American Zoo and Aquarium Association's

Palm Cockatoo

HUSBANDRY MANUAL

1998

Published by

Caloosahatchee Aviary and Botanical Gardens

and the International Aviculturists Society

PO Box 2232

Labelle, FL 33975

Edited and distributed by

Mike Taylor

Palm Cockatoo SSP Coordinator/Studbook Keeper

White Oak Conservation Center
3823 Owens Road
Yulee, Florida 32097

904-225-3308 phone
904-225-3395 fax
miket@wo.gilman.com

Proceed to the Palm CockatooTable of Contents

For further information or comments, please contact Mike Taylor

Caloosahatchee Aviary | Palm Manual | IAS | Search the Site | Table of Contents

Table of Contents

Palm Cockatoo SSP Husbandry Manual

Husbandry Manual Introduction

- **Palm Cockatoo (*Probosciger aterrimus*) - Captive Population History**
- **The Development of the Husbandry Manual**
- **SSP Population.**
- **Acknowledgments.**

Chapter I General Characteristics and Natural History by Mike Taylor (Ed.)

- **Physical Characteristics.**
- **Habitat.**
- **Social Organization**
- **Status in the Wild**
- **Diet in the Wild.**

Chapter II Housing and Enclosure Requirements by Sherry Branch and Ron Young

- **Aviary Size.**
- **Perches.**
- **Substrate.**
- **Wire.**
- **Cold Weather.**
- **Hot Weather.**
- **Breeding Pens.**
- **Breeding Palm Cockatoos in a Mixed Exhibit.**

- **Location of Feeders.**
- **Water.**
- **Sanitation.**
- **Nest Boxes.**
- **Nesting Material.**
- **Environmental Enrichment.**

Chapter III Management by Susan Healy

- **Individual Identification.**
- **Transponders**
- **Leg Bands**
- **Handling.**
- **Shipping.**
- **Pest Control.**

Chapter IV Palm Cockatoo Behavior and Social Organization by Pat Rider and Mike Taylor

- **Behavior Vocalizations.**
- **Contact Call**
- **Alarm Call**
- **Feeding and Preening Call**
- **Flight Call**
- **Juvenile Food-solicitation Call**
- **Growling**

- **Visual Displays.**
- **Congregation Display**
- **Courtship Display**
- **Threat Display**
- **Rain-bathing Display**

- **Unique Behaviors.**
- **Blushing**
- **Foot Stomping**
- **Drumming**
- **Nest Building**

- **Captive Recommendations.**
- **Social Organization**
- **Introductions**

Chapter V Palm Cockatoo Reproduction by Trent Swigert

- **First Captive Breeding.**
- **Breeding Season.**
- **Breeding Stimulus.**
- **Sexual Maturity.**
- **Nesting Behavior.**
- **Courtship.**
- **Artificial Insemination.**
- **Incubation.**
- **Egg Laying.**
- **Egg Measurements.**
- **Artifical Incubation.**
- **Hatching.**

Chapter VI Nutritional Requirements of Adult Palm Cockatoos By Carla Marquardt and Kimberly Howard, Ph.D.

- **Nutrient Requirements.**
- **Nutrient Requirements Table.**
- **Feeding Ecology.**
- **Manufactured vs Seed Diets.**
- **Dietary Intake Studies with Psittacines.**
- **Nutrient Specifications for a Manufactured Diet Table**
- **Captive Diets.**
- **Diets Used.**
- **Supplements.**
- **Practical Diets.**
- **Feeding Schedule.**

Chapter VII Medical Management of the Adult Palm Cockatoo by Matthew W.

Bond, D.V.M., Diane Downs, and Sharon Wolf, C.V.T.

- **Introduction.**
- **Life Span.**
- **Sexing Techniques.**
- **Behavioral Manifestations of Illness.**
- **Medical Testing Procedures.**
- **Parasitology**
- **Blood Chemistries**
- **Blood Chemistrie Values**
- **Hematology**
- **Microbiology**
- **Radiology**
- **Additional Tests**
- **Major Disease Problems and Treatments.**
- **Fungal Infections**
- **Protozoal Infections**
- **Bacterial Infections**
- **Psittacine Feather and Beak Disease (PFBD)**
- **Kidney Diseases**
- **Feather Problems**
- **Common Injuries and Treatments.**
- **Anesthesia.**
- **Vaccinations.**
- **Necropsy and Histopathology.**

Chapter VIII Handrearing and Medical Care of Young Palm Cockatoos by Mathew W. Bond, D.V.M., Diane Downs, Dreama Skidmore, and Sharon Wolf, C.V.T.

- **Introduction.**
- **Husbandry and Diet.**
- **Hand-rearing Diets**
- **Feeding Schedule Table**
- **Weaning.**
- **Physical Development and Growth Characteristics.**
- **Behavioral Manifestations of Illness in Chicks.**
- **Neonatal Examinations.**
- **Major Disease Problems and Treatments.**
- **Neonate Mortality.**

Chapter IX Chick Rearing Accounts edited by Mike Taylor

- Introduction.
- Palm Cockatoo Chick #1
- Palm Cockatoo Chick #2
- Palm Cockatoo Chick #3 (large file)
- Palm Cockatoo Chick #4 (large file)
- Palm Cockatoo Chick #5
- Palm Cockatoo Chick #6
- Riverbank Zoo's 1996 Chicks
- St. Catherine's Survival Center's 1996 Chicks

Appendix 1 Nest Box Examples

Appendix 2 Manufacturer List

Appendix 3 Shipping Crate used by ABRC

Appendix 4 IATA Guidelines

Appendix 5 Sarcocystosis

Appendix 6 Basket Diagram

Appendix 7 Drug Information

- Antibiotics
- Antifungals
- Miscellaneous
- Anthelmintics

Appendix 8 Routine Physical Exam Form

Appendix 9 List of Avian Diagnostic Laboratories

Appendix 10 Microbiology Worksheet

Appendix 11 Growth Charts from ABRC

Appendix 12 Hematology Values for Juvenile Cockatoos from ABRC

Appendix 13 Hematology/Chemistry/Serology Records from ISIS and White Oak Conservation Center

Appendix 14 Hand-reared Palm Cockatoo (*P.a.aterrimus*) Chick Weights from ABRC.

Appendix 15 SSP Necropsy and Histopathology Techniques/ Recommendations.

Appendix 16 Food Item Preference by Two Palm Cockatoo Pairs at WOCC.

Appendix 17 Contributors List.

References

For further information or comments, please contact Mike Taylor

Palm Cockatoo SSP Husbandry Manual

Introduction

by Mike Taylor (Editor) from the White Oak Conservation Center

Palm Cockatoo (Probosciger aterrimus) - Captive Population History.

In 1983, 100 palm cockatoos (*Probosciger aterrimus*) were confiscated by the United States Fish and Wildlife Service (USFWS). Ten zoological institutions received ten birds each to hold till the legalities of the confiscation case were completed. After the case was resolved, each holding institution was allowed to keep two pairs. The remaining birds were auctioned off to private individuals by the USFWS. Those receiving palm cockatoos were required to join the newly formed Palm Cockatoo Consortium. Ron Young of the Greater Baton Rouge Zoo became the chairman and was approved, in 1985, by the Wildlife Conservation Management Committee (WCMC) of the American Zoo and Aquarium Association (AZA) to develop a North American regional studbook. Mr. Young petitioned for and was approved by the WCMC, in 1988, to convert the consortium into the Palm Cockatoo Species Survival Plan (SSP). In 1990, Mr. Young transferred the SSP Coordinator and Studbook Keeper duties to Mike Taylor of White Oak Conservation Center with the approval of the WCMC. In October 1992, the Palm Cockatoo Management Group developed the first Master Plan for the SSP.

The Development of the Husbandry Manual

In April of 1994, a meeting was held to develop the Palm Cockatoo Husbandry Manual. In the four years since that meeting, several things have changed. Two chapters were added, one on Natural History

and one on Chick Rearing Accounts. Most of the information in the Natural History chapter was extracted from a few of the original chapters. This was an attempt to create a more cohesive document since, due to different chapter authors, some information tended to be redundant. The chapters concerning diets have also been updated.

SSP Population.

Since the American Zoo and Aquarium Association (AZA) has kept a studbook for the palm cockatoo, there have been a total of 235 hatchings within the SSP population with a sex ratio of 94 males, 71 females and 70 of unknown sex. There were 154 (73.53.28) of these captive hatched birds alive as of January 1997. This information was recorded between 1986 and 1997. There have been 155 palm cockatoos, with a sex ratio of 69 males, 49 females and 37 of unknown sex hatched at Avicultural Breeding and Research Center (ABRC) by 1997, making them the largest producer of palm cockatoos in North America and possibly the world.

Acknowledgments.

I, Mike Taylor, would like to thank the following people who helped write and/or edit this manual;

Bill Aragon, Rio Grande Zoo

Rochell Berman, White Oak Conservation Center

Matthew W. Bond, Avicultural Breeding and Research Center

Sherry Branch, Sea World of Florida

Sue Crissey, Brookfield Zoo

Diane Downs, Avicultural Breeding and Research Center

Elizabeth Ferguson, White Oak Conservation Center

Susan Healy, Sacramento Zoo

Kimberly Howard, University of California, Davis

Carla Marquardt, Avicultural Breeding and Research Center

John Olsen, Busch Gardens

Pat Rider, White Oak Conservation Center

Anne Savage, Roger Williams Park Zoo

Dreama Skidmore, Avicultural Breeding and Research Center

Tom Snider, Detroit Zoo

Janet Stephenson, Private Aviculturalist in Jacksonville, FL

Trent Swigert, Caloosahatchee Aviary and Botanical Gardens

Sharon Wolf, Avicultural Breeding and Research Center

Wendy Worth, San Antonio Zoo

Ron Young, Mesker Park Zoo

I would also like to thank the institutions which allowed their people to attend the Husbandry Manual Meeting held at the White Oak Conservation Center; the Detroit Zoo, Sea World of Florida, the Sacramento Zoo, and especially the Avicultural Breeding and Research Center who sent three individuals to the meeting and have contributed much information to this manual.

I thank the White Oak Conservation Center and especially John Lukas, the General Director of White Oak Plantation, for allowing me the time for this husbandry manual and all other duties relating to the Palm Cockatoo SSP. I also thank the WOCC for agreeing to distribute this manual.

I would like to thank Joe Barkowski from the Houston Zoo for his efforts in facilitating the publishing of this manual. I greatly appreciate Luanne and Richard Porter, Caloosahatchee Aviary and Botanical Gardens, and the International Aviculturists Society for publishing this husbandry manual, especially in such a timely manner.

I would like to thank all SSP participants who may have been anxiously awaiting this manual.

It is the hope of the authors that this manual will be beneficial to the management of the palm cockatoo in captivity. This manual is going to be dynamic, it will continue to grow and change as new information and techniques are learned about these fantastic birds.

Mike Taylor

September, 1998

White Oak Conservation Center

For further information or comments, please contact Mike Taylor

Caloosahatchee Aviary | Palm Manual | IAS | Search the Site | Table of Contents

Chapter I

General Characteristics and Natural History

by Mike Taylor (Editor) from the White Oak Conservation Center

In an attempt to present the information in this husbandry manual in a more organized and more easily accessable format, the information for this section has been extracted from the following chapters;

Housing by Sherry Branch and Ron Young

Behavior by Pat Rider and Mike Taylor

Reproduction by Trent Swigert

Adult Nutrition by Carla Marquardt and Dr. Kimberly Howard.

Adult Medical Care by Dr. Bond, Diane Downs and Sharon Wolf

Physical Characteristics.

Palm cockatoos, while similar to other cockatoos in some ways, have their own unique physical characteristics. They are considered by many to be the largest of the cockatoos (Lint, 1976; Low, 1980; Forshaw 1981), ranging from 49 cm to 68 cm in total length, measured from the top of the head to the tip of the tail. The palm cockatoo is a long, lean bird, and is relatively lightweight for its size.

There is a wide range of size among individual birds and across subspecies. At the Avicultural Breeding and Research Center (ABRC), females have ranged in weight from 503 to 950 gm and the males from 545 to 1092 gm.

Perhaps the most distinctive features of the palm cockatoo are the red, naked facial patches. Facial color in these birds may be related to several factors including stress level, general health, and their environment. Thus, the tone of the facial patches is not constant and may range from a brilliant crimson to almost white to a dull, blotchy burgundy. The bare skin may be hidden by the coverlet feathers, a further indicator of the bird's attitude.

A healthy palm cockatoo has powder down, but in a lesser amount than the white cockatoo species. The powder dulls the glossy beak and lends a subtle grey color to their black plumage. Feathering is sparse on the palm cockatoos' black legs.

Palm cockatoo beaks are unique in their size and structure. The maxilla, or upper beak, is almost twice the size of a Moluccan cockatoo's (*Cacatua moluccensis*). The beak has great strength for cracking large nuts, but the maxilla is almost hollow in the area below the cere, making it vulnerable to physical trauma. The maxilla has a large biting surface on the underside that opposes the biting edge of the mandible. The mouth is never completely closed because of the structure of the maxilla and mandible. The structure of the mouth is also different than other cockatoos in that the glottis is deep-seated.

Habitat.

Most cockatoo species are adapted to dry climates and associated vegetation. The exception is the palm cockatoo, which is adapted to tropical rainforest habitats (Forshaw, 1981; Alderton, 1983; Deifenbach, 1985; Smith, 1987). Their recent evolution has taken place in a wetter, warmer climate under very different selective forces than those experienced by other cockatoos (Smith, 1987). They, therefore, have developed many different social, behavioral, and physical traits, which enable them to compete in their rainforest environment.

Social Organization.

Unlike other cockatoos, palm cockatoos are not flock feeders. They are generally observed singly, in

pairs, or in small groups of up to five or seven individuals (Forshaw, 1981; Deifenbach, 1985). It is unknown if these small groups are made up of related or unrelated individuals. Palm cockatoos roost separately, but begin calling to each other after sunrise (Forshaw, 1981). Small groups congregate on trees in neutral areas during the day, where they preen, perform displays, and engage in various other social interactions (Eastman & Hunt, 1966; Forshaw, 1981; Wood, 1988). Pairs separate from these parties at sunset and return to their own territories. After making a round of sites within their territory, they return to roost, separately, in the same tree (Wood, 1988).

Pairs maintain territories that include several potential nest trees. They regularly visit these sites throughout the year with increasing frequency during the breeding season (Wood, 1988). The palm cockatoo's breeding season in the wild has been observed as being prolonged, and may vary in accordance with climatic conditions (Forshaw, 1981), usually occurring during the months of August through January. They inspect the nest trees, sometimes adding splintered twigs as nest material, perform displays, and defend their territories from intruders (Wood, 1988). Nest building and maintenance, and territorial defense may be very important to maintaining the "pair bond".

Breeding cavities are usually found at considerable heights and are often more than 1 meter deep with a diameter of 25 to 60 cm (Forshaw, 1981). Once the pair accepts a nest site, they will usually use it year after year (Deifenbach, 1985). After the female lays a single egg, it is incubated by both parents for about 30 days. It takes three to four days for the chick to hatch after pipping. The hatched chick is totally naked and does not develop down, unlike all other cockatoo chicks which are hisuated (Silva, 1991). In the wild, the chick is believed to be brooded primarily by the female. The chick does not emerge from the nest for 100 to 110 days, the longest nestling period known for any parrot species. For about two weeks after leaving the nest, the chick is not fully competent to fly and continues to be fed by its parents for an additional six weeks (Forshaw, 1981; Deifenbach, 1985).

Palm cockatoos are long lived, highly specialized feeders with a slow reproductive rate. As with other large birds inhabiting tropical rainforests, they appear to have a stable population where recruiting younger individuals is normally difficult.

Status in the Wild.

There have not been many recent surveys concerning the palm cockatoos status in the wild. The only concrete indication of their status comes from the population found on Cape York Peninsula, Queensland, Australia. It has been found that this population is decreasing (Bruning, 1996). Prior to this disturbing report, this population was believed to have been stable. A research project to determine the cause of this decline is being spearheaded by Dr. Don Bruning of Wildlife Conservation International/ Bronx Zoo and Joe Forshaw.

Diet in the Wild.

Researchers report that palm cockatoos have been observed feeding on seed, nuts, fruits, berries, and leaf buds. They are primarily arboreal feeders, but have been seen on the ground feeding on seeds and fallen fruit. According to Forshaw (1978), they were observed on the Cape York Peninsula eating seeds of the kanari tree (*Canarium australasicum)* and the black bean tree *(Castanospermum australe)*, and the fruits of the nonda tree *(Parinarium nonda)* and *Pandanus sp.* They have been observed eating seeds which have passed through cassowaries, possibly making them easier to open or concentrated into one area. Cassowaries have also been seen eating fruit which has been discarded by foraging palm cockatoos (D.Bruning, pers. comm.).

For further information or comments, please contact Mike Taylor

Caloosahatchee Aviary Palm Manual IAS Search the Site Table of Contents

Chapter II

Housing and Enclosure Requirements

by Sherry Branch from Sea World of Florida

and Ron Young from Mesker Park Zoo

Aviary Size.

Palm cockatoos *Probosciger aterrimus* are generally housed in the same fashion as other psittacines in a typical parrot aviary, such as flight or suspended cages. For the physical and mental well being of these birds the cage size should allow adequate flight and recreation. The Palm Cockatoo SSP Management Group feels the minimum size aviary, which would accommodate their normal activities, is 2 meters wide by 3.3 meters long by 1.6 meters high (6' x 10' x 5'). This is a subjective view based on the group's experience, not on any study, and is echoed by the following experts. Deifenbach (1985) states that "Basically, only a large, roomy aviary of stable construction is suitable for keeping these birds. Animals which are not kept in a well-planned flight often appear bored and listless. Kept in a large aviary they are in constant motion and exhibit their interesting behavioral repertoire..." and Forshaw (1981) states "A spacious aviary, not less than 16 m² in floor area, should be provided for each pair; in close confinement, the cockatoos become dull and listless." The management group feels the optimum would be any aviary larger than 2.6 m x 4 m x 2.6 m (8' x 12' x 8'). Although the smallest enclosure within which this species has reproduced is 1.3 m x 2.6 m x 1.3 m (4' x 8' x 4'), we do not encourage using any aviaries smaller than the minimum mentioned above in order to assure the birds' well being. One institution has seen an increase in the number of new breeders when their pairs were moved from small cages to the larger size cages mentioned above.

Perches.

Perches are necessary on both ends of the cage to allow adequate flight. Additional perches of various sizes and diameters from 5 cm to 10 cm (2" to 4") are recommended but should not obstruct flight space. A minimum width of 5 cm (2") is recommended for palm cockatoo perches. The perches should be low enough so that the birds' crests do not touch the top of the enclosure, but kept generally to the upper part of the cage. Palm cockatoos seem to spend more time on the higher perches when given a choice. One

perch can be made wide enough 10 cm to 30 cm (4" to 12") and long enough (at least one meter) to allow the male to strut and display. The strutting perch should be located away from human disturbance. A perch situated on end, such as a post, is also enjoyed by these birds.

Substrate.

Palm cockatoos have been housed and bred successfully in enclosures with cement and natural substrate and also in suspended cages. They seem to enjoy utilizing the earth substrate of flight cages; however, infectious and parasitic diseases can be a problem (See Chapter VII, Medical Management of the Adult Palm Cockatoo for additional details).

Wire.

Twelve gauge wire is recommended to contain these birds due to a report that a palm cockatoo chewed through 14 gauge wire. Since all palm cockatoos are considered important, the management group recommends not taking any chances with the 14 gauge wire. When planning a palm cockatoo pen, consideration should be given to construction of a safety area at the door to prevent the birds from flying out when keepers enter the pen. Another safety aspect would be to double wire the pen to ensure flighted birds do not escape by chewing out of the exhibit.

Cold Weather.

Palm cockatoos appear to do best in outdoor exhibits, but are susceptible to the effects of cold weather below -4 °C (25 °F). An indoor heated area must be provided in locations where the ambient temperatures go below freezing for more than a day or two. Wind breaks and heat lamps may provide adequate protection for birds located in areas which experience freezing weather for less than 24 hour periods.

Hot Weather.

At least one area of the exhibit should be covered to provide the birds the opportunity to find shelter and shade. In very hot climates, it is important that these dark plumaged birds are able to get completely out of the sun. Misters or showers can also be provided during hot, dry weather.

Breeding Pens.

Due to the shy nature of this species, it is best to house pairs away from other psittacines, especially macaws, and to limit human disturbance. Even though one institution has successfully bred palm cockatoos in a mixed exhibit (see next section) and another institution has bred palm cockatoos near other birds, the latter has found that some pairs start to reproduce only after being moved to private, more secluded aviaries. To minimize disturbance video cameras could be used to detect breeding behavior or parental neglect.

Breeding palm cockatoos in a mixed exhibit.

Catherine King from the Rotterdam Zoo relates that they have had a pair of palm cockatoos reproduce in a mixed exhibit. The following is her account:

"This pair is in an indoor, mixed, 16 m long, semi-circle enclosure with Long-billed corellas *Cacatua t. tenurostris* and Blue-eyed cockatoos *Cacatua opthalmica* as well as a few ground species (pheasant pigeons *Otidiphaps nobilis*, plover *Vanellus spp*., and beach stone curlews *Burhinus magnirostris*). A pair of Eclectus parrots *Eclectus roratus* were also in the cage; they were very happy there but they were quite dominant and were eventually removed. The keepers feel in retrospect that it may not have been necessary, but I think that it was probably wisest. The Long-billed cockatoos occasionally have a stand-off with the palm cockatoos if both want to sit on, or in, the same nestbox or tree but generally they are quite compatible. A pair of Yellow-tailed cockatoos *Calyptorhynchus f. funereus* was tried, but the male of this species was extremely aggressive to the male palm cockatoo, and the experiment lasted less than a day. The male palm cockatoo can become aggressive to other species, for example, the keepers introduced a new male Blue-eyed cockatoo to the enclosure when the palm chick was fledging - not a good idea. All the birds survived it but the male palm cockatoo went after that poor Blue-eyed cockatoo like a Kamakhazy pilot. He seemed never to forgive the Blue-eyed cockatoo for being in the wrong place at the wrong time, as out of six (3.3) Blue-eyed cockatoos housed in the cage over time, this was the only bird that the male palm cockatoo never accepted. No interactions to speak of occur between the palm cockatoos and the ground species. I was entirely against this multi-species idea with our precious palm cockatoos, but I have to say that with close monitoring it does work, and that the birds have quite a stimulating life. Not only because of the other species, but also because the size of the enclosure has made it possible to have a number of nest boxes, hollow trees (covered and not covered), thick ropes, branches to chew on, etc. that the birds really like. Rotterdam Zoo generally has a space shortage and this does allow each species much more room than they would have if they had to be individually housed. Some species in the enclosure, that did not breed previously, are breeding in this situation."

Catherine has since updated her account of this situation. She indicates that while the palm cockatoos

were rearing their second chick, the male became so aggressive with the other parrot species that the corellas and blue-eyed cockatoos had to be removed.

Location of Feeders.

Feed stations should always be located under shelter in an area that creates the least disturbance to the birds. The birds do not like going into a box-like feeder, but have accepted food bowls being placed inside a wire basket. Birds reach through a hole in the top of the basket to feed, but are unable to tip the bowl. (See Appendix 6, Basket diagram)

Water.

The Management Group recommends that fresh, clean water be given to palm cockatoos daily. Water has been provided in a variety of ways, from a standard water dish to a free flowing pond. Some palm cockatoos tend to tip and empty their water bowls, this should be considered when deciding upon a type to use. (See Appendix 6, Basket Design

Sanitation.

Food and water bowls should be cleaned and disinfected once a day. Several varieties of disinfectants have been used, but bleach is probably sufficient. After washing the bowls, they should be soaked or dipped into the disinfectant solution. If the birds have access to food dropped to the floor of the cage, the food should be removed from the pen before it molds.

Nest Boxes.

Nest boxes should be provided for breeding. If the cage is very large, two boxes can be used. More than two boxes may detract or confuse the pair, although the Rotterdam Zoo has had breeding from a pair with many nest boxes. Breeding success has been attained with an assortment of wooden nest box sizes. A rectangular box situated on end is the generally accepted type. Both open top boxes and boxes with large entrance holes, such as 30 cm (12") diameter, are used by palm cockatoos. These types allow the birds to drop nesting material into the box, which is an important breeding behavior. We recommend that the nest box be between 1 m to 1.3 m (3' to 4') deep. Any deeper may cause the birds to spend too much time filling the box with nesting material. Open top boxes, with a minimum 60 cm (2') of

clearance to the top of the cage, have been the most successful. (See Appendix 1, Nest Box Examples)

Nesting Material.

Palm cockatoos create their own nesting material from soft branches such as eucalyptus, bamboo, acacia, and willow. The cockatoos will splinter the branches and take the pieces into the nest, as mentioned above. Branches can be given to the birds year round, but should at least be provided at the onset of the breeding season and at regular intervals until an egg has been laid. The birds may become frustrated if there are long periods when they do not have access to nesting material. In at least one instance, aggression to the female by the male was thought to be the result of this situation. A good rule of thumb is to give the birds new branches as soon as they finish the previous branches to ensure they have a constant supply.

Environmental Enrichment

Environmental enrichment has been defined as "additions to the enclosure that enable an animal to perform behavior patterns similar to that of wild con-specifics" (Catherine King, personal communication). The practice of supplying branches and providing a wide perch for male strutting or displaying behavior are two examples of environmental enrichment. Thick, natural fiber rope has also been used. The birds not only use the rope as a perch but also for grooming; they frequently rub their cheek patches on the rope. (Catherine King, personal communication)

For further information or comments, please contact Mike Taylor




Caloosahatchee Aviary | Palm Manual | IAS | Search the Site | Table of Contents

Chapter III

Management

by Susan Healy from the Sacramento Zoo

Individual Identification.

Permanent individual identification is crucial for keeping track of inventory and maintaining accurate health and genealogy records. This is especially important so that birds can be tracked both within and outside the managed population.

-

Transponders

The Palm Cockatoo SSP Management Group strongly recommends that all birds be permanently identified with a Trovan transponder. Individuals unable to acquire this transponder should contact the Species Coordinator for assistance. Facilities using other brands are encouraged to change to Trovan as soon as possible. The birds should be implanted intramuscularly in the left breast muscle. (See Appendix 2, Manufacturers List for information on transponder suppliers)

-

Leg Bands

Closed leg bands should be used for captive hatched chicks. The bands should be stainless steel instead of aluminum because a palm cockatoo is capable of crushing an aluminum band on its leg. Open leg bands are not recommended because they have been known to catch on the side of the cage causing injuries and deaths. (See Appendix 2, Manufacturers List for information on band suppliers)

Handling.

The recommended capture method is either netting or toweling, depending upon the size of the enclosure. A net is the preferred tool when attempting to capture a bird in a large pen, but if the bird is in a small cage where they cannot fly away easily, a towel thrown over the bird works well. Palm cockatoos should be handled the same as other psittacines by securing their head with one hand, being careful not to be bitten, and securing their legs and wing tips with the other hand. Some birds may be prone to prolonged effects from being caught. After they are released back into their pen they show signs of being depressed: crest lowered tightly to their head, not moving about, being very quiet, and their cheek patches stay pale in color. After a time, normal behavior returns.

Shipping.

A size 100 or 200 kennel with metal windows and doors is recommended when shipping these birds. Wooden crates are also used for shipping (See Appendix 3, Shipping Crate Diagram used by ABRC). Some type of bedding material, such as straw or wood shavings, should be provided to prevent the birds from slipping on the floor of the crate. A secure perch, bolted to the floor or sides of the container can also help stabilize the birds. Providing the birds with food, such as nuts and fresh fruit, is recommended during shipment. Water is unnecessary and not recommended for flights within the continental United States. The water dish itself can be hazardous to the bird and the water usually sloshes out which can cause additional problems. The birds will get the moisture they need from the fresh fruit provided.

Some airlines may require that IATA guidelines be followed (See Appendix 4, IATA Guidelines), especially for international travel. However, the SSP feels that many of these specifications are inappropriate for palm cockatoos and will make recommendations to modify these guidelines in the future.

Pest Control.

As with all avian species, rodents and vermin can be a problem. The size of the wire mesh will determine which type will have access to the cage. Opossums in or around palm cockatoo cages are of special concern because of sarcocystosis. Every effort should be made to control the opossum population around the aviaries. (See Appendix 5, Sarcocystosis, and Chapter VII, Medical Management of the Adult Palm Cockatoo)

The following are some suggestions to reduce incidents of pest problems:

1. It is recommended that food storage and preparation areas be clean and free from debris.

2. Rodent proof and screen all doors (including overhead types), windows and other openings such as vents.

3. Keep doors and windows to the outside closed when not in use. This reduces the potential entry of rodents, insects and birds from the outside.

4. Grounds maintenance around the building should include removal of debris and elimination of storage against the building such as pallets, trash containers, racks, etc.

5. All ground cover and decorative plantings should be kept trimmed back 18 inches from the walls to create a barrier which reduces pest entry into buildings.

6. Damaged containers should be eliminated as soon as possible since such containers are conducive to pest development and infestation.

7. Utility rooms and mechanical rooms should be kept neat and clean. These rooms should not be used as storage or stock areas..

8. Care should be taken to see that all equipment is cleaned on a regular basis.

9. Make sure all switch boxes, electric motors and similar type compartments are kept cleaned and checked regularly.

10. Drains must be kept free of debris and garbage at all times.

11. All inside garbage and trash containers must be kept clean and dry under the plastic liners.

12. Moisture problems and water leaks must be repaired immediately.

Be sure to follow your institution’s individual pest control procedures.

For further information or comments, please contact Mike Taylor

[Caloosahatchee Aviary](#) [Palm Manual](#) [IAS](#) [Search the Site](#) [Table of Contents](#)

Chapter IV

Palm Cockatoo Behavior and Social Organization

by Pat Rider and Mike Taylor from the White Oak Conservation Center

Behavior.

Palm cockatoos have a complex system of calls, displays, and other behaviors unique to the species. They incorporate these vocalizations, displays and behaviors into a rich, complex vocabulary in order to communicate in their heavily forested environment and to maintain the social organization of their family groups and flocks. In captivity, much of this natural vocabulary is not learned and other behaviors are developed independently. Close observation of captive birds is necessary to determine behavioral changes that may indicate illness, aggression, societal disharmony, etc.

Vocalizations.

Contact Call

The Contact Call is a disyllabic whistle (Forshaw, 1981; Deifenbach, 1985). Forshaw (1981) indicates that the first note is mellow and deep and the second note is a high-pitched shrill with an upward inflection before an abrupt finish. This call is used in flight to, and while displaying at, a congregating tree. See Congregation Display and Social Organization below.

Alarm Call

The Alarm Call is a short harsh, screech, with a strong guttural undertone and is used to warn others of possible danger (Forshaw, 1981; Deifenbach, 1985).

Feeding and Preening Call

A mournful, drawn out, wailing cry is sometimes used when palm cockatoos are feeding and preening (Forshaw, 1981).

Flight Call

When the birds are moving from the congregating area to feeding areas and when they are returning to their home territories a deep monosyllabic whistle, repeated three or four times, is sometimes used (Forshaw, 1981).

Juvenile Food-solicitation Call

The Juvenile Food-solicitation Call (Smith, 1987) is a harsh, guttural sound maintained at a constant pitch or level and is used by the chick when begging for food. The chick continues this call while being fed, but due to the "pumping" action of its head, the sound is intermittent.

Growling

In captivity, some birds have been heard emitting a sound which resembles a disyllabic growl and it has been noted by Deifenbach (1985) that, in the wild, they growl while stomping their foot in a threat display. It has been remarked that the growl almost sounds like the bird is trying to say hello.

Visual Displays.

Congregation Display

The bird stands upright with its crest partially raised while giving the first note of the Contact Call. The bird then lunges forward with wings spread, and crest and tail erect giving the second note of the Contact Call (Deifenbach, 1985). This display is performed frequently, two or three times in succession, by mature and immature birds in the congregation tree.

Courtship Display

The full courtship display of the palm cockatoo is more complex than that of any other cockatoo species. The male stretches high with outstretched wings, raises his crest, deepens the color of his cheek patches and calls excitedly as he advances toward the hen (Sindel & Roberts, 1989). Many other behaviors and displays are involved in pair formation and courtship. (See Social Organization Section below, and Chapter V, Palm Cockatoo Reproduction for more information)

Threat Display

The palm cockatoo raises its crest and advances toward an intruder with slow deliberate steps (Forshaw, 1981). This is followed by growling and rhythmic foot stomping. Territorial conflicts have been observed in which males have fought using their feet, while the female flew beside her mate screeching (Wood, 1988).

