

Husbandry Guidelines for the



Galah

Eolophus roseicapillus

Aves: Cacatuidae

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Disclaimer

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Annual Cycle of Maintenance for the Galah *Eolophus roseicapillus*

	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Comments
Breeding													Will vary depending upon region where housed.
Nestboxes introduced													
Preventative Medicine (bi-monthly) -weights and body condition													Will vary upon individual breeding cycles
Routine Health Checks (visual observations)													
Faecal Collection (every 6 months)													May vary upon institutions veterinary department
Vet Checks (6 months) or as needed													Before and after potential breeding period
Enclosure Renovations and general upkeep													Major renovations occur annually
Full enclosure Cleaning (every 3 months)													
Worming													Will vary upon faecal results as to when administered
Heating													Specific to colder regions

OCCUPATIONAL HEALTH AND SAFETY CONSIDERATION FOR WORKING WITH THE GALAH (*EOLOPHUS ROSEICAPILLUS*)

Risk Category: Classified innocuous although can pose injury hazards to humans such as biting.

Possible risks: Cockatoos/Galah's have large, heavy beaks and strong jaws and have the potential to inflict a bite that could amputate a person's finger if provoked. They also have sharp nails, which can scratch and/or pierce the skin.

Methods to reduce risks: Gloves can be worn when handling Galah's to protect hands from bites or scratches although this can also hinder dexterity. It is suggested a small towel be used to cover the birds' head to prevent biting and assist in reducing stress.

When holding, face the bird away from the handler and ensure its beak and feet are immobilised (see section 7.3 for suggested handling techniques).

Other techniques such as conditioning the animal for routine procedures such as nail clipping and beak trimming could be employed.

OH&S Categories and their relationship to working with Galah's:

Biological: As stated in *Clause 29 Zoonoses EAPA General Standards (2004)*:

"Zoonoses are diseases that are transmissible from animals to humans and include Australian bat lyssavirus, chlamydia, cryptosporidiosis, hydatids, leptospirosis, psittacosis, ringworm, Salmonella, tetanus, toxoplasmosis and toxocarasis".

Of the diseases listed, three are potentially present in Galahs. These include:

- Psittacosis (Chlamydiosis)
- Salmonella (salmonellosis)
- Cryptosporidiosis

As a means of controlling cross infection the *EAPA General Standards (2004)* it suggests the following be undertaken:

"1) Visitors who are in contact with animals must be encouraged not to:

- a) suck fingers or objects.
- b) kiss the animals.
- c) touch the mouth with hands, or lick fingers.
- d) eat food intended for animals.
- e) eat.
- f) wipe hands on clothing, if avoidable.
- g) touch soil or faeces.

2) Where members of the public are allowed to contact animals, hand washing enclosures/toilet/bathroom must be provided on the premises or venue (for mobile exhibitors) and the members of the public must be encouraged to thoroughly wash their hands after touching any animals".

For keepers who are handling and working within Galah enclosures it is encourage that Personal Protective Equipment (PPE) be used/worn including: Face mask to minimise the risk of inhaling feather dust or faeces dust containing bacterial parasites, rigorous hygiene practices, disposable gloves when cleaning area such as perches where dried faeces may be present.

Strict hygiene guidelines should be practiced in the workplace to minimise the spread of infection and adhered to by all staff and/or visitors directly contacting the birds.
Vaccination should also be encouraged if applicable to any potential disease transmission.

Chemical: As stated in the *EAPA General Standards Clause 34 Point3:*

“When disinfecting solid surfaces within the enclosure these surfaces must first be washed with soap and water, or steam. Disinfected surfaces must be rinsed before animals come in contact with them again. The disinfectants are to be of a kind approved by and used in compliance with veterinary advice”.

A number of chemicals are required to be used in the cleaning and maintenance of Galah enclosures designed specifically for aviary use. These include:

- Aviclens – a bacterial preventative in water used to reduce contamination of water by fungi, algae and yeast. Can also be used in seed soak water to reduce bacterial contamination (Appendix 16.1 MSDS)
- Virkon S – a broad spectrum disinfectant that assists in the control of fungi, bacteria and viruses such as Avian Flu (Appendix 16.1 MSDS)
- F10SC – a veterinary disinfectant (Appendix 16.1 MSDS)
- Unique Pine – a commercial grade disinfectant (Appendix 16.1 MSDS)

Recommended PPE can be found on the Material Safety Data Sheets (MSDS) specific to the individual chemicals’ usage.

First aid kits should also be readily available and maintained regularly to ensure supplies are up to date and present.

Physical: If extended periods of time are being spent within the aviary or in close proximity to birds in general, it suggested that some form of ear protection be worn. This may include the use of earmuffs or earplugs to lessen the impact of repetitive, loud squawking, screeching or general bird calling on the inner ear in an attempt to prevent long term hearing loss or damage.

Psychological: The only apparent hazard falling into this category is emotional due to the sufferance of grief upon the death of an animal with which a keeper has developed a bond or cares for on a daily bases.

Ergonomic: Aviaries should adhere to recommended size and height guidelines to ensure there is adequate space for not only the inhabitants but also for keepers needing to access the enclosure. Positioning and height of perches should be located so that the birds can be easily reached at various points within the enclosure and not pose a danger to keepers moving around within the area. The height and location of feed and water bowls should also be in a location that is easily accessible for both the bird and the keeper and placed at various locations within the aviary depending upon the number of inhabitants and for enrichment in variation of feeding locations.

Environmental/Radiation: As enclosures tend to be located in outdoor environments, a number of recommended PPE items should be used including: SPF factor 15-30 sunscreen for exposed areas of the body including lips, wearing long sleeved shirts and long pants, wearing a wide brimmed hat or cap with neck flap (be aware of ear exposure) and closed in shoes. If working in the outdoors for prolonged periods areas of shade would be the preferred working location or regular breaks out of the direct sun should be taken.

TABLE OF CONTENTS

1	INTRODUCTION.....	9
2	TAXONOMY	11
2.1	NOMENCLATURE	11
2.2	SUBSPECIES	11
2.3	RECENT SYNONYMS	11
2.4	OTHER COMMON NAMES	12
3	NATURAL HISTORY.....	13
3.1	MORPHOMETRICS	13
3.1.1	<i>Mass And Basic Body Measurements</i>	13
3.1.2	<i>Sexual Dimorphism</i>	14
3.1.3	<i>Distinguishing Features</i>	14
3.2	DISTRIBUTION AND HABITAT	15
3.3	CONSERVATION STATUS.....	17
3.4	LONGEVITY	17
3.4.1	<i>In the Wild</i>	17
3.4.2	<i>In Captivity</i>	17
3.4.3	<i>Techniques Used to Determine Age in Adults</i>	17
4	HOUSING REQUIREMENTS	18
4.1	EXHIBIT/ENCLOSURE DESIGN.....	18
4.2	HOLDING AREA DESIGN	19
4.3	SPATIAL REQUIREMENTS.....	19
4.4	POSITION OF ENCLOSURES.....	20
4.5	WEATHER PROTECTION	20
4.6	TEMPERATURE REQUIREMENTS.....	20
4.7	SUBSTRATE	20
4.8	NESTBOXES AND/OR BEDDING MATERIAL	20
4.9	ENCLOSURE FURNISHINGS.....	21
5	GENERAL HUSBANDRY.....	22
5.1	HYGIENE AND CLEANING	21
5.2	RECORD KEEPING.....	21
5.3	METHODS OF IDENTIFICATION.....	22
5.4	ROUTINE DATA COLLECTION	22
6	FEEDING REQUIREMENTS.....	24
6.1	DIET IN THE WILD	24
6.2	CAPTIVE DIET	24
6.3	SUPPLEMENTS	26
6.4	PRESENTATION OF FOOD	27
7	HANDLING AND TRANSPORT.....	27
7.1	TIMING OF CAPTURE AND HANDLING.....	28
7.2	CATCHING BAGS	28
7.3	CAPTURE AND RESTRAINT TECHNIQUES	28
7.4	WEIGHING AND EXAMINATION.....	29
7.5	RELEASE.....	30
7.6	TRANSPORT REQUIREMENTS	30
7.6.1	<i>Box Design</i>	30
7.6.2	<i>Furnishings</i>	31
7.6.3	<i>Water and Food</i>	32
7.6.4	<i>Animals per Box</i>	32
7.6.5	<i>Timing of Transportation</i>	33

7.6.6	Release from Box	33
8	HEALTH REQUIREMENTS	34
8.1	DAILY HEALTH CHECKS	34
8.2	DETAILED PHYSICAL EXAMINATION	35
8.2.1	Chemical Restraint	35
8.2.2	Physical Examination	35
8.3	ROUTINE TREATMENTS	36
8.4	KNOWN HEALTH PROBLEMS	37
8.5	QUARANTINE REQUIREMENTS	45
9	BEHAVIOUR	47
9.1	ACTIVITY	47
9.2	SOCIAL BEHAVIOUR	47
9.3	REPRODUCTIVE BEHAVIOUR	51
9.4	BATHING	51
9.5	BEHAVIOURAL PROBLEMS	52
9.6	SIGNS OF STRESS	53
9.7	BEHAVIOURAL ENRICHMENT	54
9.8	INTRODUCTIONS AND REMOVALS	54
9.9	INTRASPECIFIC COMPATIBILITY	55
9.10	INTERSPECIFIC COMPATIBILITY	55
9.11	SUITABILITY TO CAPTIVITY	56
10	BREEDING	57
10.1	MATING SYSTEM	57
10.2	EASE OF BREEDING	57
10.3	REPRODUCTIVE CONDITION	57
10.3.1	Females	57
10.3.2	Males	58
10.4	TECHNIQUES USED TO CONTROL BREEDING	58
10.5	OCCURRENCE OF HYBRIDS	58
10.6	TIMING OF BREEDING	58
10.7	AGE AT FIRST BREEDING AND LAST BREEDING	59
10.8	ABILITY TO BREED EVERY YEAR	59
10.9	ABILITY TO BREED MORE THAN ONCE PER YEAR	59
10.10	NESTING, HOLLOW OR OTHER REQUIREMENTS	59
10.11	BREEDING DIET	60
10.12	INCUBATION PERIOD	61
10.13	CLUTCH SIZE	61
10.14	AGE AT FLEDGING	61
10.15	AGE OF REMOVAL FROM PARENTS	62
10.16	GROWTH AND DEVELOPMENT	61
11	ARTIFICIAL REARING	64
11.1	INCUBATOR TYPE	64
11.2	INCUBATION TEMPERATURES AND HUMIDITY	65
11.3	DESIRED % EGG MASS LOSS	65
11.4	HATCHING TEMPERATURE AND HUMIDITY	66
11.5	NORMAL PIP TO HATCH INTERVAL	66
11.6	BROODER TYPES/DESIGN	66
11.7	BROODER TEMPERATURES	67
11.8	DIET AND FEEDING ROUTINE	68
11.9	SPECIFIC REQUIREMENTS	69
11.10	PINIONING REQUIREMENTS	69
11.11	DATA RECORDING	70
11.12	IDENTIFICATION METHODS	70
11.13	HYGIENE	70

11.14	BEHAVIOURAL CONSIDERATIONS.....	71
11.15	USE OF FOSTER SPECIES.....	71
11.16	WEANING.....	72
11.17	REHABILITATION PROCEDURES.....	73
12	ACKNOWLEDGEMENTS.....	74
13	REFERENCES.....	75
14	BIBLIOGRAPHY.....	77
15	GLOSSARY.....	78
16	APPENDIX.....	79

1 Introduction

In Australia, the Galah tends to be taken for granted due to its abundant status and the fact that it is one of Australia's most viewed birds in the natural environment. Yet overseas they are highly prized captive birds and gain much interest amongst breeders and bird owners.

Galahs are not readily bred in captivity in Australian zoos and wildlife parks as they are so commonly found in the wild. In some regions they are considered a pest due to their large and noisy flocks and destructive chewing habits.

Due to their opportunistic natures, the Galah has thrived since the introduction of agricultural industry to Australia. As they are typically an open-country species, they feed on the ground with seed dominating their diet. Farming has opened up remote areas of the country not previously inhabited by Galahs due to the provision of grain crops which supply a food source all year round. Farming has also introduced man-made dams and access to water not previously available in arid regions, which has seen an increase in the Galah's home range from a once primarily coastal habitat, now, spreads right across the country.

These factors have assisted the Galah, and its subspecies, to reproduce successfully and thrive as a species and hence develop in abundance.

The common name „Galah“ by which these birds are generally called was thought to be of Aboriginal origin, but as Rowley (1990) suggests, the word Galah could possibly have stemmed from the Malay word “Gila” (pronounced geela) meaning „mad“ and as such over time become a slang term in Australia meaning „a fool“. This can also be related to the species themselves, as the Galah always seems to have time to play and socialise with other Galahs whilst performing some amazing acrobatic stunts.

Although the Galah is currently one of the most widespread species of Cockatoo in Australia, it doesn't mean that they have not earned merit in their ability to adapt to the often harsh and unforgiving elements of the Australian bush, whilst taking advantage of what European settlement has offered. In this way, Galahs can have an important educational use in relation to environmental adaptations and their ability to not only inhabit rural regions but suburbia as well.

Anatomically, their narrow wings allow them to reach speeds of up to 70 km/h and travel across considerable distances in short periods of time whilst maintaining flock cohesion and being highly maneuverable.

Galahs are a beautiful specimen of bird with their distinct pink and grey colouration, making them stand alone within the Cockatoo family, a truly unique Australian animal.

Rowley (1990) sums up the characteristics of this extroverted, exuberant and appealing bird:

“Galahs give the impression of enjoying their lives to a much greater extent than most other animals. They appear to get real pleasure from the perfection of their flying, swerving in and out of trees with a consummate skill quite superfluous to the mundane need of commuting. Swinging trapeze fashion from telephone lines, sliding down the guy-wires of aerials and indulging in near-ecstatic display during the „raindance“, are all unproductive but appear such fun”.

The characters of the Australian bush!

1.1 ASMP Category

The Galah is part of the Non-passerine TAG. There are no regional implications so in turn no regional program for the Galah and is therefore listed as Management Level 3. This level indicates a lack of need for regional management or resourcing for this species largely due to its abundant status as stated in the January 2007 edition.

The CITES listing for this species is Appendices II:

“Appendix II lists species that are not necessarily now threatened with extinction but that may become so unless trade is closely controlled. International trade in specimens of Appendix-II species may be authorized by the granting of an export permit or re-export certificate. No import permit is necessary for these species under CITES (although a permit is needed in some countries that have taken stricter measures than CITES requires). Permits or certificates should only be granted if the relevant authorities are satisfied that certain conditions are met, above all that trade will not be detrimental to the survival of the species in the wild (See [Article IV](#) of the Convention)”.

1.2 IUCN Category

Not applicable to this species.

1.3 EA Category

Not applicable to this species.

1.4 Wild Population Management

Not relevant to this species.

1.5 Species Coordinator

None listed for this species.

1.6 Studbook Holder

None listed for this species.

1.7 NZ and PNG Categories and Legislation

Not applicable to this species.

2 Taxonomy

2.1 Nomenclature

Class: Aves

Order: Psittaciformes

Family: Cacatuidae

Subfamily: Cacatuinae

Genus: *Eolophus*

Species: *roseicapillus*

2.2 Subspecies

There are still some discrepancies in relation to the genus status of the Galah and can be found in literature as both *Eolophus* and *Cacatua* (see section 2.3)

- The common subspecies in aviculture and in the wild through much of Australia is the *Eolophus roseicapilla roseicapillus* (eastern subspecies). Its distribution ranges over eastern, north-eastern, southern and central Australia as well as Tasmania where it was introduced. It is distinguished by having a whiter crest with a definite break in the crest feathers when erect and a pink periophthalmic ring around a brown-black eye.
- A second subspecies, *Eolophus roseicapillus assimilis* also referred to as *E. r. albiceps* (western subspecies) is found in much of Western Australia and is distinguished by a paler body colour, a longer, fuller and deeper pink crest with no feather division in the erect crest. The periophthalmic ring is almost white around a brown eye. Its head is also larger, flatter and squarer than its eastern relatives.
- A third subspecies, *Eolophus roseicapillus kuhli* (northern subspecies) has been recognised in the northern part of Western Australia, and into the Northern Territory. It is smaller and lighter in colour than the other two species and possesses a smaller head with a pink crest and reddish periophthalmic eye ring.

2.3 Recent Synonyms

There is some dispute between their genus names as they can be referred to as *Cacatua roseicapillus* or *Eolophus roseicapillus*. As Wikipedia states, the classification of the Galah was difficult. It was separated into the monotypic genus *Eolophus*, but the further relationships were not clear. There are obvious morphological similarities between the Galah and the White Cockatoos that make up the genus *Cacatua* and indeed the Galah was initially described as *Cacatua roseicapillus*. Early DNA studies allied the Galah with the cockatiel or placed it close to some *Cacatua* species of completely different appearance. In consequence, it was thought that the ancestors of the Galah, the cockatiel and Major Mitchell's Cockatoo diverged from the main white cockatoo line at some stage prior to that group's main radiation.

It fell to the study of Brown & Toft (1999) to compare the previously available data with their own DNA sequence research and resolve the issue. Today, the Galah is seen, along with Major Mitchell's Cockatoo, as an early divergence from the white cockatoo lineage which have not completely lost their

ability to produce an overall pink (Major Mitchell's) or pink and grey (Galah) body plumage, while already being light in colour and non-sexually dimorphic (Wikipedia, 2007).

Sindel and Lynn (1989) agree with Joseph Forshaw when he decided to remove the Galah from the *Cacatua* genus and reintroduce it as the *Eolophus* due to its distinct difference from other cockatoo species, and suggest it should remain in its monotypic genus.

2.4 Other Common Names

- Rose-breasted Cockatoo
- Rose Cockatoo
- Roseate Cockatoo
- Willock Cockatoo

3 Natural History

Cockatoos are confined to the Malaysian-Australian region and are largely stocky parrots with erectile crests and a variety of obscure diagnostic features. The Cacatuiinae comprises of 19 species in two tribes; one, a monospecific tribe, contains *Nymphicus* (Cockatiels) while the other (Cacatuiini) contains five genera, one of which is the monospecific *Eolophus roseicapillus*, the Galah.

The Galah is the most common of the cockatoos and one of the few indigenous species that have thrived throughout European settlement in Australia (Rowley, 1990).

Galahs have a pale grey back, wings and tail and a deep rose body and head. They have a pale pink to white crest, which covers the top half of the head, dividing it in half above and below the eyes. They have a pale pink ring around the eyes, which is fleshy, and a pale beak, unlike other Australian cockatoos.

Eye colour is used to determine the sex (see 3.1.2)

The flight is moderately fast with full, rhythmic wing-beats, which differ markedly from the shallow, erratic wing-beats in the flight of the *Cacatua* spp. The birds can generate a cruising speed of 50-60km/hr and glide only when alighting. They are strong fast fliers and frequently indulge in aerobatics, especially during a rainstorm and before going to roost (Forshaw, 1989).

