Husbandry Guidelines For the

Emerald Dove

Chalcophaps indica
(Aves: Chalcophaps)

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Occupational Health and Safety Risks

Every task involves risk. The information and procedures in this manual should only be carried out following the policies and guidelines of the individuals' workplace. The current OH&S Act and Regulations for NS.W. which should be adhered to in the workplace can be found at www.legislation.nsw.gov.au. Before any procedures are carried out a safety/risk assessment of the operation should be carried out. See Appendix 1 for a safety/risk assessment sheet (ACT Work Safety Commissioner, 2010). Appropriate PPE should also be used for each activity carried out.

Manual handling is the largest risk that arises most often in the workplace environment. This can be easily reduced by using approved lifting technique such as lifting with your knees and not your back. Ensuring the workplace is ergonomic in design as well as using mechanical aids where ever possible. Other hazards can be in the form of chemical, biological, psychological as well as physical and should be addressed and assessed before any procedure is carried out.

Another important but often underestimated or overlook risk to consider, are the animals themselves that are in our care. These animals pose a risk to themselves, their keepers, bystanders and the public. This risk must always be kept in mind and ways to minimize it are put into action.

Contents

1. Introduction

The Emerald Dove *Chalcophaps indica* is a small dove that was first identified in 1758 in the East Indies (Higgins *et al*, 1996). The Emerald dove is one of the many members of the Columbidae family which includes most pigeons and doves.

The Emerald dove has a wide distribution across Asia to Australia and has been kept as pets in captivity for centuries throughout Asia, as have many members of the Columbidae family.

The Columbidae family has around 310 species in around 40 genera (Higgens *et.al* 1996). The birds in this family generally have a plump and compact body with small heads and short necks. Generally the males are larger than the females. They have broad wings with rounded tips. Their remiges are rigid which causes a loud characteristic clapping sound as they fly away (Higgens *et.al* 1996). These birds can't soar but they can glide and usually their flight is strong and direct. Their bill or beaks are typically short and weak and usually have an expanded tip. The plumage in this family are often brilliantly coloured with bright greens, red, oranges and many other colours present in the feathers of wings, tail, head and neck. The males tend to be brighter than the females.

The Emerald Dove is an important species to the Australian and Asian region. The species has developed into eleven subspecies stretched across its distribution. By studying the differences in each of the subspecies and their habitats, we can gain further insight into how a species is affected by its environment. By studying the endangered Christmas Island subspecies we can gain an understanding of how a single introduced species (the Yellow Crazy ant *Anoplolepis gracilipes*) into an environment can upset the whole eco system. By saving this endangered bird we can learn how better to manage other endangered populations. The unique location and isolation of Christmas Island is a rare opportunity for conservationist to learn more about wild population management and conservation.

1.1 ASMP Category:

This species is not part of any Australian Species Management Programs.

1.2 IUCN Category:

This species is listed as 'Least Concern' under the IUCN Redlist (IUCN, 2010) due to its wide distribution. Though it is thought that its population is decreasing (IUCN, 2010) it has yet to meet the criteria that will move it to the next category of Near Threatened'. This species is not listed with CITIES.

1.3 EA Category:

The Australian Government, Department of Sustainability, Environment, Water, Population, and Communities has listed the Christmas Island Emerald Dove subspecies as an endangered species under the EPBC Act (Environment Protection and Biodiversity Conservation 1999). While the Emerald Dove species is listed as a migratory species with no threaten status.

1.4 NZ and PNG Categories and Legislation:

While the species is native to Papua New Guinea there seems to be no legislation regarding the species. It is not a vulnerable species in this country.

This species is not native to New Zealand.

1.5 Wild Population Management:

Although one subspecies of the Emerald Dove (the Christmas island Emerald Dove, *Chalcophaps indica natalis*) is listed as 'Endangered' (EPBC, 1999) on the list of Threatened Species, there is no wild population management plan. There is a management strategy plan as well as research being conducted into the sub species' main threat, the Yellow Crazy Ant (*Anoplolepis gracilipes*).

1.6 Species Coordinator:

There is no species coordinator for this species.

1.7 Studbook Holder:

There is no studbook holder for this species.

The AZA Population Manager and Studbook Keeper is Kevin Drees (kevin.drees@blankparkzoo.com) but this data is only current to 1/12/2006 and there is no listed studbook keeper for after this date (ZAA, 2010).

2. Taxonomy

Taxonomy is the classification of organisms into an ordered system that indicates natural relationships.

Below is the taxonomy for the Emerald Dove or *Chalcophaps indica.*

2.1 Nomenclature Class:

Order : Columbiformes

Family : Columbidae (Doves, pigeons)

Genus Species: *Chalcophaps indica* (Linnaeus, 1758)

2.2 Subspecies:

The Emerald Dove (*Chalcophaps indica*) has a number of subspecies, three of which exist in Australia; *longirostris* from the Kimberly, Western Australia to Cape York Peninsula, *chrysochlora* from Cape York Peninsula to southern New South Wales as well as Norfolk Island and Lord Howe Island, and *natalis* from Christmas Island.

Emerald Dove Subspecies:

Chalcophaps indica augusta (Bonaparte, 1855)
Chalcophaps indica chrysochlora (Wagler, 1827)
Chalcophaps indica indica (Linnaeus, 1758)
Chalcophaps indica longirostris (Gould, 1848)
Chalcophaps indica maxima (Hartert, 1931)
Chalcophaps indica minima (Hartert, 1931)
Chalcophaps indica natalis (Lister, 1888)
Chalcophaps indica robinsoni (E. C. S. Baker, 1928)
Chalcophaps indica rogersi (Mathews, 1912)
Chalcophaps indica sandwichensis (E. P. Ramsay, 1878)
Chalcophaps indica timorensis (Bonaparte, 1856)

2.3 Recent Synonyms:

NONE, the Emerald Dove is listed as *Chalcophaps indica* in all ARKS and ISIS databases.

2.4 Other Common Names:

In English:
Common Emerald Dove, Emerald Dove, Emerald Ground Dove, Green Winged Pigeon/Dove, Indian Emerald-Dove, long-billed or Little Green-Pigeon, Little Green-winged Pigeon, Lilac-mantled Pigeon, Green and bronze Pigeon, Green-backed dove

In Dutch:
Smaragdduif

In French:
Colombine turvert

In German:
Glanzkäfertaube

In Japanese:
キンバト

3. Natural History

The Emerald Dove (*Chalcophaps indica*) has a wide distribution across tropical southern Asia to Indonesia and to Australia. The dove is known by many names in each of the countries. The Emerald Dove is also the state bird of the Indian State of Tamil Nadu. The dove also has a number of subspecies which are thought to have been brought about by their locality and isolation. Three of these subspecies can be found in Australia.

The Emerald Dove is a widespread and common bird. This bird though can be shy so they are rarely seen and can usually be found foraging under foliage in pairs or singly or sometimes rarely even in small groups. Unlike other doves, Emerald Doves forage alone or in pairs. If a group is attracted to a food rich area they will each maintain a small feeding territory.

The Emerald Dove prefers a dense forest to open grass land and can often be found on the ground rather than in the air. While the birds roost in trees they forage for fallen fruit, seeds and plants on the ground during the day, they will also visit mineral seeps in the forest. They often fly quite low through the trees and are adapt at weaving in and out of a dense forest (Higgens, *et. al* 1996).

They are usually a bird that can be approach easily. When their FFF zone is compromised the bird will rather walk away than fly, and will only take flight when they are really pushed to do so.

Due to their beautiful coloration and soothing call the Emerald Dove is often trapped and sold as cage birds in Asia and the Indonesia region.

There is little data on the differences between the subspecies of the Emerald Dove though the differences between the Australian subspecies have been documented (Brown, D 1995). There is colour variation between the subspecies but findings differ as to the extent of the colour variation between the subspecies and again between the sexes within the subspecies especially in subspecies found outside of Australia.

There have been studies that have been completed on the growth of individuals within the subspecies of the Emerald Dove but there is no conformed growth chart for the species. The studies performed were merely measuring birds and the results were not converted into a growth rate chart (Higgins *et al.* 1996).

There again, have been no major studies into breeding for this species of bird. The breeding season can be throughout the year and depends on the locality of the birds and local environmental factors. They do nest in small leafy bushes, trees or even vines. They construct a nest from accumulated twigs and leaf litter with a recorded nest being as small as only containing eight sticks (Higgins *et al.* 1996) and other nests being quite substantial in construction.

3.1 Diagnostic features:

How to identify the bird as belonging to the Columbidae family (Higgins *et al.* 1996):

- Bodies are generally plump and compact, with small heads and short necks.
- The wings are broad with rounded tips. Their remiges are rigid, which causes loud and characteristic clapping sound when the bird flies away. Their flight is strong and direct; while they cannot soar, they will glide. Their plumage is usually shades of brown, grey and cream, brilliantly coloured with iridescence often present in feathers of wings, tail, head, neck and upperparts.
- The tail of most species is long and broad, with square or slightly rounded tip; very long and pointed in some species;
- The bill is short, weak and superficially plover-like, usually with an expanded tip, which is hard and sometimes hooked with a soft base.
- The tarsi usually short with small hexagonal or rounded scales at side and rear. The feet are a perching type with three front toes and large functional hind toe.
- In most species the sexes differ only slightly in appearance, with males somewhat brighter or more patterned and larger than the females
- Adult plumage is attained after a complete post-juvenile moult.

Identifying the bird as *Chalcophaps indica:*

Description: a small plump short-tailed pigeon. Mostly purplish brown with iridescent dark green scapulars and secondary coverts (see fig 3.1.1 for location of feathers) and conspicuous pale shoulders patch. They have eleven primaries with p1 being reduced and between 10-15 secondaries (Higgins *et al.* 1996) see Fig 3.1.2-3.1.5 for pictures of the dove.

Weights and measurements: length 23-27cm, wingspan 43-46cm, weight 110-160g

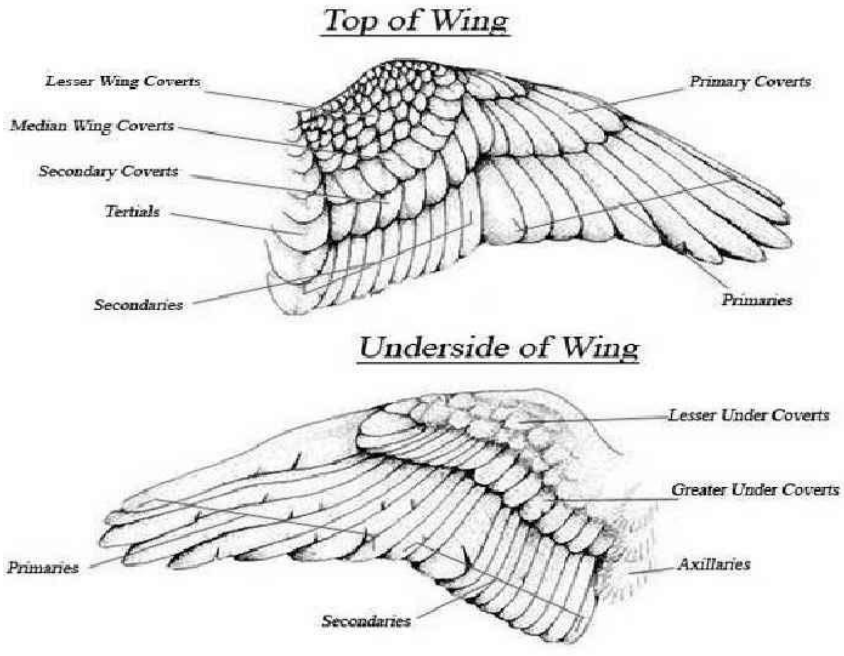

Fig 3.1.1 Feather locations (imageshak, 2009)

Sexual dimorphism: females are generally duller brown with a duller shoulder patch and a paler rufous-brown black rump and tail.

These birds have no seasonal variation and the juveniles are very distinct from the adults as seen below in fig 3.1.2 and fig 3.1.5.

It is unknown how the weights of birds from different locations and sub species differ.

Call: is a series of monotonous, mournful single "OOO" notes which is usually repeated 10-12 times in a c all. It is low pitched and uttered continuously especially during the late afternoon and sometimes after dark. The bird will usually call when perched high in a tree and has a ventriloquial quality, which makes calling birds very hard to locate.

Fig 3.1.2 Adult (sex unknown) with Juvenile (ryanphotography,2009)

Fig 3.1.3 Unknown gender (janson, 2009)

Fig 3.1.4 A known Male (Beste, 2009)

Fig 3.1.5 An older juvenile (Myer *et al*, 2008)

Fig 3.1.3 & 3.1.4 show the variation in colour that is possible with different subspecies but again how great this variation can be has yet to be studied.

There are no similar species to confuse the Emerald Dove with, as its distinct colouration makes it unique.

3.2 Distribution and Habitat:

As a species the Emerald Dove usually spends its time on the ground foraging for food in dense forest with lots of leaf litter covering the ground.

Their preferred habitat is dense forest and they will use any adjoining habitats. Suitable forests include rainforest, evergreen, closed gallery forest, wet sclerophyll forest, vine scrubs and monsoon forests (Higgins *et al.* 1996).

In drier and more open habitats they will occur seasonally. They are often also found on the fringes of forests or in regenerating patches with secondary growth or where an infestation of weeds is occurring.

Their distribution across the world stretches from India in the east through to China through southeast Asia including; Indomalaya, Philippines, New Guinea, Louisade Arch, as well as the islands of the west Pacific Ocean, such as Vanuatu, New Caledonia and Norfolk and Lord Howe Is, as well as north and eastern Australia. For the Emerald Doves' distribution across the world see Fig 3.2.1.

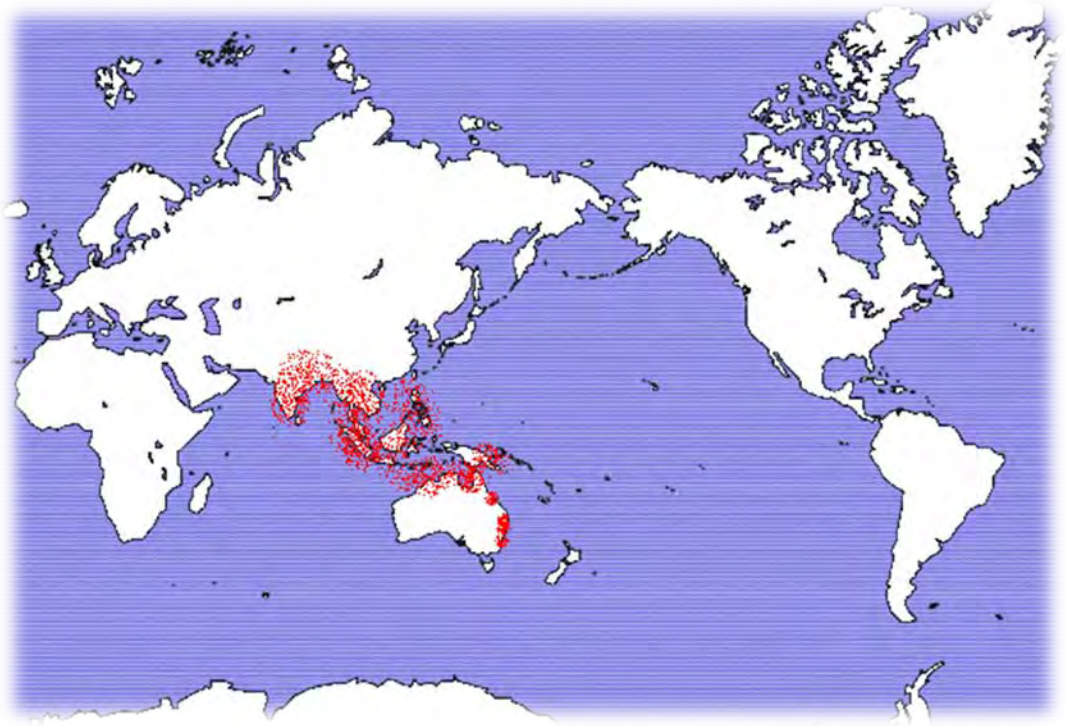

Fig 3.2.1 Distribution map of the Emerald Dove across the world

In Australia the dove is widespread in the top end and along the east coast from Torres Straight to south east NSW, there is an isolated population in Kimberley. They are widespread in Lord Howe Island and Norfolk Island and Christmas Island. See fig 3.2.2 for the Doves' distribution across mainland Australia.

Fig 3.2.2 Map showing distribution of Emerald dove across Australia

There is little known about the migratory patterns of these birds. They are thought to be partly nomadic and locally migratory (Higgins *et al.* 1996) but no large studies have been undertaken. For instance in NSW they are thought to be sedentary (Higgins *et al.* 1996) due to the local data that was available. With no studies undertaken since the early nineteen eighties there really is no information on their migratory patterns.

There are individual records of these birds being sighted far from land and being taken onto ship at sea (Higgins *et al.* 1996) which does give evidence that they have the ability to travel long distances.

Due to their natural habitat of dense forest, it is easy to assume that with the expansion of civilisation especially in the Asian region and the east coast of Australia, that their natural habitat has diminished and their distribution 100 years ago would have been much greater than it is today but with no corroborating evidence this is only a theory and cannot be verified, as there have been no studies into this area.

3.3 Longevity:

3.3.1 Wild:

There is no data of the longevity of these birds. If they were to be compared to other similar species such as other dove species then they would be expected to live between 3 to 5 years in the wild.

3.3.2 Captivity:

There is a record of juveniles free flying three weeks after hatching (Higgins *et al.* 1996) in captivity. There is little other data regarding aging or the longevity of these birds. There are individual specimens kept in the private sector which have lived up to 18 years

(Brown, D 1995). If again they are to be compared to other similar species they would live on average to around 15 years in captivity.

3.3.3 Techniques to Determine the Age of Adults:

There is no data regarding the best way to determine the age of the adults. Higgins *etal.* (1996) have recorded studies that have been conducted on recording the plumage of the birds and how this changes after their first moult. These studies can be used to loosely determine the age of a younger bird.

Once the bird is a full adult in captivity there should be records that the facility holds to identify how old the bird is.

