Husbandry Guidelines for

Common name: **Musk Lorikeet**

Species name: ***Glossopsitta concinna***

Class: **Aves**

Daisy Maria Kuc
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Western Sydney Institute of TAFE, Richmond
Certificate 3 Captive Animals, (1068).
Lecturer: Graeme Phipps, Jackie Salkeld, Brad Walker

Disclaimer

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Husbandry Guidelines provide suggestions for captive management but should not be taken to imply that there is only one right way to manage a species in captivity.

Husbandry Guidelines are utility documents rather than literature reviews, so must reflect the experiences of the compiler and those who have contributed via personal communications and through referencing to published material. Limitations include that the Husbandry Guidelines are created at AQF Certificate III level and that generally only English language literature is accessed.

OCCUPATIONAL HEALTH AND SAFETY RISKS

Occupational Health and safety risks with this species ***Glossopsitta concinna*** are

- **Physical:** Risks of bites from animals in care which should be acknowledged.

- **Health:** Psittacosis (Zoonotic Disease) which is transferred to humans by inhalation of infected particles. Clinical signs include typical cold like symptoms. It severely affects the young, elderly and immuno-compromised. It essentially suppresses immune system. All details should be passed on to the physician when in contact with infected or previously unknown infected birds.

Annual Cycle of Maintenance

January	February	March	April	May	June
Breeding Season Finishes (Substrate Change) Perches* Worming	Maintenance*	(Substrate Change) Maintenance*	Perches* Maintenance*	(Substrate Change) Maintenance*	Maintenance*
July	**August**	**September**	**October**	**November**	**December**
(Substrate Change) Perches* Worming	**Breeding Seasons starts** Refer to Section 10*	**Breeding Season**	**Breeding Season** (Substrate Change) Perches*	**Breeding Season**	**Breeding Season**

Key Notes:

- **Breeding season** (apply triggers and prepare nest boxes prior to breeding season, refer to 10.6).
- Perches* = changed every 3 months plus any new furnishings (refer to 4.9 in manual).
- Substrate change in the aviary should occur every 2 months (Exclude early months in the breeding season).
- Maintenance* = any maintenance within the exhibit including renovations or restorations should **not** occur in the months of the breeding season (i.e. between August to January) but between February to June preferably.
- Worming is to be done 6 monthly if time and resources are limited, if this is not the case, a cytology swab to see what parasites are present (if any) followed by the appropriate treatment (refer to 8.3 for more information).

TABLE OF CONTENTS

1 INTRODUCTION 7

2 TAXONOMY 11

2.1 NOMENCLATURE 11
2.2 SUBSPECIES 11
2.3 RECENT SYNONYMS 11
2.4 OTHER COMMON NAMES 11

3 NATURAL HISTORY 12

3.1 MORPHOMETRICS 12
3.1.1 Mass And Basic Body Measurements 12
3.1.2 Sexual Dimorphism 15
3.1.3 Distinguishing Features 15
3.2 DISTRIBUTION AND HABITAT 15
3.3 CONSERVATION STATUS 16
3.4 LONGEVITY 16
3.4.1 In the Wild 16
3.4.2 In Captivity 16
3.4.3 Techniques Used to Determine Age in Adults 16

4 HOUSING REQUIREMENTS 17

4.1 EXHIBIT/ENCLOSURE DESIGN 17
4.2 HOLDING AREA DESIGN 17
4.3 SPATIAL REQUIREMENTS 17
4.4 POSITION OF ENCLOSURES 19
4.5 WEATHER PROTECTION 19
4.6 TEMPERATURE REQUIREMENTS 20
4.7 SUBSTRATE 20
4.8 NESTBOXES AND/OR BEDDING MATERIAL 20
4.9 ENCLOSURE FURNISHINGS 23

5 GENERAL HUSBANDRY 24

5.1 HYGIENE AND CLEANING 24
5.2 RECORD KEEPING 26
5.3 METHODS OF IDENTIFICATION 26
5.4 ROUTINE DATA COLLECTION 26

6 FEEDING REQUIREMENTS 27

6.1 DIET IN THE WILD 27
6.2 CAPTIVE DIET 27
6.3 SUPPLEMENTS 29
6.4 PRESENTATION OF FOOD 30

7 HANDLING AND TRANSPORT 32

7.1 TIMING OF CAPTURE AND HANDLING 32
7.2 CATCHING BAGS 32
7.3 CAPTURE AND RESTRAINT TECHNIQUES 32
7.4 WEIGHING AND EXAMINATION 33
7.5 RELEASE 35
7.6 TRANSPORT REQUIREMENTS 35
7.6.1 Box Design 37
7.6.2 Furnishings 37

7.6.3 Water and Food *38*
7.6.4 Animals per Box *38*
7.6.5 Timing of Transportation *38*
7.6.6 Release from Box *39*

8 HEALTH REQUIREMENTS 40

8.1 Daily Health Checks 40
8.2 Detailed Physical Examination 42
8.2.1 Chemical Restraint *42*
8.2.2 Physical Examination *43*
8.3 Routine Treatments 44
8.4 Known Health Problems 44
8.5 Quarantine Requirements 49

9 BEHAVIOUR 50

9.1 Activity 50
9.2 Social Behaviour 50
9.3 Reproductive Behaviour 50
9.4 Bathing 51
9.5 Behavioural Problems 51
9.6 Signs of Stress 51
9.7 Behavioural Enrichment 52
9.8 Introductions and Removals 53
9.9 Intraspecific Compatibility 53
9.10 Interspecific Compatibility 53
9.11 Suitability to Captivity 53

10 BREEDING 54

10.1 Mating System 54
10.2 Ease of Breeding 54
10.3 Reproductive Condition 54
10.3.1 Females *54*
10.3.2 Males *54*
10.4 Techniques Used to Control Breeding 54
10.5 Occurrence of Hybrids 55
10.6 Timing of Breeding 55
10.7 Age at First Breeding and Last Breeding 55
10.8 Ability to Breed Every Year 55
10.9 Ability to Breed More than Once Per Year 55
10.10 Nesting, Hollow or Other Requirements 56
10.11 Breeding Diet 56
10.12 Incubation Period 56
10.13 Clutch Size 56
10.14 Age at Fledging 57
10.15 Age of Removal from Parents 57
10.16 Growth and Development 58

11 ARTIFICIAL REARING 61

11.1 Incubator Type 61
11.2 Incubation Temperatures and Humidity 61
11.3 Desired % Egg Mass Loss 62
11.4 Hatching Temperature and Humidity 62
11.5 Normal Pip to Hatch Interval 63
11.6 Brooder Types/Design 63
11.7 Brooder Temperatures 63
11.8 Diet and Feeding Routine 64

11.9 Specific Requirements 65
11.10 Pinioning Requirements 66
11.11 Data Recording 66
11.12 Identification Methods 67
11.13 Hygiene 67
11.14 Behavioural Considerations 68
11.15 Use of Foster Species 68
11.16 Weaning 68
11.17 Rehabilitation Procedures 69
12 ACKNOWLEDGEMENTS 71
13 REFERENCES 72
14 BIBLIOGRAPHY 74
15 GLOSSARY 75
16 APPENDIX 76

Introduction

Glossopsitta concinna, commonly known as the Musk Lorikeet is an absolutely beautiful species with its personality just as delightful as its appearance. I have had the opportunity to work with this species and have enjoyed it immensely. It is a member of the smaller lorikeet genus, *Glossopsitta* which it shares with two other species, the Little and Purple-Crowned Lorikeet.

Source: http://www.pbase.com/stuartgaut/image/69209040

Being a lorikeet they are classified as a nectarivorous bird, feeding primarily on nectar and pollen from native trees and cultivated fruit. They use their 'brush-like' tongue to effectively eat this food source making them a unique deviation from parrots. In my experience, I have only herd nice things about this species being held in captivity. They are a relatively easy species to keep in captivity as well as an entertaining species with bold personalities, typical of Australian lorikeet species. I encourage institutions to gain this species as they make a lovely edition to multi species exhibits as well as a nice contender for their own exhibit which I have not yet come across.

They are not classified as a threatened species under the Australian Species Management Plan (ASMP) as of September, 2010. There is only a little information on this species being held in captivity, even though it is a quite popular in my experience. Thus, I encourage those persons that are interested and enjoy this species to keep good records as it can only be of benefit to them in the future.

1.1 ASMP Category

There is no Australian Species Management Program (ASMP) on *G. concinna*. There is no regional program and this is classified as a 'level 3' where current and planned holdings for the region are published in the annual ASMP Regional Census and Plan document, refer to appendix 1.1 for 2010 Regional Census and Plan holdings for *G. concinna*.

G. concinna resides in the ASMP's Birds Taxon Advisory Group (TAG).

G. concinna is also listed in Convention of International Trade in Endangered Species of Wild Fauna and Flora (CITES) under Appendix 11. This states that even though the species is not threatened at the moment the possible trade of this species may increase this outcome. International trade in *G. concinna* needs an export permit or a re-export certificate, there are no regulations for importing but some countries do need a permit if they have stricter measures than countries that are signatories to CITES. This must be assessed by the appropriate authorities (i.e. that trade will not be detrimental to the survival of the species in the wild), refer to references for CITES website.

1.2 IUCN Category

IUCN Red List criteria = **Least Concern**
(Assessed 2009, IUCN Red List of Threatened Species).

1.3 EA Category

All the following Acts protect native birds thus *G. concinna* is protected under these acts in their corresponding state.

- NSW - National Parks & Wildlife Act 1974
- QLD - Nature Conservation Act 1992
- SA - National Parks & Wildlife Act 1972
- WA – Wildlife Conservation Act 1950
- VIC – Wildlife Act 1975
- TAS – National Parks & Wildlife Act 1970

For *G. concinna*, an Import and Export license must be obtained from the Department of Environmental, Climate Change and Water when transferring any bird's interstate.

Any international movements are governed by IATA Live Animals Regulations and CITES regulations

1.4 NZ and PNG Categories and Legislation

This doesn't apply to *G. concinna* as they are only endemic to Australia and Tasmania.

1.5 Wild Population Management

The species is not classified as threatened therefore not management plan exists.

1.6 Species Coordinator

Since *G. concinna* is not managed it therefore does not have a species coordinator managing it.

1.7 Studbook Holder

As above *G. concinna* is not managed species it does not have a studbook keeper.

2 Taxonomy

2.1 Nomenclature

Class: **Aves**
Order: **Psittaciformes**
Family: **Psittacidae**
Sub Family: **Loriinae**
Genus: **Glossopsitta**
Species: ***G. concinna***

Genus name is derived from the Greek word (γλώσσα) meaning tongue, while the modern Latin *psitta* meaning parrot. They are often referred to as the 'Brush-tongued Parrots' (Vriends 1993). There species name *concinnus* is Latin for elegant or beautiful (Higgins 1999).

2.2 Subspecies

In this species there are two Subspecies:
1. Glossopsitta concinna concinna (Shaw, 1791). The one referred in this husbandry manual.

2. glossopsitta concinna didimus (Mathews, 1915). This species is found in Tasmania. Whereas the above nominate species is found in NSW, VIC, QLD and SA (Higgins 1999).

2.3 Recent Synonyms

There are no recent synonyms for this species.

2.4 Other Common Names

Other English common names include: Musky, Musk Lory, King Parrot, Keet, Green Keet, Green Leek, Wisk Lory and Red-eared or Red-crowned Lorikeet (Higgins 1999, Hutchins & Lovell 1985).

3 Natural History

Musk lorikeets are a gregarious species, usually residing in pairs or larger groups (Higgins 1999). This species is the largest in the Glossopsitta genus (Sindel & Gill 2007). This species has often been mistaken in the field for either, Little or the Purple-crowned lorikeets, the other members of the Glossopsitta genus (Higgins 1999). They often reside with other species of lorikeets and have also been found with swift parrots (Higgins 1999). They are an arboreal species found among a variety of forest and woodland varieties such as Eucalypts, Banksia, Callistemon, Grevillea, Xanthorrhoea and Angophora (Sindel & Gill 2007), (Higgins 1999). Their favourite however are Eucalypt forests and are also found where suitable flowering or fruit trees reside (Blakers et al 1984), (Higgins 1999). In the past this species were heavily controlled (i.e killed) in the 1900's as they were deemed pests to orchard farmers, thus eradication of *G. concinna* was acceptable (Higgins 1999), (Sindel & Gill 2007).

Their diet is based mainly on pollen, nectar, native and cultivated fruit, insects and seeds (Blakers et al 1984). Historically, records of abundances are poor, to non-existent (Blakers et al 1984). The musk lorikeets name originates from their supposed musky odour (Sindel & Gill 2007).
G. concinna were known to be kept in captivity since as early as 1869 (Sindel & Gill 2007). The first musk lorikeet to breed in captivity was achieved by (Herr Nagel of Germany) in 1903, where in this instance the female died during the rearing period, the male took over and successfully reared the chicks to their independence (Sindel & Gill 2007). The first recorded breeding in Australia was conducted by W. Hamilton of South Australian 1930 (Sindel & Gill 2007). Hybrids of this species have occurred between Rainbow Lorikeets, Varied Lorikeets, Red-collared Lorikeets, and Scaly-breasted Lorikeets but not with the species co-geners the Little Lorikeet or the Purple Crowned Lorikeet (Sindel & Gill 2007).

3.1 Morphometrics

3.1.1 Mass And Basic Body Measurements

General Description:
G. concinna have a total length of around 20-23cm (Higgins 1999). They have a wing span of around 30-38cm and have a usual weight of around 70-75g (Higgins 1999) (Sindel & Gill 2007). They represent a medium sized lorikeet (Higgins 1999). There is no sexual dimorphism shown in this species however there are slight variations in some of the characteristics between the sexes which will be described below (Higgins 1999).

Adult Male: Males have a head colour of mostly dark green, with a bright red forehead/ red band covering from eyes though to the ears coverts which are a dull-blue wash on the top of their crown extending to their upper cheeks (Higgins 1999). Lower hind neck and mantle is an olive/ brown colour, fading into a green colour for the rest of the body (Higgins 1999). Upper body slightly paler then the rest of the body, also a blue tinge on breast may also be visible along with yellow patch at sides of the breast usually covered

by the wings (Higgins 1999). The undertail is mostly dull green with grading orange-red on bases of outer feathers, only seen when animals are in the light (Higgins 1999). Underwing mostly dull green like under the breast. Bill may be bright red, with half being basal, while the cutting edge blending into black (Higgins 1999). Iris varies from yellow-brown to orange and light red (Higgins 1999). Legs and feet are brown-grey (Higgins 1999).

Adult Female: Differs by male only slightly, not as much blue is found on the crown of the head (Higgins 1999). Females are generally duller with their cheeks and breasts lacking blue colourations appearing uniformly green along with their red banding appearing slightly paler (refer to figure 2.1 for a photo showing the slight difference between the male and the female) (Higgins 1999).

Figure 2.1: A Male and Female, the male is on the left, note the differences in colour on the top of their head along with the beak colour as well.

(Source: Sindel and Gill 2007).

Table 1: Shows an Average of the Body Measurements of *G.c.concinna*.

Measurements (mm) *G.c.concinna*

	Males		Females	
Wing	**1)**	130.4	**1)**	127.7
	2)	128.1	**2)**	127.2
Tail	**1)**	89.5	**1)**	88.7
	2)	88.1	**2)**	83.4
Bill	**1)**	13.2	**1)**	12.8
	2)	12.8	**2)**	12.6
Tarsus	**1)**	14.9	**1)**	14.9
	2)	15	**2)**	16.1
Toe C	**1)**	19.2	**1)**	19.2
	2)	20.4	**2)**	19.2

1) = Adults
2) = Juveniles
(Source: Higgins 1999).

Table 2: Shows an Average Weight of *G.c.concinna*.

Weights (g) *G.c.concinna*

Males		Females	
1)	79	**1)**	73.4
2)	70.75	**2)**	40,59,65

1) = Adults
2) =Juveniles
(Source: Higgins 1999).

Table 3: Shows an Average of the Body Measurements of *G.c.didimus.*

Measurements (mm) *G.c didimus*

	Males		Females	
Wing	**1)**	129.6	**1)**	126.2
	2)	128.6	**2)**	124.5
Tail	**1)**	90	**1)**	87.5
	2)	85.7	**2)**	82.7
Bill	**1)**	12.2	**1)**	12.1
	2)	12.5	**2)**	12.1
Tarsus	**1)**	15.1	**1)**	14.7
	2)	15.1	**2)**	15
Toe C	**1)**	18.8	**1)**	19
	2)	18.8	**2)**	

1) = Adults
2) = Juveniles
(Source: Higgins 1999).

Table 4: Shows an Average Weight of *G.c.didimus*.

Weights (g) *G.c.didimus*

Males		Females	
1)	64.5	**1)**	66.2
2)	61	**2)**	60,60,64

1) = Adults
2) = Juveniles
(Source: Higgins 1999).

3.1.2 Sexual Dimorphism

Species shows no sexual dimorphism, sexes only differ slightly as mentioned above (Higgins 1999). In terms of the two subspecies *G.c.concinna* and *G.c.didimus*, *G.c. didimus* have subsequently greener crowns than those in Eastern Australia (Higgins 1999). Studies have also shown that there are differences in size within the two populations (Higgins 1999). Length of *G.c.didimus* bill is significantly shorter than *G. c.concinna* along with *G.c.didimus* also being significantly lighter than *G.c.concinna* (Higgins 1999), refer to Tables 1-4.

3.1.3 Distinguishing Features

This species is unique in its appearance in comparison to its co-genres in the Glossopsitta genus (i.e. the Little Lorikeet and Purple crowned Lorikeet).

3.2 Distribution and Habitat

G. concinna is endemic to Eastern Australia (Higgins 1999). They are generally found south of 27° S (Higgins 1999). *G. concinna* are found in NSW, QLD, VIC, SA and WA with the other subspecies found in Tasmania (Higgins 1999). They inhabit tall, dry, open woodlands where *Eucalyptus* forests dominate but there are regional differences in preferred forest types (Higgins 1999). They are also known to reside near orchards, parks and gardens (Blakers et al 1984). They are either described as being nomadic or resident depending on the availability of food (Higgins 1999). In urban districts they have been known to associate with grevillea's in gardens.

Table 5: Shows Distribution of *G. concinna* and *G. didimus* in Australia & Tasmania.

