

# Husbandry Guidelines For



## Plumed Whistling Duck

*Dendrocygna eytoni*

(Aves: Anatidae)

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## Disclaimer

These husbandry guidelines were produced by the compiler/author at TAFE NSW – Western Sydney Institute, Richmond College, N.S.W. Australia as part assessment for completion of Certificate III in Captive Animals, course number 1068, RUV30204. Since the husbandry guidelines are the result of student project work, care should be taken in the interpretation of information therein, - in effect, all care taken but no responsibility is assumed for any loss or damage that may result from the use of these guidelines. It is offered to the ASZK (Australasian Society of Zoo Keeping) Husbandry Manuals Register for the benefit of animal welfare and care. Husbandry guidelines are utility documents and are 'works in progress', so enhancements to these guidelines are invited.

## OCCUPATIONAL HEALTH AND SAFETY RISKS

The Plumed Whistling Duck is classified as a low risk species, with no teeth. Their bites cause little injury; although they may result in pinching of the skin. Their claws have the potential to scratch, especially if they are being restrained incorrectly. Influenza A is a zoonotic disease that is transmitted by birds, particularly waterfowl. Symptoms are those of influenza- headache, fever etc.



This is an image of a Plumed Whistling Duck being restrained; the keeper is holding its leg and demonstrating how sharp the ducks claws can be. Taken by Jess McCray

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# 1 Introduction

Plumed Whistling Duck are one of eight species of whistling ducks found across the world. They can be found in tropical grass lands, foraging at the edge of lagoons and dams across New South Wales and the Northern States of Australia. Plumed Whistling Duck are an odd strange species of duck, as they are mostly terrestrial and more nocturnally active than most other species. On occasion they have been recorded travelling 2000km during the harsh dry season. They are abundant across the Australian continent and are vagrant to Papua New Guinea and New Zealand.

The voice of a Plumed Whistling Duck is a shrill, high pitched whistle, with their wings also making a whistle noise in flight. These ducks can be found in large flocks, roosting with other Australian waterfowl species including Wandering Whistling Ducks *Dendrocygna arcuata* and Australian Wood Ducks *Chenonetta jubata*.

Plumed Whistling Ducks are a very timid species and usually only show aggression during the breeding season, due to territory surrounding nest sites. Because of their calm and quiet nature, they house well and adjust to life in captivity efficiently. They are well adapted to life in captivity and are held in a majority of zoo and wildlife parks across Australia. According to the 2008 Regional Census Plan many of these institutions plan to breed Plumed Whistling Ducks in the next year to increase population size, this document demonstrates the success of Plumed Whistling Duck in captivity as the institutions have bred, and hope to continue breeding this species in the future.

Little is known about the Plumed Whistling Duck and with the captive institutions increasing population size, this opens a door for future research so that everyone can benefit from the knowledge gained about this amazing species.

## **1.1 ASMP Category**

Plumed Whistling Duck are not part of an ASMP. Within the Regional census plan they are part of the Non- Passerine TAG; they have no Regional Plan and are at Management Level 3.

## **1.2 IUCN Category**

According to the 2009 IUCN Red List Category, Plumed Whistling Ducks are categorised as; Least Concern. There are an estimated 100,000 to 1,000,000 individuals in the wild. (Birdlife, 2009)

“This species has a very large range, and hence does not approach the thresholds for Vulnerable under the range size criterion (Extent of Occurrence <20,000 km<sup>2</sup> combined with a declining or fluctuating range size, habitat extent/quality, or population size and a small number of locations or severe fragmentation). The population trend appears to be fluctuating, and hence the species does not approach the thresholds for Vulnerable under the population trend criterion (>30% decline over ten years or three generations). The population size is very large, and hence does not approach the thresholds for Vulnerable under the population size criterion (<10,000 mature

individuals with a continuing decline estimated to be >10% in ten years or three generations, or with a specified population structure). For these reasons the species is evaluated as Least Concern.” (Birdlife, 2009)

### **1.3 EA Category**

This is not applicable for this species.

### **1.4 NZ and PNG Categories and Legislation**

No information could be found on Plumed Whistling Duck for categories or legislation for either New Zealand or Papua New Guinea. It can be assumed that this section is not applicable as populations are substantial across Australia and populations are only vagrant within New Zealand and Papua New Guinea.

### **1.5 Wild Population Management**

This is not applicable for this species as Plumed Whistling Ducks are classed as least concern and thus their wild population does not need to be managed.

### **1.6 Species Coordinator**

TAG (non- passerine) Convenor: Chris Hibbard, Taronga Zoo, but no specific species coordinator at present date.

### **1.7 Studbook Holder**

This is not applicable for this species.

## **2 Taxonomy**

### **2.1 Nomenclature**

**Class-** Aves  
**Order-** Anseriformes  
**Family-** Anatidae  
**Genus-** Dendrocygna  
**Species-** *eytoni*

### **2.2 Subspecies**

The Plumed Whistling-Duck has no recognised subspecies.

### **2.3 Recent Synonyms**

The Plumed Whistling Duck or *Dendrocygna eytoni* is also known as Dendrocygne d'Eyton in French, Gelbfuß-Pfeifgans in German and Suirirí Australiano in Spanish.

### **2.4 Other Common Names**

The Plumed whistling may also be named Eyton's tree Duck; Eyton's Whistling Duck, Eyton's Plumed, Plumed Tree-Duck, Grass Whistle Duck, Red-legged Tree Duck, Whistler, Monkey Duck or the Whistling Tree Duck.



### **3 Natural History**

All current classification systems group most waterfowl into the family Anatidae, which is the family of ducks, geese and swans. Dendrocygna is one of 50 genera within the family, and in this genus there are eight different species of Whistling Ducks, and each of these species varying significantly in appearance.

The 8 whistling duck species are of medium size weighing between 600- 1000 grams. The ducks in the Dendrocygna genus are also known as 'tree ducks', although few of them actually have arboreal habits. More recently they have been renamed 'whistling ducks' which is more commonly used and more appropriate as they all make whistling vocalisations.

Ducks within the Dendrocygna genus are monogamous and monomorphic. Whistling ducks begin to mature at 1 year of age with males maturing later than females. Nesting behaviours vary between species but most are built on the ground. Whistling ducks, black swans and magpie geese are the only waterfowl species where the males assist with the incubation and brooding duties.

Plumed Whistling Ducks are very versatile, and can be found in a range of environments from dry grassland and dusty plains to lagoons and vast wetlands in the tropics. This species is moderately nocturnal in its foraging behaviours, as they roost in the shallows of lagoons in the day and fly up to 20km away to graze in the evenings. They are a very social species and are often seen flocking with many other wetland bird species, in numbers into the thousands.

Plumed Whistling Ducks are one of few species which have benefited from human civilisation and can be often seen grazing in farm paddocks and eating farmer's wheat and other crops. This has allowed populations to be abundant across Australia.

#### **3.1 Morphometrics**

##### **3.1.1 Mass and Basic Body Measurements**

On average the total length of a Plumed Whistling Duck is 40-60cm, weighing between 580- 1400g. The average wing span is 75- 90cm wide.

Body length (head to tail)

Males: 43.5 - 61.5cm

Female: 41.5 - 56cm

##### **3.1.2 Sexual Dimorphism**

The Plumed Whistling Duck is described as monomorphic, although it does have slight dimorphisms. Both sexes are quite similar, with only a slight difference in size and the male having longer plume- flanks.

In breeding season the female moults her breast feathers to make a nest and to allow warmth for incubation. This could be an additional indication of the sex (if it is the correct time of year).

### 3.1.3 Distinguishing Features

The Plumed Whistling Duck is the only member of the *Dendrocygna* genus that has a pale coloured iris. Most whistling ducks have a goose-like upright stance and profile, with characteristic long legs. Plumed Whistling Ducks are most commonly mistaken for the Wandering Whistling Duck which is the same size and shape but a much darker colour. They have very distinct plumages with a bright orange striped breast and prominent flank plumes.

They can also be identified by their high pitched whistle, which is very different from any of the other whistling ducks.

### 3.2 Distribution and Habitat

Plumed Whistling Ducks inhabit tropical and temperate grasslands, where they are often seen grazing throughout the day and dabbling on the shore of a dam or wetland where they will also swim and rest. In the dry season these ducks will remain close to the water bodies with those from the more arid regions moving towards the coast or larger water sources. In the wet season they disperse widely inland, as food sources are available due to the rains.

They range from northern Western Australia across the Northern Territory, from Tenant Creek to Darwin, including the Kakadu wetlands, to the eastern tropics of Queensland. They even extend into eastern New South Wales down to Victoria where the populations begin to scatter and become less frequent. They have also been recorded in New Guinea, Tasmania's south and New Zealand.

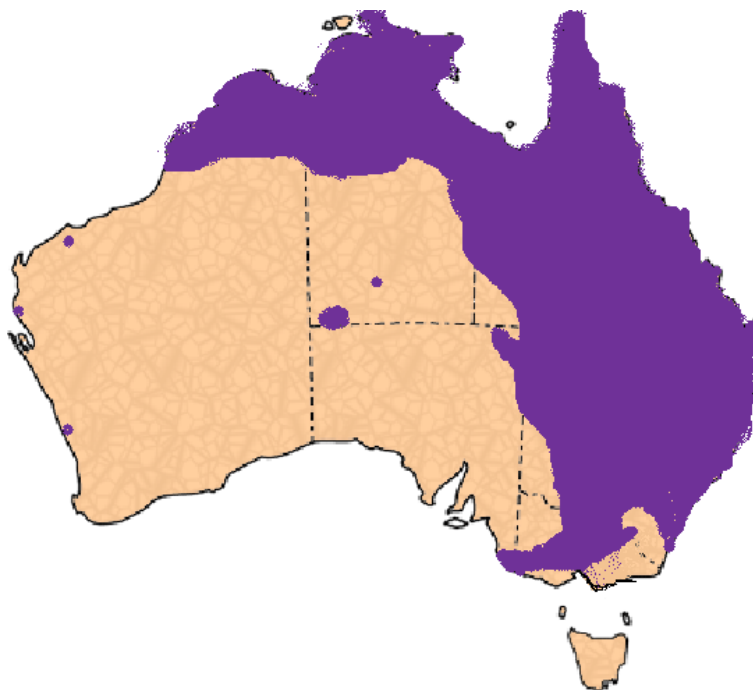


Fig. 2 Distribution map of *Dendrocygna eytoni*

Map from <http://www.apha.org.au/ourmembers.html>- distribution marked out by Jessica McCray



Fig. 3 Distribution map of the Plumed Whistling Duck according to Oiseaux.  
<http://www.oiseaux.net/birds/distribution/plumed.whistling-duck.html>

### **3.3 Conservation Status**

The species are believed to have a global population of approximately 100,000-1,000,000 individuals (IUCN Red List 2007) and are wide spread throughout this range. It is categorised as least concern with an expanding breeding range in south-eastern Australia.

### **3.4 Longevity**

#### **3.4.1 In the Wild**

Information on the longevity of the Plumed Whistling Duck in the wild could not be found. However, through the research of ducks in general, the life span on average is between 7-10 years.

#### **3.4.2 In Captivity**

Plumed Whistling Duck will live to approximately 15 years of age in captivity (The Big Zoo, 2007).