Rain-bathing Display

This display is used in the early morning. The cockatoos hang inverted with outstretched wings and tail. This display can be provoked by the sight or sound of rain, sudden alteration in light intensity, as at dawn, or the covering of the sun by a dark cloud (Smith, 1987).

Unique Behaviors.

Blushing

Unlike any other cockatoo, palm cockatoos have a large, naked cheek patch of a reddish color that deepens in intensity as the birds become excited or agitated (Forshaw, 1981; Freud, 1994). Palm cockatoos, unlike the macaws, can cover their cheeks by feather movements (Smith, 1987). This ability is useful for thermoregulation and in certain slightly stressful situations they have been observed covering their cheek patches while standing still with crest lowered. It has been postulated that this is a type of hiding behavior due to the fact that they can look like a part of the tree in the low light conditions

found in thick rainforest.

-

Foot Stomping

Sometime during its separation from other cockatoo species, the palm cockatoo lost its ability to hiss when frightened (Smith, 1987). Under stress, they noisily stomp their feet repeatedly against a perch (Forshaw, 1981; Deifenbach, 1985).

-

Drumming

Drumming by palm cockatoos is a rare example of "tool use" by a bird. Perched upon a dead, hollow tree, holding a stick or nut, the bird drums on the hollow trunk anywhere from 2 to 100 times, creating a considerable sound (Wood, 1984).

-

Nest Building

Another unique adaptation is the construction of a platform of chewed sticks or twigs within the hollow nest tree. Both the male and female partake in this activity, which possibly encourages pair bonding. The platform protects the egg and nestling from flooding during the frequent rains and protects the chick from its own excreta (Muller 1975, Forshaw 1981, Deifenbach 1985, Schubot 1990). (See Chapter V, Palm Cockatoo Reproduction, Nesting Behavior section for more details)

Captive Recommendations.

Social Organization

The Palm Cockatoo SSP Management group recommends that palm cockatoos be kept in pairs for breeding. For non-breeding, they can be kept in groups from 2 to 20 birds to prevent aggression. Most of the Palm Cockatoo SSP birds are kept in pairs with a few being kept as two of the same sex. One facility

has kept up to 20 young hand-raised birds of similar ages together in a large flight cage with no adverse effects. It is has been noted, though, in large group exhibits in SE Asia, that some inter-specific killings often occur (Catherine King, personal communication). Mixed species exhibits are not recommended in order to prevent intra-specific hostilities but, as indicated previously, it has been done successfully in Europe with plenty of space. As with other captive animals, close observation, attention to detail, and common sense should be used to determine compatibility.

Introductions

Palm cockatoos are generally peaceful birds. They can also be extremely social and territorial. Their rich vocabulary of displays and vocalizations are used to maintain social harmony and to exclude outsiders from their territories. In captivity, there have been numerous aggressive incidents with several being fatal (See Chapter VII, Medical Management of the Adult Palm Cockatoo, Common Injuries and Treatments Section for mate trauma). Most of these occurrences have been between recently introduced pairs; however, a few have occurred with established pairs, some of which had previously produced a chick. Great care should be used when introducing birds. After quarantine, it may be a good idea to house a new bird in close proximity to the rest of the collection and to give them sufficient time to learn the vocabulary before an introduction is attempted. Several methods have been used to introduce palm cockatoo pairs, such as the following:

The male is introduced into the female's pen, giving her the home turf advantage.

The male and female are placed in adjacent pens to get acquainted then placed together into either her pen or into a neutral pen.

A trio, either 1.2 or 2.1, can be placed into three adjacent pens with the single sex bird in the center pen, allowing it to choose a mate.

Both birds are placed into a neutral pen without an acquaintance period.

The following are a few guidelines recommended by the management group:

- Caution should be taken with every introduction.
- Following the introduction, the pair should be observed as much as possible.
- Do not introduce a female into a male's pen.
- Do not introduce a young female to an older male without using ample caution and observation.
- If the female is repeatedly found on the floor of the enclosure, aggression from the male is probably the cause. One bird should be removed from the cage at this point. It is possible to try

them together again at a later date, but close observation is needed due to the low probability of the pairing working out.

For further information or comments, please contact Mike Taylor

[Caloosahatchee Aviary](#) [Palm Manual](#) [IAS](#) [Search the Site](#) [Table of Contents](#)

Chapter V

Palm Cockatoo Reproduction

by E. Trent Swigert from the Caloosahatchee Aviary and Botanical Gardens

formerly from the Avicultural Breeding and Research Center

First Captive Breeding.

In recent years, the palm cockatoo has been successfully bred in a number of private and public institutions throughout the world. The world's first reported captive breeding of this species occurred in 1968, by Bob Lynn of Sydney, Australia. The chick, reportedly, was reared to full term by its parents.

Breeding Season.

In captivity, the palm cockatoo has reproduced in every month of the year. This was recorded in the Palm Cockatoo Husbandry Manual Survey by Avicultural Breeding and Research Center (ABRC). New York Zoological Society's palm cockatoos at the Wildlife Survival Center produced eggs in all but two months of the year. Other institutions show varied and sporadic breeding by their pairs throughout the year. This may be due to the fact that the palm cockatoos at the latter institutions are being housed indoors for part of the year.

Breeding Stimulus.

There seems to be no specific stimulus which consistently triggers the palm cockatoo to breed in captivity. In the past, some aviculturalists believed that the palm cockatoo had to be fed a diet consisting of natural food items found in the wild, such as the fruit of the Pandanus plant (*Pandanus sp*.), to stimulate breeding. However, this theory has been proven false by a number of the facilities which have bred this species.

Sexual Maturity.

Immature birds have a non-pigmented central ridge in the maxilla for up to two years of age. This has been noted in the offspring that have been produced in captivity. A female palm cockatoo was received at ABRC with immature plumage, and white coloration in the maxilla. After being at ABRC for five years, she produced offspring in 1992, indicating that palm cockatoos can reach sexual maturity at about seven to eight years of age. This estimation will be more accurate when the F1 generation begin reproducing.

Nesting Behavior.

The palm cockatoo's nesting behavior is considerably different than that seen in other psittacines. They construct a nest of very small toothpick-size splinters from branches. These are placed in the nesting site by both the male and female. The depth of the nest may vary from a few centimeters to approximately 60 cm (2'). This nest construction is designed to prevent the nest from being flooded during the rainy season. In captivity, palm cockatoos should be provided with some type of non-toxic branches to construct a nest. Some of the pairs of palm cockatoos in captivity have reproduced without being supplied with branches for nesting material. These pairs were supplied with pine shavings as nesting material. All of the palm cockatoo pairs at ABRC are given branches for nest construction; this seems to be a very important aspect in the breeding of this species.

Courtship.

Copulation of the palm cockatoo has been observed to occur primarily in the morning after sunrise. However, breeding behavior and copulation have also been observed during other periods of the day. The male palm cockatoo approaches the female with his wings partially extended. The male's head is upright with his crest feathers fully erect and he bows several times before mounting the female. During this time, he is vocalizing with a very loud whistle. Palm cockatoos copulate like other psittacines, with the male balancing himself on the back of the female. Like other black cockatoo species, the palm cockatoo lays only one egg per clutch, with an incubation period of 28 to 31 days from laying to pipping, with an additional 3 or 4 days to hatch.

Artificial Insemination.

At the present time, there has been no research in the area of artificial reproduction methods with the palm cockatoo. Semen collection and insemination attempts with other species of psittacines have yielded poor results. If, in the future, these techniques can be perfected, semen from unrepresented founders could possibly be collected and stored.

Incubation.

Institutions which have breeding palm cockatoos are using combined methods of natural and artificial incubation for their palm cockatoo eggs. The majority of palm cockatoo eggs are pulled from the breeding pair as soon as the egg is discovered. This is done because of the rarity of the species and the favorable results of incubating this species from day one. Whenever possible at ABRC, the egg is left in the nest box for the first 14 to 20 days before being pulled for artificial incubation. They have used foster parents (Eclectus parrots *Eclectus roratus* and Bantam chickens) for incubating palm cockatoo eggs, but artificial incubation has proven to be the best method. Presently, the Palm Cockatoo SSP Master Plan recommends artificial incubation instead of parent rearing. If the pair is capable of incubating and rearing their offspring, then they can be allowed to rear the chick, only if sufficient numbers of offspring have been produced from that pair.

Egg Laying.

At ABRC, nest boxes of pairs are checked every other day if breeding behavior has been observed. If the pair of palm cockatoos is shy or very nervous when approached, the pair is checked weekly. The majority of eggs are discovered in the A.M., but on occasion a female will lay in the afternoon. Facial coloration may be an indicator of when a female has laid. She may be very pale in color the day she lays; this should not be mistaken for a health problem. Once the egg is discovered in the nest box, it is examined for imperfections. If there are any cracks, the egg is immediately removed and placed in the incubator. Dependable pairs are given the opportunity to incubate the egg for approximately 14 to 20 days. A cracked egg is sealed with any kind of fingernail polish, because the nail polish provides a better seal for the damaged egg and will dry much quicker than the more commonly used glue. Eggs in the nest box are candled for signs of fertility after 10 days. Infertile eggs are removed and placed in the incubators for two additional days in case the parents had not been sitting the egg properly.

Prior to the placement of a fertile egg in the incubator, the egg is candled to check its progression, and measurements are taken of the egg's length and breadth. If the egg is pulled soon after it is laid, a fresh egg weight is also recorded prior to placement in the incubator.

The following charts show the average fresh egg weight, hatch weight and measurements of normal palm cockatoo eggs based on data collected from a sample population at ABRC.

Egg Measurements.

Calculations for *P.a. aterrimus* eggs.

Measurements	n	Mean	Range
Fresh Egg Weight (mm)	27	26.22	23.44 - 29
Breadth (mm)	39	32.94	31.94 - 33.94
Length (mm)	39	45.66	42.57 - 48.75
Hatch Weight (gm)	38	17.9	16.1 - 19.7
% Weight Loss	27	13.97	12.33 - 15.61

Calculations for *P.a. goliath* eggs.

Measurement	n	Mean	Range
Breadth (mm)	13	35.09	34.59 - 35.59
Length (mm)	13	49.72	48.15 - 51.29
Hatch Weight (gm)	13	20.97	19.98 - 21.96

n= the number of individuals in the sample population.

The range is $\pm$ 1 standard deviation from the mean, so the measurements of 68.26% of palm cockatoo eggs should fall within these ranges.

Artifical Incubation.

The temperature setting for the incubators at ABRC is a dry bulb reading of 37.5°C (99.5°F) and a wet bulb reading of 28°C to 29°C (82°F to 84°F), or 48 percent humidity. The Grumbach incubator uses rollers to turn its eggs while the Humidaire uses a tilted tray. Even though automatic turners are used, ABRC recommends turning the egg by hand one quarter rotation at least three times a day for the first two or three weeks. For the remainder of the incubation period the egg is turned twice a day. The temperature in the hatcher should be lowered to between 36°C to 37°C (98.5°F to 99°F), with the wet bulb increased to 33°C to 34°C (92°F to 94°F) to aid in the hatching process. To increase the humidity in the hatcher, an extra pan of distilled water can be placed inside.

(See Appendix 2, Manufacturers List)

Hatching.

Palm cockatoo eggs can be candled each morning and evening to monitor their development. Once the embryo progresses to the draw down stage of development it should be placed on the bottom of the incubator and no longer turned. This allows the embryo to position itself for internal pipping. The time period from internal pip to external pip is between 24 to 48 hours. After the egg has externally pipped it should then be placed in a container and moved to the hatcher. The eggs can also be candled in the hatcher to make certain there are no problems during the hatching process. The hatching time is between 48 to 72 hours. Palm cockatoos take longer to hatch than other psittacines. ABRC assists hatches only after 72 hours, or if we feel there is a problem with the chick. The newly hatched palm cockatoo chick should be weighed, given an identification or accession number, and then transferred to the nursery where the hand feeding process begins.

For further information or comments, please contact Mike Taylor

[Caloosahatchee Aviary](#) [Palm Manual](#) [IAS](#) [Search the Site](#) [Table of Contents](#)

Chapter VI

Nutritional Requirements of Adult Palm Cockatoos

By Carla Marquardt from the Avicultural Breeding and Research Center

and Kimberly Howard, Ph.D. from the University of California, Davis

Reviewed by Sue Crissey, Ph.D. from Brookfield Zoo

The nutrition section is based on a questionnaire that was distributed in 1992 to facilities that have bred or displayed palm cockatoos, on general knowledge of the nutritional requirements of birds (in particular successful diets and practices with psittacines), and on what has been observed with palm cockatoos at ABRC over the years.

Nutrient requirements.

Psittacines, like other animals and humans, do not require particular food items rather they require specific nutrients; water, amino acids (protein), minerals, vitamins and essential fatty acids. No scientific research has been performed on the nutritional requirements of palm cockatoos, however, numerous nutritional requirement studies have been conducted on precocial birds (chickens, turkeys, geese, ducks, pheasant, bobwhite and Japanese quail). The nutrient requirements for the growth and breeding of precocial birds are listed in Table 1 (NRC, 1984). Research conducted on the nutrient requirements for altricial birds such as cockatoos, has been limited.

Roudybush and Grau (1985) reported that for optimal growth and survival rates of cockatiel chicks the minimal protein and lysine requirement from hatching to 28 days was 20% and 0.8%, respectively. The protein and lysine requirements for precocial birds range from 24 to 31% and 1 to 1.7% of the diet, respectively. It is unlikely that the nutritional requirements differ greatly between precocial birds and psittacines, based on the protein and lysine requirement found in cockatiels and the fact that psittacine chicks gain weight faster than meat-type chickens for several weeks after hatching (Ullrey et al., 1991).

Table 1. Nutrient Requirements for Meat-type Chickens, Turkeys, Geese, Ducks, Pheasants, Bob-white Quails and Japanese Quails

Nutrient	Growth	Breeding
g/kg dry matter		
Protein	240 - 310	160 - 270
Lysine	10.0 - 16.7	5.7 - 12.8
Methionine	5.6 - 5.9	2.2 - 5.0
Linoleic Acid	11.1	11.1
Calcium	7.2 - 13.3	25.0 - 30.6
Phosphorus, available	4.4 - 6.7	2.8 - 6.1
Potassium	4.4 - 7.8	1.7 - 6.7
Sodium	1.7 - 1.9	1.1 - 1.7
Magnesium	0.3 - 0.7	0.6 - 0.7

Nutrient	Growth	Breeding
g/kg dry matter		
Iron	89 - 111	67
Zinc	28 - 83	56 - 72
Copper	7 - 9	7 - 9
Manganese	44 - 100	28 - 78
Selenium	0.16 - 0.22	0.11 - 0.22

Nutrient	Growth	Breeding
IU/kg dry matter		
Vitamin A	1667 - 5555	4444 - 5555
Cholecalciferol	222 - 1333	22 - 1333
Vitamin E	11 - 13	11 - 28

Feeding ecology.

In the wild, psittacines don’t just eat seeds, they are limited to what food choices are available, most of which are not replicated in commercial seed mixtures. In captivity they are constrained by our selection of their food which is not a "natural" diet.

In a study of the food habits of the short-billed form of the white-tailed black cockatoo, the cockatoos were reported to eat a total of 30 plant species, mainly flowers and seeds, as well as insect larvae (Ullrey et al., 1991). Eastern and pale-headed rosellas fed on the fruits and seeds of 82 and 47 plant species, respectively, including grasses, forbs, shrubs and trees, and insects (Ullrey et al., 1991). Bahama parrots fed on 16 plant species including the inner portions of green, unopened *Pinus caribaea* cones, stems of woe vine, fruits of wild dilly, poisonwood and naked wood, and the fruit and inner bark of Caribbean pine, fruit or seeds of wild tamarind, jumbay, sea grape, buffalo top palm and silver top palm (Ullrey et al., 1991). Researchers have reported that palm cockatoos have been observed feeding on seed, nuts, fruits, berries and leaf buds. For more details please refer to Chapter I, General Characteristics and Natural History, Section, Diet in the Wild, page 8. The majority of the food items consumed by psittacines in the wild, including the seeds, are not available in seed mixtures sold commercially today.

Manufactured versus seed diets.

Selected seeds found commonly in seed diets sold commercially are nutritionally deficient and do not allow for the optimal growth of psittacines. The nutrients that are deficient include calcium, available phosphorus, sodium, manganese, zinc, iron, vitamins A, D and K, riboflavin, pantothenic acid, available niacin and Vitamin B-12 (Ullrey et al., 1991). Seed diets fed for reproducing birds probably also are deficient in calcium, available phosphorus, sodium, manganese, zinc, iron, iodine, selenium, vitamins A, D, E and K, riboflavin, pantothenic acid, available niacin, vitamin B-12 and choline (Ullrey et al., 1991). Seeds generally have a high crude fat content (40.7%, 49.2%, 52.4% and 52.7% for safflower seeds, pumpkin seeds, sunflower seeds and peanuts, respectively) which can lead to obesity (Ullrey et al., 1991) and are also likely deficient in many of the essential amino acids, most notably lysine (Brue, 1990). A typical cockatiel seed diet contains 0.45% lysine while the requirement for growth and maintenance of precocial birds ranges from 1.0 to 1.6 % and 0.57 to 1.3% respectively (Brue, 1990).

Manufacturers of seed diets realize the inadequacy of seeds and attempt to overcome the deficiencies in seed diets in a variety of ways including adding manufactured diets (extruded or pelleted diets) to the seed mixture and/or coating the hulls of the seed with vitamin and mineral solutions. However, since seeds are more palatable, the birds tend not to eat the pellets when provided with the seed mixture. Rather they tend to select the seeds that are higher in fat, lower in protein and lower in calcium. Additionally, in diets where seeds are coated with vitamins and minerals, there may be a loss of vitamins and minerals as a result of birds removing the hulls of the seeds.

In a mixed diet birds can select their favorite items. This can lead to a nutritional deficiency. For example, a rachitic 8-wk-old Timneh African gray parrot was reported by Ullrey et al. (1991) as a result of being fed primarily corn from a seed mix supplied by the parents. Hypocalcemic tetany was found in a 4 year–old female green-cheeked amazon parrot fed a diet consisting solely of corn and peanuts for 4 years (Randell, 1981). Radiography revealed poor bone quality and a fracture of the left femur. Corn and peanuts both have calcium to phosphorus ratio of approximately 1:7 well above the optimal dietary level

of 1:1 to 2:1 (Randell, 1981). Tetanic seizures were also observed in a female red-sided eclectus parrot, a female yellow-tailed black cockatoo and a male Caribbean parakeet which were fed diets consisting of sunflower seeds, peanuts and whole oats (Wallach & Flieg, 1967). Osteomalacia was found on necropsy.

Feeding manufactured diets eliminates the potential selection of a seed with a particular nutrient profile. Rather the birds consume a diet with a nutrient profile designed to meet the nutrient requirement of psittacines. While a manufactured diet should provide the bulk of the nutrition, most manufactured diets are formulated to allow for supplementation of fruits and vegetables, which are a valuable source of nutrients, and a limited amount of seed and nuts to provide variety in the diet or for training purposes. Several companies manufacture diets for psittacines (See Appendix 2, Manufacturers List). It is important to select a brand from a reputable manufacturer that has a good quality control program and has tested its product with breeding facilities. Since products may differ in nutrient content and other food items are typically added to the diet, care must be taken to select a product that will provide adequate nutrient concentrations when those nutrient concentrations are diluted due to the other food items. Transition from seed diets to manufactured (pelleted or extruded) diets must be done slowly and carefully to allow acceptance and thus adequate consumption of the diet.

Dietary intake studies with psittacines.

Three adult Timneh African grey parrots were offered a mixture of an extruded diet, seed, fruit and vegetables (Ullrey et al., 1991). Because the birds could sort through their diet, seed consumption predominated resulting in diets that were marginal or deficient in the following nutrients; methionine, calcium, available phosphorus, sodium, manganese, zinc, riboflavin, vitamin B-12, available niacin, pantothenic acid, vitamin A and Vitamin D.

In another study (Ullrey et al., 1991), seeds were gradually withdrawn from a diet which consisted of an extruded diet, fruits and vegetables which was fed to green-winged macaws, yellow-headed amazons, citron-crested cockatoos, Ambonia king parrots and northern rosellas. One pair of each species was housed together and consumption of a seed free diet was measured for one week. The consumption of the extruded diet was less variable than when fed with seeds and the consumption of the other items did not produce a nutritional imbalance. Substitution of an extruded diet for the seeds did not change the number of chicks hatched per year but it did increase the fledgling percentage.

Howard et al., 1992, reported on the dietary husbandry of psittacines housed in a commercial aviary. A dietary program, which consisted of an extruded diet (Table 2), fruits and vegetables, was tested at two different seasons for its ability to support maintenance and reproduction in adult psittacines at a commercial aviary. The species studied were African gray parrots, yellow-naped amazon parrots, double yellow-headed amazon parrots, blue & gold macaws, green-winged macaws, medium sulfur-crested cockatoos, salmon-crested cockatoos and umbrella cockatoos. All nutrients were consumed in amounts sufficient to meet the needs of precocial birds and presumably were adequate for psittacines as well. At

the time of the preparation of the manuscript seven proven pairs of psittacines had produced 107 eggs. Of those 80.4% were fertile, 16.8% were infertile, 2.8% were broken prior to knowledge of the fertility. Of the 86 fertile eggs produced, one egg was broken (1 %), one chick died (1%) and 84 birds were hatched (98%) and successfully reared to weaning.

Table 2. Nutrient specifications for a manufactured diet[1]

Nutrient	**Concentration**	
	g/kg dry matter	%
Protein	240.0	24.00
Lysine	12.0	1.20
Methionine	5.0	0.50
Linoleic Acid	20.0	2.00
Calcium	11.0	1.10
Phosphorus, available	8.0	0.80
Potassium	7.0	0.70
Sodium	2.0	0.20
Magnesium	1.5	0.15

Nutrient	**Concentration**	
	mg/kg dry matter	%
Iron	150	0. 015
Zinc	120	0. 012
Copper	20	0. 002
Manganese	65	0. 0065
Selenium	0.3	0. 00003

Nutrient	**Concentration** IU/kg dry matter
Vitamin A	8000
Cholecalciferol	1900

Vitamin E	250

The previously mentioned studies demonstrate that the incorporation of manufactured diets into the diets of psittacines, including citron-crested cockatoos, medium sulfur-crested cockatoos, salmon-crested cockatoos and umbrella cockatoos, can be very successful for the maintenance and reproduction of these birds. Thus it is reasonable to assume that the use of manufactured diets for palm cockatoos will be successful as well.

Captive diets of Palm Cockatoos.

Diets Used

Palm cockatoos tend to be lean birds and obesity has not been observed. These birds have been successfully maintained on seed mixes consisting mainly of sunflower seeds and other additives like whole corn, dog kibble, dried red peppers and other seeds and grains. Many facilities also offer manufactured monkey biscuits. It is evident that holders of palm cockatoos understand the need for a nutritionally complete manufactured product in the diet. Until the past few years the only products available were primate biscuits and dog food. Although, palm cockatoos have been successfully maintained on primarily seed mixes with additives, the use of manufactured diets (pelleted or extruded) eliminate the need for nutritionally deficient seeds as the primary diet. Additionally, reliance on dog and primate foods can be decreased because they may be more variable in nutrient composition and not formulated specifically for psittacines. It is also possible that growth, reproduction and longevity may improve with better nutrition. Several companies manufacture diets of various shapes and sizes, which may help to increase the consumption of these diets (See Appendix 2, Manufacturers List; See also Section Practical Diets for examples of diets being used by institutions breeding palm cockatoos). Caution should be taken when converting birds from seed diets to manufactured diets to ensure adequate consumption of the diet. Parameters to monitor when converting the birds include food intake measurements and body weight fluctuations. It should be noted that food intake measurements must account for all food wasted such as seed hulls and chaff.

Supplements

Many varieties of nuts can be given in addition to a basic diet of manufactured diets: pine (pinyon) nuts, almonds, peanuts, coconuts, hazel nuts, walnuts, macadamia nuts, pandanus, pecans, and fruit from the queen palm (*Syagrus romanzoffianum*). Nuts should always be offered in limited amounts either daily or occasionally to ensure adequate consumption of the manufactured diet. Fruits and vegetables also can be offered daily. Apples, oranges, broccoli, corn, yams, carrots, beets, bananas, pomegranates, grapes,

beans (all types), different kinds of leafy greens, and celery are some examples. Although the availability of fruits and vegetables fluctuates seasonally, a variety can be fed daily; the amount needs to be controlled to ensure consumption of the nutritionally complete manufactured diets. A good strategy and one which compliments the feeding ecology of the birds is to allow free access to the manufactured diet (this allows the bird to consume food at anytime it pleases and decreases competition between or among birds) while providing the additional items once or twice per day. The manufactured formulation of the diet and its nutrients should be periodically checked as any changes made by the manufacturer may affect the nutrient status of the birds.

Generic multi-vitamin/mineral/amino acid supplements are not necessary if the birds consume an adequate amount of a nutritionally complete manufactured diet. However if the birds obtain no manufactured diet or if they are sick, adding a supplement may be warranted. A variety of additives are available on the market today. Again, if a manufactured diet is used it should eliminate the need for a multi-vitamin/mineral/amino acid supplement as the manufactured diet should supply a proper balance of these nutrients when intake is good and the other items are limited. Adding supplements to the diet indiscriminately could potentially lead to an imbalance of nutrients or to a toxicity of nutrients. Cuttle bone, which is 85 % calcium carbonate (calcium carbonate is 40% calcium), is a favorite of palm cockatoos at ABRC when consuming diets with little manufactured diets. But again, this potent source of calcium is not needed if the manufactured diet is appropriately formulated and is consumed by the birds.

Practical Diets

A manufactured diet formulated for psittacines, Kaytee Rainbow chunky breeder pellets, has been used at ABRC since the beginning of 1997 and may prove appropriate for the reproduction, health and well being of palm cockatoos.

ARBC palm cockatoo diet, percent contribution to total diet by weight, as fed

1.0 % Nuts: Peanuts, brazil nuts, hazel nuts

16.5 % Fruit and Vegetables: Oranges, apples, grapes, sweet potatoes, carrots, beets, broccoli, kale

16.5 % Pine Nuts

33.0 % Seed Mixture: Sunflower seeds (70%), nutritionally complete manufactured diet (15%), dehydrated whole corn (10%), cuttlebone (5%)

33.0 % Nutritionally Complete Manufactured Diet containing: 18.0 % Crude Protein

Kaytee Rainbow chunky breeder pellets 7.0 % Crude Fat

12.0 % Moisture

6.0 % Ash

5.0 % Crude Fiber

The manufactured diet is usually provided in one bowl and the other items in another. If changing diets, be sure to monitor consumption because palm cockatoos as well as other psittacines are known to be finicky and may not adjust to new diet changes readily.

As the following examples show, there are several manufactured diets currently being fed to palm cockatoos. These diets are from a few of the institutions which have breeding pairs.

Denver Zoo

Palm cockatoo diet (pair)

1/3 cup sunflower seed mix

3/4 cup safflower seed mix

½ cup Scenic Jungle pellets

½ cup chopped asst fruits

1/4 pomegranate

2 Purina monkey chow biscuits

1 tbsp pinion nuts when in season

mixed nuts

Sea World of Florida

We feed the adults two pans - morning has an array of available fresh

fruits and vegetable and a couple of Zupreem monkey chow biscuits and in the late

afternoon Mazuri diet and a couple of nuts (Brazil, almond or peanut).

Riverbanks Zoo

Zupreem pellets 75%

Produce & seeds 25%

Necton MSA sprinkled over diet. (Mineral/vit. supplement)

White Oak Conservation Center

1 cup Kaytee breeder

1 cup chopped assorted fruits/vegatables - bananas, apples, oranges, grapes, corn, greens, carrots

1 tsp petamine (vitamine/mineral suppliment)

5-6 large nuts given three times per week - walnut, Brazil nut, hazil nut, kamani nut, almond

1 tbsp pinion nuts given three times per week

Feeding Schedule

The majority of the institutions responding to the survey fed only once a day, in the morning. A few institutions indicated they fed twice a day, once in the morning and again in the evening. Fresh, clean water should be offered daily. Fruits and vegetables should be removed from the cage at the end of the day to prevent potential spoilage and bacterial contamination.

It is possible that palm cockatoos in the wild consume food sporadically throughout the daylight hours. In keeping with the birds natural feeding schedule, the manufactured diet should be made available at all times throughout the daylight hours. ABRC provides food so that the birds can eat throughout the day.

See Appendix 2, Manufacturers List,

Appendix 16, Food Item Preference by Two Palm Cockatoo Pairs at WOCC

For further information or comments, please contact Mike Taylor

[Caloosahatchee Aviary](#) [Palm Manual](#) [IAS](#) [Search the Site](#) [Table of Contents](#)

Chapter VII

Medical Management of the Adult Palm Cockatoo

by Matthew W. Bond, D.V.M., Diane Downs, and Sharon Wolf, C.V.T.

from the Avicultural Breeding and Research Center

Introduction.

Health and medical management are important to long term care and successful reproduction of palm cockatoos. Preventative medicine with avian species is still in its infancy, but great strides have been made in the treatment of many diseases. Husbandry and diet are the basis of any preventative medical protocol for psittacines. However, there is a need for continued research in these two areas.

Physical examinations can be a major key in detecting disease in a species where signs of illness are hidden based on the survival instinct. Keeper observations regarding the activity and appetite of captive psittacines provide valuable clues in the assessment of health status and in helping the veterinarian diagnose diseases.

Physical exams, done on an annual basis during the non-breeding season, serve as opportunities to identify, monitor, and document any problems or potential problems. Basic exams include parameters such as: weight, feather condition, color of mucus membranes, locomotion, and respiratory function.

Monitoring weight losses and weight gains is helpful in detecting illness and other husbandry problems. Comparative weights taken at the yearly exam, or at a time when illness is suspected, can be a very important finding. Weight loss, despite a good appetite, may point to hidden disease. On the other hand, sometimes an increase in weight may be a sign of other diseases. Obesity, as seen in other cockatoos such as galahs and Leadbeaters, has so far not been evident in palm cockatoos. Palpation of the keel muscle and the appearance of the feet can be good guides if taking accurate weights is not feasible.

Life Span.

The life span for the palm cockatoo is unknown. Most of the birds listed in the studbook are wild caught birds acquired as adults. There are several birds that are known to be at least 30 years old or more, based on their length of time in captivity.

Sexing Techniques.

In some cases, male palm cockatoos may have a larger body size and head structure than hens, but this is not an accurate method of gender determination. In the past, surgical sexing was the most common method for sex determination in monomorphic species. Risks associated with this technique include anesthetic deaths and transmission of disease through use of improperly sterilized equipment. Surgical sexing was also of limited value in very young birds due to immature undifferentiated gonads.

New DNA sexing methods are non-invasive, accurate, quick, and safe. Only a small amount of blood is required and samples may be collected via toe nail clip or venipuncture. Stress to the bird is greatly minimized with this technology. Chicks may be DNA sexed at any age; at ABRC, samples for sexing are taken when the chick is banded.

Behavioral Manifestations of Illness.

Symptoms associated with avian illness include: loss of appetite, depression, weakness, droopy wings, change in feces or urates, fluffed appearance, and tail bobbing. Since most of the symptoms are common to a number of diseases, clinical impression and testing methods must be used to determine the best course of treatment. Keeper observations and intimate knowledge of individual attitudes and appetites are important.

Poor facial color may be a sign of illness but some palm cockatoos always have paler facial color, especially those kept indoors. Some of those kept outdoors all year will also have poor color with no detectable problems. The facial patches may turn pale or deepen to a dark reddish-purple color when the birds are stressed, such as during capture, but usually turn bright red again after the bird has been released. Palm cockatoos appear very stoic; they often do not struggle when held, making it difficult to gauge the amount of stress an individual bird experiences during capture. A change in facial color not associated with stress can be considered a potential problem and the bird should be monitored or worked up for disease if additional symptoms are present.

Medical Testing Procedures.

Medical testing procedures are very valuable tools. All newly acquired birds should be screened for infectious disease during the quarantine period. At ABRC, each newly acquired bird is quarantined for 90 days. A complete physical examination is performed, consisting of: blood chemistries, a CBC, a

cloacal culture, screening for parasites, and quarantine entry weight. Blood samples are taken for PFBD and Chlamydia testing, and for DNA sexing if necessary. A routine barium radiograph is taken shortly before the end of the quarantine period for a base study. Opinions concerning a bird's health status should not be made based on the results of one test. Assess all available test results and the clinical appearance of the individual.