(Source: adapted from http://upload.wikimedia.org/wikipedia/commons/3/3b/Australia_states_blank.png)

Regional differences are present between the state populations (Higgins 1999). Differences in *Eucalyptus* forests of N and W of the Great Dividing Range are apparent (Higgins 1999). Some populations located in these areas show high preferences for White

Box *E.albens* and Red Ironbark *E.sideroxylon* whereas around Melbourne they tend to prefer woodland of River Red Gum *E.camaldulensis* (Higgins 1999). Movements are influenced by a variety of factors with the availability of food being the biggest motivator for movements of populations (Higgins 1999).

No evidence of any migrational patterns is present in this species along with no long-distance travel movements (Higgins 1999). Movements are extremely closely linked with food availability (Higgins 1999).

3.3 Conservation Status

IUCN Red List criteria = **Least Concern**
(Assessed 2009, IUCN Red List of Threatened Species).

3.4 Longevity

3.4.1 In the Wild

In the present literature it is estimated at around 15-20 yrs (however no significant studies have been conducted on *C. concinna* longevity in the wild).

3.4.2 In Captivity

Around 15-20 yrs. Musk Lorikeets are known to live to their mid to late teens (Sindel & Gill 2007). Another source has noted an individual *C. concinna* lived 12 years in captivity in a zoo in Rotterdam, Holland (Brouwer et al 2000).

3.4.3 Techniques Used to Determine Age in Adults

From my experience the only way to determine the age of *C. concinna* is when they are juveniles. Their beak is quite black with no red/ orange colouring (refer to 2.1.1).

4 Housing Requirements

4.1 Exhibit/Enclosure Design

It terms of *G. concinna* exhibit design a couple fundamental things are vital in keeping them in captivity in Australia. As a result of their diet like all lorikeets is they must have appropriate hygiene standards which involve an ergonomically designed enclosure that will allow simply cleaning of the walls, feeding stations, and water bowls (Sindel & Gill 2007). In order to achieve this galvanized wire should be used (Sindel & Gill 2007).

Another fundamental point is placement of the aviary in relation to Australian climatic conditions. Aviaries for *G. concinna* and all species should face a north direction to maximize sun (Sindel & Gill 2007). Protection should be added in the form of shelter walled on the southerly and western side with a partially shaded side on the easterly side to protect from winds (Sindel & Gill 2007). These are the fundamental when designing exhibits for *G. concinna*.

4.2 Holding Area Design

G. concinna is quite an active bird so in terms of Aviary size to house this species; it should be relatively large however a holding area is essentially needed as it is the best means of reducing escapes of this species. The aviary size will ultimately determine the holding area but it should be wide enough to enter the enclosure safely, allowing utensils to be brought in and a little room for movement inside would be ideal.

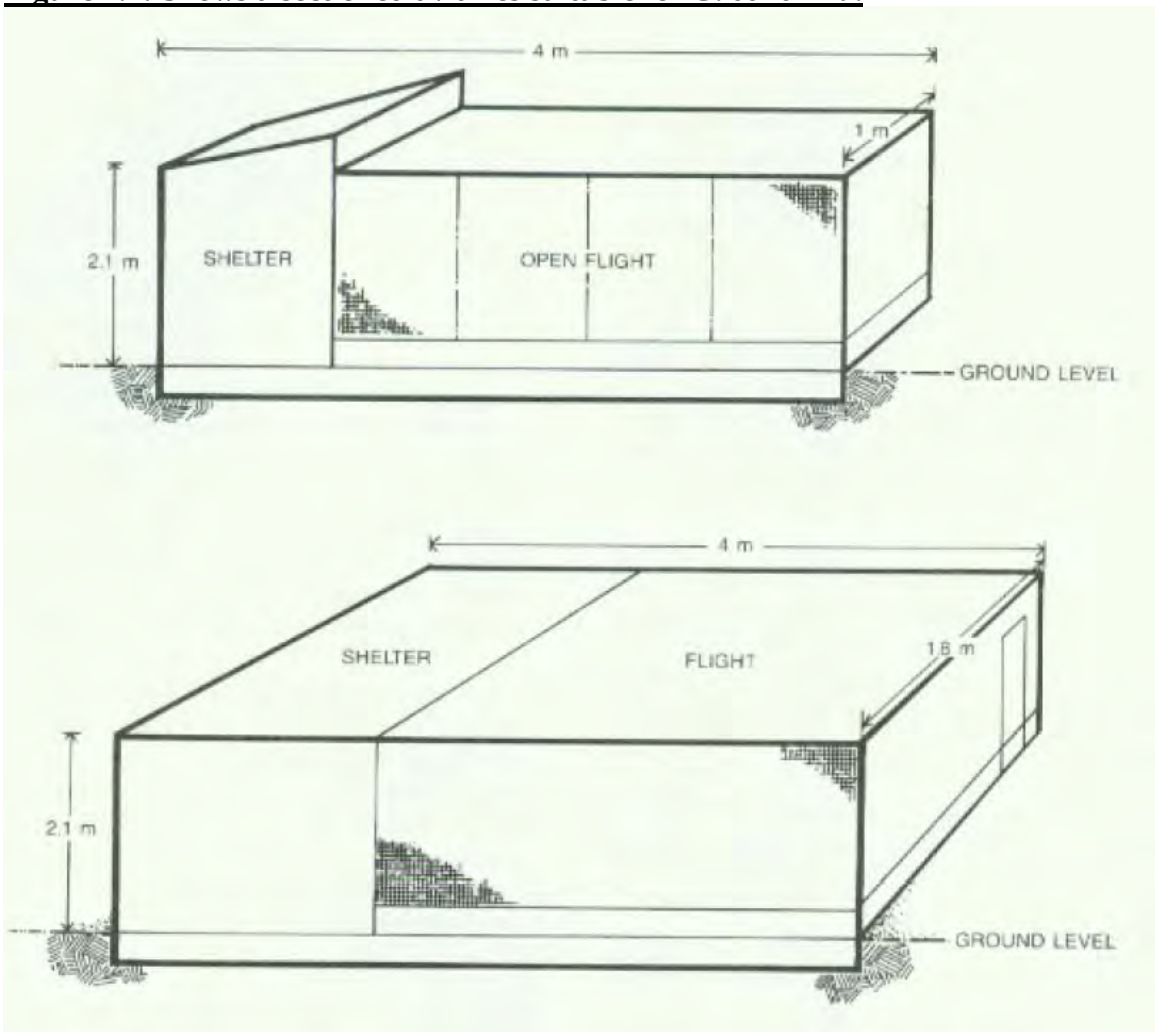
4.3 Spatial Requirements

There are no current minimal standards for keeping *G. concinna* under the Department of Primary Industries, NSW. In terms of their housing two options may be considered in exhibiting *G. concinna*. Suspended cages are the most ideal for *G. concinna* in terms of trying to maintain their hygiene and are great option when there is limited space available for exhibiting them. In terms of the spatial requirements for this species, the larger the cage the better. From experience, the minimum cage requirements for *G. concinna* would be roughly 2-3 meters long, via 1 meters wide by 1.5- 2 meters in high.
It has been noted by Sindel & Gill 2007:
“For an Aviary housing a pair of *G. concinna*: Should be **3m long**, **0.9m wide** and **2m high”.**

Furthermore it must be acknowledged that length in an aviary is more important than width as length allows lorikeets enough room to exercise (Shephard 1994). Height is also important as you want to give the birds enough room to fly over your head when you are in the aviary as a mechanism to reduce their stress (Shephard 1994). The two commonly used aviary styles are the ‘Box Aviary’, which consists of an aviary with its roof and sides covered while only exposing the front (Shephard 1994).

Whereas the other commonly used style is when the aviary is divided into two distinct sections with one half completely covered and the other half completely exposed with open wire, refer to figure 1.1 (Shephard 1994).

Figure 1.1: Shows a sectioned aviaries suitable for *G. concinna*.



(Source: Shephard 1994).

Advantages exist with both styles, but it is a matter of preference when choosing either style of aviary. Box aviaries are generally more suitable in cooler climates as they provide a lot of protection from the weather and the cold (Shephard 1994). If the box aviary is chosen the wall inside the aviary should be painted a light white/cream as to reflect light as otherwise it can be quite dark inside (Shephard 1994). Whereas, the sectioned aviaries are ideal when a large space is available as plants and shrubs can be planted inside the aviary, these are often quite appealing (Shephard 1994). When deciding on this option, positioning of the enclosure is quite important as well as the materials used in construction of the aviary. Some materials that can be used are shown in figure 1.2 along with their advantages and disadvantages (Shephard 1994).

Figure 1.2: Shows the advantages and disadvantages of some material types that can be used for Aviary setup.

Advantages and Disadvantages of materials used for Aviaries

Shelter	*Framework for Shelter and Flight*	*Advantages*	*Disadvantages*
Metal Sheeting	Galvanised steel piping & tubing	Long lasting for all bird types	Collects condensation on under side of roof
Asbestos free (Cement sheeting)	Wood	Appealing, easy to work with, cool in summer	Can not house large (chewing Parrots) not long lasting
Brick	Galvanised steel piping & tubing	Appealing, easy to work with, cool in summer	Expensive

(Source: Shephard 1994).

Another important consideration with *G. concinna*, like other lorikeets they tend to have bold, boisterous personalities, thus such considerations need to be acknowledged. Nevertheless, they are often displayed in multiple species exhibits and tend to be the smallest birds in that exhibit with the most authority.

4.4 Position of Enclosures

The orientation of the cage or aviary is important as they should generally face north or a north easterly direction (Shephard 1994). If free from obstructions this direction should provide adequate light levels to allow birds the adequate calcium and vitamin D uptake necessary from the sun. The placement of the aviary or cage in this direction further allows protection of the rain and winds generally coming from the southerly direction in Australia. However if the weather conditions occur in a different direction primarily then build or place the aviary or cage in the direction that will provide the birds the most protection (Shephard 1994). The placement of the aviary or cage should also be in an area with good drainage and on a level site and not under any obstructions that could potentially fall on the aviary in an unpredictable weather event (Shephard 1994).

4.5 Weather Protection

Protection from the weather is essential and is linked with the positioning of the cage and aviaries as mentioned above. Adequate protection should be provided in the form of providing shelter on the southerly end of the enclosure (as this is where most of the wind and rain will appear in Australia). The roofs of cages and aviaries should be positioned on a slope directing rain to the rear of the enclosure with a gutter attached to direct the water away from the aviary (Shephard 1994). The size of the shelter should be roughly a third or half the way down the aviary (Shephard 1994). There are many modifications that can be made to an aviary housing *G. concinna* but the most important are an area large enough for them to exercise, appropriate shelter from environmental conditions and security in the exhibit.

4.6 Temperature Requirements

Birds have a higher temperature than mammals which is significant to know especially when housing *G. concinna*. As a result of their higher body temperatures they also have a higher metabolic rate which can make temperature regulation sometimes problematic (Steiner & Davis 1981). Body temperatures of birds vary from (40° to 44.4°) with an average (41.6°) (Steiner & Davis 1981). Cooling occurs via the following ways; via the skin and respiratory tract (Steiner & Davis 1981). Skin cooling however is limited in birds as they have an absence of sweat glands (Steiner & Davis 1981). Whereas, cooling via the respiratory tract is achieved when water in the lungs is evaporated from the large surface area which is provided by the capillaries in the lungs, alongside air sac membranes (Steiner & Davis 1981). These collectively are the primary means of heat loss (Steiner & Davis 1981). Important signs that birds display when temperatures exceed their comfortable range is extended neck, gagging and panting (which are all signs that the bird is very hot and is trying to cool it's self down) (Steiner & Davis 1981). Birds also exhibit a variety of signals when they are trying to reduce the amount of heat lost from their bodies (Steiner & Davis 1981). They can do this via ruffling up feathers and crouching their bodies to conserve heat (Steiner & Davis 1981). When *G. concinna* undergo a moult, they should be kept warm and such considerations should be made in correspondence with the present environmental conditions (Steiner & Davis 1981).

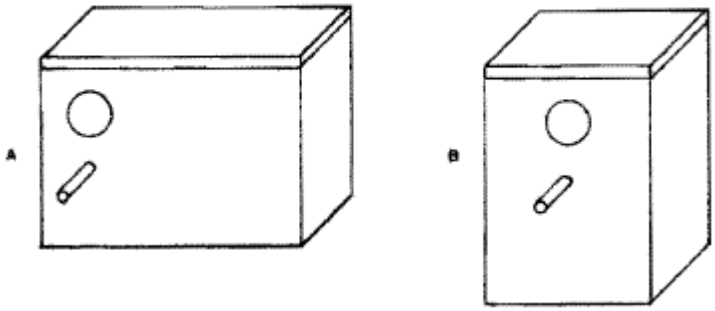
4.7 Substrate

Substrates used with *G. concinna* are a soil and mulch mix, preferable more soil than mulch as wet mulch under the right environmental conditions can grow fungi which can creating a potential bacterial hazard for the birds. From experience, *G. concinna* also tend to dig and create burrows in the soil, however sand and soil can be used as an effective substrate combination especially as sand is porous and will allow the regular cleaning of aviary floor to be able to get rid of most of the faecal droppings (Shephard 1994).

4.8 Nest boxes and/or Bedding Material

In the wild, *G. concinna* create their nests in native *eucalyptus* tree hollows (Shephard 1994). There are two types of nest box styles you can choose from, either the nest box or logs have a natural appearance refer to figures 3.1, 3.2 and 3.3 (Shephard 1994).

Figure 3.1: A – Horizontal Nest box and B – Vertical Nest box.

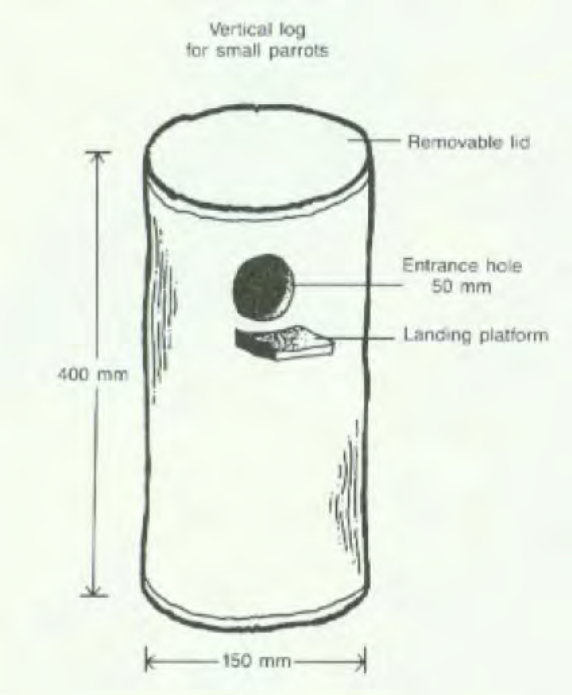


(Source: Sindel & Gill 2007).

Figure 3.2: Shows and example of *G. concinna* utilising a Vertical Nest Box.

Source: http://outdoors.webshots.com/photo/1166464825012889947zpgNbG

Figure 3.3: Natural Log Nest box.



(Source: Shephard 1994).

At first, allow the birds the option of both, they should begin to show preference soon enough. Positioning the boxes or logs either, vertically, horizontally, or at 30 to 45° angles (Shephard 1994). Whichever way you decide to position it, it will be up to the pair whether they like it or not, so it will probably take a little trial and error. If the birds accept a certain position of the box or log, leave it and make sure to return it the same way when the next breeding season occurs and make sure to record it (Shephard 1994). A couple things to take note when establishing nest boxes, the trick is to make the entrance hole just big enough for the birds to squeeze themselves into (Shephard 1994). Some recommended dimensions for *G. concinna* are shown in Table 4.1.

Table 4.1: Shows some recommended dimension for *G. concinna*.

Sloping 45° Hollow Log with a Side Entrance (cm)			**Horizontal Wooden Box** (cm)				**Vertical Wooden box** (cm)			
Length	Internal Diameter	Entrance Hole	Length	Width	Height	Entrance Hole	Length	Width	Height	Entrance Hole
45-60	10-15	5	30	15	15-20	5	20	30	30	5

(Source: Shephard 1994).

In addition, make sure that the placement is under the shelter free from sunlight as it can become very warm in nest boxes while on the other hand making sure that it is under shelter also provides protection from the event of prolonged raining (Shephard 1994).

Nesting material can be either, peat moss, soil, sawdust shavings (making sure they are from untreated wood) or wood dirt (soft rotting material found in the logs before they are hollowed) (Shephard 1994). Before nest material is added, drill some screw sized holes at the bottom of the nest box, which will allow some of the moisture to pass though (Shephard 1994).

It has been mentioned in the literature that a mixture of 75% peat moss to 25% soil is an ideal nesting material (Shephard 1994). The mixture should be placed at a depth of 8-10cm on a vertical nest and 4-8cm on a sloping facility (Shephard 1994). Nesting materials should be exchanged after each breeding season. From experience, *G. concinna* are not particularly fussy in choosing nest boxes as at one wildlife park in NSW, they had the option of logs and boxes but opted for the vermin bait box, thus provide a variety of different options for your birds. General inspection inside the nest boxes should be taught to birds from an early age and daily checks are encouraged (Shephard 1994).

4.9 Enclosure Furnishings

In the aviary a variety of natural branches (from native tress) should be available as this is the best material to produce perches from, not only for *G. concinna*, but for all bird species that are kept in captivity (Cannon 2002).

Food containers should be present and the number of containers should correspond to the number of individuals present. Container placement is also important as the placement should be high enough to discourage vermin from entering food bowls. Containers should also be placed underneath the shelter to protect food from unpredictable weather conditions. Water bowls, as mentioned above should also correspond to the amount of individuals present as mentioned above. Stainless steel or ceramic bowls are the best choice for food and water containers (Cannon 2002). A pond can serve as a multipurpose furnishing as it can provide a water hole along with a bath. A pond (that is refilled daily) is extremely suitable means for *G. concinna* as this species like all species of lorikeet love to bathe, thus in hot climatic conditions a pond should be a necessity.

Ropes can also be valuable (when placed in aviaries) as they allow birds to climb up and down as a form of exercise, thus providing an important piece of furniture for enrichment purposes. Nest boxes and logs should also be provided. *G. concinna* are a robust species so I encourage you to experiment with furnishings, the more new things they have in their exhibit the better it is as it keeps their minds stimulated, thus I encourage new furnishings at least every 3 months.