#### **3.4.3 Techniques Used to Determine Age in Adults**

The approximate age of Plumed Whistling Duck can be determined by plumage growth. Immature birds have the same markings and body shape as adults but are paler/ duller colour. They lack striped breast markings and their breast markings are not as distinct. Immature birds also have a dark brown iris compared to an adult's iris which is yellow- orange in colour; in addition they have a slate wash pattern on their legs, whereas mature adults have only pink legs.

## 4 Housing Requirements

### 4.1 Exhibit/Enclosure Design

Plumed Whistling Ducks come from a range of different habitats, from wetlands and lagoons to grass lands and dry plains. Their exhibit can be based on any of the above environments. Plumed Whistling Ducks can be housed with most other duck species and would also fit well within a mixed species exhibits or free range within a zoo or park.

The exhibit provided for the Plumed Whistling Duck would need to include:

- A pond- Plumed Whistling Duck enjoy wading in the shallows of wetlands and lakes, but also swim around. Therefore so a pond of at least 25m<sup>2</sup> with a shallow wading area as well as a deep end would be efficient.
- Grassland area- an area planted out with tall grasses and shrubs, the ducks will often retreat to these areas to sleep, hide and even nest under. Species could include; *Lomandra longifolia*, *Barley or Hoop Mitchell Grass*, *Lomandra confertifolia* or other swamp/ wetland grasses.
- Rocks, logs and tree branches- can be added as exhibit furniture. They are aesthetically pleasing and provide barriers and hides so that the ducks are provided with more security.
- Substrate- sand, pebbles (for the pond) and mulch (Eucalyptus leaf mulch or pine needle mulch). A suitable substrate must be used, to protect their feet from bumble foot, make the exhibit more aesthetically pleasing and fit in with the theme of the exhibit.
- A clear spot for a feeding station- this should be done in a clear and accessible area, so that the public can view the ducks as they feed. And keepers can access and clean the area. It is also necessary to replicate their natural feeding behaviour which is carried out in open grasslands.
- Not much vegetation should be used, as the Plumed Whistling Ducks need to be able to see threats or anything coming through the exhibit that may startle them. Low grass cover, shrubs and a few random trees or bushes are enough to complement the exhibit.
- The exhibit needs to provide certain areas were the ducks can escape from public view, especially during the breeding season, to reduce stress on the parents and young.
- The pond will need to be maintained regularly and a large log/ stump will need to be placed in the deep end so that if any animal was to fall in, they would be able to get out again.

#### 4.1.2 General Principals

Common mistakes often made when housing Plumed Whistling Ducks include:

- Choosing the wrong substrate, which can lead to bumble foot. It is necessary for the enclosure to be cleaned daily and the substrate changed or disinfected weekly.
- Not providing a water source. It is preferred that this species has access to a water body, for bathing and to assist with preening. However this species can be housed with minimal water for a temporary holding situation. If being housed for a period exceeding 2 days, a shallow water body must be provided for bathing and preening.

- Housed with aggressive adults or species. Aggression is very rare, but can occur during breeding or when birds become crowded or placed in a compromised situation within the enclosure. Thus group composition needs to be monitored.
- Poor nutrition and feeding incorrect diets e.g. bread.
- When diets are changed it is common for Plumed Whistling Ducks to reject the food when first offered, so it is important that any new diets are slowly introduced.
- Plumed Whistling Ducks are a very flighty species. This is often underestimated and can lead to injuries and feather damage. It is necessary when housing the species that the walls are covered with mesh or corflute. They need to be provided with hides and a sheltered area, where they can escape to. Soft meshing can also be used to pad the roof of the enclosure, and to prevent head trauma if the birds fly up. Wing clipping can also be considered but may not be appropriate for the display that they may be moving into.
- When raising this species, it is important that ducklings are not overexposed to large water bodies until at least six weeks of age, because Plumed Whistling Ducks are prone to head colds, and can drown. A spill proof water dispenser that only allows the bill of the duck to contact the water is a perfect solution.



Fig. 4 This is an image of a water dispenser, especially designed for ducklings. The water is slowly released from the main bottle into the shallow drinking dish. Picture taken by Jess McCray.

- Ducklings can be raised in movable coops, so that they are constantly exposed to fresh grass tips, to prevent malnutrition and other deficiencies. (Pers. Com- M. Gill, breeder of Plumed Whistling Duck)
- High mortality rate; due to stress and unknown feeding behaviours in the *Dendrocygna* genus from hatching - 4 weeks of age.

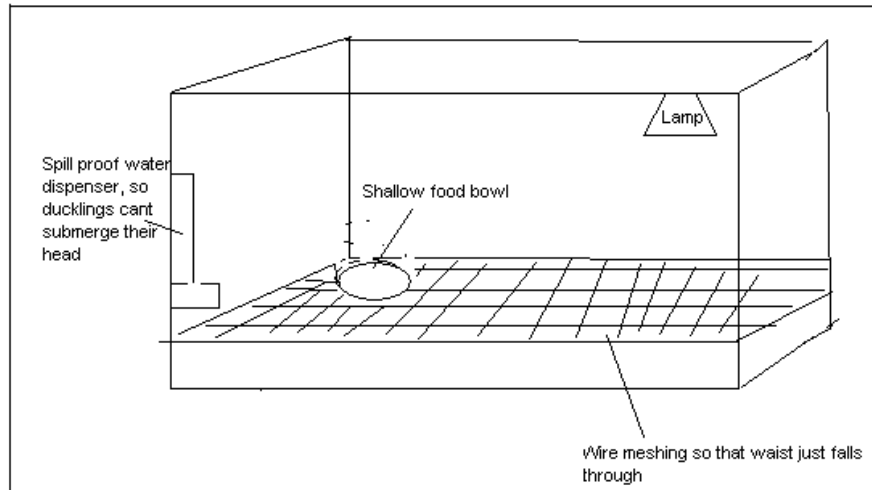


Fig. 5 Example design and set up of a movable coop

- Fixtures within enclosures need to be secured; no screws or nails should be overhanging, as this could cause injury.
- Insufficient air locks: All air locks must have double doors to prevent escapes.
- All plants and materials used must be researched to ensure that they are not toxic.

#### **4.2 Holding Area Design**

An area of 3m x 4m x 2m, per pair would provide sufficient space for freedom of movement in all directions. As there are no species specific government requirements, the enclosure must be designed using common sense. Plumed Whistling Ducks would need the following in their holding area (For both long/ short term)

- A substrate of mulch or Astroturf (back of house holding); these are easy to clean, move around and will reduce the risk of bumble foot.
- Hides; can be provided in the form of browse, boxes or the tops of pet packs and these will also provide additional shelter.
- Roof; at least half the enclosure should be covered by a solid roof, to protect the Plumed Whistling Duck from the elements.
- Pond/ water source; a number of water sources should be provided
  - A **pond** is required to allow bathing and daily preening, which will need to include a ramp.
  - **Water bowl** for drinking, as the pond will become dirty very quickly.
- Logs for climbing, standing and to hide behind.
- Enrichment items like small dirt piles for digging and shovelling grasses and a hide box.

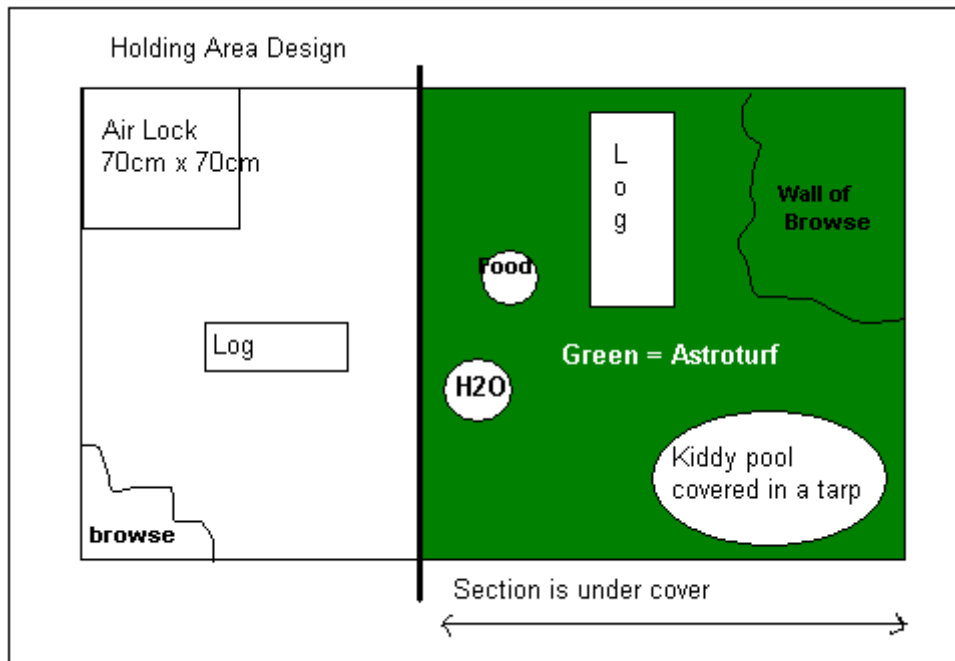


Fig. 6 Example set up of a holding enclosure including furniture.

### **4.3 Spatial Requirements**

The Department of Primary Industries (DPI) has developed an Exhibited Animals Protection Act (EAPA) which consists of state regulations for minimum requirements for a number of animal species; However many bird species including the Plumed Whistling Ducks do not have proposed guidelines.

An area of 3m x 4m with a height of 2m would hold a pair of Plumed Whistling Duck suitably. In an exhibit situation a standard space of 5m x 5m for the first pair of Plumed Whistling Ducks with an additional 1m<sup>2</sup>, for any extra duck added, is suggested (McCray, 2009)

The Plumed Whistling Duck would need the following standards (General Standards for exhibiting animals in NSW- EAPA 1986) in their holding enclosure:

- The size and shape of the enclosure needs to provide enough space for freedom of movement both horizontally and vertically.
- A water body for bathing, preening and swimming.
- Shelter to escape the weather, provide shade and a barrier for hiding.
- Fresh supply of food and water daily.
- The enclosure should be secure and allow no entrance for vermin and other pest.
- Sufficient drainage and substrate; to avoid the accumulation of faeces and still allow easy access and the ability to clean the enclosure.
- Plumed Whistling Ducks should be provided with naturalistic furniture, including logs, shrubs and grasses.
- The enclosure must encourage exercise and behavioural enrichment.
- A sheltered space where Plumed Whistling Duck can retreat from other animals and the public if necessary.

Other factors that may be included in housing Plumed Whistling Duck include:

- Having a naturalistic set-up. This will create an ideal environment for the species and provide an aesthetically pleasing exhibit for the public. The use of plants from the species habitat including trees, grasses and shrubs can accomplish this look as well as a natural-looking pond and back drop.
- Public viewing areas.
- Double doors in airlocks.
- A channel or path through the exhibit so that if the Plumed Whistling Ducks need to be caught, they can be, without unnecessary obstacles.

#### **4.4 Position of Enclosures**

The enclosure needs to be sheltered from the wind, rain and extreme temperatures and provided access to shelter, as stated in clause 13 of the General Standards for exhibiting animals in NSW.

