EEP

HUSBANDRY GUIDELINES

for

Cacatua spp.

Moluccan Cockatoo

Blue-eyed Cockatoo

Citron-crested Cockatoo

Philippine Cockatoo

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DUBLIN ZOO

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SECTION 1: BIOLOGY AND FIELD DATA

A: BIOLOGY

1.1 Taxonomy

Class	Aves
Order	Psittaciformes
Family	Cacatuidae
Genus	Cacatua

The fossil finding of a cockatoo from the early to mid-Miocene in North-west Queensland confirms that the cockatoos are of ancient origin with Australia as a centre of evolution and radiation.

Cockatoos are distinguished from other psittacines by the presence of a gall bladder, the positioning of the carotid arteries, the lack of Dyck texture (blue/green) in the feathers, the fully ossified orbital ring and bridged temporal fossa, the erectile crest and downy hatchlings.

The white cockatoos are often placed in a sub-family Cacatuinae to distinguish them from the black cockatoos (sub-family Calyptorynchinae) and the cockatiels (sub-family Nymphicinae.

The Genus Cacatua comprises 12 species, which are differentiated from other genus by a chromosome number of 82.

Species participating in managed breeding programmes:

Cacatua moluccensis, J. F. Gmelin (1788) - Moluccan/Salmon-crested Cockatoo
EEP[1] Studbook Co-ordinator – Sandra Devaney (Registrar/Research coordinator), Dublin Zoo, Phoenix Park, Dublin 8, IRELAND.
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Cacatua opthalmica, P. L. Sclater (1864) - Blue-eyed Cockatoo
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Cacatua sulphurea citroncristata, Fraser (1844) - Citron-crested Cockatoo
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Cacatua haematuropygia, P. L. S. Muller (1766) - Philippine/Red-vented Cockatoo
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[1] **EEP**
EEP programmes represent the highest form of management and these have been designated for those species with high conservation priority, where sufficient founders exist within the region and where there is clear zoo interest in population management. EEP programmes always require an elected Species Committee in addition to the Species Co-ordinator who may also act as or appoint a Studbook Keeper. EEP participants must sign a memorandum of agreement on joining these programmes.

[2] **ESB**
ESB programmes may also involve a high level of species management but do not require the establishment of a Species Committee. Participants are not requested to sign any agreements prior to joining. The Studbook Keeper may also function as a Species Co-ordinator. The EEP Parrot Taxon Advisory Group members may make recommendations on issues arising from the studbook.

1.2 Morphology*

Moluccan Cockatoo
Average weight is 850g with a body length of about 50 cm. Wing length is 288-328 mm. Tail length is 159-189 mm. Bill length is 42-54 mm. Tarsus length is 33-35 mm. The plumage is white or tinged pink and the backward-curving salmon-pink crest is characteristic. The underside of the wings and tail are pale orange. Generally, the eye is black in males and dark brown in females. However, this is not a reliable method of sex determination.

Blue-eyed Cockatoo
Mean weight is 500-570g and an average body length of 50 cm. Wing length is 273-316 mm. Tail length is 149-179 mm. Bill length 37-45 mm. Tarsus length is 29-33 mm. The overall plumage is white with the underside of the tail and wings tinged yellow. The crest is yellow. The periopthalmic ring is distinctively blue.

Citron-crested Cockatoo
Average weight is 350g with a body length of 33 cm. Wing length is 211-245 mm. Tail length is 98-115 mm. Bill length is 29-39 mm. Tarsus length is 21-25 mm. The plumage is white with yellow cheek patches. The forward-curving erectile crest is citron-yellow and very distinctive. The undersurfaces of the tail and wings are pale yellow. The periopthalmic ring is pale blue. Eye colouration is also suggested to be sex differentiated in a similar way to the Moluccan Cockatoo. In hen birds, it has been suggested that the iris goes grey at 5-6 months and turns brown by 7 months.

Philippine Cockatoo
Average weight is 300g with a body length of about 30 cm. Wing length is 201-231 mm. Tail length is 100-110 mm. Bill length is 23-29 mm. Tarsus length is 22-24 mm. The plumage is white and the undertail coverts are red with white edging. Underside of the wings and tail are yellow. The periopthalmic skin is white. Sexes are alike, although, eye colouration is suggested to be sex differentiated with a dark brown iris in the male and red-brown in the female. As for the Moluccan Cockatoo, this is not a reliable means of sex determination.

* Information from Juniper & Parr (1998) and del Hoyo, Elliott & Sargatal (1997).

1.3 Physiology[a]

Note: The information provided here applies to all four managed species but can only be considered as a guide.

Weight (g)	Resting heart rate (bpm)	Restrained heart rate (bpm)	Resting respiratory rate (rpm)	Restrained respiratory rate (rpm)
25	274	400-600	60-70	80-120
100	206	500-600	40-52	60-80
200	178	300-500	35-50	55-65
500	147	160-300	20-30	30-50
1000	127	150-350	15-20	25-40

(bpm) =beats per minute
(rpm) = respirations per minute
Normal physiological data for birds (adapted from Harrison & Ritchie, 1994).

Core body temperature = 40-44ºC
White blood cell counts of greater than 11 x 10^9/I can be suggestive of inflammatory processes.
Blood protein (normal) = 33-44 g/I
Blood glucose (normal) = 11-18 mmol/I
Blood calcium (normal) = 2-3 mmol/I
Blood uric acid (normal) = > 500µmol/I. This is a useful test for renal function. Levels of uric acid below normal may indicate renal disease, dehydration or starvation.

Blood cholesterol (normal) = 2-5 mmol/I
Blood aspartate aminotransferase (AST) – levels >230u/I can be indicative of liver disease.
Blood bile acid concentration (normal) = 23-70 umol/I. Raised levels are indicative of liver disease.

[a] Source: Beynon, Forbes & Lawton (1996).

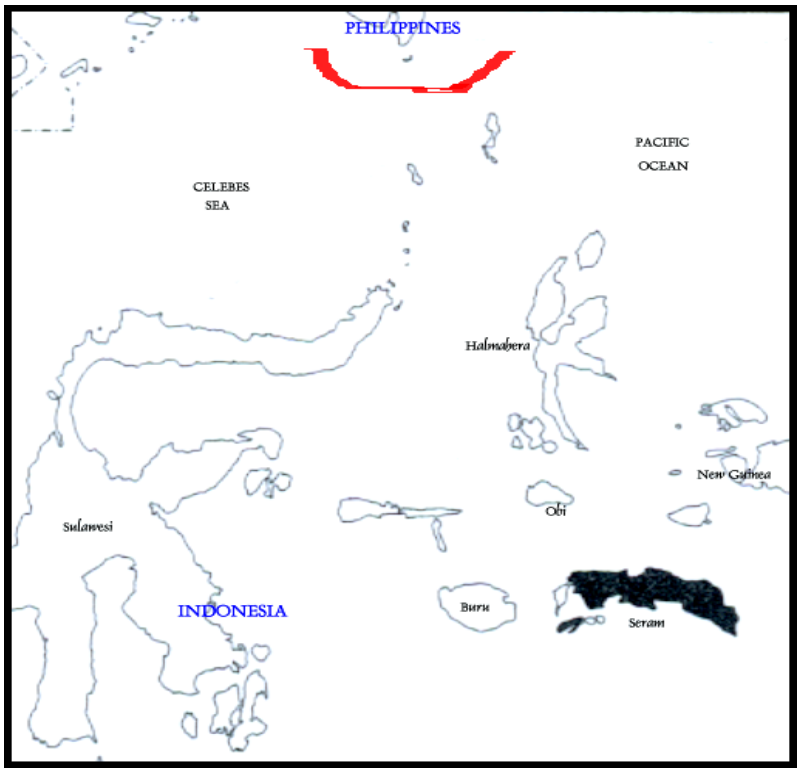
1.4 Longevity

No information is available on longevity of wild birds. Similarly, it is impossible to derive accurate ages from the captive population due to the fact that many of the individuals are wild born or of unknown origin. However cockatoos are known to be long-lived with some species suspected of living to between 50 and 60 years of age.

B: FIELD DATA

1.5 Zoogeography/Ecology [1]

Moluccan Cockatoo
The Moluccan or Salmon-Crested Cockatoo (*Cacatua moluccensis*) is endemic to the islands of Seram, Saparua, Haruku and possibly Ambon (where it may be a recent introduction) of the Maluku Province of Indonesia.



The Moluccan Cockatoo inhabits primary rainforests to an altitude of 1,000m. Classified as vulnerable and listed as CITES Appendix 1, the stronghold of the Moluccan Cockatoo is in the Manusela National Park on the island of Seram.

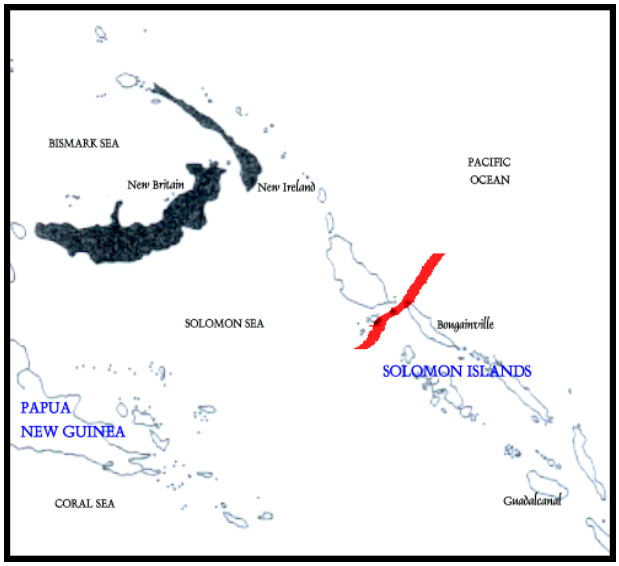
Even here, the population is fragmented and declining due to continued illegal trapping (between 1983 and 1990, 66,654 birds are reported to have been exported to CITES countries). The species' addition to Appendix I of CITES in 1987 led to a dramatic decrease in international trade, however local trade continues at an unknown rate. As a popular cage bird, however, the captive population is quite large. Recent research indicates that up to 75% of the island of Seram contains suitable forest habitat for Moluccan cockatoos, although, most of this has production or conversion status. Moluccan cockatoo populations may be reduced by up to 75% after logging (Lambert, Lambert, & Kinnaird, 2000). Recent population estimates suggest that the population on the island of Seram may be approximately 10,000 birds with a typical population density of 4-10 birds per square kilometre.

A European Breeding Programme (EEP) was established in 1992 and the fourth studbook was published in 1999. An *in situ* conservation programme was initiated in 1998 involving BirdLife International, the Wildlife Conservation Society and administered by Loro Parque Fundacion with the co-operation of a number of funding partners. This conservation project, named Project Kakatua Seram, works in collaboration with the Department of Nature Protection and Conservation in the Ministry of Forestry in Indonesia to assess the conservation problems faced by the species. Due to recent civil unrest in Indonesia, some survey work remains to be completed, although a GIS database of land use and land cover on Seram is almost finished and will provide much needed information on the availability of suitable habitat for the species.

Although the studbook population is relatively healthy with a large number of potential founders, the successful rearing of hatchlings has proved difficult and only a limited number of institutions have had regular breeding success. The studbook is co-ordinated by Sandra Devaney of Dublin Zoo, Ireland.

