bird a chance to get its bearings, locate food and water and find a suitable place to roost during the night.
• Direct faecal smears and faecal floatation’s should be carried out twice looking for internal parasites.
• The birds should be treated for any internal and external parasites during the period of quarantine.
• No bird should be removed from quarantine and placed into the main collection until the aviculturist is completely happy with its health.

9 Behaviour

9.1 Activity
Rainbow Lorikeets feed throughout the day and 70% of their time is spent feeding in order to satisfy their daily requirements. These birds are arboreal and often seen feeding high up in the canopy of Eucalyptus trees. They can be very noisy, active, and gregarious and are often seen in the company of other birds. This active bird has a shrill call while flying and chatters while eating. Lorikeets are generally nomadic, travelling large distances between their feeding and roosting sites.

9.2 Social Behaviour
Rainbow Lorikeets are generally social animals often seen in the company of other bird species and then flocking in the hundreds while feeding on the pollen and nectar from trees. They will congregate once again to roost during the night. They often form large noisy communal roosts, sometimes made up of thousands of birds which then disperse at dawn. Feeding sessions often involve loud squabbling noises as they fight over the best selection of fruit and flowers. These disturbances are rarely serious and the most aggressive display intimidates the rival to give way and then feeding will carry on as usual. A pair will spend their time throughout the day allopreening one another and participating in mutual displays.
9.3 Reproductive Behaviour
Bonded pairs tend to remain close to each other at all times, foraging, resting and roosting together. When feeding and flying they will remain in contact with a variety of contact calls. Breeding pairs do not return to communal roosts while breeding, instead returning to their nesting hollows.
Courtship and pre copulation displays are performed by the male. The female watches him passively or, if unreceptive will peck at or avoid the male.
While perched together the male stretches to full height and raises the feathers on the nape of an arched neck. Males will hang upside down, hop sideways along the perch twisting from side to side. This is often accompanied by a low single note whistle.
The female will show interest if she is near to nesting and will respond similarly, the pair then displays for several minutes before copulation.
Courtship feeding occurs throughout the year but increases greatly when breeding. The male indicates willingness to feed the female by making chewing movements and soft creaking calls. (Higgins, 1999)

9.4 Bathing
As these birds are arboreal most of their bathing is done amongst wet leaves after rain. They fluff their body feathers, flap their wings and rub themselves amongst the leaves. These birds will also hop to the ground to reach water at dams and urban sprinklers. (Odekerken, 2002)
I have personally found rainbow lorikeets love a shower from the hose all times during the year; they will often fight and jostle for the best position in front of the hose shower.
On a hot day I have witnessed Lorikeets bathing in their drinking water which is positioned close to the bottom of the aviary. I believe they would benefit greatly from having a bird bath placed in their aviary separate from their drinking water.
9.5 Behavioural Problems

Common undesirable behavioural problems seen in captive rainbow lorikeets may include:

**Feather Picking:** Excessive chewing of feathers or skin, Normal feathers on the head and neck, damaged feathers on easy to reach sections of the body. This is an obsessive behaviour and is a sign that the bird is upset and or stressed. As the problem progresses the bird will move its attention from its feathers and begin damaging the skin. Often blood tests are required to determine any infections or internal diseases. (Cannon)

**Over Preening or Displacement Grooming:** Over preening is regarded as a grooming disorder. Grooming or preening is behaviour that serves both physical and social purposes. In the presence of stressors, Displacement grooming may develop that can result in excessive grooming when chronic stress is experienced.

**Screaming:** Birds may vocalize for a number of different reasons. In the wild, vocalization may be used to locate flock members and warn of potential dangers. Lorikeets are also known for their ear piercing calls. Spend some time with the bird to see if something in particular triggers the screaming. Once identified offer a distraction spray with water, change feeding times or try introducing a new toy. (SEAVS)

**Biting and aggressive behavior:** Physical violence between birds is almost non-existent in the wild. Birds rely heavily on non-verbal communication and various display behaviors to resolve issues within the flock. In captivity, biting is mainly a learned behavior in response to a negative stimulus. Some species learn to bite readily and care
must be taken to avoid re-enforcing this behavior. For extremely aggressive birds, stick training and other positive re-enforcing activities may be used to help alleviate this undesirable behavior. (SEAVS)

**Bonding with Keeper/Separation Anxiety:** Bird separation anxiety is a neurological distress response exhibited by some birds when they are left alone or separated from the person or people to whom they are most attached. Bird separation anxiety may be exhibited by one or more of the following signs:
- Distress vocalization or excessive screaming
- Destructive behavior
- Hyper-attachment
- Lack of appetite
- Inactivity or lethargy
- Attempts to escape from the cage

These signs can range in severity from mild to severe, and most often are manifested in a very brief time frame after the bird is left alone. This time factor can distinguish destructive behavior, for example, that is due to separation anxiety from similar behavior due to boredom.

**Stereotypical behaviours:** Such as pacing, nodding, scratching, head shaking, feet shaking and gnawing their claws. These behaviours are often repetitive and caused by boredom, abnormal environment, lack of social interaction, stress etc. Providing enrichment may help alleviate this problem.

**Regurgitation:** If you notice your bird regurgitating food whenever you’re near it is a sign it has accepted you as a friend and wants to feed you. This may be mistaken as vomiting and illness. In reality, it is a sign of deep affection and is what bonded pairs of birds do for each other.

**Self-Mutilation/Mutilation Syndrome:** There are many theories as to the cause of this problem. Many people suspect a virus is the cause. It is thought that the chewing is a response to the tingling feeling that some viruses cause. Signs include: Ulcers/bleeding on the wing web and legs, bird constantly chewing at the wing web and legs.

### 9.6 Signs of Stress

Below is a list of the symptoms of stress in parrots:

- Pinning eyes, fanned out tail feathers, and raised crest or head feathers
- Constant pacing back and forth on the perch or at the bottom of the cage
- Sudden behavioral changes, such as a normally quiet bird becoming a screamer or a usually gentle bird biting people who handle it
- Feather picking or skin mutilation
- Cessation of, or slowing down of, molting cycles
- Lack of appetite and weight loss
- Excessive drinking and urination (“stress droppings”)

Certainly, many of the above mentioned signs can also be symptoms of other health or behavioral problems that are not related to stress.

With parrots the most common causes of stress are boredom, inadequate relationship between the bird and its owners, unsuitable caging, anxiety due to the environment. Your best bet is to always take your bird to an avian veterinarian for a complete physical examination. Whether your bird is stressed or has some other problem, your veterinarian is sure to offer you advice for getting the situation under control. (Sweat, 2011)
9.7 Behavioural Enrichment

Rainbow Lorikeets are an extremely active bird in the wild they would spend up to 70% of their time foraging for food. A variety of enrichment items placed into their aviary will keep them occupied throughout the day. Below are a few suggestions however the possibilities for providing various types of enrichment are endless and can be only limited to your imagination.

- Try including fresh flowering native browse such as Eucalyptus species as much as possible. Lorikeets will spend time harvesting the pollen and nectar from the flowers, chewing on bark and stripping the leaves.

- House these birds in groups of other Rainbow Lorikeets or at least with one other to give them social stimulation and interaction.

- Provide Rainbow Lorikeets with a bird bath separate from their drinking water or install a sprinkling or misting system to the aviary. Rainbow Lorikeets will readily accept being showered with water on a warm day and enjoy bathing themselves in a shallow bird bath. Many hours are spent preening and grooming themselves after a thorough drenching.

- Whole pieces of fruit hidden around the aviary takes the birds longer to eat then fruit that is chopped into smaller bite sized pieces.

- Fruit items frozen overnight stimulate all of a bird’s senses and can help keep a bird cooler in hot weather.

- Spray liquid nectar such as vetafarm’s Blossom Nectar on browse and flowers, suspending a dripper style bottle filled with nectar or fruit juice also provides the lorikeets with a challenge.

- Try out the suspended lorikeet feeding jars, they help keep the food free from fecal contamination as well as making the birds ‘work’ for their food.

- Hanging suspended ropes, ladders and various types of bird toys encourages natural climbing behaviours.

- Every so often change the aviary furnishings, move around perches to encourage exploring and offer them exercise.

9.8 Introductions and Removals

Introducing a new bird to the aviary can upset the social order within. It is not unusual for a new bird to be chased about quite vigorously upon introduction. It is good practice to introduce new birds in pairs or greater, whenever possible, so a lone bird isn’t singled out
for picking on. This is going to be a very stressful time no matter what. Placing food and water in multiple places during this period usually helps. Within a day or two, things usually settle down. Some people recommend placing the new bird in a cage near the existing birds after its quarantine period so that the birds can become a little familiar with each other before introduction. This may help to reduce the chaos that may ensue upon introduction. Others suggest moving the existing perches and nestboxes around before introducing a new bird, so the environment becomes new to everyone and everyone needs to define new territories. (Finch aviary)

### 9.9 Intraspecific Compatibility

*T.h moluccanus* is generally a flocking species and will often congregate in large groups at feeding locations. In captivity groups of Lorikeets can be housed together. There is often a dominate pair of birds who will occupy the best perching, nesting and feeding locations within the aviary. Care should be taken to ensure there are plenty of feeding stations so less dominate birds are still able to feed and perch without being constantly harassed.