The enclosure should be positioned with a north eastern aspect so that it receives as much summer shade as possible, minimal amounts of hot afternoon sun, and is protected from cold southerly winds and rains that are of a north eastern aspect. The site chosen should be level and well drained.

#### **4.5 Weather Protection**

Weather protection can be achieved by positioning the enclosure at the correct aspect as discussed above in section 4.4, as well as providing a sheltered area (See Diagram 1- Section 4.3) and hides within the enclosure. This can be achieved by placing half a pet pack upside- down, providing hides in the form of upside-down browse or by creating a physical wall for the Plumed Whistling Duck to hide behind and take shelter from the elements.



Fig. 7 Example of holding area for Plumed Whistling Ducks including – pet pack shelter and pond. Other furniture's could include logs, grasses to hide in, upside- down browse and even some woodchips as substrates.



#### **4.6 Heating Requirements**

Plumed Whistling Ducks are distributed around Australia in a number of different habitats and areas, and have become adapted to a range of different temperatures, so artificial heat is not necessarily required.

A heat lamp can be provided on one side of the exhibit, if required in winter or in colder areas. However heating is generally not required for this species, unless rearing young artificially.

#### **4.7 Substrate**

A number of different substrates could be used for housing Plumed Whistling Ducks. Mulch would be the best option as it displays well and can easily be removed and replaced over time as it gets dirty and starts to decompose (Tea Tree mulch and Eucalyptus mulch are used at Sydney Wildlife Word). If being held off-display, Astroturf would supply the ducks with sufficient comfort and floor covering for the enclosure, which will also help prevent bumble foot and other reasons already stated above. Astroturf is great to use, especially in quarantine areas, as it is easily cleaned and when maintained can be reused. Soil is another substrate which is commonly used within a number of captive institutions.

#### **4.8 Nest boxes and/or Bedding Material**

The *Dendrocygna* genus does not nest or utilise hollows for breeding or shelter. They nest in a scrape in the ground which is then lined with grass, fern leaves and dry stems. These materials can be obtained from plants within the exhibit, in which the Plumed Whistling Duck could collect the materials themselves, or these materials could be scattered in the exhibit around the time of the breeding season e.g. ferns, fresh or dry grasses.

#### **4.9 Enclosure Furnishings**

Furniture which could be used in the Plumed Whistling Duck exhibit:

- Branches, shrubs, logs, tufts of grass and escarpments provide a naturalistic shield of security.
- A large pond with a shallow wetland.
- Rocks can provide a place to hide as well as adding a naturalistic surface to wear down the sharp claws of the Plumed Whistling Duck.
- Grass tussocks may provide the Plumed Whistling Ducks with an extra food source, a place to hide and also nesting material.

## **5 General Husbandry**

### **5.1 Hygiene and Cleaning**

Table 1. Cleaning routine

Daily	Spot clean windows, clearing drains in ponds, scooping debris from ponds, watering plants, supplying fresh drinking water, removing any faeces, raking, filling any holes in, change any soiled nesting material, clean food bowls. Clean branches using F10™ disinfectant.
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Weekly	Complete change of nesting material, backwash if applicable, prune plants, full window clean using Glason Satin Remover™.
Monthly	Remove and re-lay substrate/mulch. Put in new branches. Plant new plants. Drain pond and clean, scrubbing the fixtures and pond outskirts (a small amount of bleach or chlorine can be used to help remove any bacteria. Once finished and scrubbed let the pond sit in the sun, as the U.V. removes most of the chemicals, rinse the pond thoroughly- remove the excess water, let the pond dry again and then refill it.)
Yearly	Depending on the size of exhibit and population size a top up of soil should be considered.

## **5.2 Record Keeping**

Surveys are being held across Australia within areas with Plumed Whistling Duck populations nearby, as there is little known about their social behaviours, breeding, and vocalisations, nesting and nesting materials. This and the lack of knowledge about Plumed Whistling Ducks demonstrates that there is a large opportunity for research in the future.

Records and notes should be recorded daily to monitor the health and progression of your animal. Notes that should be recorded include; health problems and veterinary check-ups or treatments, any aggressive behaviour (note which species, the time of day, or reason if known), diet changes (whether it be ingredients, amounts or additions), reproductive behaviours (courting and copulation included), weights, measurements, captures, escapes and movements within or outside of the institution.

Notes should be taken about behaviour, housing and any mistakes made (so they can be improved and so that the same mistake is not again). During the breeding season documentation must be taken to ensure that more can be learnt about this incredible species.

## **5.3 Methods of Identification**

The best way to individually identify Plumed Whistling Duck is with leg bands. They are cost effective, easily distinguishable even from a distance and also cause little disruption or discomfort for the bird. It is recommended by Echuca.com that a 12 mm ring size is used for Plumed Whistling Ducks.

Male ducks are banded in the right leg and females on the left leg (**REMEMBER:** left for ladies). If the sex is unknown it is placed on the right leg until the sex is confirmed, another band is usually added rather than removing the original p.

# **6 Feeding Requirements**

## **6.1 Diet in the Wild**

Plumed Whistling Ducks are grazers; feeding mainly on plant matter, including grasses, sedge, fresh herbs and seeds. They mostly follow an herbivorous diet but have been recorded eating insects (refer to table below). In a wild situation it

is not known if they do this on purpose, or just consume the insects as they are eating the plants on which the insects live.

**Table 2- Gizzard content of Plumed Whistling Ducks, taken from HANZAB**

Gizzard content of Plumed Whistling Duck					
	% Volume		% Frequency		
	Source 1	Source 2	Source 1	Source 2	Source 3
Plant	98.3	100	100	100	100
Poaceae	58.2	89.5	91	100	96
Animal	1.7	---	14	6	---

Plumed Whistling Ducks, feed mainly at night, plucking food from the land, but may also dabble in the shallows of nearby wetlands. They feed in constantly moving groups, which may include up to 200 individuals and are commonly sighted in the day, roosting with similar species such as the Wandering Whistling Duck (*Dendrocygna arcuata*). These roosting flocks may reach numbers into the thousands.

Plumed Whistling Duck can be classified as seasonal feeders as the harsh changes in their environment throughout the year have a large impact on the food available. In the dry season (May- September) they stay close to the water and feed on sedge and spike rushes. In the wet season (October- April) the ducks can retreat from the local water bodies and feed on fresh blades of grass, grass seeds, legumes and herbs found out in fields and plains.

## **6.2 Captive Diet**

In a captive situation, grasses can be hard to replicate and provide constantly within the environment. Therefore it is necessary to create a diet with the same nutritional components, but different, using more affordable and obtainable ingredients.

A suitable diet for a grazing duck such as the Plumed Whistling Duck would consist of grain (particularly wheat) commercial seed and freshly diced greens (endive, chicory and fresh grass clippings).

### Waterfowl mix

The following ingredients can be used to make up 20kg of waterfowl mix which can be stored in a large air-tight container and used over 2 months.

5% Safflower

5% Hulled oats

20% Shredded Lucerne

10% Cracked corn

20% Waterfowl pellets

40% Budgie blue (Seeds, hulled oats, linseed, and poppy seed)

\*Budgie blue is coated with Vitamin E prior to packaging.

(Pers. com. K. Marshall, Keeper, 2009).

It is recommended that 1 cup of waterfowl mix be fed-out, mixed with ½ cup of fresh green mix (shredded baby spinach, endive, grated carrot and alfalfa sprouts). This is enough to feed four ducks which also have access to scatter feeds of insects (mealworms and crickets) and duckweed.

The waterfowl mix is already high in calcium; however in the breeding season when more calcium and general nutrients are required, the diet can be modified by increasing the volume and availability of the above mentioned food.

When raising ducks such as the Plumed Whistling Duck it is crucial that only a rationed amount of protein is given to ducklings at an early stage. This is to avoid stunted or poor winged development, such as angel wings.

**Table 3. Food for Plumed Whistling Ducks of different ages.**

<b>Age</b>	<b>Diet</b>
<u>2 Weeks</u>	Sprouted seed and greens should be available at all times. Chick starter can be presented twice a day (morning and afternoon) for 15 minutes each time and then removed to prevent captive stunting.
<u>2 -6 Weeks</u>	Same as above but amounts are increased with time and as the duckling develops.
<u>6 -14 Weeks</u> (ducklings will be almost fully grown)	Diet should be changed to 25% Sprouted seed 50% Greens 25% Chick starter And at about 10 weeks of age Waterfowl mix should start to be introduced slowly, taking over the chick starter in the diet.
<u>14 Weeks – Adult</u>	Waterfowl mix with greens, daily scatter feeds of mealworms and crickets

\* Sprouted seeds are high in protein but low in fat, whilst greens are full of vitamins, minerals and fibers which promote healthy intestines and growth.

\*\* Use Duckweed *Lemna aequinoctialis* as an additional source of greens (Pers. com. M. Gill, Breeder, 2009)It is

\*\*\* Greens ingredients on previous page.

Browse can be provided in the form of grass tussocks, shrubs and small plants which provide extra food sources and shelter. Upside- down branches can also provided shelter. The plants used for browse should be the same or similar species to those found in the Plumed Whistling Ducks native area.

### **6.3 Supplements**

Overall the diet provided above is complete and well balanced for the species, so little supplements are needed within the ducks daily diet. However additional parts of the diet such as scatter foods (crickets and meal worms) and the water source can be improved through the use of supplements.

- **Insectivore Mix** can be sprinkled on to the mealworms and crickets provided to the ducks. Mealworms are high in fat but are an available and affordable food source that can have a number of good uses e.g. enrichment scatter feeds. Dusting the insects with the insectivore powder adds high quality and vital nutrients to the food.
- **Grit**- Ducks need access to grit as it assists with the digestion of food by grinding grains in the stomach. If ducks are not exposed to sand or dirt, a small portion should be sprinkled on their food daily. If this is to be done,

the soil/ dirt must be clean, free of disease and sourced from a reliable supplier.

- **Water and water additives** - Ducks must have a constant supply of water. Even though the Plumed Whistling Duck is mainly a terrestrial species they still drink, bathe, play and dabble, so the water provided to them needs to be clean. Products such as Aviclens and water purifiers can be used to obtain this.

#### **6.4 Presentation of Food**

Food for the Plumed Whistling Ducks should be placed in a small flat bowl. If on display to the public, a shallow bowl can be hidden or disguised by using natural furnishing. An artificial rock bowl can be used, as they are easy to clean, light, practical and aesthetically pleasing to the public. If out of sight a large flat terracotta bowl can be used. Bowls should be placed close to the window or barrier of the exhibit, so that the public can see the ducks clearly and can learn and watch their feeding behaviours.

Half a cup of waterfowl mix can be fed out with greens twice a day, as well as a number of mealworm scatters. These scatters should be carried out at a number of locations across the exhibit including in the shallow water of the pond so that they can dabble.