There is little data on how a captured wild adult bird would be aged. Skull pneumatization is one possibility, which is measuring how much of the skull has been pneumatized. A birds bone will pneumatize especially the mastoid and ethmoidal bones with growth, which means that the marrow changes and the bone fills with air sacs as the bone ages, which in turn makes the bones lighter.

4. Housing Requirements

The following guidelines should be followed for any housing for the Emerald Dove.

4.1 Housing:

In order to house the Emerald Dove in a safe and secure manner while also providing for the birds physical and mental health and wellbeing an understanding of the bird is essential.

It needs to be taken into consideration that the Emerald Dove is mainly a ground dwelling bird (Higgins *et.al.* 1996). While the bird will roost in trees, the animal will spend the majority of its time on the ground. This means that when choosing or designing an enclosure there needs to be plenty of open ground space and low level shrubs and bushes as well as perches of various heights and trees.

The EAPAct (2004) has few requirements for the Emerald Dove, besides providing food, water and shelter for the animal. When deciding on the size of enclosure it is required that the bird is able to move freely around. The birds FFF (Fright, Flight, Fight) zone does need to be taken into account. The Emerald Dove by nature can be a flighty bird but traditionally has a smaller FFF zone than most other birds (Higgins *et.al.* 1996). That being said, the larger the enclosure the more beneficial it is for the bird. A larger enclosure also opens up the possibility of a multispecies exhibit, which the Emerald Dove is very capable of fitting into. The bird is traditionally a low flyer (Higgins *et.al.* 1996) ducking in and out through the rainforest trees so a high roof is not a requirement for the bird by the EAPA, though I have known these birds to knock their heads on low ceilings when they get stressed so a higher roof can provide extra enrichment and let the birds feel secure. If the ceiling must be lower, padding may have to be considered.

An area that is protected from the weather needs to be established in the aviary. In the southern hemisphere the most efficient direction to place the enclosure is with the shelter facing north which means that the south west corner is protected from the bad weather that will blow in from that direction. For the northern hemisphere these directions would need to be reversed.

There have been no official records taken of the bird actually using a bird bath when provide with one (Higgins *et.al.* 1996) though there have been amateur observations of the birds bathing, the EAPAct (2004) also does not require that enclosures be provide with a birdbath, but with the addition of such furniture there is the potential for extra enrichment. It is considerations such as these as well as others such as misters which need to be contemplated when designing or choosing an enclosure for the Emerald Dove.

Pest management needs to be considered when choosing or designing an aviary. The more control the keepers have over the environment, the easier it is to control pests. In my experience the main pest for any aviary is rodents. Aviaries should be built to be rodent proof but even with this precaution rats and mice still manage to get into most places. A pest management plan will need to be created and this is best to do while the enclosure is being designed so that they can complement each other instead of the keeper havening to work against the design of the aviary to control its pests. Figure 4.1.1 illustrates one of the many ways an aviary can be designed to be rodent proof. Appendix 2. contains a Monthly Pest Assessment which can be conducted monthly as part of pest management program.

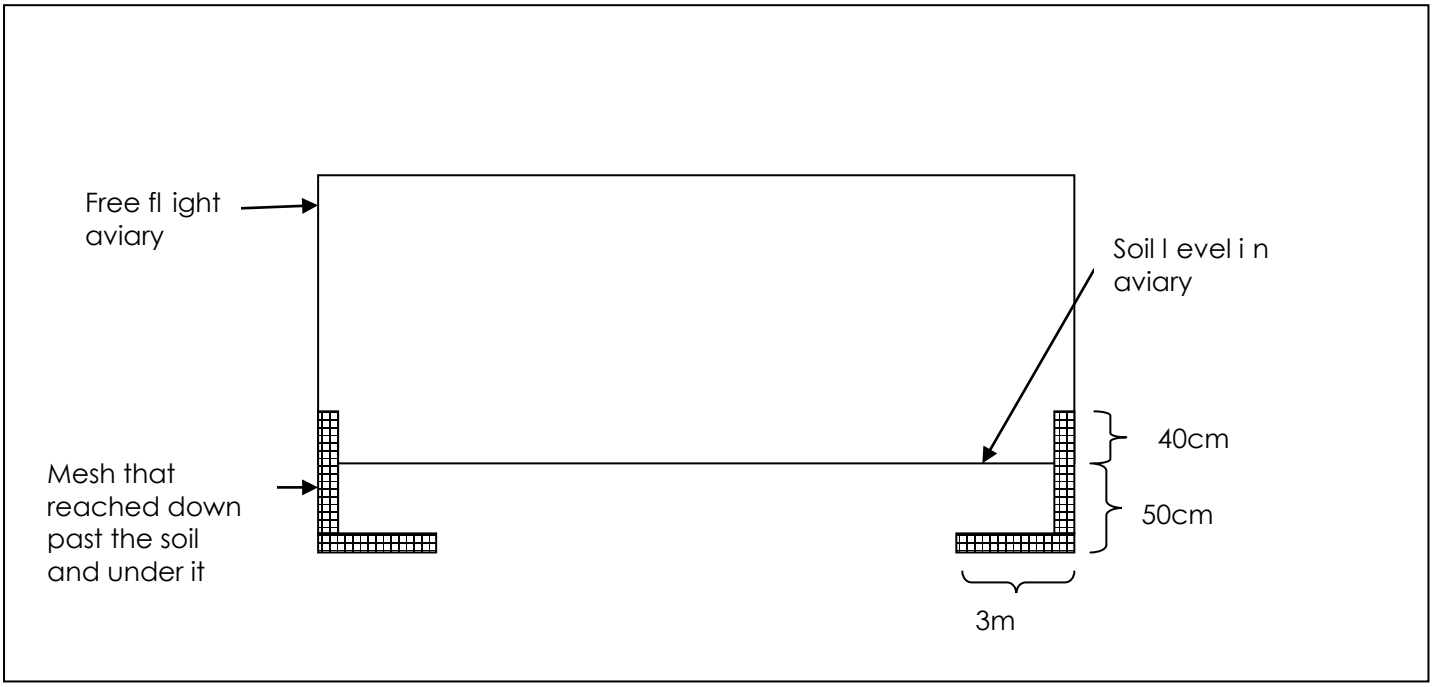

Fig: 4.1.1 One way to rodent proof an aviary

4.2 Holding Area Design:

When contemplating a holding area (an off exhibit holding area) for the Emerald Dove the duration of the holding time needs to be considered. If it is for a very temporary holding period such as a number of hours, suitable cages can be the transportations boxes such as those designs found in section 7 as long as the area;

- Allows the bird to move freely and turn around
- Has access to a sheltered area as well as food and water
- Is the length at least three time the animals length and the breadth at least one and a half times its length
- Has safe access for keepers and no blind spots

If the bird is to be housed for an infinite longer period of time, such between one and ninety days, then a suitable area needs to be set up.

Again there are few regulations that are listed in the EAPA (2004) that affect the holding area design for this bird but the area must:

- Permit normal behavioural requirements such as flying space for flying species
- Allows the bird to move freely and turn around
- Has access to a sheltered area as well as food and water

In my experience any holding area should also have a few perches, and more importantly for this species plenty browse to hide in. As this species spends the majority of its time on the ground a holding area should have some sort of substrate such as mulch to make the bird feel more secure. These birds are known to knock their heads on low roofs when they get stressed or nervous so a padded roof may have to be explored if your holding area is too short. Fig 4.2 is an illustration of a holding area that I would use to keep one or two Emerald Doves in for between one and ninety days. It is tall enough not to need padded roofing and meets the EAPA (2004) requirements. The only items to add would be browse and a couple perches. Being a ground bird the Emerald Dove doesn't need that many perches and any perches provided should be quite low to the ground.

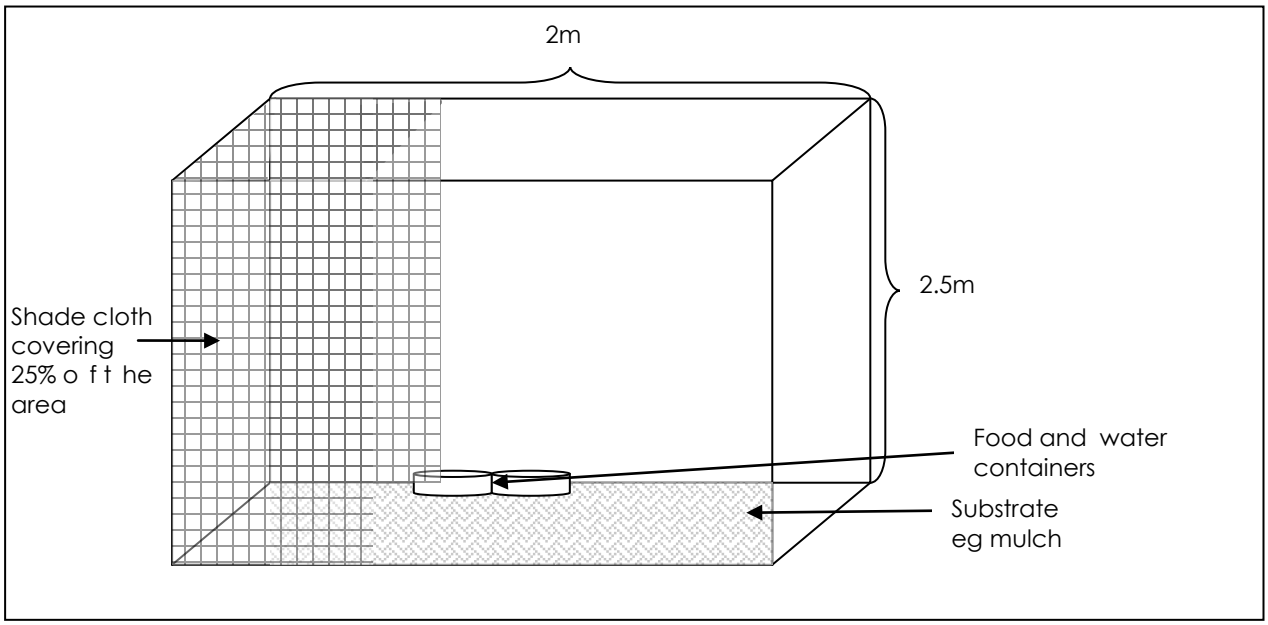

Fig 2: A sketch of an option for a holding area for an Emerald Ground Dove

4.3 Spatial Requirements:

The EAPAct (2004) does not have any specific requirement as to how much space is required for the Emerald Dove. But there are certain criteria that any enclosure must meet;

- The size and shape of the enclosure must provide freedom of movement horizontally and vertically
- The size must be large enough to
  - Avoid undue domination by a group of individuals
  - Avoid the risk of persistent and unresolved conflict between different species
  - Make it possible for an animal to withdraw from contact from other animals and people
  - Ensure the carrying capacity of the enclosure is not exceeded
  - Prevent uncontrolled accumulation of parasites and other pathogens
  - Encourage exercise and behavioural enrichment
- Each animal must be provided with enough space in all directions to
  - Take exercise
  - To be protected from undue dominance and conflict
  - To be provided with its social, breeding and husbandry needs

Brown, D. (1995) recommends that there is between 2-2.5 cubic meters of aviary space per pair of birds and in my opinion this is a good guideline to follow.

4.4 Position of Enclosures:

The best aspect for any enclosure in the southern hemisphere is a northerly facing one. Tall trees around the outside of an aviary can be an issue if they become damaged in a storm and fall so this needs to be considered. Drainage also needs to be considered but this can be controlled through a good aviary design. Other than these reasons an aviary can be placed in almost any location.

4.5 Weather Protection:

The Emerald Dove is a hardy bird and can withstand weather extremes within reason. Any enclosure used to house an Emerald Dove should be equipped with a shelter to give

protection from wind and rain as stated in the EAPAct (2004). A well designed enclosure would also be designed to always have a section in the shade and an exposed section in the sun. As aviaries often are exposed to the elements by design there does need to be an enclosed shelter somewhere in the exhibit. The shelter should face a northerly direction as this will protect the area within the shelter from the winds and storms that come up from the south, as well as the western sun.

4.6 Heating Requirements:

The Emerald Dove does not have any specific heating requirements, though in winter a heat lamp can be provided and this gives the birds the options of using it, especially if the birds are being housed in areas in Australia that is not within their normal distribution range.

4.7 Substrate:

Artificial substrates such as concrete should be avoided especially in permanent exhibits due to the birds' nature. For the majority of the time the Emerald Dove is a ground dwelling bird and as such a substrate such as mulch, leaf litter or soil is best to use, as this allows the bird to display its natural behaviours such as foraging. For temporary holding areas substrates such as newspaper can be used.

4.8 Nest Boxes or Bedding Material:

The Emerald Doves needs little nesting material. In my experience a simple platform only needs to be provided. The bird will often balance a nest in a tree if sticks and twigs are provided. It was once recorded that a nest was made out of only six sticks (Higgens *et.al.* 1996). Of course nesting material only needs to be provided in the breeding season which is usually spring although given nesting materials and the correct food trigger they can bred all year round. During the rest of the year the bird will happily roost on any tree or perches provided in the aviary.

4.9 Enclosure Furnishings:

Being a ground bird, the best furnishings should allow for a lot of space free on the ground. The Emerald Dove will also nest and hide in trees so there needs to be places to perch such as trees or perches of various heights and widths.

The aviary should be filled with a variety of plants. Grass tussocks plants are good as the birds can run around and hide in these, as are any other plants that sprout low to the ground- see appendix 5 for more species. These plants can be rotated to keep them healthy.

Browse pots should be placed around the aviary so they can be filled regularly with fresh browse.

Items such as misters should be considered for the birds' health and enrichment.

A pond or stream is a great idea for a water supply and if it is self sustaining, it may not need daily maintenance.

The Emerald Dove mainly nests in spring but can breed all year round. Nesting platforms should be provided only when breeding of the birds is required. Sticks and twigs should also be provided around the exhibit for the bird to build its nest with.

5. Exhibit Maintenance

For the animals' health and well being it is essential that exhibits are maintained on a daily basis.

5.1 Hygiene and Cleaning:

The cleaning schedule for any enclosure will depend of the design of the enclosure. Each institution will have their own specific SOPs for their own enclosures. The following are simply guidelines that can be applied to any generic enclosure but are important to complete to keep up hygiene within the enclosure.

Daily:

- Clean any areas where there is built up waste- using a hose and scrubbing the bad sections with a bush and some F10® or Aviclean® is a good method (Appendix 6)
- Remove old food bowls, scrub food platform, remove all traces of old food and ensure platform is dry
- Place new food dishes on platform
- Scarify the substrate to break up waste on the ground
- Check security of the enclosure, ensure there are no holes in any wire and all locks are secure
- Empty and change the water bowl
- Do a head count of the animals inside and a health check of them
- Check for any pests that may be in the aviary such as rodents. Rat holes should be flooded and any rats escaping should be caught. Any rat traps that are around the aviary should be checked and emptied if they have rats in them

Weekly:

- Change browse in the aviary as need or as it states on your enrichment calendar
- Pest control maintenance, means sustaining any current pest control plans whether that be weeding, laying out regular rat traps or finding rat holes to flood with a hose
- Clean any old nesting platforms that aren't being used

Monthly:

- Pest control assessment, this is where the current pest control plan is evaluated to see if it is working and modified to suit the current pest situation
- Rotate the perches in the aviary and replace any old ones
- Change smaller branches and furniture in exhibit and other furniture as needed
- Check the health of plants in enclosure, rotate if required

Annually:

- Change major furniture in exhibit, rotate large plants if needed.
- Change soil substrate
- Consider re landscaping the exhibit

Breeding Season: (usually spring but potentially all year round)

- Add breeding platforms and nesting materials
- Remove after young have fledged

5.2 Record Keeping:

Daily records to take would include:

- Daily health problems
- Behavior observations

- Breeding notes –depending on the season*
- Vet exams or any treatments given
- Any transfers that are completed within the zoo or between institutions
- Any births or deaths
- Exhibit observation

Weekly records should include:

- Changes to birds' diet
- Records regarding environmental enrichment and browse change
- New identification of any new additions and how these birds are identified

Monthly records should include:

- Weights and measurements for a preselected few individuals to measure their growth over their lifetime
- Any studies being conducted; samples should be taken and recorded here unless for the study they require more frequent samples than samples taken once a month
- Any transfers that are completed within the zoo or between institutions for the month
- Exhibit observations, areas to clean or repair or improve

Yearly records should include:

- A summary of transfers completed between institutions for the year
- A summary of births and deaths
- A summary of any constant or reoccurring medical conditions of a single individual or that keep recurring on a number of individuals with a summary of where they are housed and their individual records
- A summary of any studies currently being undertaken on the birds such as studying the growth rates of the birds, or a study on their colour variation

***In the breeding season daily notes should be taken on:**

- Behaviour of individuals, groups and interspecies interactions as well as behaviour displayed to members of other species.
- Environmental factors that influence or initiate breeding behaviour
- Nest observation about materials and construction
- Observation about the size of the clutch of eggs
- Observations about hatching and death rates
- Observation about any juvenile development

5.3 Methods of Identification:

There are three main methods for identifying these birds:

Banding is the preferred method for identification as long as it is applied by an experienced person. Coloured bands are best as they can be identified from far away. Bands that can be removed easily are the safest to use for the individual animal. This type of dove is a ground dweller so there do not have to be concerns that if a split band is used the bird will catch it on the roof wire of a free flight aviary. Banding is the most common form of identification for this type of bird. Historically leg bands could cause issues for the birds that they were used on but the bands today are a lot safer to apply for the keeper and bird as well as being safer for the bird to wear throughout its lifetime.

These birds are large enough to comfortably have an *injectable microchip* inserted, but the expenses of these verses the value of the bird is not deemed to be a cost effective method of identification.

Keepers who work continuously with the same birds can tell individuals apart and *ID the birds by name*. This is an ineffective method of identifying the birds because while the bird is flying it is hard to tell individuals apart and the keeper who knows the animals may not always be available. Birds often will have a large FFF zone as well, so it means that you need to be able to identify animals from far away.

5.4 Routine Data Collection:

There are a lot of studies that need to be conducted on these animals in order to learn more about them. There are many blank spaces in the current known research. To fill these blank spaces in there would have to be a conjoined effort between a number of zoos and institutions to start routine data collection and analysis.