5 General Husbandry

5.1 Hygiene and Cleaning

Hygiene is an essential component and one of the main duties of keeping *G. concinna*. Appropriate hygiene and cleaning will dramatically reduce the risk of disease, infection and bacterial induced sicknesses to *G. concinna* and such practices are also relevant to all species of bird kept in captivity (Steiner & Davis 1981).

Daily Routine should include the following:

- Firstly, remove any old food, fruit that was present from the day prior to cleaning.
- Wash water and food bowls with detergent (like you would your dinner dishes), then rinse thoroughly with water making sure all residue is removed.
- Collect any soiled branches (Browse that is visibly soiled and drying out).
- Inspect any furnishings that need to be cleaned and then clean them (i.e. perches, cage wire and rinse with a hose, then allow to dry in the sun).
- Wash the floor with a hose (if it's concrete); scarify the soil (making sure the fresh faeces is really thoroughly broken up in order to avoid accumulation in such areas).
- Do a final check to see whether any other areas need visual cleaning to remove faecal droppings, old or decaying fruit etc.
- Observe your birds.

Weekly Routine:

- Wash water and food bowls like you would when cleaning daily (i.e. with household detergent).
- Remove all old browse.
- Wash perches, cage, logs, rocks (any soiled furnishings with water thoroughly to remove all debris, then wipe with disinfectant).
- While disinfectant is on furnishings (it must be on for at least 15minutes), scarify soil thoroughly like is done daily however spend at least two to three times longer than as you would daily.
- Wash with disinfectant once finished if the aviary consists of a concrete slab.
- Conduct any vermin control if necessary.
- Observe your birds.

Monthly Routine:

- Do as mentioned above in weekly with rinsing, scrubbing then disinfecting surfaces.
- Remove nest bedding, soil, browse and branches/perches (if they need replacing).
- Wash nest boxes (if available i.e. birds are not breeding) and disinfect.
- Conduct any maintenance that needs to be done.
- Change floor and nest box substrate (new mulch, soil and sand, or soil and peat moss).
- Replace food, water and new browse, flowers etc like the above routines

- Conduct any vermin control if necessary.
- Observe your birds.

Table of Cleaning Produces that can be used:

Cleaning Agents	Safe
Chlorhexidine	√
Quaternary Ammonium Compounds	√
Chlorine *	√
Tertiary Amines	√
Iodine	√
Alcohols *	√

(Source: adapted Cannon 2002).

Note: * means that can be used but caution should be taken when using these substances.

Description on the above Cleaning Agents.

1. Chlorhexidine = gently on bird tissues, recommended brands include: Hibiclens, Aviclens, Nolvosan (Cannon 2002).
2. Quaternary Ammonium Compounds = be sure to follow manufactures instructions, most are quite potent thus care should be taken when choosing these (use this for furnishings) (Cannon 2002).
3. Chlorine = is a great disinfectant, it becomes inactive in sunlight, thus can be used outdoors however any debris will make it inactive (Cannon 2002). It is not suitable for metal surfaces. Safest bleach if used is household bleach around birds, do not use granulated form (Cannon 2002). Read and make solution from the manufactures recommendations. A product called 'chloramine' can be used as it combines chlorine and ammonia in a lower dosage suitable for usage around birds; products examples include Halamid (Cannon 2002).
4. Tertiary Amines = effective disinfectants, follow manufactures directions, good for sterilizing equipment, products include Avi-safe (Cannon 2002).
5. Iodine = the 'iodophors' are the iodine's that are referred as being quite effective in killing bacteria and fungi not viruses, products include Betadine (Cannon 2002).
6. Alcohols = not used inside the cages (i.e. where birds are present but can be used on some surfaces and instruments, products like methylated spirits can be used for sterilization) (Cannon 2002).

Please refer to appendix – **Section 5: General Husbandry** for 5.1 Material Safety Data Sheet (MSDS) sheet for Chlorhexidine – Hibiclens and 5.2 for the rest of the products named above MSDS sheets website listings.

5.2 Record Keeping

Encouragement of keeping good, concise records can only be seen as a benefit. Essentially good observation daily should occur with anything abnormal noted daily and followed up upon.

5.3 Methods of Identification

The most common form of identification is leg banding with the second being wing banding (Higgins 1999). In my opinion I would never wing band as it is too risky for the bird's health and wellbeing. Leg banding would be my preferred opinion. In the period of 1953-1996, 243 individuals were banded in Australia, with 5 recoveries in between these periods were found approximately > 10km from their initial banding sites (Higgins 1999).

5.4 Routine Data Collection

There are gaps in the literature when keeping *G. concinna* in captivity. Concise recording keeping would benefit this species greatly. Encouragement of data collection regarding *G. concinna* is high with all people who work with the species.

6 Feeding Requirements

6.1 Diet in the Wild

G. concinna feed on mainly nectar and pollen from native flowering plants primarily from *Eucalyptus* trees and other native flowering tress such as *Banksia, Callistemon, Grevillea, Xanthorrhoea* and *Angophora* (Higgins 1999). The dietary intake of pollen provides *G. concinna* with a high source of protein and fat whereas they gain there necessary carbohydrates from simple and complex sugars found in nectar, plant and insect secretions (Alderton 2003, Shephard 1994). *G. concinna* have an important requirement for carbohydrate in their diet and as a result their digestive physiology is well adapted to these needs, containing high levels of disaccharidases which are required to break down the sugars (Shephard 1994). There have also been known to feed on fruits on orchards, insects and their larvae; however these do not make the bulk of their diet (Higgins 1999). There are known to be seasonal variations in diet corresponding to fluctuations in flowering eucalyptus buds, thus *G. concinna* like indeed all lorikeet species are known to have their population's distributions fluctuate as a result of the availability of food sources (Shephard 1994). To date, research into the seasonal differences in *G. concinna* have not been conducted but it has been found in Rainbow Lorikeets that seasonal differences are apparent in their diet (Shephard 1994). During autumn and winter 87% of their diet consists of flowers, whereas the remainder 13% consisted of seeds, leaves and insects (Shephard 1994).

6.2 Captive Diet

In captivity, *G. concinna* diet should consists of supplementing their wild diet with three main realms, pollen and nectar dry food (in the form of a commercial high grade lorikeet mix), Fruit and vegetables and browse (in the form of eucalyptus leaves/buds and native flowers such as any of the *Banksia*, *Callistemon* (Bottlebrush), *Grevillea, Xanthorrhoea* and *Angophora*, refer to figures 6.1, 6.2, 6.3, 6.4, 6.5, 6.6 (Shephard 1994).

Figure 6.1: Shows *Banksia hookerana* (Acorn Banksia)

Source: http://www.malleenativeplants.com.au/wp-content/uploads/2006/11/banksia_hookeriana100_4734.jpg

Figure 6.2: Shows *Callistemon* (Bottlebrush)

Source: http://www.habitas.org.uk/gardenflora/images/callistemon_citrinus3.jpg

Figure 6.3: Shows *Grevillea* (Robyn Gordon)

Source: http://www.australisplants.com.au/ornamentals/images/growing/grevilleaCoastalSunset1.jpg

Figure 6.4: *Grevillea* (*Honey Gem*) Yellow form

Source: http://www.yallaroo.com.au/images/G.Honey_Gem.JPG

Figure 6.5: *Angophora* (Rough-barked apple)

Source: http://users.nsw.chariot.net.au/~bpyallaroo/images/Angophora.JPG

Figure 6.6: Show *Eucalyptus Olesoa* (Giant Mallee) buds

Source: http://www.jiggerjuice.net/plants/eucalyptus/eucalyptus-oleosa-buds.jpg

An example of a great commercial brand lorikeet mix is Passwell Complete Lorikeet mix (Refer to appendix **Section 6,** 6.1 for Passwell stockiest). Other brands can include, Sherp's Lori-Dry or Lori-wet and Avioné (refer to appendix **Section 6**, 6.2 and 6.3 for the stockiest of these brands).A commercial lorikeet mix is crucial to their diet in captivity, it can be supplied just as it is in a dry form or it can be served as a wet mix (following manufactures instructions). However, I prefer to feed them the dry form, less mess, more hygienic etc, but it's up to individual's preference. Along with the dry food a piece of fruit and vegetable should be supplied daily to each bird. Variety is the key, thus *G. concinna* should be fed different fruit and vegetable daily if available (a record should be kept to promote variety and efficiency).

Types of fruit **Types of vegetables**

- Apples Corn
- Oranges/Mandarins Spinach
- Pears Carrot
- Peaches/Nectarines Peas
- Grapes Beans
- Tomatoes Sprouts*
- Mangoes Broccoli
- All Melons Silver beet
- Berries (Raspberries, blueberries, cherries, etc)
- Pomegranate Radish
- Pawpaw
- Pineapple
- Kiwifruit
- Plums
- Apricots
- Banana

All other vegetables except
-onions, avocado & potatoes.

Note: * Sprouts are important addition to the diet (i.e.
(Source: (Shephard 1994).

A Cuttlefish or shell grit should be placed in with *G. concinna* to provide an added source of calcium and to allow the birds to naturally trim down their beaks (Shephard 1994).

Daily Food Requirement

- A heaped tablespoon of dry lorikeet mix per bird is my preferred amount, nothing less at the very least.
- One piece of fruit and vegetable per bird
- Flower or *Eucalyptus* branch per bird
- Fresh water daily

6.3 Supplements

Supplements ultimately should be directed by a qualified veterinarian. A number of different supplements can be given for a number of different things. I have included a short list of supplements that are used with birds.

- Spark – Vetafarm (Specifically used as an electrolyte).
- Calcivet – Vetafarm (Given as a calcium supplement).
- Soluvet Liquid Vitamins – Vetafarm (All purpose multi-vitamin)

(Refer to appendix **Section 6**, 6.4 for stockist of Vetafarm products).

For egg laying *G. conncina* they should definitely get a calcium supplement as birds lose 10% of their calcium store laying one egg (Hammond 2010). This should definitely be placed in with their food during breeding season as they lay 2 eggs which is, 20% calcium lost each season.

6.4 Presentation of Food

Bowls should be placed high (as high as possible) into the Aviary or Cage, *G. concinna* are an arboreal species and will not eat of the ground generally (Shephard 1994). The amount of food bowls should always be (n + 1), total number of individuals plus 1 extra bowl (Shephard 1994). Since *G. concinna* can become aggressive feeders, some may not allow others to feed with them, thus, this is the safest option to allow all birds a share in the food provided. Enrichments that are appropriate to give *G. concinna* are any of the native flower buds from the *Eucalyptus* variety or of the native flowers mentioned above daily. As well as providing new natural perches every 3 months or when needed. New bird safe toys may be added if so inclined but the former two are an absolute necessity.

Enrichments should also be added regularly, I will list some that can be used along with an enrichment calendar.

Enrichments

- Spray honey water on browse
- Browse/ Native flowers
- Egg cake mix
- Nail fruit
- Bird toys bought from pet stores

Ingredients for Egg Cake:

1 mandarin cake – plain one
1 egg hard boiled
½ cup of grated cheese

Method:

Mix all ingredients together just prior to feeding out.
© Australian Reptile Park.

Ingredients for honey water

1 cup of honey
2 Tbsp of Molasses
1 Tbsp Condensed milk from Nestlé sweetened condensed milk
2 to 3 cups water

Method:

Mix all ingredients together and put in a bottle with a rabbit drinker lid on it, the birds should feed from the opening as they wish.
Alternatively spray on browse.
© Australian Reptile Park.

Enrichment Calender for *G. concinna*

1	2	3	4	5	6	7	8
Honey	**Browse**	**Egg**	**Toys**	**Flowers**	**Nail**	**Egg**	**Toys**
9	10	11	12	13	14	15	16
Browse	**Egg**	**Honey**	**Flowers**	**Nail**	**Toys**	**Browse**	**Flowers**
17	18	19	20	21	22	23	24
Egg	**Honey**	**Toys**	**Browse**	**Flowers**	**Nail**	**Honey**	**Egg**
25	26	27	28	29	30	31	32
Browse	**Nail**	**Flowers**	**Toys**	**Honey**	**Egg**	**Flowers**	**Honey**

Key –

1. **Honey** = Spray honey water on browse.
2. **Browse** = Different left over native vegetation.
3. **Flowers** = All native flowers as mentioned in 6.2 captive diet.
4. **Toys** = Bird toys bought or made refer to figure 9.1 under behavioural enrichment.
5. **Nail** = Different placement of nail fruit.
6. **Egg** = Refer to egg cake recipe in 6.4 presentation of food.

7 Handling and Transport

7.1 Timing of Capture and Handling

The best time for capture of *G. concinna* would be in the early morning or night rather than during the day or in the afternoon. This gives the birds time to settle down (i.e. in the afternoon). Since they are a robust and active bird, an early morning capture would probably be the best time as to reduce the stress associated with capture rather than the afternoon or during the day. The age of the birds may also have an effect the behaviour of the bird during capture which should be acknowledged (Cannon 2002). As older birds may really need a quick capture as prolonging this process may leave their immune system in a compromised state (Cannon 2002). Since *G. concinna* will in fact try to bite and escape you, a quick capture will effectively benefit both parties. Make sure to observe the birds and think about their escape routine before you start capture as this can enable you to reduce the possibility of the birds or yourself from getting injured (Cannon 2002).

7.2 Catching Bags

Some equipment needed for catching *G. concinna.*

- Towels (tea towels)
- Pillowcase
- Long handled net

(Source: Parsons 1999).

7.3 Capture and Restraint Techniques

Standard Operating Procedure (SOP) for catching *G. concinna*.

1. All materials should be collected and ready to use (i.e. nets, transport box, towels, pillowcase etc).
2. Two people should be involved with the capture, as one person should be attracting the birds attention while the other should be positioned behind the animal, both persons should aim to gently move towards the birds (Parsons 1999).
3. Then as both people start to close in on the bird, the person that is situated at the rear of the bird swiftly places the net over the bird. Then the other person runs and gains a hold of the bird through the net.
4. A towel then should be ready to place over the net as it is gently lifted across and off the bird (Parsons 1999).
5. Once the bird is successfully wrapped with the towel, the bird should be placed into the transportation box as quickly as possible, removing the towel off the animal in doing so (Parsons 1999).
6. The transportation box should then be secured before removing the bird from the enclosure (Parsons 1999).

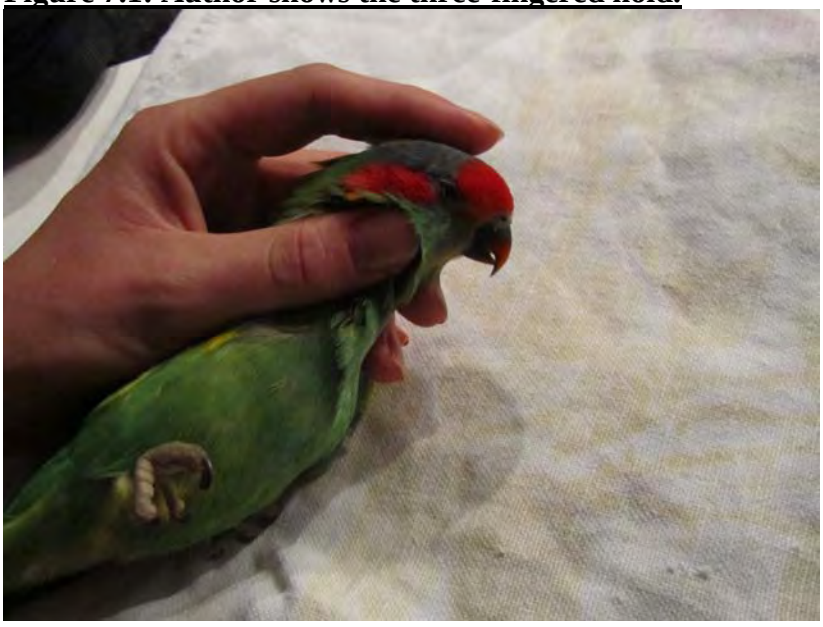
NOTE: That the above process may not go as smoothly as mentioned. It is of the up most importance to have all equipment ready and to be confident during this process of capture for the birds benefit and the persons involved. Also each person's role should be clearly outlined before commencement as such procedures can be very stressful to the animal and in some instances may not be possible to complete (i.e. bird is extremely stressed and capture needs to be abandoned and reset to a later date). Be sure to make the bird's health and wellbeing first priority.

7.4 Weighing and Examination

Examination

Prior to capture you can do a visual physical examination of *G. concinna* from a distance daily, to check for any obvious signs of illness. When performing an actual physical examination beware of the beak as they can inflict a bite if not properly handled. Once the bird has been captured by the above process, the aim now is to make sure you get a hold of back of the head through the towel tight enough that the bird can not turn around and bite (not too tight as you may injure the bird) (Cannon 2002). This should really be the only real tight hold on the individual (Cannon 2002). As birds lack a diaphragm, they use the movement of the sternum to breath, thus a tight hold on a birds body has caused asphyxiation in the past, hence restrain on the body is forbidden (plus, the beak is really the only place where it can hurt you) (Cannon 2002). There are two ways you can hold the head, three finger hold, refer to 7.1 or the universal grip, refer to figure 7.2 (Cannon 2002).

Figure 7.1: Author shows the three-fingered hold.



For the three finger hold you must place the hand that is not restraining the bird underneath the body so they feel secure and grab the birds head as mentioned in the above technique (Cannon 2002). Then you must grab the head between three fingers as shown in figure 7.1 (Cannon 2002). When doing this procedure make sure that no

pressure is put on the chest (Cannon 2002). This procedure works quite well and is my preference, however alternatively you can use the universal grip.

Figure 7.2: Author shows the Universal Grip.

The procedure as shown in figure 7.2; involves the thumb being inserted into the gap of the neck underneath the lower beak, the index finger then encircles the back of the neck while putting pressure downwards of the wings (Cannon 2002). This technique is for the experienced and does require some practice (Cannon 2002). When holding the bird refer to figure 7.3 for a diagram on how to hold *G. concinna*, note the position of the head hold, essentially the most important area to restraint area (Cannon 2002).

Figure 7.3: Show the correct way of holding a capture bird.

(Source: Cannon 2002).

Weighing
Once a Bird is captured, it can be weighed by an ordinary set of kitchen scales (measuring to 3kg, displaying in grams – as *G. concinna* generally weights around 73g for 'females' to around 79g for 'Males', such a scale would be adequate) (Higgins 1999). As mentioned above weighting can be conducted after a physical examination and can be useful when treating sick birds as this is an ideal method in measuring the recovery process (Cannon 2002). Once the above physical examination is commenced you can place the bird in a pillow case gently, place it on the scales, record the measurement and then return the bird to wherever it needs to go (i.e. cage or the aviary). Once you have the measurement reading, subtract the weight of the pillowcase from the actual weight taken with the bird in it and this figure should give you the bird's weight.