#### **Behavioural Enrichment**

Some examples of activities that would encourage Plumed Whistling Ducks to carry out natural behaviours within their environment include;

- **Sprinklers:** which can represent rain; in the case of the Plumed Whistling Ducks this would also trigger breeding and different feeding patterns.
- **Other duck species:** ducks are social animals, so this will give them the opportunity to be in a flock and encourage a lot of different behaviours. Note however in breeding season it may provoke aggression between pairs and groups.
- **Dirt and worms:** having scatter feeds will promote digging. Plumed Whistling Ducks will use their bills to shovel small holes in the dirt to search for the worms, and as stated above the dirt will provide grit to assist in the digestion of food.
- **Shallow water body:** the ducks will need water to drink, carry out bathing and preening behaviours, copulation and also to dabble food off the surface.

## **7 Handling and Transport**

### **7.1 Timing of Capture and Handling**

The best time to capture Plumed Whistling Ducks is in the morning. This allows keepers to:

- Capture the birds out of public view.
- If the capture fails, then there is still time for a second attempt.
- In the cooler part of the day; this is important as overheating can be fatal.
- The stress and behaviours of the duck can be monitored for the rest of the day.
- It allows the release to happen with as many daylight hours left, so that the Plumed Whistling Ducks have time to adjust to their new environment, and find to a nesting spot before nightfall.

### **7.2 Catching Bags**

Nets are recommended over capture bags. Plumed Whistling Ducks are a flighty species, so an extended pole allows capture without having to get too close. The bag would need to be 50cm in diameter with the measurements being at least 50cm x 65cm.

### **7.3 Capture and Restraint Techniques**

Capture of Plumed Whistling Ducks would be best done using two people; one to herd the ducks and the other to capture with the net. A large net on a long pole should be used; the long pole allows the ducks to be captured even when they are a reasonable distance from the keeper.

It is not necessary to use chemical restraint on Plumed Whistling Ducks.

Caution needs to be taken when capturing Plumed Whistling Ducks as they are a very flighty species and could fly into obstacles causing injury to the individual being caught.

Once captured the ducks should be removed from the net, with one hand holding the legs and tail, and the other supporting the front and neck of the bird as demonstrated in Fig 8 below.



Fig. 8 Restraint Techniques for the Plumed Whistling Duck

### **7.4 Weighing and Examination**

The best way to weigh a Plumed Whistling Duck is to use spring scales, making sure that they are accurate to 1g. Weigh the bag by itself first (either tare like this, or deduct the bag weight from the total weight with the bird). Capture the bird (see section 7.3) put it in the bag, tie a knot in the top and hook onto the scales. Record the weight of the bird when it is still.

For examination, the duck should be restrained around the body while gripping the legs and neck. The neck hold can be released, and that hand can be used to examine the rest of the body.



Fig.9 & 10 Different restraints for examination of the Plumed Whistling Ducks

### **7.5 Release**

The release of a Plumed Whistling Duck should occur in the morning at ground level, so that it has time to adjust to its new environment and find a roost spot. The area selected for the release would depend on the exhibit,

- If the duck is being released into an exhibit with fences and large barriers, it would be best to release the duck on land. Find a fairly clear space to release the duck. The box should be opened facing away from the keeper and pointing towards a shrubby or sheltered area so that it can hide straight away.
- If the duck is being released into an exhibit with hidden barriers (e.g. glass) it should be released straight into the water facing away from the glass. This will cause the duck to pause for a split second and become aware of its surroundings, rather than flying sporadically into the glass.



Fig. 11 Plumed Whistling Duck being released into a pond, away from glass.

## **7.6 Transport Requirements**

The IATA (International Airline Transport Association) Live Animal Regulations is the worldwide standard for transporting live animals by commercial airlines. All animals travelling, whether it is a pet, an animal transported for zoological or agricultural purposes or for any other reason all need to follow the IATA regulations. The objective of the IATA Live Animals Regulations is to ensure all animals are transported safely and humanely by air. (IATA website, 2009).

### **7.6.1 Box Design**

The box standards from IATA that apply for Plumed Whistling Ducks are; 'Container Requirements 18, page 190- Waterfowl and Poultry (including whistling ducks). IATA state in box requirement 18, that the dimensions of the box will vary, and 'the normal habits and necessary freedom of movement of the bird species involved will determine the size', (IATA Standards). Following this, the dimensions for a transport box for a Plumed Whistling Duck would be approximately 40cm x 60cm x 65cm.

Having a box length of 40cm for a Plumed Whistling Duck will allow movement and stretching, but not allow a full wing span movement, which may cause the bird to injure itself. A height of 65cm will provide enough head room for this species, which can grow to 61cm tall. Their flighty temperament should be considered, and padding be added to the roof of the box.



**Materials** (IATA, 2009)

The box's frame should be constructed of solid wood, which can either be screwed or glued together (using non toxic glue). Sides should be made of hardwood, with wire covered by hessian. The front of the box should be made of wooden slats that are close enough together so that the head of the bird cannot squeeze through. These should then be covered by a hinged door, with ventilation holes 2.5cm from the top and bottom of the door.

The floor must be a solid leak-proof material either made of metal or wood, with wire mesh and lined with astroturf fixed 2.5cm above the bottom of the container. This is so the Plumed Whistling Ducks can grip onto something while being transported.

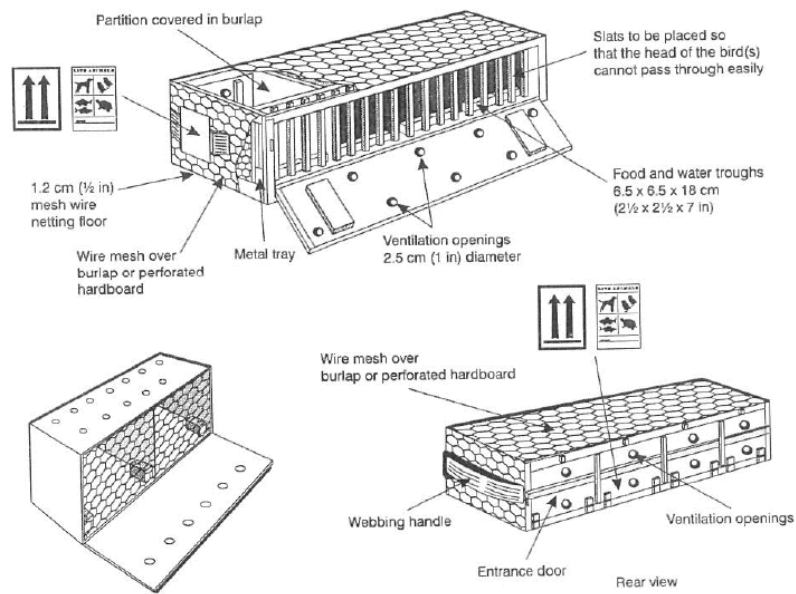


Fig.12 Examples of Transport containers from IATA.

In a temporary or short term travelling situation a pet pack would also be suitable. It should be lined with lucerne or Astroturf, and the door should be covered with shade cloth so that the ducks cannot see out; thereby minimising stress during transportation.



Fig. 13 This is a pet pack which can be used to transport Plumed Whistling Duck over short distances.  
<http://www.pet.net.au/rangeview/sales/images/catcarr>

### 7.6.2 Furnishings

- No perches are required as Plumed Whistling Ducks rarely perch and would be safer during transport, than if they were sitting on the ground.
- Shredded paper would be suitable for temporary transport; for up to two hours as ducks are fairly messy.
- Astroturf combined with lucerne would be an ideal substrate during transport as it is easy to clean, and will prevent stress on the feet from standing on a flat surface over a long period of time.
- Plumed Whistling Ducks will also need something to grip onto during transport; this could include wire meshing or astroturf.

### 7.6.3 Water and Food

Greens should be provided in a shallow bowl or scattered around the box. This will provide the Plumed Whistling Duck with enough moisture, which will provide them with hydration for up to 6 hours, if the duration of transport exceeds 6 hours a water source will need to be provided. A suitable device for this would be a spill proof water bottle which can be secured to the side of the box. It would be similar to the water bottle supplied to ducklings so that they can't dunk their heads into the water (refer to section 6- Diets).

### 7.6.4 Animals per Box

Only one Plumed Whistling Duck should be placed in each box, as is the case for most bird species. When placed in confined spaces, they are in a compromised situation, in which their behaviour can become unpredictable, and they might attack each other and this could even result in death.

### 7.6.5 Timing of Transportation

Capture of the Plumed Whistling Duck should take place in the morning, so that transport can be carried out during the day/ early morning when it's not too hot. If on the day of transport the weather is hot (e.g. over 28 °C), then the duck being transported should be misted before being boxed up as well as throughout the journey. Fresh water is to be supplied at every available chance.

### 7.6.6 Release from Box

The duck should be released from the box in daylight, so that it has enough time to establish a roost sight. Releasing during the day also allows for monitoring of behaviours such as aggression.

## **8 Health Requirements**

### **8.1 Daily Health Checks**

Daily health checks should be done first thing in the morning. The health of the duck can be continually monitored throughout the day while cleaning, feeding and maintaining the exhibit.

Keepers should observe the ducks from a distance, and whilst approaching their exhibit or enclosure. Plumed Whistling Duck, like all birds, are masters of the preservation reflex i.e. if they are sick or injured they will do their best to hide

their weakness. Therefore it is important that a distant examination is carried out first, as this timid duck species will move, change and hide any problems as the keeper approaches their location.

Plumed Whistling Ducks may, and often do, rest on one leg to conserve energy. When approached they will lower the leg, and depending on their perception of the threat, will begin to move away. At this point a body assessment can take place. Their fright, flight and fight (FFF) distances are normal and constant (FFF will vary with individual ducks – whether they are hand raised, trained or wild etc) but keepers/ institutions should know or learn what's normal for their individual birds.

**Major signs of illness** in Plumed Whistling Duck would include: reduced FFF, no movement at all, fluffed feathers, major feather loss, and loss of balance on one or both legs.

Observations should allow any injuries or abnormalities to be identified; scratches, abrasions, discharges, blood, mass/ abnormal feather loss, behavioural changes as well as, freedom and normal movement of the body. Keepers need to observe and ensure that:

- The duck is walking properly, it is not limping and it is using both legs equally.
- The ducks appear bright alert and responsive (BAR) - they should not be fluffed or behaving abnormally.
- The ducks are eating- keep note of amounts, what they eat and at what time.
- Eyes are clear, open and alert.
- Posture of the duck is normal-look at how it is sitting, is it using all its limbs properly and are all the limbs positioned properly e.g. wing folds to the body and no legs are at odd angles.
- Interaction with other birds should be observed- note any aggression or different behaviours.
- Plumed Whistling Duck plumage should be sleek and shiny- a loss of feathers in the lower breast area of a female may indicate that she's nesting. Feathers missing from the head and neck are signs of aggression, as ducks like to bite each other in these areas while fighting or defending nest sites.
- Faeces for this species should be solid, brown with slight traces of green and white. Any change in colour, consistency or frequency can indicate an illness or problem with the duck.

If any of these signs are shown by a Plumed Whistling Duck a physical examination should be done.

## **8.2 Detailed Physical Examination**

### **8.2.1 Chemical Restraint**

Chemicals and pre-medications are regularly avoided with birds as there are records of birds not recovering properly.

The duck will first need to be caught from the exhibit (see chapter 7). It can then be placed head first into an inside out material bag (e.g. pillowcase or clean insect bag) and take to the veterinarian. The duck should be restrained on the table; it is a good idea that a towel or cloth is placed over the ducks head, as the darkness will keep it calm and relaxed. The veterinarian should then identify the problem and a plan should be made.