Parasitology

Newly acquired birds should be screened carefully for parasites using direct and fecal float tests for intestinal parasites, blood film exam for blood parasites, and physical exam for ecto-parasites, paying particular attention to the inner wing web area. Palm cockatoos should be screened for intestinal parasites on a yearly basis. It is advisable to screen birds housed with access to a dirt floor more often. Previous parasitic infection and treatment may indicate the need for additional periodic screenings for an individual bird. Patients presented for weight loss, diarrhea, and poor feather condition should be screened for parasites.

Protozoal infections, such as sarcocystis, are seen in palm cockatoos housed in areas inhabited by opossums. Sarcocystis outbreaks tend to be seasonal and death is often sudden. No accurate diagnostic test has been developed for the detection of protozoal infection antemortem.

Blood Chemistries

Blood chemistries can be helpful in assessing the bird for infections, intestinal problems, organ function, and many diseases. ABRC has performed a study to establish blood chemistry normals for the palm cockatoo (Table 1). Samples were collected from a total of 41 adult palm cockatoos, 23 males and 18 females. Prior to obtaining the samples, each bird was given a thorough physical examination and was found to be clinically normal, exhibiting no signs of illness.

Approximately 2.5 cc of blood was obtained from each bird through jugular venipuncture. Whole blood samples were preserved with EDTA. Blood chemistries were performed on serum samples using a Vet Test 8008 analyzer.

Table 1. Blood chemistry values for adult palm cockatoos. Samples were collected at ABRC in November and December of 1993. Range: ± 1 standard deviation from the mean.

Test/Units	Mean and Range	# of Birds Sampled

Packed cell volume (%)	mean: 50 range: 46.5 - 53.5	n = 37
Total solids (g/dl) (refractometer)	mean: 4.2 range: 3.7 - 4.7	n = 36
Albumin (g/dl)	mean: 1.3 range: 1.1 - 1.5	n = 40
Alkaline phosphatase (IU)	mean: 77 range: 54 - 100	n = 37
Alanine aminotransferase (IU)	mean: 6 range: 2 - 10	n = 28
Aspartate aminotransferase (IU)	mean: 39 range: 26 - 52	n = 36
Calcium (mg/dl)	mean: 10.3 range: 9.6 - 11	n = 40
Cholesterol (mg/dl)	mean: 109.2 range: 95 - 123.9	n = 32
Creatine kinase (IU)	mean: 46 range: 18 - 74	n = 35
Globulin (g/dl)	mean: 2.40 range: 2.22 - 2.58	n = 39
Glucose (mg/dl)	mean: 311.3 range: 282.6 - 340	n = 39

Lactate dehydrogenase (IU)	mean: 353 range: 261 - 445	n = 39
Inorganic phosphate (mg/dl)	mean: 5.06 range: 3.37 - 6.75	n = 39
Total protein (g/dl)	mean: 3.7 range: 3.37 - 4.03	n = 39
Uric acid (mg/dl)	mean: 10.2 range: 7.7 - 12.7	n = 39

Due to differences in individual birds, an adequate sample size to perform all tests was not obtained in all cases. The maximum number of tests possible was performed with each available sample.

The majority of the birds bled for the study were wild-caught adults. Six were domestically raised birds of known age. Five of these were hatched in 1989. The youngest bird bled for the project was a 1990 hatch.

In general, the blood chemistry results for these six domestic birds were similar to those of the older, wild-caught birds. Slight elevations in calcium, phosphorus, uric acid, and LDH were noted in some of the younger birds, although the individual results did fall within 2 SD of the mean level for an adult of the species.

Hematology

Identification of white blood cells is a matter of debate among many avian health professionals. Results vary from laboratory to laboratory. It is important that in an individual laboratory, all personnel processing CBCs are of the same opinion concerning the identification of various white cells. This ensures consistent results that, combined with the patient's appearance and other test results, will be of use to the veterinarian.

At ABRC, attempts were made to establish a normal range for CBCs in palm cockatoos because clinically normal individuals often have white counts on the low side of what is considered to be normal for other psittacines. Medical staff members concluded that such a study would require more data, perhaps accumulated at other facilities, for comparison. Until additional research has been performed, we should continue to work with established normals. Serial CBCs performed during the treatment of illness may be helpful in the assessment of recovery.

Microbiology

Microbiology can play an important role in the health care of psittacines, because prompt and accurate identification of pathogenic bacteria is often critical in cases of illness or injury. Gram stains of fecal smears may confirm the presence of Gram negative bacteria, which commonly cause illness in birds, but obtaining cultures is a better method of identifying species of bacteria. In addition, antibiotic sensitivity testing may be performed on bacteria grown from cultures to determine which drugs will have the greatest effect on the bacteria. Cultures and sensitivities are performed at ABRC prior to selection of antibiotics, except in critical cases requiring immediate treatment. Gram stains are performed for further clarification in some instances, but are felt to be somewhat inaccurate when performed as a single testing method. At ABRC, *Escherichia coli* is the most commonly isolated Gram negative bacteria species cultured from clinically normal adult palm cockatoos (Table 2).

Crop and cloacal cultures should be taken in most cases of illness. Swabs of the pharynx or the choana may be easier to obtain than a crop culture if working with an uncooperative adult bird. A tracheal swab may be indicated if the bird suffers from respiratory problems. These cultures should be plated to media that supports mycotic growth since yeast and fungus are problems for some palm cockatoos. Cultures should also be performed on wounds prior to administering treatment, if possible.

It is not uncommon for cultures taken from clinically normal palm cockatoos to grow some Gram negative bacteria. If the percentage is small and treatment is not indicated, it may be useful to take serial cultures at intervals to assess the status of the individual. Cultures of clinically normal adults are also useful because they provide a picture of the floral content of a group of birds and can be compared to cultures taken from sick birds. Gram positive bacteria found in the intestinal tract are usually considered normal flora; however, some may be problems in individual cases. In evaluating the bacteria grown, it is important to keep in mind the case and the site of the culture.

Table 2: Bacteria species isolated from clinically normal adult palm cockatoos during routine cloacal cultures taken in 1993

Culture Site - Cloaca n = 20

SPECIES	# ISOLATED	ISOLATION RATE (%)
Escherichia coli	16	80 %
Klebsiella sp.	2	10 %
Enterobacter sp.	1	5 %

Non-fermentative gram negative bacilli	3	15 %
Staphylococcus sp.	6	30 %
Streptococcus sp.	8	40 %
Lactobacillus sp.	3	15 %
Corynebacterium sp.	2	10 %
Bacillus sp.	0	0 %

Radiology

Radiology is useful when treating skeletal, respiratory, or intestinal diseases. It can be used to make a diagnosis and to monitor recovery. Two views of any body part are recommended. Birds are much easier to radiograph when maintained under anesthesia; there is less chance of injury and the quality of the radiographs is enhanced.

Barium series can be done to outline the digestive tract and also to make distinctions between other organs. Double contrast studies, using barium and air, can reveal a blockage, although foreign body impaction has not been seen in palm cockatoos at ABRC. Hypaque may be used if it is desirable to highlight the kidneys.

Prior to taking barium radiographs, the bird should be fasted and water withheld for at least 12 hours. Lactated Ringers Solution may be given subcutaneously the evening prior to or directly after the procedure, if needed. Ten to 15 cc of barium sulfate can be administered into the crop using a gavage needle or feeding tube. Radiographs taken at approximately 30 minutes post administration of barium normally provide a good overview of the digestive tract. Remember that it is important to keep the bird's head elevated during administration of anesthesia, and until the bird has recovered, to prevent aspiration of the barium.

Additional Tests

Two other tests that have been helpful are bile acid tests for diagnosis of liver disease and thyroid levels, such as T4, if deficiencies are suspected.

Major Disease Problems and Treatments.

Fungal Infections

In general, adult palm cockatoos have proven to be very hardy birds but the species is susceptible to many of the same diseases that effect other psittacines. The most common disease problems seen in palm cockatoos are fungal infections. The most common fungi isolated are *Aspergillus sp*. A number of wild caught palm cockatoos, imported in the 1980s, died due to fungal infection. Fungal infection continues to be a problem for this group as the years go by. Treatment often requires long term therapy.

Fungal lesions have been seen in the syrinx, air sacs, lungs, base of the heart, and in major vessels. Auscultation, radiographs, hematology, blood chemistries, cultures, and endoscopy can be used to obtain a diagnosis. Treatment may include oral doses of Ancobon or Diflucan, surgical removal of lesions, and intratracheal or intravenous injections of Amphotercin B. Possible anaphylactic reactions were suspected in two palm cockatoos who died following intravenous injections of Amphotercin B. No other cause of death, including fungal infection, could be determined based on necropsy and histopathology.

Protozoal Infections

Protozoal infections are common in some areas, especially in Florida and California. These infections are often acute, and the birds are usually found dead with no previous signs of illness. Yellow urates, depression, and respiratory disease may be seen prior to death. Treatments include oral doses of Daraprim and sulfa drugs. Formulating an antemortem diagnosis is difficult if not impossible, and it is unclear if this treatment regimen is effective. The cage mate of a bird that has died of protozoal infection may be a candidate for treatment, however it is common to have only one of a pair succumb to this disease.

Gross necropsy findings typically include: very enlarged spleen, yellow fluid in the cardiac sac, and fluid-filled lungs. A quick diagnosis can be made from microscopic examination of impression smears of the lungs that have been stained using the Diff-Quik method. Sarcocystis may be diagnosed if extracellular merozoites are present.

Prevention is the best cure for Sarcocystis at this time. The use of electric fences to keep opossums off the cages, the humane trapping and removal of opossums, concrete floors in flight cages to prevent access to the ground, use of suspended cages, and regular cleaning of nest boxes are good preventative methods.

Bacterial Infections

Bacterial infections occur in most psittacines and the palm cockatoo is no exception. Symptoms often involve the respiratory or intestinal systems. Diagnosis can be made through the use of microbiology, hematology, chemistries, and radiology. Supportive care measures include: tube feeding, diet change,

and subcutaneous or intravenous fluid therapy.

Some antibiotics and glucose/fluid therapies are of great value when treating the critically ill patient. Antibiotics are easily administered intramuscularly, though tissue trauma can be devastating. ABRC staff members prefer to use the subcutaneous route for this reason. Oral administration of antibiotics may be difficult when working with older or uncooperative birds.

Psittacine Feather and Beak Disease (PFBD)

PFBD infection has been observed in the palm cockatoo. Currently, there is no cure for this contagious and terminal disease, but research into the development of a vaccine is ongoing. It is possible for infected birds to live a long time with supportive care but they are susceptible to bacterial and fungal infections. A DNA probe has been developed to detect the disease prior to expression of any clinical symptoms. At this time, all birds in a collection should be tested and any birds determined to be positive based on the guidelines of testing should be removed from a psittacine collection. Young birds are particularly susceptible to this and other viruses.

Kidney Diseases

Polyuria, polydipsia, and white crystals visible under the skin are some of the symptoms of visceral gout and kidney disease. Treatments include supportive care, antibiotics, oral Allopurinol, and intravenous flushing of the kidneys. The actual cause of kidney disease is usually difficult to determine so it must be treated based on symptoms.

Serum uric acid levels can be used to detect kidney problems and to monitor progress during treatment. Dehydration may cause an increase in uric acid levels; levels may return to normal after the bird has been rehydrated.

Feather Problems

Feather cysts occur in primary feathers of the wings and tail. In many cases the cause of feather cyst development is unknown. Chronic feather cyst development may require the permanent solution of complete follicle removal.

Feather plucking or chewing is not common in wild-caught palm cockatoo but has been seen in several domestically raised, hand-fed birds. These individuals pluck coverts from the chest area, leaving the down intact.

Common Injuries and Treatments.

Many injuries to captive psittacines are prevented by providing safe, well-maintained housing and by ensuring that individual leg bands are closed bands, appropriately sized, and sturdy. Two types of injury that are more difficult for the aviculturalist to prevent are self-trauma and mate-trauma. Wing and beak trims and possible beak ball application to the male may prevent the mate trauma.

In the palm cockatoos at ABRC, the most frequently treated injury involves the beak; mate trauma is the primary cause. Self trauma, particularly during capture, can also damage the beak. The maxilla of the palm cockatoo features a thin horny layer and soft center, factors that make beak injuries common.

Bite wounds in mate traumas occur mainly to beak, mouth, and face area. However, the feet, legs, tail, back area, neck, and wings should be examined when a patient is presented after a mate attack. Scratches may be seen on the facial patches and chest area. Wounds range from minor scratches to severe, sometimes fatal injuries.

Minor beak injuries may heal well after they have been cleaned. Large or deep beak wounds can be cleaned and patched with acrylic. The patch not only protects the wound from infection but also adds stability. Patients with severe beak injury may require supportive care with fluids and tube feeding, and the administration of antibiotics and antifungals.

One palm cockatoo at ABRC lost her entire maxilla to mate trauma, leaving her sinuses exposed. The area was kept clean, and antibiotic therapy and tube feedings were administered until the area granulated in. Extreme changes had to be made in the bird's diet as she would never crack seed or nuts again. She is able to eat ground parrot pellets and ground monkey chow, and she enjoys soft fruits and vegetables. Due to the severity of her injury and the need for a special diet, this bird is not paired for breeding. Her quality of life seems to be excellent.

Mate trauma cases should be assessed for evidence of shock which could result in death if not treated. Dexamethasone SP and Solu-delta can be used for shock, along with heat and oxygen therapy. Puncture wounds to the mouth and commissures can be cleaned and ointments applied or sutured if needed. Birds with beak and mouth injuries should be removed from heat therapy as soon as possible as the warm environment could encourage secondary bacterial or fungal infections. Patients should be assessed for hypoglycemia, since some trauma victims have been deprived of food by their mates.

Overgrown maxillas and mandibles are not unusual in palm cockatoos. The maxilla tip is the most common site of overgrowth. Uneven beak wear is often noticeable, especially along the occlusal or biting surfaces of the maxilla and mandible, usually occurring on both surfaces. Treatment involves periodic trimming with a Dremel tool. The bird's appetite should be monitored after a major trim has been required. Previous beak injuries may result in overgrowth.

Toe and toenail injuries are less common, but do occur. If indicated, the wound should be cleaned and bandaged, and antibiotic therapy may be initiated. Cases of frostbite in palm cockatoos have resulted in toe mutilation. If the injury is severe, amputation of toenails or complete toes may be necessary.

Anesthesia.

The safest method of anesthesia is through the use of Isoflurane. A cone induction is the best approach, and the bird may be maintained in the cone or intubated.

At ABRC, a bird is induced at 5%, with oxygen at a flow rate of 1.5 - 2%. The Isoflurane is dropped to 2.5% - 3.5% after induction, as required. Intubated patients can be maintained at 2 - 3% Isoflurane with oxygen flow rate at 0.8 - 1%. Prior to and during a procedure, the bird's condition should be monitored carefully. It has also been pointed out that palm cockatoos are sensitive to anaesthetics from the Ketamine family of drugs. It has been reported that some European zoos feel the appropriate dose is approximately ½ the normal dosage of Ketamine. (C. King, pers. com.)

Vaccinations.

At this time no proven effective vaccines are available for diseases that occur in psittacine species.

Necropsy and Histopathology.

A complete necropsy should be performed on each bird and tissues should be submitted for histopathology. Post-mortem examination is an important tool, especially when infectious disease is suspected in a group. All organs should be examined. Tissues routinely cultured at necropsy include: heart, blood, liver, lung, spleen, and kidney. Bacterial growth from tissue cultures may be enhanced by placing the swab into an enrichment medium, such as Thioglycollate, for 24 hours prior to plating onto prepared media. Follow the SSP recommended necropsy and histopathology techniques in Appendix 15.

See Appendix 7, Drug Information for Drug Dosages

Appendix 8, Routine Physical Exam Form

Appendix 9, List of Avian Diagnostics Laboratories

Appendix 10, Microbiology Worksheet

Appendix 13, Hematology/Chemistry/Serology Records from ISIS and WOCC

Appendix 15, SSP Necropsy and Histopathology Techniques/Recommendations

For further information or comments, please contact Mike Taylor

Caloosahatchee Aviary | Palm Manual | IAS | Search the Site | Table of Contents

Chapter VIII

Hand-rearing and Medical Care of Young Palm Cockatoos

by Mathew W. Bond, D.V.M., Diane Downs, Dreama Skidmore, and Sharon Wolf, C.V.T.

from the Avicultural Breeding and Research Center

Introduction.

Palm cockatoo chicks have been hand-raised in four of the facilities that responded to the 1992 survey. The following ideas are based on those replies and our experiences at ABRC.

Within the Palm Cockatoo SSP population, the majority of chicks have been hand-raised. Parent- and foster-raised young have been removed as early as twenty days, due to medical problems, or as late as five months. When left with their parents, the chicks should be observed closely and removed at the first signs of neglect. The very few captive parent-raised chicks have fledged between 80 to 100 days. Weaning usually occurs between six to seven months but some may take as long as a year due to poor health.

The hand-rearing process can be a labor-intensive undertaking. It does have several major advantages, including: an increase in the number of chicks produced, the potential for increased genetic diversity, improved ability to monitor a chick's health and development, decreased chance of disease transmission, and decrease in mortality related to poor parenting skills.

Initially, problems arose from lack of information about the species. Chicks were assisted from the egg because their incubation time was longer than that of other cockatoo species. Palm cockatoo chicks are prone to digestive disorders and much time has been spent in the development of diets, husbandry techniques, and medical management to resolve this common problem.

As more chicks are hand-reared, more knowledge about their specific needs is gained. This improved technology has been conducive to the successful rearing of palm cockatoo chicks in nursery settings.

Husbandry and Diet.

Care and husbandry of the palm cockatoo chick in the nursery is similar to that of other cockatoo species. Plastic bowls, tubs, and wire cages are used for housing, depending on the age of the chicks. Paper towels, cloth towels, rubber mesh, pelleted bedding, and wire have all been used as flooring substrates. Brooders of several varieties, including human isolettes, have been used. Cleaning and disinfection procedures are the same as those used with

other psittacines.

Due to the lack of first down and the length of time for feather growth in palm cockatoo chicks, it is important to keep them in a warm environment longer than other cockatoo species. Temperatures at day one begin at 35°C to 37.5°C (95°F to 99°F) and are gradually decreased as the chick grows. They are kept in brooders or warm rooms (about 29°C or 85°F) until they are fully feathered. Digestion and skin color may be directly related to environmental temperature.

Chicks receive their first feed when they are visibly dry post-hatching (see feeding schedule table). This first feeding can be either Pedialyte or diluted formula. Feeding intervals are the same as for other cockatoo species. A diluted formula is fed for the first three days and then switched to the regular formula. Feeding amounts are increased and intervals decreased as the chick grows. This is based on the individual chick and the diet being used. Syringe feeding is the most popular and easiest method of hand-feeding. Formula should be fed at 41.5°C (105°F). Microwaved food must be stirred thoroughly to ensure that there are no hot spots. Catheter tipped syringes, with or without a soft rubber tip, can be used. Palm cockatoo chicks have a vigorous and eager feeding response. Numerous diets have been used to successfully raise palm cockatoos, with the birds exhibiting no growth or digestive problems. Their specific nutritional requirements are unknown, but in the last few years fewer problems have been seen. Formulas that have been used successfully are: Monkey Chow based formulas, ABRC's Palm Cockatoo Formula, Kaytee Exact Macaw Formula, Prettybird 19/12 Formula, Lakes hand-feeding Formula, and Kaytee Exact Macaw Formula with added ingredients. Regardless of the diet used, recording daily weights is a good way to monitor a chick's development.

A Monkey Chow based formula was used to raise the majority of chicks in the ABRC nursery prior to 1997. A second formula, ABRC’s Palm Cockatoo Formula, was developed specifically for palm cockatoos because many of them exhibited digestive problems when fed the standard formula. Palm cockatoo chicks at ABRC were fed the Monkey Chow Formula like any other cockatoo chick until digestive disorders became present. They were then typically switched over to a 50/50 mixture of the two formulas. Their digestion usually improved after the switch. Chicks that continued to have problems and did not seem to have a medical etiology sometimes required a few days of straight Palm Cockatoo Formula until digestion improved. They would then be returned to the 50/50 mixture. A number of palm cockatoo chicks were successfully raised to weaning on the Monkey Chow Formula alone. In 1996 and 1997, ABRC experienced gout problems with their palm cockatoo chicks using the two diets they developed and Prettybird 19/12 Formula. They suspect the cause of the gout was due to an increase of vitamin D3 in the manufacture of the Monkey Chow. The makers of the Monkey Chow have been raising this level over the last few years to further refine their diet for monkeys. They do not reccommend feeding it to birds. ABRC worked closely with Kaytee to develop a palm cockatoo hand-rearing formula. Kaytee analyzed the old Monkey Chow diet and came up with a formula which should come close to it. The following is the diet ABRC started using in 1997.

70 g Kaytee Exact Macaw Hand-rearing Diet

20 g sunflower seed (hulled)

40 g apple (fresh)

40 g broccoli (green)

230 g water

Everything is blended together and fed as described above. The first couple days the chicks receive diluted Kaytee Exact Macaw Hand-rearing Diet only and then the rest of the formula is slowly added. After using this diet, ABRC has seen an improvement in the condition of their chicks. (Updated by Mike Taylor from phone conversations with Sharon Wolf)

Riverbanks Zoo hand-raised two palm cockatoo chicks in 1996 and one in 1997. They used the Kaytee Exact Original Formula for the first couple months, then changed to the macaw formula when they finished their supply of the original formula. They gave the first chick peanut oil and Nystatin to prevent Candida. They felt sufficiently confident that they decided to rear the second chick entirely on the Kaytee formula. They experienced no growth or other medical problems. The only problem they experienced was when they tried to wean the second chick, of 1996, along the same timeline as the first and it was not ready to wean (see weaning section of this chapter). Even with both chicks in the same pen, the second chick refused to eat completely on its own.

Saint Catherine's Island Survival Center also hand-raised two palm cockatoo chicks in 1996. They used Pretty Bird 19/12 formula with their two chicks. They did not experience any growth or other medical problems such as the gout problem experienced by ABRC. The only change to the basic diet was the addition of a small amout of peanut oil to the diet when the chicks started feathering. They started this when they noticed the first chick's feathers did not look right. (Mike Taylor, pers. com.)

Hand-rearing formulas

Monkey Chow Based Formula **Used at ABRC** 0.95 liter (1 qt.) Zupreem monkey chow 0.95 liter (1 qt.) water 112 cc (4 oz.) Gerber Oatmeal & Banana Cereal 29 gm (2 tbsp.) peanut butter 7 ice cubes (25 cc each) 7 gm (½ tbsp.) calcium carbonate powder Cook monkey chow and water in microwave for 8 minutes.	**Palm Cockatoo Formula developed by** **Ms. Dreama Skidmore of ABRC** 43 gm. macadamia nuts (raw and unsalted) 70 gm sunflower seeds (raw, hulled, and unsalted) 42 gm. whole wheat bread (high fiber/ low cholesterol) 75 gm. raw carrot or yam 55 gm. raw broccoli 100 gm. raw apple

Add other ingredients Blend thoroughly in blender. First 3 days: dilute 25cc formula with 8 cc water.	300 cc water Blend thoroughly in blender. Freeze into cubes for later use. You may contact ABRC with any questions.

Kaytee Exact hand-rearing formulas **Used by Riverbanks Zoo** **(mix as directed)**	**Lakes hand-feeding formula** **Used by Greater Baton Rouge Zoo** **(mix as directed)**

PrettyBird 19/12 handrearing formula used by St. Catherine's Survival Center

Mix as directed and add a small amount of peanut oil when the chicks start to feather.

The feeding schedule for palm cockatoo chicks raised at ABRC is based on the following table. However, decisions concerning a chick's progress are made on an individual basis. This information is offered only as a guideline. (See also Appendix 15 and 16 pages 163 and 165.)

AGE (DAYS)	ROOM TEMPERATURE	FEEDING SCHEDULE	COMMENT

1	35°C (95°F)	Begin with 0.2cc. Increase amount 0.2cc at each feeding, until bird is receiving 1cc per feed. Bird receives 10 feedings day 1. First feeding 5:00 A.M., last feeding 9:00 P.M.	Example: 0.2cc, 0.4cc, 0.6cc, 0.8cc, then 1cc at each feeding for the rest of the day.
2	35°C (95°F)	1cc at each feeding. Bird receives 10 feedings day 2. First feeding 5:00 A.M., last feeding 9:00 P.M.	
3	35°C (95°F)	1.5cc x 6 feedings. First feeding 5:00 A.M., last feeding 9:00 P.M.	
4	35°C (95°F)	2cc x 4 feedings. First feeding 6:00 A.M., last feeding 9:00 P.M.	
5 - 14	33 - 35°C (92 - 95°F)	Continue to feed 4 times daily. First feeding 6:00 A.M., last feeding 6:00 P.M. Begin to increase amount fed daily. Increase a total of 2cc per day divided by 4 feedings (0.5cc increase/feeding) for Aterrimus. If the bird is digesting well after several days on this schedule, this may be changed to an increase of 4 cc per day, divided by 4 feedings, as described below. Increase a total of 4 cc per day divided by 4 feedings (1 cc increase/feeding) for Goliaths	Example for an Aterrimus chick: Day 5: 2.5cc x 4 feeds Day 6: 3cc x 4 feeds Day 7: 3.5cc x 4 feeds Day 8: 4cc x 4 feeds Day 9: 4.5cc x 4 feeds, etc.
15 (approx.)	29.5 - 32°C (85 - 90°F)	Aterrimus chicks 3 times a day feeding schedule. First feeding 6:00 A.M., last feeding 9:00 P.M. Begin to increase the amount from 1 - 5cc daily divided between 3 feedings, according to the needs of the individual chick. Goliaths remain at the above schedule.	Example: Day 15: 7.5cc x 3 feeds. Day 16: 8.5cc x 3 feeds. Day 17: 9.5cc x 3 feeds Day 18: 11cc x 3 feeds Day 19: 12.5cc x 3 feeds, etc.
30 (approx.)	29.5 - 32°C (85 - 90°F)	Goliath chicks begin 3 times a day feeding schedule. First feeding 6:00 A.M., last feeding 9:00 P.M. Begin to increase the amount from 1 - 5cc daily divided by 3 feedings, according to the needs of the individual chick.	

50 - 60	27°C (80°F)	Begin to offer bread sticks, almond toast, monkey chow, peanuts, and other foods to encourage independent feeding. Aterrimus chicks 2 times a day feeding schedule. First feeding 6:00 A.M., last feeding 4:00 P.M. Goliaths stay at 3 times a day. First feeding 6:00 A.M., last feeding 9:00 P.M.	*Formula should be fed at 105 F.* *Microwaved formula may contain hot spots & must be stirred throughly before feeding*
60 - 70	27°C (80°F)	Goliath chicks 2 times a day feeding schedule. First feeding 6:00 A.M., last feeding 4:00 P.M.	*Use a separate syringe for each bird*
100 - 120	27°C (80°F)	Aterrimus chicks 1 time a day feeding schedule. First feeding 6:00 A.M. Goliaths stay at 2 times a day. First feeding 6:00 A.M., last feeding 4:00 P.M.	*Make fresh formula, or defrost* *cubes, for each feeding. Do* *not reheat or reuse formula.*
110 - 150	27°C (80°F)	Goliath chicks begin 1 time a day feeding schedule. First feeding 6:00 A.M.	

Weaning.

Nursery raised palm cockatoo chicks usually start picking at food around the age of 60 days. The types of food offered are very important. Bread sticks, almond toast, dry monkey chow, pine nuts, and peanuts are good foods to start with. After independent eating begins, this menu is expanded to include a sunflower based seed mix and a variety of fruits and vegetables.

There is no hard, set rule regarding weaning times. Each bird should be treated as an individual. Careful weight monitoring is critical at this period; care must be taken to ensure that the bird does not become malnourished due to low caloric intake. A bird that is receiving formula once a day and digesting well should not be rushed into complete independence. Some chicks will wean completely at five months but others may take up to nine months.

Physical Development and Growth Characteristics

AGE (in days)	CHARACTERISTIC
Hatch	no down feathers

Hatch	ears open
Hatch	beak, tongue, body, foot, and nail pigment are absent
14 - 18	eyes open
21 - 118	crest feather development
21 - 91	down feather development (body)
21	bright red facial color and blushing
21	tips of nails turning black
25 - 154	secondary feather development
25	red skin pigment
28 - 61	primary feather development
36 - 161	tail feather development
40 - 50	black pigmentary striations on beak
41 - 91	flank down development
43 - 105	skin develops black pigmentation
62	tongue tip begins to turn grey
110	toenails completely black
140	tongue deep red with black tip
161	total feather maturity
29 months	beak completely black (*P. a. aterrimus*)
32 months	beak black with white tip (*P. a. goliath*)

Behavioral Manifestations of Illness in Chicks.

Palm cockatoo chicks have unique characteristics, some of which are not medical in basis. They start stamping their feet as early as two weeks. Head shaking, often considered a serious problem, is actually quite normal in development. When approached with food, palm cockatoos are quite vocal, attempting to pump on anything

available. Facial color is quite variable within the first few weeks, though a strong facial flush is typical. Pale facial color, sleepiness, and constant crying are behaviors that may be associated with illness.

Neonatal Examinations.

It is ideal to handle chicks when their crops are at least half empty. Even then, care should be taken not to tip the chick on his back, causing it to aspirate. Musculoskeletal corrections such as taping, splinting, and body suits, should be applied when a chick's crop is almost empty, and the chick housed in a deep, padded, snug container. Palm cockatoos rarely require these types of corrections.

Start with an overall appraisal of musculoskeletal symmetry, skin color, and hydration. Also note how the chick sleeps, its position, and whether it is content. The chick's weight and size should correlate with others of the same age and species in the same nursery. Keeping a daily weight record is an excellent way of monitoring a chick's growth.

Starting at the beak, check for deviations of the maxilla to the right or left, and whether there is narrowing or extra growth on either side of the mandible. When the chick closes its beak, the upper should hook over the lower. Beak deviations are rarely seen in palm cockatoo chicks.

Opening a chick's mouth is relatively easy compared to an adult's. Smell the breath since many species have distinct odors. Check the choana, glottis, salivary consistency, and oral cavity. The glottis of a palm cockatoo is quite deep-seated, predisposing it to easy aspiration.

The eyes of palm cockatoo chicks open at 14 to 18 days. The eyelids open slowly, usually slightly above and caudal to the eyes. The lids then develop and move over the eyes. Problem chicks may develop more slowly, though surgical intervention has not been necessary. If the eyes are open, examine as with any other animal.

While in the area of the eye, gently palpate and examine the sinus eye ring. Swellings can be indicative of sinus or respiratory problems. The nares and ears should be clean, non-inflamed, and patent. Head shaking behavior is a normal developmental stage for palm cockatoo chicks, although it may signify sinus or ear problems in other species.

Begin the spinal examination by palpating the neck and noting the position in which it is held. A primary neck problem often results in other, compensatory problems, such as wing, beak, and leg deviations. Follow the spinal cord from head to tail, then gently tip the chick over, checking the symmetry of the sternum and pelvis. Palm cockatoo chicks rarely have spinal cord deformities.

The half-empty crop should be examined for over-all color. Look for hemorrhages, vascular congestion, and edema. Compare the crop size to that of other chicks, checking for stretched, non-functional crops, especially in previously sick chicks. Waves of motility can often be seen in the crop of a healthy chick. Food retention, leading to a stretched crop, is very common in palm cockatoos. Slow digestion can be a subtle indicator of hidden problems. At ABRC, it is not unusual to see an inflammation of the skin over the crop in weaning birds, especially those housed outdoors. This may be related to heat or to insects and resolves without treatment.

The "umbilical" area can be the key to many problems. The area should be sealed off in newly hatched chicks, the skin is often constricted at the site. There may be a dried up tag of tissue attached that usually falls off in two to three days. Fleshy protuberances can be a nidus of infection and need to be tied off and cleaned. This occurs mainly with problem hatches.

Underneath the umbilical cord, it is common to see the absorbed yolk sac. This should disappear in four to five days. Other organs can be visualized as well, including: the liver edge, the intestinal loops, the ventriculus, and the accumulation of subcutaneous and intestinal fat. This area is a wonderful window to monitor progression or deterioration.

Examine the inside of the cloaca with a cotton swab for the degree of hydration, color of the mucus membranes, and the presence of feces. Note the amount, color, and consistency of feces. Scant feces is often an indicator of dehydration and other problems.

When examining wings, legs, and feet, always look for symmetry. Buckled wings detected early can be easily corrected. Wing tip hemorrhages may be early indications of trauma or infections. With cases of leg and feet deviations, palpate up to the femoral head to determine where the deviation starts. Check the toes for plumpness. Constrictions can lead to sloughing of whole digits.