7.5 Release

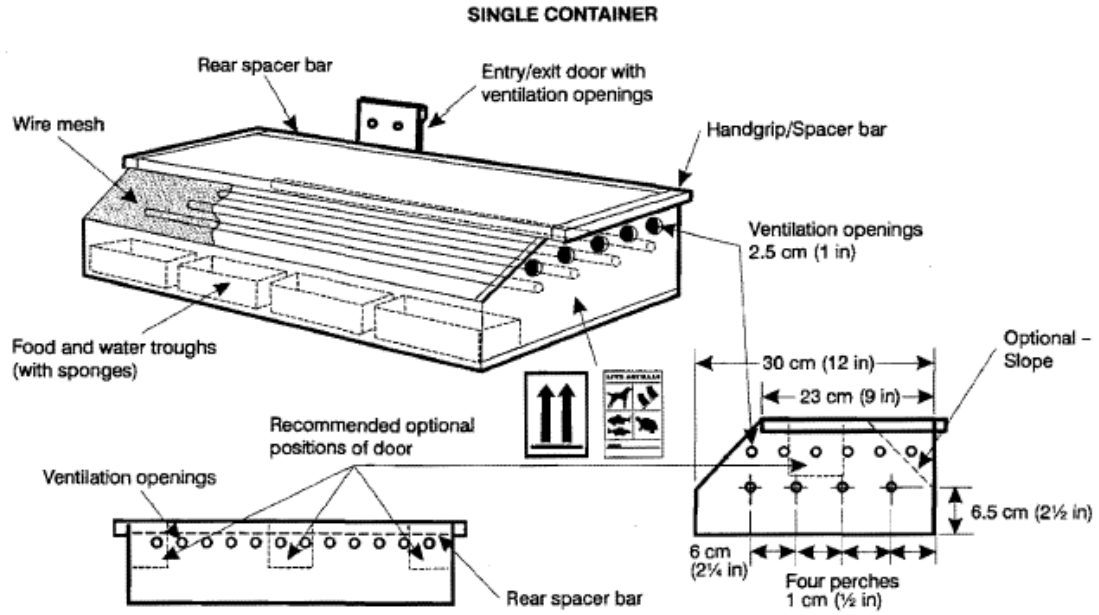
With *G. concinna,* releasing to the aviary should most definitely be in the day, not at night. Dependent on the travel situation if they arrive at night, they should be kept over night until it is morning, as this is the best time to release them. In terms of which time of day would be the most appropriate, it doesn't really matter but if it's an extremely hot day, maybe releasing them when it was cooler would properly be the better option (for the birds stress levels). The location should always be on the floor, so they can get adjusted to their surroundings before taking flight as this can be highly stressful time for the individuals (Cannon 2002). Do not every release them in midair; this can be very stressful for *G. concinna* or any bird for that matter (Cannon 2002).

7.6 Transport Requirements

Equipment needed for *G. concinna.*

- Transportation container (either made out of a plastic rigid container) see figure 7.4 for a container to house a single bird.

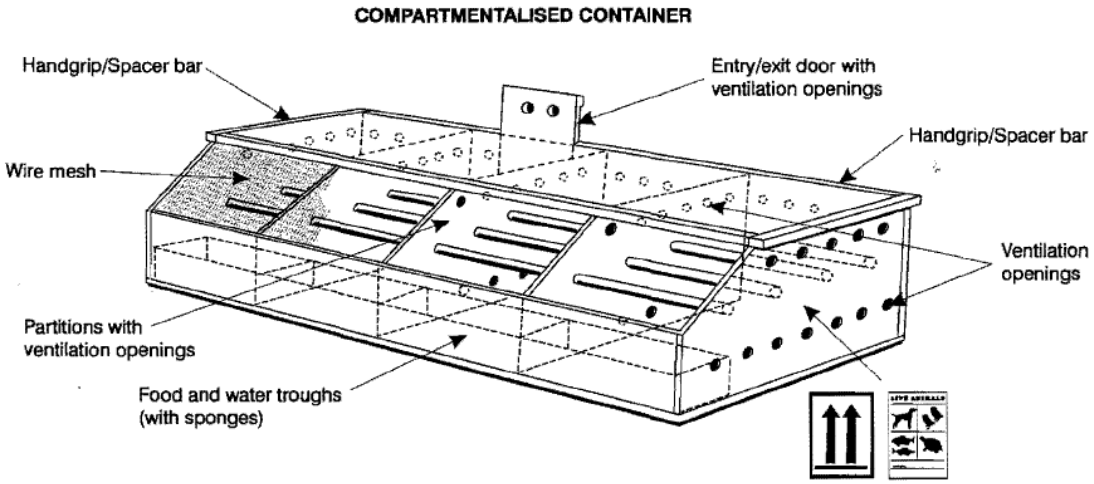
Figure 7.4: Shows the recommended single container as under IATA.



Note: *Food and water troughs must be provided.*

(Source: Source: IATA, page 215).

Figure 7.5: Shows a multi compartmental container for multiples species of *G. concinna.*



(Source: Source: IATA, page 215).

7.6.1 Box Design

Basic container dimensions are refer to figures 7.4 and 7.5.

The basic container requirements as under IATA for *G. concinna* are:
Materials: should consist of wire mesh, non-toxic wood, non-toxic plastic, fibre glass, synthetics (i.e. shade cloth)

Plus,

1. **Frame** = must be made from solid wood measuring (2 × 4 cm) with a minimum thickness of 0.6cm.
2. **Sides** = plywood or solid wood with a minimum thickness of 0.6cm along with 75% of the front must consist of wire mesh or alternatively metal bars.
3. **Floor** = solid wood or plywood in 1.2 cm thickness. A false wire floor for *G. concinna* should be provided to promote higher hygiene, as faeces and urine can pass through the wire.
4. **Door** = solid wood of 1.2cm thickness along with a sliding or hinged door along with a secure way of fastening it.
5. **Front of the container** must be sloped to provide an extra ventilation area and be covered with a 0.3 cm wire mesh which should ideally cover 75% of the frontal area.
6. **Roof** = should be solid with ventilation holes present.
7. **Perches** = must be wooden as mentioned, preferable with a diameter that is large enough for bird to grip comfortably. They must also be placed low enough that the bird will not hit its head on the top of the roof of the transport container but also not to high that the bird can be uncomfortable during transport.
   NOTE: The perch space must be sufficient enough for all birds being transported, plus the number of birds should not compromise the actual space for each individual bird.
8. **Ventilation*** (Very important) = all openings should have mesh cloth covering them allowing good air flow. The meshed ventilation openings should be 2.5cm wide in diameter, spaced around 5cm apart along at least three sides of the container. More should be made regardless though. All meshed opening should have no sharp edges within the container and all edges present should be covered with a smooth material.

(Source: IATA, page 220 & 215).

7.6.2 Furnishings

Furnishings as under IATA for *G. concinna* are:

- **Perches** = made from natural sturdy branches, with no more than 3 parallel branches (refer to figure 7.4). Alternatively, if perches are unavailable, use a non-slip lining or fixed foothold blocks can be used.
- **Padding** (i.e. non-destructible material should be placed on the roof, the doors and ventilation holes must be covered with fine mesh (shade cloth). A light cloth/curtain must cover the door and the ventilation holes to prevent large amounts of sunlight for entering.

- **Narrow-necked plastic containers** for either wet or dry lorikeet mixture are needed if transportation will last for longer than 24hrs.
- **Sponge** should be provided regardless whether high temperatures are going to be present or not.

(Source: IATA, page 220 & 215).

7.6.3 Water and Food

According to IATA, *G. concinna* do not need to be fed within the first 24hrs of travel. Fruit however, may be given to provide moisture (types of fruit used should be relatively not messy fruits like mangos but apple or pear may be given). However, if fruit is given, it must be checked with the countries/state regulations. As mentioned above, if for some reason lorikeet mixture must be fed to the birds (i.e. is very young or on medication), a narrow plastic feed container should be attached inside the transportation container to avoid bird spilling and or birds submerging in it. Water should always be provided in the form of a sponge or balsa wood floats to avoid spillage (attached inside the container).

Note: When determining the above points, consider the duration of the transportation, weather conditions, temperature and above all ventilation (extremely important).
(Source: IATA, page 220).

7.6.4 Animals per Box

The packaging density of *G. concinna* differs with birds that are bred in captivity versus wild birds. Spacing for captive birds should be a minimum of 7cm perch space for each bird. Whereas for wild birds it should be 8cm perch space per bird. A maximum of 35 birds per container/compartment are allowed.

Note: That as mentioned under IATA, all lorikeet species (i.e. *G. concinna*) must be housed separately. They are not to be mixed with any other species, not even any other lorikeet species.
(Source: IATA, page 220).

Key considerations:

- The amount of space per bird must comply with the species carried
- Food and suitable water containers must be fixed inside
- The container must be equip with a means of refilling
- Labelling must conform to IATA standards for Live Animals

(Source: IATA, page 215).

7.6.5 Timing of Transportation

Timing of transportation for short term can occur in the morning, however when transporting on long distance travels an appropriate time could be at night in order to have an appropriate release in the morning.

7.6.6 Release from Box

A release should always be timed in the morning as to allow the bird to accustom to its surroundings. This will also reduce the stress levels as you can image a bird having to fall asleep in a completely new environment would be quite stressful. Emphasis on monitoring the bird's integration throughout the day is essential.

8 Health Requirements

8.1 Daily Health Checks

There are two quite accurate measures that can be taken in order to assess the health of *G. concinna* or any bird species (Cannon 2002). While undertaking the daily duties make a note to examine,

a) Droppings of the birds
b) Distant examination of the birds and their environment

As (Cannon 2002), mentions that recognition of normal healthy droppings is quite a vital skill. Examination of the 'vent' or 'cloaca' is also vital as this is the junction of the excretory products from bird's digestive, reproductive and urinary systems (Cannon 2002). The vent should appear to be clean with no poop residue. Any deviation from this must be noted and further observations should occur.

When assessing a normal dropping from *G. concinna*, it should either contain excretory products from the intestine or the urinary tract but will most probably contain a little from both of these systems (Cannon 2002). Normal droppings will contain the urates arising from the kidneys, this resembles a white creamy paste and is usually associated with the urine, a small amount of watery liquid (Cannon 2002). The normal dropping will also contain the faeces which arise from the intestines; this is a thin coiled tube that can vary in colour reflectant on the birds prior food source (Cannon 2002). The colour will be dependent on what is currently being fed to the birds or alternatively if it is sick (Cannon 2002). Brown, black, green, and brick red which can all be normal colours (Cannon 2002). However, bright green faeces may be the sign of liver disease or a possible blood disorder (Cannon 2002). This colour is can commonly be associated with malnutrition, toxins, chlamydophila and some viral diseases (Cannon 2002). Pale coloured faeces may be associated with a disease of the pancreas (Cannon 2002). As mentioned by (Cannon 2002), it is a good idea to become accustomed to what the normal healthy dropping appears to resemble as that then any deviation from the normal can be acknowledged quickly. Note that any stress (i.e. handling or transport will generally increase the urine component in the droppings) (Cannon 2002).

Along with assessing the droppings a distant examination of the bird should be conducted from a location where they cannot see you preferably (Cannon 2002). This will allow us to determine whether they are acting normally in their behaviour (Cannon 2002). Make sure to note that each bird has a different personality and one may be more active than the other thus a little time may need to be spent in order for a proper assessment of all the individual birds.

Normal Bird Behaviours:

- Alertness, bright behaviour
- Both eyes open, round
- Both nostrils open, clean
- No darkening or stains near the nostrils
- It sees you and acts appropriately
- Sitting in the usual spots in the cage
- Standing erect with both feet evenly positioned
- Wings folded against body in the usually position
- Feathers are kept in good condition, preening is observed frequently
- Moving around actively, vocalizing
- Breathing is barely detectable
- Not overweight or really thin
- No abnormal swellings on the body

(Cannon 2002).

Any birds that are showing any of the above signs should be taken to a veterinarian as soon as possible. A change in 24hrs for a bird is the equivalent of a week of sickness keeping in mind that birds have their own 'preservation reflexes' (Cannon 2002).

While you're conducting the above observations you might as well take in some information of the general environment of the birds as this is generally associated with sick birds (Cannon 2002). Assess the following:
Is there a normal amount of droppings? Do they look normal? Are there any signs of vomiting? What foods is the bird/birds eating? Is there poop in the water bowl? Have the birds/bird been chewing on the wire cage/aviary? Are there any visible changes to the overall environment? (Cannon 2002).

Here are some general signs of sickness in *G. concinna* or any bird species:

- Weight loss, loss of appetite
- Inability to swallow or manipulate food with mouth
- Unusual perching, head held under wing
- Vomiting
- Fluffed up feathers – huddled
- Droopy wings
- Wet feathers around the head, nostrils and eyes
- Less active than normal – Sleepy in appearance
- Decease in preening and maintenance of feathers
- Any abnormal behaviours
- Stops vocalizing
- Viable lumps or masses on body
- Bleeding should be treated as a serious emergency

(Cannon 2002).

Here is an example of some of the typical signs as mentioned above visibly in a *G. concinna.*

(Source: Cannon 2002).

8.2 Detailed Physical Examination

8.2.1 Chemical Restraint

Birds rather than mammals have a unique and effective respiratory system and as a result respond more quickly to inhalation anaesthetics (Sawyer 2008).
It must be noted that both physical and chemical restraint will effectively compromise a bird that is severely ill (Sawyer 2008). Inhalation anaesthetics are the preferred method of chemical restraint and should always be performed by a professional veterinarian. The placement of a mask over the bird's beak is the best delivery method (Sawyer 2008).

Two drugs of choice preside in the literature, isoflurane and sevoflurane as birds awaken quickly and these drugs furthermore minimize self trauma during recovery (Sawyer 2008). No sedation is necessary and as a result the bird becomes fully functional after a short time (Sawyer 2008).

8.2.2 Physical Examination

A detailed physical exam should be performed annually on all birds. Once birds have been catch and restrained probably, refer to 7.3 of this manual on capture and restraint of *G. concinna.*

An examination should start from the head and proceed downwards on the bird's body.

Head

Examine the eyes, head, ears, nostrils and the cere (Cannon 2002). Establish whether there is residue at these areas or remains of residue (Cannon 2002). The head should be symmetrical, thus examine the head at various angles (Cannon 2002). Examine the beak and assess whether any breakages are present (Cannon 2002). Check the mouth, tongue and throat (Cannon 2002). See if there are any sour odours preset in or around the mouth (Cannon 2002). Begin to run your fingers down the bird's body from the crop to the abdomen (Cannon 2002).

Abdomen

The breast muscles should feel convex; the keel bone should not be prominent at all (Cannon 2002). The abdomen should be concave not convex, thus it should appear slightly sunken (Cannon 2002). Check the right side of the birds as this is where the liver is found (Cannon 2002). Feel if it is enlarged, does the bird exhibit an extreme amount of discomfort if touched? If everything is normal the bird should not demonstrate pain with a gentle abdomen examination (Cannon 2002). (Refer to appendix **Section 8**, 8.1 for diagram on sternum and pectoral musculature which related to a body score condition, note that number 3 is ideal).

Cloaca

Examine the cloaca for swellings, residues, soiling (Cannon 2002). Gently push the tail back and blow towards the vent and a clear inspection should be quite easy (Cannon 2002).

Feathers & Skin

Look at the overall feather condition of the primary and tail feathers; are there any missing or chewed feathers? (Cannon 2002). Examine the powder down feathers; this can be done by parting the feathers over the hip (Cannon 2002). Are they fully there and do they appear fluffy and healthy?

Wings

Very gently pull out each wing separately holding it by its joint and assess whether each joint has a full range of motion and no swellings are present (Cannon 2002). Assess the general appearance of each wing against the light which may bring up some abnormalities not already noticed (Cannon 2002).

Legs

Examine each leg, run fingers from the hip to each claw (Cannon 2002). Assess the gripping capabilities of each foot, are they roughly even? (Cannon 2002). Does the bird put more weight on one rather than the other? (Cannon 2002).

Claws
Assess the length of the claws; overgrown claws may be signs of poor perches, nutritional problems and liver disease (Cannon 2002). Trim the very tips if needed, the VERY tips only. If uncertain about trimming, visit the local veterinarian.
Feet
Examine the bottom of the foot; the surface should be rough, not smooth. A smooth surface could be the result of inadequate perching materials and result in the beginnings of 'bumble foot' (Cannon 2002).

Once the examination is finished, release the bird back into the aviary and watch its behaviour (Cannon 2002). If it looks normal and is fixing its feather via preening, this is a good sign (Cannon 2002). If the bird appears extremely stressed and is having difficulty breathing assume that it is sick (Cannon 2002).

8.3 Routine Treatments

In my opinion treatments should be applied once the bug or parasite is assessed. A six monthly cytology swab should be conducted by the veterinarian to see whether the birds have any parasites. If so the appropriate treatment should be applied (i.e. worming completed then rather than any unnecessarily worming of birds if they don't need it). However, if time and funds do not permit such an option worming it can be done 6 monthly if desired. A particular product on the market can be used for worming, it is 'Wormout Gel' by Vetafarm, (refer to appendix **Section 8**, 8.2). This 'Wormout Gel' kills roundworm, thread worm, tapeworm, hook worm and caecal worm and is pretty much an all round wormer. It can be crop needle fed or diluted in drinking water; I would personally just administer it in the bird's aviary water.

Method:
For one litre solution = 6 pumps of the Wormout Gel to one litre of water. Warm up some of the water from the one litre water till it's just warm not hot, like around ½ cup and pour into a small bottle with the 6 pumps of Wormout Gel. Shake well till all the gel is dissolved into the water then return it to the rest of the water to make up 1 litre of fully diluted water. It may be mixed with diluted orange juice for fussy drinkers.

Note: Medicated water must be out of direct sunlight otherwise it becomes useless so always make sure it is in the shade. It must also not get deliberately contaminated with food or droppings, thus move medicated water away from food dishes and or from underneath perches. These two points are vital when using Wormout Gel by Vetafarm.

For any other treatments a professional veterinarian visit is recommended.

8.4 Known Health Problems

Common associated diseases with lorikeets as mentioned by (Cannon 2002).