Isoflurene gas is the preferable anaesthetic used to anaesthetise birds. A modified dog or cat face cup can be used; a rubber glove should be placed across the opening and secured with a rubber band, and a small cut can then be made to slip the ducks bill through. A heat mat should be placed under the duck during the procedure, as it may not be able to maintain their core body temp efficiently while under anaesthetic. Heat lamps, heat mats and warm towels may also be used.

While under anaesthesia the bird's level of consciousness should be monitored by checking reflexes: both leg and corneal reflexes are a good indicator for birds. Also the bird's respiration and heart rate should be continually monitored by using a stethoscope.

To recover the bird, the isoflurene must be turned off as well as the oxygen flow. Staff need to ensure that all windows are closed and if possible have the curtains drawn, so that when the duck wakes up they don't think that they can escape, and then smash into the window. Once awake, the duck should be placed into a small, dark and warm box/ holding cage. The cage should be secure and padded if possible; any viewing points should be covered and only removed when monitoring the bird's progress.

### 8.2.2 Physical Examination

Physical examinations should work cranially to caudally (head to toe):

- Head: look for injuries, as many ducks, especially *Dendrocygna*, attack/ show aggression by biting the head and neck area; Also feel the skull for fractures.
- Eyes: should be clear from discharge and build up. Check the ducks pupils are clear, reacting and free from fog and foreign bodies. Compare both pupils for any differences.
- Beak: ensure that there is no build up of solids on the beak or in the mouth: waterfowl pellets tend to get "mushy" when wet from dabbling and dry solid on the beak causing bacteria to grow e.g. thrush.
- Tongue: is attached, in place and free from foreign bodies.
- Keel bone: can indicate the overall body condition of a bird. A healthy bird will have plenty of muscle around the keel as a result of exercising and eating regularly, and it should feel tight and rounded. An indent where the keel is located can indicate an overweight bird, as there is too much fat, and a pointed keel/ or protruding breast bone can be an indication of a bird being underweight.
- Vent: should be clean and clear. Dried faeces should be removed and noted as this could be an indication of diarrhoea. Note any abnormal discharges e.g. bleeding or prolapses.

- Legs: check for swelling, breaks, growths, bruises and injuries. Assess each leg's full range of movement including that it can bend at its joints.
- Feet: the bottom of the feet should be assessed for injuries, faecal build up and any debris in the webbing of the foot or the development of bumble foot (see section 8.4). Also, ensure that the legs and feet are of the right texture i.e. not peeling or flaky.
- Tail: feel the base of the tail for any growths. Ensure that the tail feathers are growing straight and properly with no breakages.
- Wings: run finger along the humerus feeling for breaks- check for growths/ abnormalities and feather development.
- Feather condition: check all flight feathers, rate of growth for clipped wings and overall plumage feathers which should be sleek and strong. Check for external parasites e.g. lice or mites.
- Check that the bird's wings don't need to be clipped (depending on institution and housing).
- Check faecal sample under microscope- check for worm's, parasites and gramstain for bacterial infections.
- Send off bloods for tests- internal functions and viruses.
- Cloacal temperature is invasive and stressful on the duck, so is not part of a normal routine.

### **8.3 Routine Treatments**

Vaccines are not routinely used in waterfowl as preventative treatments as they can be quite stressful. They are only used if a specific disease is suspected.

The only routine treatment for a Plumed Whistling Duck is regular worming. 'Worm- Out gel' should be given to the Plumed Whistling Duck every 3 months as a routine treatment. If they are housed alone it can be placed in their drinking water. However to ensure that they do get treated, and if they are held in a mixed exhibit, the 'Worm Out gel' can be mixed in with the ducks food. The treatment should be carried out for three straight days and once concluded, three random faecals should be taken (every three days if clean) and checked by a vet.

Treatment for Round Worm can be given to new stock that are going through quarantine or wild stock under two years old. Other treatments may come into place from the faecals collected or after a physical examination.

### **8.4 Known Health Problems**

<b>NAME</b>	Bumble Foot
<b>CAUSE</b>	Bacteria including <i>Staphylococcus</i>
<b>SIGNS</b>	Swelling and soreness in the balls of the feet, red swollen joints, scabs and tears in the bottom of the feet, breakdown of the base of the foot, observing the bird having pressure infection or rubbing its feet.
<b>TREATMENT</b>	Bathing the infection in antiseptic solution, antibiotics, in a severe situation bandages or surgery may be required.
<b>PREVENTION</b>	- having a clean environment (clean daily/ remove all faeces) - having perches of different textures size and thickness - appropriate floor materials e.g. Astroturf

	<ul style="list-style-type: none"> <li>- sufficient water supply for Plumed Whistling Duck, as they do like to wade sometimes</li> <li>- regularly checking the feet of the Plumed Whistling Duck</li> </ul>
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<b>NAME</b>	Duck viral hepatitis (DHV)
<b>CAUSE</b>	Caused by three different kind of viruses- DHV I and III from enterovirus family <i>Picornaviridae</i> and DHV II astrovirus
<b>SIGNS</b>	Lethargy, anorexia and sudden death with abnormal posture- spasaming and hyperextension.
<b>TREATMENT</b>	Strict isolation and control of rats
<b>PREVENTION</b>	<ul style="list-style-type: none"> <li>- Strict isolation particularly during the first 5 weeks of age.</li> <li>- Avoid ALL contact with wild waterfowl.</li> </ul>

<b>NAME</b>	Roundworm
<b>CAUSE</b>	Nematodes
<b>SIGNS</b>	Sudden death, develop poorly, become weak and eventually die or diarrhoea.
<b>TREATMENT</b>	Separation, worming, separate infected and clean animals- isolate both.
<b>PREVENTION</b>	Separation, high hygiene, clean all faeces and holding area at least once daily, start a new enclosure somewhere else with fresh stock- remove ducks from infected area, worm regularly using a roundworm specific wormer.

<b>NAME</b>	Aspergillosis
<b>CAUSE</b>	Fungal infection caused by <i>Aspergillus fumigatus</i>
<b>SIGNS</b>	Weakness, depression, reduced appetite, difficulty breathing
<b>TREATMENT</b>	Antifungal medication
<b>PREVENTION</b>	High level of hygiene and cleaning of enclosures and avoid dampness on floor of aviaries

<b>NAME</b>	Coccidiosis
<b>CAUSE</b>	Small protozoan parasite
<b>SIGNS</b>	Rapid weight loss, weakness, inflammation of the intestines and diarrhoea (which may contain traces of blood)
<b>TREATMENT</b>	The antibiotic Amprolium can be added to the Plumed Whistling Ducks drinking water daily for two weeks.
<b>PREVENTION</b>	Regular tests done to identify coccidiosis, avoid the build up of faeces, ensure enclosures are cleaned regularly and avoid overcrowding holding areas.

<b>NAME</b>	Botulism
<b>CAUSE</b>	Toxins produced by the bacterium- <i>Clostridium botulinum</i>
<b>SIGNS</b>	Weakness, difficulty breathing, vomiting diarrhoea
<b>TREATMENT</b>	None confirmed- can try fresh water and shade- studies of an anti-toxin are being undertaken in UTAH, USA
<b>PREVEN</b>	Strict enclosure hygiene and cleaning

## **8.5 Quarantine Requirements**

The purpose of quarantine is to allow the detection of those animals which may be incubating a disease, and also to detect the clinical signs of disease with a longer incubation period CCWHC (2000). Quarantine should be carried out for a minimum of 4 weeks, with 6 weeks being ideal for the Plumed Whistling Duck. If the ducks are coming in from a reliable park which has already put the birds through quarantine, the process maybe shorter. During these weeks of quarantine faecal samples need to be collected- three clear faecals indicate that the Plumed Whistling Duck are ready to be released into their exhibit. Any birds that go through quarantine routinely under go 'Worm Out gel'.

Plumed Whistling Duck should be held and removed from quarantine as a group; on an "all in, all out" basis. This will avoid 'clean' animals contracting disease and ensuring that all animals are clear before being placed on display or exhibit. Cleaning and disinfection routine should be carried out daily to ensure the ducks can recover and not reinfect themselves.

Birds that are in quarantine should be tended to last or by an individual that will not come into contact with any other birds, this is to avoid spreading diseases and cross contamination. Cleaning and PPE equipment should be labelled and each quarantine enclosure should have its own equipment, feed bowls and footbaths.

All scraps, old browse, food scraps or anything that needs to be disposed of should be done so in a quarantine bin in the quarantine area.

## **9 Behaviour**

### **9.1 Activity**

Plumed Whistling Ducks are a terrestrial species of duck, as they spend more of their time on land than in the water. They are mainly nocturnal feeders and migrate at night time, whilst resting and roosting throughout the day.

### **9.2 Social Behaviour**

By day Plumed Whistling Ducks congregate in large numbers on the banks or shallows of wetlands and ponds. At night they fly out to grasslands to feed. These areas can be up to 30km away from the nearest water source.

Outside of the breeding season Plumed Whistling Duck gather in small flocks of about 50-200, although communal flocks have been recorded with numbers exceeding into the 1000's. In particular Plumed Whistling Duck have been spotted in areas around Townsville in flocks of 3000-5000. They are highly social and are often spotted roosting in wetlands with Wandering Whistling Ducks *Dendrocygna arcuata*.

While feeding, these ducks are always alert. Whilst one feeds the other stands guard.

During the breeding season this social species of duck segregate from the flock and disperse to the grassy plains for breeding. Parents build their nests up to 2km from water. The Plumed Whistling Duck hold a small territory while nesting, and show aggression to other ducks that intrude. Both parents share the incubation process, while one sits on the egg the other flies to the nearest feeding ground, to feed with the rest of the flock.

### **9.3 Reproductive Behaviour**

Plumed Whistling Duck breed between February- April (which is also the beginning of the tropical wet season). Two weeks after the first storm males will start to become aggressive towards each other. They will lower heads and whistle a very high pitch warning to any male that may come near their partner or territory.

Very little is know about the courtship ritual of Plumed Whistling Ducks, but captive records show that both male and female will preen each other around head and neck areas. In the wild, Plumed Whistling Duck have been sighted at the beginning of the breeding season taking part in long and dramatic air chases, where males will chase the females. This behaviour has also be seen on and in the water.

### **9.4 Bathing**

While mainly a terrestrial species of duck, Plumed Whistling Ducks are know to enter the water of pond, wetlands or even muddy puddles on dirt plains in times of drought. At this time the ducks may dabble, float around or bath.

The ritual of bathing for this species is quite fascinating. The ducks will enter the water slowly, dunk their head under the water and dramatically throw the water on to their backs and shake it through their feathers. The motion is like a ducking action, repeated a number of times followed by a shake of the body.

### **9.5 Behavioural Problems**

Plumed Whistling Ducks have no recorded behavioural problems, although they can be aggressive during the breeding season, while raising young or when defending territory.

### **9.6 Signs of Stress**

Plumed Whistling Ducks are a very timid species and due to this they can become stressed extremely easy. Changes in behaviour should be noticed and recorded as birds have 'preservation reflex' which enables them to hide any problems, injuries or illnesses. Plumed Whistling Duck need to be monitored as their behaviours are the true indicator of health status.