3.1 Morphometrics (Diagnostic Features)

3.1.1 Mass and Basic Body Measurements

Body Length: For all subspecies ranges from 35 to 38cm.

Weight: *roseicapillus*: Male: 272-380g; Female: 200-356g
assimilis / albiceps: Male: 320-432g; Female: 307-371g
kuhli: Male: 259-312g; Female: 227-305g

Wingspan: up to 75cm

Wings: *roseicapillus*: Male: 256-275mm; Female: 245-273mm
assimilis / albiceps: Male: 257-275mm; Female 248-282mm
kuhli: Male: 240-269mm; Female: 239-262mm

Tail: *roseicapillus*: Male: 122-154mm; Female: 139-154mm
assimilis / albiceps: Male: 135-161mm; Female: 140-170mm
kuhli: Male: 125-141mm; Female: 118-134mm

Culmen: *roseicapillus*: Male: 25-27mm; Female: 23-27mm
assimilis / albiceps: Male: 24-30mm; Female: 24-27mm
kuhli: Male: 22-26mm; Female: 22-26mm

Tarsus: *roseicapillus*: Male: 23-26mm; Female: 22-27mm
assimilis / albiceps: Male: 25-27mm; Female: 24-27mm
kuhli: Male: 21-24mm; Female: 21-24mm

(Measurements taken from Forshaw, 2002)

3.1.2 Sexual Dimorphism

Galahs are said to be sexually dimorphic and easily sexed by eye colour, once they have reached 12 months of age. Males have dark brown to black iris, whilst the females' iris is pink to light copper-red.

Males usually have a larger head and mandible than the females. The shape of the male's head is rounder than the females.

Males will sometimes develop larger, crustier periophthalmic carunculations than the female galahs.

Immature Galahs have a duller plumage.

Eastern birds (*Sp. roseicapilla*) have a naked periophthalmic eye ring which can vary in colour from light pink to dark pink

Western birds (*Sp. assimilis*) have a naked periophthalmic eye ring which is almost white in colour.

Northern birds (*Sp. kuhli*) have a naked periophthalmic eye ring which is more reddish in colour than the other two species.

(Hunt, 1999)



Fig 3.1.2 a) Indicates male eye: Dark brown/black iris



Fig 3.1.2 b) Indicates female eye colour: pink/red iris

3.1.3 Distinguishing Features

- The Galah is one of the smaller cockatoo species found in Australia compared to the Palm or Black Cockatoo varieties or even the Sulphur Crested and Major Mitchell species in both weight and length.
- It is a distinct rose-pink and grey in colour.
- It has the greatest distribution of all the cockatoo varieties across the whole of Australia.
- According to Sindel and Lynn (1989) they tend to have greater mutations in their colour variations more than any other Cockatoo species.

(Forshaw, 2002)

3.2 Distribution and Habitat

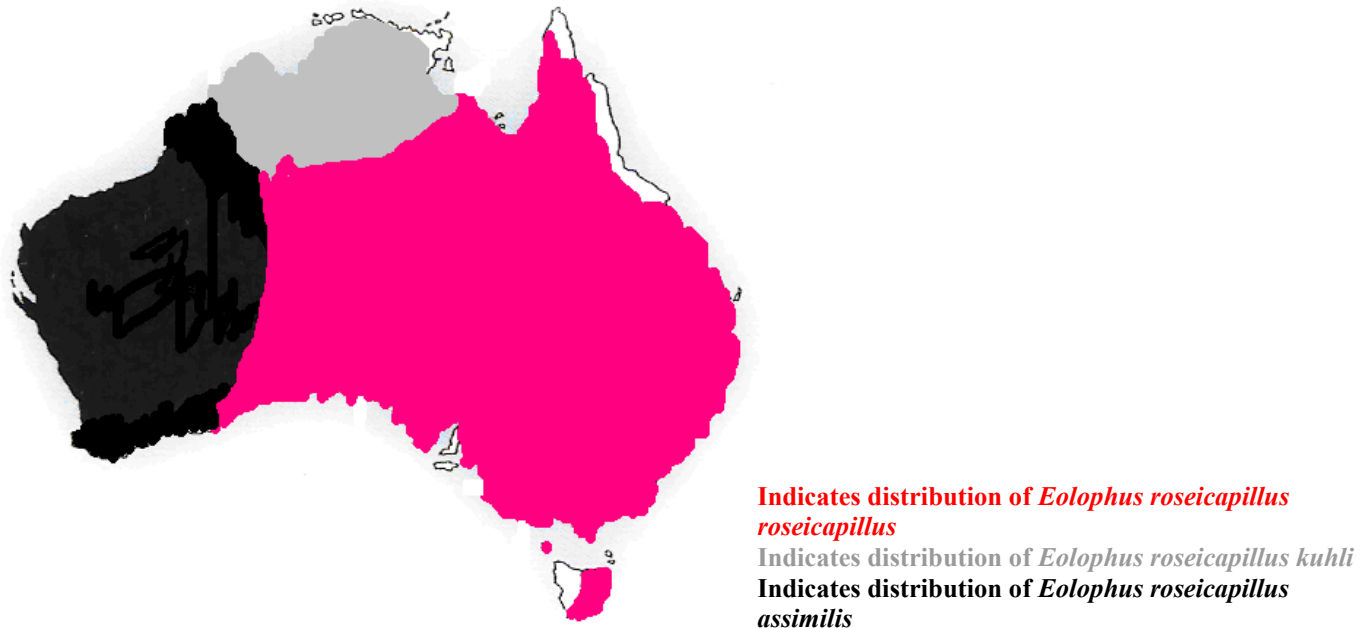


Fig 3.1: Distribution map of the Galah (After Forshaw, 1989)

The Galah is one of the most widespread and abundant of Australia's parrots, being found in all states. It is only absent from the most arid country and from the tip of Cape York. It prefers open grasslands and woodland, is a common species in the cities and towns, and has adapted well to farmed land. The species is gregarious, often forming flocks of several hundreds, although when foraging for food these large flocks will often split into small groups, coming together again at the evening roost site. Feeding is often done on the ground and their food in the wild includes seed, nuts and fruit often causing major damage to cultivated grain crops. "For this reason the bird is regarded as a pest species in many parts of its range, and licensed culling is permitted in certain states" (Owen, 1998).

It is common to very common throughout its range. During the past fifty to sixty years there seems to have been an overall increase in the numbers as well as an extension of range, the latter having been more spectacular in the southern regions.

The increase in numbers and extension of range has probably been brought about by man-made changes to the environment, namely land clearance, extension of cereal growing and the provision of stock watering holes. Serventy and Whittell (1967) agree that these factors have accelerated the process, but they suggest that fundamentally, the extension of range was initiated by slight deteriorations of the inland climate during this century.

In the past decade they have spread into the Southern Highlands of New South Wales. In this region the mountains are interspersed throughout with valleys and hills, which have been opened up for grazing and the cultivation of cereal crops, mainly oats. Galahs have moved into and established themselves in the open areas. They have now become one of the most common birds, even breeding in trees in suburban gardens. At Dry Plains near Adaminaby, New South Wales, the first pairs arrived as summer visitors in 1957; the first nest was located in 1960 and now there is a resident population of

approximately one hundred birds.

Lendon (1973) says that the range appears to be expanding in South Australia and within the past thirty years the species has colonised the more settled, southern areas. According to Boehm (1959) the first Galah seen in the Sutherlands district, South Australia, was reported in 1918. A flock of five birds appeared in 1923, and the first recorded breeding took place in 1926. Within a few years flocks of up to twenty birds were common and by 1938 large flocks containing as many as two hundred individuals were occasionally seen. Thereafter they increased rapidly. The species is now well established on Kangaroo Island where it is said to have arrived in the 1920's.

The rapid extension of the range in Western Australia has been outlined by Serventy and Whittell (1967). Prior to settlement Galahs apparently did not occur south of the mulga-eucalypt line and were restricted to riverside eucalypt habitats of the north-western river systems, south to the Murchison. By 1928 they were very abundant at Mingenew, had reached the outskirts of the north-eastern wheatbelt, and were occasionally observed near Kellerberrin. However, the southernmost visitors did not persist at the time and it was not until the 1930's and early 1940's that Galahs became really plentiful in the northern wheatbelt. By 1950 they had penetrated in strength to a line from the Hill River to Goomalling and Wickepin. They now frequently visit the Perth district along the coast, and bypassing the heavy jarrah forest country, extend deep into the wheatbelt. Breeding occurs as far south as Nyabing and Kantanning and a few birds have appeared at Broome Hill. (Forshaw, 1989)

Galahs are usually seen in small parties or flocks, but large flocks, sometimes containing hundreds of birds are not uncommon. They are occasionally observed in the company of other cockatoos, mainly *Cacatua galerita*, *C. leadbeateri*, and *C. sanguinea*. When feeding with Sulphur-crested Cockatoos they respond to that bird's 'sentinel warning system', but at other times they are not timid. They spend many hours in the morning and late afternoon feeding on the ground, over which they move with a waddling gait. Occasionally a petty squabble will break out between two feeding birds. There will be a flapping of wings, a raising of chests and the emission of loud screeches. The remainder of the flock will cease feeding and, with chests raised in alarm, will watch the two birds. Soon all is quiet and feeding resumes.

During the heat of the day the birds shelter among the foliage of trees or shrubs, stripping the leaves or bark. They have been known to kill a tree by nibbling away the bark until it has been ringbarked. They frequently perch on telephone wires, even in towns and the outer suburbs of the large cities, and often swing upside-down from the wire. In outback districts they have been responsible for failures in telegraph communications; they sit on the top wire in such numbers that it is weighed down and comes in contact with lower wire thus causing a short circuit. After their evening drink the galahs drift in small groups towards their roosting trees. At sunset they commence pre-roosting aerobatics, flying swiftly in and out through the tree tops and swooping down towards the ground, screeching loudly all the while. They sometimes fly about and call at night, occasionally for long periods. Many of these galahs, particularly the young birds, are killed by cars as they rise from the ground beside country roads. They are also preyed upon by falcons and some of the larger raptors. (Forshaw, 1989)

3.3 Conservation Status

According to Crome and Shields (1992) the status of the Galah is common to abundant, as it has increased in its numbers and range (especially on the east coast) since European settlement. This is most likely attributed to the clearing of woodlands and installation of artificial watering systems. The Galah is not listed as a species currently under threat or near threat as determined by the Department of Environment and Water Resources (2000).

3.4 Longevity

3.4.1 In the Wild

Individuals can live for up to 30 years but more likely 20 years in the wild as cars, cats and shooting are the three main causes of death for wild Galahs.

A pair of Galahs will bond for life and will be capable of breeding for up to 40 years (Lee, 2003)

3.4.2 In Captivity

According the International Yearbook (2000) the recorded minimum age of a Galah in captivity was 40 years.

Lee (2003) suggests that Galahs can potentially live for up to 80 years of age in captivity although his source for this statistic is not defined.

Hunt (1999) suggests that Galahs can live as long as humans and are capable of breeding for up to 40 years, so from this you could assume their longevity is extensive.

3.4.3 Techniques Used to Determine Age in Adults

There are a number of techniques, which can be used to determine age in adult Galahs. These include:

- Eye colour: Immature eye colour in both males and females is quite dark. Adult eye colour is attained at 2-3 years of age; in males the iris changes to a dark brown/black and as the female adult matures (which can be as early as 6 months) the iris lightens into a coppery red/pink colour.
- Mature adult Galahs are pink chested with grey wings and tail and have a whitish crest. Juveniles are similar to the adults but have a grey eye ring and grayish colouration on their breast.
- Galahs rarely breed until they are at least two years old (Crome and Shields, 1992)
- Once a bird reaches sexual maturity/adulthood, it is hard to determine its age from this point as there are no distinguishing features associated directly with old` age.

4 Housing Requirements

4.1 Exhibit/Enclosure Design

As Hunt (1999) suggests, an enclosure housing a Cockatoo can never be too big allowing the bird to move around freely and exercise as much as possible. The horizontal measurements should allow the bird to extend its wings fully without touching the sides and cater for their natural tendency to move from side to side more so than up and down.

Some points to consider when housing any Cockatoo species are:

- KNOW your species – their flight needs, size, wingspan, behavioural needs and natural behaviours such as feeding. Know how many birds you will also potentially house – single sexed, breeding pair/s, mixed exhibit, so you can provide enough room and extra space on top of the basic requirements.
- The strength of the enclosure. It must be of steel and metal construction (timber is NOT viable). Check to ensure no tags or flecks of galvanising (zinc) remain which can be picked off and are toxic if eaten. Therefore all new wire should be washed with a water and vinegar solution and thoroughly hosed. Hunt recommends the use of „Evencoat™” as it has largely eliminated galvanised particles remaining on the wire making it safer for use with birds. For small Cockatoos such as the Galah, Hunt recommends a 16 gauge wire either 12.5mm x 12.5mm, 12.5mm x 25mm or 25mm x 25mm although in an exhibit can distort viewing. Woven or netting is totally unsuitable for use on a cockatoo enclosure. Alternatively Sindel and Lynn (1989) recommend a heavy 14 gauge (2.5cm²) galvanised weldmesh (hot dipped = galvanised after it was made and minimises rusting at the joints).
- The preferred aspect is north-north-east (in the southern hemisphere) to provide maximum daily sun and protection from inclement weather such as southerly and westerly winds and rain. If this is not possible then provisions must be made for the protection of the bird/s and shelter from bad weather made available.
- Enclosure sizes will vary based upon the availability of space and the number of Galahs you are planning to house in the enclosure or it may be a mixed Cockatoo exhibit. As there are currently no specific EAPA standards relating to the housing of Cockatoos, some suggestions have been made by experience aviculturists which state that a conventional aviary housing small Cockatoos such as a Galah be 4-5.4m long x 0.9-1.5m wide x 2.15-2.2m high. If space permits, go larger as the bigger the area is, the better the environment for its inhabitants.
- Aviaries should be erected from the ground level to allow the birds to access the ground area. If designed in this way, rodent and possibly snake proofing will also need to be considered such as concrete footings or metal sheeting at the base. Where possible it should be landscaped appropriately for the species and include logs, ponds, natural perching and native grasses to allowing natural behaviours to be practiced. The choice of an earth floor does assist in a more naturalistic appearance but can be hard to maintain, so a combination of concreted areas may need to be considered for hygiene and ease of cleaning and minimise rodent entry. Suspended aviaries may be an option for your particular situation and incorporated into an overall design concept.
- Ensure bar spacing is not wide enough for the bird/s to put their heads through.
- Ensure any coatings or paint on the enclosure cannot flake off and are non toxic such as a powder-coated finish as Hunt (1999) suggests.
- Consideration must be given to access for keepers to the enclosure for ease of feeding, cleaning and general access. Entry points should be wide enough to allow for example a wheelbarrow to be manoeuvred in and out and tools for maintenance and daily husbandry routines.

- Where possible, include airlocks to minimise escape and provide a barrier system.
- Due to their hardy natures, Cockatoos can handle some exposure to the elements and Hunt (1999) suggests that at least half to three-quarters of the roof area be left open (although this may vary for each particular location and individual aviary).

As Hunt (1999) suggests, when constructing an aviary for a Galah, it is best to build it using heavier materials and wire than is required for the species making it more versatile and the potential home for a mixed enclosure with other Cockatoo species.

There are a number of examples of successful mixed Cockatoo enclosures at Taronga Zoo such as the main Helmore Exhibit with a variety of Black"s, Sulphur Crested and small parrot species and at the Education Centre where a Galah and Sulphur Crested are currently housed (pers. obs).

4.2 Holding Area Design

- Holding areas may be smaller than public display enclosures as they are often a temporary location for the bird, however, they still need to be large enough for the bird to practice some natural behaviour, although flying may be purposely restricted depending on the reasons for the animal being held.
- I have found that appropriate furnishing such as natural branches for perching and browse leaves should be supplied to ensure the natural environment is replicated, the animals is comfortable and any possible stress is minimised whether the holding period be short or extended.
- For transportation of a Galah, I found that a large (1.5 x 1m) metal cockatoo cage with raised handles at the top sides is ideal for a night cage and short periods of holding such as an animal encounter, provided appropriate furniture suited to the species is supplied and they have room to move along the perch from the base to the top of the cage comfortably.

4.3 Spatial Requirements

There are currently no EAPA standards available that directly relate to housing Cockatoos.

Advisable minimum aviary size according to Sindel and Lynn (1989) for small cockatoos (from the Sulphur Crested down) is 5.4m (18ft) in length, 0.9m (3ft) wide and 2.15m (7ft) high.

Lee (2003) also advises that an aviary required for a member of the Cockatoo group should be at least 5m x 1.2m x 2m high, but more specifically for a Galah measure 6m x 1m x 2m, constructed of material to withstand inevitable chewing.

Considering Galahs mate for life, enclosures this size would suit a nesting pair comfortably although increasing the width to 3m would also make the enclosure suitable for several birds.

4.4 Position of Enclosures

According to Sindel and Lynn (1989), aviaries in the southern hemisphere should ideally face north or in large broad cockatoo aviaries have one side facing north so as to provide maximum sunlight. Therefore aviaries should never be built to face south and must always be totally protected on the southern side.

4.5 Weather Protection

According to Lee (2003), Galahs must be protected from frost in the winter. Providing a thick walled, hardwood roosting box (40 x 40 x 90cm) or tree stumps is also necessary.

Full protection from all prevailing winds is advisable as well as fully enclosed weatherproof shelters open only at the front and situated on the southern end of the aviary facing north.

On aviaries facing east or west, there should be fully enclosed shelters on both ends.

Roofed areas should also be provided at both ends of the aviaries to afford maximum protection to front and rear perches from weather conditions (and predators). (Sindel and Lynn, 1989)

4.6 Temperature Requirements

Galahs are found right across Australia from semi arid to coastal regions in temperatures that vary from 15-40C. Providing housing for this species based on temperature control can be achieved quite easily. Provide a northern facing aviary with sheltered areas to protect them from the elements and open areas where they can perch and access the sun. Ideally in colder conditions, being able to move the bird into an indoor environment could also be a possibility.

In my experience for a singly housed Galah, placing a heat lamp in one corner under shelter allows the bird to warm itself whilst perching especially during the colder months. This lamp can be turned off during the day when warm and sunny or remain switched on when cold during the day and night.

4.7 Substrate

The following substrate can be used when housing a Galah: cement, dolerite, soil/dirt, woodchip, mulch, pebbles/stones, coarse sand and if possible a grassed/turfed section within the enclosure to encourage natural grazing and seed foraging. Ideally the substrate should be as natural a substance as possible.

4.8 Nestboxes and/or Bedding Material

As Rowley (1990) states, Galahs, like other Cockatoos nest in hollows. These are usually in a decaying of termite infested tree and will select a hollow based upon its own size, mobility, flexibility and the ultimate use of the hollow.

Galahs do not roost or shelter in the hollow except when brooding and usually start nesting in the winter when temperatures can be low and rainfall is heavy.