- Psittacosis (Chlamydophilosis)
- Paralysis syndrome
- Psittacine Beak Feather Disease PBFD (Cirocovirus)

- Bacterial infections - Septicaemia (resultant from poor hygiene and contaminated food)
- Yeast Infections

(Cannon 2002, Gelis 2007).

Psittacosis (Chlamydophilosis)

Cause:

This disease is caused by *Chlamydophila psittaci* which is a rickettsial organism and is highly contagious being transferred from bird to bird and bird to human (Steiner & Davis 1981, Cannon 2002). This particular strain of *Chlamydia* is found in psittacine birds (Steiner & Davis 1981). This disease is quite difficult to diagnose as its signs mimic a variety of other diseases (Cannon 2002). This disease essentially compromises the bird's immune system making it susceptible to a secondary infection (Cannon 2002). So they may be other signs that the birds show from the secondary infection but the underlying problem is *Chlamydophila psittaci* so laboratory tests are essential in order to find out whether this disease is present (Cannon 2002). Furthermore, there are some birds that in fact have the disease and are asymptomatic but a poor breeding rate may be a first indicator to infected birds, thus a through history and record keeping is essential as it may one day in fact lead to diagnosis of this disease (Cannon 2002). Interestedly a survey on the natural occurrence of this disease in parrots show around 30 to 70% of birds tested have anti-chlamydial antibodies and that the clinical disease is often triggered by an human-environmental agent like introduction to a new aviary, moult, bulling from other birds and overcrowding (Cannon 2002).

Signs

This disease may be carried in *G. concinna*; individuals may appear asymptomatic (Cannon 2002). These carriers are able to shed the disease after stressful situations (Cannon 2002)

Clinical signs can be the following or a combination of others and these:

- Weight loss
- Excess urine – often green
- Diarrhoea – bright green to black
- Depression
- No appetite
- Watery eyes
- Runny nose
- Sneezing

(Cannon 2002).

Outbreaks occur in late summer, peak in autumn and are consistently stable during winter (Cannon 2002).

Psittacosis in People

As this is a zoonotic disease it is usually transferred by the inhalation of infected particles like dust, dried droppings, feather dust, and respiratory tract excretions (Cannon 2002). The incubation period is around 4-15 days (Cannon 2002). The clinical signs are those of a typical cold, headache, temperature, sore throat, lethargy, loss of appetite (Cannon

2002). If left untreated relapses are common (Cannon 2002). It can severely affect the elderly, the young or the immunocompromised (Cannon 2002). It suppresses the immunity in people just like in birds thus a secondary infection is not uncommon (Cannon 2002). If left untreated in those severely affected, complications and infections of the muscles lining the heart evolve and can lead to death (Cannon 2002). Often the cases in people are mild and can be easily treated; all details must be given to the physician detailing with the birds so an appropriate diagnosis can be made (Cannon 2002). The disease can be spread through nasal and eye secretions and is also excreted in faeces (Cannon 2002). This organism is quite robust and can survive well in its environment, living up to three weeks in straw, two mouths in bird seed, poultry litter for up to eight mouths and in a frozen turkey for a year (Cannon 2002). Thus, all material in contact with infected birds must be thoroughly disinfected (Cannon 2002).

Diagnosis

Tests are conducted via the veterinarian and can include:

- Immunofluorescence
- Complement-fixation test (CFT)
- DNA Testing (PCR)
- ELISA (e.g. clearview^{TM} test)
- Isolation and growth of *Chlamydophila psittaci*

(Cannon 2002).

Treatment

For any species an antibiotic (Doxycyline or azithromycin), can be delivered intramuscularly via injection or orally through a crop needle (Cannon 2002). Some individuals despite medicating may relapse as *Chlamydophila psittaci* survive deep within the bird's bone marrow and the treatments find it difficult to penetrate this area (Cannon 2002). When medicating a lot of birds in an entire aviary it may be placed in the water however this is an unreliable method as it is hard to determine whether each bird has received its correct dosage (Cannon 2002). (Refer to appendix **Section 8**, 8.3 for oral medications).

During treatment time:

Minimise stress
Cease breeding
Improve diet
Conduct a thorough disinfectant regime every two weeks
Provide protection & security
No new introductions
(Cannon 2002).

Prevention
Prevention is hard in tackling in this disease as there is no definite measure however good record keeping along with knowing your birds and appropriate hygiene would be the first course of action.

OH&S Zoonotic disease
Gloves and masks must be worn whenever dealing with infected birds. Appropriate sterilisation of utensils and infected materials is absolutely necessary.

Paralysis Syndrome
Cause
Paralysis is thought to be associated with vitamin E and selenium deficiency (Cannon 2002). Paralysis can also be related to intestinal damage caused by Giardia infections (Cannon 2002). A virus is suspected as the cause agent but has not yet been identified (Cannon 2002).
Signs
Trembling, wobbly gait, in-coordination, reluctance to walk, lying on the floor with feet clenched, abnormal head movements (Cannon 2002).
Treatment
In the early stages of the syndrome, an injection of selenium or oral Vitamin E supplement may be successful (Cannon 2002). Physiotherapy is the next course of action and should commence immediately by bicycling each leg and clenching and unclenching the feet several times a day (Cannon 2002). Water with added electrolytes should be given as well (Cannon 2002).
Prevention
Foods high in Vitamin E & Selenium.

Psittacine Beak Feather Disease PBFD (Cirocovirus)
Cause
PBFD is caused by Cirocovirus that generally affects young birds under the age of one (Cannon 2002). It is present naturally in wild parrots in Australia; these parrots are thought to be the main contributors of the disease. It is transmitted by natural airflow via infected discharge in the form of salvia, tears, droppings and crop contents (Cannon 2002). It can also be transmitted in the form of dust particles (Cannon 2002).

Signs
- Abnormal feather growth particularly of primary feathers
- Loss of powder on down feathers
- Dirty plumage
- Patches of white feathers where there should be green feathers
- Bald patches on the body
- Susceptibility to secondary infections
- Diarrhoea
- Conjunctivitis
- Abnormal urates/urine

(Cannon 2002).

Treatment
Unfortunately there is not treatment for this disease (Cannon 2002). PBFD can be diagnosed by a blood test, specifically using immunoperoxidase staining (Forbes & Altman 1998). The outcome of this disease will progress for the entire life of the bird with progressive feather loss (Forbes & Altman 1998). Euthanasia should be considered of infected birds (Forbes & Altman 1998)

Prevention
All birds should be tested for PBFD before entering a colony (Forbes & Altman 1998).

Bacterial Infections
Cause
There are two grouping of bacteria's which is extraordinarily diverse; Gram-positive & Gram-negative bacteria's (Cannon 2002). The one which causes most of the illness seen in birds are gram-negative bacteria (Cannon 2002). The most common bacteria's cause septicaemia which make the bird very ill (Cannon 2002).

Signs
- Generally ill bird
- Ruffled feathers, huddled
- Conjunctivitis
- Feather loss around the eyes
- Nostrils plugged
- Conjunctivitis
- Sneezing
- Soiled vent
- Diarrhoea
- Excessive urine in droppings
- Sinusitis
- Depression
- Weight loss

(Cannon 2002).

Treatment
The type of antibiotic treatment used will depend on the bacteria identified; this will be determined by the veterinarian (Cannon 2002). Diagnosis will be via swab tests that will then need to be sent to laboratories for a culture growth alongside a sensitivity test will be performed for appropriate diagnosis (Cannon 2002).

Prevention
Appropriate hygiene is critical of food and water bowls, cages, perches, everything associated with *G. concinna*.

Yeast Infections

Cause

Yeast infections or (Candidiasis) can occur in the bird's body from the mouth all the way to the gastrointestinal tract to the cloaca (Gelis 2007). This organism thrives in high sugar environments where the diet is unbalanced in relation to trace elements and vitamins (Gelis 2007). The organism essentially affects the tissues lining the gastrointestinal tract allowing yeasts and a bacterium's to attach themselves (Gelis 2007). Hand raised chicks are often very susceptible if food is not made fresh daily and if chicks are not cleaned after their feed (Gelis 2007). Infected chicks will lose weight have a slow emptying crop and cry often (Gelis 2007).

Signs

- Pale or cheesy deposits in the month, tongue or corners of the beak
- Vomiting
- Weight loss
- Appear dirty around the mouth

Diagnosis

This requires a microscopic swab of the mouth, crop or faecal sample (Gelis 2007).

Treatment

This involves the use of antifungal drugs such as 'nystatin' in simple cases or an 'azole' antifungal; nevertheless this will be determined by the veterinarian (Gelis 2007).

Prevention

Appropriate diet and good consistent hygiene practices is the key along with reliable knowledge (Gelis 2007). It should also be noted that prolonged use of antibiotics can make birds more susceptible to yeast infection thus probiotics will need to be used in conjunction with any antibiotic therapy (Gelis 2007).

8.5 Quarantine Requirements

New additions of *G.concinna* should always include a quarantine period (1999 – Department of Natural Resources and Environment). This period will help to identify any illnesses the birds may have before they enter the resident collection (1999). Depending on where the birds have come from will determine the quarantine period. If they have come from a zoo that your institution is affiliated with and health records are up to date they probably do not need to go into quarantine. However, if they are coming from an unknown source, they should be kept in quarantine for a minimum of 6 weeks as this is the minimum period where a possible psittacosis infection is treated (Hammond 2010).

Once the appropriate quarantine period has finished, the birds should then be released (soft release) early in the day to allow them to accustom to their new environment (1999).

9 Behaviour

9.1 Activity

Most of the behavioural observations of *G. concinna* have been observed from individuals in captivity (Higgins 1999).

G. concinna is overall quite an active bird like all other lorikeets (Higgins 1999). Most feeding activity is associated in the early to late morning for *G. concinna* but flocks have been observed to be feeding all day (Higgins 1999). Depending on the availability of food, weather conditions *G. concinna* can potentially be active all day. From my experience, *G. concinna* can be triggered within their reproductive season to breed. Triggers can include increasing food (fruits, nuts, seedling grasses), addition of nest boxes and increasing native flowers have been known to stimulate breeding.

9.2 Social Behaviour

G. concinna are a fairly social species usually seen in pairs in captivity and pairs or in flocks in the wild (Higgins 1999). Information on their social behaviour in the literature is quite depauperate. They are known to socially play within a flock, bathe as well as roll around in wet foliage (Higgins 1999). When feeding, *G. concinna* are known to show much aggression to other birds and conspecifics (Higgins 1999). Aggression is also seen to conspecifics at roosting time/ late afternoon (Higgins 1999). When *G. concinna* is alarmed, they tend to swoop down from trees and rapidly fly off (Higgins 1999). When *G. concinna* is occupied by feeding, they can be approached (Higgins 1999).

9.3 Reproductive Behaviour

In my experience, *G. concinna* are known to increase in their already aggressive behaviour in their breeding season to conspecifics and especially other bird species. In the wild it was observed that a pair of *G. concinna* drove away a pair of Australian Ringnecks *Barnardius zonarius* from a nest hollow (Higgins 1999).

In captivity, they naturally tend to dominate aviaries, especially during their breeding season. Courtship displays made by *G. concinna* tend to include head bobbing with neck arched, pupils dilating which is sometimes followed by whistling calls (Higgins 1999). Allopreening is often seen between pairs occurring in the evening before settling themselves in for the roost (Higgins 1999). Often interactions such as allopreening after feeding, calling, touching each other and sitting close to one another can often be observed among individuals (Higgins 1999). Copulation has been observed, where a male followed a female while head bobbing, the male then briefly held the female down with one foot before releasing her then continued to mount her once again (Higgins 1999). Copulation was noted to be short lasting around 30 seconds which was followed by individual's preening each other after and before copulation (Higgins 1999).

9.4 Bathing

G. concinna like all other lorikeets species are renowned for loving to take baths. Having a facility that acts as both a water bowl and bath station in captivity is an essential. Also the behaviour exhibited by *G. concinna* when they take baths could also be an indicator of good health. Individuals should at least wash/bathe once a week at all times throughout the year. Individuals have known to bathe at least 3 times a week in summers which are all good indicators of healthy birds. Information regarding good signs of health (refer to **Section 8** of manual). The bowl should be at least 3 times the length and width of an individual *G. concinna*, with a depth of at least half the length of *G. concinna* (so it is not too deep for them so they don't drown themselves or swallowing any water into their lungs). It should be cleaned thoroughly everyday to uphold a high level of hygiene, preferably avoid using chemicals daily (for cleaning regime refer to section 5).

9.5 Behavioural Problems

Behavioural problems can be associated with an unhealthy *G. concinna*. Abnormal behaviour can include, screaming, social regurgitation and serve aggression to conspecifics (Cannon 2002). The latter sign may be quite difficult to determine as a result of the nature of lorikeets and their already quite dominating personalities (Cannon 2002). Depending on the situation, observations of the behaviour at any particular period along with any other physical signs that *G. concinna* may be presenting should be assessed. (Refer to **Section 8.1**, Daily checks for a full coverage of signs to look for if behavioural problems do arise).

9.6 Signs of Stress

Signs of stress in captivity can include any deviation from normal behaviour. Abnormal behaviours can include:

- Excessive screaming
- Severe aggression
- Severe submission
- Fluffed up appearance
- Ceasing to eat
- Dirty plumage/ no desire to preen feathers

(Cannon 2002).

Signs of stress may occur from other *G. concinna* or other conspecifics in the aviary or it can be a result of the environment (temperature, weather, wind, etc) or the individual may be sick. It is essential to figure out where the stress factor is arising from. This may be difficult but unless it is not observed, time should be allocated into watching the individual in order to figure out the cause of the stress and develop a preventative measure accordingly. Refer to **Section 8** –Health to determine whether it's a problem arising from ill health or the environmental which *G. concinna* is presently in.

9.7 Behavioural Enrichment

Enrichment must be provided to *G. concinna* as keepers have an inherent responsibly to provide birds with stimulation as a result of keeping them in captivity. Keeper creativity is to be encouraged. Behavioural enrichment must be provided in the form of native browse and flowers (refer to **Section 6** – diet). Refer to **Section 6.4**, for a list of enrichment alternatives. Since these species are quite active and intuitive birds a minimum of one new enrichment item should be placed with the birds in order for them to maintain a healthy and stable mind. Flowers and browse should be given weekly for the bird's health and greatly increases the time of bird's activity on display if placed in a central location within the aviary. A combination of shade and sunlight would be a beneficial location.

Figure 9.1: Author created enrichment feeding flower station for *G. concinna*.

9.8 Introductions and Removals

Introduction should always occur at the beginning of the day once any quarantine period has ceased. Strict monitoring throughout the day should occur and the following days to come preferably from a location where the birds cannot see you. Removals should also occur early morning.

9.9 Intraspecific Compatibility

Relations between parents and young are known to be quite compatible. Behaviours like begging (young begging via vocalizing and adopting a hovering stance while quivering with partly spread out wings) can often be seen (Higgins 1999). In captivity it has been noted that parents may become aggressive to young pushing them to fledge earlier and also after fledging thus observation of such instances like these should be noted and action to remove juveniles if behaviour continues (Higgins 1999).

The Issue of putting a lot of same sex individuals together has not been seen to be extremely detrimental but if two males are put in an enclosure with one female it should not cause any dramas with *G. concinna.* Nevertheless, strict observations should be made throughout periods of the day to assess levels of aggression between any of the individuals involved. As a general rule of thumb, providing equal sex ratios will tend to be the most effect way of equalizing intraspecific conflict with *G. concinna*.

9.10 Interspecific Compatibility

G. concinna in my experience has shown me that they are quite territorial in terms of their chosen nest site and over food and over browse at times. If appropriate aviary dimensions along with species compositions and numbers are not too small and crowded there shouldn't be any problems. At one particular institution they are housed with, Eclectus parrots *Eclectus roratus,* White-tailed Black Cockatoo *Calyptorhynchus baudinii*, Princess parrot *Polytelis alexandrae*, Stone Curlew *Burhinus oedicnemus* and the Australian King Parrot *Alisterus scapularis*. They tend to live quite harmoniously in this particular situation. Any diseases can be passed on from species to species in such exhibit, thus the appropriate preventative measures should be taken to all species (Refer to section 8- Health).

9.11 Suitability to Captivity

In my experience, *G. concinna* is an absolute delight to be kept in captivity. They are known to be a relatively easy to be kept in captivity. Apart from their bold, boisterous and sometimes aggressive personality (which are not uncommon behavioural characteristics of all lorikeet species worldwide). I haven't encountered any institutions that have any difficulties with keeping *G. concinna* in captivity.

10 Breeding

10.1 Mating System

The mating system seen in *G. concinna* is known to be monogamous, with pair bond quite strong (Higgins 1999). Pairs have known to stay close together in captivity and the wild (Higgins 1999).

Further genetic studies need to be conducted to have a more accurate knowledge of the mating system of *G. concinna* in captivity and the wild to analyse whether it's truly monogamous.

Like with all birds, a pair will have to form a 'Bond' before breeding can commence (Low 1978). This decision will determined by the individuals held in captivity and knowledge of any associated bonding behaviour should be recorded consistently

10.2 Ease of Breeding

Through personal experience of asking various institutions located in Sydney on the status of *G. concinna* breeding is quite good. Most institutions are able to have breeding successes once every season with chicks being hand-raised or left to be raised by the parents. From personal experience since *G. concinna* are known to be a relatively easy species to breed. Increases in food can be one trigger when given close to the beginning of the season. Along with all the fundamentals, such as large aviary space, good nest boxes and nesting material, appropriate diet both captive & wild, availability of browse (*Grevillea, Callistemon* and *Eucalyptus*, refer to diet **Section 6**) and a bonded adult pair, breeding should occur within the season.

10.3 Reproductive Condition

10.3.1 Females

For females to breed they will need to be in a healthy robust condition. This will be determined from their behaviour, general appearance, appetite and various other factors. (**Section 8**, refers to assessing the health of *G. concinna*). These factors should be known in order to make an accurate assessment of whether the birds in question are in a good reproductive condition.

10.3.2 Males

As mentioned above for females, males should also present healthy, vibrant conditions before commencement of breeding to ensure a high reproductive success in any season.

10.4 Techniques Used to Control Breeding

Two recommended techniques used to control breeding in *G. concinna* could be, egg removal and separation of the sexes. Culling new born birds is not a necessary option if appropriate management of the birds is conducted in the breeding season and to be honest is absolutely unnecessary as the excess birds can be sent to other institutions or can be

sold to the public as a last resort. To remedy this problem do not put males and females together.