Signs of stress in Plumed Whistling Ducks:

- Feather loss- from stress, picking due to stress or also because other ducks are targeting them
- Change in behaviour/ personality
- Loss of trust/ relationships- if a bird usually come over to eat meal worms from your hand and then one day it stays away and is reluctant to come over



- Excessive activity
- Increased aggression
- Decrease in food consumption
- Anti social behaviour- Plumed Whistling Duck are a social species, so if keepers notice that they are being isolated from the flock or isolating themselves they should be monitored
- Limping/ difficulty walking
- Obvious trauma- drooped wing or abrasion
- Ruffled feathers
- Excessive drinking
- Excessive vocalisation

A combination of these may indicate that a Plumed Whistling Duck is stressed. However, if any of these signs occur they should be noted and recorded so that the ducks health and stress levels can be monitored. This will allow keepers to monitor changes and backtrack to the ducks behaviour if anything was to happen.

### **9.7 Behavioural Enrichment**

Activities which could be provided to the Plumed Whistling Duck to eliminate behaviour problems and increase time on display would mainly involve different types of food being presented to them in different ways to keep them interested. Such strategies could include:

- Meal worm and cricket scatter feeds- this can be done in different locations around the exhibit, including in wetlands, muddy areas, in the mulch or even in the pond to encourage diving.
- Bury earthworms in mulch or a muddy tub to encourage foraging.
- Provide fresh grass for grazing or even scatter grass clippings around the exhibit.
- Provide the ducks with a pond or constant water source, to allow for swimming and/ or dabbling.
- Moving the food bowl around the exhibit so that they have to search for it.
- Provide nesting material, which they collect, but then eat it because they like the grains attached to the dry grasses, and don't particularly use nesting materials.
- Plant grasses/sprouted seed in different locations around the exhibit.
- Turn the sprinklers on, to encourage and trigger breeding, due to the simulation of rain.
- Fly pupae can be thrown into the pond, which will float on the surface. For a while the ducks will have to swim out to get, and after they can dabble in the wetlands for leftovers.

### **9.8 Introductions and Removals**

Newly acquired Plumed Whistling Ducks must be quarantined for 1 month (30 days) before being placed onto exhibit. During this quarantine period they must pass all faecal and veterinary health checks.

Introduction of a new Plumed Whistling Duck to an exhibit or enclosure should be carried out in the morning. Introductions of birds are usually carried out during

the morning as it is cooler and it allows the birds to settle in and establish a roosting spot before it gets dark. Morning introductions also allow keepers to monitor the bird throughout the day and see how it settles in, as well as recording how the other birds are reacting e.g. are the ducks being attacked or attacking other individuals.

The duck should be released into a covered area, so that it can run into, and seek shelter while it settles into the new exhibit. The duck should be placed on the ground facing away from any barriers or obstacles e.g. fences or glass. An alternative would be to release the duck over water; the duck should be placed into the water and released. Because its body is in the water it will not be able to make any sporadic movements which may cause it to fly into objects and injure itself.

After moving the Plumed Whistling Duck it should be monitored in its new environment.

### **9.9 Intra-specific Compatibility**

Plumed Whistling Ducks are a social species and should be kept with at least one other duck for company. All male or female flocks work quite well and even occur in the wild. During the breeding season males who don't find a partner will join a bachelor flock on the wetlands and spend the whole wet season roosting with them.

Aggression usually only occurs due to territories around nesting. With no members of the opposite sex to prompt aggressive behaviours it would be unlikely for this to occur in single sex flocks.

### **9.10 Inter-specific Compatibility**

Plumed Whistling Ducks can also be housed with other species of birds. For example at Sydney Wildlife World, Plumed Whistling Ducks are housed in the Flight Canyon exhibit with 80 birds of around 20 species. At this institution, the ducks house well with all other species, but sometimes show aggression to Wandering Whistling Ducks when they venture near their sleeping/ resting territory. Plumed Whistling Ducks will get along with most species but there may be some aggression shown to other duck species over territories and food.

As with any exhibit, many diseases may be passed on from one species to another. An initial health check, including full bloods and faecals should be done before any bird is cleared from quarantine. Monthly worming can be carried out in all the food so that any worms/ parasites which may somehow find their way into the exhibit can be treated.

### **9.11 Suitability to Captivity**

Although submissive, Plumed Whistling Ducks are well suited to captivity. As a duck species, they will not really show aggression towards other birds. During the breeding season when their aggression is heightened, they may challenge other birds. However, most will be faster than the Plumed Whistling Duck, and will be able to fly off before a fight occurs.

### Positive aspects:

- Their appearance is aesthetically pleasing.
- Very vocal, - they vocalise throughout the day; this can be entertaining and interesting for the public- not all ducks “whistle”.
- When they enter the water they become active and entertaining.
- Once they settle in to the exhibit/ enclosure, they adapt well to daily routines and feeding schedules.
- Although they can be aggressive, they mainly just caution intruders. They can be housed successfully with many other species of ducks or placed in a multi species aviary.
- They display well, and will sleep anywhere so even if inactive, they will still be seen on display.

### Negative aspects:

- May take a while to settle in.
- Territorial species, so may show aggression to other ducks (but cannot really do much damage).
- Plumed Whistling Ducks are more active at night. They sleep and walk around by day, but most activity occurs after night fall. This can be modified by only feeding out during the day. Although this may increase activity levels in the day, the ducks have proved that they will still be more active at night.
- Plumed Whistling Ducks like to shovel for insects, so can leave small, but noticeable holes around the exhibit.

## **10 Breeding**

### **10.1 Mating System**

Plumed Whistling Ducks are monogamous. This means they have only one partner per breeding season, it is believed that this species stay with their partner for life.

### **10.2 Ease of Breeding**

If provided with the right conditions, Plumed Whistling Ducks are quite easy to breed, especially with such a large clutch number. Plumed Whistling Ducks lay between 8-14 eggs over a 24 hour period.

Institutions which house this species have quite large populations and most comment that they plan to breed to requirement which, in itself, states that they are capable of breeding and easily do so, in a captive environment. (REGASP, 2009)

The breeding season for the Plumed Whistling Ducks coincides with the beginning of the tropical wet season (February- April). For breeding in captivity an artificial wet season needs to be provided. For example sprinklers can be used every two days for a week and then twice a week for the following six weeks. The onset of the wet season usually triggers a lot of bird species to begin breeding, so the use of sprinklers will not disrupt the aviary or the birds too much.

Population growth depends highly on the wet season. In very wet years the breeding season is extended and the whole population will breed.

If housed in a flock, males should begin to show aggression towards each other approximately two weeks after the first "rain". This can be a clear indicator that breeding is about to occur as they are establishing their territories.

Another technique which can be used to replicate the wet season (breeding season) is a change in diet. In the wet season the Plumed Whistling Duck diet change from dry grasses and seeds to rich green grasses, fresh seedlings, increased insects and sprouted seeds.

### **10.3 Techniques Used to Control Breeding**

If required there are a number of techniques/ways to control the breeding of this species:

- Have single sex flocks- as long as they have another bird to socialise with, Plumed Whistling Duck should be able to cope being housed separately from the other sex.
- Separate sexes into different aviaries until the institution is ready to breed.
- Remove eggs and replace with fake eggs.
- Do not provide the triggers required to breed i.e. rain, increase and change in diet.

### **10.4 Occurrence of Hybrids**

Whistling Duck have been recorded to hybridise with *Dendrocygna bicolor*, *Dendrocygna arborea* and *Dendrocygna arcuata* (Birds of the world, 1992).

### **10.5 Timing of Breeding**

The breeding season for the Plumed Whistling Duck is between February to April, but the last clutch may be laid as late as July. The breeding season for this species coincides with the tropical wet season.

### **10.6 Age at First Breeding and Last Breeding**

No information could be found specifically on Plumed Whistling Ducks and their ages of sexual maturity, but for ducks in general the age of sexual maturity is reached at 1-3 years of age. Males are usually a year or two later than females. Most dabbling species (that includes Plumed Whistling Ducks) reach sexual maturity at approx one year of age (Bratt, 1992).

### **10.7 Ability to Breed Every Year**

If the conditions are right the Plumed Whistling Duck can breed every year. The young from the previous years clutch will be fully independent by this time, so as long as there is enough food and rain, every mature duck with a partner does have the ability to breed each year.

### **10.8 Ability to Breed More than Once Per Year**

The Plumed Whistling Duck has only ever been recorded to breed once a year (naturally). In captivity the keepers may remove the eggs to encourage breeding through double clutching.

Plumed Whistling Ducks, like most ducks, raise their young for the entire first year. Therefore it is not practical for them to double clutch as so much energy is needed to raise the first clutch. Within a captive institute, keepers are able to help with the raising of the ducklings, and provide them with enough food, protection and resources to help them survive.

If something was to happen with the first clutch, ducks do have the ability to double clutch. 80% of ducklings don't usually make it to be one year old, it is very likely if the ducklings were to be wiped out that the mother would double clutch.

### **10.9 Nesting, Hollow or Other Requirements**

The nest of the Plumed Whistling Duck is a small scrape in the ground. After the first few eggs have been laid, fern leaves and dried leaves are added by both parents. Down is not added to the nest at any time but feathers from the chest area may be lost so that the eggs can get closer to the body warmth of the mother during incubation. Once incubation has commenced, other leafy items may be added from surrounding plants.

The nest site is often made under the shelter of a bush, shrub or some kind of vegetation.

### **10.10 Breeding Diet**

The ingredients of the Plumed Whistling Duck diet do not change due to the breeding season. But they change because of the natural change of environment due to the wet season in the tropics. The grasses become green and the seeds which they would normally consume begin to sprout.

Sprouted seeds provide the parents and young with a high source of protein that enables the ducklings to develop and grow at a fast rate. Also at this time the amount of insects the birds consume is increased significantly as they also thrive in the wet season.

In captivity the ducks should be provided with a source of calcium, especially the days following the eggs being laid, as the female will need to be supplemented from the loss of her body condition through producing so many eggs. The female may be sighted eating the eggs after the ducklings have hatched. This can be a good indicator of if she has/ is being supplied with enough calcium.

### **10.11 Incubation Period**

Incubation begins after the last egg has been laid, but the female has been sighted staying on the eggs overnight after the 6th egg was laid. Plumed Whistling Duck incubate their eggs for 28- 30 days. The incubation duties are shared by both parents with shifts lasting for 24 hours and the ducks usually swapping at sunrise or sunset.

### **10.12 Clutch Size**

Plumed Whistling Duck lay between 8-14 eggs. The eggs may be laid over a few days and the female won't begin the incubation process until the last egg has been laid.

The eggs of Plumed Whistling Duck are oval in shape, tapering at one end. They are approx. 45mmX35mm in size.