Blue-eyed Cockatoo

The Blue-eyed Cockatoo *(Cacatua opthalmica)* is restricted to the islands of New Ireland and New Britain of Papua New Guinea where they appear to favour lowland forest and cleared areas up to an altitude of 1,000m. They are often associated with forest edge habitat.



Currently, research is being carried out on this species in New Britain by John Pilgrim under the supervision of Dr. Stuart Marsden of the Manchester Metropolitan University, UK.

This species is currently managed in Europe as part of an ESB that is coordinated by Roger Wilkinson of Chester Zoo, UK.

Citron-crested Cockatoo

The Citron-crested Cockatoo *(Cacatua sulphurea citroncristata)* is a sub-species of the Yellow-crested Cockatoo *(Cacatua sulphurea)*. It is restricted to the island of Sumba (Lesser Sundas) of Indonesia. Strongholds remain in the remnant forest around Lewa and in the east of the island but these are by no means secure.

Recent research suggests that this species is absent or rare in forests of less than 1,000 hectares (Kinnaird, 1999). This finding is worrying as forest patches in Sumba make up less than 11% of the island's land area and are increasingly fragmented. Another research project currently being undertaken aims to determine the distribution and habitat use of re-released customs impounded birds using radio-telemetry. This cockatoo is reported to have declined by 80% between 1986 and 1989 (Juniper & Parr, 1998).

This species is managed as part of an EEP programme and the studbook is co-ordinated by Sandra Devaney of Dublin Zoo, Ireland.

Philippine Cockatoo

The Philippine or Red-vented Cockatoo *(Cacatua haematuropygia)* was once widespread throughout the Philippines but is now restricted to a few islands. It has been reported that this species is now absent from 98% of its former range (Juniper & Parr, 1998). Final strongholds lie in St. Paul's Subterranean National Park and on Rasa Island in Palawan.

The Philippine Cockatoo may be forced to depend on coastal mangrove forest to survive despite the fact that this is not a natural refuge for the species. Due to habitat destruction it may also now be found at the forest edge or in maize fields outside the breeding season. However, the major threat to the species is illegal trapping. The position of many of the regular nesting sites are now known to locals who take the chicks for the local pet trade. The availability of nesting trees has also been identified as a limiting factor in the breeding success of the species in the wild. Classified as critical and listed in CITES Appendix 1, the maximum world population including captive birds is estimated at 4,000 (Boussekey, 1999).

This species is managed as part of an EEP programme that was established in 1992. An *in situ* conservation programme (see Widmann, Lacerna & Diaz, 2000 for details) was also established at this time involving the Association Zoologique de St. Martin La Plaine in France and the Department on Environment and Natural Resources, Protected Areas and Wildlife Bureau (DENR/PAWB) in the Philippines. This conservation programme, which is concentrating on Rasa Island where the highest density of Philipping cockatoos are thought to inhabit, has focussed on educating the local people of Palawan on the need to protect the species and facilitated the building of a Wildlife Refuge and Rescue Centre where birds seized from the illegal trade could be accommodated. Vital behavioural and reproductive research is also being carried out as part of the project. The studbook is co-ordinated by Mark Boussekey of St. Martin le Plaine, France.

[1] Information from Juniper & Parr (1998) and del Hoyo, Elliott & Sargatal (1997).

1.6 Diet and Feeding Behaviour

Moluccan Cockatoo
This species feeds on a variety of nuts including young coconuts *(Cocos nucifera)* fruits and berries as well as insects and their larvae.

Blue-eyed Cockatoo
Feed on a variety of fruits, berries, seeds and nuts. A particular favourite are figs *(Ficus sp.)*. They are considered a pest in some regions where they damage cocoa bean and copra palm plantations.

Citron-crested Cockatoo
Food items include seeds, fruit, berries, flowers, buds, nuts (including coconut *Cocos nucifera)*. They will also feed on crops such as maize *(Zea mays)* which can cause conflict with local farmers.

Philippine Cockatoo
Food items include seeds, fruit, nuts and berries and will raid ripening maize plantations.

Food trees identified for Philippine Cockatoos on Rasa Island, Palawan. (Boussekey, 2000)

SPECIES	FAMILY	COMMON NAME	PART CONSUMED
Garuga floribunda	Burseraceae	Bogo	Seed
Erythrina variegata	Leguminosae	Dapdap	Flower/nectar?
Pithecellobium dulce	Leguminosae	Kamachile	Seed
Leucaena leucocephala	Leguminosae	Ipil-Ipil	Seed
Pterocarpus indicus	Leguminosae	Narra	Seed
Melia dubia	Meliaceae	Bagalunga	Seed?
Ficus sp.	Moraceae	Balete	Fruit
Sonneratia caseolaris	Sonneratiaceae	Pedada	Fruit
Pterocymbium taluto	Sterculiaceae	Taluto	Seed
Cocus nucifera	Palmaceae	Coconut	Flower

1.7 Reproduction

Moluccan Cockatoo
Breeding reported in the wild between July and August although activity has been observed at nesting holes as early as May.
Clutch size = 2/3.
Incubation – 28 days by both male and female.
Young remain in nest for 15 weeks. Surviving young are reported to travel with parents for four to five years following fledging.
Incubation begins soon after laying first egg with 2-day interval between eggs.
Sexual maturity reached at 4-5 years of age (Juniper & Parr, 1998).
Information provided by R.G. Sweeney (pers. comm..)

Blue-eyed Cockatoo
A definite breeding season in the wild has yet to be identified but is suspected to be similar to that of the closely related sulphur-crested cockatoo *(Cacatua galerita)* which breed between May and December.

Clutch size = 2
Incubation – 28 days by both male and female.
Young remain in nest for 12 weeks.
3-6 day interval between eggs laid.
Chicks continue to be fed by parents for around 1 month after fledging.
Breeding capability at 3-4 years for females and over 5 years for males (this data is based on captive birds and may be a consequence of the demographics of the captive population rather than a physiological obstacle).
Reproductively active up to at least 25 years of age.
Information provided by R. Wilkinson (pers. comm.)

Citron-crested Cockatoo
Breeding occurs in April and May in Nusa Tenggara Timur Province of Sumba.
Clutch size = 2/3
Incubation – 28 days by both male and female.
Young remain in nest for 10-12 weeks and are dependent on the parents for a further two months.
Information provided by M. Challis (pers. comm.)

Philippine Cockatoo
Breeding period in Philippines between February and August although a peak appears to occur between March and June.
Clutch size = 2/3
Incubation – 28 days by both male and female.
Young remain in nest for 11 weeks.
Incubation starts once the second egg is laid.
Hens do not lay until 7 years of age.
Cocks active about 5-6 years.
Information provided by M. Boussekey (pers. comm.)

1.8 Behaviour[2]

Moluccan Cockatoo
Information on courtship and breeding behaviour from the wild is sparse. They tend to occur singly or in pairs during the breeding season but may congregate in larger numbers at other times. The courtship display can last up to 20 minutes and involves both male and female calling from the top of an emergent tree and raising and lowering the crest. This activity may also be accompanied by short flights and breaking twigs from the perch. Vocal activity in the wild occurs mainly in the evening when the loud raucous call can be heard up to 1 km away.

Blue-eyed Cockatoo
Research is currently being carried out in New Britain by John Pilgrim under the supervision of Dr. Stuart Marsden of the Manchester Metropolitan University in the UK. This research will shed light on the behaviour of this species.

Citron-crested Cockatoo
The species is rare or absent from forest patches of less than 1,000 hectares. Data suggests that smaller forest patches may be utilized by foraging groups but these patches are not used when nesting.

They tend to prefer undisturbed primary forest characterized by tall emergent trees that are important nesting sites (Kinnaird, 1999). A clear preference appears to exist for cavities in large emergent *Tetrameles sp.* trees as nesting sites (Marsden & Jones, 1997). Courtship behaviour can involve mutual feeding and locating to a high branch or perch in the canopy where they call to each other. The male will 'strut' towards the female, raising and lowering his crest.

Philippine Cockatoo

Emergent trees 30-40m tall are used as nesting sites while coconut plantations on off-shore islands are used as roosting sites. During the hot hours of midday, the birds tend to rest. Activity, therefore, occurs in early morning and late afternoon. Preferred nesting trees include species such as *Garuga floribunda* generally of a height greater than 40 metres. The nest is usually located at least 20m above ground with an entrance hole diameter of at least 20cm and a depth of about 1.5m. Philippine cockatoos appear to tolerate other breeding pairs in the immediate vicinity of their nest and two active nest holes have been observed in the same tree. Mated pairs will travel, forage and roost together. However, during roosting and outside the breeding season, Philippine cockatoos appear to maintain an inter-individual distance of 20-50cm.

[2] Information from Juniper & Parr (1998) and del Hoyo, Elliott & Sargatal (1997)

SECTION 2. MANAGEMENT IN CAPTIVITY

Note: The following details apply to all four managed white cockatoo species unless specified. Some of the information is derived from a husbandry survey carried out on captive Moluccan cockatoos in 1994 by David Field and Andrew Bagnall.

2.1 ENCLOSURE

2.1.1 Boundary

All species of cockatoos are destructive and any barriers should take the following into account:

1. Primary barriers should be of strong wire mesh or other solid construction.
2. Mesh should be of small enough gauge to exclude wild birds or rodents. 2.5cm x 2.5cm is sufficient to keep out most wild birds. 10 guage mesh is suggested since a lighter mesh can be broken and ingested by cockatoos. It is important to ensure that a high quality galvanized mesh is used due to the dangers of zinc poisoning. This can be prevented by applying a non-toxic emulsion to the mesh.
3. Mesh is preferable to solid barriers, although the latter does afford some degree of shelter.
4. Divisions between aviaries should be double-wired. Moluccan and Philippine cockatoos, in particular, respond well to visual contact with other cockatoos, but should also have the opportunity to avoid contact with other birds.
5. Steel framework should be used or if timber is used, it should be protected.
6. Nuts and bolts should also be protected from the birds.
7. In public collections a stand-off barrier is advised.

2.1.2 Substrate

A wide variety of substrates can be used for aviaries. Bark chippings, sand and gravel are all acceptable. It is important that any substrate is easily maintained. There are no reports of any particular problems with any substrate.

2.1.3 Furnishings and Maintenance

Furnishings

Furnishings for the enclosure should be complex and easily replaced – the destructive nature of cockatoos requires continuous refurbishment of the enclosure.

Water

Fresh water should be available for drinking. White cockatoos generally do not use pools for bathing, preferring to take advantage of rain showers. In hot dry climates, an intermittent misting system should be employed. In Loro Parque Fundacion, the shower system is considered as enrichment as it tends to promote vocal activity and stimulates play behaviour.

Planting

Low-level planting may survive the destructive habits of these species (see Pace, 1995).

Perching

Complex perching is essential. Natural wood, hemp rope or chain have all been used very successfully. It may be important to note that cockatoos can catch their claws in rope, although no serious injuries have been reported.

Natural perching provides the birds with an extensive range of perch size which can be important in reducing the possibility of 'bumble-foot' (see Section 2.8 – Common Health Problems). Where possible, free-swinging perches should be used to encourage exercise. Careful positioning of perching will also encourage exercise, especially if it is possible to ensure that the birds must fly to their food/water dishes. It is important that perching is not positioned above food or water dishes and that there are adequate resting areas both in the open and in shelter.