Removal of the eggs which can be conducted by keepers on a scheduled day once a week during the breeding season is the most desired option. Nest box checks should be conducted once every week during the breeding season on a scheduled day preferably. Nest box checks however should occur throughout the whole year at least twice a month to ensure birds get accustomed to keepers checking their nest boxes. This will ensure the birds will not become extremely stressed when keepers are checking the nest boxes during the breeding season and especially when chicks are checked upon later in the reproductive period.
Separation of the sexes (if known) is also an option if there is available aviary space within the institution. Individuals may be returned once the breeding season is over. This technique may not also work as 'bonded' individuals may breed even when their breeding season has ended when they are reunited but through keeper observations and nest box checking should be suffice.

10.5 Occurrence of Hybrids

In the literature there have been know hybrids between *G. concinna* and Scaly-breasted lorikeets at Perth Zoo in 1970 to 1974 (Low 1978). They have also been known to hybridize with Rainbow Lorikeets (Higgins 1999).

10.6 Timing of Breeding

The breeding season for *G. concinna* ranges from August to January (Beruldsen 2003, Higgins 1999). Breeding has also been known to be associated with *Eucalypts* flowering in Northern Australian (Higgins 1999). In NSW, breeding has been recorded through July to October (Higgins 1999). In Vic, there have been recorded breeding from August to March, SA from August to December (Higgins 1999). In Tasmania, from October to December (Higgins 1999).

10.7 Age at First Breeding and Last Breeding

Generally, age at first breeding is around 12-15 months of age for *G. concinna* (Higgins 1999). The earliest known breeding age of *G. concinna* has been 12 months in captivity (Higgins 1999). Most do not however breed till they are around 2 yrs of age (Higgins 1999). At this point in time a gap in the literature exists for the oldest known breeding age of *G. concinna*.

10.8 Ability to Breed Every Year

G. concinna is known to generally breed once a year; there have been instances that they have breed twice in the literature (Beruldsen 2003).

10.9 Ability to Breed More than Once Per Year

In my experience, I have known *G. concinna* to breed twice a year in favoured conditions at some institutions in NSW. Since, *G. concinna* are a relatively easy species to breed in captivity, availability of nest boxes, nest material, food, browse, flowers if given to the

birds in their respective breeding season can generally enable good reproductive success. *G. concinna* have known to produce two clutches in a breeding season in an institution in NSW (Oates 2010).

10.10 Nesting, Hollow or Other Requirements

G. concinna in the wild have been known to create their nests in hollow of trees, stumps or fence posts (Beruldsen 2003). Nests in the wild are generally found unlined and usually ranging to a height of up to twenty-five meters above the ground usually in a tree (Beruldsen 2003). Eggs, are known to be laid on soft material like wood dust, 0.5 to 1.5 meters in from the hollow which may accumulate from the sides of the hollow (Beruldsen 2003). They will choose trees in open forest, typically where they are found (Beruldsen 2003).

Nesting facilities for the captive a management of *G. concinna* were spoken in detail in section 4.8 above. One source mentions that generally nest boxes should be positioned to the north, but whether this is the case for *G. concinna* it is nevertheless unknown in the literature.

10.11 Breeding Diet

As associated with any animals breeding event an increase in the regular food should be given to the parents (refer to section 6 for recommended diet for *G. concinna*).
Some known triggers for *G. concinna* are:

- Eucalypt flower buds
- Any of the mentioned Native Flowers (refer to section 6)
- Nuts
- Insects (Mealworms)

This addition of mealworms or maggots may be beneficial (Low 1978). All bran however must be cleaned off mealworms prior to feeding (Low 1978). One source mentioned soaked bread with powdered milk and some nectar may be added the diet as a well deserved treat for the parents during this period, refer to 6.4 for some more enrichment ideas that may be used as triggers (Low 1978).

10.12 Incubation Period

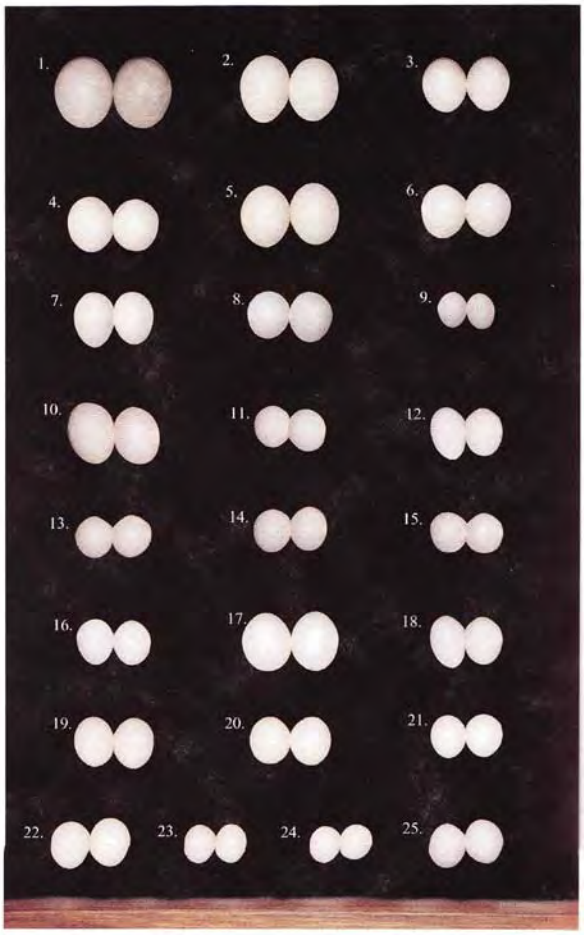
The incubation period for *G. concinna* has been noted to be 22-23 days but can range from 19 to 30 days (Higgins 1999, Low 1978). In the wild, females incubate at the nest site (i.e. hollow) with males roosting at there at night (Higgins 1999).

10.13 Clutch Size

The clutch size for *G. concinna* is usually 2 eggs in a season (Pizzey 1997). However, one source has written in the literature that it may be four but the general consensus is two (Higgins 1999).

The eggs of *G. concinna* are round to oval, smooth, close grained, white (Higgins 1999). They are known to become soiled when incubated (Higgins 1999). Measurements of eggs: 25.2 (0.81; 23.9-26.7; 12) × 20.9 (0.57; 20.1-22.1) (Higgins 1999).

Figure 10.1 Show *G. concinna* eggs: Number 22 in colour tablet.



(Source: Beruldsen 2003).

Eggs are known to be laid at intervals of 2-3 days for *G. concinna* (Higgins 1999).

10.14 Age at Fledging

The average fledging period for *G. concinna* is 48 days, but can range from 45-50 or even up to 57-58 days (Higgins 1999).

10.15 Age of Removal from Parents

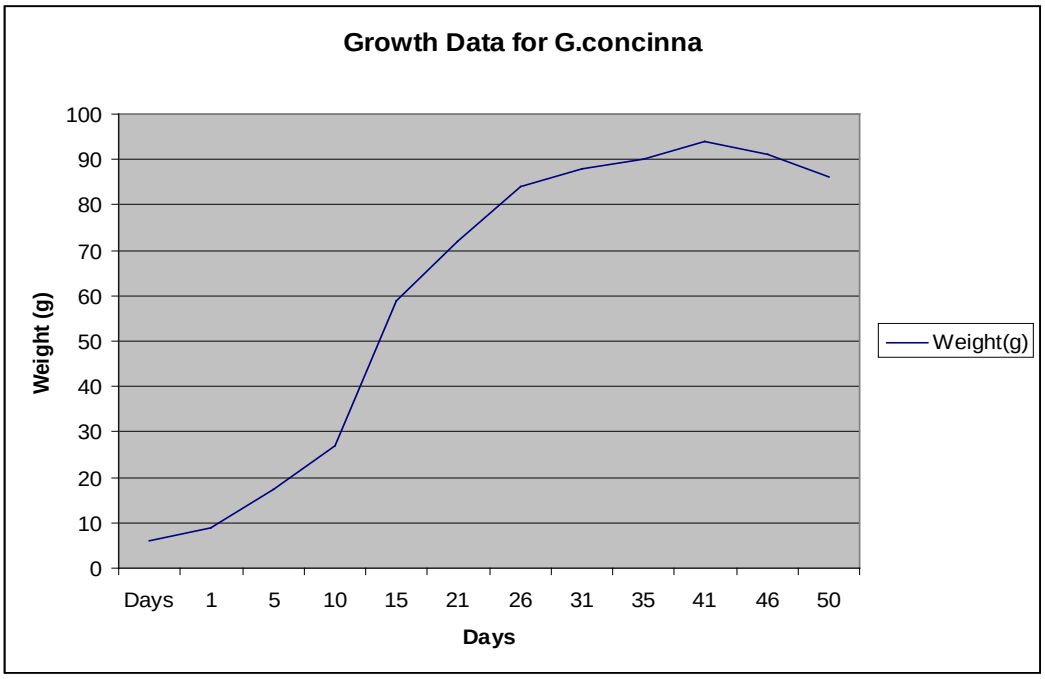
Removal of young will be dependent on whether there is any negative behaviours being directed to the young by either of the parents (Low 1978). There have been instances in other species of lorikeets that this has occurred but no information of this exists for *G. concinna* in the literature so far (Low 1978). Encouragement of such behaviour if observed should be noted in the future with the young birds removed before the next breeding season in the event of such a situation arising.

10.16 Growth and Development

Development of *G. concinna*

The young of *G. concinna* are known to hatch in a silvery-white down with their secondary down developing at around 12 days (Higgins 1999). The juveniles eyes begin to hatch at around 14 days with pin-feathers developing a few days later (Higgins 1999). An example of the means average of three chicks raised in captivity at day 1 to 55 days old are in the figure below 10.1, notice the rapid increase after day 10 till around day 41 (refer to appendix **Section 10**: 10.1 for raw data results) (Higgins 1999).

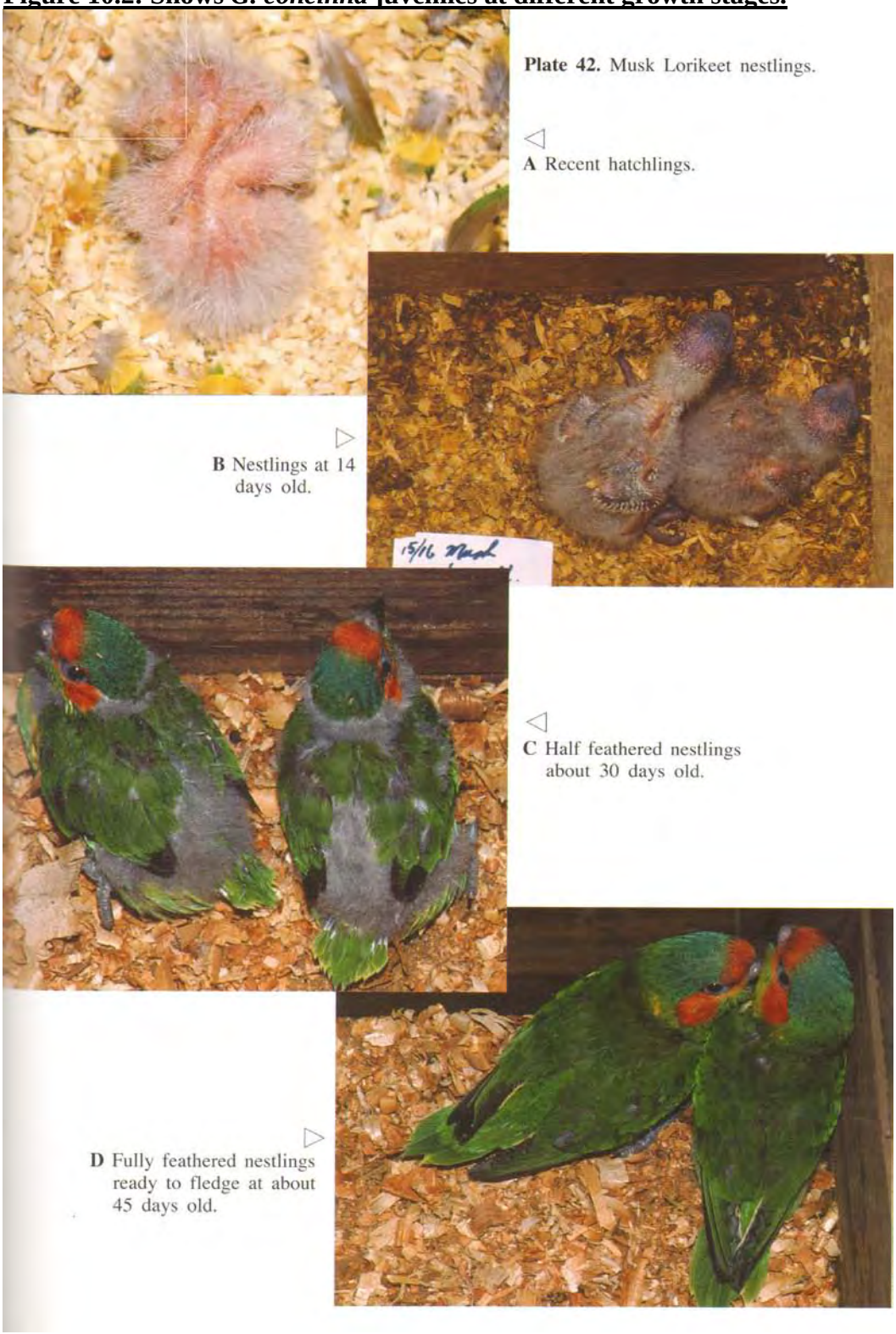
Table 10.1: Shows average weight of 3 chicks raised in captivity.



(Source: Higgins 1999).

The above data and figure 10.2 (below) may be used as a guide and or reference if hand raising *G. concinna* in order to assess if appropriate weight gain is being achieved.

Figure 10.2: Shows *G. concinna* juveniles at different growth stages.



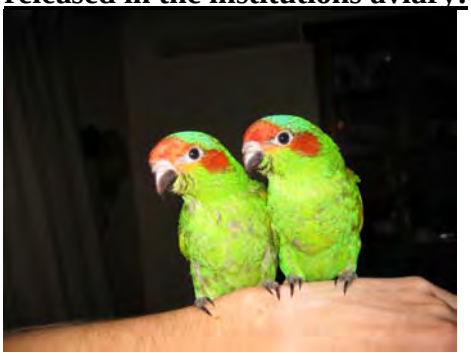
(Source: Sindel and Gill 2007).

Here are some photos of a colleague hand raising some *G. concinna*:

2 Weeks of Age:

Weeks 3 to 7: Chicks begin to develop adult feathers:

Weeks 10-12: In there weaning period, were able to fly but still to young to be released in the institutions aviary:



11 Artificial Rearing

Note: The author has not personally hand-raised *G. concinna* however the information below is current and of a reliable nature and should be applicable to this species.

11.1 Incubator Type

In terms of incubators four options are available, Hand-turn versus Auto-turn and Fan forced versus Still-air (Digney 1998). Hand-turn incubators are quite old fashioned and are generally not used as they require manual turning and an Auto-turn is a more desired option (Digney 1998). Fan forced incubators are also more desired over Still-air as they allow consistent ventilation and temperature readings (Digney 1998). In the literature a popular brand for incubators that would be suitable for *G. concinna* is Brinsea (Refer to **Figure 1**: For an example of one of the incubators by Brinsea that could be suitable for *G. concinna*) (Digney 1998, Gage & Duerr 2007).
(Refer to appendix **Section 11**, 11.1 for a table describing current incubators and brooder by Brinsea available on the market). Also, (refer to appendix **Section 11**, 11.2 for Australian Distributor of Brinsea Incubators and Brooders).

Brinsea is known for creating incubators which best simulate natural incubation (Gage & Duerr 2007).

Figure 1: Octagon 20 Advance with Autoturn Cradle – Example of the many incubators on the market that could be suitable for *G. concinna*.

Source: http://www.brinsea.co.uk/products/octagon-20-advance-with-autoturn-cradle/316/.

11.2 Incubation Temperatures and Humidity

Before any incubation should commence a thorough understanding of the incubators instructions is vital (Sindel and Gill 2007). A through clean of the incubator with a disinfectant is necessary and monitoring the incubator 24hrs before the eggs are placed into the incubator is a good idea to assess that all the machinery is working properly (Sindel and Gill 2007).

A temperature suitable for lorikeet eggs is 37.2°C (99°F) although some breeders prefer temperatures of 0.2°C (0.5°F) lower or higher (Sindel and Gill 2007). The temperature and humidity will really depend on the size of the egg (i.e. larger eggs will require it cooler whereas smaller eggs will require it to be slightly warmer) (Andrews 2000, Brown and Robbins 2002). Two thermometers should be used, one as per incubator and one placed on the egg rack (Sindel and Gill 2007, Gage & Duerr 2007). A recommendation for a second thermometer is that generally the temperature on the actual egg rack is different to the reading that is from the one built in the incubator and has a usual difference of 0.4°C (1°F) (Sindel and Gill 2007).

The relative humidity should be around 55%, however it can be advisable to have it a few points higher or lower, the corresponding wet bulb thermometer reading should be 29°C (84°F) to 32.1°C (88°F).

Turning is also fundamental and eggs should always be turned at least three times a day, from approximately 45° angle in one direction to 45° angle in the other commencing 24hrs after incubation (Sindel and Gill 2007). Additional turning is advantageous; there should always be an odd number of turns each day so they don't lie in the same position for too long (Sindel and Gill 2007).

11.3 Desired % Egg Mass Loss

Before fresh eggs are placed into the incubator, they should be lightly cleaned and their weight recorded so their weight loss can be recorded accurately (Sindel and Gill 2007). The ideal weight loss during the entire incubation period is 16% (Sindel and Gill 2007). An accurate set of scales is necessary to calculate the desired weight loss (Digney 1998). Steps in weight loss assessment:

- Weight the egg on Day 1
- Subtract 15-17% of that weight
- The result is the desired weight at external pip
- The 15-17% of weight needs to be divided by number of days from zero to external pip (2 days minus incubation period).

(Digney 1998).

The egg should be weighted 3 days after incubation and compared with the theoretical weight loss for the 3 day period (Sindel and Gill 2007). If not enough loss has occurred the humidity is too high and should be reduced, if the weight loss is too low, the humidity should be raised as the egg is drying out quicker (Sindel and Gill 2007). This should be checked every couple of days and temperature and humidity should be adjusted accordingly (Sindel and Gill 2007).