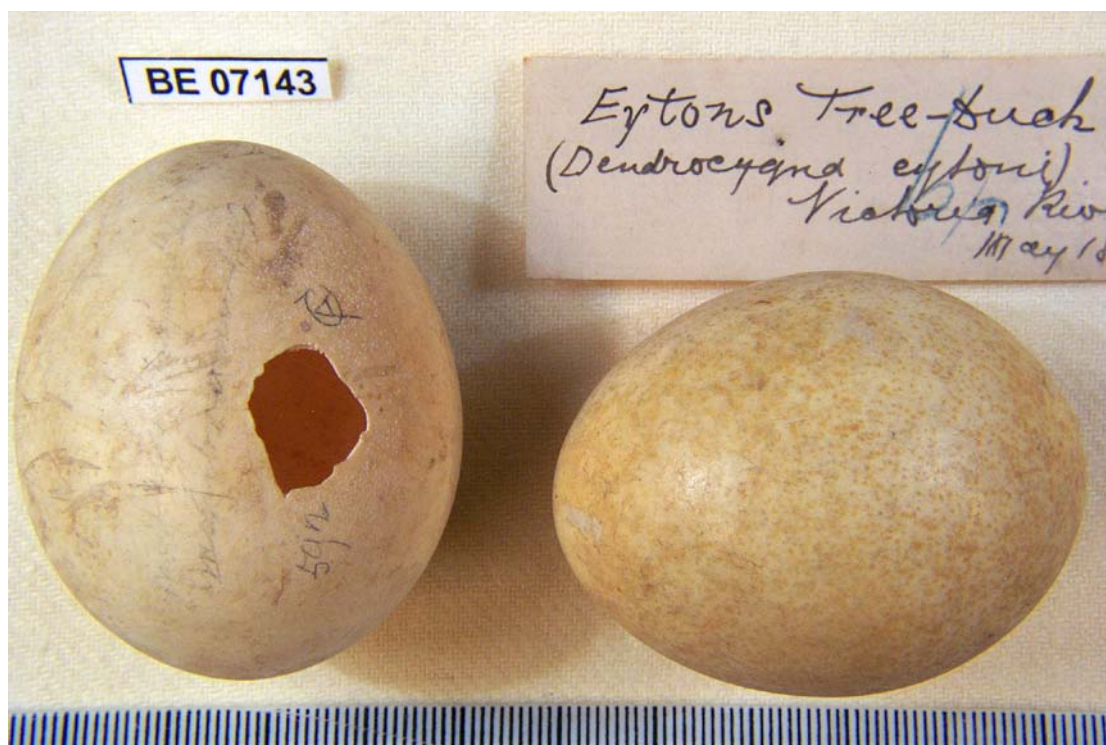


Fig. 14 Picture of Plumed Whistling Duck eggs- source unknown.

### **10.13 Age at Fledging**

Fledgling is a term used mainly for altricial birds. Plumed Whistling Duck are precocial and leave the nest straight after hatching. Young Plumed Whistling Ducks hatch completely covered with down and are able to swim and dive within a few hours.

The ducklings stay with their parents until they mature. That is, until they are feathered and no longer require to be protected by their parents. Before this time they stay with both parents but mainly the male rears the young, teaching them skills such as how to eat, what to eat and where to roost.

### **10.14 Age of Removal from Parents**

Because ducks are precocial, potentially the ducklings can be removed straight away and behaviours can be learned through natural instinct (innate behaviour). Although if possible, it is best that the ducklings are left with the parents so that they can teach them to swim and other behaviours that they will need as they grow.

### **10.15 Growth and Development**

No specific information could be found on Plumed Whistling Duck growth and development. The image below is from HANZAB and shows the difference in appearance of Plumed Whistling Duck of different ages.

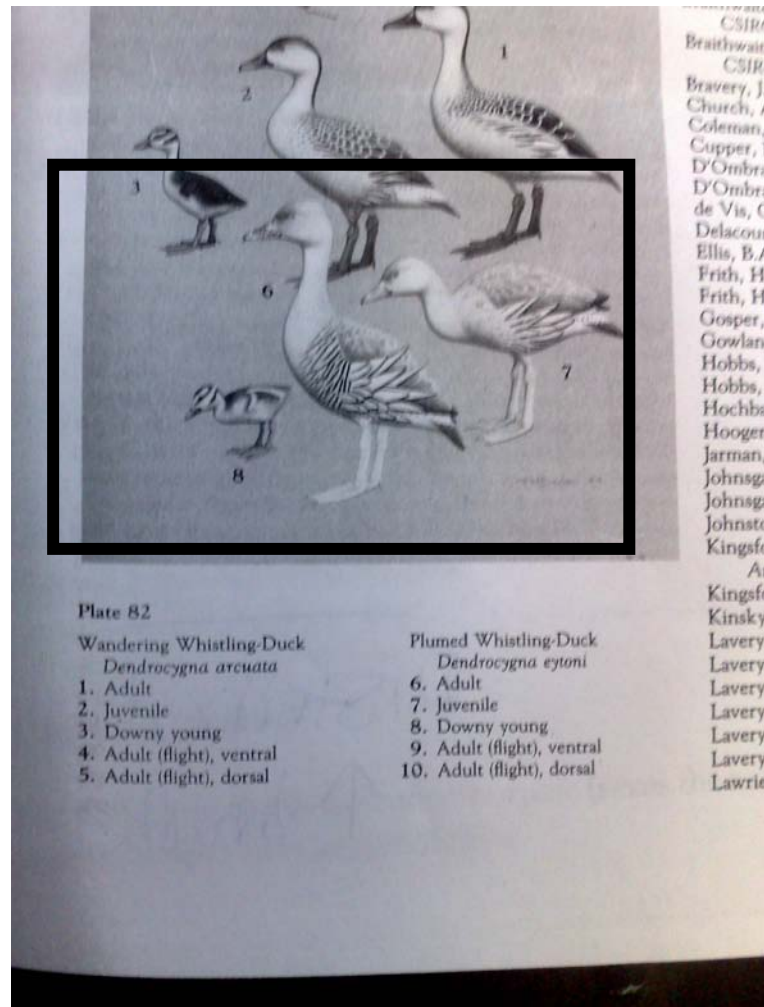


Fig. 15 Growth of Plumed Whistling Duck from HANZAB

## 11 Artificial Rearing

### 11.1 Incubator Type

An incubator is a box that holds and rotates eggs whilst maintaining stable temperature, humidity and oxygen levels so that an egg can be artificial incubated.

Generally there are two different types of incubators:

- Forced Air/ Moving Draft Incubators-

This type of incubator maintains constant temperature and humidity levels; it has the ability to regulate temperatures. Using an internal fan, air is pushed around the incubator causing an even temperature throughout. For example, if the lid is removed to check on the eggs, the temp would automatically increase so that the original temperature is maintained, which for most birds is around 37.5°C

- Still Air Incubators-

This type does not contain a fan, so the heat moves naturally around the incubator. Temperatures need to be monitored and maintained manually. The temperature gradient for still air incubators is quite large!

The same incubator can be used across many species, but egg trays need to be changed according to egg size. If a large number of eggs are being hatched a commercial incubator can be used.

If your incubator doesn't have a fan, measure the temperature half way up the side of the egg. This is because warm air rises, and hence if you don't place in the middle you will get a false temperature reading.

For Plumed Whistling Duck a standard poultry, chicken or broad species range incubators will do. While either type of incubator could be used, a Forced Air Incubator is recommended as the temperature and humidity are stable and will increase chances of a successful hatch.

The incubator needs to be set up in a room which is well ventilated and able to maintain a stable and constant temperature. The incubator will need to be set up and running for at least 24 hours before the eggs are added, so that a stable temperature can be maintained.

The Incubator that could be, and would be used at SWW is called "Incubator Auto-Elex R-Com 20, 20 egg auto turn, auto humidity, easy to set thermostat". This type of incubator has a number of egg trays which can be changed to suit the size of the eggs needing to be incubated. For Plumed Whistling Duck eggs, the poultry sized egg tray is used. The Auto-Elex R-Com 20 is installed with automatic temperature and humidity settings, so with the temperature set at 37.5°C, the humidity is maintained and an alarm is even sounded when water levels (i.e. humidity levels) are low.



Fig. 16 This is an image of the Auto-Elex R-Com 20, the image was obtained from [http://www.wapoultryequipment.net.au/sc\\_images/products/572\\_large\\_image.jpg](http://www.wapoultryequipment.net.au/sc_images/products/572_large_image.jpg)



Fig. 17 This is an example of the egg trays used within the Auto-Elex R-Com 20, taken by Jess McCray.

## **11.2 Incubation Temperatures and Humidity**

Incubation for Plumed Whistling Ducks should be carried out by a fan forced incubator at approx 37.5°C. It is recommended by C. Kuehler, International Yearbook 2007 that Plumed Whistling Duck eggs should be incubated at 37.2°C using a dry bulb and 31.1°C wet bulb and a relative humidity of 64.5%.



A temperature range of 36.6<sup>0</sup>- 37.7<sup>0</sup>C, is acceptable for most bird species during incubation. Anything outside of this range may jeopardize the hatchability of the egg. Eggs incubated at the cooler end of the range may take a few days longer than expected to hatch, and vice versa with chicks being incubated at a higher temperature hatching a few days earlier.

Having an incubator with an automatic turner is one way to maintain a constant temperature. Access to the incubator and contact with the egg is decreased; which is also very positive. With an automatic turner, the incubator would only be opened to monitor vain development through candling.

Humidity plays a big role in the incubation process; as the egg develops it loses water (and hence weight) allowing the air sack and the development of the chick to occur. Humidity has a direct effect on how much weight/ water the egg will lose. The more humid the incubator environment, the less opportunity the water has to escape the egg.

### **11.3 Desired % Egg Mass Loss**

As the ducklings develop within the egg, the size of the air cell increases as water is lost. If the development of the duckling is on track, the air cell should occupy approx. one third of the egg at the final stages of incubation. While no official record can be found on % mass weight loss for Plumed Whistling Ducks, it is recommended by poultrykeeper.com that the % weight loss for common waterfowl is approx 14%.

### **11.4 Hatching Temperature and Humidity**

When an egg begins to pip, it needs to be moved to a hatcher. A hatcher is a modified incubator, which is maintained at a higher humidity to facilitate hatching. During hatching the temperature can be maintained, although some breeders like to drop the temperature by between 0.05<sup>0</sup>C- 1<sup>0</sup>C. The important factor in hatching is humidity; the humidity needs to be increased by at least 10%. This increase stops the membrane from drying out, which could cause the duckling to be come trapped within the egg.

### **11.5 Normal Pip to Hatch Interval**

Hatching starts a few days before the expected hatch-date at approximately 26-28 days of incubation; Plumed Whistling Ducklings will begin to hatch out of their eggs. At this point in time the eggs need to stop being rotated or turned within the incubator.

Ducklings use an 'egg tooth' on the tip of their bill to begin chipping open the egg. After the initial shell crack, the ducklings tap different sections of the shell to make an opening which will allow them to get out of the egg. Within a 24 hour period all the ducklings within the clutch should be out of their eggs. So the pip to hatch interval would be between 24-48 hours long, with 48 hours being the extreme maximum amount of time it should take.

If the majority of the ducklings are fully hatched, any that are left may need assistance to carry out the hatching process.

## **11.6 Brooder Types/Design**

At SWW we have a Brinsea TLC- 4 brooder, which we also use as a hospital box for sick birds. We have not raised Plumed Whistling Ducks at SWW to date, but a number of lorikeets have been raised in this brooder.