According to Lee (2003) a nest box around 60-90cm deep and about 30cm in diameter should be supplied. An essential requirement is to keep constant supply of fresh branches of eucalyptus and other native trees available to browse on and to also line the nest box. Providing a hollowed tree stump is also

appropriate for nesting and may withstand the Galahs chewing better than a box. A combination of peat moss and sawdust, moistened may be provided for nesting material. This should be laid 10-12cm deep.

4.9 Enclosure Furnishings

- Suitable log hollows for nesting or nesting/roosting boxes.
- A variety of natural branch perches of varying shape and size attached around the enclosure and varying levels, also with natural bark for gnawing on. These should be changed when worn to prevent pressure callusing (Bishop, pers. comm.)
- A fresh supply of native browse for chewing, gripping and foraging such as Eucalyptus, Grevillia, Casuarina and Acacia should be provided daily.
- Grow or turf a section of the enclosure and rotate location as grass wears for natural seed foraging and browsing.
- A variety of substrate flooring as Galahs spend a large portion of their day searching for seeds. Included in this could be scatter feeds of seeds along the ground/substrate to encourage natural behaviour. Be aware when soil flooring is used as endoparasites can readily frequent such substrate therefore may require regular replacement to prevent infection.
- Stainless steel food and water containers located at various points within the enclosure to encourage the birds to seek out their food supply. Spiking various fruits and vegetables at varying points along the perches also encourage the birds to seek out their food. Where possible include water receptacles large enough to permit bathing eg. a pond or water feature.
- Ensure there is some flight distance available for mobile bird to move around the enclosure.

5 General Husbandry

5.1 Hygiene and Cleaning

- Excrement and other animal waste, leftover food, unwholesome food and water, bones, fur, feathers, dead animals, introduced rubbish and foreign objects must be removed daily (EAPA).
- Daily spot checks for faeces, left over food or any other waste products is essential in maintaining a hygienic environment. In a bird enclosure containing dirt flooring, bright white/green faeces are very visible to visitors during the day and therefore must be tended to as part of the daily husbandry routine (pers comm. Liana Carroll, Taronga Zoo). This is also essential practice to minimise the contract of endoparasites from soil based flooring.
- **Daily:** Spot check cleaning is essential to remove waste by raking substrate and hosing the ground area of the aviary and any sections of perches where faeces remain. These are moistened and scrubbed off. Leftover food is disposed of and stainless steel food and water bowls are removed. These washed with general purpose detergent, rinsed and allowed to air dry or are hand dried. All browse is removed and replaced daily (pers comm. Liana Carroll).
- **Weekly:** Extended cleaning of the aviary with enclosure edges being hosed and scrubbed. Any concrete/walk in areas are to be disinfected with a diluted disinfectant such as „Unique Pine“ (1:20) are to be scrubbed, hosed down and left to sun dry. If any cleaning agents are required to be used within the aviary, the preferred products would be Virkon S, F10SC or Aviclenz disinfectants as they are non-carcinogenic chemicals (pers obs, Taronga Zoo).
- **Monthly:** All branches, perching and trunks are to be scrubbed down with F10SC to stop cross infection through faeces. Replace or rearrange enclosure furniture and/or introduce new furniture as required. This may be required more frequently and needs to be monitored regularly.
- **Every second-third month:** A major enclosure clean is essential with substrate being replaced. Any areas where the substrate is frequently soiled (under perch were faeces land or feed bowls are perched) or is being dug out should be replaced more frequently.

5.2 Record Keeping

This involves recording and keeping information on the following:

- Identification numbers of the animal: ARKS, enclosure and microchip implant numbers
- Any changes in health
- Veterinary examinations
- Veterinary treatments
- Behavioural changes/problems including changes in external/visual condition
- Reproductive activity, number of eggs laid, number of successful births, condition of parent during reproductive stages
- Changes in diet or eating requirements/patterns

- Movement of the animal internally or between institutions
- Body mass and measurements especially with new juveniles

Record keeping will also involve the use of the institute's daily report and may contain the items listed above under a particular coding system, for example, Rx – would indicate treatment being given to an animal either after a vet consultation, preventative medicine routine or ongoing treatment. This will then be added to the animals' records via their ARKS number on the ISIS database.

5.3 Methods of Identification

At Taronga Zoo Microchip implants and closed ring leg bands (stainless steel „Donna“ bands) are used for bird identification along with enclosure cards/boards which contain the animals common name, scientific name, ARKS number, implant number (optional), sex and the number of birds housed in the enclosure. Some enclosure may also contain photos of each individual bird dependent upon how the birds are housed, where they are housed and how many of the same species are being housed together requiring photo identification to differentiate individuals.

5.4 Routine Data Collection

Routine data collection may include:

- Preventative medicine routines which include: most recent weight measurements, routine faecal samples collected, body condition examinations and scores and general physical condition
- Wings moults
- Contour moults
- Behavioural changes or responses to environmental changes eg. moved enclosures or introduced new bird to enclosure.
- Changes to eating habits or dietary changes.

Routine data could also be collected about a mating pair if you were attempting to breed the species in a captive environment. This would assist keepers to follow the reproductive stages of the pair from initial courting to copulation and then the presence of eggs to the development of the offspring.

Currently within the Education Centre at Taronga Zoo the Galah „Mulga“ is housed with a Sulphur Crested Cockatoo and not required to be a breeding female (Scannell, pers. obs).

6 Feeding Requirements

6.1 Diet in the Wild

As Forshaw (1981) states, the wild diet of the Galah comprises of seeds of grasses, and herbaceous plants, cereal grain, especially wheats and oats, fruits, berries, nuts, roots, green shoots, leaf buds, blossoms and insects and their larvae.

Donnelly (2003) also states that in pastoral areas, wheat can make up 75% of the daily intake of seed in a wild Galahs diet. Although this can be a destructive habit for the wheat crops, Galahs also assist pastoralists by removing introduced plants and weeds during their foraging. Donnelly also states that in nonpastoral areas the wild diet is predominantly native grasses and introduced plants including: saltbush (*Atriplex vesicaria*), bluebush (*Maireana sedifolia*), western button grass (*Dactyloctenium radulans*), Mitchell grass (*Astrebla lappacea*) and Flinders grass (*Iseilema membranaceum*). Galahs have also be seen eating the seeds from Paddy Melons, wild bitter melons, roly-poly bush, swamp oak (*Casuarina glauca*) and thistles, as well as mistletoe berries, shoots of Banksia plants and flower buds of the beach daisy.

The wild diet will also vary seasonally and depend upon the location of the Galah within the various ranges that exist across Australia.

6.2 Captive Diet

As Sindel and Lynn (1989) suggest, the Galah is a species of cockatoo subject to obesity after reaching maturity, particularly in warmer climates. Sindel (1989) also suggests that all oily and fattening seeds such as sunflower seeds, canary seeds and oats must be eliminated from the diet if a lean and healthy condition is to be maintained. If fed high quantities of fat, Galahs are susceptible to developing fatty tumours or lymphomas, which can inhibit reproduction and cause infertility.

Sindel (1989) suggested dry seed mixture consists of:

- Equal parts of French white millet, Hungarian millet (pannicum) and Japanese millet.

Supplementary foods suggested by Sindel (1989) consist of:

- Sprouted French white millet, sprouted corn, green foods such as silverbeet, broccoli, cauliflower, seeding grasses and one pod of green peas daily.

Low (2006) provides a daily dietary recommendations guide for feeding non breeding Parrots and suggests that the Galahs diet consist of 70% of small seeds and pellets, 10% fruit, 20% vegetables and green food and 0% pulses.

At Taronga Zoo's Bird Show Division, Galah's are fed seed and „Kaytee Exact“ in proportion to the Bird's weight for that day. For example, if Jasper the Galah weighs 300 grams, a typical feed amount would be 4 grams of each product with 8 portions of fruit and vegetables. Their feeding regime is as follows:

Seed

Seed is soaked in 5 litres of water with 2.5 ml of Aviclens for 24 hours prior to being fed out moist.

- Popcorn kernels:14%
- Wheat:14%
- Mung Beans:10%
- Sorghum: 7%
- Feed oats: 7%
- Barley: 7%
- Hulled Oats: 7%
- Green Lentils: 7%
- Black-eyed Peas: 7%
- White French Millet:7%
- Plain Canary Seed: 7%
- Safflower:6%

= 100%

Sunflower seeds are only used in this section of zoo with Galahs as a form or reinforcement when training or conditioning Galahs (pers obs).

Pelleted Food

The bird show feeds Kaytee Exact, a prepared pelleted product manufactured in the USA. For the Galah, the small grade is fed. For details on distribution of this product in Australia, refer to appendices 16.2.

Fruit and Vegetable

The following Fruit and vegetables are fed:

Apple, pear, paw paw, corn, cooked sweet potato, banana, kiwi fruit, orange, peas in pods and grapes.

These portions are cut according to the size of the bird.

Show Galahs typically receive daily:

- 1/8 of a slice of pear, apple, corn, sweet potato, kiwi fruit and orange
- 1/4 of a slice of banana
- 1/2 a grape

(Pers. Comm. Nicholas Bishop, Taronga Zoo)

At the education centre, the soak seed is provided by the Bird Division daily. Within the Bird Division at Taronga Zoo, soaked seed is washed and soaked over a two day period (so washed every 24 hours) before being fed out (pers obs).

The Galah receives a small dish of soaked seed, comprising of the ingredients listed previously but also includes Sunflower Seeds, along with one piece of fruit and one piece of vegetable as listed above (Pers. obs).

In both division of the zoo where galahs are held, they are also provided with:

- Fresh browse daily preferably Eucalyptus with native fruit and nuts attached.
- Fresh water supplied daily.

(pers obs)

Foster (2000) also suggests a suitable captive diet for Galahs and lists the following as a feeding guideline:

“A diet consisting, for example of sunflower seeds, would be totally inappropriate. Not only would this not be nutritionally sound, but would be very high in fat. Sunflower seed contents 35-49% fat, depending on the variety and would lead to an obesity problem for a Galah in no time. Cockatoos in general should be fed a diet consisting of no more than 5-8% fat on average, and a Galah with its propensity towards obesity, should be on a diet of about 3-4% fat. This does not mean that a Galah cannot have an occasional sunflower seed, or other seeds or nuts as a treat. The concern here is the total fat percentage of the daily diet. Fat content, calories and carbohydrate intake all need to be considered. Also a good diet does not consist of one or two items but a variety of items and those items should vary some on a daily basis (Refer to website for further details, see reference section).

Wildwood Aviaries (2004) in New Zealand provide an alternative captive diet for Galahs which can be found on their website (see reference section). You must note that some variations exist between the Australian captive diet and that of the New Zealand diet, which could be as Sindel (1989) suggests, likened to the differences in climate. Having the daily presence of high fat sunflower seed in the NZ diet may assist in thermoregulation due to lower temperatures that exist in NZ as compared to higher temperatures in many areas Galah inhabit in Australian.

Breeding vs. Non-breeding Diet

Sindel (1989) also suggests an altered diet as breeding season approaches. He states that as the breeding season approaches the limited seed diet for breeding pairs should be gradually increased to double that of the maintenance diet to help promote breeding condition. He also states that when young are being reared an unrestricted diet should be fed which includes dry and sprouted sunflower seeds.

During breeding periods (although Galahs are not currently being bred at Taronga Zoo), Galahs would be given increased amounts of protein and carbohydrates and would have seed soaked in a vitamin supplement supplied by Vetafarm® (Pers. comm. Nicholas Bishop, Taronga Zoo).

This is confirmed by Lee (2003), “Galahs have to be provided with more animal protein before and during breeding”.

6.3 Supplements

As Parson (1999) suggests, in the wild grain eating birds, such as the Galah, have a varied diet eating according to seasonal availability. She goes on to suggest that in captivity, many granivores suffer calcium deficiency from being fed a seed-only diet, due to the high fat content of sunflower and safflower seeds inhibiting the absorption of calcium. As calcium and phosphorus are metabolised together in conjunction with vitamin D, each is required for the other to be absorbed. Therefore diets

need to be balanced to ensure adequate levels of mineral and vitamins are being obtained and is not necessary to supplement vitamins on a regular basis if a balanced diet is being provided. Where a bird requires more calcium prior to egg laying or is calcium deficient Calcivet™ calcium supplement (see appendix 16.1) can be added to the drinking water within the enclosure.

In case where obesity becomes an issue for a Galah, fatty tumours or subcutaneous lipomas can develop. If managed before the tumour become ulcerated or necrotic, dietary modifications and iodine supplements to stimulate the thyroid and metabolise fatty tissues can be given in the form of Dr Marshall's Loford™ via the drinking water.

6.4 Presentation of Food

Food presentation can vary in its form from being given in stainless steel bowls suspended in stainless steel brackets at various point in the enclosure, to also include scatter feeding at the ground level. Water is also presented in suspended stainless steel bowls (Scannell, pers. obs.).

As Galahs are graivores that feed on the ground or in trees food can be presented through spiking a variety of cut fruit and vegetable at vary points throughout the enclosures along the perches. Seeds can be scattered one the base of the enclosure and will encourage natural digging behaviours if it contains dirt flooring (Scannell, pers.obs).

Providing fresh browse daily will also encourage foraging behaviours to extract the fruits from the branches provided. As suggested by Parsons (1999), states that the natural seed gathering behaviours must be recognised such as the grain-eating bills of the parrot family who crack large, strong seeds, harvest seeds from plants, glean from the ground, rip bark, chew tips and gumnuts. She also suggests that not all feed be fed from a container, but rather scattered on the ground to encourage wild behaviour. Other foods can also be spread around the aviary such as spiking fruit on twigs, insects placed into foliage, green seedheads tied to trees, grasses and seeds grown in the aviary, gumnuts tied to branches for ripping and chewing, and soaked or sprouted seeds scattered (p72).

7 Handling and Transport

7.1 Timing of Capture and Handling

The capture of a Galah is better undertaken in the morning to minimise heat stress as it tends to be cooler at this time of day and a bird should be settled by the evening (Pers. comm. Nicholas Bishop, Taronga Zoo).

7.2 Catching Bags

Parsons (1999) suggests the following items can be useful in the capture of most birds including a Galah but usage will vary depending on the size of the bird: towels, long-handled net, pillowcase, heavy gloves, cardboard box/appropriate container, dull coloured clothing.

It was also suggested that gauze nets rather than an open weave be used to prevent nails protruding and becoming entangled or calico or light canvas are also appropriate (Pers comm., Nicholas Bishop, Taronga Zoo).

Size of the bags will vary depending upon the individual bird, but as the average size of a Galah is approximately 35cm in height, bags should be a minimum of 70cm to allow some movement and area for the catcher to grasp the bag and hold firmly.

7.3 Capture and Restraint Techniques

The following diagram indicating the preferred method of handling parrots and suggests that birds which are known to bite should be held securely from behind the head to prevent the beak coming into contact with the handler.



Figure 7.3.1: Restraint hold (Hunt, 1999).



Fig. 7.3.2: One hand restraint for examination or medication of a bird (Hunt, 1999).



Fig 7.3.3: Using a towel can be beneficial when handling a cockatoo to prevent bite injuries (Cannon, 2002).

The technique Parsons (1999) suggests when using catching nets is that two people should be involved, one approaching from the front to attract the bird's attention, then moving in slowly so the bird continues to watch. The second person approaches from the rear, quietly but quickly placing the net over the bird and holding it to the ground. The front person can then run in and hold the bird through the net to minimise tangling and injury. A thick cotton towel can then be wrapped around the bird as it is taken from the net.

Parsons also suggests the same method can be used substituting the net with a towel. She makes particular reference to special precautions needed when handling parrots and suggests that after a towel is placed over the parrot; hold the bird's head from the back to prevent it from biting through the towel. Support the head from around the back and under the jawbone. Parrots can inflict a serious bite even through a towel. These birds will not suffer from a lack of oxygen while wrapped in a towel for a short time (p27).

The EPA (2004) General Standards Clause 44 Capture and Handling states:

- “1) An animal must be handled only by, or under the supervision of, staff authorised for the purpose by the exhibitor of the animal.
- 2) A sufficient number of trained staff must be available at all times to handle the animals in the manner prescribed in these standards. Care must be exercised to avoid harm to the animal handlers.
- 3) An animal must not be handled in a way that causes it undue discomfort or distress or causes it physical harm.
- 4) The supervision of physical contact between an animal and a member of the public must be limited to a period, and must take place under conditions, consistent with the welfare of the animal”.

7.4 Weighing and Examination

Parsons (1999) provides the following guidelines for the physical examination and suggests that it be a two-person process so that one can hold whilst the other examines. She advises:

- Examination be undertaken in a quiet enclosed area without disturbing noises
- Handling should be firm, but gentle
- The bird's head should be covered and the wings restrained in a natural position close to the body
- That wings be held firmly at the joint whilst being spread and careful control maintained and examined individually
- Check for signs of dehydration such as dull or sunken eyes, movement of the skin over the muscles – pinch test the skin around the chest area as it should return to its original position quickly, but if there is reluctance to return or stays in that position, the bird is dehydrated.
- Check for symmetry, lumps or abnormalities by carefully sliding hands down the length of the body
- Check temperature to touch either under the wing „armpit“ or the feet, it should be higher than your fingertips touch.
- Check for feather loss, moulting, discharges from eyes, nostrils and ears, examine the beak for abnormal growth or damage and inside the mouth.
- Check the keel and surrounding muscles
- Check the cloaca for signs of faeces.
- Check the pads under the bird's feet are free of calluses, bumble foot and general appearance.

Weighing can take place whilst the bird is restrained inside of the bag. Place the bird on the scales and ensure the weight of the bag is subtracted off the total, thus leaving the bird's actual weight. Weight can be a good indication of a bird's health and wellbeing (pers.obs, Scannell). See section 6.1 for further details in regards to this issue.

7.5 Release

It is best to release the bird from its container in the morning allowing it all day to settle into its enclosure especially if it has been travelling for an extended period of time or is a new addition to the collection (pers comm. Nicholas Bishop)

There are no specific instructions or suggestions relating to the release of a Galah from its transport box, but reference should be made to the advisable minimum standards for an aviary suitable for a Galah and its normal flight distance (see section 4). That way when it is placed inside the enclosure and the transport box is opened, the Galah has at least an area of 5.4m in length and 2.15m in height to fly into (Sindel and Lynn, 1989).

7.6 Transport Requirements

As stated in the EAPA (2004) General Standards, Clause 45 Transport:

“Except as indicated in other standards prescribed under the Exhibited Animals Protection Regulations or as the Director-General otherwise determines, transportation of animals within Australia by NSW exhibitors must comply with current International Air Transport Association (IATA) regulations”.

7.6.1 Box Design

The dimensions, recommended materials used in the design and construction of a transport container are clearly defined in the International Air Transport Association *Live Animal Regulations (2000)*.

The transport of Galahs comes under Container Requirement Section 11 with specific details in section 11D relating to special conditions for this species.