### 9.10 Interspecific Compatibility

Due to the specialised feeding nature of Lorikeets it is recommended that they are not housed with seed eating parrots. It is however possible for Rainbow lorikeets to hybridise with many of the sub-species. Refer to section 10.

### 9.11 Suitability to Captivity

*T.h moluccanus* has adjusted readily to being kept in captivity. With advances in aviculture providing a lorikeet with all its nutritional needs is accomplished quite easily by using one of the many commercially made products available on the market. T.h moluccanus breeds readily, is an excellent display species due to their bright coloured plumage. They are mostly active, often noisy and have boisterous natures. Rainbow Lorikeets will also become quite tame often allowing keepers and the public to hand feed them.

In my opinion an aviary full of these colourful clowns of the bird world provides endless entertainment and ambience to a zoo or wildlife park.

### 10 Breeding

#### 10.1 Mating System

Rainbow lorikeets are sexually monomorphic and should be DNA or surgically sexed to determine the hen from the cock. It is common in captivity for same sex pairs to form bonds and even simulate copulation. Correct sexing will prevent delays during the breeding season. Once sex has been determined *T.h moluccanus* will form strong monogamous pairings often lasting year round. (Sindell & Gill,2007)
In captivity courtship and pre copulation displays are performed by the male. The female watches him passively or, if unreceptive will peck at or avoid the male. While perched together the male stretches to full height and raises the feathers on the nape of an arched neck. Males will hang upside down, hop sideways along the perch twisting from side to side. This is often accompanied by a low single note whistle. The female will show interest if she is near to nesting and will respond similarly, the pair then displays for several minutes before copulation. Courtship feeding occurs throughout the year but increases greatly when breeding. The male indicates willingness to feed the female by making chewing movements and soft creaking calls. (Higgins)

10.2 Ease of Breeding
Rainbow Lorikeets are generally prolific breeders. When kept in ideal conditions and fed a good quality diet *T.h moluccanus* has the ability to breed year round. (Higgins, 1999) Often just supplying a pair with a nesting box will trigger them to breed. Include a selection of flowering browse to the aviary regularly may also help trigger breeding. *T.h moluccanus* can be bred in a variety of situations such as:

- One pair to an aviary with a minimum size of 3m long 90cm wide and 90cm high.
- Colony breeding in spacious aviaries with numbers limited to 5 or 6 pairs.
- Flock breeding with large dissimilar parrot species is also possible; signs of aggression in a flock situation should be carefully monitored as bullying can often escalate to death. (Sindell & Gill, 2007)

10.3 Reproductive Condition

10.3.1 Females
Birds selected for breeding should be true to type, not have any physical deformities and be in good healthy physical condition. Healthy birds will in turn breed healthy strong chicks.
All birds selected for breeding should be included in a routine worming program and be placed on a good quality diet.
Rainbow lorikeets are capable of breeding at 18 months of age however it is often better to wait for birds to reach 2 years of age where they will often breed more successfully. (Sindell & Gill, 2007)

10.3.2 Males
As previously mentioned only healthy, vibrant and active unrelated birds should be selected for breeding.
10.4 Techniques Used to Control Breeding

The removal of nesting boxes will prevent Rainbow lorikeets from being able to lay viable eggs. This however will not prevent the hen from laying, she will then lay off the perch cracking the eggs or lay directly onto the aviary floor. Separation of the hen from the cock will prevent breeding but may be stressful to the birds and is not always an available option due to space constraints. Eggs can be removed from the nest after laying and destroyed but this will encourage the hen to double clutch and deplete the levels of calcium in her body. It is possible to replace these eggs with fake ones to prevent the female from continually laying.

10.5 Occurrence of Hybrids

Rainbow lorikeets should not be housed with other lorikeet species due to the possibility of hybridization. They have been known to hybridise with Scaly-breasted Lorikeets, Red-collard Lorikeet and Musk Lorikeets. These combinations bred in captivity have proved to be fertile.

![Figure 32. An example of a Rainbow/Scaly hybrid](image)

Rainbow Lorikeets will also hybridise with the Varied Lorikeet, Chattering Lory, Red Lory, Buru Red Lory, Ornate Lory, Forsten’s Lory, Edward’s Lorikeet, Rosenberg’s Lorikeet, Violet-necked Lory, Black Lory, Dusky Lory, Cardinal Lory and Weber’s Lorikeet.

There has also been a remarkable and well recorded hybridization with a King Parrot and the equally unusual hybridization with a Superb Parrot. (Sindell & Gill, 2007)

10.6 Timing of Breeding

Breeding season begins in July right through until December. Rainbow Lorikeets may breed year round if conditions are suitable. (Sindell & Gill, 2007) (Odekerken, 2002)

10.7 Age at First Breeding and Last Breeding

In captivity these birds become sexually mature at 18-24 months old. Successful breeding’s take place when birds reach two years of age. The oldest known captive breeding was from a female at the age of 25 years old. (Sindel & Gill, 2007)
10.8 Ability to Breed Every Year
In the wild *T. h moluccanus* normally breeds every year from July-December. However they can potentially breed all year round if there is an abundance of food.

10.9 Ability to Breed More than Once Per Year
It is possible for a bonded pair to double or triple brood in the one season, this is more likely to happen if the chicks have been removed from the nest for hand rearing.

10.10 Nesting, Hollow or Other Requirements
For suitable nest box selection see section 4.8 Nestboxes and/or Bedding Material

In my experience most captive Rainbow lorikeets will tolerate nest box inspections as well as the removal of the chicks to clean and replace soiled bedding material. Gloves should always be worn when handling chicks to avoid transferring disease.

10.11 Breeding Diet
Using a good quality commercially available Lorikeet diet will ensure breeding pairs are Healthy and have all their nutrient requirements met. Offer breeding pairs plenty of fresh fruits and vegetables as outlined in section 6.2 Captive Diet. Provide calcium in the form of cuttlefish bone prior to egg laying and when chicks are being parent reared. (Sindell & Gill, 2007)

10.12 Incubation Period
Incubation takes between 22 to 25 days with most eggs hatching in 23 days. Incubation is carried out by the hen and usually commences with the laying of the second egg. Some cocks will spend time in the nest while incubation is in progress and most males will sleep in the nest at night. (Sindell & Gill, 2007)

10.13 Clutch Size
*T. h moluccanus* will usually lay two white, rounded oval eggs in a slight depression scratched into the nesting material at the bottom of the nestbox. The eggs are usually laid two days apart but it has been recorded intervals of three and four days apart with both eggs still hatching. (Sindell & Gill, 2007)
Figure 33. Two T.h moluccanus eggs laid in a simple vertical nest box with sawdust used as bedding
Photo Credit: R.Klarich

10.14 Age at Fledging
Chicks will normally fledge from 57 to 64 days old with an average fledging period of 60 days. Both parents will continue to feed the young for two to three weeks after fledging although the young will begin to sample food items after a week out of the nest. Young leave the nest a slightly duller version of the adults, with a dark brown beak. The cere and bare skin around the eye are pale grey and the eye appears black. When the young first fledge the parents should be watched for any signs of aggression. It may be necessary to remove the young and hand feed the chicks for a few days until they learn to eat. (Sindell & Gill, 2007)

10.15 Age of Removal from Parents
The young can safely be removed from their parents at around 3 weeks after fledging. (Sindell & Gill, 2007)

10.16 Growth and Development
Chicks will hatch covered in a wispy greyish white down.
At 10 days old a grey secondary coat starts to appear.

The eyes are open at 14 days old and At 18 days old the chicks are covered in a grey coloured down.

Pin feathers start to appear at about 22 days, usually on the head first.
The tail and flight feathers are visible at 28 days old, then the chest and abdomen feathers appear about 2 days later.
Chicks will be almost fully feathered at 45 days old.

Chicks at 41 and 36 days old
Figures 46. Photo credit: R. Klarich

Young will leave the nest as slightly duller versions of the adults.

Chicks fully fledged aged 71 and 66 days old
Figure 47. Photo credit: R.Klarich

11 Artificial Rearing

11.1 Incubator Type
There are two types of commercially available incubators: forced air (using a fan), and still air or draft types (using natural convection). Forced air incubators are preferred when incubating parrot eggs due to their ability to maintain a more steady temperature. (Jordan, 1989)
You should also consider whether you would like to invest in a unit that will automatically turn the eggs or if you will turn them by hand.
It should be noted that parrot eggs need turning at least three times per day for almost the entire duration of the incubation process. (Digney)
Successful incubation relies on accurate temperature control and smooth regular turning.

11.2 Incubation Temperatures and Humidity
The humidity of the incubator is a crucial aspect of successful incubation and hatching. Many incubators come equipped with a humidity dial or gauge. Traditionally the most reliable instrument has been the wet bulb thermometer. This device consists of a thermometer with a cloth wick attached to the bulb end, which is hung in a vial of water. It is a basic design, easy to read and very accurate. (Digney, 1998)
The Temperature of the incubator should generally be set at 37.2°C, This setting works well for most species of parrots. Acceptable extremes are 36.6°- 37.7°C. Temperatures outside of these limits will compromise hatchability.
If the incubation room itself is subject to considerable temperature variations during a 24 hour day this will slightly affect temperatures within.