This is an argument in favour of hand raising a number of birds across a number of institutions. These birds could be easily weighed and measured as well as photographed for colour variation between sex and subspecies without undue stress on the bird. This would have to continue for a few generations in order to obtain the best results.

Universities should be approached to see if they want feather samples to genetically identify the subspecies to prove that there are subspecies and not one species with many variations.

To further look at sub species variation and identification, a look at their migratory patterns needs to be undertaken. In order to do this a large catch, tag and release program would have to be established with observation posts around the country and overseas.

6. Diets

Monitoring and adjusting the diets of the animals in your collection is an important part of a keepers' daily work. The Emerald Dove doesn't have a complicated diet and can easily be fed along with other bird species in the same enclosure.

6.1 Wild Diet:

In the wild the Emerald Dove consumes a wide variety of foods. According to Higgins *et. al.* (1996) the dove will devour a variety of seeds, fallen fruits, grass plants and seeds and sporadically small invertebrates.

These birds naturally feed on the ground and rarely while in the trees. These birds will only eat food that can easily be reached that they don't have to stretch for. The can often be found feeding on the edges of human dwellings in forest areas and along paths in the forest.

The invertebrates that the Emerald Dove has been known to consume include snails, flies and termite pupae (Higgins *et. al.* 1996)

The Emerald Dove will consume an extensive range of plants (Higgins *et. al.* 1996) and the species consumed depends on the season and availability. There are also plants that only the seed or the fruits will be consumed or just the leaves themselves. Examples of some of the species they will consume are: from the Arecaceae family the *Calamus sp.* and from the Cyperaceae family the *Scleria sp.*, From the Chrysobalanaceae family the fruit from the *Maranthes corymbosa*. From the Ebenaceae family the *Diospyros ferrea* and the Euphorbiaceae family the *Euphorbia sp.*

Fig 6 .1.1:*Diospyros ferrea* (TPBG, 2005)

Fig 6.1.2: *Maranthes corymbosa* (Chah, 2008)

6.2 Captive Diet:

In captivity the Emerald Dove lives on a pigeons diet which is easy to maintain. A common diet consist of commercial grade pigeon seed, with mixed greens and seasonal commercial produce fruit such as apples, bananas, mangos, watermelon given daily with occasional invertebrates such as mealworms and cockroaches given out.

In my experience I have fed the Emerald Dove the diet found in Table 6.2.1. Often these birds are kept in free flight aviaries with other species. This can make it hard to work out how much food to actually feed the birds as other species will eat it. The diet provided is aimed at feeding two Emerald Doves in a free flight aviary and as such the amounts of food have been increased to account for the fact that other birds will be eating this food

too. Table 6.2.2 shows a variety of fruit that I have fed out to aviaries containing Emerald Doves as well as other species. Table 6.2.3 list a variety of insects that I have also fed out to aviaries containing the Emerald Dove.

Table 6.2.1: Captive Emerald Dove Diet

Time	Diet
Twice daily	Seasonal fresh fruit produce placed on nails around the enclosure, 10 pieces half the size of an apple
Daily	1 cup Commercial grade Pigeon Seed 1 handful Mixed greens
Twice Weekly	Fresh browse or grass plants
Spring and the months proceeding	Insects added every alternate day to diet

Every institution will receive their fresh produce from different sources. It can often be unpredictable in quantity and quality. Most often it is the fruit that is in season that is the most easily to obtain. It is for this reason that fresh fruit is listed as seasonal fresh fruit in the table above.

The Commercial grade pigeon seed, as seen in Fig 6.2.11, can be purchased from any local supplier. Its ingredients can vary from source to source or institutions can even make their own. An example of what Pigeon seed should contain includes: red corn, yellow corn, hard red wheat, red milo, red millet, Canadian white peas and maple peas. (Bird seeds, 2009)

Fig 6.2.11: Commercial Pigeon Seed (J.Brown, 2010)

"Mixed greens" is a combination of the stalks of spinach, bok choy, peas, broccoli and other greens that many institutions get delivered as part of their produce. I have used other greens such as lettuce, cabbage, parsley even small bits of cucumber. Often the leaves of such greens are consumed by other animals such as reptiles and other fussier animals, the harder stalks can be chopped finely and mixed with other greens to form a 'greens mix' which can form the staple part of many birds diets as seen in Fig 6.2.12.

Fig 6.2.12: Greens Mix (J.Brown, 2010)

Fresh browse is often hard to source each time and most institutions will recycled, and as such the browse from the aviary is first given to animals such as Koalas for a day, after which it will be switched to the aviary. To gain more variety in browse species besides eucalyptus other species should be sourced. The Emerald Dove will often eat anything with seeds, fruits or figs s prouting on the branches. See appendix 5 for examples of just a few appropriate species for the Emerald Dove which can be consumed or used simply for enrichment. Browse is often used as part of an enrichment program; see section 9 for an enrichment calendar that suggests when browse should be placed in the aviary.

"Grass plants" in Table 6.2.1 refers to grass species that I have added to aviaries for enrichment as well as part of a regular diet. Often the stalks of local grass plants growing

in the area have just been pulled and added to the aviary. Sometimes I have pulled the whole plant and transplanted it into the aviary for enrichment or merely taken the top of the plant (the pieces with seed heads on them) and fed it out with the animals' daily diet. This is a great way to add variety to the animals diet as you can use any species that you find in the local area.

The Emerald Doves' breeding season is in spring. In order to help the breeding season and increase the chance of a successful breeding season the addition of insects to their diet in my experience has been proven useful. A variety of invertebrates that can be given to the Emerald Dove can be found in Table 6.2.3.

Table 6.2.2: A selection of Fruits that can be used as seasonal produce *subject to availability

Mango	Apple
Banana	Pear
Pawpaw	Watermelon
Rockmelon	Grapes
Strawberries	Oranges
Peaches	Passion fruit

Table 6.2.3: Invertebrates that have proven successful with the Emerald Dove

Mealworms	Cockroaches
Fly Maggots	Crickets
Snails	

6.3 Supplements:

The diet that has been suggested has been used in my own experience successfully for a number of years. It is a well balanced and varied diet and proven so successful that there has been no need to add any supplements to the diet.

However there are many supplements available commercially on the market today and can be obtained from any local bird supplier.

Common supplements will contain some form of calcium. This is usually added to the diet around the breeding season to reduce the chance of calcium deficiency or weak egg shells. It should be realised that any good supplement that contains calcium should also contain the vitamin D3 to help the animal absorb the calcium. These supplements also can contain a variety of minerals and other vitamins. They are usually given when there is a high demand on the birds energies such as during breeding. But if a balanced diet is given to the bird no supplements should be needed, even during breeding season.

6.4 Presentation of Food:

My aim when presenting food is to not only to provide the food to the animal but to also provide some form of enrichment at the same time.

For this reason the fresh fruit can be placed on nails around the enclosure. The fruit should be placed in areas that the Emerald Dove would feel naturally inclined to forage for food such as the edges of the undergrowth of the plants in the enclosure. But the fruit should also be placed in areas that the bird wouldn't normally forage for food; this is for added enrichment but also as the species often shares an aviary, this fruit is for other birds to consume within the enclosure.

The browse can be placed in browse pots that are already established around the enclosure. This should leaves bunches of browse close to the ground and others higher up in the air- again this is aimed for the many species of birds that share the enclosure.

The daily feeds which includes the mixed greens and seed, can be placed into a seed dish. The design of such is open and limited only by the keeper –see section 9. Anywhere seeds are placed in the enclosure rodents are sure to become an issue. This needs to be monitored by keepers, see section 5.

Transplanted grass plants/species can be placed at various locations in the enclosure where there is enough soil so they will grow. Collected seed heads and grass cuttings can be placed around the enclosure to add enrichment and dietary variety for the animal.

Any insects given to the birds should be placed near the birds where ever they are in the enclosure. This is because as the birds usually share the enclosure with other birds' species this is the only way to ensure the Emerald Doves will get the insects. This way the birds can be watched to ensure that the insects are consumed.

7. Handling and Transport

OH&S Risks:

Capturing is an OH&S risk. There are inherit risk to the keepers and animals involved.

There is the possibility of stressing the intended animal out and risk to the keepers handling it in the process.

There is the possibility of zoonoses occurring during handling and so handling should be kept to a minimum. The claws of the animal can also cause minor scratches to the keepers involved. There is also the possibility of the keeper injuring themselves in the exhibit on a low branch and perch- therefore care needs to be taken to avoid this.

The danger to the animal itself is the possibility of its wings becoming damaged or its legs during capture. There is also the great possibility of over stressing the animal which can in extreme cases lead to death.

Any capture under taken should be well planned with experienced staff involved to reduce the inherit risks.

Handling and Transport:

When handling and transporting the Emerald Dove it needs to be remembered that birds themselves are nervous and flighty creatures that get stressed easily. It is for this reason that it is important that capturing is completed in the shortest amount of time possible and is well planned with handling minimised and the transportation well planned. This will reduce problems that may occur along the way and reduce the chance of over stressing the bird.

The IATA (International Air and Transport Association) has regulations controlling the movement of the Emerald Dove and how the bird is transported. Their regulations are described below.

7.1 Timing of Capture and Handling:

To minimise handling of the bird the planning of the capture needs to be well thought out with each person aware of the role they will be playing in the capturing process.

The capture should be planned for the early hours of the morning. This is to avoid the public because an audience is the last thing that a capture needs. The capture is also best to start in the early hours of the morning because it gives the keeper the day to complete whatever transport arrangements have been made, or treatment and examination before the animal gets too hot and stressed in the holding cage. With luck if preformed in the early hours of the morning it may be possible to capture the bird while it is still roosting.

With the purpose of the capture in mind the best handling method can be planned. If the goal is to transport the animal then the animal needs to be only handled when being taken out of the capture bag and placed in the transport container. If the purpose of the capture is to apply treatment or examine the animal then how the bird will be handled needs to be considered. The best method of securing the dove without causing undue stress or damage (pers com. Cam Candy, 2010) is by using what is known as the pigeon grip which is described in Fig 7.4.2.

7.2 Catching Bags:

The size of the catching bag can be the size of a large pillow case, of course larger bags are often easier for keepers to work with in my experience. But net can be this small as the bird is not a flighty bird to approach and keepers are able to get quite close before the

bird reaches it FFF distance and walks away. When distressed the bird will rather walk away than fly away which make capture that much easier. A converted inside out pillow case can be used attached to a catching pole to create a convenient catching bag, the neck of the pillow case would just have to be made wider and placed on a frame. This has the added advantage of not being a mesh bag. In a mesh bag the birds legs and toes may get caught and injured. The bird can be handled through the pillow case easily and maneuvered into the required position. The birds head is not as big of a threat to the keeper as it is with other species and so the keeper does not have to keep a constant eye or hold on the head. The solid material of the pillow case will also help to calm the bird quicker. Fig 7.2.1 is an example of a catching bag but it is made of a mesh material. For the Emerald Dove a solid material is recommended.

Fig 7.2.1 Example of catching bad (animal traps, 2010)

7.3 Capture and Restraint Techniques:

To capture these birds is a reasonably simple process. If the capture is planned for the early hours of the morning the keeper may find the bird still roosting in a tree and can easily place the bag on the catching pole over the bird. The bird will fly up shocked and then is captured.

If the bird is running around on the ground their small FFF distance can be used to take advantage of them and by using a couple of keepers armed with their own bags the bird can be herded into a corner and then the bag thrown over the bird. The bird will naturally prefer to run away before it will fly- this makes the bird very easy to catch.

Once in the catching bag the keepers hand can enter the bag and grab the easiest hold on the bird depending on the purpose of the capture in the first place. The birds wings should be secured closed against the birds body and can be secured first from outside the bag. The birds legs may cause slight scratches but with the wings secured from the outside of the bag it is easy for a single keeper to place the bird in the bag on the ground, hold it from the outside with one hand holding the birds wings against its body and place the other hand in the bag and grab the bird in a pigeon grip (see Fig 7.4.2). From this grip the bird can be transferred to a transport box or examined by a vet. The bird doesn't even have to taken out of the bag for weighing.

Chemical restraints are not recommended for these birds. They will become calm if in a darken place and are easily to catch and handle with low risk to the keeper.

Precautions need to be taken while capturing the bird in the exhibit with the keeper watching for low branches and perches. Care also must be taken around the birds legs as they can cause scratches with their claws.

7.4 Weighing and Examination:

Once the bird is captured and held in a cotton bag the bag should be placed in a cardboard box with the tops folded over. This box can then easily be placed on a set of scales to weigh the bird as seen in fig 7.4.1.

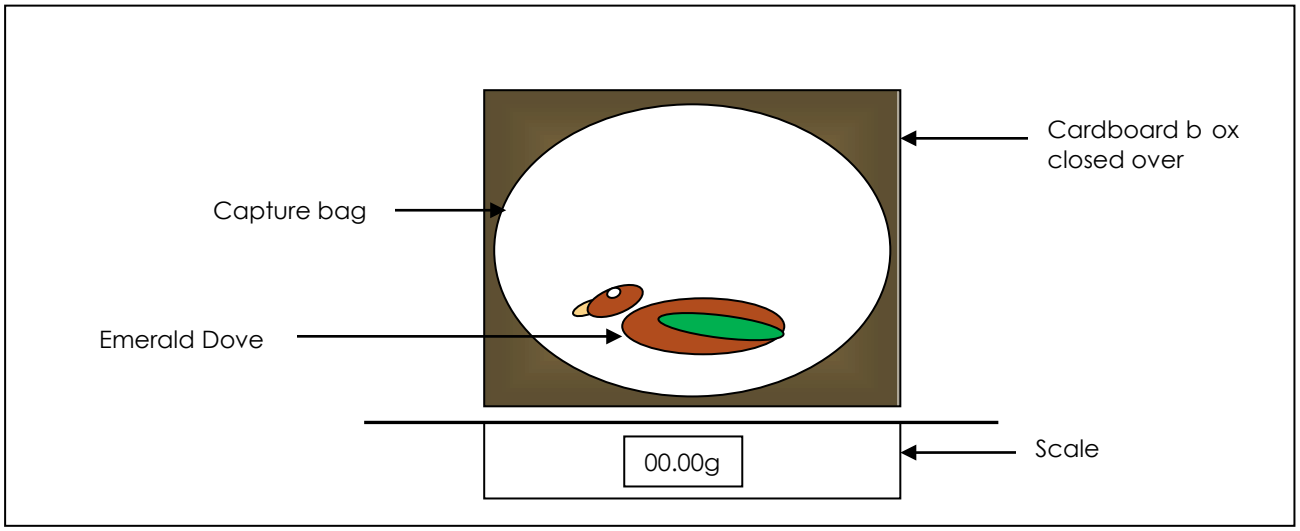

Fig7.4.1: Bird being weighed

To examine the bird it is easier with two keepers to allow one keeper to focus on handling the bird and allow the other to focus on examining the bird. Though the examination and handling can also be accomplished by one keeper if that is all the staff that is available. See Fig 7.4.2 for a demonstration of how to hold the dove using a pigeon grip.

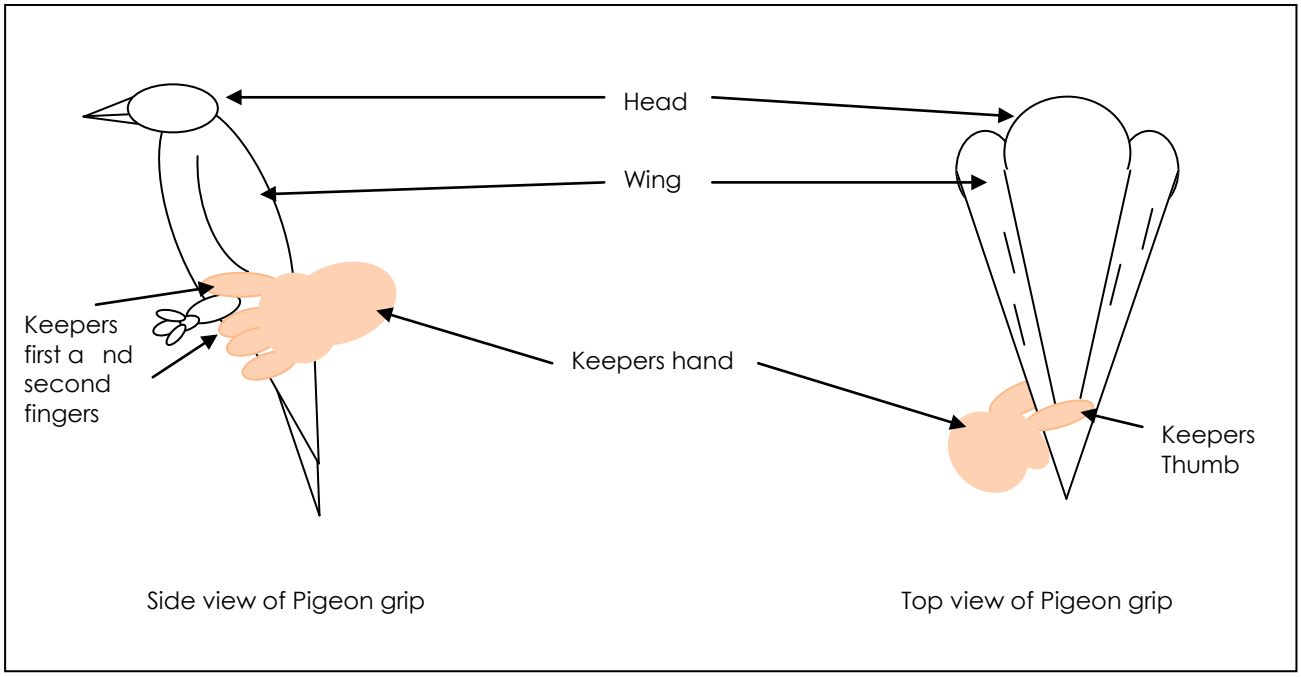

Fig7.4. 2 : How to restrain bird for examination

To hold a bird using a pigeon grip, the keeper holds the birds' feet side by side between the first and second fingers with the palm of the hand facing upwards. The thumb of the same hand closes over the top of the tail and the ends of the primary flight feathers which keeps the wings in a normal closed position. This allows one hand free to examine the bird and extend its wings or to support the birds' breast.