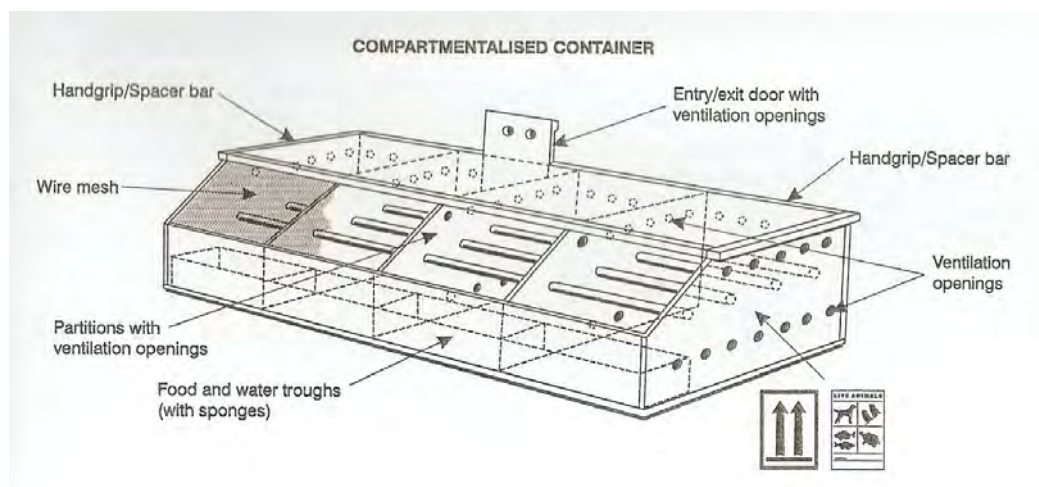


Figure 7.6.1: Compartmentalised Container design and dimensions (11D)

According to the IATA (2004) regulations, the following are recommended in the construction of the transport containers:

- **Materials:** Wire mesh, non-toxic wood, non-toxic plastics, fibreglass, synthetics and muslin or other material.
- **Size:** The normal habitats and necessary freedom of movement of the bird species involved will determine the size. For example, the wing span of a Galah can be up to 75 cm, so the box should allow for some wing movement without the bird injuring itself. Its tail feathers can reach a length of up to 17cm and this should not be touching the base of the transport box and their overall body length is approximately 35cm.
- **Sides:** Plywood or other material of equivalent strength is generally suitable. Both side of the container must be of a minimum thickness of 0.6cm. The interior of the container must not have sharp edges or protrusions on which the bird can injure themselves. The front of the container must be sloped to provide extra ventilation area and be covered with 0.3cm wire mesh which must comprise 75% of the frontal area. A muslin curtain must also be provided to reduce light inside the container.
- **Handling Spacer Bars/Handles:** Must be provided as shown in the illustration on three sides of the container.
- **Floor:** Solid and leak-proof with smooth raised bars down the length of the container for non-perching species.
- **Roof:** The roof must be solid, however ventilation holes are permitted. The must have non-destructible padding for some species.
- **Door:** There must be a door, sliding or hinged, to each container or compartment of a container. There must be a secure means of fastening each door.
- **Ventilation:** Meshed ventilation openings, approximately 2.5cm in diameter must be provided at approximately 5cm distance apart along three sides of the container. Whenever opening are covered by mesh, care must be taken that there are no sharp edges present within the container, all edges must be covered with a smooth material.

For small numbers or individual birds, modified rigid plastic pet containers are suitable for use.

Specific Container Requirements 11D:

Special conditions are applicable to parrot-like birds, large (including other large psittacines (parrot like) birds over 23cm long): Cockatoo species (Galahs) are included here.

Container Construction:

- **Sides:** Plywood or solid wood with a minimum thickness of 0.6cm or metal. Parrots have powerful beaks and the construction must reflect this fact. The interior must have no projections which the birds can get hold of.
- **Ventilation:** All meshed openings must be covered with light material that allows good airflow.

7.6.2 Furnishings

The general container requirements relating to furnishings as set out by the IATA (2004) are as follows:

- **Perches:** Wooden perches must be provided for all perching species. The diameter of the perch must be large enough for the birds to grip firmly and comfortably and keep its tail feathers off the ground.
- **Those special conditions relating to IATA container 11D are as follows:** Perches: Most members of this group rest by perching. For those birds that rest by perching, round perches must be provided per container. The diameter of the perch will depend on the species to be shipped and must be large enough for the birds to grip firmly and comfortably at the same time. The perch must be placed so that droppings do not fall into the food and water troughs.
For those psitticines that do not rest by perching, suitably sized smooth rails fixed to the floor must be provided so that birds can feel secure.

7.6.3 *Water and Food*

The general container requirements relating to feed and water containers as set out by IATA (2004) are as follows:

- **Feed and water containers:** Separate food and water containers must be provided, they must be accessible for refilling and the side of the water container(s) must be flange to prevent spillage. For small birds it is necessary to have a float or sponge or similar material on top of the water to prevent drowning. Soldered tin must never be used.
- **Those special conditions relating to container 11D are as follows:** Water containers: Must be filled at time of shipment, have flanged sides and be sufficiently narrow so that the birds cannot wet themselves because they
Feeding and watering guide (for emergency use only): Birds do not usually need additional feeding during the 24 hours following the time of dispatch, other than the food provided in the troughs as specified in the Basic Container Requirements.
If additional feeding is required due to an unforeseen delay, seeds eg. Sunflower, groundnut (natural peanuts), boiled maize, pine or brazil nuts and fruit must be provided.

7.6.4 *Animals per Box*

The **general** container requirements relating to stocking density containers as set out by IATA (2004) need to be considered and reviewed for each individual situation. They should be used as a minimum guideline only, but your own knowledge about the birds you are transporting should also be considered when preparing their transport container. For example, Cockatoos held too closely or in the same area of a container have the potential to seriously injure if not kill another bird and should therefore be placed in either its own containers or one with solid divisions between each compartment.

- **The special conditions relating to container 11D are:** For smaller parrots, a maximum 25 per container or compartment of a container is permitted. All birds must be compatible and able to sit simultaneously in comfort. The numbers of the larger species must be reduced accordingly to permit this to happen. The tight control of the numbers within a container is in order to prevent smothering from overcrowding. Cockatoos are best shipped in small groups of **no more** than 6 as like the Kea and kakapo tend to be aggressive and must be shipped singly or in pairs.

Personally **I would not** have 6 Cockatoos held together for risk of injury and feel its best if like the Kakapo and Kea were held individually (pers. obs).

Sindel and Lynn (1989) confirm this when stating that Cockatoos must be boxed individually during transportation and that minimum space be provided to prevent injury and restrict movement especially if stressed or frightened. Sindel suggests that the size of a transport box be the overall length of the cockatoo squared to calculate the base area whilst the standing area should be the height of the bird plus 7.5cm which provide adequate room to move without causing injury. The box should be totally enclosed except for ventilation holes drilled in two sides or half of the front area be weldmesh of adequate gauge, as this will provide security for the bird and minimise stress and potential injury.

Boxes must be constructed of durable material such as aluminium sheets or weldmesh wire cages within a cardboard carton due to the chewing abilities of Cockatoos and should be provided with a non-slip plywood false floor for added comfort.

7.6.5 Timing of Transportation

This will vary greatly due to the means of transport being used and the availability for the birds to be dispatched and time may not always be an available choice.

As suggested by the IATA (2004) regulations, birds are very nervous by nature and so containers must be handled carefully. Excess light and noise must be avoided. Birds will not feed in the dark and must be stowed in at least dim light sufficient for them to see their food.

Considering this information, timing of transport would best be undertaken in the early morning before the presence of full and/or direct sunlight. As Galahs will not feed in the dark, travel during daylight hours would be optimum as opposed to the evening.

Night travel could be an option as this is the normal „sleeping“ hours for the bird and could allow for less activity, although it could pose addition stress if the bird cannot adequately rest.

7.6.6 Release from Box

Release from transport boxes are again best undertaken early in the day or at least during daylight hours to allow the bird/s sufficient time to settle into their enclosures or release site before dark allowing them to locate a roosting site or sleeping perch for the night and a food supply (pers obs).

8 Health Requirements

As suggested by Cannon (2002) birds are very good at masking signs of disease and initial signs of illness are often very subtle, this is called the Preservation Reflex. Knowing your birds well will assist in the detection of any behaviour which differs from the norm for a particular individual as variances will exist within your birds.

8.1 Daily Health Checks

As part of the daily husbandry routine, any birds in the collection should be observed at least once a day but preferably twice inspecting upon arrival in the morning and again before leaving in the afternoon. Cannon (2002) suggests a distant examination be carried out preferably in a location where you cannot be seen by your birds as they will potentially mask any signs of illness when you are present. After a minute or so, quietly approach the bird and see how it responds to you.

Cannon (2002) states that a normal bird should display the following:

- Bright and alert behaviour
- Both eyes wide open and clear with no swelling or discharge
- Both nostrils open and clear
- No darkening or stains on feathers near the nostrils
- It looks at you and responds to your approach
- Sitting in the normal spots in its cage
- Standing erect with weight evenly spread on both feet
- Wings folded against the body in the usual position
- All feathers are in good condition
- Moving around actively
- Singing normally
- Breathing is barely detectable
- Not overweight nor very thin
- No abnormal swelling anywhere on the body
- No ragged or untidy feathers

It is also important to observe if the bird/s are:

- Eating and drinking (monitor changes in consumption levels on a daily basis and record any changes to be monitored)
- That their droppings are formed normally and of an expected consistency (not too runny, or discoloured, not containing blood)
- General behaviour of the bird/s; is it normal for that individual at the time you observe it?
- Is the bird moving and flying normally for the particular individual you are observing?
- Are there any signs that indicate to you that the bird you are observing may be ill and require closer examination (Scannell, pers obs, Taronga Zoo)

Cannon (2002, p.15) goes on to say that as a general rule “any caged bird that appears to be ill to its owner is seriously ill”.

8.2 Detailed Physical Examination

Sindel and Lynn (1989 p.42-43) state that “any inactive, dull and listless bird should be caught up and examined for loss of weight, dirty vent, canker (fungal) infections in the mouth, beak abnormalities or injuries and the appropriate measure be taken”.

8.2.1 Chemical Restraint

Chemical restraint is not normally required when undertaking a physical examination if the handler uses correct physical restraint techniques appropriate for holding a Galah.

The only need for a chemical restraint to be used on a bird is during any surgical procedures they may require where a General Anaesthetic will be administered by a veterinarian. Such anaesthetics may include the use of Diazepam (Valium®) or Xylazine (Rompun® or Xylaze®) and Ketamine (Ketamav®) as written by Dr Bob Doneley (1996) in his studies on bird disease.

The other occasion where anaesthetics may need to be used is when surgically sexing a Galah when eye colour is not a clear indication of gender.

8.2.2 Physical Examination

Refer to Section 7.3 of this manual for Capture and Restraint Techniques to be used when catching up a Galah for a physical examination.

Cannon (2002) lists the following steps for undertaking a physical examination:

- Start at the head of the bird and move down the body. Place emphasis on any suggestive signs detected during your daily distant examination.
- Examine the head, eyes, ears, nostrils, and cere. Pay attention to the feathers immediately adjacent to the nostrils for discharge or staining.
- The head should be symmetrical. Examine the head on top, from the front and back and each side looking for any asymmetry.
- Examine the beak for damage or malformations as bruising of the beak may be associated with liver disease or trauma.
- Open the mouth and examine the tongue, choana and throat. Note any sour or abnormal odours, excessive mucous or cheesy plaque. Examine the fringe lining the choana as in chronic respiratory disease or vitamin A deficiency the fringe will be damaged or missing.
- Carefully run your fingers over the entire bird beginning at the crop, working down the keel to the abdomen. The crop may contain food but rarely fluid. In captive aviary birds, the crop will be empty in the middle of the day as they eat early in the day and late in the evening similar to their wild behaviour.
- The breast muscles should be convex and the keel bone should not be prominent.
- The abdomen should be concaved (slightly sunken) not convex. If the abdomen is enlarged then examination must be extremely gentle.
- Examine the vent for swellings, encrustations or soiling, indicative of loose droppings. If the tail is gently flexed towards the back, the vent will open and allow inspection of the cloaca.

- Examine the feathers and the skin. Look for any chewed or missing feathers. Look for any damaged or malformed feathers particularly the primary and flight feathers. For the Galah, part the feathers over the hip and closely examine the powder down feathers: are they fluffy making it difficult to see the skin beneath or are they thin and deformed? Does the bird have a powder covering on its beak and all feathers as lack of powder and a shiny beak may be early signs of Psittacine Beak and Feather Disease (Pbfd).
- Pull out each wing individually and feel the bones from the shoulder to the wing tip. Examine each joint for full range of motion or for any swelling. Hold each wing up to the light to transilluminate the feathers as this may reveal bruising of a swollen area.
- Examine each leg individually. Run your finger from the hip to the end of each claw paying particular attention to the joints.
- Assess the gripping ability of each toe. A weak grip may indicate abdominal tumours, fractures or disease of the nervous system.
- Lameness of one leg is more common than both legs so note if the bird is placing more weight on one leg and favouring the other.
- Assess the length of the claws as overgrown claws can be associated with liver disease, nutritional problems or poor perches.
- Inspect the bottom of each foot. The surface should be rough, not smooth. A smooth surface at the base of the foot may be the first sign of incorrect perching material or the beginning of „bumble foot“.
- Once the examination is complete immediately replace the bird into its enclosure and assess its tolerance of the procedure you have just carried out. Most birds will look „normal“ and preen to replace any disturbed feathers caused by the examination. If the bird is looking obviously stressed or is breathing heavily, assume it is ill.

If you have any concerns about the health of your bird, seek veterinary advice as they will carry out a more detailed physical examination along with other procedures such as faecal or blood tests to assist the diagnosis and subsequent treatment.

8.3 Routine Treatments

The main form of routine treatment for the Galah is worming. This process, institute dependent, usually occurs on a quarterly basis with bird being wormed every three months for a three week period usually via their daily food/seed (Scannell, pers obs, Taronga Zoo, 2007).

The preferred wormers to be used with cockatoos are Avitrol™ and Avitrol Plus™ as Hunt (1999) states; these products are registered for use in birds. A number of other parasiticide products are also available which are used by aviculturists and include: Panacur 25™, Ivermectin, Moxidectin, Pyrantal pamoate, praziquantel and oxfendazole (see appendix 16.1).

It is recommended that birds be weighed previous to the administration of wormers as the weights of individual birds can vary greatly and some wormers require specific dosage: weight ratios.

Worming should not be carried out in extremely hot weather, if a bird is stressed or feeding young (Hunt, 1999).

At Taronga Zoo, routine faecal collection from all sections of the zoo are carried out every three months and examined by the Veterinary section for general health of the animals and detection of any underlying diseases as part of the preventative medicine regime (Scannell, pers obs).

8.4 Known Health Problems

As suggested by Sindel and Lynn (1989), Cockatoos are a relatively robust and hardy group of birds. Yet there are a number of diseases both infectious and non-infectious that Galahs and Cockatoo's in general, are more susceptible to. Hunt (1999) lists common disease and disorders relating to cockatoo species which includes the following:

Viral Diseases:

Psittacine Circovirus Disease (PCD) also known as Psittacine Beak and Feather Disease (PBFD)

Cause: By a virus that which infects and kills the rapidly dividing cells of the beak, feathers and the immune system of parrot-like birds and particularly in young birds. The virus is shed in the feather dander, faeces and possibly oral fluids.

Signs: The disease can take two forms; the **acute** form where birds present very ill often with green or mucoid diarrhoea but without any obvious feather or beak abnormalities.

The **chronic** form which is the most recognisable form in cockatoos where birds gradually have their moulted feathers replaced by abnormally formed new feathers. These affected feathers are often fragile, uneven in shaft thickness, may be dried or withered, with blood in the base of the quill. Many fall out prematurely.

In cockatoo the powder down feathers are often the first affected resulting in a decrease in the production of the fine white „feather dust“ so the plumage appears darker than normal. Galahs will therefore appear darker pink and grey (relative to the subspecies' normal colour range). Bare areas begin to appear, first in the powder feathers, then as the contour feathers are affected, bare areas appear on the body become more apparent. Eventually the wing and tail feathers fall out.

The actual appearance of the bird will vary dependant upon the stage of moulting when the bird was first affected.

The beak as well as appearing shiny, may also grow excessively and show cracks on its surface. As the disease progresses secondary infections can also cause the beak to rot causing part of it to fall off causing eating difficulties.

Treatment: Blood tests and examination of feathers and/or tissue samples from a suspect bird will help to diagnose this virus. Unfortunately there is no treatment for this disease and its results nearly always fatal.

Supportive care can be given to infected birds through soft food diets, vitamins and antibiotics for secondary infections if this does not pose a risk to other birds in your collection.

Prevention: Quarantining all new birds and isolating them from existing collection birds until they have been tested for PBFD/PCD.

Routine cleaning of aviaries or in the case of an outbreak with disinfectants such as Virkon S™ or Parvocide™ and disposing of wooden aviary furniture such as perches or nest boxes and removal of substrate from the aviary floor will help to minimise the spread of infection.

Avian Polyomavirus (Papovavirus)

Cause: A viral pathogen which can cause widespread death in psittacine nestlings particularly in hand rearing environments. Cockatoos in general are highly susceptible to this infection but unlike many other parrots, rarely develop the disease unless suffering from an immunosuppressive disease such as PBF. D.

Signs: In a young bird: enlarged abdomen, crop emptying slowly or not at all, bruising under the skin, pale skin, weakness or yellow urate shortly before death and death within 2-3 days.

In older birds: abnormal flight and tail feathers, weight loss, poor growth.

Treatment: In a nursery outbreak, there is not much that can be done for infected chicks except to provide supportive care.

Disinfection should be undertaken using a bleach dilution of 50ml/litre of water or VirkonS™.

Testing for the disease is available in Australia with a vaccine only existing currently in the USA.

Strict personal hygiene procedures should be put in place as the virus can be carried by humans on their hands, clothes and shoes.

Prevention: With young birds personal hygiene should be improved, birds should be spread out as much as possible and individual feeding syringes should be used for each chick. No new chicks should be introduced to the nursery. Raising young from other collections, moving between indoor and outdoor aviaries, poor traffic flow between adult birds and hand reared chicks and not quarantining new arrivals all increase the risk of avian polyomavirus entering your collection.

Chlamydiosis or Chlamydophilosis (Psittacosis), also know as Parrot Fever

Cause: By the organism *Chlamydia psittaci* or more recently referred to as *Chlamydophila psittaci* which can infect cockatoos and other parrots, as well as other birds and mammals (in which it is called Ornithosis). It is not uncommon for a healthy bird to carry the disease in its system and even remain this way its entire life without developing signs or associated illness.

It can be very contagious and can cause a wide range of clinical signs.

This disease is of particular concern as it can be passed on to humans with the symptoms appearing like a cold or flu that won't clear up and can cause severe illness.

Signs: Mild depression, lethargy, rough plumage, huddled posture, sneezing, inflamed watery eyes/conjunctivitis, feather loss around one or both eyes, nostrils plugged, heavy breathing (tail bobbing), soiled vent, yellow-green or watery droppings and diarrhoea, excessive urine in droppings, weight loss and occasionally tremors and fits and sudden death.