As an egg develops it loses fluid and therefore weight. The rate of this fluid loss is controlled by the level of humidity within the incubator.
Humidity is directly linked to the water surface area. Increasing the surface area raises humidity, decreasing it, lowers humidity.
A humidity or wet bulb reading of 27.7°- 28.3°C or Relative humidity of 35-45% is the preferred setting for incubating the majority of parrot species. As a rule, the humidity reading should not move outside 27.7°- 28.3°C wet bulb for more than a day or so, as this could be detrimental to the developing embryo. (Digney, 1998)

11.3 Desired % Egg Mass Loss
Commonly 13.5% to 15% is the weight loss target to external pipping, but a variation between 10% and 20% should not cause any significant problems. (Priam)

11.4 Hatching Temperature and Humidity
The hatching unit should be set at around 36.7°C for fan forced incubators or approximately one degree less than the incubator unit. (Priam)
The humidity of the hatcher must be elevated enough to prevent the hatching chick from drying out and adhering to the inner membranes. A relative humidity of 60% to 70% is desirable for hatching.
11.5 Normal Pip to Hatch Interval

The first indication of hatching will be the noticeable movement of the air cell, referred to as drawdown. Once movement of the air-cell is detected in a 24 hour period the egg will be roughly four days away from hatching. (Digney, 1998)

The next step of the hatching process is the internal pip. The chick will pip through the air-cell membrane and begin to enter the air cell using a sharp ridge on the top of its beak known as an egg tooth. It is at this point the egg should be transferred into the hatcher, where it is no longer turned and the humidity is elevated. (Digney, 1998)

Once chicks have internally pipped, which is generally 3 or 4 days prior to the hatching day. It is not necessary to turn the eggs and turning may actually have negative effects on hatchability. (Jordan, 1989)

Once internal pip has occurred and the egg has been placed in the hatcher the next stage of hatching is the external pip.

Eternal pip will be first noticed as a small, slightly raised piece of shell with fine cracks forming a star shape, the result of the chick tapping away with its egg tooth. Generally this will be at the top of the egg, within the air-cell. (Digney, 1998)

Between 24-72 hours after the external pip the chick should have kicked free of its shell and should then be placed in the brooder.

11.6 Brooder Types/Design

Brooders are available in two types. The still air and the fan forced brooder. Fan forced brooders will offer a more uniform and stable temperature where the still air brooders with the heat source at one end will often have significant variations in temperature.

The advantage of a fan forced unit is when a chick is placed back into the brooder after feeding the chick is heated quickly encouraging quicker crop movements. Ultimately the decision on what brooder to use is up to the individual.
Figure 49. Homemade temperature controlled hot box or brooder
Photo Credit: R.Klarich

Figure 50. Close up of heating element and thermostat, the element provides no light keeping the box nice and dark reducing stress on chicks.
Photo Credit: R.Klarich
11.7 Brooder Temperatures
Brooder temperatures are critical in the first few weeks of a chick's life and a one to two degree adjustment can make all the difference in weight gains and crop movements.
Temperature guidelines for the brooding of chicks:
Newly hatched: 36.6°C
5-12 days: 35°-31.6°C
12 days – pin-feather: 31°-28°C
Fully feathered: 26.5°C

11.8 Diet and Feeding Routine

There are many types of commercially available hand rearing mixes on the market that provide a balanced diet in terms of protein, fat, energy and vitamin/mineral content. The advantages of selecting a commercially made product are:
- Ease of preparation
- Can be used in a crop tube easily
- Balanced nutritional levels

It should be noted that the user must follow the manufacturer's instructions when mixing these formulas.
I have personally found RoudyBush™ to be an excellent product, it’s easy to mix and the end result is a healthy bird equal to that of a parent reared chick.
There are three options to consider when hand raising birds. Often the item selected to feed the bird will depend on what the eventual purpose for the bird will be. Ideally the person hand raising should be proficient in all three options, the spoon, the syringe and the crop tube/needle. There may be a point during hand feeding that you may need to switch to one of the other methods.
**Spoon Feeding**

Using a spoon (teaspoon or tablespoon with bent up sides) to hand raise birds is often the most popular method alongside syringe feeding. Spoon feeding is the easiest but can sometimes be time consuming especially if you have quite a few chicks to feed. Spoon feeding will stimulate a chick’s natural feeding behaviours known as ‘pumping’.

![Figure 52. Spoon feeding a Rainbow Lorikeet chick](image)

To Spoon feed and syringe feed a chick:
- Hold the chicks head gently with the thumb and forefinger either side of the beak.
- Dribble a small amount of warm prepared formula onto the tongue.
- The chick will begin a feed response known as pumping.
- Keep the formula flowing off the spoon but avoid overfilling its beak so it spills out the sides.
- After each spoon fill allow the chick a moment to catch its breath.
- Continue this procedure until the crop is full.
- Spoon feeding can be messy so always wipe the chicks beak and clean up any formula that may have dribbled onto its feathers. A cotton wall ball dipped in warm water makes this task easy.
- It is highly important that the volume of formula consumed by the chick is measured after every feed. Weighing the chick before and after each feed and recording the difference where basically 1 milliliter of formula is equal to 1 gram.
Figure 53. It’s important to weigh the chick before and after every feed.

Photo Credit: R.Klarich

**Syringe feeding**

Is a compromise between spoon and crop feeding. This method still produces a quite bird and is quicker and cleaner than spoon feeding. Volume control is the major benefit of syringe feeding. As long as the chick is pumping, the formula can be pushed into the mouth, meaning more can be fed in a shorter time. The 1ml syringe is an excellent instrument for feeding newly hatched chicks because the increments provide volume knowledge of 0.05ml and as the chick grows so too does the size of the syringe.

**Crop Tube**

Before attempting to crop feed a bird you should be trained in how to correctly insert the crop tube into the birds esophagus and down into the crop. Do not attempt to crop feed unless this procedure has been demonstrated to you and you are confident in doing so. It is possible to insert the tube down the chicks windpipe resulting in aspiration and death.

<table>
<thead>
<tr>
<th></th>
<th><strong>Advantages</strong></th>
<th><strong>Disadvantages</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Spoon</strong></td>
<td>Produces quieter birds</td>
<td>Possible imprinting</td>
</tr>
<tr>
<td></td>
<td>Accommodates any formula</td>
<td>Messy</td>
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<tr>
<td></td>
<td>Most pleasurable</td>
<td>Slow</td>
</tr>
<tr>
<td></td>
<td>Stimulates natural feeding</td>
<td>No chick control</td>
</tr>
<tr>
<td></td>
<td>Easiest method</td>
<td>No volume control</td>
</tr>
<tr>
<td><strong>Syringe</strong></td>
<td>Cleaner than spoon</td>
<td>While quicker than spoon still slow</td>
</tr>
<tr>
<td></td>
<td>Quicker than spoon</td>
<td>No chick control</td>
</tr>
<tr>
<td></td>
<td>Produces quieter bird</td>
<td>Danger of killing chick through aspiration</td>
</tr>
<tr>
<td></td>
<td>Volume control</td>
<td>Will not accommodate lumpy formulas</td>
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<tr>
<td><strong>Crop Tube</strong></td>
<td>Quickest method</td>
<td>Will not accommodate lumpy formulas</td>
</tr>
<tr>
<td></td>
<td>Cleanest method</td>
<td>Difficult to use on some weaning birds</td>
</tr>
<tr>
<td></td>
<td>Total volume control</td>
<td>Bird not quite as tame unless extra time is spent at feeding</td>
</tr>
<tr>
<td></td>
<td>Avoids imprinting</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total chick control</td>
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</table>

Figure 54. Advantages and disadvantages of feeding techniques (information from Digney, 1998)
**Feeding intervals**
A newly hatched chick will require feeding approximately every two hours resulting in nine to ten feeds per day.
Volume and thickness of formula increases to its maximum, somewhere from day 7 and 16 depending on the chick. The chick will remain on this consistency until weaned.
Work towards three feeds per day by day 24-30.

Below are some general guidelines for hand raising young chicks:

<table>
<thead>
<tr>
<th>Age in days</th>
<th>Feed intervals</th>
<th>Feeds per day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day 1</td>
<td>2 hourly</td>
<td>9-10</td>
</tr>
<tr>
<td>By day 8</td>
<td>3 1/2 -4 hourly</td>
<td>5-6</td>
</tr>
<tr>
<td>By day 14</td>
<td>5 hourly</td>
<td>4</td>
</tr>
<tr>
<td>By days 24-30</td>
<td>8 hourly</td>
<td>3</td>
</tr>
<tr>
<td>At peak/weaning</td>
<td></td>
<td>2</td>
</tr>
</tbody>
</table>

Figure 55. In formation adapted from (Digney)

### 11.9 Specific Requirements
- Never mix any formula with overly hot or boiling water, doing so will change the true consistency resulting in a gluggy mix with all the important nutrients being diminished.
- Feeding temperatures for all chicks should be 37.7°C – 43.3°C
- All water used to mix formula should be boiled before use to minimize harmful bacteria.
- Crop stretching is an important practice in the first few days of life and throughout the entire growth phase. It involves feeding slightly more in volume at every feed, which will result in more volume fed in 24 hours. This will help speed up digestion and will see a healthy chick surge through the growth phase and peak at adult weight.