A handy hint is to keep the bird facing the keeper as this will reduce escape attempts if the grip on the hand relaxes slightly.

7.5 Release:

The safest way to release or introduce new birds into an existing aviary is to use a Noegel cage (see Fig 7.5.1) and a soft release method. This cage can be suspended up at the back of the aviary though for the Emerald Dove a cage on ground level would be more appropriate see Fig 7.5.2. By housing the bird in this enclosure for a week the new animal can get used to its surroundings and the existing animals in the enclosure can get used to the new bird. After a week the door to the Noegel cage can be opened and the bird can come and go as it likes. By supplying the Noegel cage with food and water for an extra week you are giving the bird the chance to adjust to its surrounding while giving it a safe haven if the bird cannot find the food in the aviary or is being bullied out of the available food. After a week the Noegel cage should be taken away and the bird should be acclimatised to its new enclosure.

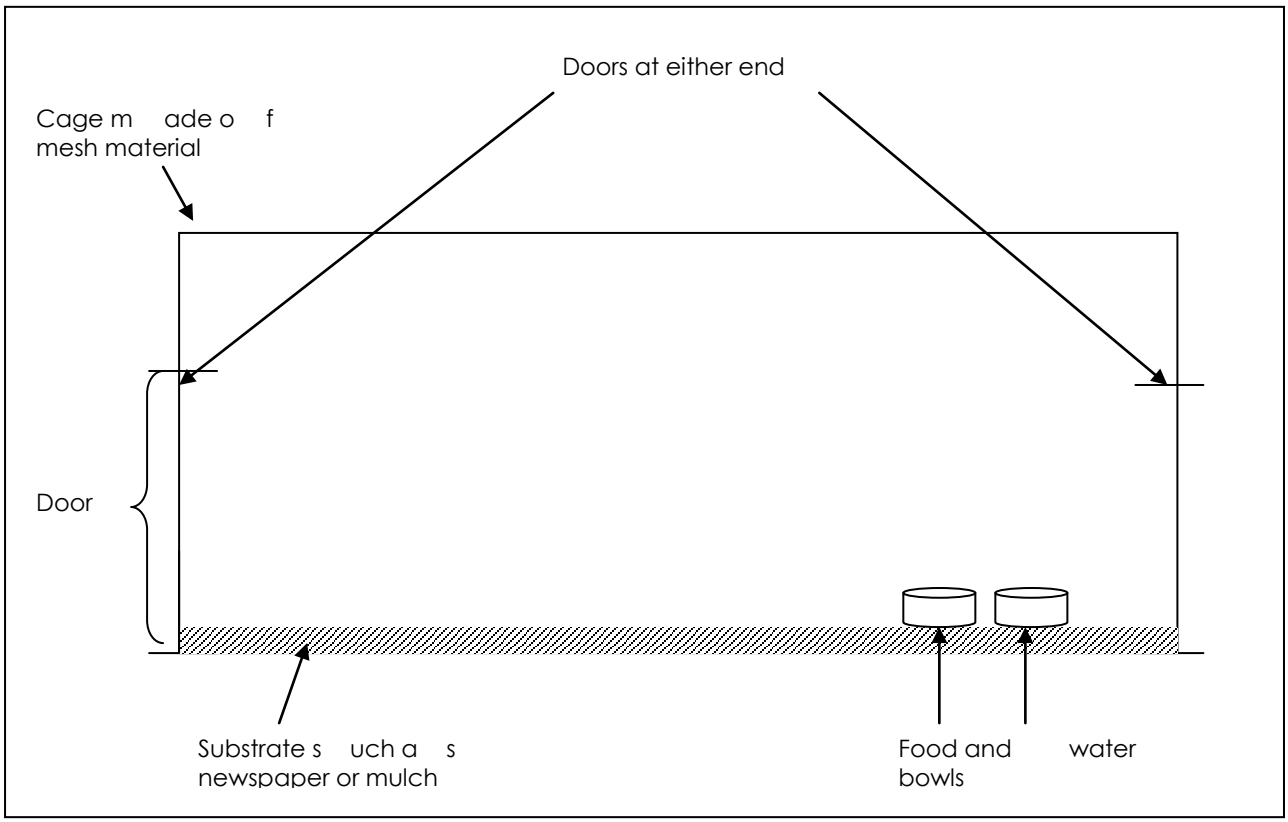

Fig 7.5.1 Example of a Noegel cage

A Noegel cage can employ a two door system as seen in Fig 7.5.1. This allows a keeper to access the food and water which is at one end of the cage while giving the bird the other side of the cage as a safe haven. When it is time to move the bird out of the cage both doors can be used if the bird is unwilling with one left open for the bird and the keeper accessing the other. These cages are made of sturdy mesh material and can be suspended or left on the ground. It should be remembered that the cage should be

covered in shade cloth or placed in a shady area as there is no shelter inside the cage for the bird.

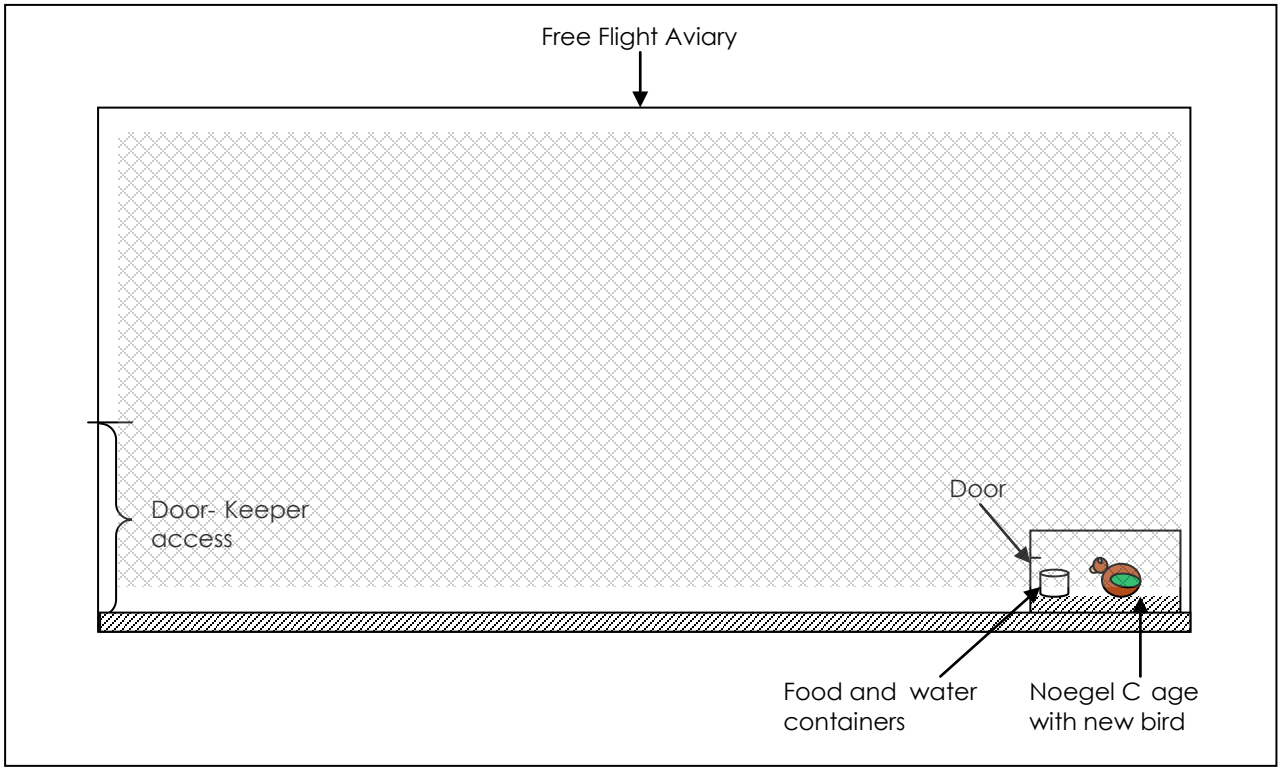

Fig 7.5.1: Soft release set up

7.6 Transport Requirements:

When planning transportation the main consideration needs to be whether the transportation is long term transportation or temporary transportation.

For the transportation of doves the key thing to consider is how conditioned the animals are to human contact. For domestic doves the IATA suggests a wicker basket can be used for temporary transportation.

As the Emerald Dove is not considered a domestic species the safest option for the bird is to use a long term transportation box for all transportation no matter the length. This way the same box can be used for animals in a captive situation but also for wild caught birds.

The idea behind using the sturdier box for all transportation is to reduce the stress on the animals themselves. The box design and construction is described below. This is the box that is recommended for long term transportation by the IATA. The advantage to this box is that since the size of the animal is not that large, the long term transportation box is not that large either and can easily be moved by a single person and transported in a car as easily as on a plane.

7.6.1 Box Design:

As recommended by the IATA the transportation box for the Emerald Dove must:

- Be constructed of a water resistant fiberboard, wood, non toxic plastic or fiberglass
- Be crushproof
- The height of the container must of be sufficient to allow the birds to perch naturally with the birds hitting their head- excess height will let these nervous species injure themselves

- 75% of the front of the container must be a strong wire mesh or rounded wooden bars placed 1.3cm apart.
- There must be a muslin curtain that can be raised and lowered and fixed over the wire mesh to provided dim light into the container.
- Food and water troughs must be provided
- Handles or spacer bars must be provided on two sides
- The roof must be padded with a non-destructible soft material
- Ventilation holes of 2.5cm covered with mesh must be provided at intervals of 5cm on three solid sides of the container
- Be labeled correctly
- The edge of all mesh must be protected so the birds cannot injure themselves

These requirements are incorporated into the diagram below (Fig7.6.11)

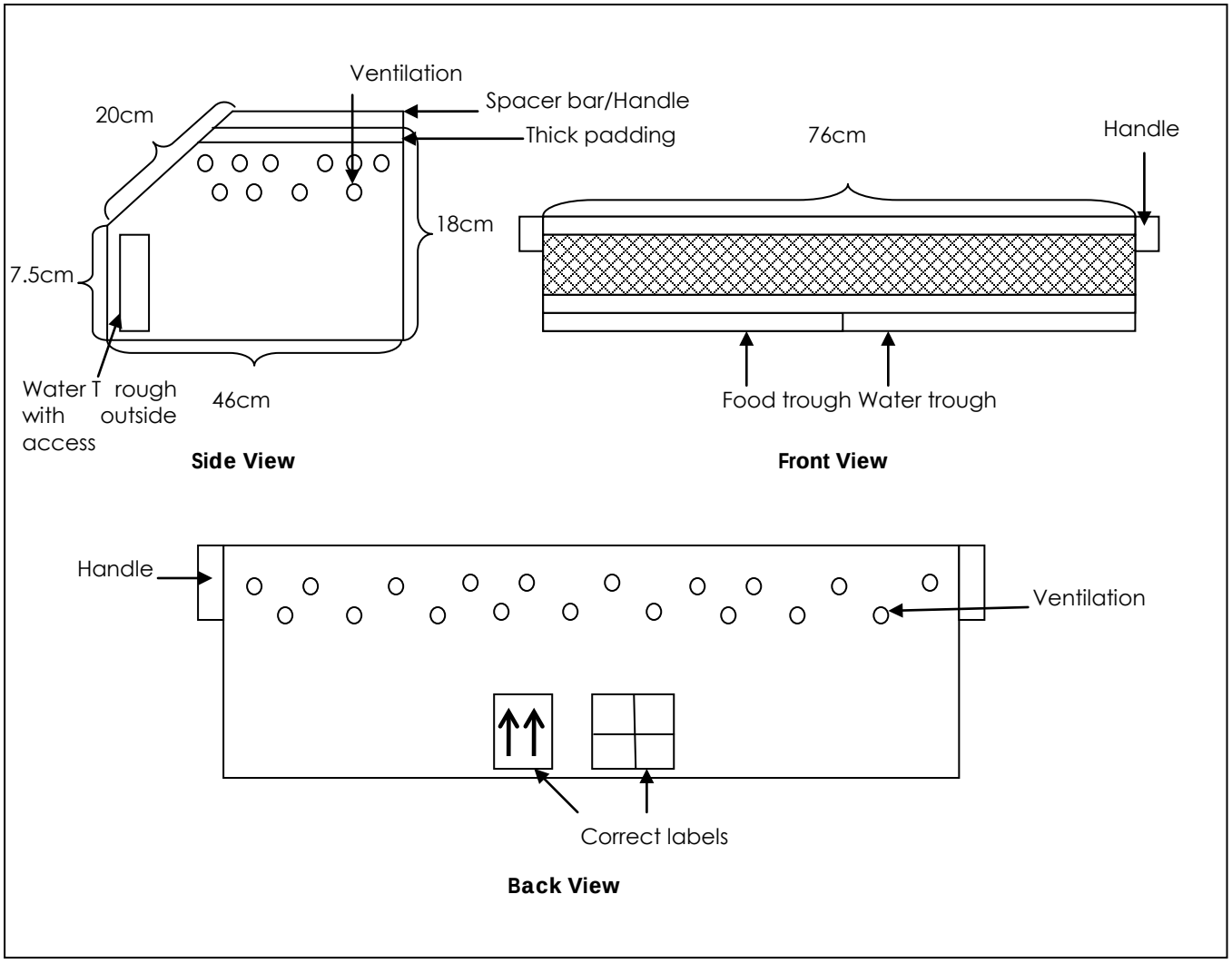

Fig 7.6.11: Diagram of Emerald Dove Transport box

A rigid plastic pet pack can be modified (see Fig 7.6.12) to carry these birds but the following modifications would have to be carried out for it to meet the IATA's standards:

- A suitable perch must be fixed inside the container at a height that just allows the bird to perch naturally with minimum head and tail clearance
- The roof must be padded with soft material that is non-destructible
- The door and ventilation openings must be covered with a fine wire mesh
- A muslin curtain that can be raised and lowered can be fixed to the container door

- If it is a nervous bird the ventilation openings must also be curtained.
- Separate flanged food and water containers that allow outside access must be fixed inside the container
- The container must be labeled correctly
- If the container had wheels these must be removed

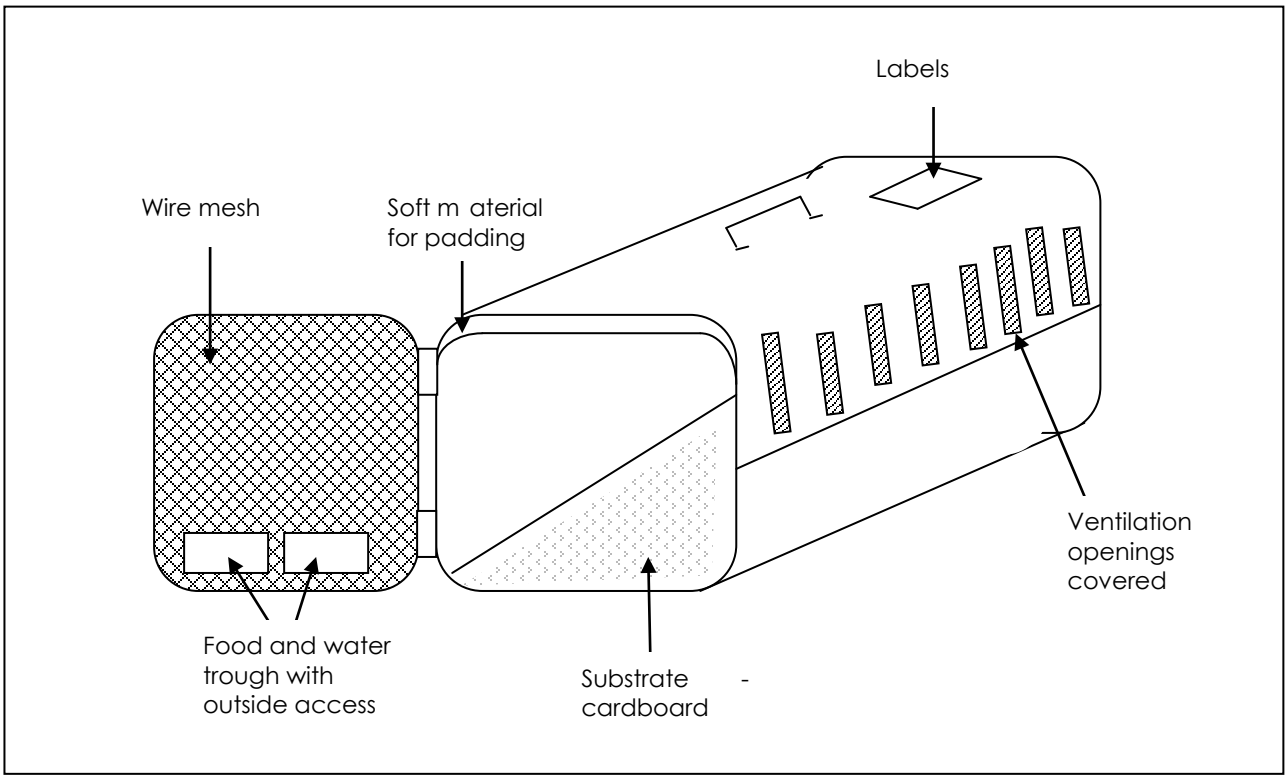

Fig 7.6.12: Modified pet pack used to carry Emerald Doves

7.6.2 Furnishings:

The Emerald Ground Dove as it name implies is a ground dwelling bird. While it does perch at times, for transport purposes no furnishing are required in its transport box. The IATA doesn't have any specific regulations regarding furniture for transportation.

7.6.3 Water and Food:

Flanged food and water containers must be provided (Live Animal Regulations, 2009) and these containers must have outside access for refilling. To prevent the birds drowning a float of balsa wood needs to be provided with perforations of 1cm.

During transportation additional feeding is not required. The seed trays provided should be filled before transportation commences.

In emergency situations and extended delays, grain must be provided (Live Animal Regulations, 2009) but care must be taken so as to not over feed.

Wild caught birds must be held for a period of 30 days before transportation to ensure that the stress of capture has been overcome and the birds have adapted to their new diet.

Water must be provided at the time of departure, transfer and layover and at the destination (Live Animal Regulations, 2009).