Treatment: There are laboratory tests which can be performed to detect the organism in a suspected or ill bird called the „Clearview“ test. Birds that survive the infection are often still very susceptible to the disease.

Treatment is a long process with the drug of choice being doxycycline (Psittavet™) or azithromycin. It can be administered by a weekly intramuscular injection, crop needle or as a drinking water medication (least reliable due to the amounts of water required to be ingested and is broken down by light and temperature exposure). Birds must be treated for a minimum of 6 weeks.

Prevention: During treatment periods minimise stress, cease breeding, do not introduce new birds, improve the diet, remove any „bullies“, provide a secure aviary, clean and disinfect the aviary every 2 weeks during treatment and wear a face mask and gloves when cleaning or attending to ill birds and allow 2-4 weeks after treatment before commencing breeding.

Personal hygiene procedures must also be followed including hand washing between handled any suspected ill birds to minimise cross infection of both yourself and other birds.

Bacterial Infections:

Bacteria can cause a wide variety of diseases in cockatoos with signs that mimic those of other disease. Some types may include: *Pseudomonas sp.* (found in water), *Yersinia sp* and *Salmonella sp.* (associated with rodents infecting birds“ food).

Cause: The most common cause is septicaemia where the poisons from the bacteria make the bird look generally ill. Bacterial infections can be localised to particular body systems to cause specific diseases such as upper respiratory tract disease causing blocked nostrils, swollen sinuses and sneezing or intestinal disease causing diarrhoea or can cause general disease throughout the body.

Signs: Lethargy, not eating, fluffed feathers, eyes closed, discharge from nostrils and eyes, sneezing, laboured and/or noisy respiration, tail bobbing, diarrhoea (often bright green), soiled vent, excess urine production, weight loss and even sudden death. Signs can be indistinguishable from Chlamyphilosis.

Treatment: There are many different species of bacteria and often many strains within one species causing variance in the diseases they causes and therefore variance in the treatment required or antibiotics to which they are sensitive. No one antibiotic can be effective against all bacterial infections.

Prevention: Improved husbandry including: healthy, nutritious diets and clean, stress free environments paying particular attention to – cage floors and the removal of faeces and old food; clean water and fresh food daily; cleaning and replacing nestboxes regularly; elimination of rodents or rodent infestations in food prep areas; wild bird faeces entering the enclosures; introduction and quarantine of new birds; location of aviaries as a potential stressor due to exposure to the elements or high traffic areas; overcrowding or intimidation by dominant birds.

Fungal Infections:

Aspergillosis

The *Aspergillus* organism is found commonly in the environment and breathed in by most animals and people everyday. Disease is thought to occur through either exposure to very high numbers of fungal spores or more likely in cases of birds with immunosuppression.

Cause: Stressors such as transport and handling, poor ventilation, inadequate nutrition, very young or old age, abuse of antibacterial or corticosteroid medications, respiratory irritants and underlying disease may predispose a bird to aspergillosis.

This is primarily a disease of the respiratory system although other body systems can be involved. Contraction of this disease may result in two main physical responses.

Signs: The first group of signs are shown through the birds' obvious breathing difficulties where tail bobbing and open mouthed breathing occur especially after exercise. They may also be depressed and have obvious weight loss indicating a long term affliction. These birds may also have green stained droppings.

The second form of this disease occurs quickly with the bird showing a sudden onset of breathing difficulties without the weight loss. Often these birds will die quickly without treatment and are often found dead without any previous signs of illness.

Treatment: Obtaining an exact diagnosis in a live bird can be difficult and so it is suggested that an immediate veterinary examination be undertaken and treatment provided according to their diagnosis.

Prevention: Huge fungal spores can be found where there is rotting organic matter with split feed, seed husks and stale greens especially when exposed to moisture and warmth can all support growth of this fungus. So improved husbandry procedures during feed outs and collection of old food bowls and waste matter within the enclosure will assist to keep these fungal levels down. Optimum nutrition, housing and hygiene standards in particular the cleaning of aviary floors, nest logs and carry cages on a regular basis and eliminating wet spots in the aviary are all important.

Candidiasis

Cause: Caused by the yeast *Candida albicans* which is an organism common in the environment and may be a normal inhabitant of a bird's digestive tract. Its ability to cause disease is dependent on the birds' age and its immune status.

In young birds: It is frequently seen due to their underdeveloped immune systems, and especially in hand reared birds due to factors such as fluctuating brooder temperature or humidity, problems with decomposition, temperature, texture or nutritional content of feeding formulas, caking of food on the face and plumage and abuse of antibiotics in chicks.

Signs: Chicks will usually regurgitate or vomit, have slow crop emptying time, are depressed and refuse food, crop impactions.

In older birds, the crop may be full of mucous and crop emptying is often delayed and therefore a sour smell is often associated with this condition.

Underlying Vitamin A deficiency will also predispose birds to *Candida* infections.

Birds may show raised white areas lining the inside of their mouth, crop or other affected areas of the gastrointestinal tract. Occasionally yeast infections can also occur on the skin, feet and respiratory tract.

Treatment: Firstly involves correcting the underlying management or other disease problems and then treating the bird with nystatin (Nilstat or Mycostatin). Or in severe or non-responsive cases antifungals such as ketoconazole (Nizoral) which can cause side effects especially in chicks.

Supportive therapy such as fluids and vitamin A may also be required.

Prevention: In young birds: Improved hand rearing practices and procedures in relation to feeding amounts, temperatures, nutritional content of feeding formulas and feeding techniques. If this is a reoccurring problem for handrearers, they need to assess their handrearing techniques and daily chick management.

Endoparasites:

Roundworm (*Ascarids*)

These are the most common worms found in parrots and cockatoos.

Adult worms are long, creamy white and smooth often seen in the droppings of birds after worming.

Worms are rarely seen in the droppings unless the infestation is severe.

Cause: This worm is transmitted by direct contact with infected droppings either from the same or another infected bird. The eggs of roundworm are very resistant and can persist in an environment for years especially in moist, organic matter.

Signs: Weight loss, lethargy, diarrhoea, more susceptible to other diseases, and poor breeding results can all indicate worms. In severe cases birds may be emaciated and pass whole seeds in their droppings and some will die suddenly.

Other bird may not appear ill but shed worm eggs in their faeces.

Treatment: Diagnosis of worms in a live bird is best done via examination of their droppings microscopically as the eggs are not visible to the eye.

Treatment can occur via the administration of a wormer (anthelmintics) either directly to the mouth or via a crop needle. The preferred wormers to be used with cockatoos are Avitrol™ and Avitrol Plus™ as Hunt (1999) states; these products are registered for use in birds. Other treatments that can also be used include: Ivomec and Panacur 25. It is preferred where possible that any infected birds be weighed previous to treatment to gauge the correct weight to dosage ratio.

In water medication is not as reliable due to the volume of water needing to be ingested and monitoring this amount.

Prevention: To prevent reinfection, faeces must be removed regularly or birds should be housed so they can't access their faeces. Disinfectants are ineffective in destroying the eggs, so prevention must occur via strict quarantine procedures and worm treatment for all new acquisitions.

Having easily cleaned aviary floors, such as sloped concrete, which are kept dry and fully roofed aviaries to prevent wild bird infections being the source will all assist in minimising roundworm infection.

Regular faecal sample collecting and testing will all assist the indication of infected birds and regular routine worming will assist in individual load management (institution and situation dependent).

Threadworm or Hairworms (*Capillaria*)

Theses are tiny, thread-like worms which are difficult to see with the eye, that can live from the oesophagus and crop through to the intestinal tract.

Cause: The life cycle begins when a bird ingests a hairworm egg which is infective (contains larva and been on the ground for at least 4 weeks). Once swallowed, the larva hatch and burrow into the gut lining where they develop into adult worms.

Signs: Diarrhoea, weight loss, lack of appetite, vomiting and anaemia.

Treatment: The eggs can remain infectious in the environment for several months. They can be resistant to more traditionally used worming medications therefore the use of moxidectin such as Cydectin Sheep Drench may be effective (seek veterinary advice).

Prevention: Earthworms can carry a larval stage of the hairworm and therefore should be eliminated from the environment. Follow prevention procedures as listed above. A full substrate change is also needed when an aviary has been infested with *Capillaria*, otherwise it will reoccur.

Tapeworms:

These are long, flat and whitish worms whose bodies are usually made up of segments. They are most commonly seen in wild cockatoos and only occasionally in captive bred birds.

Cause: The life cycle begins when the end segment of an adult worm which contains the eggs is shed in the droppings. An egg is then eaten by an intermediate host such as an insect, earthworm or snail, which is then eaten by a bird. The tapeworm matures inside the bird where it attaches itself directly to the intestine.

Signs: In large numbers they can cause diarrhoea and failure to thrive, although many birds may appear „normal“. The segments are infrequently shed in bird faeces, but can be occasionally observed hanging from the cloaca after defecating.

Treatment: Praziquantel (Droncit™ or Avitrol Plus™)

Prevention: Elimination of insects from the enclosure environment where possible or bird access to them.

Ectoparasites:

There are many species of lice, mites, ticks and flies which can affect cockatoos:

- Scaly mite (*Cnemidokoptes*) usually affects Budgies and Canaries may occasionally be seen in cockatoos.
Signs: The mite burrows into the skin producing a crusty reaction visible as a honeycombing of the skin especially around the eyes, beak and face (although it can occur elsewhere on the body).
Cause: The mite is spread by direct contact or through skin flakes shed from an affected bird.
Treatment: Ivermectin or moxidectin.
Prevention: When seen in cockatoos, it is usually an indication of an underlying immunosuppressive disease such as PCD. Cleaning the enclosure and treating with an insecticide (Avian Insect Liquidator) especially in cases of mite infestations.
- Lice.
Signs: Excessive chewing or preening of feathers/skin, bald spots and damaged feathers. Lice eggs can usually be seen on the underside of feathers as a fine white or grey powder arranged along the shaft of the feather.

Adult lice will normally be seen scurrying away from the light.

Cause: Large numbers of lice on a bird also suggest that its immune function is poor and the bird should be checked for PCD.

Treatment: Dusting with Carbaryl™ or pyrethrin powders or sprays once a week until all lice are removed or ivermectin or moxidectrin drops into the mouth or onto the skin on the back of the neck once weekly until all lice are removed. This normally requires only 2-3 treatments to clear a bird.

Prevention: Cleaning the enclosure and treating with an insecticide (Avian Insect Liquidator) especially in cases of mite infestations.

- Flies.
Pigeon fly are flattened flies which live on the cockatoo's body and often crawl out when being handled or onto the handler. They are generally considered harmless but may be involved in the transmission of blood parasites.

Protozoan parasites:

There are several species of microscopic organisms which are parasites of the digestive tract of birds. The one most likely to cause problems in Australia is *Giardia spp.*

Signs: Smelly mucoid diarrhoea, anorexia, excessive feather grooming, oily/greasy feathers, feather picking and screaming, whole seeds in droppings, depression, weakness and death especially in young or immunosuppressed birds. Microscopic examination of fresh faeces is required for diagnosis.

Treatment: Administration of antiprotozoal drugs such as metronidazole (Flagyl™) or ronidazole (Ronivet-S™) for approximately 7 days and supportive care with fluids, antibiotics, antifungals and/or multivitamins.

Prevention: The environment must be kept dry to prevent survival of the cystic stage of the organisms' life cycle, preventing reinfection. Clean the enclosure regularly and remove all traces of faeces. Isolate sick birds from non-infected birds.

Non-infectious Diseases:

Nutritional problems: Obesity

Obesity is very commonly seen in mature Galahs with the presentation of large fatty deposits under the skin, particularly in the lower abdomen and around the feet.

These growths (lipomas) may become traumatised due to rubbing on the cage floor or perch causing bleeding. The birds may also bite at the lesions as they may cause irritation which may require the lipoma to be surgically removed.

Long term treatment: Involves dietary adjustments reducing the fat level of food/seed and improved vitamin, amino acid and mineral balance, gradually limiting oily seeds and adding vegetables, fruit and greens to ensure starvation does not occur.

Many obese birds also have fatty livers predisposing them to liver failure, rupturing and bleeding of the liver resulting in death. It can also predispose the bird to other problems due to poor liver function including restricted respiratory function.

Other problems associated with excess fat include: diarrhoea, infertility, oily feathers and calcium deficiency. These birds are also more susceptible to heart disease.

Feather Plucking:

This term is used to describe any damages done by a bird to its own feathers. If it extends to the skin, muscles or other tissue it is then referred to as „self mutilation“. These terms can describe a whole series of problems in a bird with different causes and clinical signs.

Birds who feather pluck may nip off the tips of their feathers, strip the vane of the feather, split the feather down the shaft, break the feather off anywhere along the shaft or pull the entire feather from its follicle. This can occur all over the body or be concentrated on wing or tail feathers or the chest.

Cause: This can be a challenge as the underlying cause is not always apparent and can differ from case to case. Some can be caused by bacterial and fungal infections of the skin, external parasites such as mites and lice or even intestinal worm infections.

If the feather plucking is a result of poor skin and feather quality due to nutritional problems, a change in feather colour may also be seen.

In Galahs, malnutrition may show as a change in feather colour from grey to pink.

Behavioural causes such as boredom, frustration, anxiety, insecurity, changes to routine or environment, over or under exposure to daylight, poor socialisation and aggression.

Treatment: Identification of the underlying cause/s will need to be established before any form of treatment can be offered. A thorough history, physical and feather examinations, skin biopsies, blood and faecal tests, x-rays, infectious disease and allergy tests will all provide useful information towards treating the bird.

Prevention: Further damage to the bird can be prevented through the use of a collar with the design relating to the area of the body being plucked. Individual personalities in relation to tolerance of a collar will also need to be considered before implementing its use. The collar should be left on until the damaged areas have healed and new feathers have grown and by that time the underlying cause may have been identified.

Bumblefoot

Bumblefoot is an inflammatory or degenerative condition of the avian foot commonly seen in pet cockatoos.

Cause: There can be several causes of this condition including malnutrition, Vitamin A deficiency, obesity and lack of exercise resulting in erosion and ulceration of the foot pads and the use of inappropriate perching material.

Signs: The skin on the underfoot appears thin and smooth instead of a rough, knobby texture. Flaky skin may also be present. As the disease progresses, the underfoot becomes redder and eventually

infected. The infection firstly involves the soft tissue of the foot but in severe cases can spread to the bones.

Clinical signs can vary from very slight changes in perching posture to more obvious leaning to one side and eventual total disuse of the foot.

Treatment: This will vary with the severity of the lesions. In early detection multivitamin supplements containing Vitamin A and Biotin for short term assistance and the addition of long term dietary changes. In cases where wounds have occurred, administer antibiotics and possible padding of the perches will be beneficial.

Prevention: Improved nutrition and diet to reduce obesity (especially in Galahs) and improve vitamin, mineral and amino acids levels and balance.

Use natural materials for perching with variety in widths and diameters and textures such as Eucalyptus and Melaleucas and avoid using dowel, metal or plastic perches. Discourage birds from hanging on the cage wire for long periods. Increasing levels of exercise and activity will also be beneficial.

8.5 Quarantine Requirements

As Cannon (2002) suggests, the aim of quarantine is to prevent any disease entering the premises and infecting your birds as well providing an opportunity to monitor a new bird as it settles in as this is when any disease will become apparent.

He goes on to say that a recommended quarantine period should be a minimum of four weeks, although up to six weeks is preferable. Even if a new bird has been examined by a vet and deemed „healthy“ prior to arrival at your establishment, quarantine should still be undertaken.

Most Parrots at Taronga Zoo have 40 days in quarantine and are treated with Psittavet in their drinking water at all times (pers comm., Jackie Salkeld).

Moving a bird to a new location or environment can be stressful and any diseases which their immune system has been controlling under normal circumstances can break out. The bird may have also been exposed to particular diseases on its way to or in the new premises can pose a serious health threat.

Cannon (2002) suggests the following procedure be addressed in a quarantine program:

- Try and begin with the acquisition of a healthy bird as possible.
- Perform both a distant and physical examination to assess its health status. All new birds should be examined thoroughly.
- During the quarantine process reduce stress levels in the bird by having the quarantine area as far away as possible from other birds and existing aviaries, that isn't too brightly lit and in a quiet location.
- Provide separate feeding and water bowls that are never used in the existing aviary areas.
- Introduce the new bird to the quarantine cage as early in the day as possible as this gives it an opportunity to settle down and locate the food and water dishes and a safe and secure perch for the night. In the case of multiple birds, ensure there are enough perches and feed dishes to avoid fighting. Have enough perches at the highest point of the cage for all birds to roost for the night. Spend time observing the birds to detect any signs of bullying or aggression as this will cause further stress and should be avoided.

- During the quarantine period the bird/s should be wormed at least twice and have their droppings tested by a vet.
- Cockatoos may have been exposed to Psittacosis and should therefore be given a 6 week course of doxycycline (Psittavet™).
- Other preventative treatments may also be given during this period but this can be discussed with your vet (eg scaly face mite)
- Record all observations and interactions with the bird and include records on any treatments administered (when, medication used, dose, method of administration and for what purpose)
- Have strict hygiene procedures in place for keepers who enter the area or have contact with the bird as human can be instrumental in the movement of disease within a collection.

If you suspect a bird in your collection is ill, isolate it from other birds as a preventative measure and weigh it and check its keel.

9 Behaviour

9.1 Activity

“In the wild Galahs feed mainly in the early morning and late afternoon, mainly on the ground. During the middle of the day they shelter in the foliage of trees and shrubs, entertaining themselves by stripping leaves and bark.

They will also perch on telephone wire and bare tree branches, indulging in a series of acrobatics, hanging upside down flapping their wings and screeching loudly. During rain showers they will excitedly bathe while perched on wires and branches, flapping their wings while hanging upside down and screaming.

After feeding and watering in the late afternoon they will move back to their nesting sites (and in the case of nonbreeding flocks, a roosting site near a watercourse), and indulge in late evening flying and acrobatics before settling for the night. In the morning, activity begins before light as the birds call to each other and begin to move around in the treetops. They then drop to the ground and feed for a short period before returning to the branches, grooming themselves and then finally flying off in search of food.

Often this departure is initiated by one bird, which calls and stretches its wings and tails before flying off. It may have to repeat this several times before the entire flock departs for the day” (Doneley, 2003).

Rowley (1990) in Chapter 4 of his book (pg 31-42) provides a very concise list of „Basic Elements of Galah Behaviour“ and includes activities such as: **Locomotion** (sidling, walking, tripodding, promenading and flight), **At rest** (awake, freeze, sleep), **Body Care** (preening, scratching, nibbling, chewing, grinding, stretching, jaw stretching, wing arching and wing/tail/leg stretches), **Feather Postures** (crest, face-fan, body feathers and wing and tail feathers), **Feeding**, **Drinking**, **Bathing**, **Acrobatics** and **Defaecation** which are all part of the daily activity of the Galah (see appendices for behaviour in detail).