Feather development is species specific and may be retarded in previously sick chicks. Poor development of down feathers can be an early indicator of infection which may surface later. The flank down is slow to mature. The pin feathers (blood feathers) should be examined for hemorrhage, loose follicles, constrictions, and stress lines. Chicks exert a large amount of energy in feather production, making this a very sensitive, stressful time. As the birds feather out, the environmental temperature should be reduced.

Finally, re-examine the condition of the chick's container. Individual, snug-fitting, deep containers with a towel covering part of the top provide a nest-like environment. As the chicks get larger, they can have more room to explore. Monitoring temperature changes in the nursery from day to night may prevent a variety of problems.

Major Disease Problems and Treatments.

The most frequently observed manifestation of illness in the palm cockatoo chick is failure to digest. Many years have been spent trying to devise the right diet and methods to enhance digestion through feeding management and medical treatment, with more success in recent years.

In 1989, Cupcake was hatched at ABRC, and had major digestive problems throughout her life. At six months, this *P. a. aterrimus* chick had not yet attained a weight of 200 grams. She was a day to day obsession for the nursery and the medical staff. Each day, retained formula was pulled from her crop. The amount of food digested was often estimated to be only 1 to 2 cc in a 24 hour period. Finally, she became neurologic and humane euthanasia was elected. Throughout the bird's life, crop, cloacal, tracheal, and blood cultures had not revealed signs of bacterial or fungal infections. Histopathology reports revealed multi focal aspiration pockets and bacterial granulomas in the lungs. While aspiration may be related to hand-feeding techniques in some cases, it can also be caused by chronic illnesses involving weakness, food retention, regurgitation, and coughing.

In 1993, seventeen palm cockatoos were raised at ABRC. Medical and nursery staff members coordinate efforts to monitor and treat birds with digestive problems. Palm cockatoo chicks are most vulnerable to digestive problems a few days after hatch, at around two months of age, and at weaning. At these critical periods management, as well as medical parameters, should be evaluated. Always assess brooder temperature and intervals of feeding. Problems related to temperature of the environment, formula temperature, feeding amounts, and intervals between feeding are the most common causes of digestive disorders. Cultures should be taken, though bacterial infections are not always the cause.

It is ideal for most neonate psittacines to have an empty crop after the overnight fast. However, residual food between feedings and in the morning is common in palm cockatoos. This amount varies according to the size of the bird, quantity of food, and the number of times fed. In weaning chicks, residual food is usually less than 5 cc. A possible cause for this is the palm cockatoo chick's apparent ability to regurgitate from the proventriculus back into the crop. Care must be taken with assessing the caloric intake of a growing bird. Any chick that is not obtaining enough nutrition to grow will deplete body resources for nutrients.

If digestive problems are exhibited, evaluate hydration. Dehydrated chicks of any age may benefit greatly from subcutaneous fluid therapy. Well-hydrated chicks show improved digestion. A single bolus of subcutaneous fluids, such as Lactated Ringers, is sometimes all that is needed. The preferred site for administering subcutaneous fluids is the inside of the thigh, pointing toward the inguinal area.

Crop bras are an excellent adjunct to other digestive therapies, but are most effective when applied to older chicks. Because palm cockatoos are prone to aspiration, it may be helpful to remove the crop bra while feeding the bird.

Digestive problems in chicks from pinfeather to weaning can be grouped together. It is a common mistake to feed diluted food, more times a day, reducing the calorie intake. A better solution may be the reverse - feeding full strength formula, increasing the amount, and increasing the interval of time between - total caloric intake remaining the same. Crops which fail to empty, can be emptied via feeding tube. Care must be taken when attempting this procedure so as not to damage the crop wall. Fresh formula can then be fed.

Weaning chicks that have free access to water may appear to be retaining formula, but the real problem may be over-consumption of water. If this is suspected, a simple preliminary approach is to remove access to food and water for 24 hours, leaving the bird with access only to syringe fed food.

In some cases, digestive problems are the result of bacterial and fungal infections. These microorganisms proliferate in warm, humid environments, common in psittacine nurseries. Gastrointestinal infections are best assessed by cloacal cultures. It is accepted that many normal chicks will grow low levels of Gram negative bacteria, species varying by nursery. Flora from crop cultures is often directly related to the bacterial content of hand-feeding formula. It is common to culture yeast from a palm cockatoo chick's crop. Because this is a common cause of digestive problems in palm cockatoos, birds are treated after yeast is cultured, even if they appear clinically normal. At ABRC, we treat with Nystatin, Ketoconazole, or a combination of the two. Vitamin C may be a potential treatment for control of low grade yeast infections. Antibiotics, if indicated, are easy to administer orally to chicks because of the feeding response. Chicks with crop stasis should receive antibiotics subcutaneously or intramuscularly until digestion is returned to normal. The subcutaneous route is preferred in chicks with little keel muscle to prevent inflammation to the muscle. Chicks being treated with antibiotics are given Nystatin concurrently.

CBCs and blood chemistries can be used to screen for infections and to evaluate a chick's organ function and nutritional status. While these tests usually require a larger amount of blood than can be obtained from a debilitated

chick, a toenail clip can yield a sample sufficient for a PCV, total solids, and a WBC estimate. Specific normals for CBC and blood chemistries for palm cockatoo chicks have not been established at this time. ABRC staff members refer to the normals established for other cockatoo species.

If not properly addressed, maldigestion typically leads to malnutrition. In addition to other parameters, it is crucial to monitor the patient's uric acid, calcium, and albumin levels. Uric acid typically increases while the calcium and albumin decline. Uricemia (uric acid in the blood) is a better terminology than kidney failure because we are not sure whether this is pre-renal or renal. In the seriously compromised patient, an intravenous catheter can be placed into the jugular to give direct access to the venous (circulatory) system, facilitating transfusions, parenteral nutrition, antibiotic therapies, and the administration of Reglan to enhance digestion. Reglan may be administered subcutaneously if an intravenous catheter has not been placed.

Neonate Mortality.

With advancements in husbandry, diet and pediatric medicine, mortality in palm cockatoo chicks is relatively low. In cases of death, necropsy techniques are the same as those used on adult birds. However, special attention should be applied to lymphoid organs, *i.e.* bursa and thymus. These organs, the original basis of the immune system, involute with age and are invaluable in assessing the bird's immune status. Tissues are routinely submitted for histopathology. If the situation warrants, tissues may be frozen.

See Appendix 2, Manufacturers List for the diet manufacturers

Appendix 7, Drug Information for drug dosages

Appendix 8, Routine Physical Exam Form

Appendix 9, List of Avian Diagnostics Laboratories

Appendix 10, Microbiology Worksheet

Appendix 11, Growth Charts from ABRC

Appendix 12, Hematology Values for Juvenile Cockatoos from ABRC

Appendix 13, Hematology/Chemistry/Serology Records from ISIS and WOCC

Appendix 14, Hand-reared Palm Cockatoo Chick Weights from ABRC

Appendix 15, SSP Necropsy and Histopathology Techniques/Recommendations

Chapter IX, Chick Rearing Accounts

For further information or comments, please contact [Mike Taylor]

[Caloosahatchee Aviary] [Palm Manual] [IAS] [Search the Site] [Table of Contents]

Chapter IX

Chick Rearing Accounts

by Mike Taylor (Ed.) from the White Oak Conservation Center

Introduction.

The following pages have six different chick rearing accounts of palm cockatoos. I have tried to get notes from most of the SSP participants who have reared chicks to send two accounts of hand-rearing. I wanted to have an account of a hand-rearing experience which did not go smoothly and one which went well. I have tried to keep each institution anonymous, but not leave out any information. Chicks #1 and #2 were from the one place and Chicks #3 and #4 were from another place. Chick #5 is an example of a failed parent-rearing. I did not have very much information with Chick #5's account. Chick #6 is an account from someone who has many years experience raising other cockatoo species but was only able to raise this, their first, palm cockatoo chick to three months of age. The following are some of the diets used in these accounts.

In addition to these six chicks I have added feeding schedules and weight gains from Riverbanks Zoo and St. Catherine's Island from their rearing experiences in 1996.

1) Monkey Chow Based Formula used at ABRC

- 0.95 liter (1 qt.) Zupreem monkey chow
- 0.95 liter (1 qt.) Water
- 112 cc (4 oz.) Gerber Oatmeal & Banana Cereal
- 29 gm (2 tbsp.) Peanut butter
- 7 ice cubes (25 cc each)
- 7 gm (½ tbsp.) Calcium carbonate powder

Cook monkey chow and water in microwave for 8 minutes

Add other ingredients

Blend thoroughly in blender

First 3 days: dilute 25cc formula with 8cc water

2) Palm Cockatoo Formula developed by Ms. Dreama Skidmore of ABRC

- 43 gm Macadamia nuts (raw and unsalted)
- 70 gm sunflower seeds (raw, hulled, and unsalted)
- 42 gm whole wheat bread (high fiber/low cholesterol)
- 75 gm raw carrot or yam
- 55 gm raw broccoli

- 100 gm raw apple
- 300 cc water

Blend thoroughly in blender

Freeze into cubes for later use

Note: ABRC has stopped using the above diets and is using the Kaytee Exact Macaw hand-rearing formula with selected vegetables blended into it. See Chapter VIII Hand-rearing and Medical Care of Palm Cockatoos.

3) Kaytee Exact Macaw hand-rearing formula (mix as directed)

4) Lakes handfeeding formula (mix as directed)

5) Prettybird 19/12 hand-rearing formula (mix as directed)

See Appendix 2, Manufacturer List, for the addresses where information on the last tthree diets can be obtained.

Palm Cockatoo chick #1

Hatched 6/21/88

Palm cockatoo chicks #1 and #2 were both hatched at the same institution. Chick #1 had problems, chick #2 had virtually no problems. Both chicks were incubated and hatched under the same conditions. Chick #1 was hand-fed a diet of egg cream, Hi-Pro Monkey Chow and applesauce. Chick #2 was hand-fed on Lake's Parrot Buffet hand-rearing formula. This does not say that palm cockatoo chicks raised on the Lake's formula will not have problems.

Date	Weight	Age	Medications	Comments
6/21/88				seems strong
6/22	21.26 g	1 day		
6/28	28.35 g	7 days		
7/5	35.44 g	14 days		
7/17	56.70 g	26 days		eye slits opening
7/31	77.96 g	40 days		
8/7	99.22 g	47 days		

8/16	141.75 g	56 days		
9/4	283.5 g	75 days		
9/17	354.38 g	88 days		
10/2				started picking up food
10/8	453.6 g	109 days		
10/14	510 g	115 days		Moved to zoo
10/20	453.6 g	121 days		
10/26	583.65 g	127 days		Picking at regular diet/cracking p-nuts
11/3		135 days	10 mg Ketaconazole BID	Inactive - but ate
11/4			10 mg Keta - BID	looks better
11/5			10 mg Keta - BID	
11/6			10 mg Keta - BID	
11/7			10 mg Keta - BID	
11/8	538.65 g	140 days	10 mg Keta - BID	
11/9				discont. Keta; cont. w/ Nolvasan sol.
11/14	567 g	146 days		
11/17				first flight across room!
11/21	567 g	150 days		
11/29	524.47 g	158 days		
12/7	538.65 g	166 days		eating regular diet but still not gaining - feeding infant diet AM & PM.
12/12	538.65 g	171 days		
12/19	538.65 g	178 days		

1/3/89	538.65 g	193 days		Now feeding 1 level tsp of infant diet, instead of heaping & mixed thinner.
1/9	538.65 g	199 days		
1/16	538.65 g	206 days		
1/23	510 g	213 days		
1/24			20 mg Keta. BID	problem - Candida
1/25			20 mg Keta. BID	
1/25			20 mg Keta. BID	
1/27				

Palm Cockatoo chick #2

Hatched 3/28/90

See introduction to palm cockatoo chick #1.

Date	Weight	Age	Amt. of Diet	Comments
3/28/90	14.175 g		½ spoon	
4/2	28.35 g	4 days	3 spoons	
4/12	85.05 g	15 days		
4/17	113.4 g	20 days		
4/20	127.58 g	23 days	7-8 spoons	
4/26	155.93 g	25 days	3 spoons	Changed spoons (size?)
5/1	191.36 g	31 days		
5/8	255.15 g	38 days		
5/14	283.59 g	46 days		

6/1	354.38 g	64 days		
6/11	389.81 g	74 days		
6/14	361.46 g	77 days		
6/16			5 spoons	added fruit and nuts
6/19	382.73 g	82 days		
6/25	368.55 g	88 days		
7/2	354.38 g	95 days		
7/6	311.85 g	99 days		lost 1.5 oz
7/17	481.95 g	110 days		gained 6 oz - 11days-
7/23	326.03 g	116 days		feeding BID
7/25	283.5 g	118 days		
8/6	290.59 g	129 days		
8/14	326.03 g	137 days		Discontinued Lakes diet
8/20	333.11 g	143 days		cont’d to give water w/ fruit and nut
8/27	396.90 g	150 days		
8/31	411.08 g	154 days		
9/14	425.25 g	168 days		
10/2	524.48 g	186 days		moved to Bird House
10/11	same	195 days		
10/26	567.0 g	210 days		

Other chick rearing charts are quite lengthy and are included as separate web pages.

For further information or comments, please contact Mike Taylor

[Caloosahatchee Aviary](#) [Palm Manual](#) [IAS](#) [Search the Site](#) [Table of Contents](#)

Palm Cockatoo chick #3

Hatched 2/20/89

This chick had lots of problems, as you will see. It was given Nystatin as a preventative. The diet was changed in an attempt to curtail the problems. Chick #3 and chick #4 were both raised by the same institution. Chick #4 was raised on formulas developed by ABRC.

Date	Day	Weight	Amt. Fed	Diet	Medications	Remarks
2/20/89	1	17 g	0.2 cc	oatmeal cereal w/ applesauce+banana w/ water		Strong, healthy, good color
			0.2		0.05 Nystatin	good feeding response. ½ dose Nyst. - preventative.
			0.25			made formula thicker
			0.25			took fecal & throat culture
			0.3			
			0.3			thicker formula
			0.35			
			0.35			

2/21	2	17 g	0.4			
			0.4		0.05 Nyst.	
			0.45			
			0.5			
			0.55			
			0.55	26 Zupreem monkey chow, ½ oatmeal, ½ cream corn, ½ garden veg., Tsp. p-nut butter	0.05 Nyst.	
			0.65			
			0.7			
2/22	3	18 g	0.8			
			1.5		0.05 Nyst.	
			1.75			
2/23	4	18 g	2.0		0.05 Nyst.	
			2.4			
			2.0			
			3.0			
			3.0		0.05 Nyst.	

2/24	5	21 g	3.5		0.06 Nyst.	
			4.0			
			4.0			
			4.5		0.06 Nyst.	
2/25	6	24 g	5.0		0.08 Nyst.	
			5.5			
			5.5			
			6.0		0.08 Nyst.	
2/26	7	28 g	7.0		0.08 Nyst.	Eye slits becoming very apparent
			7.5			
			7.8			
			8.0		0.08 Nyst.	
2/27	8	34 g	8.5		0.1 Nyst.	
			9.0			eye slit opening
			9.0		0.1 Nyst.	both eyes opening
2/28	9	42 g	9.5		0.12 Nyst.	
			10.0			feather tracks on wings
			11.0		0.1 Nyst.	
3/1	10	46 g	12.0		0.12 Nyst.	
			13.0			

			13.0		0.12 Nyst.	
3/2	11	55 g	14.0		0.15 Nyst.	
			14.0			
			14.0		0.15 Nyst.	
3/3	12	66 g	15.0		0.18 Nyst.	Food still in crop from last night feeding - 7 ½ hours.
			15.0			
			15.0		0.18 Nyst.	
3/4	13	72 g	17.0		0.21 Nyst.	
			17.0		0.21 Nyst.	
3/5	14	79 g	18.0		0.24 Nyst.	Formula thinner. Is active, color good, pin feathers on
			20.0		0.5 Nyst.	head, back, wings. Passing food slower than should.
			18.0		0.5 Nyst.	Throat mucus thick - incr. Nyst. to regular dose.
3/6	15	92 g	24.0		0.54 Nyst.	
			25.0		0.54 Nyst.	
3/7	16	107 g	26.0		0.6 Nyst.	
			25.0		0.6 Nyst.	
3/8	17	115 g	28.0		0.4 Nyst.	½ dose again

			15.0		0.4 Nyst.	filled crop only ½ full
3/9	18	117 g	30.0		0.4 Nyst.	
			32.0		0.4 Nyst.	
3/10	19	165 g	35.0		0.4 Nyst.	Using tap water.
			30.0		0.4 Nyst.	
3/11	20	141 g	40.0		0.42 Nyst.	
			40.0		0.42 Nyst.	
3/12	21	157 g	42.0		0.45 Nyst.	
			45.0		0.45 Nyst.	
3/13	22	172 g	45.0		0.46 Nyst.	
			30.0		0.5 Nyst.	
3/14	23	177 g	45.0		0.53 Nyst.	
			50.0		0.53 Nyst.	
3/15	24	195 g	45.0		0.55 Nyst.	Weight w/ crop ½ full.
			35.0			
3/16	25	197 g	50.0		0.57 Nyst.	Weight w/ food in crop
			40.0		0.57 Nyst.	Cheeks turning pink
3/17	26	205 g	50.0		0.61 Nyst.	

			35.0		0.61 Nyst.	
3/18	27	195 g	35.0		0.6 Nyst.	
			55.0			
3/19	28	203 g	55.0		0.61 Nyst.	
			35.0		0.61 Nyst.	
3/20	29	210 g	55.0		0.62 Nyst.	
			35.0		0.62 Nyst.	
3/21	30	206 g	55.0		0.62 Nyst.	Weight ⇓ - changed weighing time from AM.
			50.0		0.62 Nyst.	* First sign of problem
3/22	31		55.0		0.62 Nyst.	Formula thicker w/ ⇓ veg.
3/23	32	215 g	50.0		1.26 Nyst.	Regular dose Nyst. + extra tsp garden veg./cream corn
			40.0		1.29 Nyst. 0.08 Ketaconizole	food passing well extra veg. given.

					1.29 Nyst. 0.04 Keta.	
3/24	33				1.3 Nyst. 0.08 Keta.	
					1.5 Nyst.	Food not passing.
			20.0	regular formula thin w/ 2cc glucose	1.2 Nyst. 0.08 Keta.	flushed crop w/ 1/5 vinegar /water. 2.5cc LR Sub-Q each side. 0.1 Piperacillin
			20.0		1.2 Nyst. 0.08 Keta	food from last feeding not passing. emptied crop. flushed. 8cc LR SubQ BID
3/25	34	200 g	15.0	2cc glucose 50/50 13cc Lactated Ring. 0.2cc Calcium 0.3 Vibromycin	0.1 Piper. 4 mg Amikacin	Sub-Q fluids BID
			25.0	Oatmeal w/ banana & applesauce , LR, 2cc glucose	1.3 Nyst.	

					4 mg Amik. 0.1 Piper. 8cc LR	
			15.0	13cc LR 2cc glucose	0.3 Vibromycin 1.3 Nyst. 0.08 Keta.	
3/26	35	192 g			0.02 Amik. 0.1 Piper.	Weight ⇓ 8g
				12 cc LR 2cc glucose tsp Oatmeal	0.2 Vibra. 0.3 Nyst. 0.08 Keta.	Flushed with vinegar
					1.2 Nyst.	
					0.02 Amik. 0.1 Piper.	food not passing - bird weak

					0.2 Vibra. 0.08 Keta.	stool mainly bile
			35.0	10cc Nutrical 30cc Formula 2cc glucose 10cc LR		*make crop support bandage
3/27	36	182 g	37.0	Same as above	0.08 Keta. 0.1 Piper. 0.02 Amik. 8cc LR	passed 20 cc from last night
			15.0	Thin reg. formula	1.0 Nyst. 0.3 Vibra.	
			30.0	Reg. formula, LR, nutrical, glucose	1.0 Nyst. 0.06 Keta.	Formula regular consistency
3/28	37	195 g	30.0	Same as above	1.0 Nyst. 6cc LR S/Q	Weight w/ tape & 5cc formula / Digested 27cc!!
					0.06 Keta.	

					0.02 Amik. 0.1 Piper.	6cc LR Sub-Q
					0.06 Keta.	
			40.0	Same as above		
3/29	38	199 g			0.02 Amik. 0.1 Piper. 6cc LR	Digested 30cc from last night
			?	Same as above	0.3 Vibra. 1.0 Nyst. 0.06 Keta.	Flushed w/ vinegar & water
					0.02 Amik. 0.1 Piper.	
			30.0	Above formula with peanut butter	1.0 Nyst. 0.3 Vibra. 0.06 Keta.	Added peanut butter to formula

3/30	39	199 g			0.02 Amik. 0.1 Piper. 6cc LR	
			30.0	Formula w/o peanut butter		Food from last night didn't pass as well.
			35.0		0.06 Keta. 1.0 Nyst.	Tightened bandage. Food passed much faster.
3/31	40	215 g			1.0 Nyst. 0.06 Keta. 0.02 Amik. 0.1 Piper. 6cc LR	
			35.0			Removed 5cc.
					0.02 Amik. 0.1 Piper.	

4/1	41	208 g	40.0	Formula w/ P-nut	0.06 Keta.	
			35.0		0.06 Keta. 1.0 Nyst. 0.1 Keflex (oral)	
			40.0	Formula, nutrical	0.06 Keta. 0.1 Keflex	
4/2	42	213 g	30.0		0.06 Keta. 0.1 Keflex 6cc LR	Pulled out 20 cc Changed bandage
			35.0	Added high-protein cereal	0.06 Keta. 0.1 Keflex	*Regurgitation Began emptied crop & fed again.
			25.0	Reg. form. & Nutrical		Without cereal
4/3	43	208 g	30.0	Added tsp protein powder.	0.06 Keta.	Had to remove 5cc - choking
			27.0		0.06 Keta.	

			27.0			
4/4	44			1 piece soaked monkey chow		
			10.0	Formula w/ garden veg.		Removed 25 cc
					1.26 Nyst.	Flushed crop w/ vinegar, heavy yeast in stool cytology (?)
			30.0		0.5 Chloromycetin 0.08 Keta.	
			20.0		1.26 Nyst.	
4/5	45	220 g	35.0	Reg. formula	1.26 Nyst. 0.08 Keta. 0.5 Chlor.	Added vinegar to Keto.
			35.0	Took out nutrical & protein powder	0.08 Keta. 0.5 Chlor.	Changed vinegar with Gatoraid.

4/6	46	226 g	40.0	Reg. Formula	0.08 Keta. 0.5 Chlor. 1.29 Nyst.	
					1.3 Nyst.	
			40.0		1.3 Nyst. 0.08 Keta. 0.5 Chlor.	Changed bandage.
4/7	47	230 g	35.0		1.3 Nyst. 0.08 Keta. 0.5 Chlor.	
					1.3 Nyst.	Continues to regurgitate
			40.0		0.08 Keta. 0.5 Chlor.	
					1.3 Nyst.	

4/8	48	226 g	35.0		1.38 Nyst. 0.08 Keta. 0.5 Chlor.	
			37.0		1.38 Nyst. 0.08 Keta. 0.5 Chlor.	Crop empty. Formula made w/ LR
			7.0			
4/9	49	238 g	40.0		1.38 Nyst. 0.08 Keta. 0.5 Chlor.	
			20.0			
			40.0		1.38 Nyst. 0.08 Keta. 0.5 Chlor.	D/Chloro.

4/10	50	224 g	20.0		1.3 Nyst. 0.08 Keta.	
			36.0		1.3 Nyst.	
					0.1 Piper.	Removed 20cc
			40.0			Changed bandage.
			20.0		1.39 Nyst.	Removed 10cc
4/11	51		40.0		1.39 Nyst. 0.1 Piper.	lowered temp. Regurgitation is worse
			20.0	Just oatmeal w/ banana/applesauce	Stopped Nyst.	Cleaned crop w/ vinegar
					0.1 Piper. 6cc LR	

			30.0	Diet #7: 1: roudybush 1: oatmeal cereal 2: monkey chow tsp: oatmeal w/ applesauce+banana		*Changed diet. Bird did not throw up as much.
			20.0	Diet #7		
4/12	52	258 g	30.0	Diet #7	0.1 Piper. 6cc LR	flushed w/ vinegar
			30.0	Diet #7	0.1 Piper.	No throwing up!
4/13	53	254 g	35.0	monkey chow diet		Throwing up 45 min after fed.
			35.0	monkey chow diet	0.1 Piper. 0.02 Amik.	Removed old food. Flushed w/ vinegar.
			20.0	monkey chow diet		a little throwing up.
			7.0	monkey chow diet	0.02 Amik.	

4/14	54	256 g	35.0	monkey chow diet	0.02 Amik. 0.1 Piper. 6 cc LR	flushed w/ vinegar bird regurgitating
			35.0	Diet #7		Removed monkey chow food, flushed w/ water.
			15.0	Diet #7	0.02 Amik.	No regurgitation.
			17.0			
4/15	55	244 g	30.0	+0.33 cc Nutrical	0.04 Claforan	changed bandage.
			40.0	+0.33 cc Nutrical	0.04 Claf.	
4/16	56	247 g	35.0	w/o Nutrical	0.04 Claf.	Flushed w/ bi-carb.
			½ piece	monkey chow	0.04 Claf.	
			40.0	+ pinch of Vionate		removed 15 cc
4/17	57	244 g	35.0	w/ Nutrical	0.04 Claf.	Stools are yellowish

			35.0	W/o Nutrical	31 mg Itraconazole (ICZ) 0.04 Claf.	Removed 15cc of first feeding.
			15.0			
4/18	58	250 g			0.04 Claf. 1.55 ICZ 0.03 Bcomp	flushed w/ vinegar 1:5 removed 5cc
			35.0	W/ 2cc Nutrical		
			35.0	+ pinch Pancrezyme	0.005 Depen	No Nutrical
					1.55mg ICZ + Iron	
			15.0	Pancrezyme & yogurt	1.55mg ICZ	Regurgitating
4/19	59	242 g	40.0	Pancrezyme	1.55mg ICZ	removed 17cc smelled fermented (vinegar)

			40.0	Plain form.+ yogurt	1.55mg ICZ	removed 25cc flushed w/ bicarb. Throwing up worse
			30.0	Plain formula	0.33 Ciproflaxacin 6 cc LR 0.03 Bcomp	removed all food - 25cc
			18.0	⇓		
4/20	60	255 g	40.0		0.33 Cipro. 6 cc LR	removed 17cc. Flushed w/ bi-carb. Still regurgitating.
			15.0			removed 8cc
			40.0		0.06 Cipro.	no regurgitation
4/21	61	252 g	40.0		? Cipro. 0.03 Bcomp	removed 18cc flushed w/ bi-carb.
			10.0			

			20.0		0.17 Cipro.	
			20.0			
4/22	62	260 g	45.0		6 cc LR 0.17 Cipro.	flushed w/ bi-carb.
			45.0		0.17 Cipro.	
4/23	63	263 g			0.03 Bcomp 0.005 Depen 3 cc LR	Added more monkey chow to diet.
			45.0		0.17 Cipro.	
			20.0			
			30.0		0.17 Cipro.	regurgitated much

4/24	64	270 g			0.03 Bcomp 0.005 Depen 6 cc LR	still regurgitating
			45.0		0.17 Cipro.	removed 17cc
			20.0			regurgitating
			30.0	Back to diet #7	disc. Cipro.	
4/25	65	264 g	40.0		6cc >R	
			35.0			⇑ monkey chow
			30.0			
4/26	66		45.0		6cc LR	did not flush
			30.0			

			10.0			
4/27	67	275 g	45.0		0.81 Nyst.	Flushed w/ bi-carb
			45.0		0.81 Nyst.	Loose stool.
4/28	68	270 g	50.0		6 cc LR	*changed method of feeding Adding Vionate.
			2 pieces	monkey chow		
			45.0			
4/29	69	278 g	20.0 2 pieces	diet monkey chow	6 cc LR	still full from last night. Changed bandaged. Flushed w/ vinegar.
			3 pieces	monkey chow		stool still soft. Only little regurgitation.
			30.0			

4/30	70	289 g	20.0 2½ piece	diet monkey chow (MC)	Nyst. TID 6 cc LR	flushed w/ bi-carb. Soaked MC w/ corn, p-nut butter, oatmeal.
			2 MC			
			1½ MC			
5/1	71	290 g	4 MC	w/ p-nut butter	1.7 Nyst.	Flushed w/ bi-carb.
			1½ MC			
			30 cc			
5/2	72	300 g	4 MC	w/ p-nut butter corn, oatmeal	1.0 Chloro. 1.8 Nyst.	Flushed w/ vinegar.
			2 MC		1.0 Chloro. 1.8 Nyst.	
			1½ MC		1.0 Chloro. 1.8 Nyst.	

5/3	73	305 g	4 MC	w/ cereal, corn, p-nut butter.	1.0 Chloro. 1.8 Nyst.	Flushed w/ bi-carb. Changed bandage.
			1½ MC		1.0 Chloro. 1.8 Nyst.	
5/4	74	310 g	2 MC	w/ p-nut butter corn, oatmeal	1.0 Chloro. 1.8 Nyst.	
			1½ MC	w/ P-nut butter oatmeal		
			1 MC			
5/5	75	317 g	3 MC	w/ p-nut butter oatmeal, corn	1.0 Chloro. 1.8 Nyst.	Eating millet!
			1½ MC	"	1.0 Chloro. 1.8 Nyst.	
			1 MC		1.0 Chloro. 1.8 Nyst.	
5/6	76	324 g	2½ MC	w/ p-nut butter corn, oatmeal.	1.0 Chloro. 1.8 Nyst.	

			1¾ MC	"	1.0 Chloro. 1.8 Nyst.	
			1 MC		1.0 Chloro. 1.8 Nyst.	
5/7	77	332 g	2½ MC	w/ p-nut butter corn, oatmeal.	1.0 Chloro. 1.5 Nyst.	
			2 MC	"	1.0 Chloro. 1.5 Nyst.	
5/8	78	336 g	2 MC	"	1.0 Chloro. 2.0 Nyst.	Flushed w/ bi-carb. Changed bandage.
			2 MC	"	1.0 Chloro. 2.0 Nyst.	
			1 MC		1.0 Chloro. 2.0 Nyst.	
5/9	79	343 g	2 MC	w/ p-nut butter corn, oatmeal.	1.0 Chloro. 2.0 Nyst.	
			2 MC		1.0 Chloro. 2.0 Nyst.	Flushed w/ bi-carb.

			1 MC		1.0 Chloro. 2.0 Nyst.	
5/10	80	342 g	2 MC	w/ p-nut butter corn, oatmeal.	1.0 Chloro. 2.0 Nyst.	
			1½ MC	"	1.0 Chloro. 2.0 Nyst.	
			1 MC		1.0 Chloro. 2.0 Nyst.	
5/11	81	350 g	2 MC	w/ p-nut butter corn, oatmeal.	1.0 Chloro. 2.0 Nyst.	
			2 MC	"	1.0 Chloro. 2.0 Nyst.	
					1.0 Chloro. 2.0 Nyst.	
5/12	82	350 g	2 MC	w/ p-nut butter corn, oatmeal.	1.0 Chloro. 2.0 Nyst.	

			3 MC		1.0 Chloro. 2.0 Nyst.	
					1.0 Chloro. 2.0 Nyst.	
5/13	83	363 g	3 MC	w/ p-nut butter corn, oatmeal.		just pulled old feed out
			3 MC			
5/14	84		2 MC			
			2 MC			
5/15	85	376 g	2 MC			flushed w/ bi-carb. Doesn't want to give feeding response.
			2 MC			

5/16	86	373 g	2½ MC		2.0 Nyst.	Picking up food on own.
			2 MC			*Moved to cage.
5/17	87		2½ MC			
			2 MC			
5/18	88	380 g	2 MC	w/ mixed veg. + peanut butter	2.0 Nyst.	Giving shelled p-nuts and corn, apple, beet.
			2 MC			
5/19	89		2MC			*Removed bandage
5/22	92			BID hand feeding MC w/ cereal, p-nut butter.	Full strength Nyst. BID	eating on own some; p-nuts, almonds, bread sticks. Passing food w/o bandage.
5/26	96	387 g				
5/29	99	390 g		BID hand feeding same diet ⇑	2.5 Nyst. BID	stools are still occasionally yellowish.

6/5	106	400 g				
6/12	113	412 g		MC rolled in hulled sunflower seeds + chopped p-nuts.	Nyst. BID	weighed w/ food left in crop
6/14	115	400 g			D/C Nyst. 6/13	BID bird eating almonds, Brazil nuts, MC on own.
6/15	116			2 soaked MC w/ warm p-nut butter rolled in hulled sunflower seeds BID		Offered daily: Psittacine mix cracked almonds cracked Brazil nuts hulled sunflower hulled p-nuts corn, grape, banana, wheat bread, steamed veg., green beans and dry monkey chow

For further information or comments, please contact Mike Taylor

palm gif

Small IASlogo

Caloosahatchee Aviary **Palm Manual** **IAS** **Search the Site** **Table of Contents**

Palm Cockatoo chick #4

Hatched 3/24/95

See introduction to Chick #3.