11.4 Hatching Temperature and Humidity

For *G. concinna* the temperature should change around 3 days before the hatch date.

The incubation period for *G. concinna* is 20-23 Days. Thus, at **Day 20** do the following:

- Increase humidity from 55% to 75%

- Wet Bulb thermometer reading should be 33.3°C (93°F)
- Turning should cease
- Eggs should be placed on a mesh substrate to allow full ventilation around the egg (Sindel and Gill 2007).

A separate (hatcher) brooder is required if alot of eggs are being incubated (Sindel and Gill 2007). This is because once some eggs start hatching around other eggs that are still being incubated; they compromise the still developing eggs by increasing the humidity in the incubator (Sindel and Gill 2007).

11.5 Normal Pip to Hatch Interval

This interval should be around 3 days before the actual hatch date but this can vary in certain cases (i.e. larger eggs or smaller than average eggs) (Sindel and Gill 2007).

11.6 Brooder Types/Design

Like incubators there are many brooders on the market so it's really up to the individual. A fan forced brooder with a thermostatic control is the preferred option (Digney 1998). An appropriate and well known brooder could be the 'New Octagon 20 Parrot Brooder' by Brinsea, (refer to appendix **Section 11**, 11.3 for a website address on information about this particular brooder) (Digney 1998).

11.7 Brooder Temperatures

Brooder temperatures at this early stage of one or two weeks are critical and even the slightest increase or decrease in a single degree can cause some undesired effects which include the following, decreased weight gain and decreased crop motility (Digney 1998).

These two effects are directly linked. Like for example, if a chick is to cold it will use its energy to keep itself warm rather than spend the energy on digestion (Digney 1998). This occurs vice versa if the chick is too hot; it will waste a lot of energy on trying to find a cooler area, thus wastes its energy on this activity creating a potential weight gain and stress consequently all leading to decreased crop motility (Digney 1998). The best temperature is somewhere close to the recommended setting and where the chick sleeps most of the time (Digney 1998). Visual observation is also extremely important in brooding, as this should always be done in conjunction with setting and establishing the correct temperature (Digney 1998).

For example, if a chick is shivering it is too cold and increasing the temperature slightly is the next course of action. If the temperature is too hot the chick will be panting, the temperature must be reduced immediately (Digney 1998).

The following temperatures can be used as guidelines =

- Newly hatched = **36.6°C**
- 5-12 Days = **35 to 31.6°C**
- 12 Days to Pin Feather = **31 to 28°C**
- Feathers begin to cover most of body = **26.5°C**

- (Digney 1998).

The temperature becomes less of an issue when the chick is at a late pin feather stage; at this point it may already be able to thermo regulate by itself (Digney 1998). Nevertheless, **OBSERVE** your *G. concinna* (Gage & Duerr 2007).

Another key consideration is that the brooder should also be quite dark, thus simulating their natural nest environment (Digney 1998). If the brooder is one that uses a light source as the main heating element the light should be dimmed or diffused in some way (Digney 1998).

Humidity is not as important in brooding as it is in incubation but if a homemade brooder is used a small bowl (i.e. the size of a butter lid) of water should be used to generate humidity (Digney 1998).

Another consideration is if there is only one chick (being reared from the incubator or pulled from the nest), a soft toy should be given as this allows the young one a 'buddy', giving it a sense of security satisfying it with a companion and mother (Digney 1998).

11.8 Diet and Feeding Routine

There are a lot of different formulas on the market available for rearing *G. concinna*. Options can include, (Vetafarm – Neocare or Handrearing mix), Pretty bird or Loristart, refer to appendix for stockists (refer to **Section 11,** 11.4 for the above listed formula stockists) (Digney 1998). When choosing a formula make sure it relates to the age of the bird (i.e. Vetafarm, Neocare is suitable for new born hatchlings after 24hrs once the birds have passed their first faeces along with having an electrolyte solution. Whereas, the Handrearing mix by Vetafarm can be used for *G. concinna* once its 7 to 10 days old up until weaning). The formulas made by Pretty bird come in different concentrations for different age groups also.

All of these contain the required amounts of nutrients and trace elements necessary for growing chicks (Digney 1998). Shown below are the different protein, fat and fibre concentrations of the above mentioned formulas.

Brand	**Protein**	**Fat**	**Fibre**
Vetafarm - Neocare	21%	17%	3%
Vetafarm – Hand Rearing Mix	21%	8%	5%
Pretty Bird	19%	8/12/15%	2%

(Digney 1998).

A colleague of mine, reared two *G. concinna* with (Vetafarm – Parrot Handrearing Mix) together with probiotic from 2 weeks onwards (these birds are pictured in figure 10.2 above) (Oates 2010).

One condition when preparing formulas is never to add boiling water to the mixture as this essentially extinguishes all the important nutrients and minerals in the formula (Digney 1998).

The temperature of the formula is extremely important as *G. concinna* or any lorikeet or parrot chicks will not take the formula if it is cold. It must be around 39 to 43°C in order for the juvenile to accept the food (Gage & Duerr 2007).

Depending on whether the chick is pulled from the nest or if it was artificially incubated from the beginning will determine the feeding schedule. New hatching's a day or so old will need at least a feed every two hours (or when the crop empties) (Gage & Duerr 2007). A good plan would be to continue this every 2 hrs around the clock for 7 days (Gage & Duerr 2007). After this time, the chicks should have a steady weight gain between 7 to 10 days (Gage & Duerr 2007). Feeding at regular intervals throughout the day and decrease times during the night after this point, refer to 11.1 Table below (Gage & Duerr 2007). My preferred method would be to use a spoon, that way you're not forcing any food down before the chick gets to swallow plus you build a response relationship with your *G. concinna* (Gage & Duerr 2007). Always allow enough time for the baby to swallow before offering again (Gage & Duerr 2007).

11.1 Table of a feed interval regime for *G. concinna*:

Day 1 - 8	2 Hr Feeds
Day 8 - 14	3 - 4 Hr Feeds
Day 14 - 24	5 Hr Feeds
Day 24 - 30	8 Hr Feeds
Wean	**2 Feeds a Day**

(Source: Digney 1998).

The above table shows that from day 1 to day 8, feeds should occur every two hours. As of day 8 to day 14 it should reduce to 3 to 4 hrs between every feed. Then as of day 14 to day 24, feeds should occur every 5 hrs then from day 24 to day 30 it should reduce to 2 feeds per day (Digney 1998).

Note: Feeding requires patience and this is essential when raising young. If this is not suitable in the workplace alternate measures should be taken in raising the young, (i.e. leaving with parents or transferring to other zoos).

11.9 Specific Requirements

Other specific requirements when incubating and brooding that have not yet been discussed are:

- Containers
- Bedding

(Digney 1998).

When choosing containers, ice-cream containers are cheap and easy to clean and become great homes for *G. concinna*. Advantages of this type of container are:

- Helps the chick to sleep upright (so that it doesn't run the risk of aspirating while sleeping filling it's oesophageus back up with food from the crop).
- Helps the chick prevent splayed legs which results from constant sliding out under its belly.
- Chick will feel secure if it has a buddy, refer to 11.7.

(Digney 1998).

In terms of bedding, the first few days tissues can be used a couple layers thick (Digney 1998). Once the chick enters the growth phase (i.e. pin feathers developing), saw dust or hay can be used (Digney 1998). However, the saw dust bits must not be too small or too large; as if they are too small they will produce airborne dust and run the risk of entering the respiratory tract (Digney 1998). If they are too large, *G. concinna* may chew and swallow sharp pieces causes damaged to the oesophageus or crop (Digney 1998). Either way the choice is up to you, I personally haven't heard that this may happen with *G. concinna* but be aware nevertheless (Digney 1998). A toxic free substance should always be used (i.e. check packaging) (Digney 1998).

11.10 Pinioning Requirements

Pinioning is the act of surgically removing the pinion joint (which is the furthest part or a bird's wing) as a means of preventing flight. Personally unless the *G. concinna* has wings that have been damaged pinioning should not be an option. It is typically done privately with a variety of companion birds nevertheless.

11.11 Data Recording

Good records can be of value when refereeing to past successful clutches and also for communication of information with other staff members (Gage & Duerr 2007). Daily carts should include:

- Weights
- Times of feeds

This should ensure that proper growth is occurring (Gage & Duerr 2007). Weights should also be taken in the morning before a feed when the crop is empty (Gage & Duerr 2007).

Records of brooder temperatures, food temperatures, appetite, chick activity, abnormal droppings and colour should all be documented at each feed (Gage & Duerr 2007).

Example of a Report Chart for *G. concinna*:

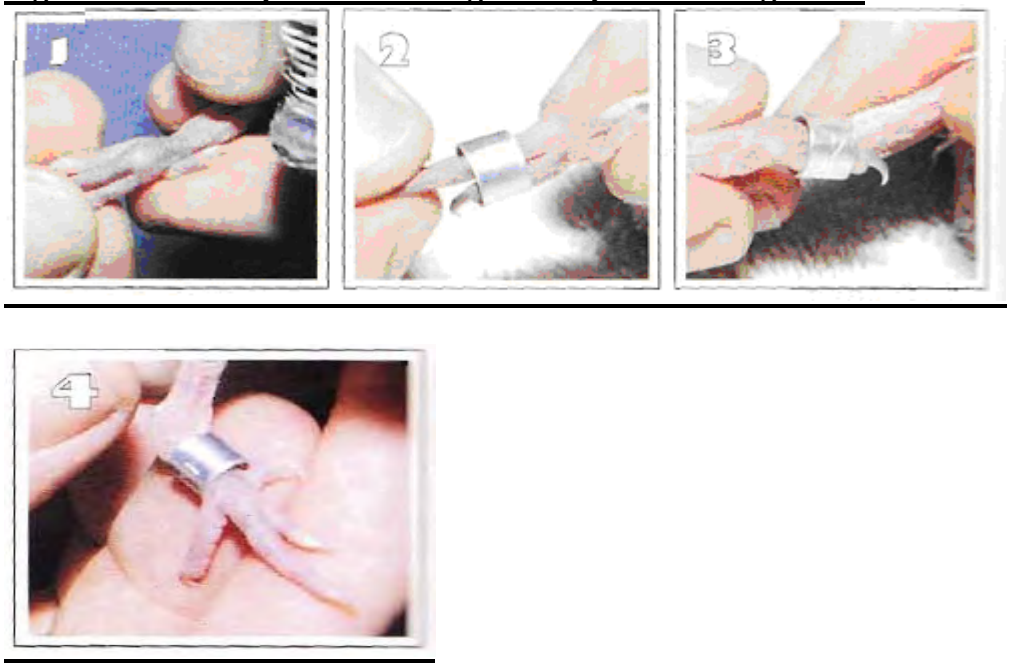
DAY	WEIGHT	FEEDS	TOTAL VOLUME
Day 1:	6g	(*Record time – mls & crop status – Empty, Not Quite Empty)	
Day 2:	6.5g		
Day 3:	7g		

(Source: adapted from Digney 1998).

11.12 Identification Methods

Leg bands can be used as a means of identifying a number of chicks from the same nest (Digney 1998). If using the closed ring it must be put on a quite a young age, refer to figure 2: when fitting these on *G. concinna*.

Figure 2: Series of photo's showing how to put on the leg band:



(Source: Digney 1998, p.g. 70).

1 & 2 – The band is placed over the three longest toes and moved down to meet the fourth toe.
3 & 4 – Gently pull the toe through the ring till the ring is correctly on the chick's leg. Otherwise plastic rings can be applied later on in the bird's life.

11.13 Hygiene

An appropriate disinfectant that can be used for sterilization of equipment both for incubation, brooding and hand rearing is the iodine based chlorhexidine (A popular brand is Hibitane, refer to appendix **Section 11**, 11.5 for Hibitane stockist) (Gage & Duerr 2007, Digney 1998).

Feeding
Before every feed, hands must be washed thoroughly before formula preparation and handling. Also when handling eggs as they are porous and with young chicks (Digney 1998).

Feeding Equipment Checklist

- Distilled water
- Formula
- Feeding Records

- Scale
- Bedding (tissue – shavings, etc)
- 1ml syringe
- Curved spoon
- Small shallow feed dish
- Measuring spoons (tsp & Tbsp)
- Measuring cup
- Disinfectant

(Gage & Duerr 2007).

11.14 Behavioural Considerations

Imprinting concerns when hand rearing lorikeets is that if they bond with one person (i.e. the keeper raising it) they become extremely aggressive to anyone else that will come along. It is vital when hand raising birds for the zoo that contact with them be kept to a minimum, whereas if they are being raised as companion birds they can have more contact but still care must be taken so that they do not bond to that person rather than the owner.

11.15 Use of Foster Species

G. concinna has been known to be used as a foster species especially when hybridizations occur with the species (Gallagher 2010). In terms of fostering *G. concinna* it may be fostered with other lorikeet species if the size of the birds is similar, like if a smaller lorikeet species were to foster a small species this can be done (i.e. if they have the same reproductive interests at heart). On the other hand if *G. concinna* were to foster a rainbow lorikeet *T. haematodus* this is not an ideal match because as the baby develops the foster parent will not be able to be meet the requirements of the baby as this is a much larger lorikeet species requiring a larger food intake than a baby of *G. concinna* (Gallagher 2010).

11.16 Weaning

The weaning process does change a slight bit when the birds are being hand fed for the public or just for zoological institutions. As one may expect that if it's being raised as a pet bird, more interaction should occur, whereas if it's not less interaction should occur.

Throughout the feeding process a small bowl with the nectar formula should be given to the birds (Gage & Duerr 2007). This can first be fed to the birds using the spoon (Gage & Duerr 2007). The chicks will show interest in this bowl soon enough, encouragement can also occur with dipping their heads into the bowl gently (Gage & Duerr 2007). Tapping the spoon on the bowl should also draw their attention to the food (Gage & Duerr 2007). Remember the food should still be quite warm as the chicks will not eat if it's cold (just like their formula) (Gage & Duerr 2007).
The process of weaning can take anywhere from 7 to 20 days or longer (Gage & Duerr 2007). At around 40 days old start introducing small amounts of fruit and vegetables (no avocado) so they can start becoming familiar with fruit, refer to section 6 (Gage & Duerr 2007). This is the time toys can be introduced as well like plastic chains, flowers (free

from insects) and wood blocks (Gage & Duerr 2007). No toys with rope or twine are appropriate at this stage (Gage & Duerr 2007). The addition of a low perch elevated at one corner of the brooder can be added (Gage & Duerr 2007).

Once *G. concinna* become fully feathered and start to become active they are ready for a small cage with low perches and food bowls located on the floor (Gage & Duerr 2007). As they become stronger, the perches and food bowls should be located higher in the cage to persuade them to climb and increase their activity levels (Gage & Duerr 2007). Exposing the birds to a variety of foods, toys and people is essential to raise a well balanced bird, refer to the below schedule (Gage & Duerr 2007).

Schedule for weaning *G. concinna* or any Lorikeet species:

- **Day 50-23** = Reduce formula by half and leave out nectar formula* (Lori mix – dry or wet but if using wet make sure it is made fresh everyday).
- **Day 55** = Introduce fruit.
- **Day 60** = Reduce the use of distilled over regular water.
- **Day 67** = Discontinue baby formula with adult food (Lori mix) plus fruit and vegetables.
- **Day 70** = Discontinue all distilled water.

(Source: adapted from Gage & Duerr 2007).

11.17 Rehabilitation Procedures

When discussing the rehabilitating procedure for *G. concinna* two things are quite important. Firstly is the *G. concinna* a juvenile or is it an adult?

If it is a juvenile comes into the institution by the member of the public I would be looking at reuniting it with its parents, so found out the location as this is really the best option if the bird is in good condition (Kennedy 2009). If a *G. concinna* does come into the institution and does look like it is injured it will need to see a veterinarian and this would be the next step. If the bird is a nestling, make a make-shift nest box out of a old plastic ice cream container, add some nesting material and then secure to a tree under foliage as high as possible to where it was found (Kennedy 2009). This should only be done once the parents have been located, (this generally takes time and encouragement of the baby to call is the first step as usually the parents are still around the area) (Kennedy 2009).

If the baby is a fledgling, you can get it to sit on the edge of a rescue basket or perch until you are sure that the parents are feeding and accepting it (Kennedy 2009). If the bird needs a few days to recover from an injury until its releasable then go back to the site and try again (Kennedy 2009). Parents will generally accept the babies back even if they have been missing for up to a week (Kennedy 2009).

For initial care (Juvenile):
If the *G. concinna* is very young place it on a heat pad or give it a heat source (40 watt bulb) preferable a coloured one as warmth is the key to its survival (Kennedy 2009). Check the temperature with your hand around the bird and its surroundings, it should feel

warm (Kennedy 2009). Add a buddy also to help calm the stress levels. Add a thermometer in to the area to check the temperature, 35°C for unfeathered (Kennedy 2009). Treat for dehydration with 'spark electrolyte', refer to section 6.3. Use a dropper and place at the sides of the beak; this may take time foe the bird to accept the solution (Kennedy 2009). If the *G. concinna* is extremely stressed then a subcutaneous injection may need to be given by a veterinarian (like Hartman's or a saline and glucose solution) (Kennedy 2009). At this point in time a wildlife organization should be contacted as keepers already have limited time and such a case requires lots of effort and time and a 'wildlife carer' would be the ideal option at this point.

Initial care (Adult):

Depending on the injury which could be temporary or permanent (this should be assessed by an experienced bird veterinarian). The result is that it may need to go into care. Thus, a small, dark and warm area should be provided if the injury is quite serious. A steady progression to a long aviary or noegel cage would be ideal. The length in an aviary is more important than width because length allows the birds to exercise their flight muscles. These need to be strong when the time to release arrives.

When rehabilitating *G. concinna* or any bird for that matter, it is generally a long process and must be done by people which have experience in this area (i.e. Wildlife carers), Thus, if in doubt contact a wildlife service if unable to devote the time or effort.

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- Lauren Oates, Keeper, Symbio Wildlife Gardens, Helensburgh, NSW.

13 References

Alderton. D. 2003. *Practical Handbook, Complete Guide to Bird Care*. Lorenz Books, London.

Beruldsen. G. 2003. Australian Birds their Nests and Eggs, *Phoenix Offset*.

Blakers. M, Davies. S & Reilly. P. 1984. *The Atlas of Australian Birds*, Melbourne University Press.

Brouwer. K, Jones. M, King. C and Schifter. H. 2000. Longevity records for Psittaciformes in captivity, *International Zoo Yearbook,* 37: p.g. 299-316.