Maintenance

Where possible, a routine should be established which will reduce stress to the birds. Although many institutions reduce maintenance during the breeding season, this may not be necessary. Indeed, close monitoring during the breeding season and routine examinations of the nest-box can impart valuable information.

Pest Control

Every effort should be made to exclude pests such as rodents and wild birds from both the indoor and outdoor enclosures.

Physical barriers are the first step in pest control. Ensuring that mesh size is sufficient to exclude most pests is a vital component of any control policy. Furthermore, the enclosure barrier should be checked regularly to ensure that no breach has formed.

Food storage bins should be well sealed and elevated above ground. Waste food should be removed promptly from the aviary and suitably disposed of.

Live-trapping is suitable for the removal of vertebrate pests and avoids the difficulties of toxicity to zoo animals associated with baiting. However, it is very labour intensive and a suitable means of disposing of the captured animals must be identified

Baiting, while less labour intensive than live-trapping and generally more effective poses difficulties with toxicity to non-pest animals. This difficulty can be overcome by using a reputable pest control company and following general guidelines as outlined below.

The following precautions should be taken when using any pest control compound:

a) Follow exactly the directions outlined by the supplier. If no directions are supplied, contact the relevant company for advice.
b) Avoid contamination of animal food, food utensils, water supply and bedding material.
c) Zoo animals and the general public should not be able to come into direct contact with pest control chemicals. When this is not possible, compounds that are toxic to only the target pest(s) should be used. Only authorised and trained staff should have access to pest control compounds.
d) Application of pest control compounds should only be carried out by trained staff using appropriate safe procedures e.g. wearing protective clothing as required.
e) Areas where pest control has been applied should be marked and identifiable.
f) A safe storage area for pest control chemicals should be maintained in an area removed from animal activity, food preparation and water supplies.
g) Pest control containers and compounds past their use-by-date should be disposed of in a safe manner.

A typical cockatoo aviary at Dublin Zoo.

2.1.4 Environment

In temperate climates, an indoor shelter is strongly recommended.

Access

Where possible, unrestricted access to indoor and outdoor areas should be facilitated. Shelter should be provided in the outdoor area also.

Heating

Heating may be required in the colder months of cooler temperate climes. The consensus among institutions appears to be thermostatically controlled heating at about a range of 50°F - 59°F (10°C - 15°C).

Lighting

Where necessary, artificial light should be operated with a dimmer control and a 12-hour cycle. The extended light cycle prolongs the feeding time during the short winter days of temperate climes. For birds lacking access to outdoor areas, artificial UV light should be considered.

Humidity

Where birds do not have access to outdoor enclosures, a misting system is recommended.

2.1.5 Dimensions

The dimensions of the aviaries reported for successfully breeding pairs vary considerably in size. An enclosure with a height of 2.5m – 3.0m with a floor area of 15 – 20m² is recommended as a minimum.

2.1.6 Nestboxes

Note: the following details apply to all four managed white cockatoo species, unless specified.

As is the case with aviary construction, many nest-box designs have proved successful. The husbandry survey indicates that the most common form is a box of 1 metre height and 30-50 cm².

Some factors for consideration:

1. The box must be constructed from a robust material due to the destructive nature of cockatoos. However, re-modelling of the nest-box by the bird should be facilitated. This can be achieved by using metal for the entrance and inspection hatch with a wire basket support for the bottom and constructing the rest of the nestbox from timber. The inner walls can be lined with wire mesh to provide grip.
2. The box should be large enough to allow both cockatoos into the box at the same time. Two access points should be incorporated into the design. This allows the female to escape harassment from males.
3. Boxes with a slope down to the nesting chamber have proved beneficial.
4. A degree of choice should be provided for the pair. White cockatoos are known to spend considerable time in their chosen nest-box outside of their breeding season. As a result, suitable nest-box construction can be readily ascertained by experiment.
5. Nesting materials, such as sawdust, bark chippings and newspaper, have been used successfully. It is important to ensure that the substrate is not too soft, supports the egg readily and facilitates turning of the egg. The same substrate type should be used throughout the incubation period.
6. Nest-boxes should be positioned as high in aviary as is convenient with solid support although it may also be beneficial to provide the birds with some choice with regard to nest-box position as well.
7. Nest-boxes can be left in the aviary year-round as they can double as a roost/shelter.
8. Incorporate the checking of nest-boxes into your daily routine if possible. This will, of course, depend on the disposition of the pair.

Examples of successful nest-box designs are appended (see Appendix 2).

2.1.7 Quarantine

Note: Quarantine requirements for cockatoos will vary depending on national legislation and the requirements of the relevant veterinary authorities. The relevant authorities should be contacted prior to accepting a cockatoo transfer.

Quarantine protocols for cockatoos are similar to that of all other birds. The area does not need to be quite as large as that outlined in enclosure requirements although an area that does facilitate some flight and the exercise of flight muscles is advantageous. There should be no contact between cockatoos in quarantine and any other birds, either within or outside Quarantine, due to the risks of disease transmission. Separate utensils and cleaning equipment should be used. If possible, avicultural staff should not enter the Quarantine area – the care of quarantine birds to be carried out by other members of staff. A full veterinary exam is recommended during the quarantine period by a suitably experienced vet. Diagnostic tests can include cytology, faecal analysis, haematology, biochemistry and/or endoscopy. It is impossible to screen for every possible health problem and efforts should be concentrated on diseases which are relatively common e.g. aspergillosis, psittacosis, avian polyoma virus etc. or those that are highly transmissible e.g. Psittacine Beak and Feather Disease (PBFD) etc. (see Common Health Problems, Section 2.8).

2.1.8 Aviary Location

It is suggested that new cockatoo aviaries are located in as quiet an area as possible. Off-show pairs tend to reproduce considerably better than birds on-show and the less disturbed an exhibit is, the greater the probability of successful breeding. Consideration should be given to building the aviary in a sheltered position as cockatoos do not appear to enjoy windy conditions. However, the site should not be so sheltered as to limit exposure to the sun. It may be beneficial to orientate the enclosure away from prevailing winds.

2.2 FEEDING

Note: the following details apply to all four managed white cockatoo species, unless specified.

2.2.1 Basic Diet

A variety of diets have been used successfully and examples are listed in Appendix 1. Diets should be based on the individual requirements of the birds in your collection and Appendix 1 is included only as a guide.

Some fundamental points to note are:

1. The diet should contain a variety of fruits and vegetables.
2. Pulses are readily accepted and form an excellent base to the diet while providing a good protein source.
3. Although pellets provide a complete nutritional package, they reduce food-handling time and should be supplemented with fruits, vegetables and pulses.

4. Vitamin and mineral supplements should be provided on a daily basis along with a palatable source of calcium (cuttlefish, provided directly or scraped over food, is a reliable source).

2.2.2 Special dietary requirements

The individual food preferences of birds may change during the breeding season which may require some modification of the diet.

Calcium, phosphorous and Vitamin D_3 are vital for the formation of the egg shell and development of the chick's skeletal structure. If calcium is not available from the hen's diet, it is sourced from the hen's skeleton which may lead to weakness. Cuttlefish bone is an ideal source of calcium and other vital minerals as it has a chemical composition very similar to that of egg-shell. A calcium to phosphorous ratio of 3:1 is suggested. In cases where cockatoos do not have access to outdoor facilities or UV light, Vitamin D_3 supplements in the diet are recommended, although care must be taken not to overdose (Jordan, 1989).

2.2.3 Feeding methods

Fresh food should be provided daily. Avoid 'topping up' on food from the previous day. Food dishes should be clean and dry prior to the addition of food. It is recommended to facilitate a food station per bird in the enclosure. Cockatoos forage continuously during the day and this activity can be promoted in captivity by providing the daily ration early in the day to encourage maximum use of daylight hours. Foraging behaviour can be promoted through the use of enrichment foods that are supplementary to the daily nutritional requirement (see Enrichment). Some birds will actively forage for seeds scattered on the aviary floor and this can be an excellent from of enrichment although this can also attract pests.

2.2.4 Water

Fresh water should be available for drinking. This can be provided in the form of pools on the enclosure floor which require regular cleaning or in water dishes which are routinely cleaned and refilled.

2.3 SOCIAL STRUCTURE

2.3.1 Basic Social Structure

Generally, white cockatoos are maintained in pairs. Young cockatoos should, where possible, be maintained in same-age groups once separated from their parents. It is suggested that cockatoos from fledgling up to 5 years of age can be managed in this way. After this period, problems with aggression arise which are associated with the onset of sexual maturity. Managing young cockatoos in this way encourages natural mate-choice and increases potential breeding success.

Aggression can be a major problem during the breeding season. Placid males can suddenly kill their female partners. Environmental enrichment that increases activity and food handling may help to alleviate this problem. If aggression is a factor, consideration should be given to substituting one partner for another bird. The Moluccan Cockatoo Husbandry Survey carried out in 1994 indicated that only pairs that displayed no aggression successfully raised young. In addition, it has been reported that adult males may become aggressive to fledgling males once the next breeding season begins.

2.3.2 Changing Group Structure

The usual precautions are recommended when introducing new birds. Allow visual and vocal contact prior to introduction. This will give some indication of compatibility. A recurrent problem with white cockatoos is the tendency of male birds to kill female partners (Cliff Wright, pers. comm.). In order to overcome this difficulty during an introduction, consideration should be given to allowing the female to explore the aviary independently. This may require that the resident male be removed for a couple of days. This will allow her to locate escape routes and safe areas more quickly if the male becomes aggressive on introduction. However, if two or more birds are being introduced to a previously uninhabited enclosure, then they should be released into the aviary together. Monitor progress carefully for an initial period.

2.3.3 Mixed-species and Adjacent-species considerations

Moluccan and Philippine cockatoos, in particular, may benefit from the presence of other white cockatoos in visual/vocal contact, particularly during the breeding season although privacy in the vicinity of the nest box is recommended. Escape from visual contact should also be facilitated. Moluccan Cockatoos should not be housed adjacent to each other. When two breeding pairs must be housed close together, at least one other species should be housed in between.

Some institutions have successfully mixed species of psittacines in aviaries but tend to remove breeding pairs during the breeding season to off-show or separate aviaries to eliminate aggression.

The cockatoo aviaries at Dublin Zoo. A pair of Moluccan Cockatoos occupy either end of the aviary with a pair of Citron-crested cockatoos occupying the middle aviary.

2.3.4 Re-socialisation of pet or hand-reared birds

The success of any attempt to introduce a pet or hand-reared white cockatoo to con-specifics in an aviary depends on the individual bird. Very dependent birds may find the new social situation extremely stressful and consideration should be given to their welfare.

The re-socialisation process generally requires great patience on the part of the keeper. The guidelines outlined for "Changing Group Structure" above should be followed and where possible, an extended period of visual and vocal contact prior to introduction should be facilitated. For birds of a nervous disposition, it is prudent to introduce them to a non-aggressive individual before attempting to form a breeding pair. A reduction in the level of human contact should accompany the introduction of a tame bird to a potential partner. The breeding success of such birds depends greatly on the individual.

2.4 BREEDING

Note: The information given here has been provided by the relevant species co-ordinators unless otherwise specified.

2.4.1 Mating

Moluccan Cockatoo

There are conflicting reports as to the breeding season of captive Moluccan Cockatoos in Europe. It is tentatively suggested that there are three 'windows' where breeding tends to occur – February/March, May/June/July and October/November. Once established, a pair will generally breed in the same 'window' each year, although birds may lay more than once a year.