9.2 Social Behaviour

Galahs are gregarious birds and have a social organisation in the wild that can be viewed at three different levels: the breeding pair, the juveniles and the non-breeding nomadic immatures with unmated adults, with birds from all levels often occurring in the same foraging flock (Rowley, 1990). Rowley breaks the social behaviours down into the following elements: Vocalisation, Non-agonistic and agonistic behaviour and these elements are explained below.

Vocalisation:

Rowley (1990) also suggests that Galahs appear to actively seek out the company of other Galahs with their vocalisations serving as the means to make contact between individuals and evoke a call in response. This vocal contact may occur between members of a mated pair, members of a flock or even relative strangers that pass by.

Galahs have approximately 9 distinctive calls which they use primarily to coordinate activity such as feeding, mobbing and flight.

Rowley breaks these calls down into the following categories:

- ***Distant Contact calls***: Occurring between pairs, flock members or unrelated birds.
- ***Close Contact Calls*** or “***murmurations***”: Are soft sounds occurring between perched mated pairs side-by-side or by a parent to its nestlings.
- “***Chet***”: Basic, brief utterances that Galahs use to recognise each other especially young who are about to leave the nest recognise their parents. This call is given quietly in flight or at rest and functions as a contact and identification call. It is also used as an alarm call with a decreased interval rate and increased intensity as the bird becomes more alarmed.
- “***Lik-Lik***”: Flight indication and flock co-ordination call. A double sometime triple call indicating the caller is about to fly off usually after resting or preening and usually followed by a wing, tail or leg stretch showing a lack of urgency. Upon hearing this other Galahs in the area will repeat the call before flying off together.
- “***Cheat***”: Repeated 2-4 times and often given by a member of a pair returning to the hollow advertising territorial ownership and sometime leads to *Heraldic Display* (see below).
- “***Titew***”: A two part call used in transit on a long travelling flight.
- “***Chet-it***”: Similar to the “*Titew*” but given when perched as a contact call to birds a distance away.
- ***Screech (“Scree”)***: A loud call varying in length and used in a variety of situations such as during *Mobbing* (see below), *Heraldic Display*, when a bird is caught or held or when biting or being bitten by another Galah. It can convey threat as well as express fear or pain.
- ***Begging***: A monotonous utterance that continues over a long period given by a hungry nestling or dependent fledgling.
- ***Being Fed***: During the process when the parent passes food via its beak to the young, the begging call becomes a loud duet between the two and only ceases when the parent withdraws its head.
- ***Greeting or “Kwee”***: Made by the parent on their return to the nest hollow softly to the nestling before feeding.

Non-agonistic Behaviour

- ***Courtship feeding***: Occurs seldom and cannot be included as integral reproductive behaviour. Involves the feeding of one adult by another (mate). Tends to be the male feeding the female with her adopting a *begging* posture.
- ***Mobbing***: A sequence of calls (“*Chets*”) that indicate increasing alarm can lead to a group of Galahs „mobbing” an intruder, also referred to as “*Hover Flight*” where the Galahs fly slowly with brief wing beats whilst calling. Alternatively “*High Flying*” can be displayed where a

large number of Galahs form a tight flock and fly as high as 100m above the ground to confuse predatory Raptors.

- **Foraging:** Individuals space themselves within the flock on the ground just out of „biting“ distance whilst feeding. In cases where the food supply is limited or confined, that distance is reduced and quarrelling is frequent and noisy.
- **Roosting:** Galahs usually roost socially in the canopies of large trees where they settle just prior to nightfall/dark. Previous to this time and after foraging, Galahs will perch on more exposed branches below the canopy.
- **Resting:** A large part of the Galahs day, when food is plentiful, is spent perched whilst digestion occurs. This results in a large group of birds gathered in a clump of trees, organised so that breeding pairs, immature and juveniles settle in different trees. Unless a parent or breeding pair, they will space themselves a bird length apart.
- **Allopreening:** Interactions between resting, perched Galahs can lead to one bird preening another with the behaviour reciprocated by the other. These can often be members of a pair or parent, but is not always the case. This process is an important part in maintaining pair bonds. The preening bird attends to the areas normally out of reach for the recipient (head and neck regions) and this process may be initiated by either partner.
- **Bowing:** A ritual performed as breeding season approaches and birds are searching for a new hollow. As Rowley states it is a “display of territorial advertising” as the bird looks around during the process to ensure they are „being watched“ whilst perched on the rim of the desired hollow before resuming to bow into it once again.
- **Occupied:** Usually exhibited during the breeding season by either sex by perching on the rim of their hollow facing outwards displaying that the hollow is occupied. Most common during the middle of the day after the completion of their morning feed.
- **Heraldic Display:** Holding itself upright, the crest is raised, wings are half opened and the tail is fanned whilst emitting a piercing “Scree” call and performed by either sex usually in defence of their territory/nest hollow. During an extreme display, the bird will also rock forward with a full wing spread and bowing action. It can also be performed simultaneously by a pair and acts as bond reinforcement.

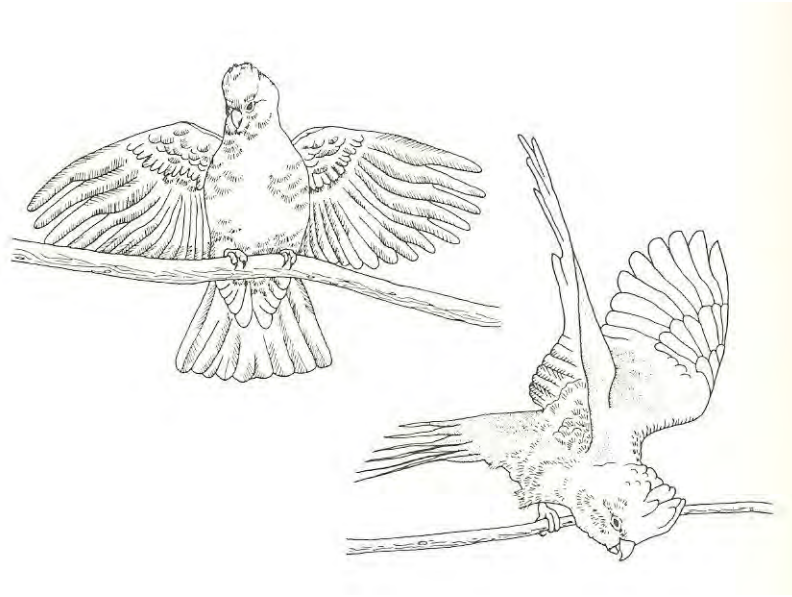


Fig. 9.2.1: Heraldic Display (Rowley, 1990).

- **Gaping:** A mildly threatening display given silently where the beak is slightly opened as if ready to bite, pointed towards the predator.

Agonistic Behaviour

Agonistic behaviour against other species usually takes the form of *Mobbing* an intruder or being in direct competition for a nesting site/hollow.

Between Galahs, they take place under three circumstances: Defence of territory, in competition or to maintain „personal distance“ (Rowley, 1990).

- **Territory:** A pair of Galahs will defend the area around their nest hollow and any species that attempts to move within a 3 meter distance from the hollow entrance. This is usually accompanied by a warning call especially if another Galah is too close. If the call doesn't work, then the defending Galah may either fly at the intruder (*Gape*) or walk along the branch towards them until they have no where to go but fly away (*Walking off*). If neither of these processes proves successful, a fight will follow with the owner biting the intruders' foot, followed by the two birds biting each other whilst screeching loudly.
This form of aggression tends to be observed early in the breeding season but may reoccur in October when potential hollows are being investigated.
- **Individual Distance:** Although social animals, Galahs generally space themselves out whilst feeding or roosting so they are approximately a bird length away from each other. The reaction of the Galahs to the invasion of space can be either friendly (allopreen or close contact call) or agonistic accompanied by a *Gape*, a bite attempt or a jab from the beak.
- **Competition:** This can occur between Galahs for a number of reasons such as access to food and water, roosting sites or nesting hollows or even other species especially those who are also hollow nesters.

9.3 Reproductive Behaviour

This area of Galah behaviour is examined in detail in Section 10 (Breeding), of this husbandry manual. In brief, if the male is ready to breed first, the female will not respond to his courtship behaviour such as allopreening, until she herself is ready to mate.

As Rowley (1990) states, there are no elaborate displays or calls associated with Galah pair formation, although allopreening and hollow lining are important courtship activities. Some soft chattering vocalisation may be used by the male whilst approaching the female and an acrobatic flight display usually follows with the female taking off first. During this time flight is erratic and the process often repeated before allopreening begins.

Once the pair is formed and breeding approaches, they will together inspect potential nesting sites and once chosen will perch at its opening and beginning lining its interior.

According to Rowley (1990) courtship feeding is so rare amongst Galahs, that is cannot really be considered as a requirement of reproductive behaviour.

The breeding season for the Galah when these behaviours are potentially displayed will vary according to climate and weather conditions but will usually take place during winter, spring and summer in most parts of Australia. In the far north, breeding occurs after the wet season, which usually means nesting commences in late autumn or early winter. In the arid inland areas of Australia, breeding is totally related to rainfall and in dry seasons may not occur. In general, the further south the habitat the later the breeding season (Sindel and Lynn, 1989).

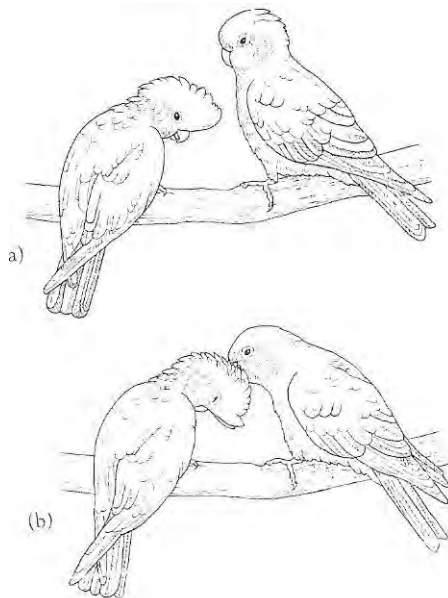


Fig 9.3.1: Allopreening (Higgins, 1999)

9.4 Bathing

According to both Rowley (1990) and Higgins (1999) Galahs are cautious in their approach to water with bathing rarely seen in the wild. Yet when it rains, Galahs become excited tilting themselves far forward from their perches or by hanging upside down ruffling their feathers and spreading their wings

and tails apart as they wave them around. Rowley (1990) has labelled this display as the “*Rain Dance*” as it is particularly prevalent during summer storms when the weather is warm. It is often a simultaneous display amongst Galahs and last for about five minutes or ceases when the bird fears it will become soaked through and seeks shelter.

This same type of behaviour can be induced in the captive environment through the use of a fine spray hose or sprinkler system directed into the enclosure.

9.5 Behavioural Problems

The Galah’s (especially pets) present frequently to vets with behavioural disorders (Doneley, 2003) which may range from mild feather picking through to a form of apparent hysteria, where the bird compulsively pulls out or chews its primary feathers and many of its coverts and, when approached by humans, screams hysterically and throws itself around its cage, often traumatizing its wing tips. The problem is most commonly seen in juvenile, hand-reared birds, often raised individually. It is relatively uncommon in mature birds (Doneley, 2003).

One school of thought presented by Doneley (2003) feels that the basis for these disorders lies with inadequate socialization of the bird, either during the hand-rearing process or after weaning. Wild Galah chicks are reared, typically in a clutch of 3 to 5, at first in a dark hollow for 6 to 7 weeks and then in a crèche for another 5 to 6 weeks. During this time they learn to interact with other birds and establish their social status. They learn what to eat, how to locate it, and how to eat it. They learn how to groom themselves, how to recognize predators and how to protect themselves and the flock (Doneley, 2003).

They have learned most, if not all, of these skills before joining the large nomadic flocks where they learn to socialize even more and go on to reach sexual maturity, select a mate, and repeat the cycle.

Doneley goes on to say, “However, birds that have been bred in captivity or have been “rescued” from the wild and are taken for hand rearing grow up in a very different environment. They are often raised alone as individuals, and are kept in warm but often brightly-lit containers. They are fed large quantities of food at lengthy intervals and, when weaning, have their food presented in front of them with no effort needed to locate it. They never have to learn to forage for their food and often only recognize the limited diet provided by their carer as food. With no siblings or crèches, they have no social interaction with their own kind, and do not learn how to establish a social order and their own place within one. In place of a flock they have human companions whom, however hard they try, cannot replicate the constant 24-hour a day social interaction of a flock. As a consequence, juvenile Galahs in captivity often live confused lives, never sure of their environment and their place within it.” Doneley feels a review is required in hand rearing techniques to improve socialisation of Galahs in the early stages of life.

Feather Plucking/ Self Mutilation

Describes any damage done by a bird to its own feather but can also include mate plucking if damage to feathers occurs on the birds head. It is important to distinguish self plucking or mate plucking from other distinguishing feather disease.

If damage to the bird extends to the skin, muscles or other tissues then it is a case of self mutilation. Both of these conditions can be caused through stress, boredom or other underlying illnesses so it is vital to establish what the potential cause may be.

Heavy Metal Toxicosis

Galaha are naturally curious birds and if held kept in a barren environment, Galaha frequently ingest inappropriate materials; consequently there is a high incidence of heavy metal toxicosis in these species. Special consideration must be given not only in enclosure design and materials used, but also in the behaviours which may be displayed such as cage climbing and hanging in order to gain attention. Providing an environment which also caters to the inquisitive nature of the Galah will also assist to reduce developed behaviours by redirecting their interests away from the wire through the provision of enrichment items.

Screeching

If housed individually Galaha can often resort to loud vocalisations and screeching in order to gain attention from its „flock substitutes“ namely humans, by resorting to behaviour they exhibit in the wild. Being a social animal, they seek out other Galaha in the wild and communicate through a variety of vocalisations which can often be misunderstood as an annoying behaviour when in captivity.

Obesity

Obesity is a common problem for Galaha in captivity particularly mature birds and can develop into other health problems such as growths or lipomas forming around their feet and cause further stress to both the animal and the growths through their rubbing on perches or enclosure floors. Limiting food supplied, the type of food provided, altering feeding routines, improved vitamin and mineral balances should be used to assist in the reduction of fat in the birds“ diet over time. By making the bird work for their food such as having to forage or hiding in around the enclosure will encourage movement and reduce boredom along with the expectation that food will always be presented in the same way each day.

9.6 Signs of Stress

Signs of stress in a Galah can be caused by a large range of factors and can include:

- Introduction of a new mate or aviary species
- The loss of a mate especially in long term breeding pairs
- Changes in routines or new routines
- Transporting or moving the animal
- Changes in their enclosures or surroundings
- Changes to their immediate/surrounding environment outside of the enclosure
- Changes in handlers/staff especially if bonds formed which captive Galah will do as they are a flock species
- Changes in their diet
- Loss of territory within an enclosure
- Aggressive behaviour shown by other birds towards them/agonistic behaviour

The resulting signs from the presence of these stressors can include:

- Loss of appetite or especially with Galah overeating and obesity
- Anxious behaviour such as screeching when staff approach the enclosure
- Flying at staff, biting staff, increased aggression

- Withdrawn behaviour, retreating to one area and remaining there
- Loss of condition
- Feather plucking
- Over grooming
- Self mutilation
- Panting
- Screeching
- Repetitive or stereotypical behaviours such as rocking or pacing along a perch.

9.7 Behavioural Enrichment

Being very social animals that actively seek out the company of other Galahs, in captivity especially if housed alone will suffer greatly if confined to a cage with nothing to do. As listed in the ASZK handbook (2003) they can be very destructive within their exhibit especially of furniture and vegetation, if they are left without any form of stimulation. Forshaw (2002) also that captive Galahs are prone to lethargy and obesity and therefore the aviary should also be designed and equipped to promote activity.

Some basic idea and toys that can be provided could include:

- cardboard boxes
- toilet rolls
- gum branches and gumnuts
- pine cones, Banksia flowers and native grasses
- stainless steel toys eg. wire like balls with nuts or seeds hidden with and surrounded by shredded paper or native grass
- rope and wooded toys

There is a diverse range and concise list of potential enrichment for Australian Cockatoo's and specifically the Galah contained in the Australasian Society of Zoo Keeping's (ASZK) „Australian Animal Environmental Enrichment Handbook“ (2003). It also contains the relevant Galah/Cockatoo enrichment documentation for enrichment planning and implementation tools of which some examples have been included in appendix 16.3. This publication is an excellent resource and provides a vast amount of information and should be sort out by any keeper caring for cockatoos with relevant pages ranging from p.91-191.

9.8 Introductions and Removals

As has been observed whilst working as a keeper at Sydney's Taronga Zoo, Galahs have been successfully housed in mixed species aviaries containing other Cockatoo's.

Mulga, the resident Galah at the Education Centre had been housed for a number of years with only one other species, an Australian Gang-Gang Cockatoo, who due to ill health was removed and rehoused. After the removal of The Gang-Gang, Mulga displayed more reclusive behaviours such as retreating to the rear of the enclosure and perching higher in the areas where the Gang-Gang primarily

perched. It was then decided that another bird be introduced to the enclosure in order to increase the number of birds available for educational encounters hence Elliot, a Sulphur Crested Cockatoo. The process for the introduction was gradual through the use of a Noegal cage (after Raymond Noegal) containing Elliot being placed within the enclosure in a location Mulga did not normally frequent. The Noegal cage also contained its own food, water and browse source, with the browse also acting as a visual barrier.

By placing the Noegal cage within the enclosure allowed for the birds to be slowly introduced to each other without any confrontational or physical contact in the initial stages. Their distant interactions were monitored and recorded and over a period of weeks the birds were slowly introduced to each other with the Noegal cage being eventually opened to allow Elliot access to the larger enclosure.

For a brief period of successful introduction, Mulga would enter the Noegal cage when it was left opened and perch within it, as would Elliot perch in areas frequented by Mulga.

Once the relationship was established and there were no displays of aggression or agonistic behaviour, the Noegal cage was removed with the birds being housed successfully together (pers. obs, 2007).

In general with any introductions especially for breeding, it is suggested that the male always be introduced to the female so that she has the territorial advantage and

Quarantine was not an issue in this case as the birds were both part of the existing collection at Taronga Zoo.

9.9 Intraspecific Compatibility

The combination of sexes placed within an exhibit, whether they are of breeding age/stage and the species management plan will assist in the determination of suitable Galah exhibit combinations. If they are being held for breeding purposes, then the pair may need to be housed in their own enclosure for added protection of their young (especially if normally in a mixed enclosure), closer monitoring and claim over nesting hollow territories.

Alternatively, a bachelor group of males could successfully be housed together only if the presence of a potential female mate is absent and therefore not causing competition stress or aggression between them. Or, a group of females not vying for a mate or housed with elderly males could also work effectively.

Unless the actual age of the Galahs is known, it is difficult to suggest having birds housed together who are past breeding age as they have the potential to produce offspring until the age of 40. So potentially multiple or established pairs could be housed together as they are monogamous and as long as adequate hollows or nesting boxes are provided if breeding is to occur. Alternatively lack of nesting provisions can also deter breeding as part of their mating ritual is to line their hollow previous to mating occurring.