It needs to be remembered that these birds will not feed in the dark and so they must be stowed in at least dim light that allows them to see their food.

7.6.4 Animals per Box:

According to IATA guidelines, no matter how many birds are house together all the birds must be able to perch simultaneously. With this in mind no more than 25 birds are allowed to be housed in a single container. This is to avoid smothering by overcrowding.

Aggressive animals must be housed separately.

If there are similar species being house with the Emerald Dove during transport they are allowed to mix as long as they are a similar size. If the other species are larger they must be housed separately.

7.6.5 Timing of Transportation:

Transport is best stared in the early hours of the morning. Just after sunrise is the best time to commence transportation.

Birds are very nervous by nature and care must be taken to handle the container carefully. Tilting of the container is to be avoided.

While the birds need dim light in order to feed, the temperature of the container needs to be considered. It is for this reason that the timing of the transport is so important as overheating needs to be avoided at all costs. Any source of light will heat the container and the birds within.

7.6.6 Release from the Box into the Wild:

The method of releasing the birds into the wild depends on whether it is a soft release or not. For a soft release the same technique that is described in *7.5 Release* should be used. Otherwise to release the birds the concept is quiet simple. The best course of action is to place the transport cage in the shade- incase the animals decides to linger in the box- but where they can see the light. Open the door to the transport cage and the bird will fly out into the light. If the birds decide to linger in the cage they will come out in their own time to forage. If there is a reason to quicken the process, the box merely has to be tipped to remove the birds, though this process is stressful for the animals involved. Again it is best for this to be performed in the early hours of the morning.

8. Health Requirements

It is essential that the health of the animal is maintained and monitored on a regular basis, for this to happen the following guidelines should be adhered to.

When birds are ill their behavior will often change. They will become more indrawn and fluff up their feathers and sit on the perch, when they think no one is looking. They will also change how they react towards other members of their species and other species of birds often hiding from these individuals. Other birds will also change how they react to an ill bird and will sometimes attack a sick bird in the aviary.

8.1 Daily Health Checks:

Daily health checks are a vital important part of monitoring the health and therefore maintaining the health of the animals within your collection.

The Emerald Dove is no different and daily health checks can help prevent a wide range of diseases, infections and parasitic outbreaks.

These daily health checks are non-invasive and should be completely stress free for the animal. Any examination that places stress on the animal should be re-evaluated and undertaken at a more appropriate time such as during a complete physical examination and possibly even when the animal is anesthetised.

Birds are naturally flighty animals as well as having a very strong preservation instinct. This means that it can be difficult to perform a daily health check as birds are more likely to fly away when you try to gain a closer look. With their strong preservation instinct this means that birds will always act as if they are fit when the birds can see anything they perceive as a threat such as their keepers or other birds. Birds will often only shows signs of illness when they are in the final stages when their health has been drastically compromised.

The most common solution to this problem and the one that places the least stress on the bird, is to perform the daily health check before the bird is aware of anyone's presence. This is usually performed before the keeper has even entered the aviary, as that alerts the bird to their presence. The daily health checks are performed by visually assessing the animal so it is possible to complete it before entering the aviary to feed and clean it. This can often be difficult if it is a large aviary. If this proves to be impossible the keeper must keep in mind that the bird will also show signs of being well even when illness is presence.

Another challenge to giving daily health checks with these birds is that often the Emerald Dove species is housed with other birds in a free flight aviary situation. This makes it hard to track eating habits, and fecal output. As part of the daily health check is to ensure that the bird is eating and their fecal output is normal, the solution to this is to ensure that the keeper knows the animal that they are looking after.

Birds tend to roost and eat in the same areas each day. By placing the birds' favorite food in the area that the bird seems to spend the most time eating and by using observational skills, an understanding of the birds' fecal outputs can be obtained. Knowledge of the birds' normal perching or foraging (as the Emerald Dove spends a lot of its time on the ground) behavior also comes in handy for assessing the birds' health, as unhealthy birds will display strange behaviors such as perching or hiding in the aviary at different spots to where the birds would usually perch.

One thing to always check are a birds eyes, as no matter what their behaviour is a bird can't change its eye shape. A healthy bird will have a very round clear eye, while a bird that is showing the first signs of illness will often become oval in shape-see Fig 8.1.1.

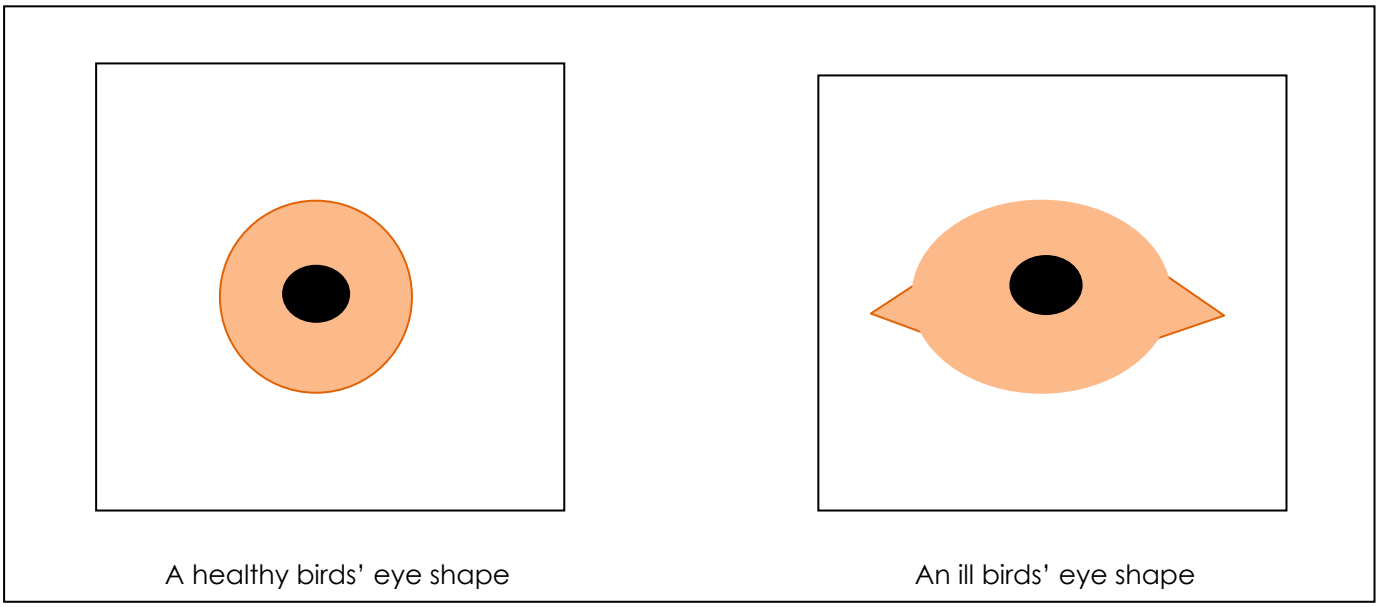

Fig 8.1.1 diagram of an ill birds eye and a healthy eye

The daily health check of the animal should include a visual check to:

- Ensure all limbs are moving freely including wings and legs
- Ensure that there are no physical injuries, bleeding or breaks
- Ensure that flight is unhindered and strong
- Ensure the animal is eating normally
- Ensure that the animals fecal output is of normal consistency and colour
- Ensure eyes are clear and fully open and round (see Fig 1)
- Ensure feathers are orderly with none sticking out and the colour is shiny and not dull
- Ensure that the nose has no discharge
- Ensure that there are no unusual vocalisations
- Ensure that there are no bald patches or evidence of over grooming
- Ensure cloaca is clear and free of discoloration and discharge
- Ensure that the bird is behaving normally, not sitting with their feathers fluffed up and their posture is normal and their wings are held in tight and are not droopy
- Ensure that the bird is interacting normally with animals of its own species and animals from other species and these birds are interacting normally with it

Record any finding in the daily report sheet so the results can be compared to previous days. By comparing the results is the easiest way to detect a slow progressing illness that may not seem evident on initial inspection but is obvious when compared to how the bird looked or behaved a week or month ago.

Ensure that the birds are displaying their normal behavior daily to make certain that they are well, such as preening see Fig 8.1.2.

Fig 8.1.2. An emerald dove preening – displaying normal behaviour (oceanwide images, 2010)

8.2 Detailed Physical Examination:

Before a complete physical examination is carried out the decision must be made as to whether the bird will be anesthetised or not. A complete examination can be carried out under anesthetics where tests can be performed that may otherwise stress a conscious animal.

The dangers of anesthetising birds should also be taken into account. Anesthetising can be extremely dangerous for birds (Brinker, 1998) as their respiratory system works differently to mammals. Air and thus the anesthesia circulates throughout their entire body unlike with mammals where it stays localised in the lungs. This means that there is more danger associated with anesthetising birds with the results being potentially deadly.

The occurrence with which these examinations take place also needs to be taken into account. A detailed physical examination may only be undertaken once a year while anesthetising the bird for an examination may only be undertaken once when the bird first comes into the collection. The pros and cons of each scenario needs to be considered and the best routine to fit the institutions health monitoring and maintenance scheme also needs to be decided.

The Emerald Dove can tolerate small levels of stress and is not likely to lose all its feathers in a stress molt at the first sign of handling. Though the individual animals personality and history (such as whether the bird was hand raised or wild caught) should be taken into account when assessing whether to anesthetise the bird or not. Due to the nature of the Emerald Dove many tests can be performed while the bird is still conscious.

8.2.1 Physical:

Before a physical examination is carried out the individual bird must be captured. The best method to carry this out depends on the birds individual personality- such as how it reacts to humans and where the bird is house- such as if it's in a free flight large aviary or in a small cage by itself.

The greater challenge is if the bird is in a free flight aviary with other birds. The best method to separate the bird then is left to the head keeper of the section to chose the safest method for bird and keeper whether it includes nets and catching the bird from the air or placing a smaller cage in the aviary and slowly crate training the bird till it can be separated from the rest.

Once the bird is separated the best method for holding the bird is one that places as little stress on the bird as possible but allows maximum exposure of its body for the actual examination. For these reasons the pigeon grip is recommended (see section 7.4 for detailed description of the pigeon grip) This grip can also been seen in Fig 8.2.11. This grip allows the keeper to hold the bird with one hand and as the Emerald Dove does not have a hard or powerful bite its head doesn't need to be supported as seen in Fig 8.2.1. To give the bird more support the keeper can place his hand under the birds keel to support its chest and weight, as seen in Fig 8.2.2.

Fig 8.2.11: Pigeon Grip (QLD gov, 2010)

Fig 8.2.2: Supporting underneath the bird while exposing a wing (Miller, 2001)

It is recommended that two people complete a physical examination of the bird this way one keeper can concentrate on restraining while the other inspects the bird.

During a complete physical examination all aspects of a daily health check should be undertaken in addition to the following:

- A full feather check should be performed including inspecting the entire wing and its feathers to ensure that they are straight and present (see section 3.1 for a complete wing and its feathers)
- A complete beak and feet and claw check should be preformed to ensure that they are undamaged and the toes are not deformed in any way. If the claws or beak need to be trimmed it should be done now.
- The bird should be weighed as well as examining the keel (breast) muscle to ensure that it is not malnourished
- Any swellings should be checked for especially if it is female to ensure that it is not egg bound.
- An ectoparasite examination should be performed for lice and other organisms that live on the skin as well as an inspection for any bald patches that may indicate a skin irritation.
- If the bird isn't stressed a blood sample should be taken at this time, what to examine in the blood test is discussed in the next section.
- If possible fecal and crop swabs should be taken but it is less stress for the bird if these are taken under chemical restraint.
- Any identification on the bird should be checked against records and any banding that needs to be taken should be performed at this time.

8.2.2Chemical:

For the safest method to chemically restrain the individual bird an experience vet who specialized in birds should be contacted as the chemical used to anesthetise would depend on availability, expertise as well as the birds individual age and health concerns.

An example of chemical that can be used to anesthetise is Isoflurane® which is administered via a gas mask at an induction of 3% which is then maintained on 1.5-2%, this should only be administered by a qualified individual.

Once the bird is safely anesthetised the complete physical exam should be repeated as well as the daily health checks. With the bird in this state you can get as close as you need to, to ensure that you are completing the health checks thoroughly.

In addition to the pre-mentioned examination the following should be preformed:

- Skin scrap for ectoparasites. Birds have lice permanently living of them but it is a indication of a more serious illness when the number of ectoparasites increase.
- Crop and faecal smears should be taken to be viewed under a microscope to determine presence of parasites and df ungi (*giardia*, *trichomonads*, worms, *coccidia*, megabacteria) and salmonellae
- A faecal sample should be taken so a faecal flotation test for other parasites can be preformed.
- A blood sample should be taken to perform a number of tests.
    - A chlamydophila test- to determine the presence of the chlamydophila organisum or previous exposure (Bird Veterinarian, 2010)
    - Polyoma and Psittacine Beak & Feather Disease (PBFD) test- to determine presence of disease (Bird Veterinarian, 2010)
    - A haematology work up- to determine a personal profile of the bird to compare at later dates to determine the birds health, to count the white blood cells to see if there is an underlining problem such as viral or bacterial infection
    - A biochemistry work up to ensure that internal organs such as kidneys, liver and pancreas are working and functionally normally
    - DNA sexing can be carried out as well. Though the sexes in the emerald dove are morphologically different, in experienced keeper may be unable to tell the difference and this just confirms what the keepers should already know.

8.3 Routine Treatments:

With careful monitoring of the birds health there are few routine treatments that the bird needs regularly.

- Faecal sample should be taken biannually to rule out the possibility of internal parasites- but this is often hard in a free flight mixed aviary situation as such;
- An anthelmintic (wormer) should be given regularly, especially for protection against round worm. Eg Ivermectin® (Bird Veterinarian, 2010)
- If the bird is young and is still developing there are several additives that can be added to their water solution to give protection against certain bacteria that can be harmful.
- All birds should be vaccinated with PMV-1® & Sal–Bac® against Avian Paramyxovirus. (Bird Veterinarian, 2010)
- An experienced vet who has knowledge of birds in the local area can recommend other vaccinations to give your bird as bird disease can vary between locality.

If there are common recurring problems in your population, preventative supplements and medication should be added to your routine treatments.

8.4 Known Health Problems:

There are many known health problems or disease that keepers must be aware of to successfully look after their emerald doves.

The following are aetiologies for the more common health problems.

Canker (*trichomoniasis*)

Very common disease among wild birds especially pigeons. It is contagious and occurs in areas where people feed pigeons and doves as the high concentration of birds aids transmission. (Bourne, 2000)

Fig 8.4.1: Bird with canker sores (canker, 2009)

Cause: Canker is caused by a flagellated protozoan organism called *Trichomonas gallinae*, which lives in the sinuses, mouth, oesophagus and other organs. Birds can often carry the disease and will only show signs when under stress.

Signs: Bird becomes very sick and thin. Characteristically a diseased bird will have white plaque inside its beak (fig 8.4.1) or a hard lump on its neck or in its crop. Some birds can carry the disease without showing signs and the disease will only come forth when the bird is under stress.

Treatment: a bird may not always survive treatment. The birds oesophagus may need to be cleared of plaque, which is done under general anesthetic, so that it can be crop fed. The bird will also need to be treated with an anti-protozal medication which a vet would be able to supply and often a vet will also prescribe antibiotics to prevent secondary infections.

Prevention: Once a bird is identified as having the disease it should be separated from breeding stock as it is readily passed on to off spring. The disease can be prevented by routinely treating your population with an anti-protozal medication. There are many commercial supplements available that can routinely be added to their water supply, one such example is Ronivet® or Poly-Aid Plus®.

Worms –*Internal Parasites*

Internal parasites occur usually in the birds intestines although they can also appear in their lungs and other body organs such as the liver.

Fig 8.4.2 Internal parasites-worms (Wikipedia, 2010)

Cause: As all birds usually have worms they do not have a significant negative effect on the birds health until their numbers build up. The increase in internal parasites is often a sign that the bird is already ill or overly stressed and this has allowed the internal parasites to increase in number.

Signs: Visible signs on the bird include weight loss and diarrhea which can suggest a number of problems so it's not a specific diagnosis. It may be possible to visibly see worms in a bird's mouth or in their droppings. Completing a fecal flotation test is the surest way to identify the presence of worms in the bird.

Treatment/Prevention: Treatment and prevention can be achieved by using the same broad spectrum worming syrup which is added to the birds' water. Such worming solutions can be supplied from a vet or even pet shops. Such brands included Panacur® or Ivomectin® or Avitrol®. Keepers should be aware of cheap brands as they often only kill one or two types of internal worms and are not a complete solution.

Chlamydiosis (*psittacosis*)

Chlamydiosis is a very common disease among wild birds. It is a disease of concern because it is also a zoonotic disease and can infect human who have close contact with

these birds. It is highly contagious and is transmitted through faeces and secretions from infected birds.

Cause: Many birds are carriers of the disease. It is a chlamydial zoonosis that is caused by inhaling or ingesting contaminated dust.

Fig 8.4.3: a blue heron showing severe signs of Chlamydiosis (Wikipedia, 2010)

Signs: The signs of Chlamydiosis are very general, in the acute form the disease infected birds will become extremely ill and die. While in the chronic form signs include weight loss, depression, anorexia, diarrhea (usually green in colour), discharges from the nose and eyes and difficulty in breathing.

Birds can also carry the disease without showing any signs and pass the disease on through their faeces. The disease will make itself known when the bird becomes stressed.

Treatment: The infected bird will need to be given fluids, will also have to be crop fed while it's kept warm. The vet will prescribe a 30-45 day course of antibiotics eg Psittavet®.

Prevention: Isolate treated/diseased birds and before birds are added to the collection they should be quarantines and treated with tetracyclines for 30days.

Cryptococcosis

This is a common saprophyte found in excreta of pigeons. It is of concern as it is a zoonotic disease and can infect humans with serious results.

Cause: C. neoformans var. neoformans is the saprophyte that grows in bird faeces. The disease is caused by inhaling contaminated dust.

Signs: It is quite rare to find in birds but signs include vomiting, dysponea, oral/nasal masses, nasal discharge and depression.