### 11.10 Pinioning Requirements
NSW Guidelines for the Pinioning of Birds states the definition of pinioning “A surgical procedure performed on a bird's wing to render the bird permanently incapable of flight. The definition of pinioning does not include feather clipping.

The operation typically involves amputation of that part of the wingtip from which the flight (primary) feathers grow by severing the second and third metacarpal bones. An alternative, but less effective operation is commonly referred to as tendonotomy. Tendonotomy involves the removal of part of a tendon from a wing causing reduced flying ability, but leaving the bird fully feathered.

It is only necessary to perform these procedures on one wing to prevent flight.

NSW Guidelines for the Pinioning of Birds also states: “Suitable candidates for pinioning are therefore those adapted primarily to a terrestrial existence, where the majority of time is spent on water or land feeding, resting or breeding”.
Since the rainbow lorikeet is primarily an arboreal species I believe pinioning this species unsuitable.

### 11.11 Data Recording

Record keeping is a vital aspect when hand raising birds. Record keeping allows you to:

- Monitor a chicks weights and development
- Monitor feed volumes to avoid underfeeding
- Gives you a history on the bird in case of a problem

Anything of interest or concern should also be recorded:

- Condition of chick at hatch or when pulled
- Details of formula thickness and additives used
- Brooding temperatures
- Behavioural changes
- Physical development and growth
- Slow crop, poor feeding responses
- First feeding of lori mixes, water and vegetables consumed (Digney, 1998)

### 11.12 Identification Methods

Coloured wrap around plastic leg bands can be used to identify chicks of the same species when brooded together. This can be used until the chicks are ready to be permanently identified by a closed leg band.

Stainless steel closed leg bands are the preferred method of permanent identification of a Rainbow lorikeet.

Australian Bird and Bat Banding Scheme recommend a size 25 band.

The closed ring must be fitted in the early growth stage while it will still slip over the toes and feet. When the chicks toes and feet grow the ring will not be able to slip off and cannot be physically removed. (Digney, 1998)

### 11.13 Hygiene

Sterilisation of feeding utensils, disinfection of counter tops and the brooder, and frequent hand washing are essential. Remember that the dishwasher does not disinfect.

Wash all utensils with soap and water, rinse, then disinfect. Rinse disinfectant off utensils with clean water before use.

Milton Antibacterial Solution, Avi-Safe or any other antibacterial solution that is suitable for babies’ bottles. Follow the directions as per sterilising babies’ bottles.
11.14 Behavioural Considerations

Hand raised birds often imprint on the person raising them. This may not be an issue if the bird is designated to be a pet or required to be tame and friendly for educational purposes.

If the bird imprinting on its keeper is undesirable than every effort must be made to avoid excessive handling during feeding times. Using the crop tubing method while hand raising is very quick and will minimize time spent with the chick and reduce the occurrence of imprinting.

If at all possible the chicks should be kept with other chicks of the same species and allowed to socialize.

11.15 Use of Foster Species

Rainbow lorikeet chicks can successfully be fostered to lorikeets of a similar size e.g. red collared lorikeet and the scaly breasted lorikeet. As the Rainbow lorikeet is quite large compared to some species of lorikeet, a smaller bird should not be used as they will not be able to meet the nutritional requirements during the chicks growth phase.

11.16 Weaning

The final stage of a chicks development is the weaning stage. The chick will start to become difficult to feed and may begin regurgitating some of its formula. The chick soon stops gaining weight once it has reached the average weight for an adult.

Shortly the chick will begin shedding fat in preparation for its first flight. During this phase the bird will begin picking up and nibbling at its own food and will eventually begin breaking it up and swallowing it.

I have started the weaning process by adding a small bowl of Lori-wet mix into the weaning cage with some finely chopped apples. I found it took only a day or two for the young chicks to begin eating this mix. Rainbow lorikeets in my experience are usually quick to wean and once they realize they can eat for themselves will often refuse hand feeding all together.

Usually once the birds are eating and drinking confidently it should only be about 2 weeks and they can be released into a larger aviary with other birds.

11.17 Rehabilitation Procedures

Rehabilitation is the caring for sick, injured or orphaned wild birds with the ultimate aim of releasing them back into their natural environment.

Rainbow Lorikeets are very common in suburban areas, they are often presented to staff after they have flown into windows, hit by cars and attacked by cats and dogs.

The instant a sick or injured bird is bought into your facility the animal needs to be assessed and a decision should be made if rehabilitation is a viable option.
Rehabilitating any wild animal is time consuming, can be expensive and may not always turn out to be the best thing for the bird. You must consider that rehabilitation is not always an option and that some birds should be humanely euthanased and not subjected to any further pain or stress. (Parsons, 2007)

When a bird has been presented to you the initial physical examination is very important. This will help you determine the next mode of action. You should always obtain and record any available history:
- The exact location of where the bird was found
- The situation, in which the bird was found, was it on the ground or road etc.
- The date and time it was found
- Did the person see what happened to it? E.g. attacked by dog, flew into a window.
- Was the bird able to fly before brought in?
- Any treatment given to the bird by the finder, particularly food.
- Perhaps the finders contact number. People often like to know the outcome of a situation. (Parsons, 2007)

Make your own observations on the condition of the bird and record this information.
- Any obvious signs of blood or broken bones?
- Is the bird stumbling around? Can the bird stand and perch?
- Are both wings held at the same angle? A wing held lower than the other can often indicate a broken bone.
- Can the bird see you and follow you with its eyes. Are the pupils a normal size and reactive to light?
- Is the bird alert or is it sleepy and withdrawn?
- Are the feathers tight or fluffed out?
- Is the bird able to hold its head straight? Or is it held to one side, held at a strange angle, or even upside down?
- And unusual twitching or excessive shaking of the head?
- What is the feather condition of the bird? Dirty, oily, sticky, broken, missing or bloody.
- How is the bird breathing? Panting, gasping or rapid. (Parsons, 2007)

Decide now as to whether the bird may need to be transported for immediate veterinary attention or forwarded on to an appropriate wildlife carer.

If the bird is to stay at your facility for rehabilitation a physical examination should now be conducted. Refer back to section 8.2.2 for detailed instructions on how to do a complete physical examination. Record your findings.

Treatment for shock and dehydration can now begin. All birds suffer stress from handling and stress causes dehydration. The bird should always be treated for dehydration no matter what the bird is presented with. The survival rate will increase if you treat the bird for dehydration.
The bird should now be moved into a dark quite area to begin to recover. Warmth is often critical for the survival of an injured, sick or orphaned bird.

Cover the tops and sides of a cage with a thick blanket and supply a heat lamp with a 60 watt globe. Provide space for the bird to be able to move away from the heat to prevent overheating. Fluids should not be offered to the bird until it has reached its ideal body temperature of 40°C - 42°C. Maintain the temperature inside the cage at 30°C - 32°C. Monitor the temperature inside the cage with a thermometer. Dry heat can cause further dehydration. Increase the humidity by placing a shallow bowl of water in the cage between the heat source and the bird.

When the bird has sufficiently warmed, the feathers will be smooth not fluffed up and the bird will be alert and active. Fluids can now be offered in a container warmed up to body temperature if the bird is able to drink, or drip it onto, not into the birds beak. Provide birds with a solution of poly-aid plus, spark or Glucodin or an electrolyte. Fluid replacement should continue for 24 hours, food should not be given until the bird has been rehydrated. (Hawcroft, 1994)

Following the long rest period and rehydration food can now be offered or given with assistance if necessary. If a good electrolyte replacement is used, food is not a priority for at least 2 or 3 days. Observation of the birds behaviour will be the indicators of whether its condition is improving. Offer the bird some natural food such as flowering browse. A lorikeet wet mix can also be provided as well as some fruit. Ideally the bird should be thermo regulating on its own, able to exercise or be ready to be released. Concussed birds may be released before three days of care and should be returned to the site in which it was found.

If the bird is remaining in care the following need to be considered:

- Flight requirements
- Level of alertness
- Eating on its own or being forced fed
- The need for isolation from the institutions collection
- The behaviour of the bird in a smaller cage. Is the bird coping?
- Feather damage due to hitting the wire in the cage
- The need for medication and handling for dressings. (Parsons, 2007)

**Immediate care of an unfledged chick.**

The chick must be warmed as described above in a temperature controlled hot box or at the very minimum a 40 watt light bulb heating a cardboard box. This is a critical step that must never be overlooked.