9.10 Interspecific Compatibility

As the Galah does choose a mate and pair for life monogamously, issues can arise in relation to nesting sites within a mixed exhibit especially if there is competition from other nest hollowing species. This can be overcome through the addition of multiple nesting sites for a mixed exhibit or alternatively holding breeding pairs off exhibit within their own enclosure (if space and numbers allow).

As Forshaw (2002) suggests, Galahs normally have a placid temperament which can sometimes disadvantage them when housed with more aggressive or potentially aggressive species, so any introductions would need to be gradually and monitored closely for signs of stress or injury. The Galah itself poses little threat to other species with which it is housed.

One issue that could become a problem in a mixed Cockatoo exhibit such as that at Taronga or Melbourne Zoo (who also hold mixed parrot species) is that of disease such as Psittacosis, Beak and Feather disease or bacterial infections (see Section 8 for further detail). But this can be avoided through strict quarantine procedures for new birds, regular health assessment and daily husbandry routines.

9.11 Suitability to Captivity

“It is often said that “familiarity breeds contempt” and nothing could be a better description of the status of the Galah in captivity. In Australia, where wild Galahs are seen on an almost daily basis, aviculturists have (until recently) shown little interest in keeping and breeding this cockatoo” (Doneley, 2003).

Yet as Hunt (1991) suggests, Galah’s are abundant in character and will breed quite readily in the captive situation and are therefore a useful cockatoo to gain breeding experience with. A young pair can commence breeding at 2-3 years of age and are not as temperamental or difficult to breed as other cockatoo species. It must be remember though; Galahs are capable of breeding for up to 40 years with a breeding pair having the potential to produce 120 young in their lifetime (Hunt, 1999).

They tend to have a placid temperament as Forshaw (2002) stated which then opens there potential to be interactive birds as they seek out companionship not only within their species but with the humans with whom they have contact.

Hunt (1991) also states that Galah’s in captivity can become quiet and tame towards their owners/handlers and have to ability to be trained especially to talk, along with being a very hardy bird. He also states they are easy to feed but obesity is an issue that needs to be monitored and diets must be formulated to avoid this occurring.

Hunt also suggests that some undesirable behaviour can develop in the captive situation such as feather plucking often due to boredom or stress along with screeching and whistling loudly when very excited. ASZK also suggest that they can be very destructive with enclosure furnishings and vegetation.

Therefore captive Galahs need to be stimulated through enrichment activities and potentially through training and conditioning for use in public presentations such as the Free Flight Bird Show and educational encounters which are currently being demonstrated at Sydney’s Taronga Zoo (per obs.).

10 Breeding

10.1 Mating System

Galaha are considered monogamous birds as they form a mostly, permanent pair for life. Pair bonds are reinforced throughout the year through the pair visiting their nest hollow and travelling, foraging, resting and roosting together. Outside of breeding season the pair spends at least half of each day perched together with frequent reciprocal allopreening (Higgins, 1999).

In his extensive studies of Galaha in the wild, Rowley (1990) indicates that Galaha may form a pair in several ways as suggests that “two naïve individuals of opposite sex may develop a regular association in the nomadic flock and on reaching sexual maturity, search for and occupy a vacant hollow, becoming regular breeding members of the population; or males and females that have lost their mates, usually by death but sometime „divorce“, may form pairs” (p 59).

When Rowley uses the term „divorce“, he refers to the fact that often both members of a pair are still alive but either has breed with another partner or remained unmated in the flock.

10.2 Ease of Breeding

In the wild a Galaha breeding season will vary according to climate and weather conditions but will usually take place during winter, spring and summer in most parts of Australia. In the far north, breeding occurs after the wet season, which usually means nesting commences in late autumn or early winter. In the arid inland areas of Australia, breeding is totally related to rainfall and in dry seasons may not occur. In general, the further south the habitat the later the breeding season (Sindel and Lynn, 1989).

Extra daylight and longer day lengths along with „Spring like“ conditions and the warmer Spring weather will also act as a trigger for Galaha to breed.

Through the wild studies of Rowley and captive breeding successes of Sindel, Lynn and Hunt, it can be said that Galaha breed easily in the wild and in captivity when the correct environment and nesting materials are provided.

This is also confirmed by their current conservation status falling into the common and abundant ranges.

10.3 Reproductive Condition

As Sindel and Lynn (1989) state, obesity is a major problem with Galaha, particularly after they are six or seven years old and unless they are kept in a lean condition they will not breed.

Many of the preparatory behaviours are exhibited by both the male and the female such as the cleaning out and organisation of the nest site. Both the male and female Galaha need to be sexually mature and the female receptive to the males advances indicating her readiness to breed. The pair will also commence allopreening as a sign of acceptance and readiness.

10.3.1 Females

The availability of a compatible male mate, in apparent „good condition“ is paramount. In response to the advances of a potential mate (as listed below), the female will fly across an

open area, followed by the male, twisting and turning whilst calling excitedly indicating her keen interest and readiness to mate.

If the female is not ready, she will not respond to the courtship behaviours of the male.

10.3.2 Males

As with the female Galah, not only is the availability of a compatible mate required, but a female that is sexually mature and open to the advances of the male. His courtship displays are simple and generally include acrobatics. The male will raise his crest and weave his head from side to side, strutting along the branch towards the female, uttering a soft chattering note as he approaches (Forshaw, 1981), indicating his keen readiness to mate. If the male is ready first, then the female will not respond to his courtship behaviour, such as allopreening until she is ready herself.

10.4 Techniques Used to Control Breeding

A number of techniques are used in the captive environment to prevent breeding from occurring which can include:

- Single sexed or bachelor group housing.
- The non provision of appropriate nesting sites such as hollows, logs or boxes and the non provision of nesting materials such as green eucalyptus leaves for lining.
- Continuation of the maintenance diet throughout the year.
- Pricking the eggs so the bird may continue to sit without the eggs developing.

(Pers. comm., Nicholas Bishop, Taronga Zoo, 2007).

10.5 Occurrence of Hybrids

According to Sindel and Lynn (1999), hybrids have been recorded both in the wild and captivity between Galahs and the Gang Gang, Sulphur Crested and Major Mitchell Cockatoo's along with the Long-billed and Short-billed Corella and the lesser Sulphur Crested Cockatoo.

Forshaw (1981) also records wild hybrids occurring between the Galah and Major Mitchell and Short-billed Corella.

10.6 Timing of Breeding

As mentioned in section 10.2, the breeding season of the Galah will vary dependent on their location in Australia and environmental conditions.

Due to their abundant status in the wild, most captive institutes within Australia do not currently breed their Galahs. It is more commonly bred for the pet cockatoo market in private aviaries and sold through the breeders directly. Because it is also legal to catch wild Galahs in many states of Australia due to their common and abundant status and as part of cockatoo control measures, they are often consigned into the bird trade.

At Taronga Zoo in Sydney, their current stock of Galahs which are located at the Free Flight Bird show and a single female held in the Education Centre, are not involved in a breeding program and breeding control techniques are in place to prevent it from occurring.

The ARAZPA Avian TAG Action Plan for 2006-7 lists the current number of Galahs being held in wildlife institutes within the Australasian region and indicates a planned reduction of the number of Galahs currently being held. It also indicates that there are no current regional programs for breeding or conservation in place for the Galah species.

Sindel and Lynn (1989) also comment that breeding success in early Australia went unrecorded with the first recorded breeding success occurring at Adelaide Zoo in 1940 which states that Galahs were bred in a large mixed collection.

10.7 Age at First Breeding and Last Breeding

The Galah is usually sexually mature by the age of 2-3 years with the male maturing before the female. There is little evidence supporting the age at which last breeding occurs, although one unusual incident of hybridisation involving a Galah and Sulphur Crested Cockatoo was reported by Crome and Shields (1992) between a pair of aging birds. The male Galah, at the age of at least forty, tore his way through the wire and into the adjoining cage containing a female Sulphur Crested Cockatoo and commenced mating with her. It was assumed that the resulting two eggs would be deemed infertile but they surprisingly hatched to produce two offspring.

10.8 Ability to Breed Every Year

Hunt (1999) has observed that Galahs in captivity are usually the first birds in a cockatoo collection to begin nesting, laying from as early as July-August through to December.

In the wild, Galahs are capable of breeding yearly although very dry seasons can occasionally prevent its occurrence. In captivity this will also occur if nesting sites and materials are made available for breeding pairs.

As Hunt (1999) states, a breeding pair of Galahs are capable of breeding 120 young in their lifetime.

10.9 Ability to Breed More than Once Per Year

In the wild, galahs do not normally double brood but according to Sindel and Lynn (1989) in good seasons they may nest twice although Rowley (1990) disputes this as he states it is extremely unlikely that a pair of Galahs could raise two broods in one season and this idea was probably based upon observation of a pair re-laying after the first failed attempt.

In captivity they may go to nest again if the young are removed from the first clutch at two-three weeks of age (Hunt, 1999).

10.10 Nesting, Hollow or Other Requirements

In the wild, Galahs will seek out a nesting hollow in the trunks of trees as they tend to prefer vertical hollow logs with natural entrance spouts for their nesting sites. In the experiences of Sindel and Lynn (1989) Galahs have accepted logs with internal diameters ranging from 30cm to 60cm and depths of 45cm to 1.5m below the entrance hole. Hunt (1999) provides some different figures and suggests logs from 50cm to 2m long with an internal diameter of 20-30cm can be used or alternatively a nesting box

approximately 30cm² x 90cm deep with a closed top and bottom and a natural spout on the side for the entrance hole.

In captivity as is done in the wild, Galah pairs will spend a lot of time stripping and chewing bark and smoothing the entrance hole and adjacent areas of the log causing scarring . The will then commence bill stropping rubbing the alternate sides of their beaks on the bare scar and eye wiping to leave dustings of fine powder from the skin of the periophthalmic ring acting as territorial advertisements (Rowley, 1990).

A bout of lining typically begins with the pair perched together near their nest. The male then cuts a spray of new eucalyptus foliage and immediately starts shaking it then moves to the nest. This will continue as the female attempts to grab the spray from the male which she succeeds in doing then begins to shake it in the same way as the male. The male will then gather another spray and both birds will move to the nest hitting the leaves on the inside edge of the hole before eventually dropping them inside.

The nest chamber is lined or filled often to a depth of 15cm or more with Eucalyptus leaves or any herbage available such as grasses and weeds along with stones and bones (Sindel and Lynn, 1989).

As explained by Hunt (1999), Galahs have two unusual habits when they begin to nest.

Firstly, they take eucalyptus leaves, branches and twigs into their nests to chew up and lay their eggs on. Therefore when breeding the Galah in captivity it is vital that fresh Eucalyptus branches be provided daily from the time the birds begin preparing their log up until they begin to lay. They can be placed in close proximity to the nest entrance for easy access and a constant supply.

When leaving the nest, a Galah will cover its eggs with a few leaves.

Secondly, both parents will strip and chew bark from around the nesting hollows entrance until it is almost a smooth, polished surface around the entire circumference of the hollow. This behaviour is said to be practised as a form of protection for themselves, their eggs and their young from predation such as Lace Monitors, as this polishing causes the surface to become slippery and extremely difficult to enter the nest.

In the wild, the pair will often visit the nest site throughout the year to maintain ownership of the hollow. This behaviour has also been observed in captivity, with Galahs maintaining their log at various periods throughout the year (Hunt, 1999).

In captive enclosure where multiple Galah's may be held, it is recommended that breeding pairs be separated from the main group, housed individually with a number of logs or nesting boxes provided for the pair to choose from.

10.11 Breeding Diet

In order to breed, Galahs must be in good condition and any issues relating to obesity should be managed prior to breeding attempts.

In addition to their daily diet, Galahs will require extra animal protein by way of chicken or chop bones, mealworms or other insects before and during breeding (Lee, 2003).

An increase in calcium throughout the breeding season should also be considered especially for the hen and in more so if double brooding occurs. This can be provided through a liquid calcium supplement such as Calcivet or Calcium Sandoz in the water along with extra cuttlefish bone and grit within the aviary (Hunt, 1999).

10.12 Incubation Period

Incubation is generally carried out by the female after the second or third egg is laid, for the first day or two and is then shared with the male. The male/cock usually incubates during the most daylight hours with the female incubating at night. Often when the nest is left unattended for a short period, the eggs are covered or partially covered with leaves.

Incubation periods can range from 23-25 days.

10.13 Clutch Size

The clutch size for a Galah can range between 3-5 eggs being laid every two to three days.

The eggs of a Galah are elliptical to elliptical ovate and when freshly laid are pure white with a slight gloss. As incubation proceeds, the gloss dulls and the eggs frequently become discoloured (Rowley, 1990).



Fig 10.13.1 A Galah egg with an average measurement of 35.3 x 26.5 mm and average weight of approximately 13.5g (Lee, 2003)

The average dimensions of a Galah egg range between a minimum size of 30.3 x 23.0mm, weighing 8.9g to a maximum size of 38.6 x 27.8mm, weighing 16.5g, almost double the size (Rowley, 1990).

Hatching occurs usually after an average of 24 days, although this is variable due to the size of the clutch and the intervals at which they were laid and the intensity of incubation by the parents. The eggshells disappear within 2 days of hatching and are probably eaten (Rowley, 1990).

10.14 Age at Fledging

For the first 8-10 days the chicks are brooded continuously by both parents, after which they are only brooded at night until they are covered with contour feathers, at approximately 21 days, and are no longer brooded. The size of the clutch affects the survival of the chicks; clutches of 3 chicks have a survivability of 22%; 4 chicks 42%; and 5 chicks 24%. Clutches less than 3 or greater than 5 have very poor survivability (Doneley, 2003). Crome and Shields (1992) also state that there is a high chick mortality in Galah with up to 50% dying in the first 6 months.

Fledgling usually occurs at about 7-8 weeks (50-55 days) after hatching with the young leaving the nest as smaller and duller replicas of their parents with a light brown iris and pale grey eye ring (Sindel and Lynn, 1989). Remarkably, they are able to fly strongly with the parents present for the first flight (Rowley, 1990). The departure of a young Galah appears to be simultaneous with by the arrival and approach of a parent that refuses to deliver food. The fledglings remain entirely dependent on the parents for food for 6-7 weeks after leaving the nest and therefore form crèches during this time, although they will begin to accompany parents down to the ground where they are fed (Rowley, 1990).

10.15 Age of Removal from Parents

Galahs differ from other cockatoos in that they wean their young within two months of leaving the nest. This early independent (or desertion) appears to stem from a parental conflict of interest between returning to the nest hollow each night or, having to locate their young who now drift further and further away from the site to feed them. This and the onset of a major energy consuming moult assists the parents to allow their young to disperse (Rowley, 1990).

10.16 Growth and Development

Galah chicks hatch with orange skin, sparsely covered in pink down with the slightest trace of a whitish down which gradually disappears, their eyes closed and they weight about 5g.

At 10 days the chicks' eyes will start to open initially as a split, then fully by 16 days. Pin feathers start to appear in the second week

The contour feathers over the shoulders come through first at about 13 days, followed almost immediately by the crest and coverts on the head, crop, wings, abdomen and legs.

The primary feathers on the wings and tail come next at about 23 days, along with contour feathers on the back and abdomen. The contour feathers on the flanks are the last to appear at about 30 days. These feathers continue to grow and mature until growth is complete at approximately 94 days at the time of weaning (Doneley, 2003).

Rowley (1990) provides a number of Galah chick development charts of varying aspects of growths and development in his extensive study of the species which can be found in the reference section of this manual and is worth examination.

Fig 10.16.1: The following table provides varying growth rates of Galah chicks from 0days-14 weeks from two different sources which can be used as a guide when caring for young (After Donnelly, 2003):

AGE	Weight in Grams (Schubot et al.)	Weight in Grams (Hunt)
0 days	7-12	-
1	7-12	-
2	9-13	-
3	10-15	-
4	11-16	-
5	12-19	-
6	13-22	-
7	15-27	-
8	16-28	-
9	18-37	-
10	22-43	-
11	24-51	-
12	32-57	-
13	34-68	-
14	35-77	-
15	38-90	99

16	43-101	112
17	47-115	126
18	50-126	148
19	57-132	157
20	63-141	171
21	67-146	186
22	-	197
23	-	212
24	89-161	226
4 Weeks	114-181	262
5	172-257	259
6	205-300	260
7	240-305	266
8	225-292	-
9	220-289	-
10	209-294	-
11	228-285	-
12	237-309	-
13	243-302	-
14	248-299	-

11 Artificial Rearing

From the literature available, most aviculturists agree that artificial incubation and rearing should be used when no other alternatives are available. As Sindel and Lynn (1989) state, if it is possible to have the egg fostered under any suitable sized bird for at least the critical first two weeks before an incubator is used, then hatching results are greatly increased.

11.1 Incubator Type

There are a variety of egg incubators available which consist of moving-air incubators and still-air incubators. Harvey (1990) explains them in the following way:

Moving-air = an incubator which has a fan inside to move the air around. The air in this incubator has a fairly consistent temperature throughout and tends to move in a circular motion (model dependant).

Still-air = an incubator that does not contain a fan and therefore the air is very slow moving by means of convection (warm air rising) and thus moves in a circular motion. The downside of this method is that there can be a large temperature gradient between top and bottom of the incubator, so correct temperatures are vital with this system. These incubator types are better used with a small number of eggs which can be set on one level.

There are also auto turning incubators as opposed to manually turning the eggs.

If manually turning the egg, the minimum requirement as suggested by Digney (1998), is three times a day, although this amount will vary between breeders.

Automatic turning incubators will turn the egg anywhere from 12-48 times during a 24 hour period.

Priam Psittaculture Centre initially set their incubators to turn 96 times per day at 180° per turn although this amount decreases as the egg nears hatching to 45° turning either way until the air cell collapses or the external pip appears.

Whereas Hunt (1999), sets his incubator to turn the eggs 180° every 60 minutes.

With either method, turning must begin the day the egg is placed in the incubator and continue until the hatching process begins.

Some examples of incubators are shown below:



Brinsea Octagon 20 fan forced incubator with auto turn cradle



Brinsea Octagon 40DX with auto turn



Brinsea still air incubator



AB Newlife 75 Mk4 moving air incubator

11.2 Incubation Temperatures and Humidity

As suggested by Priam (2008), the target parrot egg incubation temperature is 37.2°C for fan forcer incubators with acceptable variations of $\pm 0.5^\circ\text{C}$. The target parrot egg humidity is variable and is directly dependant upon the egg shell density and weight loss trends. Priam runs incubators at different relative humidity (RH): one at RH 35-40% and one at RH 70-80%. If multiple incubators are not available, they advise small eggs to start at RH 50% and larger parrot eggs at RH 40%.

As Daniel Gowland said, it is better to keep eggs cooler than to overheat them as temperatures can always be increased. Same as it is better to have higher humidity as it can always be decreased, but more difficult to add moisture to an egg (pers. obs.).