Treatment: the vet can prescribe a long lasting course of antibiotics. The bird will need heat and fluids and to be hand fed until it can fend for itself.

Prevention: isolation of sick birds

Mycotoxin

Mycotoxins are toxins that are produced by fungi and are commonly found in mouldly grain. Seed will become mouldy after sitting in water for more than 24hrs. (Bourne, 2000)

Cause: Often affects birds in aviaries with concrete floors during the rainy months. The seed falls on the fall and the bird will eat it.

Signs: The clinical signs that are shown will depend on the type of fungus that has grown on the grain, but they commonly involve depression and anorexia. This can occasionally be a fatal infection.

Fig 8.4.4: Mouldy seed-cause of Mycotoxin (Wikipedia, 2010)

Treatment: To treat an ill bird the bird needs to be force fed and given fluids while it is given heat and kept clean. In serious cases a vet can prescribe an tifungal drops depending on the type of infection. But with a dedicated keeper a vet will not have to be called.

Prevention: To prevent this problem good hygiene practices are a must. Seed should be cleaned out daily and fresh dry seed fed out and cement floors should be cleaned with bleach or a similar agent

and well washed after.

Sour Crop

Fig 8.4.5 A pigeon with sour crop (Wikipedia, 2010)

Sour crop is an infection that is usually a secondary infection caused by a more serious problem.

Cause: It's an infection of the birds' crop that can be caused by a various number of things such as canker, yeast, bacteria or residual food.

Signs: Signs include inflamed full crop, regurgitation, weight loss, anorexia and lethargy- all of these signs can also point to other diseases which can often be the main cause for the infection

Treatment: Will usually involve antibiotics or antifungal drops, but unless the main cause of the infection is found and treated, the sour crop will return once it has been treated. The crop will need to be massaged to remove any built-up debris, and flushed with warm water.

Prevention: As it is a secondary infection the best prevention is to treat illness at the first sign and not to let it continue so it can cause a secondary infection.

Trauma

Trauma relates in any physical injury the bird may suffer.

Cause: Trauma can be caused by the animal scalping itself, getting caught in wire in the aviary or caused by other birds such as bullying, or other animals such as rodents.

Signs: signs include, the bird behaving abnormally such as hopping on one leg, holding one wing abnormally. Obvious signs of trauma such as visible injuries to the bird. Feathers out of place or struck up in odd directions. Initially the bird may present with signs of shock before any signs of trauma may be seen. Signs of shock include fluffing up of feathers, keeping still on the perch, acting abnormal.

Treatment: Shock needs to be treated first with heat provided by a heat lamp and fluids being provided with such products such as Poly Aid Plus®. The bird should be placed in a dark environment and left to settle, any bleeding should immediately be stemmed. Once the bird has calmed down the trauma can be assessed. Minor wounds such as scratches can be treated with an antiseptic wash or cream such as Betadine®. If visible trauma cannot be found a vet should be consulted. A vet should also be consulted if the trauma is assessed as anything more than minor, as it may include broken bones which would have to be set and possible internal injuries. An extreme course may be that the injuries are too great and the bird may have to be euthanised. Before the bird is taken to the vet the animal does need to be secured. Any wounds should be covered with gauze and wrapped up- but not too tight- with a bandage. This may mean that the birds wings are secured to its body. This is to prevent further injury to the bird and to stop further blood loss.

Prevention: The best way to prevent trauma is to prevent situations where trauma may occur. This can included keeping up with rodent control, observing and controlling bullying in the aviary and removing sharp edges in the aviary and lose wire.

8.5 Quarantine Requirements:

8.5.1 Coming from overseas:

The Emerald Dove is a native species to Australia. As such there would be little reason to import the animal, and there are even fewer specimens outside the country. If there was a specific reason to import an animal, it would be quite difficult to almost impossible with the restrictions that AQIS places on bird importations.

8.5.2 Moving within Australia:

Birds that are moved within Australia should be place in quarantine for a minimum of twenty one days. This gives the vet enough time to perform the health checks on the bird including a complete physical examination using chemical restraint as well as sending off labs and receiving the results.

Faecal samples should be taken on a regular basis and the animal should not leave quarantine until three clean samples have been taken. Weekly weights should also be taken. Blood samples should be taken while the bird is under chemical restrain as well as the birds' identification being confirmed. This can be by scanning a microchip that is in the bird or inserting a microchip, applying a leg band or by making note of particular markings that mark the bird as unique, as well as sexing the bird.

It is also during the quarantine period that the bird will need to be acclimatised to its new location. This can include keeping the bird in a controlled environment where the temperature can be maintained and slowly reduced or increased to meet the birds new location. The birds diet will also need acclimatising. This can be accomplished by feeding the bird its old diet and slowly changing it out for the birds new diet. Of course this is only required if there is going to be a change in the birds diet.

Record keeping is extremely important during this phase especially to compare animals' behavior with at later stages.

During this quarantine time the birds should be isolated well away from other birds. Appropriate signage should be displayed and appropriate OH&S precautions should be taken. Keepers should use barrier nursing when cleaning and feeding this section or let a keeper from another section look after the animal to prevent the potential spread of any diseases to the rest of the collection- this may have a negative impact as a keeper from another section would not know of what signs of illness to look for in birds. Ensure all equipment that is used is disinfected and cleaned daily. Ensure any waste from this section does not end up in another enclosure but goes straight to the refuse area.

9. Behaviour

Understanding what constitutes as normal behaviour and abnormal behaviour for the Emerald Dove is vital to the animals' wellbeing when being kept in captivity. It helps the keepers manage undesirable behaviours as well as creating an enrichment program which allows the bird to express its natural behaviours. It is also useful in managing the birds health and diet.

9.1 Habits:

While it is important to know what a 'normal' habit for the Emerald Dove is, it is important to note that this species is successfully kept in captivity and captive animals can sometimes exhibit varying behaviours to their wild cousins. For this reason section 9.1.1 will describe recorded wild observations while section 9.1.2 shows the results of observations made of the behaviour displayed by a captive pair of Emerald Doves which was completed by the author.

Fig 9.1.11 Emerald Dove exhibiting preening behaviour (oceanwide images, 2010)

9.1.1 Wild Habits:

Studies conducted on wild bird behaviour included observations studies by Higgens et.al. (1996). These studies found that the Emerald dove spends the majority of its time foraging for food on the ground, and is particular prone to taking food that the animal doesn't have to stretch to get. As the Emerald dove is found in the wild in a variety of habitats the type of ground that the dove forages on varies site to site. The bird has been observed in the wild (Higgens et.al. 1996) not only foraging on the ground but occasionally will reach up into a low bush to forage. The animal has also been recorded eating discarded seeds that have been thrown to the ground from other bird species foraging up in the trees. It is also not unheard of the Emerald Dove to frequent farmhouses to feed with the fowl or even swine (Higgens et.al. 1996) that it finds inside. Other wild behaviours that have been observed include mating behaviours and associated displays including territorial displays. Additional observed behaviours consist of roosting on low forest trees while giving an 'Advertising Call' (Higgens et.al. 1996) as well as grooming or preening. These birds have also been recorded sunbathing on the forest floor with one wing held high above the body.

Fig 9.1.12 Emerald Dove displaying perching while fluffed up (janson, 2009)

When in the wild the birds were often observed to be alone or in pairs (Higgens et.al, 1996), unless it was breeding season then small family groups have been seen. Occasionally these birds will form small groups to feed (Higgens et.al, 1996) but their

numbers rarely exceed 12 individual animals. Even when flocks this large are observed the animals have been seen arriving separately and they will depart separately and will walk alone even with the other doves nearby.

There is little migration data on these birds and it is thought that though there may be small populations that display local migration, on a population level there is no major migration (Higgens et.al, 1996), with the birds staying in their own habitat all year round.

9.1.2 Captive Habits:

An observational study of two captive Emerald Doves was conducted by the author, in a mixed species free flight walk through aviary. Instantaneous recording sheets were used, see appendix 4B for raw data and 4A for a sample recording sheet. The observation sessions were an hour in length and were conducted on three separate occasions. The results of the observation are displayed in Fig 9.1.21 (raw data in Appendix 4B). An ethogram of the behaviours observed can be found in Appendix 4C.

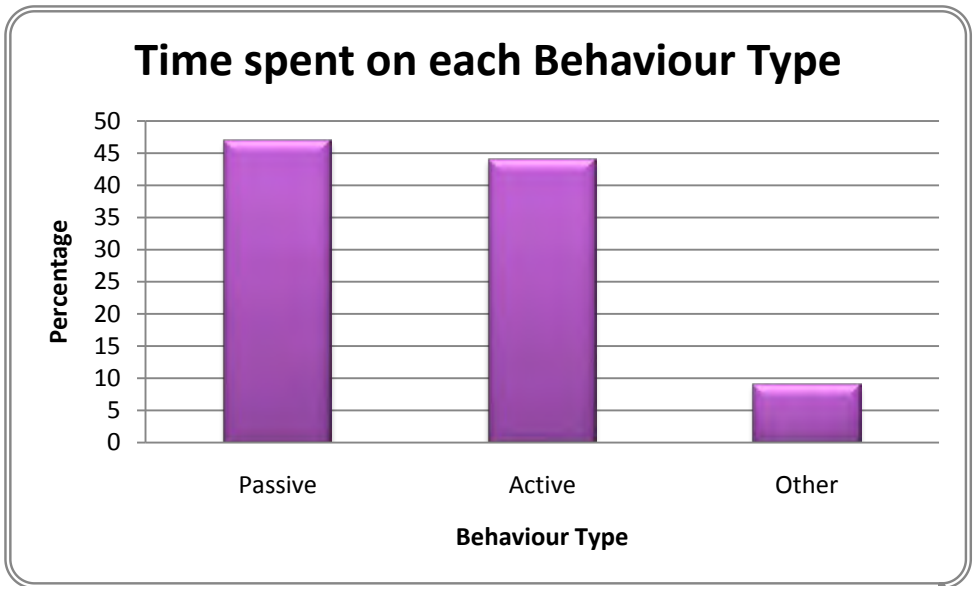

Fig 9.1.21: Observation results of two captive Emerald Doves

As it can be seen from Fig 9.1.21, the Emerald dove spends almost an even amount of time in active behaviours such as grooming or foraging as it does in passive behaviours such as loafing on a tree branch. The observational study was conducted at three different times to see a wide range of displayed behaviours, including feeding time- when they are most active, midday and dusk –when they are preparing to roost for the night.

This data can then be used later on to help develop a successful enrichment program.

Fig 9.2.1 Emerald Dove foraging (bird forum, 2009)

9.2 Reproductive Behaviour:

The male Emerald Dove has a very specific mating dance that he will do in order to attract a female. Details of this

behaviour are found in section 10 of the manual in the breeding section under 10.1 *Mating System*.

The Emerald Dove can breed all year round and as such it is possible to witness the mating displays all year round (Higgens et.al, 1996). In New South Wales the dove tends to breed in the spring months.

In captivity if no trigger is given for the breeding season to begin, such as media for nest building or a change in diet, the mating displays may not be seen until the triggers are given (pers com Cam Candy, 2010).

9.3 Bathing:

The Emerald Dove has not been observed in a formal study in either the wild or in captivity bathing in any water bodies, though it has been observed drinking, but there have been amateur observations of the bird bathing. A suitable bathing area is not required by the EAPAct (1986) standards and therefore doesn't have to be given. Though a standard bird bath given occasionally can be a great enrichment idea and worked into a monthly program.

The Emerald dove has been observed to sunbathe regularly lying on the ground (Higgens et.al, 1996) so it is important that a suitable area is allowed for this activity within its captive environment.

Fig 9.4: Left Parrot shows signs of over preening (people to pets, 2009)

9.4 Behavioural Problems:

If there is insufficient environmental stimulation or enrichment it is possible that undesirable behaviours may occur. These can include stereotypical behaviours such as over preening (see fig 9.4) or short strings of repetitive behaviours. Such undesirable behaviours can be easily be adverted by establishing a successful enrichment program.

These birds are timid of humans, even if they are hand raised, so there is little chance of aggressive behaviour developing towards the public or keepers (pers com Cam, 2010).

The most common undesirable behaviour that develops is shyness of keepers as keepers get to close to the animal (pers com Cam, 2010). This can be problematic when trying to catch the animal for health checks, making the activity overly stressful for the animal and potentially hazardous for the keepers involved. To curtail this, it is good practice to condition the birds to regular close human company/contact and sudden moves.

These animals are naturally very laid back creatures (Higgens et.al. 1996) and due to this often make good display birds as they will not shy away from the public in aviaries, but further conditioning can improve this behaviour.

9.5 Behavioural Enrichment:

The methods used for behavioural enrichment to minimise behavioural problems can be varied and are only limited by the keepers imagination. A successful enrichment program will improve the health and wellbeing of the animal in care and when managed correctly can increase the time the animal spends on display.

The following 30 day calendar is a suggested monthly calendar of enrichment activities which aims to achieve all the goals of a successful enrichment program. The enrichment calendar is made up of various ideas that I have tried to enrich the Emerald Doves in my care. The ideas are self explanatory and are on a random rotating roster.

Fig 9.5: Browse can be cut from trees for enrichment (J.Brown, 2010)

The fresh browse that is used regularly in the enrichment colander is often the browse left over from the Koalas, but many other species can be used. See Appendix 5 for a list of species that can be used for the Emerald Dove and are found in the birds' natural habitat. These species are also low maintenance which means they would be easy to keep in a plantation and cut only when required. These species are also suitable to use as furniture in an exhibit as they require little water and maintenance and are a variety of shapes and colours.

The feed platforms that are mentioned in the calendar consist of two types. These are switched around to provide extra enrichment. One is a free standing platform that stands in the ground. The other is a hanging platform that is suspended from the ceiling. The designs of such devices are limited only by the keepers' imagination.

Emerald Dove Monthly Enrichment Calendar

1	2	3	4	5	6	7	8	9	10
Fresh Browse- various species, some wi th nuts- placed on perches and near ground level	Provide sandpit with seeds hidden shallow underneath surface	Change Browse location Swap f eed platform Provide B ird bath	Fresh Browse- various species- placed o n perches a nd near grou nd level	No enrichment	Change fed platform location	Fresh Browse- various species- placed on perches a nd near grou nd level	Change Browse location Swap f eed platform Provide B ird bath	Scatter feed seed a round base o f perches a nd bushes	Fresh Browse- various species- placed o n perches a nd near grou nd level
11	12	13	14	15	16	17	18	19	20
Fresh Browse- various species- placed o n perches a nd near grou nd level	Change Browse location Swap f eed platform	Change fed platform location Provide B ird bath	Fresh Browse- various species- placed o n perches a nd near grou nd level	Change Browse location. Scatter feed seed a round base o f perches a nd bushes	Provide B ird bath	Fresh Browse- various species- placed o n perches a nd near grou nd level	Change fed platform location	Change Browse location Swap f eed platform	Fresh Browse- various species, some wi th nuts- placed on perches and near ground level
21	22	23	24	25	26	27	28	29	30
Fresh Browse- various species- placed o n perches a nd near grou nd level	Scatter feed seed a round base o f perches a nd bushes	Swap f eed platform Provide B ird bath	Fresh Browse- various species, some wi th nuts- placed on perches and near ground level	Fresh m ulch placed i n aviary Provide B ird bath	Change Browse location. Change fed platform location	Fresh Browse- various species- placed o n perches a nd near grou nd level	Provide sandpit wi th seeds hidden shallow underneath surface	No enrichment	Fresh Browse- various species- placed o n perches a nd near grou nd level

9.6 Introductions and Removals:

Before any new birds are introduced to the free flight aviary a quarantine period of at least 30 days should be observed.

The most successful way of introducing a new Emerald Dove is by placing the new bird in a small cage which is placed up the back of the aviary and a soft release approach should be used. This leaves the small cage as a refuge for the new bird until it becomes accustomed to its new environment.

Individual animals can be removed successfully and kept away for as long treatment is required of them with no undue aggression aimed toward the animal upon its return to its enclosure (pers com Cam, 2010). There are no special preparations that need to be made for the removal of this individual animal.

Aggression between introduced animals is not common (pers com Cam, 2010) as long as males are not introduced to each other- see section 9.8.

Fig 9.1.4 Emerald Dove Yawning (Flickr, 2010)

9.7 Interspecific Compatibility:

As these birds are good display animals they are popular for walk through aviaries as they will often let the public walk quite close to them. Free flight aviaries are often filled with many species and it has been experienced that the Emerald Dove mixes well with the other species (pers com Cam, 2010) with no aggression displayed towards the other species.

The Emerald Dove is mainly a ground dwelling species, which needs to be taken into account when designing the aviary and stocking it with other species. As long as there is adequate space for all species that require the ground level of the aviary there should be no problem mixing this bird with other species (pers com Cam, 2010.

Unfortunately the Emerald Dove is susceptible to many of the transboundry animal diseases that can plague free flight aviaries, as well as being possible carriers for such diseases. For more information on these health issues see section 8 of this manual Health Requirements under *8.4 Known Health Problems*.

9.8 Intraspecific Compatibility:

There is often no problem with intraspecific compatibility (pers com Cam, 2010). These animals are solitary or pair animals in the wild and it is best if they are kept in that same social grouping in captivity. For compatibility purposes it is best if they are kept in male, female pairs. Males have been known to be aggressive when defending their territory against other Emerald Doves (Higgens *et.al.* 1996) and by keeping males separated this can be prevented.

10. Breeding:

By following the guidelines below it is possible to have a successful breeding program established for the Emerald Dove.

10.1 Mating System:

The male birds are territorial and will established territory, and even defend a dozen feet around their nest from other birds (Higgens *et al.* 1996), though mating displays are never given as signs of aggression between males. Males have been known to fight in small aviaries (Higgens *et al.* 1996).

Fig 10.1: Emerald doves mating (Pbase, 2008)

To attract a female the male will issue an advertising call while perched on low branches. Once a female is drawn to them they will then begin their advertising display which is a silent display given by solitary males which involves rhythmic swinging of the abdomen and tail, the male will then lower their head as if to bow and swings their tail and rear end high to 60° horizontal. The male then raises head and breast a little and swings their tail and rear end down again. Their tail remains closed throughout although their wings are raised slightly as their tail moves down (Higgens *et al.* 1996). It takes about 2-4 seconds for this dance to be run through once and the male will do it 9-10 times before they rest for a break.