- Do not attempt to feed any young bird immediately
- Warm the chick, it will become more active and alert as it regains normal body temperature, see section 11. 7 for correct brooding temperatures.
- After half an hour of normal body temperature begin rehydration by providing a warmed solution of Spark, Poly-aid or Glucodin and water (1 teaspoon to 1 cup water). Drip the solution on the tip of the beak.
• Leave the chick under the heat. Repeat rehydration each half an hour for one and a half hours.
• The chick may now be fed with a runny mix of hand raising mix as described above in section 11.8 diet and feeding routine.
• Feed small amount hourly if the chick will beg. If not begging repeat rehydration steps.
• Disturb as little as possible between feeds
• Clean the bird and container following feeding
• Wear gloves and wash your hands regularly when handling chicks (Parsons, 2007)

Due to the constant contact between the carer and young birds for feeding, these birds are prone to imprinting. They are best raised in groups and should where possible be raised with other Rainbow Lorikeets. Handling should be minimized as much as possible to reduce imprinting, however even wild Rainbow lorikeets will become tame with constant feeding. (Parsons, 2007)

Wild Rainbow Lorikeets will sometimes become tame and will approach people for food

If you have little to no experience in rehabilitating wildlife I would recommend you contact a veterinarian or an association such as WIRES which are fully equipped when dealing with sick, injured and orphaned birds.

The information supplied above is for the initial emergency care of a bird or chick that displays symptoms of shock and dehydration. If the bird displays signs of broken bones, disease, bites from cats or dogs or internal injuries the bird should be taken to a veterinarian immediately for treatment and then forwarded on to a specialist wildlife carer.
12 Acknowledgements

Thank you to Graeme Phipps, Jackie Salkeld and Brad Walker from Richmond TAFE who have provided guidance and critique throughout the development of this manual. Thank you also to Chris Irving and Maree Costigan from Central Gardens Nature Reserve for your constant encouragement and also Rebecca Plunkett for your help during photo taking and capture and restraint. Tom Patterson from Wildlife Sydney provided an outstanding peer review and a special thanks goes to Keith Gallagher from Aviculture Accessories who’s wealth of knowledge and the willingness to share it with me has been extraordinary.

Figure 58. Photo Credit: L. Smitheringale
13 References


Director General, NSW Agriculture. (2004) *General Standards for Exhibiting Animals*


*Personality conflicts*, viewed November 2011, <http://www.finchaviary.com/Maintenance/PersonalityConflicts.htm>


14 Bibliography


*Personality conflicts*, viewed November 2011, <http://www.finchaviary.com/Maintenance/PersonalityConflicts.htm>


15 Glossary

**Arboreal** - Spends the majority of its time living amongst the trees.
**Brooder** - A temperature controlled environment for warming young birds.
**Browse** - Cut branches supplied in the aviary for feeding, enrichment and shelter.
**Cere** - Is typically coloured and at the base of the beak and typically contains the nares. As an example the cere of a budgerigar will be blue in males and pinkish brown in females.
**Copulation** - Is the term used for sexual intercourse in animals
**Crop** - In a bird's digestive system, the crop is an expanded, muscular pouch near the gullet or throat. It is a part of the digestive system. The crop is used to temporarily store food.
**Enrichment** - The practice of providing animals under managed care with stimuli such as natural and artificial objects.
**Gregarious** - Living in flocks or loosely organized communities.
**Husbandry** - Providing the highest quality care to our animals to maintain their physical and psychological wellbeing.
**Hybridisation** - is the crossing of two species. Hybridisation does occur naturally, but it is uncommon because animals prefer to breed with their own species.
**Imprinting** - a form of learning in which a very young animal fixes its attention on the first object with which it has visual, auditory, or tactile experience.
**Incubation** - refers to the process by which certain oviparous (egg-laying) animals hatch their eggs, and to the development of the embryo within the egg. The most vital factor of incubation is the constant temperature required for its development over a specific period.
**Insecticide** - An insecticide is a pesticide used against insects.
**Monomorphic** - Birds can be described as monomorphic if their sex cannot be determined by their markings or the color of their feathers.
**Nares** - Two holes or cavities (nostrils) that lead into the nasal cavities within the birds skull
**Nectar** - Nectar is a sugar-rich liquid produced by plants.
**Nectarivore** - is an animal which eats the sugar-rich nectar produced by flowering plants.
**Papillae** - They are located around the small structures on the upper surface of the tongue, and give lorikeets their brush like tongue adaption.
**Pin Feathers** - A pin feather, sometimes called a "blood feather", is a developing feather on a bird. This feather can grow as a new feather during the bird's infancy, or grow to replace one from moultting.
**Pinioning** - Pinioning is the act of surgically removing the pinion joint, the joint of a bird's wing farthest from the body, to prevent flight. Pinioning is often done to waterfowl and poultry. It is not typically done to companion bird species such as parrots.
**Pip/ Pipping** - In birds, the process of breaking open the eggshell is commonly referred to as pipping.
**Plumage** - refers both to the layer of feathers that cover a bird and the pattern, colour, and arrangement of those feathers
**Preening** - Straighten and clean its feathers with its beak
**Primary Flight Feathers** - Especially important for flapping flight, as they are the principal source of thrust, moving the bird forward through the air. The first 9-11 feathers are known as primary flight feathers.

**Quarantine** - is compulsory isolation, typically to contain the spread of something considered dangerous, often but not always disease.

**Roost** - A place where birds regularly settle or congregate to rest and sleep.

**Thermo regulating** - Is the ability to be able to maintain a normal body temperature without the need of heating or cooling devices.
16 Appendix

Product suppliers:
Central Gardens proudly uses avian products supplied by:

Aviculture Accessories
91 Vine St
Marsden Park, NSW, 2765
(02)98381256.
Prompt delivery service as well as excellent customer service.

Section 4.7- substrate:
The substrate options listed in this section can be purchased from your local landscape supplier. Central Gardens has used products sourced from these suppliers:

Australian Native Landscapes
Wicks Road (Cnr. Waterloo Road)
North Ryde 2113
(02) 9887 2788
And
Sundown Nursery & Landscape Supplies
199 Fairfield Road, Fairfield,
NSW 2165
(02)9632 8677

Section 5- General Husbandry:
Pest control supplier:
Generation Block and Ditrac Blox
Garrards
Unit 2, 7 St James Place,
Seven Hills, NSW 2147
(02) 9674 2188

Section 5.3- Methods of Identification:
DNA sex testing:
DNA SOLUTIONS
4 Eastgate Court
Wantirna VIC 3152
1800000362
AND
MDS Australia
163 Swan Drive, Fernleigh Park,
Googong, NSW, 2620
(02) 6299 7740

Leg Band suppliers:
Lentra Direct
Unit 1 SHED 6
87-95 Quarry Road
Section 6.2- Captive Diet  
Suppliers:  
Aviculture Accessories  
91 Vine St  
Marsden Park, NSW, 2765  
(02)98381256.

Sheps Lorikeet wet and dry mixes, Avione Lorikeet dry mix, Passwell Lori dry  
www.petshopaustralia.com.au

Avian science wet and dry  
www.petsuppliesaustralia.com.au

Wombaroo Lorikeet mix  
www.wombaroo.com.au

Section 6.3- Supplements  
Suppliers:  
Aviculture Accessories  
91 Vine St  
Marsden Park, NSW, 2765  
(02)98381256.

Vetafarm Calcivet, D’Nutrical, Poly-aid Plus, Soluvet  
www.vetafarm.com.au

Section 7.2- Catching Bags  
Central Gardens uses cloth nets supplied by:  
Aviculture Accessories  
91 Vine St  
Marsden Park, NSW, 2765  
(02)98381256.

Section 7.4- Weighing and Examination  
Ricks bird supply  
http://birdscales.com  
and  
Med Shop Australia  
www.medshop.com.au

Section 8.3- Routine Treatments  
Worm Out Gel and Avian Insect Liquidator  
www.vetafarm.com.au
Section 11.1- Incubator types
Brinsea Incubation Specialists
Australian Distributor:
Top Knot Poultry Supplies
PO Box 222
Deer Park VIC 3023
Email: loi@tkpoultrysupplies.com.au
Tel: +61 411 720 732 (Australia call 0411-720-732)
www.tkpoultrysupplies.com.au

Section 11.6- Brooder types
Brinsea Incubation Specialists
Australian Distributor:
Top Knot Poultry Supplies
PO Box 222
Deer Park VIC 3023
Email: loi@tkpoultrysupplies.com.au
Tel: +61 411 720 732 (Australia call 0411-720-732)
www.tkpoultrysupplies.com.au

Section 11.8- Diet and Feeding Routine
RoudyBush
Aviculture Accessories
91 Vine St
Marsden Park, NSW, 2765
(02)98381256.
Check website for other Australian suppliers in your area
www.roudybush.com

Aviclen
www.vetafarm.com.au

Section 11.17- Rehabilitation Procedures
Spark
www.vetafarm.com.au

Glucodin
Available from most supermarkets and pharmacy’s
MSDS for products used in manual
DITRAC ALL WEATHER BLOX RODENTICIDE
SAFETY DATA SHEET
ACCORDING TO REGULATION: EC: 1907/2006
DATE OF ISSUE: 29 August 2008
PREPARED BY: TH

1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND COMPANY

PRODUCT NAME: DITRAC ALL WEATHER BLOX RODENTICIDE
MANUFACTURER: Bell Laboratories, Inc.
5699 Kinsman Blvd.
Madison, WI 53704, USA
email: registration@belllab.com