Date	Day	Weight	Amt. Fed	Diet	Meds	Remarks
3/24	1	17.35	0.3cc	Oatmeal w/ Bananas Applesauce and H2O		Good fecal just before feeding. Great feeding response (F.R.).
			0.4	"		Sm.fecal, good F.R., vocal
			0.7	"		Lg.fecal, very hungry, vocal
			0.7	"		No defecation, Exl. F.R.
			0.8	"		Lg. fecal, Exl. F.R.
			1.0	"		Good fecal, Exl. F.R., very vocal
3/25	2	19.0	0.9	"		Added small H2O for ⇑ humidity (skin a little dry)

			1.0	"		Dropped temp 1°F Seemed warm
			0.8	"		Good at 95°F. Very active.
			1.0	"		
			1.1	"		
			1.3	"		
			1.3	"		becoming very responsive to my voice
			1.4	"		
3/26	3	18.2	1.5	"		Good hydration.
			1.5	"		Hungry
			1.0	Macadamia/sunflower broccoli/carrot formula		Seemed chilled, ⇑ temp. to 96° F. Diet given thin.
			1.1	"		Diet a little thicker. Passing formula very well.

			1.5	"		Diet a little thicker.
			1.7	"		Seems to get too hot when temp. is set at 96°F, ⇓ to 95.5° F.
			1.9	macadamia/sunflower, broccoli, carrots, and sweet potato		Removed dish w/ wet towel.
3/27	4	18.3	2.0	"		
			2.2	"		hungry, wanted more but crop full
			2.1	"		gave 0.4 H2O between feedings.
			2.5	"		holding head up well.
			2.6	"		
3/28	5	20.0	3.0	"		chick warm ⇓ to 94°F
			3.0	"		⇑ back to 95°F
			3.3	monkey chow form. (½) + mac/sunflower form. (½)		

			3.5	"		
			3.7	"		
3/29	6	22.9	4.0	"		
			4.0	"		
			4.5	"		put in sm. dish with wet towel for humidity due to dry skin.
			4.7	"		
			5.0	"		
			5.0	"		
3/30	7	28.1	5.0	"		⇓ temp to 94°F
			5.0	"		
			5.4	"		

			5.5	"		eye opening becoming obvious.
			5.5	"		
			6.0	"		
3/31	8	33.3	6.0	"		
			6.0	"		⇓ to 93°F due to temp ⇑ back to 95-95.5°F when set at 94°F.
			6.2	"		
			6.5	"		⇑ temp back to 95°F
4/1	9	39.4	7.0	"		very sensitive to touch, jumpy.
			7.5	"		eye slit more prominent
			8.0	"		Rt. Eye slightly open.
			8.0	"		

			8.0	"		continue to have small dish of H_2O for humidity
4/2	10	44.0	9.0	"		
			9.0	"		
			9.5	"		
			10.0	"		seems to have slight redness around nares.
4/3	11	51.8	10.0	"		
			1.0 H2O			
			10.0	"		eyes _ open
			10.5	"		
			1.0 H2O			
			10.5	"		toes starting to uncurl
4/4	12	58.9	11.0	"		eyes ½ open

			11.0	"		⇓ temp. to 93°F
			11.0	"		
			1.0 H2O	"		lump of formula in crop even though form. is relatively thin.
			11.0	"		for most part, continues to empty crop completely in 5 hours on 11.0 cc formula.
4/5	13	64.1	11.5	"		bird spooks very easily. Gives an alarm call at first touch.
			11.5	"		eyes ¾ open. Can see fat deposits under skin. feather tracts on wings very prominent.
			12.0	"		
			12.0	"		
4/6	14	71.7	12.0	"		
			12.5	"		feather tracks on wings prominent

			12.5	"		
			13.0	"		toes ½ way uncurled.
4/7	15	79.9	13.0	"		feathers starting to emerge - wing
			13.0	"		toes ≈ ¾ way open.
			14.0	"		
			14.0	"		feather tracts visible on top of head, upper legs & back. Eye fully open.
4/8	16	88.1	14.0	"		
			14.0	"		⇓ temp. To 92°F
			14.0	"	Fecal cult. due to	still very sm. amt. of food in crop. ∴ thinned form. slightly for this feeding.
			2.5 H2O	"	yellow stains on towel Neg.	crop still ≈ _ - unusual. Last defecation thicker than usual even though last formula was thin. No behavior changes.
			6.0	"		⇑ back to 93°F

4/9	17	100.4	2.0 H2O	"		1-1.5cc food left in crop. Gave H2O to flush.
			14.0	"		crop empty - very hungry.
			15.0	"		no yellow stains in defecation.
			15.0	"		feathers emerging on wings and top of head.
			2.0 H2O	"		crop ≈ ¼ food left ∴ gave H20
4/10	18	108.7	10.0	"		still some food in crop - not much thinned formula considerably.
			16.0	"		crop completely empty.
			15.0	"		⇓ temp. 92°F
			17.0	"		crop completely empty. Has good foot stomping action.
			17.5	"		

4/11	19	115.6	18.0	"		
			18.0	"		⇓ temp. 91°F
			18.0	"		started leaving lid partly opened, spooks easily if he can't see as he's being moved.
			18.0	"		feet darkening, toes almost completely uncurled.
4/12	20	126.0	19.0	"		crest feathers emerging.
			19.0	"		feathers emerging on upper legs
			19.0	"		
			3.0 H2O	"		still had ≈ 4cc left in crop ∴ gave H2O
			19.0	"		feathers around crop emerging. sm.. amt. food left in crop.
4/13	21	138.0	20.0	"		crop completely empty.

			19.0	"		⇓ temp. to 90°F
			20.0	"		
			3.0 H2O	"		had sm.. "lump" of formula in crop
			20.0	"		feathers emerging along backbone. Toes uncurled. More feathers on head.
4/14	22	151.9	21.0	"		
			5.0 H2O	"		had small "lump" of food ∴ gave H2O.
			21.0	"		
			21.0	"		wings covered w/ pin feathers
			21.0	"		⇑ temp. to 91°F. Spooks easily.
4/15	23	159.4	22.0	"		stands up when upset
			22.0	"		

			22.0	"		
			5.0 H2O	"		crop ≤ ½ full ∴ gave H2O. Feces thicker than usual. Chick not as warm to touch as usual ∴ ⇑ temp. to 91°F
4/16	24	165.6	23.0	"		got out of bowl overnight.
			23.0	"		
			24.0	"		
4/17	25	174.5	24.0	"		
			25.0	"		
			25.0	"		⇓ temp. to 90°F
			24.0	"		passing food well.
4/18	26	187.3	26.0	"		
			26.0	"		⇓ temp. to 89°F

			26.0	"		
4/19	27	195.2	27.0	"		
			27.0	"		
			27.0	"		⇓ temp. to 88°F
4/20	28	199.5	28.0	"		
			28.0	"		
			28.0	"		got out of bowl (medium crock) walks when out of bowl.
4/21	29	211.2	29.0	"		
			29.0	"		
			29.0	"		
4/22	30	222.1	30.0	"		

			30.0	"		brooder alarm went off (set at 90°F) even though brooder has been set at 87°F this a.m.
			30.0	"		the temp. ⇑ in p.m. had to open side panel to ⇓ temp. to 87°F.
4/23	31	228.2	31.0	"		
			31.0	"		
			31.0	"		took humidity bowl out.
4/24	32	240.1	32.0	"		
			32.0	"		
			32.0	"		
4/25	33	242.5	33.0	"		
			35.0	"		tail feathers emerging
			35.0	"		

4/26	34	261.2	35.0	"		
			37.0	"		
			40.0	"		⇓ temp. to 86°F. passing food well.
4/27	35	274.3	40.0	"		
			40.0	"		
			40.0	"		
4/28	36	287.9	40.0	"		⇓ temp. to 85°F. passing food well.
			40.0	"		⇓ temp. to 84°F
			40.0	"		
4/29	37	300.6	40.0	"		
			40.0	"		

			35.0	"		Formula on inside of brooder, occurred btwn 9:00 & 10:00. At 9:00 bird had ≈ 5cc in crop ∴ don't know why it would have slung formula. Crop empty at 10:00. Thinned form. & fed 35 cc.
4/30	38	292.9	40.0	"		
			40.0	"		
			40.0	"		
5/1	39	305.9	40.0	"		
			40.0	"		⇓ temp. To 82°F
			40.0	"		has been getting out of bowl on occasion, ∴ removed bowl.
5/2	40	313.7	42.0	"		
			43.0	"		
			45.0	"		

5/3	41	332.1	45.0	"		covered in pin feathers
			45.0	"		⇓ temp. to 80°F
			45.0	"		observed preening it's leg.
5/4	42	321.5	45.0	"		a lot more feces than usual overnight ≈ 0.5cc form. on inside walls. Bird seems OK. ⇑ temp. to 83°F
			45.0	"		vet recommends culturing feces & formula due to regurgitation.
			45.0	"		
5/5	43	341.0	45.0	"		feathers emerging from sheaths. ⇓ temp. To 82°F.
			45.0	"		
			47.0	"		took two cultures of crop.
5/6	44	345.6	50.0	"		

			50.0	"		preens well
			50.0	"		preening sheaths.
5/7	45	351.2	50.0	"		
			50.0	"		
			50.0	"		
5/8	46	364.7	50.0	"		
			50.0	"		diet culture - *pseudomonus sp.*, vet. - no rx due to bird looking great.
			50.0	"		
5/9	47	373.5	50.0	"		
			50.0	"		
			50.0	"		

5/10	48	384.6	50.0	"		
			50.0	"		
			50.0	"		
5/11	49	382.6	50.0	"		having some trouble zeroing out scale. Formula may have been too thin yesterday. Made thicker today.
			50.0	"		
			50.0	"		
5/12	50	401.9	50.0	"		
			50.0	"		mostly feathered.
			50.0	"		moved to tub - heating pad in a/c
5/13	51	409.9	50.0	"		no heating pad - gets too warm.
			50.0	"		

			50.0	"		
5/14	52	420.0	50.0	"		
			50.0	"		
			50.0	"		
5/15	53	426.6	50.0	"		thermo-regulating well - not using any heat source.
			50.0	"		
			50.0	"		
5/16	54	440.4	50.0	"		
			50.0	"		
			50.0	"		
5/17	55	451.7	50.0	"		

			50.0	"		
			45.0	"		
5/18	56	454.7	50.0	"		
			50.0	"		
			55.0	"		started giving bread sticks
5/19	57	462.3	50.0	"		
			50.0	"		
			55.0	"		
5/20	58	472.4	50.0	"		
			55.0	"		
			50.0	"		
5/21	59	474.6	55.0	"		

			55.0	"		
			55.0	"		tries to perch on finger & climb out.
5/22	60	486.3	55.0	"		started giving fruits and veggies.
			55.0	"		
			55.0	"		
5/23	61	484.3	55.0	"		
			55.0	"		
			55.0	"		
5/24	62	494.1	55.0	"		
			60.0	"		
			60.0	"		

5/25	63	505.4	60.0	"		standing to pick at food more, esp. bread sticks.
			60.0	"		enjoyed cantaloup.
			55.0	"		
5/26	64	515.0	60.0	"		
			60.0	"		.
			60.0	"		
5/27	65	515.1	45.0	"		lost interest in syringe feeding
			60.0	"		exc. feeding response this time
			45.0	"		started to climb out of tub. Flapping wings a lot. Lost interest in syringe.
5/28	66	511.5	41.0	"		total lack of int. in syringe after 40cc
			50.0	"		total lack of int. in syringe after 50cc

			60.0	"		hungry! Picking at solids more - likes apples & broccoli.
5/29	67	518.9	45.0	"		lost int. In syringe feeding
			55.0	"		ate well
			37.0	"		refused after 37cc
5/30	68	511.3	37.0	"		refused after 37cc
			60.0	"		is starting to climb. Started leaving overnight.
			50.0	Feeding all types of fruits/ veg., shelled sunflower, cracked nuts, Mazuri pellets, bread sticks, soaked MC, 3 bowls full/day.		Feed bowl removed over night.
5/31	69	514.4	60.0			
			40.0			
			45.0			
6/1	70	506.0	60.0			

			60.0		
			45.0		ate fair, stops a lot
6/2	71	511.5	42.0		ate well but shut down early
			60.0		
			40.0		doesn't like me- tongued it & spit out
6/3	72	502.0	38.0		only gave F.R. for 2 then tongued rest
			30.0		great F.R.
			38.0		ate good at first then slowed
6/4	73	501.0	38.0		
			40.0		reduce noon feeding
			40.0		

6/5	74	499.0	28.0		
			30.0		F.R. for a short time
			45.0		
6/6	75	500.0	35.0		
			30.0		good F.R. but also playing w/ food
			45.0		
6/7	76	491.1	60.0		
			30.0		eating well out of a.m. pan
			30.0		gave dish overnight w/ dry MC, Mazuri pellets, sunflower, nuts.
6/8	77	484.2	50.0		ate OK, weight down
			27.0		

			50.0		
6/9	78	493.0	10.0		Poor FR, tried feeding MC - no go.
			10.0		starting to get powder down
			≈35.0		took quickly then "shut off"
6/10	79	487	1 MC soaked		absolutely no interest in syringe. Took the hand feeding of MC well.
			¾ MC		discontinue noon feeding.
			49.0		
6/11	80	494	27.0		
			45.0		
6/12	81	499	30.0		
			60.0		

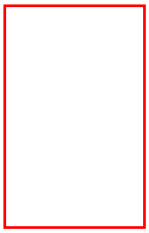
6/13	82	498	40.0		
			60.0		
6/14	83	507.8	50.0		
			55.0		
6/15	84	510.8	29.0		
			40.0		
6/16	85	505.8	30.0		
			60.0		
6/17	86		50.0		
6/18	87		35.0		refusing a.m. syringe feeding plays more than eats.
			60.0		discontinue a.m. feeding

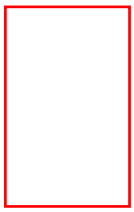
6/19	88	510.0	60.0			staying outside full time.
6/20	89	520.0				
6/21	90	510.0	60.0			great FR
6/22	91	510.0	60.0			
			40.0	"		

6/24	93	Started hand feeding 1 - 2 soaked monkey chow biscuits in the a.m.
7/7	106	Discontinued with the a.m. monkey chow feeding due to bird losing interest in eating from the food dish. Bird also started "whining" every time people got close to him.
7/21	120	Reduced the p.m. feeding to 55cc of formula to begin weaning off the formula. Also started giving 2 pans of adult diet in an effort to stimulate him to start picking at the food again.
7/29	128	Reduced the p.m. formula to 50cc.
8/2	132	Reduced the p.m. formula to 40cc.
8/4	134	Discontinued p.m. formula feeding and hand fed 2 soaked monkey chow instead.
8/20	150	Pans hardly touched.
8/24	154	Started feeding one soaked monkey chow in the a.m. and one in the p.m. Moved to the macaw run next to another hand-raised palm cockatoo.
8/27	157	Started feeding 2 soaked monkey chow in the a.m. and p.m. due to weight loss.
8/28	158	Started on Nystatin orally, TID for 7 days due to Candida being cultured from the bird’s crop. Also started feeding 40cc of the Palm formula in the a.m. and p.m.

9/1	162	Started on ½ of a 5 mg tablet of Baytril orally, BID for 14 days due to coughing.
9/25	186	Discontinued a.m. formula feeding.
10/1	192	Bird has started "whining" again. Took a crop and fecal culture. Also did a crop wash - one hyphenae seen & what could be early signs of a yeast infection. Started back on 1.7cc of Nystatin oral, BID for 14 days. Continued feeding 40cc of Palm formula in the p.m.
10/ 12	203	Weight has been stable around 530 grams.
10/ 14	205	Discontinued the p.m. formula feeding. Bird continues to "whine " when around people.
10/ 17	208	Started feeding 40cc of the Palm formula in the p.m. again. Also started back on ½ of a 5mg tablet of Baytril orally, BID.
10/ 24	215	Bird aspirated while being given the Baytril and Nystatin in the a.m. Put on oxygen for 1 ½ hours. Bird was also given Dexamethasone.
11/2	224	All meds were discontinued.
11/6	228	Reduced p.m. formula to 30cc.
11/ 19	241	Reduced p.m. formula to 20cc - started feeding the monkey chow formula.
12/2	254	Discontinued p.m. formula feeding. This bird is weaned. The a.m. and p.m. pans continue to consist of a large variety of fruits and vegs, soaked and dry MC , nuts and Mazuri parrot pellet

For further information or comments, please contact Mike Taylor





Caloosahatchee Aviary **Palm Manual** **IAS** **Search the Site** **Table of Contents**

Palm Cockatoo chick #5

Hatched 12/29/84

This chick was parent-raised to 44 days of age. I do not know what was the cause of death. The letter I found attached to these notes indicated that the parents consumed meat while feeding the chick but not at all after the chick died. It also indicated that the chick was taken out daily for photographs and weights.

December 30, 1984 Day 1: Chick has been fed this morning by its parents and looks healthy.

December 31, 1984 Day 2: The chick seems to be to light in color. The crop has food, but certainly is not full. Perhaps the chick was chilled. It is quivering, can't hold its' head up and does not cry.

Day 3 to Day 7: Chick observed once or twice daily. Adult bird, usually the male, reluctant to leave the nest barrel. Red marks appear on chick, but are not long-lasting.

January 5, 1985 Day 8: Weight is 53.6 grams at 9:00 AM with a full crop. Could hear the chick crying when I entered the aviary.

Day 9 to Day 14: Chick observed once or twice daily when the adults were fed. Extra rations include chicken, beef bones, corn, peanuts, fruits and vegetables plus extra quantities of seed. Chick continues to be bruised from time to time. A light was installed so that the adults would be able to ward off rats or other predators at night.

January 12, 1985 Day 15: Weight is 132.6 grams. Crop full. Bruises over the mantle and on the chin. Under the mandible, the 2 red marks could possible be from overzealous feeding by the adult.

Day 16 to Day 20: Chick continues to develop, but very slowly. The adult birds are attentive and have to be chased out of the nest barrel when the youngster is checked.

January 18, 1985 Day 21: Weight is 201.6 grams. Slight indication of feathers and normal development.

Day 22 to Day 23: Chick continues to have some bruise marks in spite of constant light at night. Checked for red mites but did not secure any in the barrel.

January 21, 1985 Day 24: Weight is 250.5 grams. Parents less attentive to the chick, however, the crop is always full.

January 22, 1985 Day 25: Continue to supplement diet.

January 23, 1985 Day 26: Adult birds are almost always out of the nest barrel. The most attentive is still the male. The chick continues to be well fed. Plants were chewed up and dropped under the nest barrel, so green beans were fed to them for the first time.

Day 27 to Day 28: Feathering is coming in nicely. The crest is barely starting to show. The chick is almost always sitting upright when the nest is checked in the morning.

January 26, 1985 Day 29: Weight is 305.2 grams. Feathers continue to expand daily. Chick was very aggressive when photos were taken. It reacts well to movement and is very alert. Feet are formed normally. Put in new mineral supplement.

January 28, 1985 Day 31: At the 10:00 AM check, the chick had not been fed much. The adults are much less interested in the nest barrel and in food. The crop was not completely full at 3:30 PM either, but the chick had been fed.

January 29, 1985 Day 32: Weight is 343.2 grams. There is wood chewing in the enclosure and some has been dropped by the nest barrel. Can't tell if any has been taken into the barrel, but the chick stands in a clean area.

February 5, 1985 Day 39: Weight is 437.3 grams. Pin feathers are in but none have broken yet. The bird blushes pink and makes a variety of calls now. It walks well in the nest barrel and moves from place to place daily. Crop about ¼ full at 8:30 AM and full at 1:30 PM.

? Black Palm Cockatoo was checked by Richard Hart, local representative of the American Federation of Aviculture. He commented about the length of the unbroken quills. The bird seems to develop slowly, and Richard is going to see if he can find any information about other closely related species.

February 8, 1985 Day 42: Weight was very difficult to get today because the chick constantly moved; it is about 456.2 grams. As the bird becomes upset, the color change in the cheeks is clearly visible.

February 9, 1985 Day 43: The crop is very low; the chick is not being fed much. There is wood chewed outside the nest barrel, and also a few pieces inside. The first quill feathers on the back are open at the tips.

February 10, 1985 Day 44: I have been increasingly concerned about the quantity of food being fed to the chick. An 8:00 AM check increased my concern because the crop was completely empty. By 9:30 the adults had gone to eat; the walnuts, peanuts, corn and fruit had been scattered (but feral birds are also in the cage - although they could not have cracked the nuts). At 12:30 PM the chick had been fed a small amount. At 4:00 PM there was about 1 tablespoon of hard material in the crop. The vigor in the bird today was what I would expect, a nice change from the lethargy observed yesterday.

Chick died.

Palm Cockatoo chick #6

Hatched 5/25/95

This chick was the first palm cockatoo chick this person has ever tried to raise. They have been raising psittacines for many years. At first they thought the problem with the chick was "reflux" - a type of digestive problem. After reading The Large Macaws by Joanne Abaramsom, *et al.*, they feel the problem their chick had was "crop stasis". When this condition occurs in macaws it is recommended in The Large Macaws to use a proventriculus tube to bypass the crop. I do not know of anybody who has tried this with palm cockatoos.

Black Palm Cockatoo hatched May 25, 1995 or late May 24th, 1995 by foster parents -- African grays; fed by foster parents for the first 24 hours. Pulled chick May 26, 1995 to be sure it had been fed, which it had. Baby kept on bottom heat (92-degrees) with cup of water in same container as chick, this was covered with strawberry container so chick would not fall into water. Psittacine chicks naturally gravitate to water and will drown in 1 cc or less.

Chick was perfect and appeared to have perfect hatch, nothing wrong with the shell.

weight 12 or 14 grams

Started on Pediolyte--used 0.3 cc insulin syringe.

May 27, 1995: Started on dilute formula mixed with Pediolyte.

Formula

3 parts Monkey chow

2 parts ground sunflower

2 parts ground peanuts

3.5 parts Gerber Hi-Pro

Aquarium salt

Powdered soy milk

(Not my recipe--put together by Ralph Small for African gray parrots and I have used it since 1982 on cockatoos).

May 28, 1995: Continued formula diluted with Pediolyte (approximately 1 cc per feeding). Continuing to feed every 3-4 hours, as needed.

May 29, 1995: Weight 18 grams.

June 1, 1995: Eye slit showing.

June 2, 1995: Little tail stub--looks like macaw.

June 3, 1995: Crop slow in emptying. Dropping's color changed green to black. Started powdered Nystatin with formula x 2 daily.

June 4, 1995: Weight 24 grams--weighing chick with the crop the same size because it is not totally emptying.

June 5, 1995: Fecal cultures for bacteria and yeast done.

June 7, 1995: Weight 38 grams. Started Baytril for bacteria and Fluconazole to prevent Candida which antibiotics cause in chicks. (Fluconazole more effective because it is systemic Nystatin is only topical.)

June 10, 1995: Feather tracts appearing.

June 13, 1995: Shoulder and head feather tracts appearing. Chick wants more food and less heat. Formula increased small amount max 5 cc.

June 14, 1995: Last day of Baytril. Continued Fluconazole 3 more days x 2 daily--can develop yeast infection if you don't do this.

June 15-16, 1995: Quiet; no problems, eat, sleep and potty.

June 17, 1995: Still feeding small amounts 3-4 times daily. Cannot feed as much as suggested in chart, chick simply could not hold it.

June 21, 1995: Weighed twice, 1 weight was 80 grams, second 90 grams (problem with scales).

June 23, 1995: Continuing to grow, feathers appearing, weight 92.6 grams; crop not empty but same size as in previous weights.

June 26, 1995: Weight 107 grams. Feeding 9 cc z 3 daily. Repeat cultures negative.

June 30, 1995: When chick through with formula crop appeared to get larger, as if formula was going up instead of down, and I called it a reflux.

July 1, 1995: 145 grams; crop not empty but approximately same size as when previously weighed.

July 4, 1995: White cheesey looking stuff in back of chick's mouth. Culture done--negative. Stuff disappeared when chick swallowed. I was afraid of fungal infection so started Nystatin then switched to Fluconazole for 10 days.

July 6, 1995: 183.5 grams; after talk with Charlie Osterbrink changed formula; started

3 parts Kaytee Exact

2 parts Gerber Oatmeal

Something just was not right at this point in the chick's life. Vet suggested Ensure Plus-High Calorie. I was apprehensive about the high sugar content, but fed some anyway.

July 17, 1995: Finished Fluconazole.

July 26, 1995: 9 days later from time we finished the Fluconazole saw white stuff back in the mouth again; did not want to put chick back on medicine so went to Health Food Store (See copy of Candida causes, cure and alternatives); bought lactobacillus and caprylic acid thinking we possibly were dealing

with a fungal problem. Chick had been crying a lot as if hungry so went back to original formula and added lactobacillus and caprylic acid. This seemed to have a very soothing effect because chick quit crying so much, pottied more and slept better.

July 27, 1995: Much better day; white stuff gone; cheeks more flushed; continuing lactobacillus and caprylic acid x 2 daily. (Nutrition encyclopedia-caprylic acid is an essential fatty acid made from coconut.)

NOTE: Somewhere along in here I talked with M. Hayes and she felt the white stuff was something that was disagreeing with the chick and asked what the formula had in it. When I told her the contents of the formula she did not feel that there was anything in the formula to cause this problem.

July 28, 1995: Very small amount of white stuff in back of mouth.

July 30, 1995: White stuff is gone.

August 6, 1995: Mouth still clean; discontinued lactobacillus and caprylic acid.

August 9, 1995: Chick crawled out of box x 2. Chick still on low heat--seemed to still want the warmth; was put in taller box.

August 10, 1995: Chick picked up Cherrios and played with toys.

August 11, 1995: Crop started to empty slowly again; crop still not totally empty. Repeat cultures negative. Chick almost fully feathered. Back on Lactobacillus and caprylic acid x 2 daily.

August 14, 1995: Increased caprylic acid to 3 times daily.

August 22, 1995: Crop not emptying as much as should--turned sour--to Vet--crop aspirated. During second aspiration chick closed eyes as if it might pass out. Blood panel done. Weight 400 grams. Gave Infalyte (which is ricelyte) plus Earth's Best apple sauce (no preservatives no additives).

August 23, 1995: Talked with M. Hayes and she said Dr. Graham told her to keep formula thin and oily. In the past she had used dietary supplements like Nutri-cal and Stat (an animal sterol).

August 24, 1995: Crop not emptying well in spite of aspirations or being cleaned out.

August 25, 1995: Continued Pediolyte and alternating with Infalyte and dietary supplements.

August 26, 1995: Gave small amount of formula diluted with Pediolyte. Added ½ teaspoon Stat to 5 cc of Pediolyte. Fed only as chick cried and acted hungry. Do not remember number of times chick fed.

Slept 16-20 hours straight that night, as if totally exhausted.

August 27, 1995: Weight 355.8 grams. First feeding added papaya enzyme to diluted formula. No contractions felt in crop. No sour odor. Small amount of fecal material. 1 PM chick wanted to pump as if being fed. It held onto the finger of one hand and the other hand was on the crop, felt good contractions, first time in 2 days. 8:30 PM got in touch with Mathew Bond, D.V.M..

August 28, 1995: Followed through with his instructions needed to get digestive system working again. Blood transfusion, 5 cc fresh blood; 2 hours after that (6 PM) fed 15 cc of Kaytee Exact. Crop bra put in place due to stretching of crop from regurgitation. 10 PM crop felt empty, 15 cc Kaytee Exact given.

August 29, 1995: 12:45 AM chick died. 1 AM owner fixed strong drink!

Palm Cockatoo chicks raised at Riverbanks Zoo

Hatched 1996

Riverbanks Zoological Park raised two chicks in 1996. They had no problems with the first chick. The second chick did not want to wean, but it turned out fine. They used a commercial diet - Kaytee Exact Macaw Hand Rearing Formula.

Day 1-2

36.8 °C and 80% RH (we left the chick in the Grumbach for several days).

1 part Kaytee Exact : 6 parts lactated ringers, fed every 2 hours from 08:00-22:00.

A probiotic was added to the food (Lacto Plus) and Nystatin was used to prevent *Candida* overgrowth; dose in cc's = body wight / 400 BID. With the second chick, we decided not to use the Nystatin. There have been no problems and we continue to clean the mouth religiously after feeds.

Day 3-4

Dilution of food varied from 3:1 to 4:1, depending on rate of digestion. Feed interval increased to about

3 hours.

Day 5-onwards

Feed interval increased to 4-5 hours. We were not completely happy with the rate of digestion; on the advice of ABRC we started adding peanut oil to the Kaytee diet of the first chick. The oil made up 10% of the whole formula. The second chick did not have peanut oil added and seemed to grow as normally as the first chick. Liquid feeds of lacted ringers were also given between main feeds, which significantly improved the rate of digestion/crop motility without affecting weight-gain.

Day 47

2 feeds per day of up to 75cc. Bird kept at room temperature.

Day 60

Starting to pick at food items.

Kaytee Exact

Crude protein (min) 22%

Crude fat (min) 8%

Crude fiber (max) 5%

Moisture (max) 10%

Weight gains of two chicks raised in 1996.

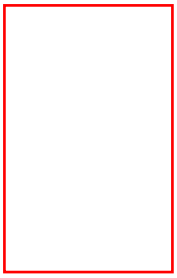
Age/Day	First	Second
1	17.95	18.9
2	21.1	21.4
3	18.0	24.3

4	**20.7**	**27.8**
5	**21.3**	**31.4**
6	**24.5**	**36.6**
7	**27.7**	**41.9**
Age/Day	**First**	**Second**
8	**33.3**	**43.4**
9	**37.2**	**52.9**
10	**45.5**	**61.4**
11	**48.6**	**69.1**
12	**56.5**	**75.5**
13	**65.3**	**81.1**
14	**76.9**	**89.2**
15	**83.3**	**101.2**
16	**88.2**	**110.9**
17	**101.3**	**122.8**
18	**114.0**	**135.1**
19	**121.5**	**140.0**
20	**135.9**	**151.0**
21	**149.2**	**174.9**

22	**150.0**	**176.0**
23	**169.4**	**192.2**
24	**177.7**	**214.1**
25	**193.4**	**231.3**
26	**214.5**	**238.0**
27	**233.1**	**247.4**
28	**256.3**	**259.4**
29	**269.3**	**275.6**
30	**289.7**	**293.0**
31	**300.3**	**312.7**
32	**314.5**	**336.7**
33	**323.6**	**354.9**
34	**339.2**	**368.7**
Age	**First**	**Second**
5 weeks	**353.2**	**390.4**
6 weeks	**461.5**	**463.4**
7 weeks	**501.0**	**504.5**
8 weeks	**555.0**	**532.7**
9 weeks	**598.8**	**615.7**

10 weeks	**544.4**	**627.1**
11 weeks	**510.0**	
12 weeks	**515.0**	**655.0**
27 weeks		**570.0**
32 weeks	**528.0**	

For further information or comments, please contact Mike Taylor



Caloosahatchee Aviary **Palm Manual** **IAS** **Search the Site** **Table of Contents**

Palm Cockatoo chicks raised at St. Catherine's Island Survival Center

Hatched 1996

St. Catherine's Island Survival Center raised two chicks in 1996 without any problems on Pretty Bird 19/12 Hand-rearing Formula. The only change to the basic diet was the addition of a small amout of peanut oil to the diet when the chicks started feathering.

This is a general guide. Please use your judgement as the chick develops.

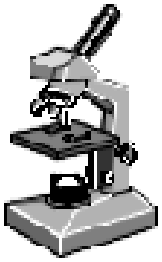
A small amount of peanut oil was given to the chicks when they started feathering.