Blue-eyed Cockatoo

Breeding period (Chester, U.K.) eggs laid March to August and in October – peak in July and October.

Citron-crested Cockatoo

Mating tends to occur from early March (Chris Gough & Matthew Lewis, Dudley Zoo, UK). Peak breeding in captivity (John Heath, Private UK) occurs between April and June although eggs have been laid as early as February and as late as July if an earlier clutch has been removed.

Philippine Cockatoo

Breeding period in captivity in France – May to July.

2.4.2 Egg Laying and Natural Incubation

Note: Clutch interval – most parrots will wait a full incubation cycle after laying the last egg of the initial clutch before laying again.

Moluccan Cockatoo

Clutch size 2/3
Incubation – 28 days by both male and female.
Incubation begins soon after laying first egg with 2-day interval between eggs.
Mr. John Heath (Private, UK) has reported that one pair consistently laid 3 eggs in their first clutch each year and laid 2 per clutch thereafter, if the first clutch was removed.

Blue-eyed Cockatoo
Incubation – 28 days by both male and female.
Clutch size = 2
3-6 day interval between eggs laid.

Citron-crested Cockatoo
Citron-crested Cockatoo – Clutch size 2/3
Incubation – 28 days by both male and female.

Philippine Cockatoo
Philippine Cockatoo – Clutch size 2/3.
Incubation – 28 days by both male and female.
In France, normally lay 3 eggs at 3-day intervals usually in the second week of May.
Incubation starts once the second egg is laid.

2.4.3 Hatching

Note: In all four species, pip to hatch interval should not be greater than 48 hours. After this time period, hatching assistance may be required (see below).

Moluccan Cockatoo
Internal pip = Day 25/26

Blue-eyed Cockatoo
Internal pip = Day 26

Citron-crested Cockatoo
Internal pip = Day 25/26

Philippine Cockatoo
Internal pip = Day 26

Hatching Assistance

The following is adapted from Jordan (1989) and may be of assistance when encountering problems with hatching:

Problem	**Possible causes**
Chick adhered to shell membrane	Wet bulb temperature too low Fan blowing across eggs
Normal looking chicks dead in shell after pip	Dry bulb temperature too low Possible bacterial problem Check vent position for possible ventilation problem
Chicks hatch and abdomen red or dark	Possible bacterial problem Substrate or cloth used in hatching dish too abrasive
Chicks pip but take too long to hatch	Eggs are being turned Wet bulb temperature too low Dry bulb temperature too low Weak due to improper incubation environment Hatch assistance may be helpful
Chicks die after being moved to hatcher	Temperature difference too great between incubator and hatcher Wet bulb temperature too low Ventilation problem Weak due to improper incubation environment
Chicks pip same spot and fail to rotate	Hatch in need of assistance Wet bulb temperature too low Eggs are being turned Weak due to improper incubation environment
Chicks die after pip with unabsorbed yolk sac	Temperatures too high.

2.4.4 Development and Care of Young

Moluccan Cockatoo

Young remain in nest for 15 weeks.

Information on a puppet-reared youngster in London Zoo* suggested that the eyes begin to open around Day 7. Food begging behaviour occurs from Day 1. Balance and perching ability develop around Day 65. The chicks first vocalisation (hissing) was heard on Day 18 and its first adult alarm call on Day 52. Wing flapping and preening first occurred on Day 30. The first short flight occurred on Day 96. It has been suggested that food preferences are developed in the nest box. The hand-reared chick was feeding itself from Day 65 and was independent of hand feeding after Day 80.

* Information courtesy of Paul Harrington, London Zoo.

Blue-eyed Cockatoo

Chicks weigh 14-18g, mean 16.2g (N=19) at hatch.

Eyes fully open at 10-12 days. Feathers show at 15-20 days and break from sheaths at 20-30 days. Retrices and remiges are last to open at 70-80 days. Most chicks become fully feathered by 130-140 days.

Chicks continue to be fed by parents for around 1 month after fledging.
Young in nest for 12 weeks.
Breeding capability at 3-4 years for females and over 5 years for males (this may be a consequence of the demographics of the captive population rather than a physiological obstacle).

Citron-crested Cockatoo
Young remain in nest for 10-12 weeks.
Breeding capability at 3-4 years.

Philippine Cockatoo
Weight at hatch approximately 10g and attains weight of around 300g by week 7.
Young remain in nest for 11 weeks.
Hens do not lay until 7 years of age.
Cocks active about 5-6 years.

2.4.5 Artificial Incubation and Hand Rearing

Artificial Incubation
Embryos begin to develop at temperatures of about 97ºF (36ºC) and continue to do so up to a temperature of 102ºF (39ºC). If incubation is carried out at the top end of this range, development will proceed rapidly. If carried out at the lower end of the range, development will proceed quite slowly. Either way, if development occurs at a rate different to that which would occur during natural incubation, the probability of survival at hatch time is reduced.

Calculating the daily weight loss target:

$$\frac{\text{(Fresh laid weight) x (Desired \% weight loss to pip)}}{\text{Number of days to pip}}$$

Estimating weight loss trend:

Step 1: $\frac{\text{(Laid weight – Current weight)}}{\text{\# days incubated}}$ = Average daily weight loss.

Step 2: $\frac{\text{(Average daily weight loss) x (Total incubation period)}}{\text{Laid weight}}$ = Decimal percentage weight loss.

Step 3: (Decimal percentage weight loss) x 100 = Percentage weight loss trend to pip.

Adapted from Jordan (1989).

Moluccan Cockatoo
Temperature 99.3ºF (37.4ºC) from initiation of incubation to time of internal pip (25-26 days), after which reduced to 97.9ºF (36.6ºC). Humidity maintained at 55% for incubation period and increased to 90%+ when internal/external pip has been observed. Eggs turned through 180º several times a day, always in alternating direction at each turning until internal pip has occurred, thereafter no turning should occur.
Emergence from initiation of external pip is 36-48 hours.
After 8 hours moved to brooder at 96.8ºF (36.0ºC). After first five days the temperature is lowered 1ºC every three days.
Egg weight ranges from 28.0g to 33.0g.
Desired egg weight loss = 16-20% of fresh weight to internal pip (Day25/26).

Blue-eyed Cockatoo
Eggs incubated at 99.5ºF (37.5ºC) and moved between incubators set at different relative humidities to achieve a predetermined weight loss.
Incubation period 27-29 days
To minimise handling, eggs are candled at each time of weighing.
Once internally pipped, eggs are transferred to hatcher at 97.7ºF (36.5ºC). Hatching occurs approx. 48 hours later. When dry after 4-6 hrs, transferred to a parrot brooder for hand-rearing.
Egg weight = 22.7g – 26.0g (average 24.4g, N=5).
Desired egg weight loss = 15% of fresh weight to internal pip (Day 26).

Citron-crested Cockatoo
Pip to hatch interval 36-48 hours.
Egg weight ranges from 20.0g to 23.5g.
Eggs incubated at 99ºF (37.2ºC). Humidity varies according to what the egg weight loss measurements show to be necessary with an average of about 50%. The egg is transferred to the hatcher on internal pipping where the temperature is 98.1ºF (36.7ºC) and the humidity is 70%. On hatching, the chick is moved to a brooder set at 95ºF (35ºC) and between 70-75 % humidity.
Desired egg weight loss = 13-17% of fresh weight to internal pip.

Philippine Cockatoo
Pip to hatch interval 24-48 hours.
Eggs incubated at 99ºF (37.2ºC). Humidity varies according to what the egg weight loss measurements show to be necessary with an average of about 45%. The egg is transferred to the hatcher on internal pipping where the temperature is 98.1ºF (36.7ºC) and the humidity is 70%. On hatching, the chick is moved to a brooder set at 95ºF (35ºC) and between 70-75% humidity.
Desired egg weight loss – 14-16% of fresh weight to internal pip (Day 26).

Hand-rearing

Note: It is important to monitor how quickly the crop fills to prevent excess food filling the esophagus. Regurgitation of food is an indication that the crop is full and feeding should be stopped to prevent aspiration of food into the trachea.

Moluccan Cockatoo

First feed 12-hours after hatching (dependent on amount of yolk sac still visible). Comprises lactated ringers solution with psittacine-specific strain of *Lactobacillus* added. From second feed use commercially available hand-rearing diet – fat level of approximately 8-12%. Food prepared at 40ºC.

Blue-eyed Cockatoo

Day 1-9 – fed Kaytee Exact Hand-rearing Formula (Kaytee Products Inc., Chilton WI 5304) at 2-hour intervals between 08.00 and 24.00 with pipette or plastic spoon with deep cup and definite 'tip'). Amount determined from observation of crop emptying. Begging behaviour encouraged by touching the beak.
Day 10-29 – feed interval 3 hours.
Day 30-39 – feed interval 4 hours.
Day 40- 49 – feed interval 5 hours. Begin weaning process with fruit, soaked seed etc.
Day 50-70 – feed interval 6 hours.
Weaning occurs between 100-140 days.
Growth – 550-650g at 8-11 weeks.

Citron-crested Cockatoo

Day 1-7 – Fed every 2 hours from 07.00 to 23.00 on Mixture 1 (See Appendix 1B).
Day 8-18 – Fed every 2 hours from 07.00 to 11.00 and thereafter every 3 hours from 11.00 to 23.00 on 'Pretty Bird 19/8' hand-rearing formula (See Appendix 1B).
Day 19-45 – Fed every 4 hours from 07.00 to 23.00 on 'Pretty Bird 19/8' formula.
Day 46–Wean – Fed every 5 hours from 07.30 to 22.30 with 'Pretty Bird 19/8' formula. Fruit, pellets and sprouted seeds made available. As soon as chicks are observed eating some fruit, they are reduced to three feeds and dry seed is added to the diet. This can later be reduced to two feeds (the morning feed is discontinues) and then one feed during the afternoon.

Philippine Cockatoo

The following rearing formulae and protocol have been used successfully by MA Regina De Dios Jardinel, Birds International Inc., Philippines.

EDF Formula = 250 ml boiled water, 2 tbsp high-protein mix, 2 tbsp quaker oats, 1 tbsp ceresoy.
Preparation: Dry ingredients mixed in pan, hot water added, cooked for 3 mins, cooled and blended.

Rearing Formula 1 = 250ml Boiled Water, 2 tbsp Oatmeal, 3 tbsp Ceresoy, 4 tbsp Apple Jungle Pellets, ¼ tbsp Pregistimil (Germany), 1/8 tbsp D-CA-FOS.
Preparation: Pour hot water in blender, add dry ingredients, mix and leave for 1 minute. Blend for 1 minute and add Pregestimil and D-CA-FOS. Blend until mix is smooth.

Rearing Formula 2 = 400ml Boiled water, 50g hulled Sunflower Seeds, 5 tbsp Apple Jungle Pellets, 3 tbsp Ceresoy, 3 tbsp Oats, ½ tbsp Pregistimil (Germany), ½ tbsp D-CA-FOS (Germany)
Preparation: Pour 200ml boiled water into blender. Add sunflower sees and grind. Add remaining water and blend for 2 mins. Add dry ingredients and mix. Add Pregistimil and D-CA-FOS and blend until smooth.