AUSTRALIAN DISTRIBUTOR: Bell Australia, Pty Ltd.
Level 4 Grant Thornton House
102 Adelaide Street
Brisbane QLD 4000

AUSTRALIAN REGISTRATION NUMBER: 49867
SCHEDULE: 6

EMERGENCY PHONE NUMBERS:
• Poisonings: 131 125 POISON
• INFORMATION CENTRE: (02) 9647-2111

2. HAZARD IDENTIFICATION

CLASSIFICATION: Not classified as hazardous according to the criteria of Worksafe Australia

PRIMARY ROUTES OF ENTRY: Ingestion

3. COMPOSITION/INFORMATION ON INGREDIENTS

COMPOSITION: Brodifacoum [3-[3-(4-Bromo-[1,1'-biphenyl]-4-yl)-1,2,3,4-tetrahydro-1-methyl-3-pyryliumyl]-4-hydroxy-2H-1-benzoopyran-2-one] 0.005 %
CAS NO.: 56073-10-0
EC NO.: Not Established

4. FIRST AID MEASURES

EYE CONTACT: Flush with cool water for at least 15 minutes. If irritation develops, obtain medical assistance.
SKIN CONTACT: Wash with soap and water. If irritation develops, obtain medical assistance.
INHALATION: None
INGESTION: Call physician or emergency number immediately. Do not give anything by mouth or induce vomiting unless instructed by physician.
SYMPTOMS: Ingestion of excessive quantities may cause nausea, vomiting, loss of appetite, extreme thirst, lethargy, diarrhea, bleeding.
ADVICE TO PHYSICIAN: If ingested, administer Vitamin K1 intramuscularly or orally as indicated by biohydroxycoumarin overdoses. Repeat as necessary based on monitoring of prothrombin time.

5. FIRE FIGHTING MEASURES

EXTINGUISHING MEDIA: Extinguish with water, foam or inert gas.
MEASURES UNSUITABLE FOR SAFETY REASONS: None

PROTECTIVE EQUIPMENT: Firefighters should be equipped with protective clothing and self-contained breathing apparatus.

6. ACCIDENTAL RELEASE MEASURES

PERSONAL PROTECTION: Gloves should be worn during clean up.
ENVIRONMENTAL PROTECTION: Avoid entry to watercourses.
CLEAN UP AND DISPOSAL: Sweep up spilled material in properly labeled containers for disposal or reuse. Dispose of all wastes in accordance with all local, regional and national regulations.

7. HANDLING AND STORAGE

HANDLING: Keep product in the original container. Do not handle the product near food, animal feedstuffs or drinking water. Keep out of reach of children. Do not use near heat sources, open flame, or hot surfaces. Wash thoroughly with soap and water after handling.
STORAGE: Store in a cool, dry place inaccessible to children, pets and wildlife. Keep container tightly closed when not in use. Avoid contamination of lakes, streams and ponds by use, storage and disposal.
8. EXPOSURE CONTROL/PERSONAL PROTECTION

<table>
<thead>
<tr>
<th>SPECIAL PROTECTIVE EQUIPMENT:</th>
<th>VENTILATION:</th>
<th>RESPIRATOR TYPE:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not Required</td>
<td>Not required</td>
<td>Not required</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SKIN PROTECTION:</th>
<th>EYE PROTECTION:</th>
<th>HYGIENE RECOMMENDATIONS:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rubber gloves (recommended)</td>
<td>Not required</td>
<td>Wash thoroughly with soap and water after handling</td>
</tr>
</tbody>
</table>

9. PHYSICAL AND CHEMICAL PROPERTIES

<table>
<thead>
<tr>
<th>APPEARANCE:</th>
<th>BOILING POINT:</th>
<th>MELTING POINT:</th>
<th>FREEZING POINT:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red blocks with sweet grain-like odor.</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>FLASH POINT:</th>
<th>DENSITY:</th>
<th>VAPOR PRESSURE:</th>
<th>SOLUBILITY:</th>
</tr>
</thead>
<tbody>
<tr>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

10. STABILITY AND REACTIVITY

<table>
<thead>
<tr>
<th>STABILITY:</th>
<th>INCOMPATIBILITY/CONDITIONS TO AVOID:</th>
<th>HAZARDOUS DECOMPOSITION PRODUCTS:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stable if stored in original container in a cool, dry location.</td>
<td>Strongly alkaline materials.</td>
<td>Oxides of carbon.</td>
</tr>
</tbody>
</table>

11. TOXICOLOGICAL INFORMATION

<table>
<thead>
<tr>
<th>LD50, ORAL (INGESTION):</th>
<th>LD50, DERMAL (SKIN CONTACT):</th>
<th>LC50, INHALATION:</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;5000 mg/kg (rats)</td>
<td>&gt; 5001 mg/kg (rats)</td>
<td>N/A</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>EYE IRRITATION:</th>
<th>SKIN IRRITATION:</th>
<th>DERMAL SENSITIZATION:</th>
</tr>
</thead>
<tbody>
<tr>
<td>None (sablots)</td>
<td>None (sablots)</td>
<td>Not considered a sensitizer</td>
</tr>
</tbody>
</table>

12. ECOLOGICAL INFORMATION

<table>
<thead>
<tr>
<th>ENVIRONMENTAL BEHAVIOR:</th>
<th>ENVIRONMENTAL TOXICOLOGY:</th>
<th>EFFECTS ON WASTEWATER TREATMENT:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solid, non-volatile. Material is essentially insoluble in water.</td>
<td>Prevent access to non-target mammals and birds.</td>
<td>Unlikely to have any effect on wastewater treatment.</td>
</tr>
</tbody>
</table>

13. DISPOSAL

| WASTE DISPOSAL METHOD: | |
|------------------------| |
| Wastes resulting from use may be disposed of on-site or at an approved waste disposal facility. Dispose of all wastes in accordance with all local, state and national regulations. |

14. TRANSPORT INFORMATION

<table>
<thead>
<tr>
<th>CLASSIFICATION:</th>
<th>SHIPPING NAME:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not regulated or not classified as dangerous by DOT (USA), IATA (Air), or IMDG (Vessel).</td>
<td>Rodenticide containing Brodifacoum.</td>
</tr>
</tbody>
</table>

15. REGULATORY INFORMATION

| CLASSIFICATION: | |
|-----------------| |
| Not classified as dangerous for supply use. |

16. OTHER INFORMATIONS

The information provided in this Safety Data Sheet has been obtained from sources believed to be reliable. Bell Laboratories, Inc. provides no warranties, either expressed or implied, and assumes no responsibility for the accuracy or completeness of the data contained herein. This information is offered for your consideration and investigation. The user is responsible to ensure that they have all current data relevant to their particular use.
1 IDENTIFICATION OF THE MATERIAL AND SUPPLIER

Product Name: BLEACH
Other Names: None
Manufacturer’s Product Code: BLS, BL20
Product Use: Cleaner, whitener and sanitisers for cleaning baths, basins and toilets.

COMPANY DETAILS
Company: Agar Cleaning Systems Pty Ltd.
Address: 12-14 Cope Street, Preston, Vic. 3072
Telephone: 03 9480 3000 Facsimile: 03 9480 5100
Web: www.agar.com.au
E-mail: admin@agar.com.au
Emergency Telephone Number: 131 126 (Aust wide)

2 HAZARDS IDENTIFICATION

Not classified as hazardous according to criteria of Worksafe Australia.

Bleach contains not more than 5% available chlorine.

3 COMPOSITION / INFORMATION ON INGREDIENTS

Ingredients:
- Chemical Entity: CAS No.: Proportion:
  - Sodium hypochlorite: 7783-50-5: < 10%
  - Sodium chloride: 7647-14-5: < 10%
  - Water: 7732-18-5: > 90%

4 FIRST AID MEASURES

Poisons Information Centre: Phone 131 126

Swallowed: If poisoning occurs, contact a doctor or Poisons Information Centre. If swallowed, do NOT induce vomiting. Give a glass of water. Rinse mouth with water. Never give anything by mouth to an unconscious person.

Eye: Immediately hold the eyes open and wash continuously for at least 15 minutes with fresh running water. Ensure irrigation under eyewash by occasionally lifting the upper and lower lids. Transport to hospital or doctor without delay. Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

Skin: Remove any contaminated clothing and flush area immediately with water and soap if available. Seek medical attention in the event of irritation.

Inhaled: Remove to fresh air. Lay patient down. Keep warm and rested. If breathing is shallow or has stopped, ensure airway and apply resuscitation. Transport to doctor or hospital.

5 FIRE FIGHTING MEASURES

Fire/Explosion Hazard: Bleach is not combustible. No risk of hazardous polymerisation.


Special fire-fighting procedures: None.

6 ACCIDENTAL RELEASE MEASURES

Clean up all spills immediately. Avoid contact with skin and eyes. Contain spill and mop up. Prevent contaminating waterways. Place in a suitable, labelled container for waste disposal.

7 HANDLING AND STORAGE

Safety: Keep out of reach of children. Do not mix with other chemicals.

Storage and Transport: Store in a cool, dry place that is well-ventilated and away from toxic materials. Direct sunlight should be avoided.