Age	Exp. Weight	Brooder Temp.	Pretty Bird formula/H2O	Amt. Fed per Feeding	Feeding Schedule
Hatch	16g (20g) (goliath wts)	95-99 °F	1:5	0.1 - 0.2 ml	6 hrs after hatch
1	17g (22g)		1:4	0.3 ml work up to 1.0 ml	every 2 hrs w/ a 4 hr
2	18g (23g)		1:4	1.0 - 1.3 ml	break 2-6 am
3	20g (24g)		1:3.5	1.5 - 1.75 ml	
4	21g (27g)	95 °F	1:3.5		
5	24g (29g)		1:3	2.0 - 2.5 ml	every 3 hrs
6	27g (33g)		1:3		6 am to

7	**30g (36g)**		**1:3**	**3.0 - 3.5 ml**	**midnight**
week 2 **8 to 14**	**32g (40g)** **60g (73g)**	**92 - 95 °F**	**1:2.5**	**Inc. amt. daily by 0.5 to 1.0 ml**	**every 4 hours**
week 3 **15 to 21**	**66g (80g)** **102g (121g)**		**1:2.5**		
week 4 **22 to 28**	**153g (194g)**		**1:2.5**		
week 5 **29 to 35**	**208g (271g)**	**86 - 90 °F** **when pin feathers emerge**	**1:2.5**	**Increase amount daily by** **1.5 - 2.5 ml**	**every 6 hours**
week 6 **36 to 42**	**260g 338g)**		**1:2.5**		
week 7 **43 to 49**	**310g (370g)**		**1;2.5**		
week 8 **50 to 56**	**349g (410g)**		**2:3** **adult diet**		**every 8 hours**
week 9 **57 to 63**	**389g (438g)**		**2:3** **adult diet**		
Age	**Exp. Weight**	**Brooder Temp.**	**Pretty Bird formula/H2O**	**Amt. Fed per Feeding**	**Feeding Schedule**
week 10 **64 to 70**	**399g (489g)**		**2:3** **adult diet**		

week 11 **71 to 77**	**417g (508g)**	**2:3** **adult diet**	
week 12 **78 to 84**	**428g (544g)**	**2:3** **adult diet**	
week 13 **85 to 91**	**443g (577g)**	**2:3** **adult diet**	
week 14 **92 to 98**	**450g (577g)**	**2:3** **adult diet**	
week 17 **119 to 125**	**450g (580g)**	**weaned**	**12 hours (BID)**

For further information or comments, please contact Mike Taylor

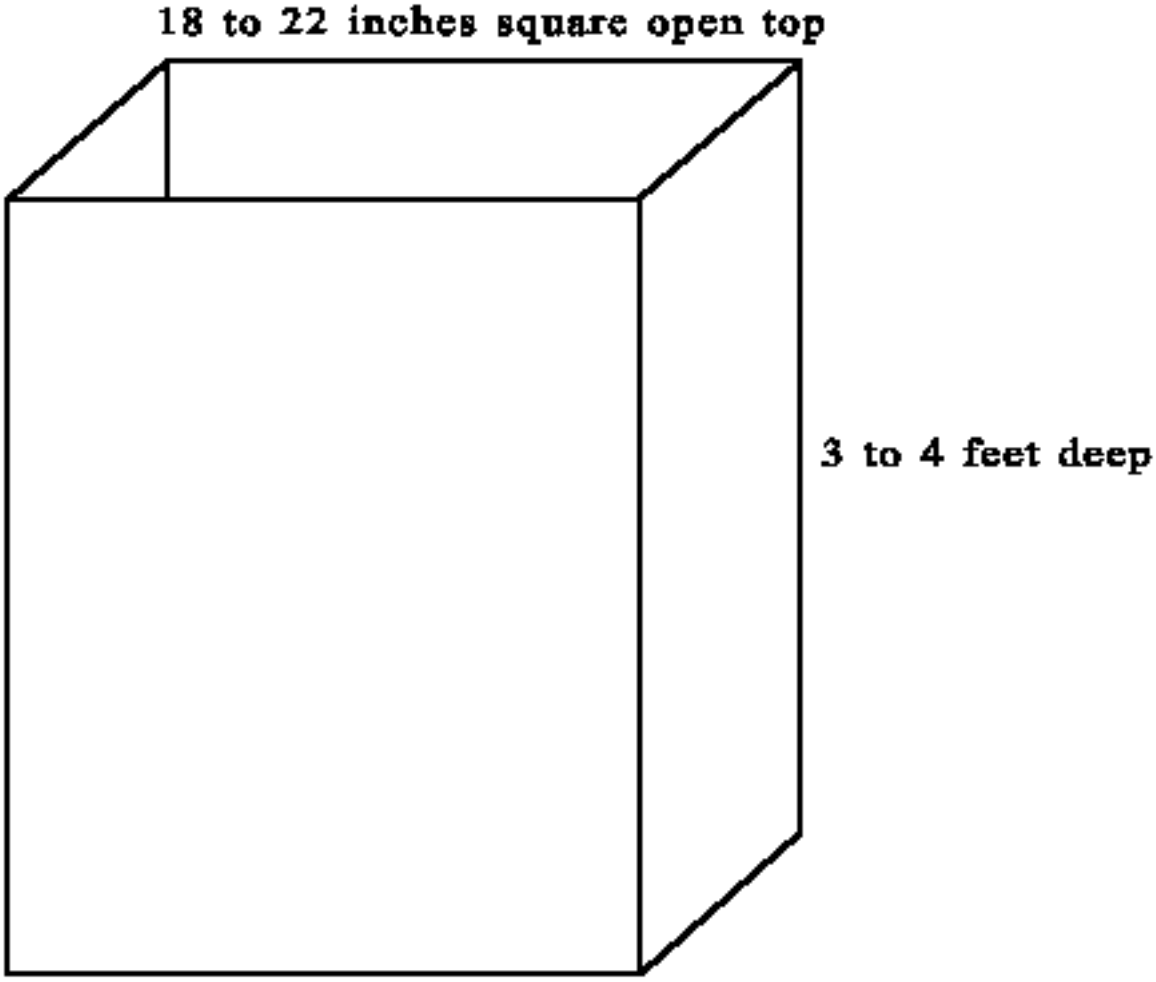


Caloosahatchee Aviary **Palm Manual** **IAS** **Search the Site** **Table of Contents**

Appendix 1

Nest Box Examples

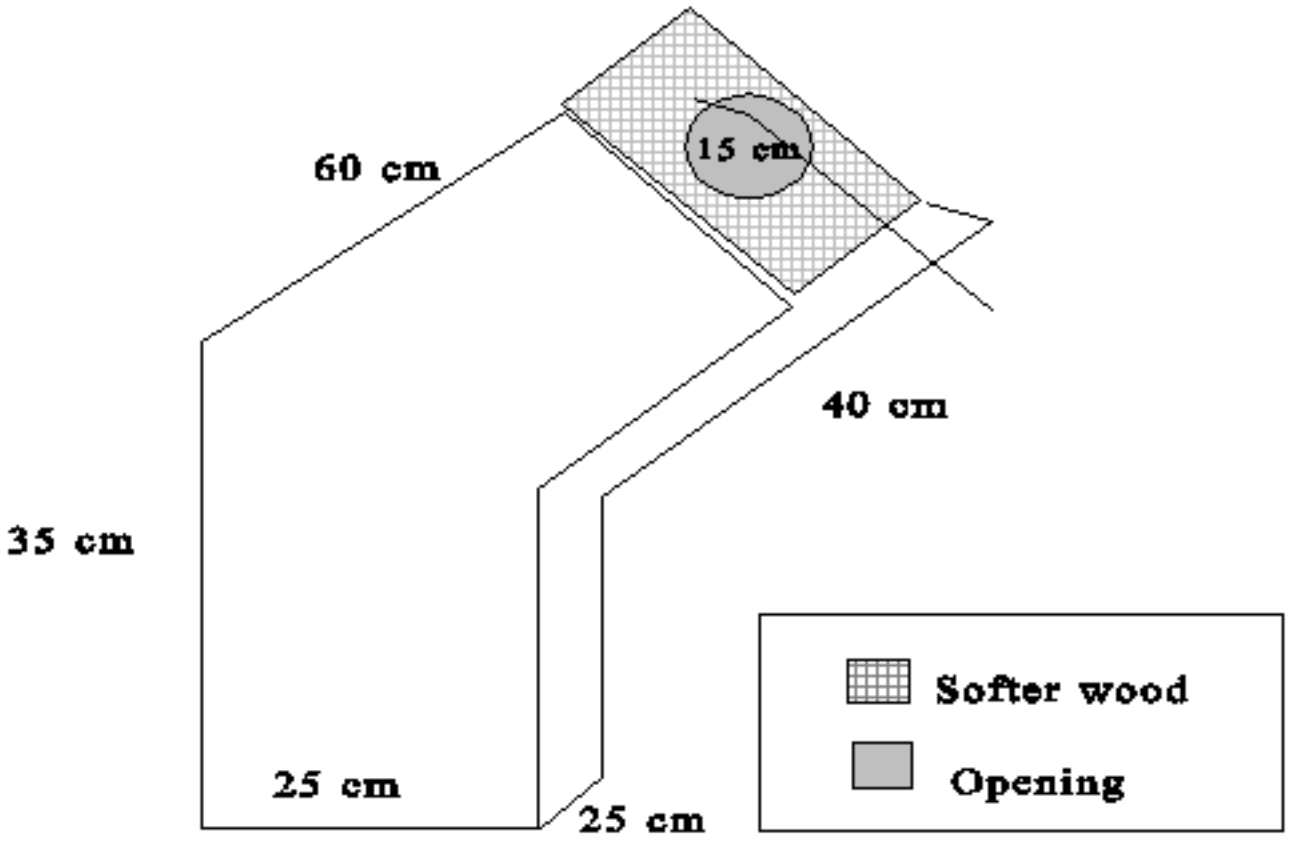
-



Open Top Style

Open top boxes can be made with ¾" to 1" plywood or, if a particular pair tends to chew the plywood too much, similar sized hardwood planks can be used. There should be at least two feet of clearance above the box to allow the birds to comfortably perch on the edges. This allows the birds to drop the splinters, which make up their nesting material, into the box.

Palm Cockatoo nest box used at the Rotterdam Zoo



This slanted entrance nest box is constructed from "Trespa", an extremely hard material formed from layers of paper pressed together under extremely high pressure. The nest boxes have very wide openings over which replaceable entrances of much softer wood of the appropriate thickness is mounted. The wood used for the palm cockatoos is at least 2 cm thick. (King, C., pers. comm.)

For further information or comments, please contact Mike Taylor

[Caloosahatchee Aviary](#) [Palm Manual](#) [IAS](#) [Search the Site](#) [Table of Contents](#)

Appendix 2

Manufacturer List

Grumbach Incubator, Swan Creek Supply, Inc., 12240 Spencer Road, Saginaw, Michigan 48603

Humidaire Incubator, The Humidaire Incubator Co., Department W, 217 West Wayne Street, New Madison, Ohio 45346

Closed leg bands, DL Products, 1550 Clark Street, Arcadia, CA 91006: 818-359-5048,

FAX 818-303-2497

Pedialyte, Ross Labs, 3700 Corporate Drive, Columbus, OH 43231

Necton USA Inc., 14405 60th St. North, Clearwater, FL 34620: 813-530-3500

Gerber Products Co., Mfr., General Office, Fremont, MI 49413

Zupreem Primate Diet, Hills Pet Products, P.O. Box 148, Topeka, KS 66601

Exact Hand-Feeding Formula, Kaytee Products, 292 Grand, P.O. Box 230, Chilton, WI 53014

Lakes Hand-Feeding Formula, Lakes Minnesota Macaws, Inc., 639 Stryker Ave., St. Paul, MN 55107

Manufacturers of Adult Psittacine Diets.

Abba Products Corp., Dept. BT, P.O. Box 122, Elizabeth, NJ 07207.

Dr. D's/Avi-Sci Inc., Dept BT, P.O. Box 598, Okemos, MI 48805: 800-942-DIET.

Harrison's Bird Diets Inc., Dept., BT, 5770 Lake Worth Rd., Lake Worth, FL 33463.

Kaytee Products, 292 Grand, P.O. Box 230, Chilton, WI, 53014.

Kellog Inc., Dept BT, P.O. Box 684, Milwaukee, WI 53201: 800-627-5495.

Lafeber Co., Dept., BT, RR No.2, Odell, IL 60460: 800-842-6445.

Premium Nuritional Products, Inc., P.O. Box 2094, Mission, Kansas 66202: 800-345-4767.

Pretty Bird International Inc., Dept. BT, 1170 Eagan Industrial Rd., Eagan MN 55121

(800) 356-5020.

Purina Mills Inc., Dept BT, P.O. Box 66812, St. Louis, MO 63166-6912.

Roudybush, Dept BT, P.O. Box 908, Templeton, CA 93465-0908: 800-326-1726.

Scenic Bird Food/Marion Zoological Inc. Dept. BT, P.O. Box 212, Marion, KS 66861

(800) 327-7974.

Sqoz/Topper Bird Ranch, Dept. BT, Rt. 19, Box 529, Lexington, NC 27292.

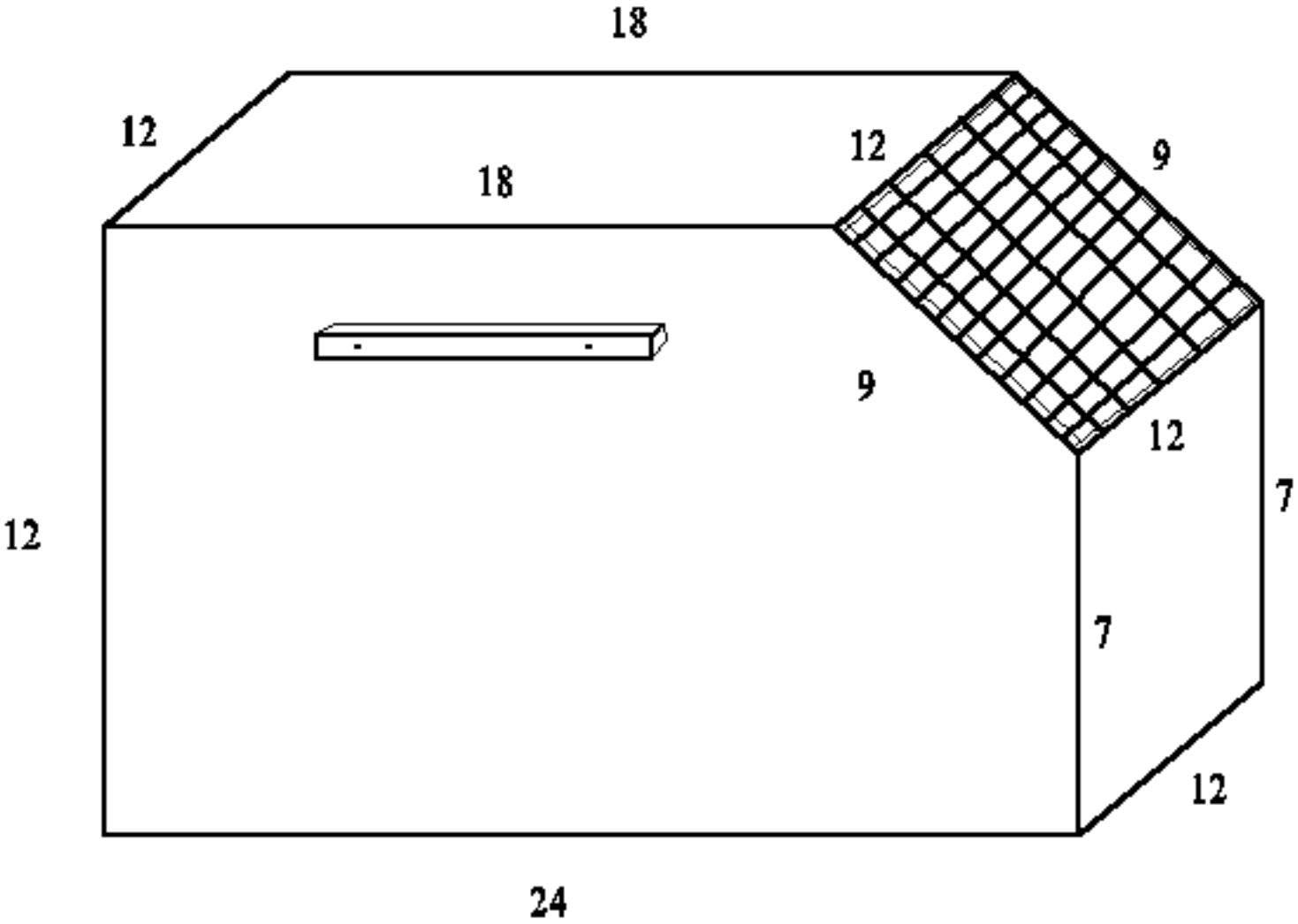
Tropican/Rolf C. Hagen (U.S.A.) Corp., Dept. BT, 50 Hampden Rd., Mansfield, MA 02048.

Ziegler Bros. Inc., Dept BT, P.O. Box 95, Gardners, PA 17324-0095: (800) 841-6800.

For further information or comments, please contact Mike Taylor

[Caloosahatchee Aviary](#) [Palm Manual](#) [IAS](#) [Search the Site](#) [Table of Contents](#)

Appendix 3



Shipping Crate used by ABRC

For further information or comments, please contact Mike Taylor

[Caloosahatchee Aviary](#) [Palm Manual](#) [IAS](#) [Search the Site](#) [Table of Contents](#)

Appendix 4

IATA Guidelines

Reprinted from: International Air Transport Association's (IATA) Live Animals Regulations, 21st Edition, Effective 1 October 1994.

GENERAL CONTAINER REQUIREMENTS FOR BIRDS (CR 11-25)

Design and Construction

When constructing containers for shipment of birds, the normal habits and necessary freedom of movement must be considered.

For general transport purposes, birds will be carried only in closed containers. The container must be well constructed and be able to withstand other freight damaging it or causing the structure to buckle or collapse. It must be constructed of non-toxic materials. Chemically impregnated wood may be poisonous and must not be used.

The container must be suitable to keep the bird inside at all times and protect the bird from unauthorized access. The door must be constructed so that accidental opening cannot occur, either from the inside or the outside.

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

Wooden perches must be provided for birds that rest by perching. There must be sufficient perch space for each bird inside the container and enough height for the bird to perch with its head upright and its tail clear of the floor. The diameter of the perch must be large enough to permit the bird to maintain a firm, comfortable grip with its claws. The perches must be placed so that droppings do not fall into the food and water troughs, or onto other perching birds. Non-perching birds must be able to stand upright except in the case of pheasants.

The container must be clean and leak-proof. If it is being reused, it must be thoroughly disinfected or

sterilized. Absorbent bedding must be provided by the shipper that is suitable for the species. Straw is unacceptable as many countries prohibit its importation.

Handles and/or spacer bars must be provided to facilitate handling and preventing the ventilation openings becoming blocked by other freight.

If forklift spacers are required they must be at least 5 cm (2 in) thick. Allowance for the extra height must be made when calculating the dimensions of the container.

Dimensions and Stocking Density

Dimensions of containers shown in the Regulations are illustrative and therefore must be related to the actual size of the bird for which the container is constructed. Quantities of birds must be limited to permit sufficient perch space so that each bird can perch at the same time.

Ventilation

The container must be adequately ventilated on at least three sides, with the majority of the ventilation being provided on the upper part of the container. There are exceptions to these requirements which are stated in the specific container requirement for that particular species.

The ventilation openings must be small enough or baffled to prevent the egress of the bird and to avoid any part of the bird to protrude from the container. When ventilation openings are to be covered with wire mesh, the edges must have suitable protection to prevent injury to the birds. For small birds, all the openings must be covered with wire mesh.

Feeding and Watering

Separate food and water troughs must be provided, either fixed inside the container or attached to it so that they are accessible for replenishment purposes. They must have rounded edges and be made of non-toxic material suitable for the species. Their ends and sides must have a flange to prevent spillage of water and food. Precautions must be taken to reduce the risk of drowning by floating a sponge or other suitable material on the surface of the water in the trough. Soldered tin water containers may be poisonous and must not be used.

Shipper’s instruction for feeding and watering must be given in writing at the time of acceptance. Feeding

and watering instructions must be affixed to the container and a copy of the instructions must accompany the shipping documents. Any feed or water given must be recorded on the container instructions with the date and time of supply.

Food must be provided by the shipper, but it must be checked that it does not contravene any regulations of the country(ies) of transit or importation. In the case of sealed container, feeding is not possible and the shipper must be aware of this fact. Likewise, products of animal origin, such as meat or food containing meat, must not be accepted inside the container for the same reason.

Labeling and Marking

The container must be correctly labeled and marked with the consignee's name, address and telephone number. Labels must not block ventilation holes, especially on small containers.

Special Care

For species which are obviously disturbed by the shipment, reducing the light within the container and the noise level within its vicinity will usually be sufficient to quieten the bird. They must be held in a darkened area with as little noise as possible nearby.

Important Notes

Many bird species including all parrots are listed in the CITES appendices (see 6.2). It is imperative that the appropriate CITES documentation is completed before acceptance of shipment. Such documents must accompany the shipment as well as the usual shipper's and health certification, export and import permits or licences. All CITES controlled species must be packed in accordance with the IATA Live Animals Regulations. See Chapter 11 for CITES requirements.

It is also a legal requirement by many governments that have incorporated the Regulations into their National Legislation in regards of the shipment of live animals by air. Therefore care must be taken that compliance is evident at the time of live animal shipment acceptance.

In addition to the above General Requirements, the Specific Requirements that are relevant to the individual species must be consulted and adhered to.

The illustrations shown in the following specific container requirements are examples only. Packages that conform to the principle of the written guidelines for the species but look slightly different will still meet the IATA standards.

IATA CONTAINER REQUIREMENT 11

Basic requirements applicable to all species of birds. *See Exceptions CNG-01, GBG-10 and USG-01 in Chapter 2*

Note 1: *Special conditions applicable to small and medium seed-eating birds, small and large parrot-like birds, fruit-eating birds, insect-eating birds, small game birds and small wading birds are laid down in Container Requirements 11A to 11H.*

Note 2: *For individual or small shipments of birds see Container Requirement 23.*

1. DESIGN AND CONSTRUCTION

(see Exception QF-01 in Chapter 3)

Materials

Wire mesh, wood, non-toxic plastic, fibreglass, synthetics and muslin or other light material.

Principles of Design

The following principles of design must be met in addition to the General Container Requirements outlined at the beginning of this chapter.

When constructing containers for shipment of birds, the normal habits and necessary freedom of movement

must be considered.

Wooden perches must be provided for such birds that rest by perching. The diameter of the perch must be large enough to permit the bird to maintain a firm, comfortable grip with its claws. The perches must be placed so that droppings do not fall into the food and water troughs, or onto other perching birds. They must also allow head room, so that a bird can move on and off the perch without hitting the top of the compartment/container and to perch without the tail being damaged, but perches must not be place too high off the floor.

Quantities of birds must be limited to permit sufficient perch space so that each bird can perch at the same time. In addition, for small birds no more than approximately 50 must be contained in one single compartment, so as to avoid smothering by crowding.

Non-perching birds must be provided with smooth raised wooden bars at intervals on the floor down the length of the container in order to give the birds secure foothold.

Separate food and water troughs must be provided. They must be accessible for replenishment purposes and both ends and sides must have a flange to prevent spillage of water and food. Precautions must be taken to reduce the risk of drowning by floating a sponge or other suitable material on the surface of the water in the trough.

Warning: *Soldered tin must not be used.*

Whenever ventilation openings are to be covered with wire mesh, the edges must have suitable protection to prevent injury to the birds. For small birds, all the openings must be covered with wire mesh.

Dimensions, where quoted, may vary according to the quantities being carried.

Three-ply wood, wood or other material of equivalent strength, is generally regarded as suitable for the main structure, with a solid wooden framework, and ends of 1.3 cm (½ in) solid wood.

There must be a door with an adequate fastening device, per compartment/container.

To facilitate handling and ventilation a handgrip/spacer bar must be provided as illustrated.

Meshed ventilation openings, approximately 2.5 cm (1 in) in diameter, must be provided at about 5 cm (2 in) spacing along the other three sides of the container.

The sloping front of the container must be covered with 0.3 cm (_ in) wire mesh to constitute 75% of the front. A muslin curtain which can be lowered over the outside front of the container must be provided. Ventilation openings must be covered with muslin or other light material that does not occlude ventilation to prevent possible inhaling of infectious droplets by handlers.

Four perches approximately 1 cm (2/5 in) in diameter must be provided in the approximate positions indicated and must provide **3 cm (1 1/5 in)** of perching space for each bird.

Birds that fight must be packed in separate compartments.

2. PREPARATIONS BEFORE DISPATCH

(see Chapter 5)

It is advisable the shipper must ensure that wild birds are held in captivity for approximately thirty days before dispatch to overcome the stress of capture and allow them to become accustomed to confinement and the new diet. The use of anti-stress tonic is beneficial. It is of utmost importance that all birds be given, under close supervision, an opportunity to drink an ample supply of water before departure.

On no account must excess birds be loaded into a compartment or container to ensure against mortality. Species of widely differing sizes must not be mixed in the same compartment/container.

3. FEEDING AND WATERING GUIDE

(for emergency use only)

Adequate food and water must be provided in the compartment/container by the shipper at the time of acceptance. Birds do not usually require additional feeding or watering during 24 hours following the time of dispatch.

If feeding or watering is required due to an unforeseen delay, the shipper’s instructions must be followed. With the smaller species, it is essential to make sure that the sponge floats are well wet at the time of departure.

4. GENERAL CARE AND LOADING

(see Chapter 5 and 10)

Birds are very nervous by nature and containers must be handled carefully. The container must not be jolted or tilted unnecessarily. Excess light and noise must be avoided. Birds must be provided with water at the time of departure, transfer, layover and at destination.

Birds will not feed in the dark and must be stowed in at least dim light sufficient for them to see their food.

IATA CONTAINER REQUIREMENT 11D

Special conditions applicable to parrot-like birds, large (including other large psittacines [parrot-like] birds over 23 cm [9 in] long):

Amazon parrot species Grey parrot Macaw species

Cockatoo species Parrot (large) species Scythbill

Conure species Kakapo Touraco species

Corella species Kea

See Exceptions ARG-03, CNG-01, GBG-10, NGG-02, SAG-04 and USG-01 in Chapter 2 and Exception LH-02 in Chapter 3.

Note: *Refer to Container Requirement 11 for basic requirement applicable to all species of birds.*

1. DESIGN AND CONSTRUCTION

(see Exception QF-01 in Chapter 3)

Materials

Wire mesh, metal, wood, non-toxic plastic, fiberglass, synthetics and muslin cloth.

Principles of Design

The container must be made of plywood or other wood with a minimum thickness of 0.5 cm (1/5 in), or metal. Smooth wooden rails must be placed on the floor so that the birds can perch safely. Parrots have powerful beaks and the construction must reflect this fact.

Numbers must be limited to permit sufficient floor space so that each bird can sit at the same time. In addition, for the smaller species, no more than 25 birds must be contained in any single compartment in order to avoid smothering by crowding. In the case of cockatoos, it is recommended that no more than six be put into one compartment/container.

Separate accessible food and water trough must be provided with wide flanges to prevent spillage and a small enough access that the birds do not soak themselves.

Water must be provided at the time of shipment.

Kea and kakapo tend to be aggressive and must be shipped singly or in pairs.

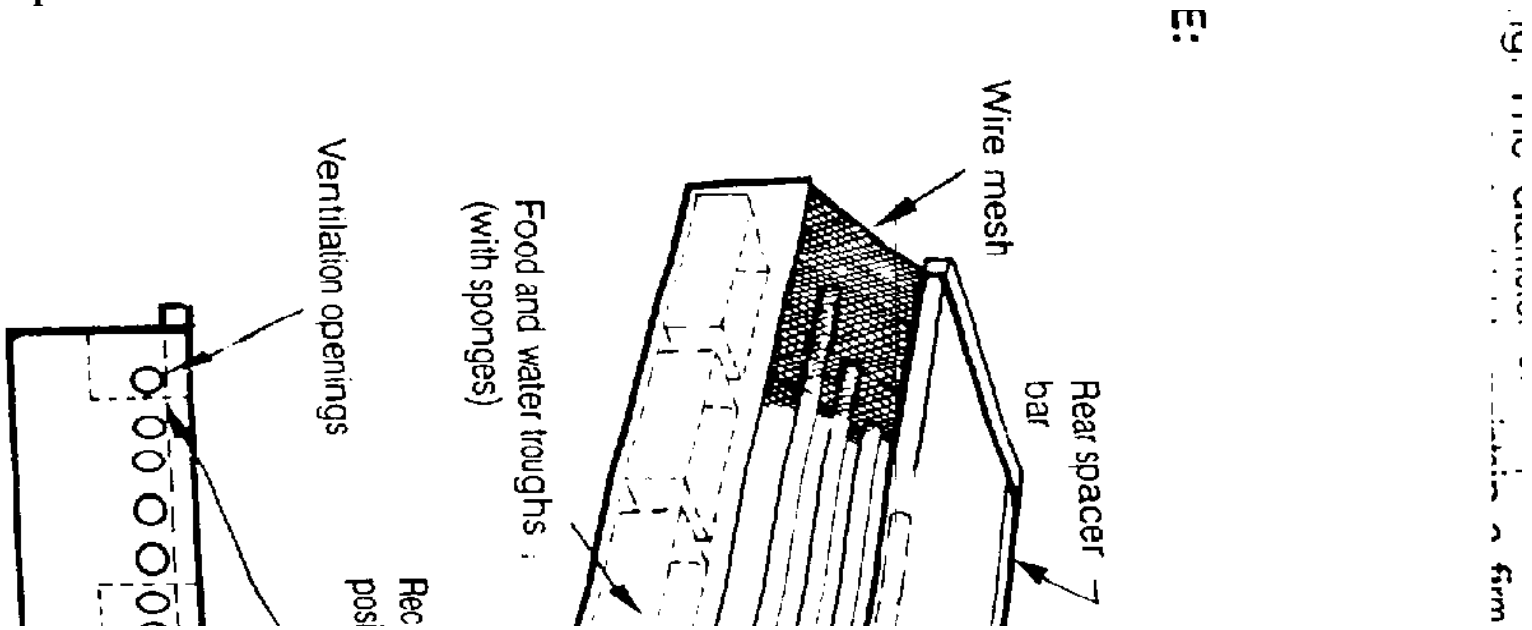
2. FEEDING AND WATERING GUIDE

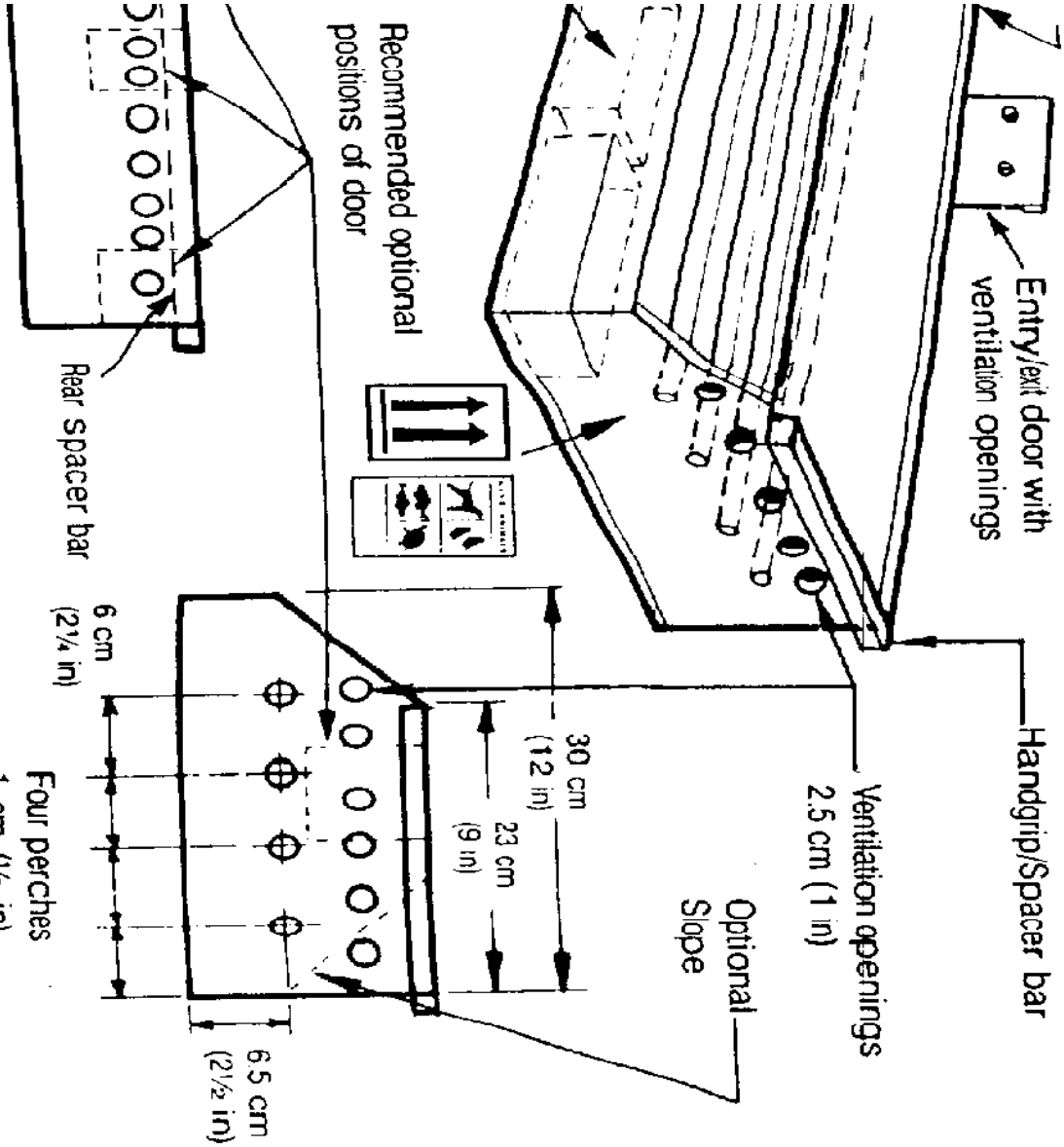
(for emergency use only)

Birds do not usually need additional feeding during 24 hours following the time of dispatch, other than the seed provided in the troughs as specified in the Basic Container Requirements.