Rearing Formula 3 = 550ml Boiled Water, 30g pressure-cooked Peanuts, 50g Sunflower seeds, 4 tbsp Ground Oats, 50g Apple Jungle Pellets, 50g Starter Breeder Pellets, 60ml pressure-cooked Papaya, 1/8 tbsp Kormivin (Germany), ¼ tbsp D-CA-FOS (Germany), ½ tbsp Isomil.
Preparation: Soak Apple Jungle and Breeder Pellets in 150ml water for 2 mins. Blend peanuts and sunflower seeds. Pour 200ml boiled water into peanut/sunflower mix. Grind for 1 min and add 200ml boiled water. Blend for 2 mins while adding oats, papaya and softened pellets. Add Kormivin, D-CA-FOS and Isomil and blend until smooth.

Rearing Protocol
Day 1 – Chick starter (2 ml baby food formula, 2 ml EDF Fromula, 1 ml Volamin (Germany).
Day 2 – Rearing Formula 1 with half of Day 1 feed.
Day 3 to 16 – Rearing Formula 1.
Day 17 to 74 – Rearing Formula 2.
Day 75 to 90 – Half Rearing Formula 2 and half Rearing Formula 3.
Day 90 to 110 – 75% Rearing Formula 3 and 25% Rearing Formula 2.

Feeding Frequency
Day 1 to 16 – 8 times a day from 5.00 am to 12.00 midnight
Day 17 to 35 – 6 times a day from 5.30 am to 11.00 pm.
Day 36 to 45 – 4 times a day from 6.00 am to 10.00 pm.
Day 46 to 65 – 3 times a day from 7.00 am to 8.00 pm.
Day 66 to 75* – 2 times a day from 9.00 am to 5.00 pm
Day 76 to 90 – Once a day at 5.00 pm.
Day 91 to 110 – Weaning time.

* By the age of 70 days, Ziegler Frugivore Pellets and soft foods (steamed carrot, boiled banana/ sweet potatoes/rice) are given. This is increased as the chick learns to eat. Sprouted beans, guava, safflower seeds, millet and leaves can be given also from this age.

2.5 POPULATION MANAGEMENT

2.5.1 Up-to-date species reports from Studbook co-ordinators are appended (see Appendix 3).

2.5.2 Identification and Sexing

Transponders
Careful consideration should be given to the site of implantation of a transponder chip. The following points are worth considering:

1) There should be minimum discomfort and risk to the animal.
2) The site should facilitate reliable reading.
3) There should be no risk of transponder migration.
4) Ease and safety of implantation and reading for the operator.

Recently the Federation of Zoological Gardens in Great Britain and Ireland issued a 'Recommended Code of Practice for Microchipping Zoo Animals.' The guidelines for birds are as follows:
Under 200g = sub-cutaneous on left lateral side over ribs.
Over 200g = intra-muscular of the left pectoral muscle.

Rings
Birds should ideally be close-rung with a stainless steel ring. This is normally done within the first five days after hatch.

Surgical Sexing
This involves the use of a quality rigid endoscope and a powerful light source. The procedure should be carried out under general anaesthesia and should be carried out by a qualified vet.

DNA Sexing*
This is the most accurate method of sex determination for birds. Sex can be determined from blood or feather samples.

Preparation of Blood Samples.
Blood Samples are generally collected from the end of the toenail. Restrain the bird and clean off any obvious dirt. Clip the toenail (starting at the tip) until a drop of blood is seen to form. Collect the blood using a capillary tube and place in a collection tube. Bleeding from the toenail should cease within a couple of minutes. However, a blood coagulant, cornflower or soap can be used to stop blood flow. It is recommended that this procedure is carried out by a vet. If more than one sample is being taken, it is important to ensure that contamination of samples does not occur.

Preparation of Feather Samples
Only freshly plucked feathers can be used for DNA Sexing. Generally, three or four whole breast feathers are sufficient. It is important to ensure that feathers from different birds are not mixed in sample bags.

* These procedures can be carried out by Avian Biotech International (UK), P.O. Box 107, Truro, Cornwall, TR1 2YR, UK. Tel/Fax + 44 1872 262737. E-mail abiuk@globalnet.co.uk Website: www.avianbiotech.co.uk
Contact a local vet for other nearby laboratories.

2.6 HANDLING and TRANSPORT

2.6.1 Handling and Restraint

Psittacines are best approached in a darkened or dull room. Handling is best carried out using a cloth towel since gloves are often too thick to feel or manipulate through. The bird should be grasped firmly around the head with fingers and thumb on either side of the head. The bird's head can be held in one hand, with the bird's body clamped between the forearm and chest, leaving the other hand free. The thumb should be placed immediately underneath the lower beak to prevent biting. However, if medication is required it is best to have an assistant that can hold the head while a thorough examination can be carried out.

Anaesthesia
The aims of anaesthesia should be to provide a smooth, safe and reliable induction with adequate restraint, muscle relaxation and analgesia followed by a fast but full and uneventful recovery. The degree of restraint will depend on the purpose for which the bird is being sedated or anaesthetised. Sedatives may be sufficient to immobilise a bird for a brief but thorough clinical examination. A light anaesthesia may be required for radiography, laparoscopy or biopsy while moderate to deep anaesthesia will be required for most surgical procedures.
Handling of birds directly before induction should be kept as short as possible and equipment and anaesthetic agents should be prepared well in advance and located close to hand. Dehydrated or hypoglycaemic birds should be treated with fluids before, during and after surgery. Isoflurane and medetomidine have both been used successfully as anaesthetic agents. It is good practice to wrap the bird in a towel to maintain the core body temperature and prevent injury from wing fluttering post-anaesthesia.

2.6.2 Shipper's Responsibilities

The shipper or its authorized agent has the following general responsibilities:

- Finalising the route and any special care required by the shipment upon reservation and prior to acceptance.
- Obtaining all documents and correct information for the Shipper's Certification.
- Compliance with national, carrier and IATA regulations.
- Providing containers that conform to the IATA Live Animal Regulations.

- Providing suitable bedding for the species and food that does not contravene national regulations.
- Affixing special feeding and watering instructions to the container and attaching a copy of the documents that accompany the shipment.
- Recording on the container the date and time that food and water had been given to the animal prior to acceptance.
- Recording any medication given (drug, dosage, time given and route). This information must accompany the documents and a copy affixed to the container.

2.6.3 Animal Behaviour

Transportation has a stressful effect on animals and there are a number of basic principles which will ensure the comfort of the cockatoos in transit.

A) Feeding – if this cannot be carried out during the flight, the cockatoo(s) should be fed at least 12 hours prior to departure and again on arrival.

B) Water – if this cannot be carried out during the flight, the cockatoo(s) must be watered before dispatch and upon arrival.

C) Defecation – sufficient absorbent material should be provided for in the container.

D) Behaviour – this can change dramatically for individuals during transportation. Compatible pairs may suddenly become aggressive. It may be worthwhile to separate aggressive birds during separation.

E) Environmental – Temperature changes can and do occur in cargo holds. Bedding material will contribute to the comfort of the birds. Adequate aeration must be provided for. Birds often travel best in darkened containers.

2.6.4 Container Requirement

A) Dimensions – this will depend to a large extent on the number of birds being transported together.

B) Frame – A solid wood frame of 2x4 cm either screwed or nailed and glued with a non-toxic adhesive.

C) Sides – Plywood or solid wood with a minimum thickness of 0.6 cm or metal. Cockatoos have powerful beaks and the construction must reflect this fact. The interior must have no projections that the birds can get hold of. One side of the container must have a mesh (2.5 cm x 2.5 cm 10 guage mesh) area covering at least 75% for ventilation

D) Perches – Perching is generally not required but suitably sized smooth rails should be fixed to the floor so that the cockatoos can feel secure.

E) Stocking Density – cockatoos are best shipped in small groups of not more than six individuals. However, only compatible individuals should be shipped together but see 2.6.3 (D) above.

F) Ventilation – All meshed openings must be covered with a light material that allows good air flow. Muslin cloth is ideal.

G) Food and water containers must have flanged sides

2.6.5 Container Labelling

Each container must be marked legibly and durably on the outside with the following information:

A) The full name, address and contact number of the shipper and consignee. At least one of these should be a 24-hour contact.
B) The scientific and common name of the animal(s) and the number of individuals in the container.
C) A warning label indicating that 'These Animals Bite.'
D) Any medication administered prior to shipment and details. It is advised not to medicate any birds prior to shipment unless absolutely necessary.
E) At least one IATA 'Live Animals' label.
F) Suitably positioned 'This Way Up' labels.

* A local import authority should be contacted for details of your requirements regarding cockatoo transportation under national and international law.

2.7 LEGISLATION

* The relevant authorities in your country should be contacted to determine your obligations under national and international law.

CITES
The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) entered into force in 1975 and is adhered to by most countries. The primary objective of the Convention is to establish and maintain world-wide controls on trade in designated wild animals and plant species including their respective parts and products. The designated species are listed in three appendices to the Convention. Each Party state has designated one or more authorities that are responsible for the issue of import and export permits for designated species.

2.8 COMMON HEALTH PROBLEMS

* In all cases, a veterinary consultant with experience in exotic birds should be contacted in the event of suspected illness and to carry out examinations on birds in quarantine and prior to transfer to other institutions or collections.

Avian Polyoma Virus (APV)
This widespread virus appears to affect neonates (young birds between the ages of 15 to 56 days) more so than any other age class. The virus can be present in a carrier state with no clinical symptoms in adult birds until they undergo some form of stress.
Infected birds may die without developing any clinical symptoms while others die within 12 to 48 days after developing clinical signs. Symptoms of APV include depression, loss of appetite, weight loss, crop emptying, vomiting, diarrhea and bleeding under the skin.

Obviously, birds which do not display typical clinical symptoms create an opportunity for inter- and intraspecific transmission of the virus before it can be contained. Research into the aetiology for transmission of the disease is inconclusive. It has been suggested that the virus can be transmitted vertically via the egg. However, horizontal transmission between birds is the most common route.

Bumble-foot

The type of acscess found on the toes and ball of the foot is referred to as 'bumble-foot' and generally represents a chronically infected corn. It is essentially a normal abscess or granuloma, but owing to its position and continual pressure from beneath during perching or walking, the tissues are constantly irritated. The horny skin becomes undermined with infected granulation tissue, often surrounded by a thick fibrous capsule.
It is often caused by perches being too narrow resulting in the birds puncturing the ball of the foot with their own nails and becoming infected.

Ectoparasites

Ixodidae (hard ticks) are ubiquitous and are known to secrete a toxin. Feather mites and lice from a variety of taxa are also common. Mosquitoes and other arthropods in the nest or aviary can also be problematic. Treatment of ectoparasites requires care due to the potential danger of toxicity to the bird. Pyrethrin or permethrin can be used in powder form. Ivermectin (e.g. 0.5ml of 1% Ivomec Injection for cattle in 1.1 litres of water) has also been used successfully although care should be taken not to exceed a dose of 200mcg/kg.

Egg-binding

This can occur with an oversized or malpositioned egg in the oviduct. Fatigue, hypocalcaemia, disturbance and environmental conditions have also been implicated. Indications are swollen abdomen, restlessness, may appear to strain and often rests off limbs. In such cases, temperatures should be increased to 30ºC and relative humidity should be increased. Lubrication using a warm sterile isotonic saline can be beneficial. Calcium (1-5ml of 10% solution slowly intravenously) and oxytocin (0.1-1.0 units/kg intramuscularly) have also been used. A topical or intramuscular prostaglandin (e.g. arginine vasotocin 0.01-1.0 mg/kg) can also be used.