Hunt (1999) suggests the incubator dry temperature suitable for Cockatoos be set at 37.6°C and the humidity (or wet bulb) reading be set at 27.75°C. Then once the egg begins to pip, it should be moved to an incubator set at 36.9°C dry temperature with a higher humidity.

11.3 Desired % Egg Mass Loss

As suggested by Priam Psittaculture Centre, The percentage of weight loss is commonly around “13.5% to 15%, but a variation between 10% to 20%, should not cause significant problems”.

Digney (1998) suggests the ideal weight loss for a parrot egg between day 1 and external pip is 15% to 17% of its original weight when laid.

To calculate this weight loss, a number of formulas have been established for example, Digney (1998) states:

“Weigh the egg on Day 1, then subtract 15% to 17% of that weight. This will give the desired weight of the egg at external pip. That 15% to 17% of the freshly laid egg now needs to be divided by the number of days between zero and external pip (incubation period minus two days) to calculate the desired daily weight loss”. He provides an example using an egg weighing 25g, with an incubation period of 28 days and uses the following formula:

25 g X 16% = 4 g (total weight loss necessary over 26 days between zero and external pip)
4 g ÷ 26 days = 0.15 grams daily weight loss.

Priam also uses this formula to establish the target daily weight loss, but also have a more detailed method for greater accuracy as follows:

$$\{[(\text{Fresh weight} - \text{actual weight at T (t)}) \div \text{T (t)}] \times \text{estimate days to pip}\} \div \text{fresh weight} \times 100$$

Jordan (1989) suggests that the desired egg weight loss for a Galah be between 15 – 18%.

Jordan also relates egg weight management to environmental factors of the incubator such as humidity which effect the weight of the egg: High humidity = lower weight loss (as lower fluid loss and therefore lower weight loss); lower humidity = higher weight loss (as moisture will evaporate faster out of the egg, losing weight faster).

11.4 Hatching Temperature and Humidity

Priam (2008) suggest that the target hatching temperature for parrots be 36.7°C ±0.5°C for fan forced incubators, with the target hatcher humidity for parrots being RH 60% - 70% with consideration of weight loss trends during incubation eg. High weight loss = high RH and low weight loss = low RH.

Digney (1998) suggests that the humidity in the hatcher be raised to 34.4°C wet bulb or higher to prevent the membranes from drying out and trapping the chick and the dry temperature be lowered slightly but not lower than 36.9°C.

Hunt (1999) suggests similar temperatures for Cockatoos with the pipped egg being moved to an incubator set at 36.9°C dry temperature and a higher humidity, with the chick remaining there for a further 24 hours before being transferred to a brooder.

11.5 Normal Pip to Hatch Interval

As suggested by Digney (1998), normal pip to hatching is generally three to four days once the internal pip is confirmed, although this will vary between both species and individuals. Once the internal pip has occurred, the egg should be placed in a hatcher, in preparation for the external pip stage. Digney goes on to say that the first signs of external pip should appear within 24-48 hours after internal pip or collapsing of the air cell, although it can be as soon as 12 hours after internal pip.

According to Jordan (1989) the pip to hatching interval for a Galah is 24 -36 hours with a total incubation period of 22 – 24 days.

11.6 Brooder Types/Design

As with incubators, there are a number of brands and types to choose from with same examples shown below:



TLC 4 Brooder (Suitable for all Parrots)



Brinsea Parrot Rearing Module Brooder



Parrot Brooder IM 36 I.C.U



Kimani New-hatch Parrot Brooder

11.7 Brooder Temperatures

As Hunt (1999) suggests brooder temperatures will vary and decrease depending upon the comfort of the chicks and the development of their feathers. He suggests through observation you will be able to tell when chicks are too hot as they become restless and have their mouths open and wings out and if too cold, will be less active, will huddle together and digestion will be slow.

There will be temperature variations between species, the amount of down the chick/s have, the number of chicks in the brooder and the speed of their development.

Hunt (1999) provides a brooding temperature guide with Day 1 starting at 36.5°C and slowly decreasing by about 0.5° per day to 27°C at Day 45.

Digney (1998) also provides a brooding temperature guideline as follows:

- Newly hatched: 36.6°C
- 5-12 days: 35°- 31.6°C
- 12 days – pin feathers: 31° - 28°C

- Once feathers begin to cover most of the body: 26.5°C

Digney states that these are only a guide and are species dependant. This guide would be suitable to follow for a Galah due to the development of their feather coverage.

At this time humidity isn't as important as it was during the incubation phase, although Digney (1998) suggests that the environment should not be excessively wet/humid as this provides the perfect setting for harmful organisms to flourish, or excessively dry as this will cause dehydration. By placing a small container of water will provide sufficient humidity to maintain healthy chicks.

11.8 Diet and Feeding Routine

Hunt (1999) suggests that when chicks are first hatched, they may be dehydrated and weak, therefore require dehydrating before being fed and this can be achieved through the use of an electrolyte such as Hartmanns™ solution and a nutritional source such as Ensure™. Hunt continues and suggests that when rehydrated (approx. 48 hours), a thin formula be fed to the chicks which will gradually increase in volume as the chicks require until feeding intervals and crop emptying process are balanced.

Hunt (1999) provides the following guide which would be suitable to follow when raising Galahs, but affirms it is only a guide and chick's crops should be checked prior to feeding to ensure it has emptied correctly:

- 1-2 weeks: every 2-2.5 hours
- 3-4 weeks: every 3 hours
- 5-6 weeks: every 5 hours
- 7-8 weeks: every 7 hours
- 9-10 weeks: every 12 hours

Digney (1998) suggests the following general guide for feed intervals:

- Day 1: 2 hour feeds (9-10 feeds a day)
- By day 8: 3 ½-4 hour feeds (5-6 feeds daily)
- By day 14: 5 hour feeds (4 feeds daily)
- By day 24 -30: 8 hour feeds (3 feeds daily)
- At peak: 2 feeds daily

Digney (1998) also adds that the introduction of handrearing formula from rehydrating fluids, or any dietary changes, be done on an empty crop and after an extended nights break. This may see the crop slow as the body digests the food with total volume amounts remaining the same or even reducing for the first day of changeover.

As both Hunt (1999) and Digney (1998) suggest, there are a large variety of commercial handrearing mixes available and include brands such as: Lakes™, Pretty Bird™, Vetafarm™, Wombaroo™, Roudybush™ and Loristart™ with some being manufactured in Australia and other from overseas.

For example, when handrearing a Galah chick, the preferred formula could be Pretty Bird™ 22/10 Handrearing Formula, as it is suitable for small Cockatoos and contains 20% protein and 10% fat. The amount of fat, fibre and protein present in each of the products varies with the individual manufacturer.

Priam (2008) maintains food at 10% of the morning body weight of the chick when the crop is completely empty after a break of up to 8 hours and the overall growth and digestion rates of the individual chick. A total of 100g of food is fed out comprising of 80% water and 20% solid (1g food = 1ml water; 20g of food = 20% solid). 20% solid is fed out at between 1-3 days of age.

Priam's Handrearing formula of choice is Harrison's Organic bird foods Neonate formula (imported from the USA) as it has a probiotic added to introduction gut flora and contains 14% crude fat and 26% crude protein. As Daniel Gowland stated, high amounts of solids can dehydrate the food and cause organ damage in a chick especially if there is too much protein and food is not prepared correctly (pers. obs).

Hunt (1999) suggests that formula temperature is very important, if too hot it can burn the crop or affect the contents of the formula, but if too cold it can chill the chick or cause crop related problems so suggests that handrearing mix be fed to chicks at 41°- 43°C.

Digney (1998) suggests that feed interval increases are a natural progression once feeding formula and as the volumes increase, the formula is thickened, but if thickened too quickly, the crop may slow down too greatly, so slightly thinner is better.

11.9 Specific Requirements

When handrearing parrots and more specifically cockatoos, Digney (1998) suggests that crop stretching is an important practice especially in the first few days of life and entire growth phase. It involves feeding slightly more in volume every feed which will naturally result in more total volume fed every 24 hours. Digney states that the principle behind this technique is that a full, tight crop by inward and downward pressure will speed up digestion and high crop motility (movement) will see a healthier chick surge through the growth phase, peaking around adult weight.

With smaller species such as Galahs, one volume increase per day will suffice.

In recommending this technique, Digney also stresses that volume increase should only be slight as overstretching the crop can be detrimental. Rather, once the formula or fluid has filled the crop and begins to sit in the lower neck area, then no more should be fed.

Digney (1998) suggests that 1ml – 5ml syringes be used for feeding in the first few days of life as they allow total volume control.

11.10 Pinioning Requirements

The Department of Primary Industry has formulated a document titled *NSW Guidelines for the Pinioning of Birds* which outlines the justification for and acceptable methods of pinioning birds. It states that the practice may only be conducted on birds held for public exhibition and therefore subject to the *Exhibited Animals Protection Act 1986* and is limited to only a few bird orders.

Birds within the order Psittaciformes are not included in the guidelines for pinioning and therefore are not allowed to have the procedure performed on them. Any act of pinioning on birds in this order would be considered an act of cruelty and be potentially prosecuted under section 4 (2) of the *Prevention of Cruelty to Animals Act, 1979* as follows:

“Under section 4(2) of the Prevention of Cruelty to Animals Act, 1979, an offence has been committed if an animal is "unreasonably, unnecessarily or unjustifiably: beaten, kicked, killed, wounded, *pinioned*, mutilated, maimed, abused, tormented, tortured, terrified or infuriated".”
(Dept. of Primary Industry)

11.11 Data Recording

A variety of data should be recorded and maintained daily about the eggs being incubated as well as the hatchlings and young birds for which you are caring. Records should be kept on:

- egg „age“, weights, size and volume including egg weight loss
- lay and collection date
- temperature and humidity of incubators and brooders
- changes in the egg
- membrane development
- candling observations
- turning times (if turning manually)
- *drawdown* – movement of the air cell prior to hatching
- pip to hatching
- feeding: amount, frequency, food given, how much eaten
- Weight of hatchlings to monitor health and growth and development
- faecal output and regularity
- crop status
- Notes on hatchling behaviour
- weaning behaviour and dates

Examples of record data sheets which are used at Priam Psittaculture Centre have been including in the appendix but are not to be duplicated for personal use.

Along with these are some examples used by Jordan (1989) which have been taken from *Parrot Incubation Procedures* (see appendix).

11.12 Identification Methods

Two types of identification should be used when incubating eggs and rearing young. Firstly the egg should be identified and marked to show:

- species
- location it was taken from eg. flight or aviary number
- date it was laid
- if known, the order number in the clutch

Secondly, the chick should be identified through the use of a leg ring which can be placed on a Galah chick at 10-14 days according to Hunt (1999) using a closed 10mm leg ring.

11.13 Hygiene

As Digney (1998) states, hygiene is a crucial aspect of handraising and the greater the number of chicks being reared, the more important it becomes. Poor hygiene directly relates to illness and poor

development therefore, "...frequent, thorough cleaning and disinfecting will keep bacterial, fungal and viral contamination to a minimum".

Digney goes on to state that handreared chicks are more susceptible to infection because they have not received the enzymes or „gut flora“ from their parents leaving them vulnerable until they build up their immunity systems.

Digney suggests the following be undertaken:

- Feeding instruments: be cleaned thoroughly under running water after each feed and soaked in a disinfecting solution such as Milton or Avisafe.
- Instruments should be rinsed in clean water prior to feeding to remove excess solution.
- Hands should be washed thoroughly before and after handling chicks and the use of disposable surgical gloves should also be considered. This is especially important if other aviary birds are being tended to.
- Brooders, benches and sink areas need regular disinfecting and an extra set of brooder containers should be maintained to replace soiled ones every three to four days. These should also be lined with tissue so faeces can be removed and replaced regularly after feeds and/or soiling.
- Formulas which have been exposed to moisture should be thrown away to minimise risk of fungal growth and re-feeding leftover formula is not recommended.

Hunt (1999) also suggests that if hand rearing more than one chick at a time, separate feeding utensils should be used for each chick to minimise cross infection and disease between chicks.

11.14 Behavioural Considerations

Changes in feeding behaviour can occur at different periods of a chick's development and can relate to feeding procedures, feeding amounts and environmental factors such as temperature. But, if a chick is developing normally and feeding well and gaining weight its behaviour can begin to alter as it reaches its peak phase and is potentially ready to wean the closer it gets to its desired adult weight.

Digney (1999) suggests there are two behavioural changes that occur at this time which include:

- The chick becoming difficult to feed
- Regurgitation may occur

That's why regular weighing of developing chicks is vital, as it will give the hand raiser an indication of when it is nearing this point, for example, Hunt (1999) suggests, a Galah chick weighing around 271g at approximately 50 days of age is reaching its peak and will wean at around 51 days, although this can vary depending upon the individual chick and weaning weights may vary. Digney (1998) suggest a Galah chick weans at 80 – 90 days, so there is a great variation in opinion and experience, so it pays to monitor individual weights and behaviours as it nears adult weight.

Other behaviours to be aware of around this time of weaning Hunt suggests, include vocalising feeding demands often for attention and this behaviour is not uncommon in the wild either even long after they have been weaned and are fully independent.

11.15 Use of Foster Species

As Low (1987) suggests, the use of foster parents of either the same or differing species is possible as long as the chicks are approximately the same age and size of those of the fostering bird and the female is willing to accept them if they are a totally different species. Low also suggests that every attempt

must be made to use a related species where possible. In the situation with Cockatoo chicks, they can be fostered by Cockatiels, but aspects of their behaviour such as “soliciting food vocalisations” they are less likely to be fed by other species.

Sindel and Lynn (1989) suggest that fostering of deserted or poorly reared Cockatoo chicks is not a common practice in Australia possibly due to their large size, making them easy to hand raise from a young age. They continue on to say that given the choice, fostering is ideal, even if for a few days, as long as the chosen foster parent is large enough to cover the eggs or the young, they can be an unrelated psittacine. Regular inspection of the fostered young is vital and at the first sign of distress or desertion by the foster parent, the young can be removed for handraising.

11.16 Weaning

There are four distinct phases according to Digney (1998) typical of all parrot species which include:

- First few days: minimal weight gain and no visible changes in relation to development.
- Growth phase: begins approximately on day 7 for most species where weight gain is substantial and the bulk of the chick’s development takes place and weight gain tapers off as the chick nears adult body weight
- Peak phase: around adult body weight (eg. approx. 330g for a Galah) and weight gain virtually ceases, preceding weaning.
- Weaning: a period lasting between two weeks and five months (species dependent) ending when the chick no longer requires any handfeeding. Natural weight loss occurs in preparation for flight.

Digney goes on to say that during the peak/weaning phase, chicks will begin to pick up and nibble at food and slowly learns to break up and swallow its own food.

Weight is also a good indication as around adult body weight, chick weight gain will slow until; no gain or even loss. For a Galah the approximate peak age according to Digney is around 40 -45 days, although these ages will also be influenced by diet, volumes fed and whether there were any health or development problems during the growth phase.

Hunt (1999) suggests the following as being suitable weaning foods: corn, peas, sprouted seed, soaked seed, fresh fruits and grain bread.

Hunt also states that the crop and faeces of weaning chicks be checked to ensure that food is being ingested and should indicate a change in colour and substance with some bulk and the presence of urates separate to the urine and faeces.

Digney (1998) suggest that once a bird is largely feathered and entering the weaning phase, they should be placed in a weaning cage where it can learn to perch, use its wings properly and pick at food and preferably allow short flights and free movement.

11.17 Rehabilitation Procedures

This can relate to a chick that has been found abandoned or rejected from the nest, but may also relate to a parent reared chick that is not being cared for and may require pulling.

Key indicators of a chick in need may include:

- Weight on visual examination
- State of the crop
- Continual calling from the nest may indicate hunger or illness
- Neglect if part of a large clutch

As with breeders seeling birds, a wild bird should also be fully weaned and independent before being released. As hunt suggests a cockatoo can be up to the age of 4-5 months old before it is fully self sufficient. For rehabilitated wild birds, the introduction of a wild diet during the weaning phase will be required so it is equipped with the necessary skills to feed and survive once it's released. It may also require socialising, especially Galahs, as they are a gregarious species who as young fledglings form a juvenile flight groups and roost closely together.

If found at a young age, the possibility of the chick being reared by a foster parent may be available and would be the ideal solution, but if it has been rejected by the parent, a surrogate may do the same, so close monitoring would be required. This would allow the chick to be raised by its own species preferably and therefore expose to the required gut flora and bacteria's and aid its immunity during development and subsequent release.

A rehabilitated bird must be able to fly independently so will require time in a weaning cage until its perching and wing skills are able to develop over a short flight distance first and food intake and faeces can be monitored to ensure it is eating sufficient amounts to sustain itself in the wild.

Depending on how well the bird is developing, the decision can be made whether it is a suitable candidate for release or whether it is maintained as an exhibit bird or re-homed in a suitable private or commercial aviary.

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Some of the following books have been referenced within the manual but have been repeated here as they are a recommended read if you interested in or are caring for Galahs or Cockatoos in general.

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15 Glossary

Acronyms:

- IUCN: The World Conservation Union (previously International Union for the Conservation of Nature).
- CITES: Convention on International Trade in Endangered Species of Wild Fauna and Flora.
- TAG: Taxon Advisory Group
- AQIS: Australian Quarantine and Inspection Service
- ARAZPA: Australasian Regional Association of Zoological Parks and Aquaria.
- ASMP: Australasian Species Management Program

Allopreening: The grooming of one animal by another usually around the head, neck and breast feather areas in birds and can be associated with courtship behaviour, although it will occur at other times.

Carunculations: A fleshy growth as on the head of a bird

Cere: A soft waxy structure containing the nostrils at the base of the upper beak of a parrot.

Choana: Slit in the roof of the mouth.

Cloaca: The common cavity into which the intestinal, genital, and urinary tracts open in vertebrates such as fish, reptiles, birds, and some primitive mammals.

Culmen: The dorsal ridge of a bird's bill.

Nomenclature: The procedure of assigning names to the kinds and groups of organisms listed in a taxonomic classification:

Nymphicus: Cockatiel. A diminutive cockatoo endemic to Australia.

Periophthalmic ring: It is the ring around the Galahs eye containing the rough, raised skin and will vary in colour dependent upon the subspecies of Galah

Pinioning: To remove, bind or cut the wing feathers of a bird to prevent flight.

Psittacine: Relating to, resembling, or characteristic of parrots. Of or belonging to the family Psittacidae, which includes the parrots, macaws, and parakeets.

Suffusion: To spread through or over, as with liquid, colour, or light:

16 Appendix

16.1: Material Safety Data Sheets

Chemicals:

- 1.** F10SC Veterinary Disinfectant
- 2.** Unique Pine Disinfectant
- 3.** Virkon S

Medical:

- 4.** Calcivet
- 5.** Ivermectin
- 6.** Panacur
- 7.** Avitrol/Avitrol Plus

16.2: Product Manufactures and Distributors

16.3: Enrichment monitoring and calendars

16.4 Artificial Rearing Data Recording