If additional feeding is required due to an unforseen delay, seeds, e.g. sunflower, groundnut (natural peanuts), boiled maize, pine or brazil nuts and fruit must be provided.

Examples:





For further information or comments, please contact Mike Taylor

[Caloosahatchee Aviary](#) [Palm Manual](#) [IAS](#) [Search the Site](#) [Table of Contents](#)

Appendix 5

Sarcocystosis

Reprinted from: Schubot, R., et al. 1992. Psittacine Aviculture: Perspectives, Techniques, and Research. Willis Printing Group, Inc.; Loxahatchee, FL. With permission from Scott Schubot, Owner/Director of Avicultural Breeding and Research Center.

Sarcocystosis In Psittacine Birds

Susan L. Clubb

Sarcocystosis is a disease which affects psittacines, primarily those of Australian, Asian and African origin. It is caused by a protozoan parasite *(Sarcocystis falcatula)* which is introduced into the aviary by opossums (*Didelphis virginiana*). It is not infectious from one parrot to another; however, cases tend to occur in clusters because the infected opossum seeds the aviary grounds with infectious sporocyst. Diagnosis in the live bird is difficult primarily due to the hyperacute (rapidly fatal) nature of the disease. A treatment program has been developed for birds in which the disease is tentatively diagnosed. Prevention and control of the disease must be aimed at eliminating opossums from the aviaries and adjacent grounds. (1,4,5)

The Greek root *sarco* refers to flesh or muscle, with sarcocyst referring literally to a cyst in muscle. *Sarcocystis* is a genus of protozoan parasites that is associated with the presence of muscle cysts which are usually grossly evident, in straited muscle of an intermediate host species. The muscle cyst stage in the intermediate host is relatively benign. It is during the early developmental stages in other tissues of the intermediate host when infection can prove fatal.

Sarcocystis falcatula is the species associated with an acute fatal disease in psittacine birds. Disease occurs during the early stages of the infection as the parasite is undergoing schizogony (an asexual reproductive stage) in the lung.

The life cycle of *Sarcocystis* requires both definitive and intermediate hosts. The host in which sexual reproduction of the parasite takes place is called the definitive host, whereas the host in which asexual reproduction takes place is called the intermediate host.

The intermediate host is usually a herbivore or insectivore and becomes infected by ingesting foods contaminated by feces of the definitive host. The intermediate host range may be broad, as in this parasite involving several orders of birds. The degree to which the intermediate host is affected by the parasite varies according to the natural resistance of the host to the sexual reproductive stages of the parasite.

Sarcocystis species typically have a limited definitive host range and cycle with little associated morbidity or mortality in mature individuals. The definitive host is typically a carnivore which becomes infected by eating an animal which has mature cysts in its muscles.

Muscle cysts have been noted in many species and are seldom associated with disease. Generalized early sarcocystosis in the intermediate host is not often recognized because in native species it is an insignificant temporary stage. However when excessive numbers of this stage develop, such as in exotic psittacine species, lesions develop which are often fatal. (1,5)

Sarcocystis falcatula cycles normally between the opossum as the definitive host and its prey cowbirds *(Molothrus ater)* and grackles *(Quiscalus quiscula),* as intermediate host species. When certain species of exotic birds accidentally ingest the sporocyst shed by infected opossums severe illness, often hyperacute and fatal, can occur.

Species Susceptibility

Sarcocystosis has been observed in a variety of exotic species but is most prevalent among non-American (African, Asia and Australian) psittacine species. Cockatoos, cockatiels and African parrots are most commonly affected with the acute fatal illness. The disease has been diagnosed in virtually all species of cockatoos in U.S. aviculture. It has also been reported in eclectus parrots, great-billed parrots, ring-necked, moustache and Alexandrine parakeets, many species of lorys and lorikeets, king parrots and lovebirds.

American or neotropical (Mexico, and South and Central America) psittacine species appear to be resistant to the disease as adults however, young birds are sporadically affected. For example, in one

facility one to two percent of conure chicks (*Aratinga sp*.) Removed from the nest for hand feeding at five to seven days of age succumbed to sarcocystosis. This indicates that chicks of neotropical species are more susceptible than adults, and that the disease can be transmitted to the young birds which are being fed by adults that do not themselves succumb to the disease. Rarely were all chicks in a clutch affected. For instance, in a clutch of military macaws pulled from the nest, one chick died acutely at 18 days of age, the second died at 21 days and the third was never ill. (4)

Death in adult neotropical psittacine birds is uncommon. Acute fatal disease was documented in a yellow-faced Amazon (*Amazona xanthops*), a thick-billed parrot (*Rhynchopsitta pachyrhyncha*) and a Pacific parrotlet (*Forpus coelestis*). Both the thick-billed parrot and Pacific parrotlet are species which occur in arid, high altitude habitats not within the natural ranage of the opossum. (4)

Todd reported muscle cysts of Sarcocytis in a half-mooned conure (*Aratinga canicularis*). He cited reports of muscle cysts in green-rumped parrotlets (*Forpus passerinus*), gold-capped conures (*Aratinga auricapilla*), blue and gold macaws (*Ara ararauna*) and orange-chinned parakeets (*Brotogeris jugularis*). This would indicate that these species are more resistant. Fewer asexual reproductive stages develop in the lung and the complete development to the muscle cysts could take place. (12)

Exotic columbiforms (pigeons) such as blue crowned pigeons (*Goura sp*.) And pheasant pigeons are also susceptible and succumb to acute fatal disease associated with schizogony in the lung.

Clinical Signs And Course Of The Disease

Pulmonary sarcocystosis is a hyper acute disease and birds are often found dead or near death without showing previous signs of illness. Birds may die unexpectedly after being observed as normal just a few hours before. Clear fluid usually exudes from the mouth when the dead bird is lifted. Birds are typically in good condition with no weight loss or other indications of chronic disease. Smith *et al*. found that budgerigars usually died within two to four weeks of experimental infection. (11)

Males appear to be affected more often than females. This may be associated with the male working the nest box and incidentally ingesting sporocyst. Often cage mates die within days of each other; however, many birds survive after the death of their mates.

In birds found ill prior to death, clinical signs include severe dyspnea (labored breathing), excretion of yellow pigmented urates and lethargy. Birds often show elevated serum enzymatic activities, including LDH (lactate dehydrogenase), and AST (aspartate aminotranferase). Other serum chemistry values are typically within normal ranges. (4) Birds which survive the initial pulmonary sarcocystosis often die within a few days to two weeks following the initial illness, and may show early muscle cysts.

Antemortem diagnosis is difficult to confirm because the disease is hyperacute and there are no specific diagnostic tests available. Affected birds do not shed sporocyst. Changes in CBC and serum chemistries are non-specific. Differential diagnosis could include any systemic infection producing an acute onset of pneumonia and/ or hepatitis. Clinical history, species susceptibility and the potential for exposure are keys to making a presumptive diagnosis.

The antemortem clinical diagnosis can only be confirmed by lung biopsy; however biopsy could not be recommended as a routine procedure due to the high risk. Lung biopsies have been accomplished in birds utilizing gaseous anesthesia. (A) The bird is placed in lateral recumbency. An incision is made in the upper intercostal area cranial to the 6th rib. Intercostal muscle is bluntly dissected to expose the caudal aspect of the lung. A section of lung tissue is removed using cutting biopsy forceps.

(b) For best results, the biopsy should contain some tissue from within the lung parenchyma rather than just a small piece of the surface of the lung which may not be diagnostic. Application of pressure to the biopsy site or cautery may be helpful to reduce hemorrhage. Closure involves immobilization of the ribs and suture of the skin. The biopsy specimen can be submitted for histopathology or a lung smear can be prepared for rapid diagnosis.

Surgical risks include hemorrhage and hemoaspiration. Birds which are clinically ill with this disease are poor surgical risks due to their compromised respiratory capability. Therefore this diagnosis procedure should not be considered lightly but is rather of more academic importance. The exception being that presentation is very similar to acute pulmonary mycosis and the treatment protocol for the two diseases are very different. In case of a presumptive diagnosis, initiation of therapy instead of lung biopsy may be prudent.

Treatment

Due to the difficulty of making an antemortem diagnosis, treatment of confirmed cases has not been documented. However, several birds which survived the death of cage mates and in which a presumptive diagnosis was made survived following treatment. Although the disease was not confirmed, clinical signs (dyspnea, biliverdinuria, elevation of serum enzyme activities) were consistent with clinical signs seen in other cases that were subsequently confirmed on necropsy, and the birds had the potential for exposure.

Therapy included a combination of drugs with antiprotozoal activity in combination with supportive care. Pyrimethamine, a drug used for treating toxoplasmosis and other systemic protozoal infections, was used in conjunction with trimethoprim-sulfadiazone in an attempt to control the organism. Pyrimethamine was administered by gavage twice daily, 0.5 mg/kg for two to four days, then reduced to 0.25 mg/kg for 30 days. © Trimethoprim-sulfadiazone was administered by injection at the rate of 5 mg/

kg BID for seven days. (d) Supportive care included administration of oxygen and feeding by gavage. Furosemide was used in an attempt to relieve pulmonary edema and was administered parenterally at the rate of 1.6 mg/kg BID. (e)

Post Mortem Findings

Generalized sarcocystosis in psittacines is a systemic disease affecting multiple organ systems, but the primary site of pathology is the lungs. The lungs are congested and deep red to grey in color with serous (clear) fluid exuding from the surface. Liver and spleen are markedly enlarged, especially the spleen. Bacterial cultures of liver, spleen, lung and heart blood usually yield no bacterial or fungal growth. There is typically no muscle wasting or other signs of long standing disease.

Microscopic lung lesions consist of diffuse interstitial edema extending into the alveoli, with mononuclear cell infiltration and reticulo-endothelial cell hyperplasia. Protozoal schizonts and merozoites are present in the capillary endothelium. Individual merozoites measure about 2 x 7 *u*m and occur in clusters of a few to up to 40 merozoites, often obstructing capillaries. Schizonts and merozoites are also found in reticuloendothelial cells of the spleen and other organs, including liver, proventriculus and pancreatic islets.

Microscopic lesions may be confused with those of *Toxoplasma gondii* and *Isospora serini*. Definitive identification of schizonts in tissue is not possible by light microscopy; however, characteristic morphological features are recognizable by electron microscopy (Photo 20-1). Tissue phases of blood parasites such as *Haemosporidia* and *Haemogregarines* can be ruled out by their absence on peripheral blood smears.

Rapid in-house diagnosis can be made by preparing a squash preparation of lung tissue from an affected bird. A small piece of lung tissue is blotted to remove edema fluid then squashed between two microscope slides. The squash preparation can be stained with stains appropriate for blood smears. Extracellular merozoites can be seen by light microscopy under oil-immersion (Photo 20-2).

Life Cycle And Pathogenesis

The life cycle of *S. Falcatula* is complex, involving several reproductive stages in the definitive and intermediate hosts. For simplicity the life cycle is illustrated in Figure 20-1.

Infective sporocysts are shed in the feces of an opossum. Sporocysts are ingested by the intermediate host (bird) directly from the soil or via a transport carrier such as a cockroach. (9) The sporocyst contains sporozoites which are released on the day of ingestion in the intestine of the bird. Sporozoites

invade the host's gut wall, migrate via the blood vessels to the walls of venules where they undergo schizogony. The nucleus of the schizont divides (schizogony) to form merozoites.

Smith, et al. experimentally inoculated budgerigars with sporocysts collected from infected opossums in order to study the early pulmonary pathology of *S. Falcatula* infection. Early schizogony and merogony of *S. Falcatula* occurs first in endothelial cells lining pulmonary capillaries, then in venules and veins. The development of enlarging schizonts in these endothelial cells results in hypertrophy of the cells. This hypertrophy narrows or occludes the lumen of capillaries and venules producing obstruction of blood outflow in affected areas of the lung, and endophlebitis. Schizonts rupture, releasing merozoites which are found free in capillaries or in edema fluid filling respiratory spaces. Merozoites then penetrate other endothelial cells producing more schizonts or migrate to muscle cells and form cysts. Leukocytes, platelets and fibrin attach to denuded cell membranes at the site of rupture of the schizont. This results in endophlebitis and formation of fibrin-platelet thrombi (blood clots) which contribute to venous obstruction.

Pulmonary edema (collection of fluid) in the interstitium results as blood flow is obstructed by enlarging schizonts and blood pools around affected capillaries and venules, edema causes displacement of the myelinoid surfactant layer lining the pulmonary alveoli. This layer is a fatty surface in which gaseous exchange occurs. Retraction and degeneration of pneumocytes making up the alveoli follows. Interstitial edema formation results in what is recognized as congestion of the lungs on gross examination. Edema fluid first appears in the interstitium, and subsequently fills airspaces. Fluid wells up in alveoli spilling into bronchi. Death due to asphyxiation occurs in heavily infected birds in which significant portions of the lung are affected. Schizogony also occurs in endothelia of liver, kidney, brain, heart and skeletal muscle. (10-13)

The hyperacute form of the disease is related to the rapid proliferation of the parasite in a susceptible host. Smith found schizonts in the lungs as early as two days post inoculation. Schizonts increase in size and divide to form merozoites. Mature schizonts rupture releasing merozoites which form more schizonts. The number of schizonts increases progressively from the second day postinoculation with the highest number occurring between eight to ten days postinoculation. It is at this time that the hyper acute form of the disease is most likely to occur. Smith estimated a schizont would contain 72 to 333 merozoites. Data on number of schizonts/mm2 suggest a biphasic pattern (two peaks in population) of parasite burdens, the first at eight to ten days and the second at four weeks postinoculation. Two peaks of inflammation lag slightly behind the peak parasite burdens.

It is apparent that the disease can also have a chronic aspect which would also be virtually impossible to confirm without lung biopsy. Smith found that interstitial edema was evident at four days postinoculation and reached a peak at eight to nine days post infection. Edema then waned, but was still prominent in heavily infected birds at four to six weeks postinoculation. Schizonts still occurred in the lungs of sacrificed budgerigars five to five and a half months postinoculation.

In birds infected for four weeks, transudate often contained bacteria or fungi. The edema, loss of

surfactant layer and degeneration of pneumocytes resulted in atelectasis. Some alveoli become over distended resulting in emphysema.

At eleven weeks to five and a half months postinoculation edema was supplanted by collagen deposition, severely restricting respiratory exchange because of pulmonary fibrosis. Healing involved migration of pneumocytes into affected areas but as a result of collagen deposition (scar tissue formation) in tissues, affected birds had foci of emphysema and atelectasis. (11)

In order for the immediate host (grackles or cowbirds) to transmit the infection to the definitive host (opossums), it must survive schizogony in the lung or other tissues so merozoites can migrate to skeletal muscle and form typical muscle cysts. These tissue cysts also form in psittacine species if they survive initial lung schizogony. The cyst form more frequently in neotropical psittacines. Spindle-shaped muscle cysts in infected birds contain metrocytes which become infectious bradyzoites several weeks after infection (7).

Sexual development of *Sarcocystis* occurs in the gut of the opossum. Upon ingestion, bradyzoites are released from the muscle cysts by proteolytic enzymes in the opossum's small intestine. Bradyzoites penetrate the intestinal mucosa where fertilization takes place producing oocysts. In most coccidia unsporulated oocysts are shed in the feces. However, *Sarcocystis* sporulates (divides) to form two sporocysts, each containing 4 sporozoites in the intestinal mucosa of the opossum (lamina propria). Tiny sporocysts (11-12 *u*m by 7-8 *u*m) and an occasional oocyst shed in the feces. Sporocysts are infectious at the time they emerge from the intestinal lining and are shed in small numbers over an extended period of weeks of months.

Opossums start to shed sporocysts five days after eating an infectious meal. Shedding has been reported for at least 15 weeks after infection. Prolonged shedding occurs because sporocyst are trapped beneath epithelial cells within the interstitial layer of intestinal villi by intestinal contraction. Sporocysts are distributed throughout the small intestine with a predominance in the upper middle section.

Epidemiology

Sarcocystosis occurs sporadically during the year, however heaviest losses are experienced from late fall to spring in south Florida. Losses can be isolated or clustered. Affected birds have been housed in a variety of cages and aviaries, including suspended cages, large flight cages, and even screened porches. While psittacines may not have direct access to opossum feces, transmission can be accomplished by mechanical carriers.

In order to prove this route of transmission, an opossum was trapped on one facility where the disease had occurred. It was found to be shedding sporocysts of *Sarcocystis falcatula*. This opossum was housed in a room with birds which included some cockatoos. Several cockatoos died of sarcocystis even though

they had no direct contact with the feces of the opossum. Transmission by cockroaches was suspected. Feces from the opossum were fed to cockroaches which were subsequently blenderized and fed to cockatoos by gavage. These experimentally inoculated birds died of pulmonary sarcocystosis at 10 to 14 days post-inoculation.

Cockroaches are known to be coprophagic (eat feces). It was proven that cockatoos will eat cockroaches by adding them to feed (with their legs pulled off to prevent escape). Cockroaches were placed in feed bowls along with feed. Feeding was recorded on videotape where cockatoos were seen consuming the insects. It is also possible that cockroaches could contaminate feed with their feces. (9)

Box, et al. investigated the life cycle and host range of *Sarcocystis falcatula*. In laboratory experiments which included cats, rats and a dog , only opossums were found to be suitable definitive hosts for *S. falcatula*. The intermediate host spectrum of *S. falcatula* was investigated by feeding sporocysts to birds of four orders, including *Psittaciformes* (budgerigars), *Passeriformes* (canaries and zebra finches), *Galliformes* (chickens and guinea fowl) and *Columbiformes* (pigeons). Budgerigars and pigeons experienced acute fatal illness, but Canaries, zebra finches, chickens and guinea fowl survived the lung schizogony stage and developed muscle cysts.

Due to the vast distribution of both the definitive and intermediate host species, the natural life cycle of *S. falcatula* can occur over most of the U.S., placing psittacines in outdoor facilities at potential risk.

The range of the opossum extends over most of the continental U.S. with the exception of the Rocky Mountains, the desert southwest and the extreme northern areas.(3), The brown-headed cowbird ranges over the entire continental U.S., and the common grackle ranges over the continental U.S. east of the Rocky Mountains. Both are in the order *Passeriformes*.(8)

Psittacine diets spilled from cages attract both cockroaches and opossums which feed around cage areas at night. Opossums easily hide during the day in rubbish piles, heavy vegetation or under outbuildings, making their presence on a farm difficult to detect. Opossums are strictly nocturnal and arboreal often covering several miles in an evening. They can easily climb fences and move around through the trees and over the roofs of aviaries. Feces deposited on the roof of an aviary can serve as a source of infection. Since sporocysts of *S. falcatula* are shed over a prolonged period of time, a single infected opossum visiting a farm regularly could seed the farm with infectious sporocysts which parrots might ingest resulting in sporadic cases.

The higher incidence of disease from late fall to spring may be related to a massive influx of migratory grackles and cowbirds at that time, and their subsequent breeding season. Many cowbird or grackle chicks fall from the nest and are easy prey for opossums. Adults birds consume large quantities of insects in order to raise their chicks, some of which may have fed on the feces of opossums. Opossums are known to prey on birds and may feed on chicks around rookeries. A diet high in infected birds would increase the contamination of areas with *Sarcocystis* sporocysts. In *Sarcocystis muris*, both primary infection and reinfection of the definitive hosts leads to shedding. (9)

The relative resistance of adult neotropical psittacines to acute fatal sarcocystosis is possibly related to natural selection of these species in an environment where opossums infected with *S. falcatula* are prevalent. Non-American species, evolved in an environment free of opossums, have not been naturally selected for resistance and show a variable outcome of infection.

Control

Because of its sporadic nature, control of the disease in psittacines by prophylactic drug therapy is impractical. Control efforts must be aimed at the disseminators of infection. Opossums should be excluded from psittacine breeding areas by use of livestock electric fences. Electric wires can be affixed to insulators on the exterior of existing fencing or may be free standing. In southern coastal areas of the United States, control of cockroaches in heavily planted outdoor areas is difficult, if not impossible. Chickens may be utilized to eat cockroaches and reduce the chance of transmission. Chickens readily feed on cockroaches and are resistant to *S. falcatula* infection. The use of flightless chicken breeds, such as silky chickens, will help avoid roosting of chickens on the top of cages and soiling cages, food and water bowls, which may result in contamination with other infectious agents. It is also possible that some sporocysts of *Sarcocystis* could pass through the intestines of both cockroaches and chickens.

Outdoor aviculture of non-American psittacines in southern coastal areas of the U.S. can be limited by sarcocystosis. For success with these species, exclusion of opossums must be considered in aviary design and management procedures.

REFERENCES

1. Box, J.Meier and J.H. Smith, 1984., Description of *Sarcocystis falcatula*, stiles, J. Protozoal. 31:521-524. 1983.

2. Box, E.D. and J.H. Smith, The intermediate Host Spectrum in Sarcocystis Species in Birds. J. Parasitol. 64:668-673. 1982

3. Burt, W.H. and R.P. Grossenheider., A field Guide to the Mammals, Houghton Mifflin Company, Boston, MA. 1964.

4. Clubb, S.L., J.K. Frenkel, C.H. Gardiner and D.L. Graham, An Acute Fatal Illness in Old World Psittacine Birds Associated with *Sarcocystis falcatula* of Opossums, Proc Annual Conference of Association of Avian Veterinarians., pp 139-150, 1986.

5. Dubey, J.P., C.A. Speer, R. Fayer., Sarcocystosis of Animals and Man. CRC Press, Boca Raton, Fl. 1989.

6. Frenkel, J.K., Tissue-dwelling Intercellular Parasites; Infection and Immune response in the Mammalian Host to Toxoplasma, Sarcocystis and Trichinella. American. Zoological. 29:455-467. 1989

7. Neill, P.J.G., J.H. Smith and E.D. Box. Pathogenesis of *Sarcocystis falcatula* (Apicomplexa: Sarcocystidae) in the Budgerigar (*Melopsittacus undulatus*). IV. Ultrastructure of Developing, Mature and Degenerating Sarcocysts. J. Protozool. 36:430-437. 1989

8. Robbins, C.S., B. Bruun, and H.S. Zim. Birds of North America, Golden Press, New York, N.Y. 1966.

9. Smith, D.D. and J.K. Frenkel. Cockroaches as Vectors of Sarcocystis muris and Other Coccidia in the Laboratory. J. Parasitol. 64(2):315-319. 1978

10. Smith, J.H., J.L. Meier, P.J.G. Neill anad E.D. Box. Pathogenesis of *Sarcocystis falcatula* in the Budgerigar. I. Early Pulmonary Schizogony. Lab Invest. 56 (1): 60-71. 1987.

11. Smith, J.H., J.L. Meier, P.J.G. Neill and E.D. Box. Pathogens of *Sarcocystis falcatula* in the Budgerigar. II. Pulmonary pathology. Lab Invest. 56 (1) : 72-84. 1987.

12. Todd, K.S., A.M. Gallina and W.B. Nelson. Sarcocystis Species in Psittacine Birds. J. Zoo Animal Med. 6:21 - 24. 1975.

13. Smith, J.H., P.J.G. Neill and E.D. Box, Pathogenesis of *Sarcocystis falcatula* (Apicomplexa: Sarcocystidae) in the Budgerigar (Melopsittacus undulatus) III. Pathologic and Quamtitative Parasitologic Analysis of Extrapulmonary Disease, journal of Parasitologic Analysis of Extrapulmonary Disease, Journal of Parasitology, Vol. 75 (2): pp. 270-287, 1989.

Footnotes

(a) Isoflurane, Aerrane,Anaquest, Madison WI 53713.

(b) Spoon cup Biopsy Forceps -Richard Wolf Medical Instruments Corp.,m Rosemont, IL 60018

(c)Daraprim (pyramethamine) 25 mg - Burroughs Wellcome Co., Research Triangle Park, NC 27709

(d) Di-Trim, Syntex Animal Health, WestDes Moines, IA 50265.

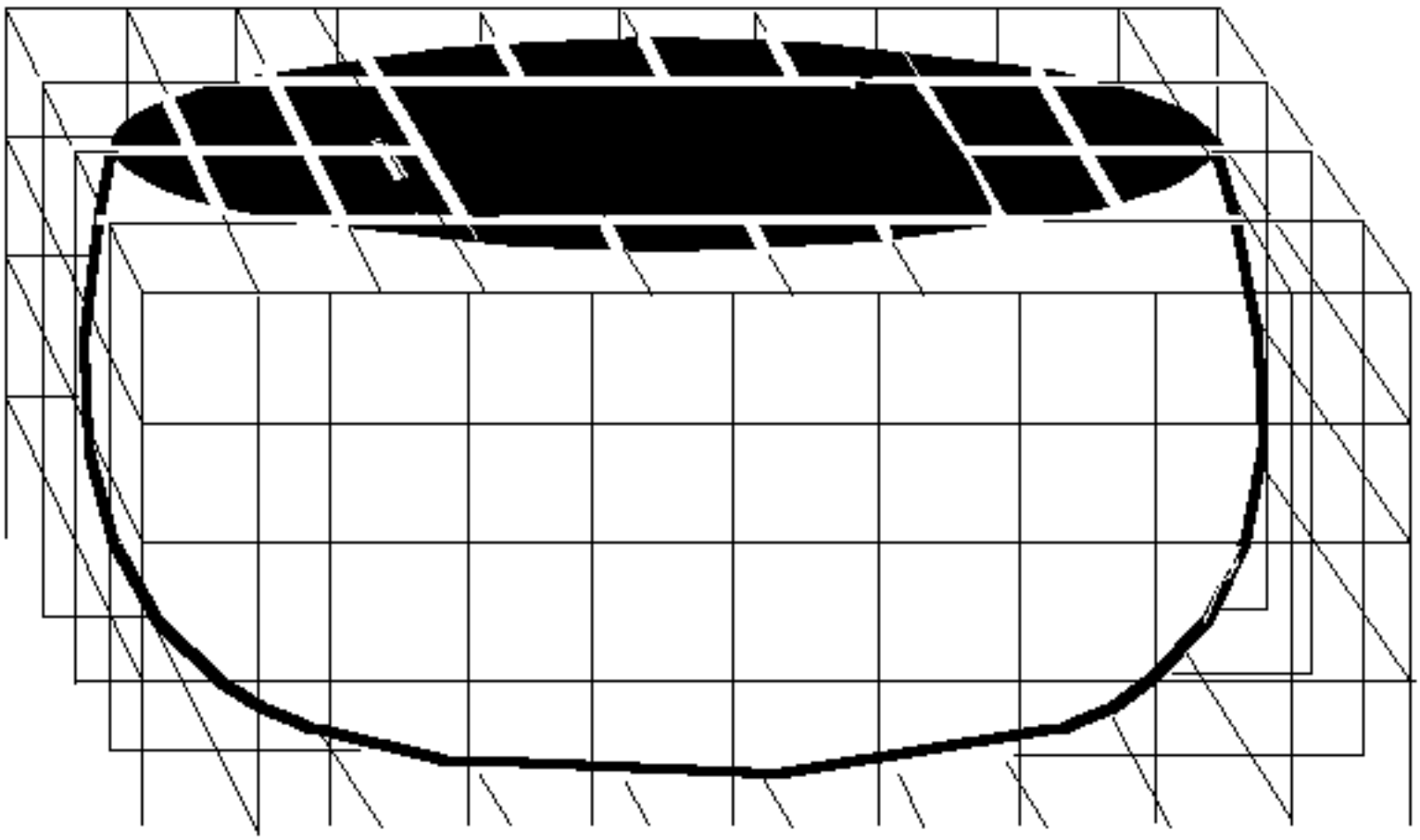
(e) lasix - Injection 5 %, Hoechst-Roussel, Agri-Vet Company, Somerville, NJ 08876.

For further information or comments, please contact [Mike Taylor]

[Caloosahatchee Aviary] [Palm Manual] [IAS] [Search the Site] [Table of Contents]

Appendix 6

Basket Diagram



As mentioned in the text, the wire basket has a hole in the top allowing the birds to reach into the bowl. This design prevents the birds from tipping their bowl over. The wire basket can be made out of 1" x 1" welded wire and "J clips" and can be attached to the side of the pen. A small access door on the outside of the pen allows the bowl to be placed into the basket.

For further information or comments, please contact Mike Taylor

Caloosahatchee Aviary **Palm Manual** **IAS** **Search the Site** **Table of Contents**

Appendix 7

Drug Information

Antibiotics

DRUG	MANUFACTURER	CONCENTRATION	DOSE	ROUTE	DOSING	COMMENT
AMIGLYDE V (Amikacin)	Aveco	250 mg/ml	10 - 15 mg/kg	IM	BID, TID	Patient must be well hydrated. May cause nephrotoxicity Broad spectrum.
BAYTRIL (Enrofloxacin)	Miles	22.7 mg/ml	15 - 20 mg/kg *5mg/ kg	PO, IM, SQ	BID	Can be irritating to muscle. Broad spectrum
CEFA-DROPS (Cefadroxil)	Aveco	50 mg/ml	100 mg/kg	PO	BID, TID	Broad-spectrum with low toxicity. Store up to 2 weeks in refrigerator.
CLAFORAN (Cefotaxime)	Hoechst-Roussel	300 mg/ml	100 mg/kg *75-100 mg/kg	IM	TID, QID	Broad spectrum with low toxicity. Store up to 10 days in refrigerator.
DOXYCYCLINE (Vibramycin monohydrate)	Pfizer	5 mg/ml	25 mg/ kg	PO	SID, BID	For *Chlamydia*

PIPERACIL (Piperacillin)	Lederle	400 mg/ml	200 mg/kg *100-200mg/kg	IM	BID, TID	Broad spectrum with low toxicity. Store up to 7 days in refrigerator.
TMS (Trimethoprim w/ Sulfamethoxazole)	Rugby	8 mg/ml	16 - 24 mg/kg *8mg/kg	PO	BID, TID	Can cause vomiting. Limited spectrum

Antifungals

DRUG	MANUFACTURER	CONCENTRATION	DOSE	ROUTE	DOSING	COMMENT
ANCOBON (Flucytosine)	Roche	125 mg/ml	250 mg/kg *20-50mg/kg *50-250mg/ kg of feed	PO	BID for 21 days	1 capsule/ 4 cc H2O/KY jelly mixture For Aspergillosis and candidiasis Toxic to bone marrow.
DIFLUCAN (Fluconazole)	Roerig	5 mg/cc	4 mg/kg *2-5 mg/kg	PO	SID	For Aspergillosis and candidiasis. May cause regurgitation.
FUNGIZONE (Amphoteracin B)	Squibb	5 mg/ml	1 - 1.5 mg/kg	IV, IT	BID for 3 days	For Aspergillosis. Store up to 7 days in refrigerator. Nephrotoxic.
NIZORAL (Ketoconazole)	Janssen	5 mg/ml	20 mg/kg *20-30 mg/kg	PO	BID	1/4 tablet in 10 cc Gatorade H2O. For Candidiasis. Works upon absorption.

NYSTATIN (Mycostatin)	Rugby	100,000 units/ml	1 ml/ 300 gm	PO	BID, TID	0.33 per 100 gm Not absorbed - works on contact.