Internal papillmoatous disease

This occurs most frequently in New World parrots but it is transmissible. The symptoms are the presence of fresh blood in the faeces and/or cloacal prolapse. Polyp-like lesions can also occur on the palate, glottis and in the upper oesophagus. Pancreatic atrophy and bile duct tumors occur in up to 10% of cases that are usually fatal. Transmission is believed to be by oral or venereal contact although the infective agent has yet to be identified.

Intestinal problems

Intestinal parasites of psittacines (adapted from Beynon, Forbes and Lawton, 1996).

PARASITE	CLINICAL SIGNS	DIAGNOSIS	TREATMENT
Protozoa			
Giardia spp.	Intermittent diarrhoea. Greasy/mucoid faeces. Can be associated with feather-plucking.	Serial examination of very fresh faecal samples necessary.	Metronidazole (10-30mg/kg p/o bid for 10 days). Dimetridazole (50mg/kg p/o bid for 10 days).
Helminths			
Ascarids	Weight loss Intermittent diarrhoea	Faecal flotation	Fenbendazole (100mg/kg p/o by crop tube – repeat after 3 weeks). Do not use during period of active feather growth.
Capillaria	Diarrhoea	Faecal flotation	Ivermectin (200mcg/kg i/m – repeat after 3 weeks).
Cestodes	Weight loss	Proglottids in faeces. Serial samples required.	Praziguantel (10mg/kg p/o or 7.5mg/kg i/m – repeat after 3 weeks).

p/o = post-orally i/m = intra-muscularly bid = twice a day

Diarrhoea-causing bacteria (adapted from Beynon, Forbes and Lawton, 1996).

GENUS	TRANSMISSION	FREQUENCY	COMMENTS
Gram-negative			
E. coli	Oral	Very common	This is a normal inhabitant of the gastrointestinal tract. Large numbers can be significant.
Klebsiella spp.	Oral?	Common	Diarrhoea generally associated with hepatitis or nephritis. Very resistant to antibiotics.
Pasteurella multocida	Rodents and wild birds	Relatively uncommon	Diarrhoea in acute phase only.
Pseudomonas spp.	Oral, especially through contaminated water.	Uncommon	Highly resistant to antibiotics. Catarrhal to haemorrhagic enteritis.
Salmonella spp.	Oral	Common in imported birds	Generally unresponsive to treatment.
Yersinia spp.	Oral. Rodents and wild birds.	Common	Acute form causes diarrhoea. Generally unresponsive to treatment
Gram-positive			
Clostridium perfringens	Oral	Rare	Acute diarrhoea that may be haemorrhagic. Generally diagnosed *post mortem*.
Campylobacter spp.	Oral	Uncommon	Diarrhoea secondary to hepatitis.
Acid-fast bacteria			
Mycobacterium spp.	Alimentary	*M. avium* common in some collections. *M. tuberculosis* rare	*M. avium* treatable but requires follow-up monitoring. *M. tuberculosis* untreatable. Zoonotic implications must be considered.

It is important that diarrhoea is distinguished from polyuria which is an increase in the fluid component of the droppings. Diarrhoea causes a loss in the shape or form of the faecal component of the droppings.

Generally, the faecal component of the droppings has a white urate component and a dark green faecal component. Lime-green or mustard coloured faeces can be associated with hepatic disease. Brown or haemorrhagic faeces may indicate enteritis. However, the colour of the faeces may also change naturally due to food staining.

Faecal screening

Regular faecal screening should form an integral part of the management of the birds both within the enclosure and whilst in Quarantine. Birds that develop diahorrea should be screened immediately for *Chlamydiosis psittaci* in view of the zoonotic potential of this pathogen. Fresh faecal samples should be placed in an airtight container, wrapped and marked suitably and sent to an experienced diagnostic laboratory (contact a local veterinarian for details). Faecal samples can be taken from the floor of the aviary (although contamination can occur) or swabbed directly from the cloaca (contamination from urates may occur) by rotating a moistened swab inside the cloaca and transferring the swab to a suitable transport medium.

Nail Trimming

The nails of some birds may require clipping. As is the case with all birds, very small sections of nail should be removed, progressing gradually along the length of the nail until reaching the desired length. In some cases, haemorrhage may occur and this can be cauterised using a suitable agent e.g. ferric perchloride, silver nitrate, cornflower or soap.

Polyuria

Polyuria is an abnormal increase in the liquid urine component of the droppings, independent of the faecal component which retains its shape and consistency. Stress, a high water diet and/or the onset of egg-laying are physiological contributory factors. It is difficult to isolate a pathological cause for polyuria since it can be a symptom of many avian diseases. As a result, a full history and examination for other clinical signs will be required to isolate the cause.

Proventricular dilatation disease

Adult birds suffering disease lose condition rapidly and die after periods of regurgitating food and passing undigested food in the faeces whilst still eating well. In chicks, unusual begging behaviour, paralysis and changes in vocalizations together with regurgitation of food occur.

As yet, no virus has been definitively associated with the disease making diagnosis difficult and treatment almost impossible. There appears to be a long latent period thus making identification of the carrier bird difficult. It is worth noting that candidiasis or gastric foreign bodies may cause similar symptoms and these should be ruled out first.

Psittacine Beak and Feather Disease (PBFD)
PBFD is the smallest virus known capable of causing disease. It belongs to a recently discovered group of viruses called the Circoviridae. Incubation periods for the virus vary from 21 days to a maximum of about 18 months. Clinical symptoms include rapid weight loss, depression, shedding of developing feathers, development of abnormal feathers, beak elongation and abnormal growth. The virus affects the rapidly multiplying epithelium of the feather and beak causing new pin feathers to become pinched off or twisted and the beak to become, at first shiny, and then to crumble away. PBFD can be a fatal disease. Transmission is possible through direct contact with infected faeces, crop secretions, infected materials and surfaces and feather dust (even on keepers' clothing). Vertical transmission via the egg may also be possible but remains unproven.

Psittacine herpesvirus infection
This virus , one of a group of avian herpesvirus which includes pigeon herpesvirus and falcon herpesvirus, is most common in New World parrots. Death occurs due to acute liver disease. Carriers of the disease typically begin shedding the virus due to stress (breeding, dietary change, transport, change of owner etc.). Serological and viral isolation tests (from faeces) are available. It may be worth pointing out that New World conures are suspected of being regular symptomless carriers and should not, therefore, be mixed with cockatoos.

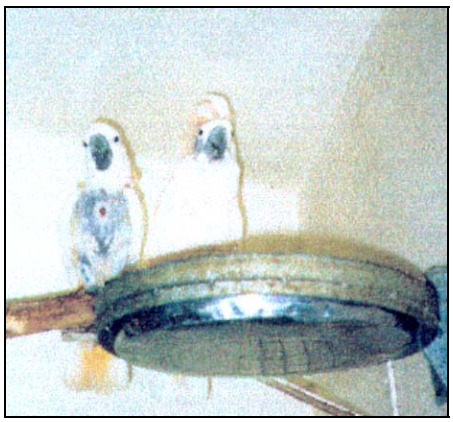
Psittacosis
This disease can infect birds of any age and size. The infective agent (*Chlamydia psittaci)* causes weight loss due to liver disease, anorexia, hypothermia, lethargy and yellow-green gelatinous droppings leading to death in as many as 40% of cases. However, if detected in its early stages, psittacosis can be treated effectively with antibiotics. Psittacosis is typically manifest at times of stress such as change of ownership, breeding, bad weather etc. Sensitive faecal tests for the infective agent are now available which can detect clinical cases as well as many carriers.
It is important to note that *Chlamydia psittaci* may cause disease in humans if close physical contact occurs with an infected bird.

Respiratory Problems
Respiratory problems can be divided into upper respiratory tract (UPT) and lower respiratory tract (LRT) infections.
Clinical symptoms of UPT infections include open-mouthed breathing, nasal discharge and/or sneezing, periorbital swelling, head-shaking and yawning.
LRT symptoms include change of voice, inspiratory/expiratory difficulty and coughing.
It is crucial that a specific diagnosis is made prior to the instigation of therapy for respiratory tract infections. Diagnositic tests include cytology, faecal examination, haematology, biochemistry and/or endoscopy.
Fungal pathogens such as *Aspergillus spp., Candida spp.* and *Chlamydia psittaci,* and bacterial pathogens such as *Pseudomonas aeroginosa, Klebsiella pneumonia, Pasteurella spp. Yersinia pseudotuberculosis, Streptococcus spp.* and *Staphyloccocus spp.* have all been isolated. Treatments for these pathogens vary enormously and as a result an accurate diagnosis is required.

Stereotypies

Stereotypies can take various forms in cockatoos – head-bobbing or weaving and feather-plucking are the most common. Stereotypies may be prevented by providing cockatoos with an enriched environment (see below). Once a stereotypy has established itself it can be extremely difficult to eliminate. Ensuring that stereotypic birds are provided with a stimulating and novel environment can prove beneficial. There has been some suggestion that feather-plucking activity can be associated with a low calcium intake attributable to either dietary or physiological factors.

Moluccan cockatoo suffering from feather -plucking and self-mutilation.



Moluccan cockatoo suffering from feather-plucking.

Vitamin Deficiencies

The most common vitamin deficiency seen in psittacines tends to be Vitamin A deficiency. Pathogenesis includes squamous cell metaplasia of the epithelial surfaces of the oropharynx, renal tubules, reproductive tract and air sacs. Poor condition or chronic upper respiratory problems are common presenting signs. Vitamin A can be supplied naturally to birds in the form of ß-carotene present in fruits and vegetables.

For birds that do not have outdoor access or during the incubation period, vitamin D_3 deficiency can occur.

The high fat diets of some psittacines are generally low in B vitamins. Indications of deficiency are poor condition, convulsions and perosis.

Any form of stress tends to deplete endogenous stores of Vitamin C.

In all cases, dietary supplements in the form of commercially available powders (e.g. ACE-High, Vetark Animal Products, Winchester, UK) can be used to prevent vitamin deficiencies.

* *Information adapted from personal communication from Andrew Greenwood, M.R.C.V.S., International Zoo Veterinary Group to the EAZA Parrot TAG.*

2.9 ENRICHMENT

Enrichment should be based on the stimulation of all senses to elicit natural behaviours so as to conserve the behavioural diversity of a species.

For cockatoos that inhabit complex environments and spend a great deal of time foraging and manipulating food, enclosure enrichment will certainly contribute a great deal to their overall welfare and, therefore, their reproductive potential. In order to ensure that captive cockatoos display as wide a range of natural behaviours as possible, it is necessary to incorporate 'non-essential' items into their daily husbandry.

Food as enrichment

Certainly, enrichment through food and its presentation is the most commonly used method in zoos. In most cases, enrichment foods supplement the daily nutritional requirement. This ensures that individuals are sufficiently fed, although the provision of food in easy-to-access feeders may preclude the desire to forage for enrichment foods. In cases where a dominant individual monopolises the feeder and consumes the choicest and often more nutritional items first, food presentation by means of enrichment devices can reduce this problem and ensure that all individuals have access to a full nutritional complement of food.