Incompatibilities (Materials to avoid for purposes of transport, handling and storage only): Avoid storing with acids, oxidising agents, reducing agents, metals and metallic salts.

8 EXPOSURE CONTROLS / PERSONAL PROTECTION

Exposure Standards: None assigned for mixture.

Atmospheric Contaminant Exposure Standard for: chlorine CAS No. 7783-50-5: TLV = 1 ppm (3 mg/m³), STEL = Peak limitation same as TLV

[Source: Worksafe Australia NCHSC: 1003 (1985)]

Engineering Controls: Mechanical ventilation: Not required under normal conditions, but local exhaust ventilation should be used to control any air contaminants to within the Exposure Standards.

Personal Protection:
- Gloves: Wear rubber, neoprene or nitrile gloves.
- Eye protection: Not normally required but safety glasses should be worn if there is a risk of splashing.
- Respiratory: If inhalation risk exists, a suitable cartridge type Respirator should be worn.

Other: Protective overalls are desirable. An eyewash unit should be available.

9 PHYSICAL AND CHEMICAL PROPERTIES

Appearance: Pale green liquid
Colour: Faint chlorine colour
pH: 10 - 11
Vapour Pressure: N/K
Vapour Density: N/K
Boiling Point: Approx. 100°C
Freezing Point: < 0°C
Solubility in water: Complete
Specific Gravity: 1.06
Evaporation rate: As water
% Volatile by vol: 95 - 99%

Please turn to page 2.
10 STABILITY AND REACTIVITY

Stability: Stable. However, heat, light, contamination with acids or contact with metal surfaces may promote the formation of toxic chlorine gas.

Bleach is corrosive to aluminum, zinc and tin.

Bleach can burn holes in clothes and cotton mops.

Hazardous polymerization: None.

11 TOXICOLOGICAL INFORMATION

Health Effects: Acute:

Swallowed: Mildly irritating to the gastro-intestinal tract if swallowed.

Eye: Eye contact may result in slight irritation.

Skin: Principal route of exposure is usually by skin contact.

Repeated or prolonged skin contact may cause swelling, redness, blistering or dermatitis. It is not absorbed through the skin.

Inhalation: Overexposure to inhalation can result in coughing and respiratory difficulty. The vapour if concentrated may irritate the lungs. If reaction occurs to liberate chlorine (such as accidental admixture with acids), self-contained or air-supplied breathing apparatus will be required.

Health Effects – Chronic: None known.

Toxicity Data: No chronic effects known to occur as material is inactivated by tissue and blood serum.

(Note: this data is from published information. Agar Cleaning Systems does not carry out animal tests).

12 ECOLOGICAL INFORMATION

Ecotoxicity: No data available.

Persistence and degradability: -

Mobility: -

Advice: -

13 DISPOSAL CONSIDERATIONS

For disposal, refer to State Land Waste Management Authority.

14 TRANSPORT INFORMATION

UN No.: -

Class: -

Pack Group: -

Hazard: -

15 REGULATORY INFORMATION

Poisons Schedule Number: Schedule 9.
Material
Safety Data Sheet

Nolvasan S

WWMSDS No. 30-0403

Section 1. Product and Company Identification

Manufactured/Supplied by: Fort Dodge Animal Health
800 6th Street NW
P.O. Box 518
Fort Dodge, IA 50501
Phone: 515-565-4400
Fax: 515-565-9149

Data of Preparation: 17 January 2003

Product No.: 30-0403

Product Trade Name: Nolvasan S

Formula No.: Not available.

Common Name: Not applicable.

CAS No.: Mixture.

Synonyms: Nolvasan Scented Disinfectant; Chloran Scented Disinfectant.

UN No.: UN1983

Chemical Formula: Mixture.

EINECS No.: Not applicable.

Chemical Family: Disinfectants.

Material Use: Pharmaceutical: Antiseptic.

In Case of Emergency:

Packaging: Container, medium.

Formula Type: Not available.

Section 2. Composition - Information on ingredients

<table>
<thead>
<tr>
<th>Name of Ingredient</th>
<th>CAS No.</th>
<th>Conc.</th>
<th>EU Symbol</th>
<th>R Phrase</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Chlorsolone Acetate</td>
<td>50-05-1</td>
<td>2</td>
<td>Xn</td>
<td>R22</td>
</tr>
<tr>
<td>2) Isopropanol</td>
<td>67-63-0</td>
<td>7.6</td>
<td>F</td>
<td>R11</td>
</tr>
<tr>
<td>3) Inert Ingredients</td>
<td></td>
<td>60.1</td>
<td>Not controlled.</td>
<td>Not controlled.</td>
</tr>
</tbody>
</table>

Section 3. Hazards Identification - Summary of Primary Effects and Critical Hazards

Acute Health Effects: Adverse health effects are associated with chronic high level exposures.

Chronic Health Effects: Potential organ systems affected are: Kidneys, Nervous System. Adverse effects could include; nausea/vomiting, headache, respiratory tract irritation.

Environmental Hazards: No known significant effects or critical hazards.

Section 4. First Aid Measures - (by medical responders using "Universal Precautions")

Eye Contact: Flush eyes with plenty of water for 15 minutes, occasionally lifting upper and lower eyelids. (Check person for contact lenses and remove if present.) If redness or irritation persist, have eyes examined by doctor immediately.

Skin Contact: Flush skin with plenty of soap and water for at least 15 minutes (remove all contaminated clothing and shoes). Get medical attention if symptoms persist.

Inhalation: No specific treatment, treat symptomatically. If breathing is difficult give oxygen, if respiratory arrest occurs provide artificial respiration and seek immediate medical assistance.

Ingestion: No specific treatment, treat symptomatically. Call medical doctor or poison control center immediately if large quantities are ingested.

Notes to Medical Doctor: Direct treatment at control of symptoms.

Continued on Next Page
Section 5. Fire-Fighting Measures

Extinguishing Media and Instruction:
Follow your company’s procedures. Use an extinguishing agent suitable for the surrounding class of fire.

Special Exposure Hazards:
None. Dispose of fire debris and contaminated fire-fighting water in accordance with regulations.

Special Fire Fighting Protective Equipment:
No special precautions or equipment.

Section 6. Accidental Release Measures

Small Spill Guidelines:
Follow your company’s spill procedures. Keep people away from spill. Put on appropriate personal protective equipment (see Section 6). Use a tool to scoop up solid or absorbed material and put into appropriate labeled waste container.

Large Spill Guidelines:
Initiate company’s spill response procedures immediately. Keep people out of area. Put on appropriate personal protective equipment (see Section 6).

Environmental Precautions:
No special measures are typically indicated.

Section 7. Handling and Storage

Handling (ventilation and fire prevention):
Avoid contact with eyes, skin, and clothing. Avoid generating or breathing product aerosol. Wash after handling.

Storage (conditions and interactions):
Store tightly closed in original container. Keep containers in a well ventilated, secure location.

Section 8. Exposure Controls and Personal Protection - (normal and intended use)

Exposure Guidelines:

<table>
<thead>
<tr>
<th>Component</th>
<th>REG. Limit</th>
<th>OSHA (PEL)</th>
<th>ACGIH (TLV%)</th>
<th>Company Guidelines</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Isopropanol</td>
<td></td>
<td>400 ppm</td>
<td>400 ppm</td>
<td></td>
</tr>
<tr>
<td></td>
<td>TWA:</td>
<td>500 ppm</td>
<td>500 ppm</td>
<td></td>
</tr>
<tr>
<td></td>
<td>STEL:</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Engineering Design and Control Measures:
General ventilation is typically sufficient to keep airborne levels below established values. Provide eye wash and quick shower drench to work station. Clean, appropriately launder, or dispose of all potentially contaminated work clothing, foot wear, and protective equipment after use.

Protective Clothing

Eyes: Safety glasses, Goggles, face shield, or other full-face protection where the potential exists for direct exposure to aerosols or splashes.

Skin: Lab coat.

Hands: Gloves, Chemical resistant.

Respiratory: Respirator selection must be based on anticipated exposure levels, product hazards, and the safe working limits of the selected respirator. A respirator is not needed under normal and intended conditions of product use. If using the product for aerosol fogging, use a NIOSH-approved respirator with pesticide filter cartridges with a protection factor appropriate for the exposure levels associated with the application.
Section I - Product Identification

An aqueous, buffered glutaraldehyde solution. Slightly acidic pH (The pH is about the same as distilled water).

Section II - Composition/Information on Components

<table>
<thead>
<tr>
<th>Ingredients</th>
<th>CAS#</th>
<th>OSHA PEL</th>
<th>ACGIH TLV</th>
<th>Other Limits</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glutaraldehyde</td>
<td>111-30-8</td>
<td>0.2 ppm</td>
<td>0.05 ppm</td>
<td>2.65%</td>
<td></td>
</tr>
</tbody>
</table>

Wavicide-01 also contains proprietary buffers, surfactants and detergents.

Section III - Hazard Identification

Overview: May be harmful if swallowed. Irritating to skin eyes and respiratory tract.