Miscellaneous

DRUG	MANUFACTURER	CONCENTRATION	DOSE	ROUTE	DOSING	COMMENT
ALLOPURINOL	Geneva	100 mg/tablet	1 cc/ 400 gm	PO	BID	Xanthine oxidase inhibitor. For treatment of uricemia.
AMINOPHYLLINE	Elkins Sinn	25 mg/ml	10 mg/ kg	IM, IV, SQ	as needed	Broncodialator.
BANAMINE (Flunixin)	Schering-Plough	50 mg/ml	5 mg/ kg *1-10 mg/kg	IM	BID, TID	Analgesic and anti-inflammatory. Antipyretic.
DARAPRIM (Pyrimethamine)	Burroughs Wellcome	25 mg/tablet	0.5 mg/kg	PO	BID for 2 - 4 days, then ½ dose for 30 days	1 tablet/ 10 cc H2O/ KY jelly mixture. For Sarcocystis.
DEX SP (Dexamethasone sodium phosphate)	Burns	4 mg/ml	0.1 cc/ 100 gm	IM, IV	as needed	For treatment of shock, trauma, and certain inflammations.
FUROSEMIDE	Burns	50 mg/ml	0.5 mg/ 300 gm *0.15-2 mg/ kg	IM	BID	0.0016 mg/gm for Sarcocystis. Diuretic

REGLAN (Metoclopramide hydrochloride)	A. H. Robins	5 mg/ml	0.2 - 0.4 mg/kg *0.5 mg/kg	IM, IV, SQ	TID, QID	For stimulating gastrointestinal motility.
VITAMIN C (Sodium Ascorbate)	Burns	250 mg/ml	250 mg/lb *20-40 mg/kg	PO	BID	For yeast control. (experimental)
VITAMIN K (Phytonadione)	Bimeda	10 mg/ml	2 mg/kg *0.2-2.5 mg/kg	IM	as needed	Involved in blood clotting.

Anthelmintics

DRUG	MANUFACTURER	CONCENTRATION	DOSE	ROUTE	DOSING	COMMENT
DRONCIT (Praziquantel)	Haver	23 mg/tablet	0.1 cc/ 350 gm *10-20 mg/kg *9 mg/kg	PO	once, repeat in 10 - 14 days	For tapeworms.
IVOMEC (Ivermectin)	Merck	10 mg/ml	20 ug/kg *200 ug/kg	IM	once, repeat in 10 - 14 days	For some nematodes, coccidia, mites, and lice
PANACUR (Fenbendazole)	Hoechst-Roussel	suspension	30 mg/kg *20-50 mg/kg	PO	SID for 3 days	For ascarids, capillaria, microfilaria and flukes.

NEMEX II (Pyrantel panoate)	Pfizer	4.5 mg/ml	4.5 mg/ kg	PO	once, repeat in 10 - 14 days	For intestinal nematodes.

For further information or comments, please contact Mike Taylor

Caloosahatchee Aviary **Palm Manual** **IAS** **Search the Site** **Table of Contents**

Appendix 8

Routine Physical Exam Form

Date:_____ Species:_____ Bird ID#:_____

Location:_____ Weight:_____

Head/beak region:

Eye exam:_____

Maxilla & mandible:_____

Oral cavity:_____

Nostrils:_____

Ears:_____

General feather condition:_____

_____

Muscle/ Weight condition:_____

Respiratory System:_____

Cardiac System:_____

Wings:_____

Body:_____

Legs:_____

Feet/ Toes:_____

Abdomen:_____

Cloaca/Vent Area:_____

For further information or comments, please contact Mike Taylor

Caloosahatchee Aviary **Palm Manual** **IAS** **Search the Site** **Table of Contents**

Appendix 9

List of Avian Diagnostic Laboratories

Avian & Exotic Animal Clin. Path. Labs 3701 Inglewood Ave Suite 106 Redondo Beach, CA 90278 (213)542-6556	Hematology, Chemistries, Microbiology, Parasite Testing
Avian Biotech International 4500 Shannon Lakes Plaza Unit 1, Suite 138 Tallahassee, FL 32308 (404)392-1707	DNA sexing
Avian Research Associates, Inc. 100 TechneCenter Dr., Suite 101 Milford, Ohio 45150 (513)248-4700	Psittacine Beak and Feather and Polyoma Virus

California Avian Laboratory 6114 Greenback Lane Citrus Heights, CA 95621 (800)783-2473	Hematology, Chemistries, Microbiology, Histopathology, Chlamdia Testing, Cytology, Parasite Testing.
Clinical Endocrinology Lab Department of Environmental Practice 2407 River Drive, RmA105, VTH Knoxville, TN 37996	Endocrinology Testing
Department of Veterinary Pathology College of Veterinary Medicine University of Georgia Athens, GA 30602 (706)542-5844	Necropsy, Histopathology

List of Avian Diagnostic Laboratories (cont.)

The Raptor Center University of Minnesota College of Veterinary Medicine 1920 Fitch Avenue St. Paul, MN 55108 (612)624-4745	Aspergillus Testing
RoadRunner Laboratry, Inc. Veterinary Specialists 1501-A South Belcher Rd. Largo, FL 33771 (800)808-7812	Hematology, Chemistrics, Microbiology, Histopathology, Chlamydia Testing, Cytology, Parasite Testing.
Dr. Robert Schmidt Zoo/Exotic Pathology Service 2825 Kour Drive W. Sacramento, CA 95605	Histopathology
Sam Silverman, D.V.M. 60 Marie Street Sausalito, CA 94965 (415)331-5212	Radiology Consultant

Schubot Exotic Bird Health Center Texas Veterinary Medical Center Texas A&M University College Station, TX 77843-4467	Necropsy and Histopathology
Dr. Chris A. Schiller Palm Cockatoo SSP Pathology Advisor All Creatures Pathology Service c/o Antech Diagnostics 13633 North Cave Creek Rd. Phoenix, AZ 85022 (800)592-0503 or (602)996-6644	Necropsy, Histopathology

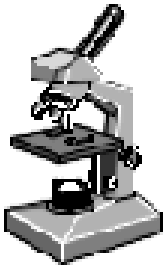
List of Avian Diagnostic Laboratories (cont.)

Southeast Vetlab Supply 18131 S.W. 98th Ct. Miami, FL 33157 (305) 253-1848 FL (800)330-1522	Hematology, Chemistrics, Microbiology, Histopathology, Chlamydia Testing, Cytology, Parasite Testing

Texas Veterinary Medical Diagnostic Laboratory Post Office Drawer 3040 College Station, TX 77841 (409)845-3414	Chemistries, Chlamydia, Cytology, Electron microscopy, Necropsy, Hematology, Histopathology, Microbiology, Mycoplasma, Toxicology, Pacheco's virus, Polyoma.
Waters Agricultural Laboratories, Inc. Newton Highway P.O. Box 382 Camilla, GA 31730-0382 (912)336-7216	Feed Testing such as crude fat, fiber, protein, Calcium, Phosphorus, and digestible nutrients.
Zoogen 1105 Kennedy Place, Suite 4 Davis, CA 95616 (916)756-8089	DNA sexing

For further information or comments, please contact Mike Taylor






Caloosahatchee Aviary **Palm Manual** **IAS** **Search the Site** **Table of Contents**

Appendix 10

Microbiology Worksheet

Date: _____ Reason For Culture: _____

Species: _____ Bird #: _____ Band/Trans #: _____

Name: _____ Egg #: _____ Cage #:_____

Lab #: _____ Source: _____ Lab: _____ Source: _____

TSA Amount: _____

Gram +	Gram -
1.	1.
2.	2.
3.	3.
4.	4.
%_____	%_____

TSA Amount: _____

Gram +	Gram -
1.	1.
2.	2.
3.	3.
4.	4.
%_____	%_____

MacConkey Amount: _____

1.

2.

MacConkey Amount: _____

1.

2.

3.

4.

Sab Dex Amount: _____

Gram + _____

Gram - _____

Yeast: _____

Fungus: _____

EMB Amount: _____

Chocolate II: _____

Coag Test: positive negative

Isolations: _____

Gram Stains: _____

API: _____

Sensitivity: _____

3.

4.

Sab Dex Amount: _____

Gram + _____

Gram - _____

Yeast: _____

Fungus: _____

EMB Amount: _____

Chocolate II: _____

Coag Test: positive negative

Isolations: _____

Gram Stains: _____

API: _____

Sensitivity: _____

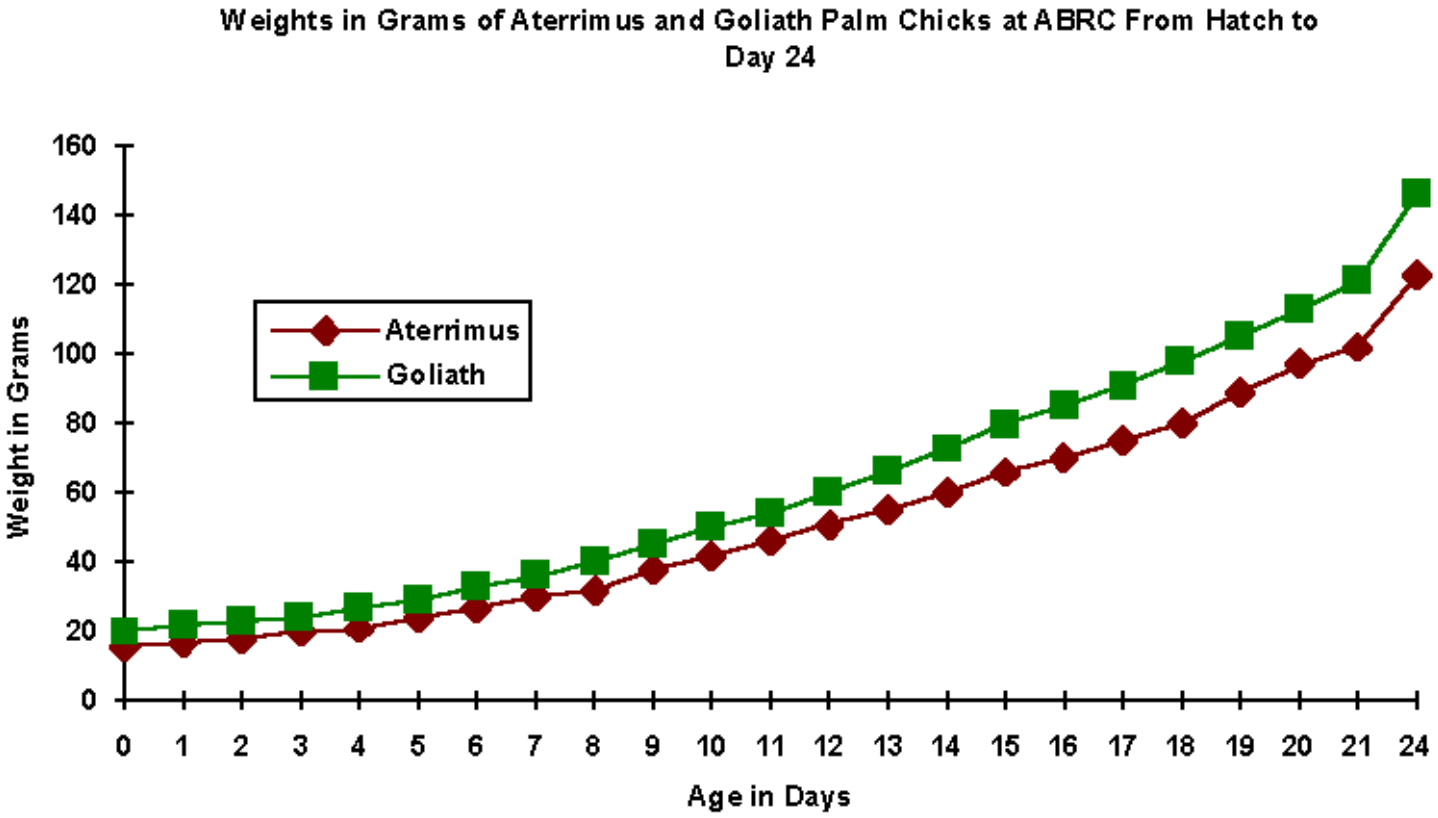
Organism	PIP	ENO	CTX	STX	G	AN	C			

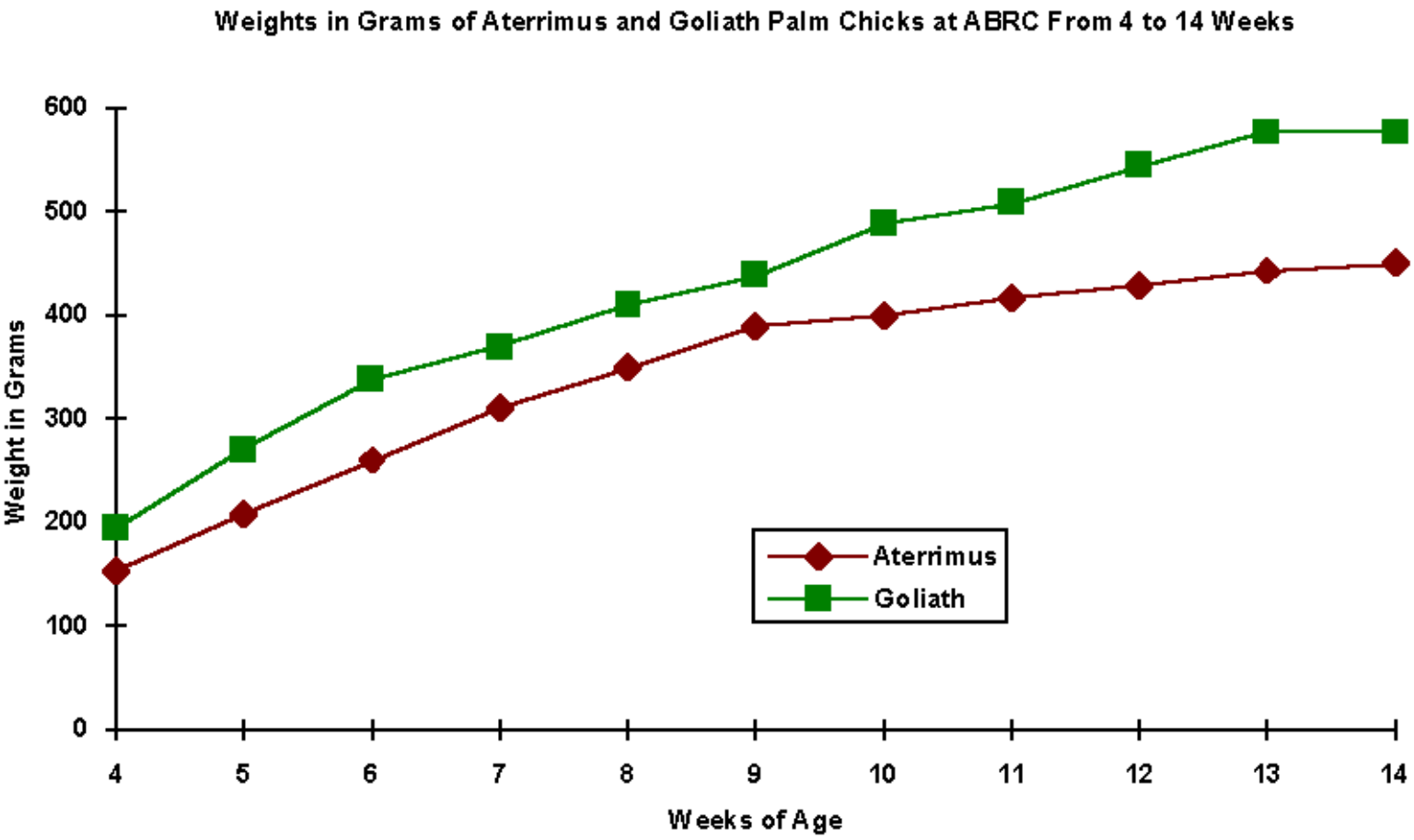
For further information or comments, please contact Mike Taylor

[Caloosahatchee Aviary](#) [Palm Manual](#) [IAS](#) [Search the Site](#) [Table of Contents](#)

Appendix 11

Growth Charts





For further information or comments, please contact Mike Taylor

[Caloosahatchee Aviary](#)

[Palm Manual](#)

[IAS](#)

[Search the Site](#)

[Table of Contents](#)

Appendix 14

Hand-reared Palm Cockatoo (*P.a.aterrimus*) Chick Weights

(Raised at ABRC)

Age in Days	Mean Weight in Grams	Weight Range in Grams
1	17.6	16.6 - 18.6
2	18.4	17.4 - 19.4
3	20.0	19.5 - 20.5
4	21.5	20.2 - 22.8
5	23.5	22.3 - 24.7
6	25.5	23.8 - 27.2
7	29.9	28.0 - 31.8
8	35.3	31.9 - 38.7
9	41.0	37.2 - 44.8
10	45.3	41.5 - 49.1
11	49.5	45.0 - 54.0
12	55.8	50.4 - 61.2
13	62.7	57.3 - 68.1
14	67.8	61.5 - 74.1

15	77.3	70.6 - 84.0
16	84.5	77.2 - 91.8
17	93.5	86.2 - 100.8
18	103.5	96.1 - 110.9
19	111.7	104.2 - 119.2
20	118.8	110.9 - 126.7
21	128.2	119.3 - 137.1
22	139.6	129.6 - 149.6
23	152.8	144.1 - 161.5
24	162.4	153.2 - 171.6
25	173.8	162.8 - 182.8
26	184.0	174.4 - 193.6
Age in Days	**Mean Weight in Grams**	**Weight Range in Grams**
27	193.4	181.9 - 204.9
28	204.6	193.6 - 215.6
29	219.6	202.9 - 236.3
30	233.4	218.0 - 248.4
31	248.0	233.6 - 262.4
32	260.0	246.7 - 273.3
33	270.4	257.5 - 283.3
34	283.2	268.5 - 297.9

35	293.8	280.1 - 307.5
42	358.0	333.3 - 382.7
49	443.0	418.0 - 468.0
56	482.0	422.7 - 541.3
63	519.5	427.8 - 611.2

For further information or comments, please contact Mike Taylor

[Caloosahatchee Aviary](#) [Palm Manual](#) [IAS](#) [Search the Site](#) [Table of Contents](#)

Appendix 15

Palm Cockatoo SSP Necropsy and Histopathology Techniques/Recommendations

Developed by John Olsen, DVM, Palm Cockatoo SSP Veterinary Advisor

and Chris Schiller, DVM, Palm Cockatoo SSP Veterinary Pathology Advisor

and approved by the Palm Cockatoo SSP Management Group

These guidelines are designed to enable veterinarians to perform thorough gross necropsies on palm cockatoos. A necropsy protocol, including a gross necropsy worksheet, is included.

SSP Pathologist:

Dr. Chris A Schiller

All creatures Pathology Service

c/o Antech Diagnostics

13533 North Cave Creek Road

Phoenix, AZ 85022

1-800-592-0503

1-602-996-6644

OPTIONS:

1. Send tissues to own institution's pathologist and send copy of final necropsy report to Dr. Schiller, (include copies of histopathology slides if possible).
2. Send tissues to Dr. Schiller along with copy of gross necropsy report.
3. Send entire bird to Dr. Schiller along with copy of clinical history. (**PLEASE** call Dr. Schiller prior to sending bird).

Dr. Schiller is also available to answer any questions if necessary.

SAMPLES:

4. DUPLICATE sets of **formalized** tissue. One set to pathologist and one set for tissue banking. (Tissues to be sampled are listed on next page).
5. Antemortem (Postmortem if necessary) **serum** and **plasma** stored frozen at -70° C.
6. Fresh, frozen tissue. Store at least 10 grams (if possible) of liver, brain, kedney, and lung in separate plastic bags at -70° C.

Formalized tissues reserved for banking, frozen tissues and frozen serum and plasma may be stored by the institution or sent to the SSP Veterinary Advisor at the following address:

Dr. John H. Olsen

Busch Gardens Zoo Department

3605 Bougainvillea Avenue

Tampa, FL 33612

1-813-987-5546 phone

1-813-987-5548 fax

FORMALIZED TISSUE COLLECTION

Sections of tissues should be no more than 1 cm in width and should be placed in 10% buffered formailin at a ratio of one part tissue to ten parts formalin.

TISSUES TO BE SAMPLED (including an lesions or abnormalities within these or other organs):

- Skin with feather.
- Skeletal muscle - longitudinal section of thigh and pectoral muscle.
- Bone/bone marrow - femur.
- Peripheral (Sciatic) nerve.
- Thymus.
- Thyroids and parathyroids.
- Frontal sinus - cross section obtained with strong scissors.
- Trachea and syrinx.
- Lungs - section from each lung including major bronchus.
- Air sacs.
- Heart-sections including atrium, ventricle and valves from right and left heart.
- Tongue - cross section.
- Esophagus - 3 cm in length, opened longitudinally.
- Crop - 3 cm in length, opened longitudinally.
- Proventriculus - 3 cm long sections.
- Ventriculus - 3 cm long sections.
- Small intestine - multiple sections, each 3 cm in length, opened longitudinally.
- Ceca and large intestine - multiple section, each 3 cm in length, opened longitudinally.
- Liver - multiple sections.
- Pancreas.

- Spleen - split between containers.
- Adrenal.
- Kidney - multiple sections from each kidney.
- Testis/Ovary.
- Oviduct - with longitudinal cut into lumen.
- Brain - half in formalin and half frozen

NEONATAL/EMBRYONIC TISSUE

In addition to the above tissues, the following should be sampled:

Neonate: Umbilical area and surrounding tissue.

Embryo: Fix in toto - open celomic cavity.

Egg membranes and shell.

PALM COCKATOO NECROPSY PROTOCOL

Genus/Species:_____

Bird Identification - leg band#/Name:_____

ISIS #: _____ Studbook #: _____ TRANSPONDER #: _____

Date of Birth: ___/___/___ Age: _____ Weight: _____kg

Date of Death: ___/___/___ Date of Necropsy: ___/___/___

Gross Necropsy Performed By: _____

Telephone: _____

Histopathology Performed By: _____

Telephone: _____

Institution/Owner: _____

Address: _____

_____

_____

Complete Necropsy Report Sent to SSP Veterinary Advisor? _____

Complete Necropsy Report Sent to SSP Pathologist? _____

and

Copies of Slides Sent to SSP Pathologist? _____

OR

Gross Necropsy Report Sent to SSP Veterinary Advisor? _____

and

Formalin Fixed Tissues Sent to SSP Pathologist? _____

OR

Whole Bird Sent to SSP Pathologist? _____

Palm Cockatoo Necropsy Protocol Page 2

Bird ID: _____

History: (Include housing and /or quarantine status, diet, clinical signs, treatments, antemortem test results and circumstances of death. Include incubation and hatching history for embryos and hatchling).

PLEASE ATTACH COPY OF MEDICAL RECORDS

Palm Cockatoo Necropsy Protocol Page 3

Bird ID: _____

GROSS NECROPSY EXAMINATION

General Condition: (Nutritional status/physical condition)

Integumentary System: (Skin/feathers)

Musculoskeletal System: (Skeletal muscle, bone, joints)

Celomic Cavity: (Fat stores, abnormal fluid)

Hemolymphatic System: (Spleen, thymus, Bursa of Fabricius)

Respiratory System: (Nares, sinuses, choana, larynx, trachea, lungs, air sacs)

Palm Cockatoo Necropsy Protocol Page 4

Bird ID: _____

Cardiovascular System: (Heart, pericardium, great vessels)

Digestive System: (Beak, oral cavity, tongue, crop, esophagus, proventriculus, ventriculus, intestines, cloaca)

Glandular Organs: (Liver, pancreas)

Urinary System: (Kidneys, ureters)

Reproductive System: (Testis/ovary, oviduct)

Endocrine System: (Adrenals, thyroid, parathyroids, pituitary)

Palm Cockatoo Necropsy Protocol Page 5

Bird ID: _____

Nervous and Sensory Systems: (Brain, spinal cord, peripheral nerves, eyes, ears)

Gross Diagnosis: (List each lesion separately. Include organ, type of lesion, severity, etc.)

Most Significant Finding/Lesion Contributing to Death: (Based on gross examination)

Laboratory Tests: (List bacterial, fungal, and viral cultures submitted and results if available. List postmortem fecal flotation and direct fecal exam results)

_____

_____

Photography Performed? (List organs/lesions photographed)

_____

_____

_____

_____

_____

Palm Cockatoo Necropsy Protocol Page 6

Bird ID: _____

NEONATAL/EMBRYONIC GROSS EXAM: In addition to routine gross exam, the following guidelines should be used for neonates and embryos:

EMBRYOS

_____

Shell and Egg Membranes: (Shell irregularities, membrane discolorations or exudates)

_____

Yolk Sac: (Internal or external, abnormal contents)

_____

Embryo: (Position in shell in relation to air cell)

Open celomic cavity and fix in toto. Describe any congenital or obvious abnormalities.

NEONATE

_____

Yolk Sac: (Internal or external, size and abnormal contents)

_____

Umbilical Area: (Describe and fix entire area)

_____

Malformations:

_____

Bursa/Cloaca: (Describe and fix entire cloaca in unable to locate bursa)

_____

Assess Hydration: (Tissue moistness)

_____

Evidence of Eating: (Food in crop or proventriculus)

Did Breathing Occur? (Do lungs float in formalin?)

For further information or comments, please contact Mike Taylor



Caloosahatchee Aviary | Palm Manual | IAS | Search the Site | Table of Contents

Appendix 16

Food Item Preference by Two Palm Cockatoo Pairs at WOCC

by Mike Taylor

White Oak Conservation Center (WOCC) sponsored a three year diet/nutritional study of the diets fed to two pairs of palm cockatoos at the center. When the researcher, Greg Flemming, publishes the complete study, a copy will be added to this manual. The following chart lists the food items offered, the percentage consumed by each of the pairs, and the average consumed by the two pairs. The chart may give you an idea of what these birds at WOCC prefer to eat.

Food Type	Pair #1 (%*)	Pair #2 (%)	Average (%)
Peanut	7.5	7.6	7.55
Pine nut	3.9	5.0	4.45
Pandanus nut	1.5	1.3	1.40
Almond	1.6	2.4	2.00
Brazil nut	2.9	3.2	3.05
Hazel nut	2.2	2.9	2.55
Banana	12.1	7.4	9.75
Apple	4.6	6.4	5.50
Carrot	4.9	7.0	5.95
Kale	1.2	1.6	1.40

Grapes	6.9	6.3	6.60
Orange	11.1	10.7	10.90
Corn	11.1	10.4	10.75
Monkey Chow	3.8	3.1	3.45
Excell	24.3	23.9	24.1
Cuttle bone	0.3	0.5	0.4

*The percentage is calculated from the weight in grams of the food items consumed.

For further information or comments, please contact Mike Taylor

Caloosahatchee Aviary Palm Manual IAS Search the Site Table of Contents

Appendix 17

Contributors List

Matthew W. Bond, 552 Rambling Drive Circle, West Palm Beach, Florida 33414.

Sherry Branch, Sea World of Florida, 7007 Sea World Dr., Orlando, Florida 32821.

Diane Downs, Avicultural Breeding & Research Center, 1471 Folsom Rd., Loxahatchee, FL 33470

Susan Healy, Sacramento Zoo, 3930 Westland Park Drive, Sacramento, California 95822.

Kimberly Howard, University of California, Davis

Carla Marquardt, Avicultural Breeding & Research Center, 1471 Folsom Rd., Loxahatchee, FL

33470

Pat Rider, White Oak Conservation Center, 3823 Owens Road, Yulee, Florida 32097, (904)225- 3308, patr@wo.gilman.com.

Dreama Skidmore, Avicultural Breeding & Research Center, 1471 Folsom Rd., Loxahatchee, FL 33470

E. Trent Swigert, Caloosahatchee Aviary & Botanical Gardens, PO Box 2101, Labelle, FL 33975

Mike Taylor, White Oak Conservation Center, 3823 Owens Road, Yulee, Florida 32097, (904)225-3308, miket@wo.gilman.com.

Sharon Wolf, Avicultural Breeding & Research Center, 1471 Folsom Rd., Loxahatchee, FL 33470

Ron Young, Mesker Park Zoo, Bement Avenue, Evansville, Indiana 47712.

For further information or comments, please contact Mike Taylor

Caloosahatchee Aviary **Palm Manual** **IAS** **Search the Site** **Table of Contents**

References

Alderton, D. (1983) *Parrots, lories and cockatoos*. Learnex (Publishers) LTD.

Amato, G. & D. Bruning. (1996) A Molecular Genetic Study on Subspecies of Palm Cockatoo (*Probosciger aterrimus*). Unpublished Progress Report. New York Zoological Society.

Brue, R.N. (1990) Feeding balanced diets to pet birds. *Multi-State Pet Bird Conference*. Apr. 6-7.

Bruning, D. (1996) Proposal for a conservation oriented field project for palm cockatoos. (Unpublished ms.).

Campbell, T. W. (1988) *Avian Hematology and Cytology*. Iowa State University Press; Ames, Iowa.

Deifenbach, K. (1985) *The World of Cockatoos*. TFH Publications; Neptune City, NJ.

Eastman, W.R. Jr. & A.C. Hunt. (1966) *The Parrots of Australia, a guide to field identification and habits*. Angus and Robertson; Sydney.

Forshaw, J.M. & W. Cooper. (1978) *Parrots of the World* (2nd edition). Lansdowne Editions; Australia.

Forshaw, J. (1981) *Australian Parrots* (Second Edition). Lansdowne Editions; Melbourne, Australia.

Forshaw, J. (1989) *Parrots of the World* (Third Edition). Lansdowne Editions; Willoughby, NSW Australia.

Freud, A. (1994) Parrots and other hookbills. *American Cage-Bird Magazine*. Feb. **66**(2).

Grau,C.R. & T. E. Roudybush. (1986) Lysine requirement of cockatiel chick. *American Federation of Aviculture Research Report*. Dec-Jan., pp. 12-14.

Harrison, G. J. & L. R. Harrison. (1986) *Clinical Avian Medicine and Surgery*. W. B. Saunders

Company; Philadelphia, Pennsylvania.

Hawkey, C. M. & T. B. Dennett. (1989) *Color Atlas of Comparative Veterinary Hematology*. Iowa State University Press; Ames, Iowa.

Howard, K.A., D.E. Ullrey, & R.R. Howard. (1992) Dietary husbandry of psittacines housed in a commercial aviary. *Proceedings of the Ninth Dr. Scholl Conference on Nutrition of Wild Animals*.

Koneman, E. W., S. D. Allen, W. M. Janda, P. C. Schreckenberger, & W. C. Winn, Jr. (1992) *Color Atlas and Textbook of Diagnostic Microbiology* (Fourth Edition). J. B. Lippincott Company; Philadelphia, Pennsylvania.

Lint, K.C. (1976) Cockatoos . . . parrot family ornamentals. *Avicultural Bulletin*. Feb.

Low, R. (1980) *Probosciger palm cockatoo P. aterrimus aterrimus, parrots their care and breeding*. British Library Cataloguing in Publication Data. Blandford Press Ltd. **104**, 326-328.

Muller, K. A. (1975) News from the bird department, Taronga Zoo, Sydney. *Avicultural Magazine* **80** (2):68-69. [Notes first breeding of Palm cockatoo - reared by parents].

National Research Council (1984) *Nutrient Requirements of Poultry* (8th Revised Edition). National Academy Press; Washington.

Randell, M. A. (1981) Nutritionally Induced Hypocalcemic tetany in an Amazon Parrot. *Journal of the American Veterinarian Medical Assoc*iation **179**(11):1277-1278.

Ritchie, B. W., G. J. Harrison, & L. R. Harrison. (1994) *Avian Medicine: Principles and Application*. Wingers Publishing, Inc.; Lake Worth, Florida.

Schubot, R. (1990) Black palm cockatoos - king of the cockatoos *AFA Watchbird* **17**(1):4-9.

Schubot, R.M., K.J. Clubb, & S.L. Clubb. (1992) *Psittacine Aviculture: Perspectives, Techniques and Research*. Willis Printing Group, Inc; USA

Sindel, S., & L. Robert. (1989) *Australian Cockatoos: Experiences in the Field and Aviary.* Singil Press PTY LTD; Austral, NSW 2171, Australia.

Silva, T. (1991) *Psittaculture; The breeding, rearing and management of parrots*. Silvio Mattacchioni and Co. 117-125.

Smith, G.A. (1987) The palm cockatoo *Probosciger aterrimus*; Adaptations and convergences.

Magazine of the Parrot Society. April. 105-108.

& (1987) *Bird Keepers of Australia*. **30**(11):181-183.

Ullrey, D. E., M. E. Allen, & D. J. Baer. (1991) Formulated diets versus seed mixtures for psittacines. *Journal of Nutrition* **121**:S193-S205.

Wallach, J. D., & G. M. Flieg. (1967) Nutritional Secondary Hyperparathyroidism in Captive Psittacine Birds. *Journal of the American Veterinarian Medical Asso*ciation **151**(7): 880-881.

Wood, G.A. (1988) Further field observations of the palm cockatoo (*Probosciger aterrimus*) in the Cape York Peninsula, Queensland. *Corella* **12**(2):48-52.

For further information or comments, please contact Mike Taylor

[Caloosahatchee Aviary](#) [Palm Manual](#) [IAS](#) [Search the Site](#) [Table of Contents](#)