An attracted female will land beside the displaying male, once this happens the advertising display stops and the bobbing display begins. The bobbing display consists of the male standing effect with its head and neck arched towards and above the female- who will start crouching next to the male. The male then rapidly starts bobbing its entire body up and down several times without spreading tail, raising wings or feathers. Once this occurs the female will crouch lower next to the male once the bobbing display is over mating will begin immediately (Fig 10.1) (Higgens *et al.* 1996).

Once mating has finished the male will preen the female and then there will be a period of intensive courtship feeding (Higgens *et al.* 1996).

10.2 Ease of Breeding:

These birds can be bred quite easily in captivity as long as appropriate media is given. Mate compatibility can always be an issue but the females seem accepting of most males and shouldn't present a real issue. (pers com Cam Candy, 2010)

10.3 Reproductive Condition:

It is important that the specimens that you intend to breed are in good condition, and contain the genetic material that you wish to pass on to the next generation.

10.3.1 Females:

Females need to be in good condition physically. This can be established during the animals' yearly physical examination. Close examinations should be conducted weekly as the breeding season approaches, to ensure the birds condition remains healthy. The animals diet should also be supplement with extra calcium to help the bird prepare for the strain that egg production will place on its own calcium deposits (pers com Cam, 2010).

Fig 10.2: Emerald dove nesting (ZooChat, 2008)

10.3.2 Males:

Unlike females, males do not go under a strenuous labor such as producing eggs. Males merely need to have a good physical condition which can be established during the birds annual physical examination (pers com Cam, 2010).

10.4 Techniques used to Control Breeding:

It is very easily to control breeding without going to extreme measures. The simplest method to ensure 100% control is to separate the sexes in the aviary, although this is not always possible. Any adult males would have to be housed in separate aviaries to prevent possible fights over territory. The more common method to control breeding is to not provide any breeding triggers or media to build a nest (pers com Cam, 2010). This allows the birds to remain in the environment they know and takes away any stress they would suffer from moving them to a new aviary. Though it should be noted that even with no triggers or media these birds still may breed, as some nest are only constructed from eight sticks (Higgens *et al.* 1996) which could easily be found in any aviary.

Fig 10.3: Unknown Subspecies (janson, 2009)

10.5 Occurrence of Hybrids:

There are no records to indicate whether the Emerald Dove is able to create a hybrid with another species, but as there is little documentation or studies conducted in the breeding of this species that means very little. Though these birds have been housed with similar species for years in free flight aviaries with

Fig 10.4: Christmas Island Subspecies (Christmas island, 2006)

no hybridisation occurring between the species.

It is important to note that as the species has eleven subspecies, effort should be made to keep these sub species separate from each other as they will breed between themselves. Studies need to be conducted to determine as to whether some of the sub species are actually sub species or a separate species on their own. Distribution of certain sub species and some physical characteristics (Fig 10.3, 10.4, 10.5) lend to the theory that certain subspecies are in fact species but this has yet to be confirmed by genetic analysis. Until further genetic mapping and phylogenetic analysis is conducted it is advisable that individuals from each subspecies are only allowed to breed with their own subspecies.

10.6 Timing of Breeding:

The Emerald Dove breeds all year round and merely waits for the triggers to be in its environment before it will breed. In the wild the breeding season will vary depending on where the animal is located, the species will even nest twice a year but only produce eggs once a year and again if this happens it depends on where the animal is located.

Fig 10.5: Unknown Subspecies (Beste, 2009)

In the Northern Territory it is common for eggs to be produced in Oct to Feb while nesting can occur in Jun, Nov and Jan-March. In NSW eggs and young can be produced all year round but tend to peak in Jun-Aug. In QLD it has been seen that eggs are produced in Aug, Oct and Dec-Feb. Norfolk Island sees the birds producing eggs in Oct and Nov which is similar to the Lord Howe Island subspecies, while the Christmas Island subspecies will produce eggs in Oct-Feb (Higgens *et al.* 1996).

In captivity especially in NSW the animals will successfully breed all year round when their breeding triggers are introduced, but in my experience are more likely to produce young in the spring.

10.7 Age at First Breeding and Last Breeding:

The female Emerald Dove is able to breed in their first year. With little to no data on their longevity and reproductive habits in the wild it is hard to determine an age for last breeding. These birds can be compared to more common species as they have a similar reproduce cycle with other species of doves (pers com Cam 2010). With this in mind it is estimated that the females last breeding year would be around the age of 13 years.

Fig 10.6 Adult (sex unknown) with Juvenile (ryanphotography,2009)

10.8 Ability to Breed Every Year:

These birds are able to breed every year due to the fact that they can breed all year round which gives them an advantage and that it takes only a couple of months to raise their young from the previous generation (pers com Cam, 2010).

10.9 Ability to Breed More than Once Per Year:

There are no records indicating that these animals will breed more than once a year, though due to their reproductive cycle it is possible but has not been recorded. In captivity these birds can be hand raised but there are no records that indicate that a female will doubled clutched after her first clutch is taken for hand rearing (Higgens *et al.* 1996).

10.10 Nesting, Hollow or Other Requirements:

These birds require little media to breed. It has been reported that an Emerald Dove once made a nest out of six to eight small twigs (Higgens *et al.* 1996). A platform and materials to make a nest out of such as twigs, small stick and coconut fiber is the easiest media to provide and has proven successful (pers com Cam, 2010). A platform is the easiest area for keepers to provide for nesting, as it is the safest and easiest for keepers to check daily. If a platform is not provided for the birds they may decide to nest high on a perch which can be a potential OH&S risk for keepers to check.

Fig 10.7: Emerald dove on nest (Lonely planet, 2010)

10.11 Breeding Diet:

A trigger to induce breeding in these birds is to increase the number of insects in their mainly grains and seeds diets, as well as providing the nesting material. For greater success this

should be undertaken in the spring months (pers com Cam, 2010). The amount of calcium should be increased in the diet as well to help supplement the calcium that will be taken from the female when she starts producing her eggs. The amount of food the animals are given in their daily ration should also be increased and stay increased until the chicks are fledging. The amount by which to increase the diet is learned by trial and error as each animal is different but without enough food mating may not be successful (pers com Cam, 2010) so it is better to error on the side of caution.

Fig 10. 8: Emerald Dove clutch (blog spot, 2006)

10.12 Incubation Period:

The emerald dove has a recorded 14 day incubation period in captivity and observed in the wild (Higgens *et al.* 1996)

Fig 10.9: An older juvenile (Myer *et al*, 2008)

10.13 Clutch Size:

Records indicate that the clutch size for the Emerald Dove is 2 eggs (Higgens *et al.* 1996).

10.14 Age at Fledging:

In captivity the age of fledging was once recorded at 3 weeks but it has been observed at 5 weeks in the wild (Higgens *et al.* 1996), the difference in results can be assumed to be that the captive breeding pair was under closer scrutiny than the wild breeding pair.

10.15 Age of Removal from Parents:

Once fledglings are free flying young there have been reports of the young still receiving food off their parents (Higgens *et al.* 1996). Due to this it is unwise to separate young from their parents just after they have become free flying young.

The Emerald dove goes through its first molt to get rid of its juvenile feathers and gains its immature plumage at the age of 3months. It has been determined that it is at this point that it becomes a young adult and can safely and much more easily be removed from its parents without causing any undue harm to the individual (Higgens *et al.* 1996).

10.16 Growth and Development:

According to Higgens *et al.* (1996):

- Chicks are born semi-altricial and nidicolous meaning they stay in their nest. They are covered in a sparse yellow down.
- 3 to 4 days after hatching, quills of primaries, secondaries and rectrices start to appear
- 7-8 days the head, neck and back are bare with wings completely feathered but the plumes have emerged only a little, the lower tail-coverts and rectrices

are appearing with some feathers appearing on throat and on the two main ventral tracts.

- 14 days the longest primary would be 19mm and the longest rectrix at 10mm
- 16 days the chick is fully feathered except for a bare throat, neck and lower breast.
- The chick will gain between 3.4 and 6.4 grams a day
- Chick fledges around 3 weeks
- 26 days- juvenile plumage is complete
- Juvenile is a free flying young at 5 weeks
- First moult is complete by 90 days and bird now has immature adult plumage

11. Artificial Rearing

Artificial rearing can be very intensive for the keepers involved and should be considered as a last resort. That being said, an experienced keeper can have a higher success rate artificial rearing a chick than a chick being parent raised. If you have a valuable chick the decision should be made if it will be hand raised.

11.1 Incubator Type:

There are many different incubator types out on the market. Often it will depend on an institution resources on which incubator can be procured. Some of the better brands of incubators are found overseas such as the A.B Startlife brand. So unless an Australian distributer can be found other Australian brands may have to be considered such as Brinsea, Novital, Multiquip and Masalles.

A good incubator which can be a little expensive to buy is the A.B. Startlife 25Mk3 moving air incubator. It is an investment incubator as the company is based in England. But it does have the features that are needed in an incubator for the Emerald Dove. For an incubator for the Emerald Dove it should have;

- Automatic turning of the egg using rollers
- Close temperature and humidity control accurate to ±0.5^{0}C - though there should always be a back up thermostat connected
- A probe that can be positioned over where the egg lays to gain a better understanding of the temperature and humidity
- External water supple to limit contamination and bacteria build up
- Easy to clean to prevent contamination
- See through lid so you can see the eggs
- Have a good ventilation system

11.2 Incubation Temperatures and Humidity:

The incubation temperature and humidity will stay constant up until around 2-3 days before hatching. The temperature and humidity used can be the same that is used to incubate a chicken egg (Brown, D .1995) which is at a temperature maintained between 37.2 and 37.5^{o}C. The humidity should be kept at levels between 55-60%. If the right incubator is used they should automatically turn the egg. For this type of egg it can be turn up to 25 times per day at 90^o per turn (Brown, D. 1995). The egg should be incubated for 14 days so for the first 12 days the above settings apply. In the last 48hrs of incubation the settings change slightly-See ***Hatching Temperature and Humidity***

11.3 Desired % Egg Mass Loss:

A healthy egg will lose 15% of its total mass at any point when it is weighted during incubation (Brown, D. 1995). If the egg is losing more than 15% then the humidity in the incubator needs to be increased. If the egg is losing less than 15% then the humidity needs to be lowered. The egg can be weighted every second day to make sure it is on track. To find out if the egg is healthy the following formula can be applied:

Fresh weight=Fwt	Actual weight=Acwt
Actual age of egg=Age	Expected days to pip=Dpip

$$\text{Daily egg weight loss} = \frac{\left\{\left\{\frac{Fwt - Acwt}{Age}\right\} \times Dpip\right\}}{Fwt} \times 100$$

If the daily egg weight loss is not 15% then the setting on the incubator will have to be changed.

11.4 Hatching Temperature and Humidity:

48 hours prior to hatching the egg shouldn't be turned anymore. The humidity should be raised to 70-75% (Brown, D. 1995). It is around this time that the egg should be pipped. Once the egg is pipped the egg should be turned for the last time to ensure that the pipped section of the egg is facing up to ensure oxygen will be able to get into the egg.

If pipping does not occur during this time assisted pipping should be considered towards the end of the 48hour period. Candle the egg to ensure where you pierce the egg is not near any blood vessels. Though this can often cause more harm than good.

11.5 Normal Pip to Hatch Interval:

There is no specific data on the Emerlad Dove for pip to hatch interval but if it is to be compared to other similar species, once the egg has been pipped it takes an additional 24hours for the chick to absorb the contents of the yolk sack before it will hatch out of its shell (Brown, D. 1995). Once it hatches the chick can be moved into a brooder.

11.6 Brooder Types/Design:

Brooders can be as simple as a heated box or enclosure or can be as complex as a purpose built brooding unit. As Emerald Doves are altricial when they are born they require a controlled environment with a high initial temperature and humidity control (Brown, D. 1995). The A.B. Startlife 25Mk3 moving air incubator can be used as a brooder for the Emerlad Dove. But often a separate brooder is needed as eggs will hatch at different times. As chicks get larger and their pin feathers develop, they can be moved from a controlled environment that the incubator provides into a heated box.

In the brooder the chick is placed in a small container which is filled with shredded paper. This should be changed daily.

Chicks are less likely to stress if they are raised in pairs, so there can be two chicks in each small container.

Chicks will be in the brooder until they fledge at approximately three weeks of age.

11. 7 Brooder Temperatures:

The initial temperature of the brooder should be 35°. This temperature is slowly lowered to 29°. The temperature should be lowered by 1 or 2 degrees at a time. When the chicks are no longer huddled together and are spaced apart it means that they are

hot and the temperature should be lowered. Humidity can be returned to 60% and slowly reduced as well.

The chick can be moved out of the brooder when its pin feathers develop at about 3 weeks. It is at this point that it can be moved to a tub or a larger heat box. If it is going to kept in a tub there should be a heat mat under the tub to still provide heat. The substrate can still be shredded paper. But as the chick ages substrate such as wood chips should be introduced to get the chick used to the substrate it will meet when it goes into the aviary. The chick should stay in this controlled environment until the bird can fly. At which point it can be moved to a small weaning aviary with other birds of a similar age.

11.8 Diet and Feeding Routine:

Initially their diet needs to mimic 'Pigeon Milk' which should be high in protein (11-23%) high in fat (6-12%) and high in water content (65-85%) (Brown, D. 1995). This is provided in the first 3-6 days of life (Brown, D. 1995). After this period, the formula can start to resemble a normal hand raising formula which should slowly start to decrease the protein and fat while increasing the carbohydrates and solids.

The easiest way to feed the chick is to use a modified syringe. If the end is cut out of the syringe which leaves a 1 mm margin around the inside edge (Brown, D. 1995). The syringe size will need to be increased as the chick grows. The chicks' beak should be able to fit inside the tube opening and open up to drink the formula that it is immersed in (Brown, D. 1995).

Rates and Diets taken from Brown, D. (1995);

From day 1 to 10 feed pigeon milk that progressively get thicker

Feeding rates should be reduced from 5-6 times a day to 3 times a day

From day 11 to weaning feed hand rearing formula for granivorous species

Start to introduce small portions that gradually increase of an adults diet (eg seed) around fledging

Feeding rates should be reduced from 3-4 times a day to 1 time a day at weaning

Age of weaning will depend on how well chick adapts to adult diet. For successful weaning portions of an adult diet should be added as soon as possible which is around fledging.

To ensure the bird is feeding correctly the bird should start 'pumping' when it is being fed.

Suggested Formula taken from Brown, D.1995.

For a supplier see http://www.roudybush.com/

The ratios below should be as follow with the amounts fed to the chick enough to fill the chicks crop.

From day 1 to day 3 –Formula Roudybush Squab Handfeed®

Feed 6 parts water: 1 part formula

From day 3 to day 5- Formula Roudybush Squab Handfeed®

Feed 4 parts water: 1 part formula

From day 6 to day 10- Formula Roudybush Squab Handfeed®

Feed 3 parts water: 1 part formula

From day 11 to day 21 to weaning- Formula Roudybush Formula 3®

Feed initially 3 parts water: 1 part formula and reduce water as chick approaches weaning

When formula is fed out it should be the same temperature as your wrist

11.9 Specific Requirements:

If the above methods and guidelines are followed then there are no other special requirements needed to hand raise this bird.

It should be noted that success rates will be higher if birds of a similar size and age are kept and raised together.

11.10 Pinioning Requirements:

There is no reason to pinion this bird.

11.11 Data Recording:

There are two stages to the data recording. There is data recording for the egg and data recording for the chick.

When the egg is collected the following should be recorded:

- The eggs fresh weight (g)(Length*Breadth*Breadth*0.548)
- Date it was collected
- Date it was layed
- Length (cm)
- Breadth (cm)
- Egg volume (cm^3)(L*B*B*0.51)
- Egg condition
- If it is fertile

The egg can be determined to be fertile by candling.

The egg can be written on with a lead pencil. It should be labeled with the date it was collected, where it was collected from, the species and its initial weight.

Once the egg is in incubation it should have a records chart. On the chart should be recorded:

- The number of days the egg has been in incubation
- The eggs actual weight
- Density
- Vein growth (%)
- Date
- Expected number of days till pipping

- Expected number of days till hatching
- Humidity
- Temperature

Once the chick has hatch the following should initially be recorded:

- Date
- Weight
- Chick condition

Once the chick has hatched the following should be recorded at every feeding:

- Date
- Time
- Condition of crop –full empty
- Formula being fed
- How much fed
- Temperature
- Humidity
- Pin feathers developing?

11.12 Identification Methods:

If two chicks are hand raised together in the same container, one can be marked with a dark high lighter to tell them apart. Due to chicks colouration the highlighter mark will need to be near the chicks' beak to be able to see it, when the chick reaches 7 days old the mark can be on the top of the head and it will be visible. As the chick ages and becomes larger a temporary plastic leg ring can be attached for identification until the chick is weaned. It is at this point that a permanent leg band can be attached or a microchip inserted into the bird for adult identification.

11.13 Hygiene:

While the chick is in the brooder hygiene is very important, warm boiled sterile water should be used for all washing and formula making. Once the pin feathers have appeared tap water can be used for washing but still warmed boiled water should be used for making formula. This is because it is at this point you want to introduce bacteria and bugs that the animal will face in eth real world slowly into its system.

Gloves should be worn when preparing food and once any formula has been made it should not be reheated and fed out again. Left over formula should be fed out to adult birds or other animals.

11.14 Behavioural Considerations:

Imprinting is always an issue with any hand raised animal, but if birds are raised with other birds and then weaned successfully with birds of similar ages, imprinting can be avoided.

11.15 Use of Foster Species:

Cross fostering has proven quite successful with this species (Brown, D 1995). The most often used species for cross fostering are:

- Barbary Doves
- Common Bronzewings
- Diamond Doves
- Peaceful Doves
- New Guinea Ground Doves

This species itself is a good fostering species (Brown, D 1995) for other species as well.

11.16 Weaning:

Weaning will be successful if birds of a similar age are kept together.