Safety Ratings:

Health: Hazardous Flammability: None Reactivity: None Contact: Slight

Recommended safety equipment: safety goggles, lab coat and proper gloves

Storage: General storage

NFPA Ratings

Health = 2 Flammability = 0 Reactivity = 0

Potential Health Effects:

The toxicology of this compound have not been completely examined. It is presumed that the toxicity of this item is similar to other aldehydes.

Inhalation: Irritating to respiratory tract. May cause asthma like symptoms in sensitive individuals.

Ingestion: Can cause irritation and chemical burns to the mouth, throat, esophagus and stomach. Can also cause nausea, vomiting, diarrhea, etc.

Skin contact: May cause skin irritation or aggravation of existing dermatitis. May cause temporary discoloration of the skin.

Eye contact: Vapors may cause stinging sensation and tearing. Solution contact can cause corneal injury which can cause visual impairment if not dealt with immediately.

Chronic Exposure: May be a sensitizer in some individuals.

Aggravation of preexisting conditions: May aggravate preexisting asthma and other lung diseases.

Section IV - First Aid Measures

Inhalation: Remove from source of exposure and get medical attention for any breathing difficulty.
Ingestion: Do not induce vomiting. Drink large quantities of fluids and call a physician immediately.

Note to Physician: Probable mucosal damage from oral exposure may contraindicate gastric lavage.

Skin Contact: Remove contaminated clothing and wash affected area with soap and water. Get medical advice if irritation develops. Wash or discard contaminated clothing before reuse.

Eye Contact: Immediately flush thoroughly with running water for at least 15 minutes. Get immediate medical advice.

Section V - Fire Fighting Measures

Flash point: Not applicable.
Flammable Limits: Not applicable.
Fire: Not normally a fire Hazard.
Explosion: Not Normally an explosion hazards.
Fire Extinguishing Media: Any means suitable for surrounding fire.
Special information: Pyrolysis will release carbon monoxide.

Section VI - Accidental Release Measures

Wear appropriate protective gear such as gloves, apron and protective eye wear. Absorb with a suitable absorbent (such as paper towels) and store in a suitable container for disposal. Large spills may be neutralized with sodium bisulfite (about 230 g/gallon), glycine or ammonia.

Section VII - Handling and Storage

Store in a closed container at controlled room temperature, 59°F to 86°F (15°C to 30°C). Solution that is being reused should be stored in a tightly closed container and used in a room with adequate ventilation (i.e. at least ten changes of air per hour).

Section VIII - Exposure Control/Personal Protection

Airborne Exposure Limits: See section II
Ventilation System: Use appropriate ventilation. If the vapor is irritating to the eyes and nose the threshold limit value is probably exceeded and additional ventilation may be needed. When required, Refer to the ACGIH document, "Industrial Ventilation, a Manual of Recommended Practices" for details about ventilation.
Personal Respirator: Not required unless the threshold limit value for glutaraldehyde is exceeded. In case of emergency, or when exposure levels are unknown, use a half face or full face respirator with organic vapor cartridges.
Skin Protection: Chemical resistant gloves are recommended. Latex gloves are not impervious to glutaraldehyde and are not as appropriate as nitrile gloves.
Eye Protection: Laboratory safety goggles, safety glasses or face shield are required.

Section IX - Physical and Chemical Properties

Boiling Point: 100°C
Vapor pressure (mm Hg): 18 @ 20°C
Vapor Density (air = 1): 0.6
Appearance and Odor: A clear, yellowish liquid with the characteristic odor of glutaraldehyde.

Density: About 1.01 g/ml
Evaporation Rate (water = 1): 1
Solubility: Infinitely miscible with water

Section X - Stability and Reactivity

Stability: Freezes at low temperature.
Hazardous Decomposition Products: Nothing unusual.
Hazardous polymerization: Will not occur.
Incompatibilities: Nothing unusual.
Conditions to avoid: Excessive cold/heat and light. High pH catalyses an aldol type polymerization that is exothermic but not expected to be violent.
Section XI - Toxicological Information

Toxicity: The chronic toxicity of this product is unknown but may include sensitization in sensitive individuals. The toxic effects of glutaraldehyde are believed to be the result of its ability to cross link proteins, which is the same property responsible for its antimicrobial effect. The manufacturer is unaware of any target organ toxicity.

Mutagenicity: MCC is unaware of any evidence that the product is mutagenic or teratogenic. However, the effects of these products, glutaraldehyde-based disinfectants, are not well investigated and we recommend that pregnant customers use an abundance of caution with these products.

Oral LD₅₀ for rats = 134 mg/kg for pure glutaraldehyde
Oral LD₅₀ for mouse = 100 mg/kg for pure glutaraldehyde

Cancer lists

Wavicide-01 is not a carcinogen or suspected carcinogen.

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Known Carcinogenicity?</th>
<th>NTP?</th>
<th>Anticipated?</th>
<th>IARC Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>glutaraldehyde</td>
<td>no</td>
<td>no</td>
<td>no</td>
<td>none</td>
</tr>
</tbody>
</table>

Section XII - Ecological Information

Environmental Fate: Biodegradable

Wavicide-01 is biodegradable when diluted to a level such that it is not microbicidal.

Environmental Toxicity: None known.

Section XIII - Disposal

Normally not restricted but local governments may restrict the amounts of aldehydes that can be flushed down the drain. In localities where drain disposal is restricted the product may often be neutralized with glycine or sodium bisulfite and then flushed down drain. Insure compliance with all government regulation.

Section XIV - Transportation Information

Not Required

Section XV - Regulatory Information

Chemical Inventory Status

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>TSCA</th>
<th>EC</th>
</tr>
</thead>
<tbody>
<tr>
<td>glutaraldehyde</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Federal, State and International Regulations

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>SARA 302 (RQ, TPQ, List, Category)</th>
<th>SARA 313</th>
<th>RCRA</th>
<th>TSCA</th>
</tr>
</thead>
<tbody>
<tr>
<td>glutaraldehyde</td>
<td>No, No, No, 261.33</td>
<td>No</td>
<td>No</td>
<td>8(D)</td>
</tr>
</tbody>
</table>

Chemical Weapons Convention: No
TSCA 12(b): No
SARA 311/312: Acute: None, Chronic: None
CDTA: No

Section XVI - Other Information

This information is believed to be correct but is not warranted as such, nor does it purport to be all inclusive.

Prepared by: P. B. Revision Date: Oct. 26, 2005
MATERIAL SAFETY DATA SHEET
Quaternary Ammonium
(Dimethyl Ammonium Chloride & Dimethyl Benzyl Ammonium Chloride)

FIRST AID
EYES: FLUSH WITH LARGE AMOUNTS OF WATER FOR AT LEAST 15 MINUTES
SKIN: REMOVE CONTAMINATED CLOTHING; WASH WITH SOAP AND WATER
INHALATION: REMOVE FROM EXPOSURE
INGESTION: DILUTE STOMACH CONTENTS WITH MILK OR WATER; DO NOT INDUCE VOMITING;
CONTACT PHYSICIAN IMMEDIATELY

HEALTH: 3 FLAMMABILITY: 1 REACTIVITY: 0 PRECAUTIONS: CORROSIVE

MANUFACTURER
Lonza Incorporated
1717 Route 208
Fair Lawn NJ 07410

PHYSICAL DATA
volatile: 20% (by weight)
viscosity: < 100 cps
solubility: soluble in water
flash point: 47°C
appearance: yellow liquid
freezing point: 20°C
specific gravity: 0.91 @ 25°C
pH of 10% solution: 0.5 - 0.0

REACTIVITY
stability: stable
materials to avoid: strong acids, strong oxidizers
conditions to avoid: extremely high temperatures
hazard classification: corrosive

FIRE FIGHTING
special procedures: wear NIOSH-approved self-contained breathing apparatus and full protective clothing
extinguishing media: dry chemical, alcohol foam, carbon dioxide, water
combustion products: amines, ammonia, hydrogen chloride, organic chlorides
Products of combustion are toxic.
Use water-spray to keep containers cool and to knock down fumes.
Heated solvent vapors can travel to an ignition source and flash back.

PERSONAL PROTECTION
handling / storage: follow good hygiene practices / do not store near water, food or feed
eyes: safety goggles
skin: full work-clothing, impervious gloves
respiratory: if vaporous, use NIOSH-approved respiratory protection
ventilation: none specified by manufacturer

HEALTH HAZARD DATA - HAZARDOUS
route of entry: eyes, skin, ingestion, inhalation
eye contact: direct contact may cause severe damage
skin absorption: prolonged contact may cause severe irritation
ingestion: may cause severe irritation and swelling of mucous membranes; may be fatal
inhalation: vapors may cause irritation and headache
Toxicology: LD50 (oral, rat): 366 mg/kg, LD50 (dermal, rabbit): 421 mg/kg

STORAGE & HANDLING
Store in a cool, dry area away from acids or oxidizers.
Protect from physical damage.
Keep container closed.

SPILLS & DISPOSAL
Floors may be slippery.
Prevent spills and contaminated wash water from entering sewers and bodies of open water.
Contain spills with inert material, such as sand or earth; scoop absorbed material into containers.
Dispose of in accordance with all local, state and federal regulations; incineration is preferred.