Commonly used food presentation techniques include:

1) Fruit kebabs – large pieces of fruit/vegetable speared onto thick pieces of wire can be hung from perching and aviary walls. This method stimulates food manipulation and increases food-handling time.
2) Forage trays – seeds and nuts can be mixed with bark chippings and placed in a tray in the enclosure. This increases foraging behaviour.
3) Tube-feeders – enrichment foods can be placed in a tube feeder of suitable durability with a weld-mesh end. This device requires manipulation in order to 'tease' out food items.
4) Puzzle feeders – pieces of fruit and seeds etc. can be pushed into holes drilled into blocks of wood. Effort is required to remove the food items from the holes and thus foraging time is increased.
5) Whole foods – unprocessed foods like papaya, melon, orange, coconut etc. can be speared onto or hung from perching. Small incisions can be made in the outer rind to facilitate access to the pulp.

Enclosure Design

Various modifications can be made to the basic aviary to elicit natural behaviours. Complex perching is of vital importance for cockatoos. Branches are ideal as they provide a range of perch sizes which can reduce the incidence of bumble-foot. Cockatoos will strip the bark from branches and this activity can be encouraged by replacing perching on a regular basis. Browse, can also be utilised to serve the same purpose. Rope is also suitable for cockatoos as long as it is suitably durable.

The type of nest box provided for cockatoos can also be an important means of enrichment. Birds are incredibly fastidious when it comes to the nest site and if nest boxes facilitate some degree of modification by the birds, they are more likely to be accepted. Cockatoos should be allowed to adapt their nest box and by providing a range of nest boxes, the chances of one being suitable are greatly increased.

Social enrichment

While it is recommended not to mix breeding pairs of cockatoos with other birds, non-breeding individuals can benefit from mixed-species exhibits. Whether this can be achieved or not will depend greatly on the disposition of the individuals in question. It has been suggested the Moluccan cockatoos benefit from being housed within auditory distance of other Moluccan cockatoos. However, breeding pairs of should not be housed in adjacent aviaries.

Novel items

A range of play items has been given to cockatoos as enrichment devices. These can range from plastic toys to cardboard boxes. Any such item will be enthusiastically destroyed by cockatoos. The only requirements are that they are non-toxic and easily replaced.

2.10 RESEARCH

Much of the recent research on white cockatoos relates to the effectiveness of various enrichment techniques (see References).
New information is being published on cockatoos in the wild, although much remains to be studied.

Ms. Tiawanna Taylor of the University of Nottingham has carried out research on the use of genetic markers to assist forensic investigations involving a number of selected psittacines, including Moluccan cockatoos *(Cacatua moluccensis)*. Genetic profiling can be used to determine identification in the event of theft or to discriminate between captive bred and wild caught birds in the cases where illegal importation is suspected. The methodologies involved are of use in both *in situ* and *ex situ* conservation by facilitating wild population analysis and assisting the management of captive breeding programmes particularly where inbreeding effects in isolated or closed populations is suspected.

Rather than using the conventional method of multilocus DNA fingerprinting which requires relatively large quantities of DNA, Ms. Taylor concentrated her research on the isolation of microsatellites that only requires small amounts of DNA. To date, nine genetic markers have been obtained for the Moluccan cockatoo, of which four appear to be of use. However, further examination is being carried out to elucidate the effectiveness of these markers.

Difficulties have been encountered with psittacines, such as the Moluccan cockatoo, that are restricted to small islands due to their low levels of genetic variability. It could be anticipated that similar research into other island-bound species such as the Blue-eyed cockatoo *(Cacatua opthamica)* and the Citron-crested cockatoo *(Cacatua sulphurea citroncristata)* will prove difficult.

Further information can be obtained from Ms. Tiawanna Taylor at:
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Suggested areas of captive behavioural research include:

1. The value of early rearing in same-age groups using reproductive output as a measure of reproductive success.
2. The influence of the activity of adjacent pairs or species in triggering reproductive behaviour in captive cockatoos.
3. Much research remains to be carried out on the aetiology of a number of psittacine diseases that have implications for the success of captive breeding programmes and the general health of the population.
4. The levels of inbreeding in the captive population for some species is unknown and can only be estimated. Analysis of the genetics of the studbook populations would be of immense value.

SECTION 3: LITERATURE

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APPENDIX 1 – SAMPLE DIETS

SAMPLE DIET 1 – LONDON ZOO

Rearing Diet (courtesy of London Zoo) for hand-reared Moluccan Cockatoo.

Primate Pellet (20% protein)
Heinz tinned baby fruit
Sesame Seed
Saline (0-9%)
Boiled water
Calcium lactate
SA37

Weaning diet (courtesy of London Zoo) for hand-reared Moluccan Cockatoo.

Sprouted pulses (aduki, mung, lentil, chick pea)
Sprouted wheatbread (bread made from sprouted wheat)
Sesame snack bar (sesame seed and honey)
Hard-boiled egg
Tuna (mixed with peanut butter and sesame seed)
Cheese
Tinned Guavas (syrup washed off)
Sweetcorn
Brocolli
Lettuce
Tomato
Grape
Banana
Apple
Pear
Orange
Carrot
Peppers
Alfalfa
Pumpkin seed (hulled)
Sunflower seed (hulled)
Cuttlefish bone
Brazil nuts (shells broken)
Hazel nuts (shells broken)
Peanuts (unshelled)
Sunflower
Buckwheat
Safflower
Millet

SAMPLE DIET 2 – JOHN HEATH (PRIVATE), CORNWALL
General Diet

White millet
Canary seed
Buckwheat
Whole hemp seed
Safflower
Pinenuts
Parrot Mix (sunflower, peanuts, safflower, pinenuts)
Chilli peppers
Peanuts (in shell)
Banana
Orange
Apple
Grapes
Carrot
Cooked chicken
Beetroot
Sweetcorn/Corn on the cob
Sprouted sunflower seeds
Sprouted pulses (beans, peas, lentils)
Cuttlefish bone, Nutrobal, Acehigh
Washed dandelion leaves (in Spring)
Wholemeal bread soaked in skimmed milk (during breeding season)
Hawthorn berries (when in season)

*Rearing Diet**

Nectarblend (John E. Haith Ltd., Cleethorpes, UK)
P.T.X (John E. Haith Ltd., Cleethorpes, UK)
Milupa Fruit Salad Infant Dessert
Milupa Spring Vegetables Infant Dinner
Ace-high (Vetark Animal Products Ltd., Winchester, UK)
Nutrobal (Vetark Animal Products Ltd., Winchester, UK)
Avipro Paediatric (Vetark Animal Products Ltd., Winchester, UK)

Preparation:
Nextarblend and P.T.X mixed together and ground to a powder and sieved. Milupa infant foods are put through a sieve and course material is ground down to remove all lumps. Ace-high, Nutrobal and Avipro Paediatric are added and mixed. The food is then mixed with previously boiled water and brought to a temperature of 104º F (40ºC).

* This diet is used for the first 2½ weeks. Thereafter the Weaning diet below is used. Alternatively 'Pretty Bird 19/8' formula commercially available is used.

Weaning Diet

Nectarblend (John E. Haith Ltd., Cleethorpes, UK)
P.T.X (John E. Haith Ltd., Cleethorpes, UK)
Milupa Fruit Salad Infant Dessert
Milupa Spring Vegetables Infant Dinner
Ace-high (Vetark Animal Products Ltd., Winchester, UK)
Nutrobal (Vetark Animal Products Ltd., Winchester, UK)
Sunflower seeds (hulled)
Sesame seed
Pumpkin seeds (hulled)

Preparation:
As for Rearing diet above, except seeds are not ground and mixture has a porridge-like consistency.

SAMPLE DIET 3 – CHRIS GOUGH/MATTHEW LEWIS, DUDLEY ZOO, UK

Dry seed – Sunflower, Melon, Peppers, Safflower, Millet, Flaked maize, pine nuts.

Sprouted seed (48 hours) – Sunflower seed, mixed pulses, wheat.

Fruit and Vegetable – Apple, orange, pear, banana, boiled carrot, grapes, paw paw, melon, broccoli, cherries, mango, apricot, pineapple, etc.

Other – boiled egg, Vionate.

SAMPLE DIET 4 – MIGUEL BUENO, LORO PARQUE FUNDACION, TENERIFE

During the breeding season, a special cake is produced as a protein and mineral complement during chick-rearing. Fresh maize is also provided which is an easily absorbed source of energy.
Supplemental cake formula:
1kg cornflour
1kg wheat flour
1kg soya
2kg carrot
1kg beef
12 eggs
30g calcium
½ glass salt
5lt water.
This mix is baked at 150ºC for 60 minutes and the amount is sufficient for up to 200 birds.

SAMPLE DIET 5 – DAVID FIELD, DUBLIN ZOO, IRELAND

General diet for Moluccan cockatoos and Blue-eyed cockatoos

Foodtype	Daily Individual Requirement		Notes
	Breeding	Non-breeding	
Pulses	45g	35g	
Fruit/Veg	70g	70g	Large chunks
Sunflower	20g	25g	
Peanuts	5g	10g	
Hemp/Millet	5g	10g	Hemp in winter only

General diet for Citron-crested cockatoos and Philippine cockatoos

Foodtype	Daily Individual Requirement		Notes
	Breeding	Non-breeding	
Pulses	35g	25g	
Fruit/Veg	55g	55g	Large chunks
Sunflower	10g	20g	
Peanuts	5g	5g	
Hemp/Millet	10g	10g	Hemp in winter only

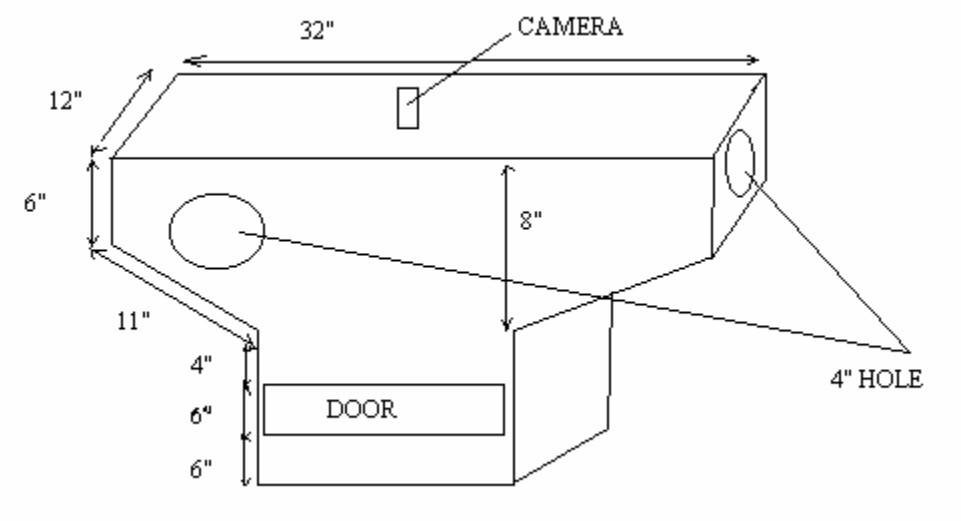
APPENDIX 2 – NEST BOX DESIGN

DESIGN A

Dimensions: Height = 137 cm
Length = 44 cm
Width = 44 cm
Entrance Hole Diameter = 12 cm
Distance of hole from base = 61 cm

Courtesy of Birds International Inc. Philippines.