A reduce adult diet should have been added to their feed roughly 10 days before weaning, with the proportions increasing slowly. By the age of weaning which should be as the bird fledges or just after, the bird should be down to one feed a day and eating seed. This bird should be placed in a weaning aviary with a number of birds the same size. Some of these birds would have been weaned and some are being weaned. The theory behind this method is that the weaned birds will teach the younger ones. Though it can backfire, if the ages between birds or the sizes of the birds vary too much. The larger older animals will become bullies to the small ones.

11.17 Rehabilitation Procedures:

Rehabilitation procedures for handrasied birds to be released into the wild or wild caught birds recovering from injury that are to be released, follow the same procedures. Though there are extra considerations when the bird being rehabilitated is a wild caught bird.

It does need to be remembered that the Emerald Dove is a territorial bird especially the males. If the injured bird is a male and the recovery period from the injury is estimated to be longer than a few weeks the decision does need to be made whether it should be released or if it should be euthanized. As these birds are common in their habitats in the wild there is every chance that once a male is taken from the wild for rehabilitation from injury, a new male bird will find the empty territory and take it over. This means that once the rehabilitated bird is released there will be a fight for territory which can lead to a slow death through starvation or injury.

If a wild caught bird is deemed to be a chick or juvenile then it should be placed in care until it fledges and receives its adult plumage. Once it is deemed an adult it should undergo the health checks and then placed in a rehabilitation aviary.

For any wild caught bird received, records stating the exact location where the bird was found should be taken along with the details of the person who found the bird. This is to ensure that the animal can be released back into its own territory.

Once birds are deemed fit and healthy for rehabilitation they should be placed in a rehabilitation aviary. For birds to be deemed fit and healthy they should have fledged, have all their flight feathers, be completely recovered from any injury and eating a regular normal healthy diet. A number of birds should be rehabilitated together as they higher survival rate if released together (pers com Cam Candy, 2010).

A rehabilitation aviary should be as large an aviary as possible. It needs to be remembered that the Emerald Dove is mainly a ground dwelling bird and as such any

rehabilitation aviary needs to have plenty of ground space. The Emerald Dove is also a migratory species, but it is unknown how far they fly during their migrations so due to this a rehabilitation aviary needs to be long and high enough to develop and exercise the flight and endurance muscles that the bird will need to survive in the wild an example of this in my opinion would be an aviary at least 10m long and 6m high. This aviary also needs to be placed away from people and human habitation to start to dehumanise the birds, so that they are not released as imprinted animals.

Once the birds are in their rehabilitation aviary a release site needs to be chosen (this is only required for hand raised birds as wild caught birds have their own territory to be release into). The release site chosen should have a habitat that is suitable for the bird in a location that they would find desirable, see section 3 for further details about the Emerald Doves' wild habitat and distribution. This site should also be assessed for any pests that may be around with particular focus of pests that live on the ground such as feral cat or foxes. The chosen release site should also have the natural diet of the bird which can be found in section 6. Any release site chosen should be thoroughly inspected to ensure it has all the desired qualities. Preferably the release site will be inspected a number of time throughout the year to gain an understanding of the changes that the seasons bring to the release site. For example there is no point releasing an animal in spring if it will starve to death in winter because there is no food source present. If an unsuitable release site cannot be chosen there is a chance to modify a release site to suit the Emerald Dove but this can be costly and time consuming. Most keepers and conservationist do not have the resources to upkeep release sites for any length of time.

Once it is deemed that it is possible release site for the birds being rehabilitated, actual food sources from the release site should be slowly introduced to the rehabilitated birds diet. The portion of this release site food should be slowly increased until it makes up the majority of the birds diet.

The animals then need to be deemed fit and healthy enough to be released back into the wild. This should include a health check to ensure the animal has no health problems and a flight check to ensure the bird can fly normally and has the strength for endurance flying. The bird should also be eating normally. Some form of identification microchip or leg ring should be attached to the bird for later surveying.

For the best method for capturing, transportation and release into the wild for these birds see section 7.

Once the birds have been successfully released into the wild, regular surveys should be undertaken of the area to see if any of the released birds can be found to assess the success rate of the rehabilitation program.

The rehabilitation program can be considered successful in my opinion when the released birds have mated and successfully raised their own young.

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15. Glossary

AQIS: Australian Quarantine Inspection Service

Barrier nursing: Using barriers such as disinfectants or physical barriers such as gloves to protect a keeper while caring for animals

Egg bound: The process of having a half developed egg 'stuck' within the bird

Ethmoidal bone: A light spongy bone located between the eye sockets, forming part of the walls and septum of the superior nasal cavity, and containing perforations for the passage of olfactory nerve fibers

FFF Zone: Fright, Flight and Fight zone. Describes how close you can get to the animal before it is frighten, before it flies away and before it will try to fight its way free.

Mastoid bone: A conical protuberance of the posterior portion of the temporal bone that is situated behind the ear and serves as a site of muscle attachment. Also called mastoid bone

Pigeon Milk: A special rich milk that pigeon species produce for their young before the chick moves on to regular milk

Pipping: When the chick puts the first hole in the egg to let oxygen into the egg

Pneumatization: The development of air cells or cavities, such as those of the mastoid and ethmoidal bones

Pumping: An action that young birds display when they are successfully drinking milk. Their head will bob up and down and you can see their throat working to swallow the milk.

Remiges: The large quill feathers of a bird's wing; the primary and secondary contour feathers

Tarsi: A group of bones in the ankle region of birds

Ventriloquial: of, having to do with, or using ventriloquism

16. Appendix

1. Source: ACT Work Safety Commissioner, (2010)

Work Safety Risk Assessment & Control Form	Business Name _____ Risk Assessment completed by: _____ ACT Occupational Health & Safety Commissioner

Division:	Section/Unit:

Document number	Initial Issue date	Current version	Current Version Issue date	Next review date

For additional information refer to the publication *6 Steps to Risk Management* or the ACT OHS Commissioner's website – www.worksafety.act.gov.au .

Risk Assessment title:

Step 1: Identify the activity

Describe the activity:

Describe the location where the activity occurs:

Step 2: Identify who may be at risk by the activity

A number of people may be at risk from any activity. This may affect the risk controls needed. These people may include fellow workers, visitors, contractors and the public. The location of the activity may affect the number of people at risk.

Steps 3 to 7: Identify the hazards, risks, and rate the risks

1. An activity may be divided into tasks. For each task identify the hazards and associated risks.
2. List existing risk controls and determine a risk rating using the Risk Rating Table on page 4.
3. Additional risk controls may be required to achieve an acceptable level of risk. Re-rate the risk if additional risk controls used.

Tasks	**Hazards** (Step 3)	**Associated risks** (Step 4)	**Existing risk controls**	**Risk rating with existing controls *** (Step 5)			**Additional risk controls required** (Step 6) (Apply the hierarchy of risk controls)	**Risk Rating with additional controls *** (Step 7)		
				I	**L**	**R**		**I**	**L**	**R**

*** I = impact or consequence L = likelihood R = risk rating from the Risk Rating Table (page 4)**

Step 8 Documentation and supervisor approval

Completed by: (name)	(signature)	Authorised by: (name)	(signature)	Date:

Step 9: Implement the additional risk controls identified

Indicate briefly what additional risk controls from Step 6 above were implemented, when and by whom.		
Risk control:	Date:	Implemented by:
Risk control:	Date:	Implemented by:
Risk control:	Date:	Implemented by:
Risk control:	Date:	Implemented by:
Risk control:	Date:	Implemented by:

Step 1 0: Monitor a nd rev iew t he r isk controls

It is important to monitor risk controls and review risk assessments regularly. Review is required when there is a change in the process, relevant legal changes, and where a cause for concern has arisen. Reviews could be scheduled on an annual basis. If the risk assessment has substantially changed a new risk assessment is warranted.

Review date:	Reviewed by:	Authorised by:
Review date:	Reviewed by:	Authorised by:
Review date:	Reviewed by:	Authorised by:
Review date:	Reviewed by:	Authorised by:
Review date:	Reviewed by:	Authorised by:

Documentation

It is a important that any legal and advisory documentation that supports this risk assessment be listed. Such documentation includes Acts, Regulations, Australian Standards and

Codes of Practice, where applicable.

ACT OHS Commissioner OHS Risk Rating Table

IMPACT:	*How severely could someone be hurt*
Catastrophic	death or permanent disability to one or more persons
Major	hospital admission required
Moderate	medical treatment required
Minor	first aid required
Insignificant	injuries not requiring first aid
LIKELIHOOD:	*How likely are those consequences?*
Almost certain	expected to occur in most circumstances
Likely	will probably occur in most circumstances
Possible	could occur at some time
Unlikely	is not likely to occur in normal circumstances
Rare	may occur only in exceptional circumstances

IMPACT	LIKELIHOOD				
	Rare 1	**Unlikely 2**	**Possible 3**	**Likely 4**	**Almost Certain 5**
Catastrophic A	**M**	**M**	**H**	**C**	**C**
Major B	**L**	**M**	**M**	**H**	**C**
Moderate C	**L**	**M**	**M**	**M**	**H**
Minor D	**L**	**L**	**M**	**M**	**M**
Insignificant E	**VL**	**VL**	**L**	**L**	**M**

Risk level	Required action
Critical	Act immediately: The proposed task or process activity must not proceed. Steps must be taken to lower the risk level to as low as reasonably practicable using the hierarchy of risk controls.
High	Act today: The proposed activity can only proceed, provided that: (i) the risk level has been reduced to as low as reasonably practicable using the hierarchy of risk controls; (ii) the risk controls must include those identified in legislation, Standards, Codes of Practice etc. (iii) the risk assessment has been reviewed and approved by the Supervisor and (iv) The supervisor must review and document the effectiveness of the implemented risk controls.
Medium	Act this week: The proposed task or process can proceed, provided that: (i) the risk level has been reduced to as low as reasonably practicable using the hierarchy of risk controls; (ii) the risk assessment has been reviewed and approved by the Supervisor.
Low	Act this month: Managed by local documented routine procedures which must include application of the hierarchy of controls.
Very Low	Keep a watching brief: Although the risk level is low the situation should be monitored periodically to determine if the situation changes.

Hierarchy of controls

1	**Eliminate the hazard** — remove it completely from your workplace.	*If this isn't practical, then...*
2	**Substitute the hazard** — with a safer alternative.	*If this isn't practical, then...*
3	**Isolate the hazard** — as much as possible away from workers.	*If this isn't practical, then...*
4	**Use engineering controls** — adapt tools or equipment to reduce the risk.	*If this isn't practical, then...*
5	**Use administrative controls** — change work practices and organisation.	*If this isn't practical, then...*
6	**Use personal protective equipment (PPE)** — this should be the last option after you have considered all the other options for your workplace.	

2. **Monthly Pest Assessment**

Date	Pests found	Abundance (low, medium, high)	Proposed Treatment	Referred Action (yes/no) and to whom	Date actioned	Actioned by (initial)

4.

Observation Instantaneous Recording Sheet:

Captive Observations .

Completed by:

At

Date: Weather conditions:

Describe the captive environment/habitat:

Time	Active	Passive	Other	Notes
.00				
.05				
.10				
.15				
.20				
.25				
.30				
.35				
.40				
.45				
.50				
.55				
TOTALS				
%				

4B. Raw data from observations:

Table A1 Observation 1

Observation 1- Feeding Time			
Time	Passive	Active	Other
0		x	
0.05		x	
0.1		x	
0.15		x	
0.2		x	
0.25		x	
0.3	x		
0.35	x		
0.4		x	
0.45		x	
0.5		x	
0.55		x	
Totals	2	10	0

Table A2: Observation 2

Observation 2- Midday			
Time	Passive	Active	Other
0	x		
0.05	x		
0.1	x		
0.15		x	
0.2			X
0.25			X
0.3			X
0.35	x		
0.4	x		
0.45	x		
0.5		x	
0.55		x	
Totals	6	3	3

Table A3: Observation 3

Observation 3- Dusk			
Time	Passive	Active	Other
0	x		
0.05	x		
0.1	x		
0.15	x		
0.2		x	
0.25		x	
0.3	x		
0.35	x		
0.4	x		
0.45	x		
0.5	x		
0.55	x		
Totals	10	2	0

Table A4: Combined Data

Combined Data			
time	Passive	Active	Other
0	2	1	0
0.05	2	1	0
0.1	2	1	0
0.15	1	2	0
0.2	0	2	1
0.25	0	2	1
0.3	2	0	1
0.35	3	0	0
0.4	2	1	0
0.45	2	1	0
0.5	0	2	0
0.55	0	2	0
Totals	16.00	15.00	3.00
percentage	47.05882	44.11765	8.823529

4C Ethogram of behaviours observed

Table A5: Ethogram of behaviours

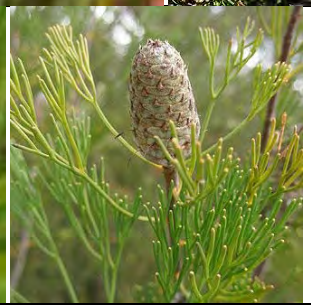
Active	Passive	Other
Foraging on ground (FG) Foraging on ground in bush (FGB) Feeding on feeding platform (FP) Inspecting browse on perch (BP) Inspecting browse on ground (BG) Flying from perch to perch (P2P) Flying from ground to perch (G2P) Flying from ground to ground (G2G) Mating display (MD) Drinking (D) Interacting with members of other species (IOS) Interacting with members of own species (IS) Preening (P) Alert (A)	Roosting (R) Loafing on low perch (LP) Loafing on high perch (HP) Standing on ground (HG) Fluffed up on perch (FUP) Yawning (Y)	Out of sight (OS)

5.

Table A6: Ten plant species suitable for the Emerald Dove (PlantFile Pty Ltd, 2009)

Name	Scientific Name	Picture	Height	Spread
Rosemary Grevillea	*Grevillea rosmarinifolia*		1.5 - 2.5 m	3 m
Spiny-head Mat-rush or Basket Grass	*Lomandra longifolia*		0.5 - 1 m	1 m
Common Correa o r Native Fuchsia	*Correa reflexa*		1 - 1.5 m	1 m

Gristle fern	*Blechnum cartilagineum*	  	1m	1m
Geebung	*Persoonia isophylla*	  	1.5 - 2 m	1 m
Sarsaparilla, Native L ilac, Purple Coral Pea	*Hardenbergia violacea*	  	1.5 - 2 m	3 m
Coastal Rosemary, Australian Rosemary	*Westringia fruticosa*	  	1.5 - 2 m	4 m

Downy Zieria	*Zieria cytisoides*	  	0.8 - 1.2 m	1.5 m
Box-leaved Wattle	*Acacia buxifolia*	  	2 - 3 m	2.5 m
Honeysuckle Banksia, Hairpin Banksia	*Banksia spinulosa*	  	2 - 3 m	2 m
Conesticks	*Petrophile pulchella*	 	1.5 - 3 m	1 m

6A. MSDS for F10
source:Lomb Scientific2010

MATERIAL SAFETY DATA SHEET

COMPANY DETAILS
AUSTRALIAN DISTRIBUTOR:
COMPANY: Chemical Essentials (Pty) Ltd
Address: 13 Abelia Str, Doncaster East,
Victoria 3111
Emergency Telephone number:+03 9841 9901
Fax: +03 9841 9909

MANUFACTURER:
Health and Hygiene (Pty) Ltd
P O Box 347. Sunninghill 2157,
South Africa.
Tel:+27 11 474-1668
Fax: +27 11 474-1670
e-mail: info@healthandhygiene.co.za

IDENTIFICATION

PRODUCT NAME: **F10 SUPER CONCENTRATE DISINFECTANT**

UN Number: None
D G Class: None
Hazchem code: None
Poisons Schedule: 5

HAZARDOUS ACCORDING TO CRITERIA OF WORKSAFE AUSTRALIA IN THE PACK CONCENTRATE ONLY (eyes and skin irritant)

USE: Biodegradable multi purpose Disinfectant for all hard surfaces, equipment and airspaces

PHYSICAL DESCRIPTION/PROPERTIES

Appearance:	Clear, colourless liquid, with a slight natural odour.
Boiling Point:	110^{0}C
Vapour Pressure:	Not known
Specific Gravity:	1.00
Flash Point:	Not flammable
Flammability Limits:	Not flammable
Solubility in water:	Soluble

INGREDIENTS

	CAS Number	Quantity (w/w)
Benzalkonium Chloride	68424-85-1	5.4%
Biguanide	27083-27-8	0.4%
Ingredients not determined to be hazardous		to 100%

HEALTH HAZARD INFORMATION

HEALTH EFFECTS:
Acute

SWALLOWED: Low. Substantial ingestion may cause irritation to mouth, throat and digestive tract.

EYE: Low. Will cause irritation but not serious damage.

SKIN: Low. Concentrate may act as mild degreasant to sensitive skin.

INHALED: Low. No significant hazard.

Chronic

INHALED: Low. No significant hazard

FIRST AID

SWALLOWED: DO NOT induce vomiting. Give milk or water to drink. Seek medical advice where necessary.

EYE: Rinse eyes with water. Seek medical advice where necessary.

SKIN: Wash affected area with soap and water.

INHALED: Non-toxic. Avoid long term inhalation of neat liquid. Remove to fresh air.

FIRST AID FACILITIES: Contact a doctor or Poison Information Centre (phone 131126)

ADVICE TO DOCTOR: Treat symptomatically

F10 SUPER CONCENTRATE DISINFECTANT

PAGE 2 OF 2

PRECAUTIONS FOR USE

EXPOSURE LIMITS:	No data found
Engineering controls:	None required
PERSONAL PROTECTION:	Not required
FLAMMABILITY:	Not Flammable

SAFE HANDLING INFORMATION

Storage and Transport:	Store below 30^0C in dry conditions
SPILLS AND DISPOSAL:	Soak up on an inert material e.g. dry earth and dispose of in an area approved by local authority by-laws. Flush small spills with copious amounts of water
FIRE/EXPLOSION HAZARD:	The product is not flammable or explosive.
OTHER INFORMATION:	Ensure good industrial hygiene. DO NOT mix with soaps or other chemicals.

CONTACT POINT: Managing Director, +03 9841 9901
Chemical Essentials Pty Ltd

KEEP OUT OF THE REACH OF CHILDREN

Issue number:	**2**
Issue Date:	**August 2004**