Cannon. M. 2002. *A Guide to Basic Health & Disease in Birds, Their Management, Care & Well-being. Revised Edition.* Australian Bird Keeper ABK, Tweed Heads, NSW, Australia.

Digney. P. 1998. A Guide to Incubation and Hand raising Parrots, *ABK Publications,* p.g. 41-66.

Forbes. N & Altman. R 1998. *Self Assessment Colour Review of Avian Medicine*. Manson Publishing/The Veterinary Press.

Gage. L and Duerr. R. 2007. Hand-Rearing Birds, *Blackwell Publishing*, p.g. 255-261.

Gelis. S. 2007. Lorikeet Disease and Health Aspects, *Australian Birdkeeper,* vol 20, Issue 11, p.g. 700-703.

Higgins. P.J. 1999. *Handbook of Australian, New Zealand & Antarctic Birds: Volume 4 Parrots to Dollarbird*, Oxford University Press, Melbourne.

Hutchins. B & Lovell. 1985. Australian Parrots A Field and Aviary Study, *The Avicultural Society of Australia*, p.g. 32-34.

IATA Live Animals Regulations 36th Edition, Effective 1 October 2009- 30 September 2010.

Kennedy. H. 2009, 'Initial care for nestlings and fledglings (Altrical Birds), *Basic Training Course Manual*, Sydney Metropolitan Wildlife Service Inc, p.g. 105-108.

Low. R. 1978. Lories and Lorikeets, The Brush-Tongued Parrots, *Inkata Press Melbourne*.

Parsons. H. 1999. *Caring for Australian Native Birds*. Kangaroo Press, Australia.

Pizzey. G. 1997. The Graham Pizzey & Frank Knight, Field Guide to the Birds of Australia, *Angus & Robertson*, p.g. 269.

Sawyer. D. 2008. The Practice of Veterinary Anesthesia: Small Animals, Birds, Fish and Reptiles, *Teton NewMedia*, p.g. 300-307.

Shephard. 1994. *Aviculture in Australia Keeping and Breeding aviary birds*. Reed Books, Victoria, Australia.

Sindel. S and Gill. J. 2007. *Australian Lorikeets: Experiences in the field and the aviary*, Surrey Beatty & Sons Pty Ltd.

Steiner. C & Davis. R. 1981. *Caged Bird Medicine Selected Topics*. The Iowa State University Press, Iowa.

Internet

- BirdLife International 2009. Glossopsitta concinna. In: IUCN 2010. IUCN Red List of Threatened Species. Version 2010.3. <www.iucnredlist.org>. Downloaded on 22 September 2010

http://www.iucnredlist.org/apps/redlist/details/142409/0

- Distribution Map adapted from:

http://www.worldatlas.com/webimage/countrys/oceania/auoutlz.gif

- Material Safety Data Sheet for Chlorhexidine – Hibiclens

Accessed 23/09/10.
http://www.molnlycke.com/Global/Surgical_Products/Global/documents/HIBI/MSDS%20Hibiclens.pdf

- Brinsea Incubators & Brooders

Accessed 18/10/10
http://www.brinsea.co.uk/information/choosing-an-incubator/41/

- Legislation

Accessed 28/10/10
https://rirdc.infoservices.com.au/downloads/W97-026.pdf

- Convention of International Trade in Endangered Species of Wild Fauna and Flora (CITES) Accessed 4/10/10

http://www.cites.org/eng/app/index.shtml

14 Bibliography

Jackson, S.M. (2002) *Standardizing captive-management manuals: guidelines for terrestrial vertebrates* revised, in International Zoo Yearbook (2003) 38: 229-243, The Zoological Society of London, London.

15 Glossary

- Allopreening – mutual preening between two birds.
- Cere – a fleshy, membranous covering of the base of the upper mandible of a bird, especially a parrot through which the nostrils are open.
- Conspecifics – belonging to the same species.
- Cloaca – the common opening for reproduction and waste.
- Depauperate – poorly or imperfectly developed.
- Disaccharidases – an enzyme that catalyses the hydrolysis of disaccharides as sucrose or lactose to produce monosaccharides as fructose or glucose.
- Septicemia – the invasion and persistence of pathogenic bacteria in the blood stream.
- Soft release – when a cage is placed in the aviary with the new bird and the bird is left to leave when it is ready (i.e. door is opened). It is up to the birds to leave when it is ready.
- Sinusitis – inflammation of the sinus or the sinuses.

16 Appendix

Section: Introduction

1.1 Regional Census and Plan 2010, holdings for *G. concinna*.

Musk Lorikeet *(Glossopsilta concinna)*

- Auckland Zoo 6 0 0 10 0 0 Acquire males
- Australian Reptile Park 2 2 2 2 2 2 Maintain
- Blackbutt Reserve 1 0 2 3 3 0 Acquire or breed to requirements during 2010
- Brooklands Zoo 1 3 4 1 3 4 Purchase locally during 2010
- Cleland Wildlife Park 2 2 0 3 3 0 Acquire during 2010
- Dreamworld 0 0 5 6 6 6 Acquire
- Gorge Wildlife Park 1 1 0 1 1 0 Maintain
- Hamilton Zoo 3 0 0 0 6 0 Acquire
- Healesville Sanctuary 1 3 5 3 3 0 Delete excess juveniles
- Melbourne Zoological Gardens 0 1 1 0 0 0 Delete by attrition
- National Zoo and Aquarium 2 2 0 2 2 0 Maintain
- Rockhampton Botanic Gardens and Zoo 0 0 5 0 0 5 Maintain
- Taronga Zoo 3 1 0 10 10 0 Acquire
- **Totals 22 15 24 41 39 17**

  CITES: II ASMP Birds TAG; No Regional Program

  TAG Notes: No regional implications.

Source: http://www.zooaquarium.org.au/ASMP-Publications/default.aspx

Section 5: General Husbandry

5.1 Material Safety Data Sheet MSDS for Chlorhexidine – Hibiclens:

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION
Name: HIBICLENS®

Addresses/Phone Numbers:
Mölnlycke Health Care US, LLC
5550 Peachtree Parkway
Suite 500
Norcross, GA 30092
Customer Service: 800/843-8497
Manufacturing DPT Lakewood, Inc.
Lakewood, NJ 08701
Emergency Contact Number Infotrac 800/535-5053
Contract was signed on September 16, 2002.
Elaine Jenkins and Steve Gross are the key contacts.

2. COMPOSITION/INFORMATION ON INGREDIENTS
CAS No.: None assigned for the product
Use: Antimicrobial agent

HAZARDOUS INGREDIENT(S) CAS No. % (w/w)
Chlorhexidine gluconate 018472-51-0 4.0
Isopropanol 000067-63-0 4.0
(2-Propanol)

3. HAZARDS IDENTIFICATION
Form: Clear liquid
Color: Pink
Odor: Fragranced
Repeated or prolonged skin contact may cause irritation in sensitive individuals.
Harmful to aquatic organisms, may cause long-term adverse effects in the aquatic environment.
Date Prepared: December 16, 2004 Page 2 of 6

Name: HIBICLENS®

4. FIRST-AID MEASURES
Inhalation: Remove patient from exposure, keep warm and at rest. Obtain medical attention if ill effects occur.
Skin Contact: Wash skin with water.
Eye Contact: Irrigate with eyewash solution or clean water, holding the eyelids apart, for at least 15 minutes. Obtain medical attention.
Ingestion: Wash out mouth with water. Obtain medical attention.

Note to Physicians
Symptomatic treatment and supportive therapy as indicated. For further detail, consult the prescribing information.

5. FIRE-FIGHTING MEASURES
Flammable Properties
Flash Point (Deg C/Deg F): 64.4/148
Flammable Limits (Lower) (%v/v): 2
Flammable Limits (Upper) (%v/v): 12
Flammable Limits: (Isopropanol)
Auto Ignition Temperature (Deg C/Deg F): No data
Combustible.
If involved in a fire, it may emit flammable vapors.

Extinguishing Media
Water spray, foam, dry chemical or CO2.

Fire-Fighting Instructions
A self-contained breathing apparatus and suitable protective clothing should be worn in fire conditions.

6. ACCIDENTAL RELEASE MEASURES
Small spillages: Clear up spillages. Drench spillages with water and wash to drain.

Large spillages: Do not allow to enter drains, sewers, or watercourses. Absorb spillages onto sand, earth, or any suitable absorbent material.
Transfer to a container for disposal.
Wash the spillage area with water, and flush to a sewer services by a wastewater treatment facility.
Date Prepared: December 16, 2004 Page 3 of 6

Name: HIBICLENS®
7. HANDLING AND STORAGE
7.1 HANDLING
Avoid contact with eyes.
Follow procedures specified in the National Fire Protection Association Codes and Standards for handling flammable liquids.
7.2 STORAGE
Keep container tightly closed. Protect from light.
Storage Temperature: room temperature
8. EXPOSURE CONTROLS/PERSONAL PROTECTION
Engineering Controls
Occupational Exposure Limits
No ACGIG TLV or OSHA PEL is assigned to this mixture.
TWA STEL/CEILING (C)
HAZARDOUS INGREDIENT(S) ppm mg/m3 ppm mg/m3
Chlorhexidine - - - 0.1 COM
This is an in-house standard for the active ingredient during manufacture.
Isopropyl alcohol 400 983 500 1230 TLV
Personal Protective Equipment
Respirators: Use NIOSH approved respirator for dusts, mists, and fumes with a TLV greater than 0.05 mg/m3 in combination with an organic vapor cartridge.
Protective Clothing: Impervious gloves and apron.
Eye Protection: Chemical tight goggles; full faceshield in addition if splashing is possible.
Other Protective Equipment: Eyewash station and safety shower in work area.
Date Prepared: December 16, 2004 Page 4 of 6

Name: HIBICLENS®
9. PHYSICAL AND CHEMICAL PROPERTIES
Form: Clear liquid
Color: Pink
Odor: Fragranced
pH (Value): 5-6.5
Boiling Point (Deg C/Deg F): No data
Vapor Pressure (mm Hg): No data
Solubility (Water): Soluble
Specific Gravity: 1.06
Vapor Density (Air = 1): No data
10. STABILITY AND REACTIVITY
Stable under normal conditions.
Hazardous Reactions: Incompatible materials: Strong oxidizing agents, anionic compounds
Hazardous polymerization will not occur.
Hazardous Decomposition Product(s): Carbon monoxide, carbon dioxide, nitrogen oxides, ammonia
11. TOXICOLOGICAL INFORMATION
Inhalation: The vapor has anesthetic properties and when inhaled at concentrations above the occupational exposure limit, it may cause headache, fatigue, dizziness, incoordination, and loss of consciousness.
Skin Contact: Repeated or prolonged skin contact may cause irritation in sensitive individuals.
Eye Contact: Liquid splashes may cause eye irritation.
Ingestion: The swallowing of small splashes is unlikely to cause any adverse effects.
Long Term Exposure: Chronic effects are unlikely.
Date Prepared: December 16, 2004 Page 5 of 6

Name: HIBICLENS®
12. ECOLOGICAL INFORMATION
Environmental Fate and Distribution

The product is soluble in water.
Toxicity
Harmful to aquatic organisms, may cause long-term effects in the aquatic environment.
Effect on Effluent Treatment
Low toxicity to sewage microorganisms.
13. DISPOSAL CONSIDERATIONS
Disposal should be in accordance with local, state, or national legislation.
Disposal Method
Discarded product is not a hazardous waste under RCRA, 40 CFR 261.
Container Disposal
Empty container contains product residue. Observe all hazard precautions.
14. TRANSPORT INFORMATION
Not Classified as Dangerous for Transport.
15. REGULATORY INFORMATION
TSCA (Toxic Substances Control Act) Regulations, 40 CFR 710:
All ingredients are on the TSCA Chemical Substances Inventory.
CERCLA and SARA Regulations (40 CFR 355, 370, and 372):
This product does not contain any chemicals subject to the reporting requirements of SARA Section 313.
16. OTHER INFORMATION
This Material Safety Data Sheet was prepared in accordance with ANSI Standard Z400.1, 1993.
Date Prepared: December 16, 2004 Page 6 of 6

Name: HIBICLENS®
GLOSSARY
COM: The company aims to control exposure in its workplace to this limit.
This is an in-house standard for the active ingredient handled during manufacture
TLV: The company aims to control exposure in its workplace to the ACGIH limit.
Sk: Can be absorbed through skin.
Sen: Capable of causing respiratory sensitization
The information herein is given in good faith, but no warranty, expressed or implied, is made.

5.2 List of Website MSDS Sheets for the rest of the products named:

- MSDS Quaternary Ammonium Compounds
http://www.closedsystemlabs.com/Pdf's/MSDS%20-%20Quaternary%20Ammonium.pdf

- MSDS Chlorine
http://www.sciencelab.com/xMSDS-Chlorine_Water_Saturated-9925756

- MSDS Tertiary Amines
http://www.ilpi.com/msds/ref/amine.html

- MSDS Iodine
http://www.jtbaker.com/msds/englishhtml/i2680.htm

- MSDS Alcohol
http://www.ilpi.com/msds/ref/alcohol.html

Section 6: Feeding Requirements:

6.1 Stockist for Passwell Lorikeet mix:
http://www.petshopaustralia.com.au/prod274.htm

6.2 Stockist for Sherp's Lorikeet mix:
http://www.petshopaustralia.com.au/prod183.htm

6.3 Stockist for Avioné Lorikeet Mix
= http://www.petandgarden.com.au/browse/details.asp?ProdID=128981

6.4 Stockist Website for Vetafarm Products:
http://www.vetafarm.com.au/pages/FIND-A-STOCKIST.html

8.2 Wormout gel Stockist:
http://www.vetafarm.com.au/products/WORMOUT-GEL.html

8.3 Oral Medications for Psittacosis:

Psittacosis (Chlamydophilosis) Oral Medications that can be used are Chlortetracycline (CTC) (Aureomycin™, Tricon™). **Note:** these should always be used under the direct provision of professional veterinarian instructions.

Dose:
G. concinna = Use in Nectar Formula with 0.05% CTC for 45 days
Flock = 150mg/L of water for 45 days

Note: The CTC treatment must be made fresh everyday and provided in a glass, glazed earthware, plastic or stainless steel container only (Cannon 2002).

Intermuscular injection:
Enrofloxacin™ (Baytril)
Dose: 15-30mg/kg twice daily orally or intermusculary (Cannon 2002).

Psittavet™ injectable 50mg/ml (Vetafarm)
Dose: Manufacturer recommends using 0.1ml per 100grams body weight once weekly for 6 6-7 weeks (Cannon 2002)

Viravenos SF™ injectable 20mg/ml (Pfizer)
Dose: 0.35 – 0.5ml per 100grams body weight once weekly for 6-8 weeks (Cannon 2002).

All these drugs are light & temperature sensitive, thus the effectiveness will decrease the more time it's spend it the sun and the more it heats up so any water bowls should be placed into a shaded and preferably cool area (Cannon 2002).

Section 10: Breeding

10.1 Raw Growth Graph data

1 Day, 6.0; at 5 Days 9.0; 10 Days, 17.25; 15 Days, 27.0; 21 Days, 59.0; 26 Days, 72.0; 31 Days, 84.0; 35 Days, 88; 41 Days, 90.0; 46 Days, 94.0; 50 Days 91.0; 55 Days, 86.0 (Higgins 1999).

Section 11: Artificial Rearing

11.1: Shows current table by Brinsea on types of Incubators and Brooders.

Breeding Set Selector Chart

Product Name	Egg Capacity Hens	Egg Turning	Ventilation	Temp Alarm	Humidity Display	Auto Humidity Control	Additional Features
Octagon 10	10	Automatic	Natural	No	No	No	N/A
Octagon 20 Advance	24	Automatic	Fan	Yes	Yes	Optional	N/A
Octagon 20 Advance EX	24	Automatic	Fan	Yes	Yes	Yes	N/A
Octagon 40 DX	48	Automatic	Fan	Optional	Optional	Optional	N/A
Hatchmaker	36	Manual	Natural	No	No	No	N/A
Polyhatch	42	Automatic	Natural	No	No	No	N/A
Hatchmaster 'A'	104	Automatic	Natural	No	No	No	N/A
Hatchmaster 'H'	160	Manual	Natural	No	No	No	N/A
Ova-Easy 190	192	Automatic	Fan	Optional	Optional	Optional	N/A
Ova-Easy 380	384	Automatic	Fan	Optional	Optional	Optional	N/A
Contaq Z6	60	Programmable	Natural by Contact	Yes	Yes	Yes	3 operating modes:Contact, conventional & hatch mode.Programmable cooling periodsPower back up

Brooder Comparison Chart

ProductName	Type of Bird	Ventilation	Temp display	Temp Alarm	Humidity Display	Auto Humidity Control	Additional Features
Cosy lamp	Poultry,game and waterfowl	Natural	No	No	N/A	N/A	N/A
Octagon 20 Rearing Modue	Small parrots and birds of prey	F an	Yes	Optional	Optional	Optional	N/A
TLC-4 portable brooder	Allparrots and birds of prey. Smalladult birds	Fan	Yes	Optional	No	No	Airfiltration Quadrant nest tubs to maximise useof circular shape
TLC-5 larger portable brooder	Allparrots and birds of prey. Largeadult birds	Fan	Yes	Optional	No	No	Airfiltration Optional wire door to contain largerbirds. Floor liner

Source: http://www.brinsea.co.uk/information/choosing-an-incubator/41/

11.2 Australia Distributor Brinsea – Incubators and Brooders

Top Knot Poultry Supplies
PO Box 222
Deer Park
VICTORIA 3023
AUSTRALIA
Email: loi@tkpoultrysupplies.com.au
Tel: +61 411 720 732 (Australia call 0411-720-732)
Fax: +61 393 528 882 (Australia dial 03 9352-8882)

11.3 The New Octagon 20 Parrot Brooder

http://www.brinsea.com/pdffiles/bw%20leafs/prm.pdf

11.4 Formula Stockists

Vetafarm

- Neocare Mix = http://www.vetafarm.com.au/products/NEOCARE.html

- Hand Rearing Mix = http://www.vetafarm.com.au/products/HAND-REARING-FOOD.html

Pretty Bird = http://www.prettybird.com/index.htm

Loristat = http://www.junglegoldlimited.com/loristart.htm

11.5 Hibitane Stockist:

http://www.vetnpetdirect.com.au/HIBITANE5