DESIGN B



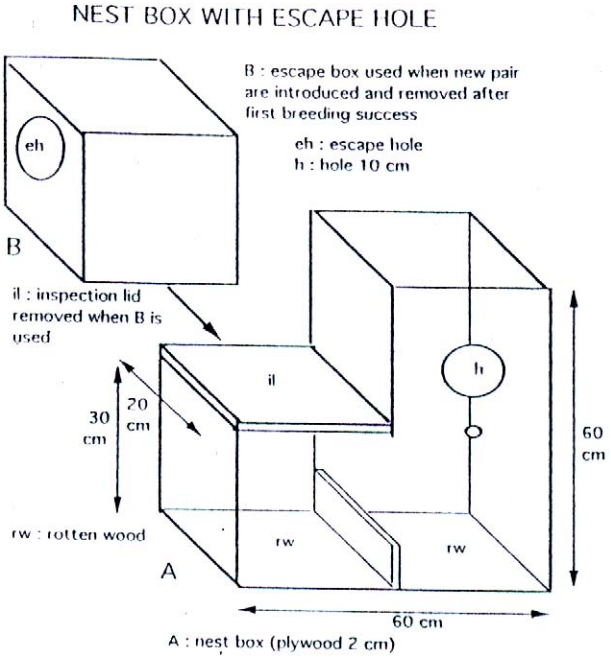
Courtesy of Mark Boussekey, St. Martin La Plaine, France.

DESIGN C

Dudley Zoo, UK have constructed a successful nest box for citron-crested cockatoos from a section of plastic drainage pipe with a 30.5 cm internal diameter (12" Ø). A 115cm (45") length is used and furnished with a wooden base and an internal concave made from a 'hypa tufa' type mix (sand, cement and wood shavings). An internal ladder made of heavy guage 5cm (2") weld mesh provides access to the base. The nestbox is positioned under a solid roof at an angle of 45º using steel wire.

The citron-crested cockatoo aviary at Dudley Zoo, UK (see nest-box at left)

DESIGN D



Courtesy of Cliff Wright, UK

APPENDIX 3 – STUDBOOK REPORTS

Moluccan cockatoo *(Cacatua moluccensis)* EEP population
Status and developments 12-months to 31st July, 2000

LOCATION	31 July 1999	Birth	DNS	Death	EEP		Non EEP		31 July 2000
					IN	OUT	IN	OUT	
Alfriston/GB	1.2.1*								1.2.1
Antwerp/B	1.2.0					0.1			1.1.0
Aywaille/B	1.0.0				0.1				1.1.0
Baden,private/G	1.1.0								1.1.0
Banham/GB	1.3.0					0.1			1.2.0
Barcelona/ES	1.2.0								1.2.0
Belfast/GB	5.4.0*	3.0.1	3.0.1	1.1					4.3.0
Berlin TP/G	0.0.0						1.0		1.0.0
Blackpool /GB	0.1.0*					0.1			0.0.0
Blossom, private/GB	2.2.0								2.2.0
Bratislava/SLO	1.0.0*								1.0.0
Bristol/GB	1.1.0								1.1.0
Burford/GB	1.1.0								1.1.0
Chessington/GB	1.1.0								1.1.0
Cleres/F	1.0.0								1.0.0
Colchester/GB	3.2.0								3.2.0
Dublin/IRE	2.0.0				0.1		1.1		3.2.0
Dudley/GB	1.1.0								1.1.0
Dvur Kralove/CR	1.1.0								1.1.0
Echterhoff, private/G	2.2.1*						1.0		3.2.1
Edinburgh/GB	2.1.0			0.1		1.0			1.0.0
Exmoor/GB	1.1.0								1.1.0
Farnham/GB	2.1.0								2.1.0
Givskud/DK	0.1.0								0.1.0
Great Yarmouth	2.1.0								2.1.0
Hannover/G	0.0.0								0.0.0
Hayle/GB	0.0.0								0.0.0
Heath,private/GB	1.1.0							1.1	0.0.0
Heiligenkirchen/ GB	4.5.0								4.5.0
Herbertstein/A	2.1.1			0.1.1					2.0.0
Hunnebostran/S	7.6.5			2.1.1			1.1	1.0	5.6.4
Jerusalem /IS	1.2.0*								1.2.0
Jurques/F	1.1.0								1.1.0
La Londe/F	2.0.0								2.0.0
Ljubljana/SL	1.2.0*				1.0				2.2.0
Leeds/GB*	2.0.0				0.2				2.2.0
Liberec/CR	0.0.0								0.0.0
Linton/GB	1.1.0								1.1.0
Lisbon/P	2.6.2*								2.6.2
London RP/GB	2.2.0					0.1			2.1.0
Los Cristianos/ES	2.2.0								2.2.0
Madrid/ES	2.0.0							2.0	0.0.0

LOCATION	31.07.99	Birth	DNS	Death	EEP		Non EEP		31.07.00
Manor House	0.0.0								0.0.0
Marwell/GB	1.1.0								1.1.0
Maspalomas/ ES	8.4.3	0.2.2		1.1				2.0.3	5.5.2
Massa Lombarda/I	2.1.0								2.1.0
Mulhouse/F	1.2.0								1.2.0
Muzillac/F	1.1.0								1.1.0
Neath/GB	0.0.0								0.0.0
Novosibirsk/ RUS	1.1.0								1.1.0
Parcfloral/F	1.1.0								1.1.0
Pastrengo /I	0.1.0*								0.1.0
Pistoia / I	1.1.0								1.1.0
Plzen/CR	1.1.0								1.1.0
Puerto De la Cruz/ES	11.7.15*								11.7.15
Ramat Gan/Is	1.1.0								1.1.0
Riga/LAT	2.2.0								2.2.0
Rode/GB	1.1.1								1.1.1
Romaneche/F	1.1.0								1.1.0
Rostov/RUS	2.2.0								2.2.0
Royan/F	1.0.0								1.0.0
St Aignan/F	4.6.0	1.0		0.1				0.2	5.3.0
Saarbrucken/ G	0.0.1								0.0.1
Scales, private/GB	1.1.0								1.1.0
Serranova/I	1.1.0								1.1.0
Simpson, private/GB	1.1.0								1.1.0
South Lakes/GB	1.1.0								1.1.0
Spreen, private/G	1.1.0								1.1.0
Strasbourg/G	1.0.0								1.0.0
Strasser, private/G	2.3.0								2.3.0
Stuttgart/G	3.2.0								3.2.0
Tallin/EST	1.0.0								1.0.0
Twycross/GB	1.1.0						1.1		2.2.0
Tyn Helyg/GB	1.1.2								1.1.2
Upie/F	2.1.0								2.1.0
Walsrode/G	1.1.0								1.1.0
Wroclaw/P	1.0.3*								1.0.3
Wust, private/G	1.1.0								1.1.0
TOTALS	**123.109.35***	**4.2.3**	**3.0.1**	**4.6.2**	**1.4.0**	**1.4.0**	**5.3.0**	**6.3.3**	**119.105.32**

* - Incorrectly reported in 1999

Blue-eyed cockatoo *(Cacatua opthalmica)* ESB population
Status and developments in 1999

Participants	Status 01-Jan	Births (DNS)	Transfers between EEP zoos in	Transfers between EEP zoos out	Transfers with non-EEP zoos in	Transfers with non-EEP zoos out	Deaths	Status 31-Dec
BELFAST/GB*	3.0	-	-	-	-	-	-	3.0
BERLIN TIERPARK/D	1.1	-	-	-	-	-	-	1.1
CHESTER/ GB	9.5	-	-	-	-	-	0.2	9.3
HAYLE/ GB	1.1	-	-	1.0	-	-	0.1	-
NEWQUAY/ GB	1.1	-	1.0	-	-	-	-	2.1
PUERTO DE LA CRUZ/ ES	4.5	2.1.1(0.0.1)	-	-	-	-	-	6.6
RODE/ GB	2.1	-	-	-	-	-	-	2.1
ROTTERDAM/ NL	2.2	-	-	-	-	-	-	2.2
SEVENOAKS, PRIVATE/ GB	-	-	-	-	2.2	-	-	2.2
WALSRODE/ D	2.1	-	-	-	-	-	-	2.1
Totals 10 participants	25.17	2.1.1(0.0.1)	1.0	1.0	2.2	-	0.3	29.17

Citron-crested cockatoo *(Cacatua sulphurea citroncristata)* EEP population.
Status and developments in 1998.

Participants	Status 01-Jan	Births (DNS)	Transfers between EEP zoos in	Transfers between EEP zoos out	Transfers with non-EEP zoos in	Transfers with non-EEP zoos out	Deaths	Status 31-Dec
ALPHEN A/D RIJN/NL	1.2.1	-	-	-	-	-	-	1.2.1
BELFAST/GB*	2.1	-	-	-	1.1	1.0	-	2.2
BERLIN TIERPARK/D	2.2	1.0	-	-	-	-	-	3.2
DECIN/CZ	1.1	-	-	-	-	-	0.1	1.0
DORTMUND/D	1.0	-	-	-	-	-	-	1.0
DUBLIN/IRE*	1.1	-	-	-	-	-	-	1.1
DUDLEY/GB	1.1	1.0.1	-	-	-	-	-	2.1.1
FARNHAM/GB	1.1	0.0.1	-	-	-	0.0.1	0.1	1.0
HAYLE/GB	1.1	-	-	1.0	-	-	-	0.1
LEIPZIG/D	3.0	-	-	-	-	-	-	3.0
PARIS ZOO/F*	0.0.1	-	-	-	0.0.1	0.0.1	-	0.0.1
PUERTO DE LA CRUZ/ES	3.3	-	-	-	-	-	-	3.3
RODE/GB*	-	-	1.0	-	-	-	-	1.0
ST. AIGNAN/F	6.2	0.1	-	-	-	-	-	6.3
WALSRODE/D	1.0	-	-	-	-	-	-	1.0
Totals 14 participants * new EEP participant	26.16.2	2.1.2	1.0	1.0	1.1.1	1.0.2	0.2	28.15.3

Philippine cockatoo *(Cacatua haematuropygia)* EEP population.
Status and developments in 1999.

Participants	Status 01-Jan	Births (DNS)	Transfers between EEP zoos		Transfers with non-EEP zoos		Deaths	Status 31-Dec
			in	out	in	out		
ALPHEN A/D RIJN/ NL	0.0	-	-	-	-	-	-	0.0
BELFAST/ GB	2.1	-	-	-	-	-	0.1	2.0
BERLIN TIERPARK/ D	1.1	-	-	-	-	-	-	1.1
BROUWER PRIVATE/ NL	3.1	-	-	-	-	-	-	3.1
CHESTER/ GB	2.2	-	-	-	-	-	-	2.2
LONDON/ GB	0.0	-	-	-	-	-	-	0.0
PRIVATE A/ GB	4.5	0.0.1(0.0.1)	-	-	-	1.1	1.2	2.2
PRIVATE B/ GB	7.6	-	-	-	-	-	-	7.6
PRIVATE C/ GB	7.6	4.1	-	-	-	3.3	-	8.4
PUERTO DE LA CRUZ/ ES	4.3	-	-	-	-	-	0.1	4.2
ST. MARTIN LA PLAINE/ F	6.4	1.1	-	-	-	-	0.1	7.4
SWINKELS PRIVATE/ NL	4.4	-	-	-	-	1.0	0.1	3.3
UPIE/ F	1.0	-	-	-	-	-	-	1.0
WALSRODE/ D	1.0		-	-	-	-	-	1.0
Totals 14 participants	42.33	5.2.1(0.0.1)	-	-	-	5.4	1.6	41.25