More information on this brooder can be found at- [www.wapoultryequipment.com/](http://www.wapoultryequipment.com/)



Fig. 18 & 19 These are images are of the Brinsea TLC- 4 at SWW the photo on the right shows all the buttons and dials that control the temperature and lighting settings.

As stated before Plumed Whistling Ducks are a precocial species of bird. This means that they are able to maintain a relatively constant body temperature; they are able to feed themselves with little assistance from parents and are basically independent within the first 24 hours of hatching.

Precocial birds are born covered in a fluffy down, which assist in regulating their body temperature. Due to this, it is not necessary for species such as Plumed Whistling Ducks to be raised in a typical brooder. An open top heat box can be used, following the hot zone/cool zone brooding method. This method allows the young to sit under a lamp to keep warm and move away if they need to cool down.

An example of this brooder method is as follows; a size appropriate tub or box can be set up lined with paper, saw dust or even open bottomed over grass. A heat lamp is set up in one corner; which the ducklings can sit under if they were cold and move away from if they are too warm. Food and water should be placed up the opposite end of the enclosure out of the heat.

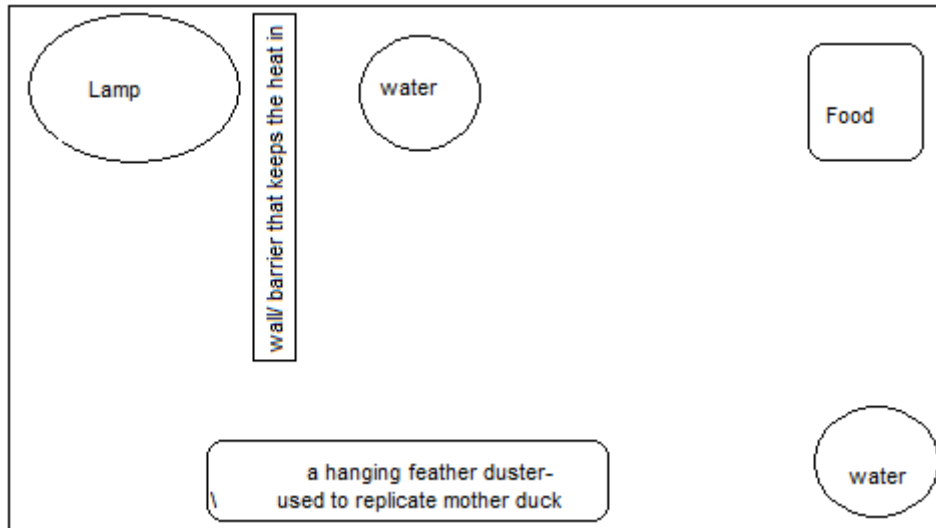


Fig.20 The above is a diagram of the layout used in the example of a hot zone/ cool zone brooding method.

As the ducklings grow they will need to be moved in to bigger tubs/ enclosures depending on the number of ducklings. As they get older the lamp can be moved further away, hence reducing the heat provided. Depending on the location of housing (whether it is outdoors or in a cold climate) the heat lamp will probably be removed by the time the ducklings start to get pin feathers at approx 4 weeks of age.

### **11.7 Brooder Temperatures**

DPI recommends that for the first week the brooder temperature should be set between 30<sup>0</sup>C- 35<sup>0</sup>C. The temperature of the brooder can gradually be reduced by approx. 3<sup>0</sup>C, this is easily monitored when using a standard brooder but as stated before the best method to brood Plumed Whistling Duck is the open top hot zone/ cold zone brooding method.

To reduce the heat following this method, the lamp can be moved further away each week. The ducklings will demonstrate/ signal when the heat needs to be adjusted; if they become too cold they will huddle together under the lamp and, if to warm they will spread out around the enclosure away from the lamp. After approximately 4-6 weeks the young Plumed Whistling Duck will no longer need heat from an external source, as their feathers will be starting to develop and they should also be able to generate their own body heat.

### **11.8 Diet and Feeding Routine**

Ducks are precocial, that is they are independent from birth, and rely on their parent for security and protection more than anything else. This means that the ducklings can feed themselves from day one and little assistance is required (carers may need to guide them to the food by tapping the bowl).

Plumed Whistling Ducklings will need their food topped up constantly throughout the day, as they eat a lot of greens as they grow. They are also very messy, walking and defecating in their food and water, especially when confined to a small area. For a clutch of about 8 or more, their food will need to be changed at

least four times a day. The diet for young Plumed Whistling Duck can be seen in Section 6 of the manual.

As stated in section 6, it is crucial when raising ducks such as the Plumed Whistling Ducks that only a rationed amount of protein is given to ducklings at an early stage, to avoid stunted or poor winged development, such as angel wings.

**Table 3. (FROM SECTION 6) Food for different ages.**

<b>Age</b>	<b>Diet</b>
<u>2 Weeks</u>	Sprouted seed and greens should be available at all times. Chick starter can be presented twice a day (morning and afternoon) for 15 minutes each time and then removed to prevent captive stunting.
<u>2 -6 Weeks</u>	Same as above but amounts are increased with time and as the duckling develops.
<u>6 -14 Weeks</u> (ducklings will be almost fully grown)	Diet should be changed to 25% Sprouted Seed 50% Greens 25% chick starter And at about 10 weeks of age Waterfowl mix should start to be introduced slowly, taking over the chick starter in the diet.
<u>14 Weeks – Adult</u>	Waterfowl mix with greens, daily scatter feeds of mealworms and crickets

\* Sprouted seeds are high in protein but low in fat, whilst greens are full of vitamins, minerals and fibers which promote healthy intestines and growth.

\*\* It is recommended by Michael Gill a breeder of Plumed Whistling Ducks for over 15 years that duck weed is used as an additional source of greens

### **11.9 Specific Requirements**

Being a precocial species, Plumed Whistling Ducklings are quite independent. With the correct heating, food and shelter they should be able to be hand raised successfully. When raising ducklings, warmth and security need to be provided. This can be done by raising the ducklings in a group and providing them with a small feather duster which also provides them with an extra sense of security.

Wood shavings, shredded paper and/ or leaf much should be used as a substrate. The substrate needs to be changed regularly as some harvest bacteria faster than others. Ducklings can be quite active and defecate a lot, so the substrate (depending on the size of the enclosure/ age of the ducklings) made need to be changed at least twice a day.

Ducklings always need a fresh supply of water, as they use it to help soften/ digest their food, clean their faces and also to drink. As a water species they also like to swim and stand in their drinking water. Water should be provided in a shallow water bowl and changed regularly. After the ducklings are a few days old, keepers may decide to introduce them to a shallow swimming pool.

#### **DUCKLING SHOULD NEVER BE LEFT SWIMMING UNSUPERVISED!**

Their down becomes wet very quickly and they can drown instantly, so keepers need to monitor the ducks while they swim and remove the 'pool/ water body' from the enclosure before they leave.

### **11.10 Pinioning Requirements**

Pinioning is a surgical procedure, carried out on a bird's wing to stop it from flying. Basically it is the removal of the second and third metatarsal bones (DPI NSW) from which the primary flight feathers grow. The procedure only needs to be carried out on one wing to prevent flight.

Regulations for pinioning can be found on the DPI website;

<http://www.dpi.nsw.gov.au/agriculture/livestock/animal-welfare/codes/general/bird-pinioning>. The guidelines state that Anseriformes (the bird order that includes ducks, swans and geese) are one of the orders that are a suitable candidate for pinioning. These orders are said to be suitable as they are "adapted to a mostly terrestrial existence, and the majority of time is spent on water or land feeding, resting or breeding" (DPI- Pinioning guidelines).

The pinioning procedure must be carried out within the first three days of life, as at this stage the wing tip is not fully developed and the duckling will be able to adapt to a flightless lifestyle. At this time a registered pet own can perform the procedure, following vets instructions without anaesthetic. When the bird is over three days old, a registered veterinarian must carry out the procedure and the bird must be under anaesthetic during the procedure.

The DPI standards refer to the Prevention of cruelty to animal's Act 1979, which state "For the purposes of subsection (2) (a), the pinioning of a bird is not an act of cruelty if it is carried out in the manner prescribed by the regulations."

[http://www.austlii.edu.au/au/legis/nsw/consol\\_act/poacta1979360/s4.html#regulation](http://www.austlii.edu.au/au/legis/nsw/consol_act/poacta1979360/s4.html#regulation)

### **11.11 Data Recording**

Growth and development is very important when it comes to raising young, and it needs to be monitored thoroughly. Things that need/ can be monitored and recorded include:

- Heights- can be recorded weekly
- Weights- recorded twice weekly for the first month then weekly until fully feathered. Weight is a good indicator of how the ducklings are developing and their health.
- I have found that taking photos of the birds as they grow is also very helpful.
- Diet- records must include; amounts, time of feed, type of foods fed out, what was left from the previous feed and any changes in diet.
- Cleaning- this is important, as ducklings are extremely messy. Keepers need to keep on top of cleaning out their enclosure and keeping it hygienic. Time and date of cleans need to be recorded.
- Vet checks
- Medical treatments- amounts, dosage, when and keeper administering
- Changes in appearances and/ or identification methods

### **11.12 Identification Methods**

Plumed Whistling Ducks will be continually changing and growing in the first few months after hatching, and throughout this time the methods used to identify each individual duckling will change. Most commonly a non- toxic marker will be

used to mark the ducklings (in different colours and positions over the body) for the first few weeks and when they start to develop pin feathers coloured or coded leg band can be used.

Other identification methods could include;

- Individual markings and traits
- Coded/ coloured poultry tags
- Head markings
- Paint dots

### **11.13 Hygiene**

Hygiene is a big factor in artificial rearing, from setting up the incubator all the way to the final stages of rearing; the cleanliness of the environment affects the health and well being of the ducklings.

Brooders and incubators are warm and moist and hence, provide the perfect environment for germs and diseases to develop. It is extremely important that all equipment, utensils and enclosures are cleaned and disinfected daily; it will take a while for the duckling's immune system to develop so keepers must do their part to keep the ducklings environment as clean as possible.

#### **Incubator or brooder:**

The incubator needs to be clean and disinfected before use. The unit can be washed in a warm detergent solution and then rinsed in a disinfectant solution e.g. F10, let it air dry over night.

#### **Eggs:**

Egg shells are porous and can absorb bacteria. It is important that keepers wear gloves when handling eggs.

Ducklings in general are very messy, and their enclosure will need to be cleaned out a number of times each day. If being held in a small box/ pen area the substrate will probably need to be changed daily. The enclosure should also be disinfected each day to ensure that it is as clean as possible.

### **11.14 Behavioural Considerations**

As a duck species, Plumed Whistling Ducks can potentially become imprinted on humans. Before incubation commences keepers need to come up with a plan, of what they want from the ducks in the long run. This will determine how the ducklings are raised and the level of contact the keepers will have with them.

In saying this many species of ducks that have been released into the wild and have survived independently from humans. Keepers are able to do this by limited visual and audio contact, with the young ducklings, they may learn to associate people with food, but once released, natural foraging behaviour will allow them to find their own food and they will no longer rely on people.

### **11.15 Use of Foster Species**

Any duck or female chicken which is on the same or similar reproductive cycle to the Plumed Whistling Duck can be used as a foster parent for the eggs. Precocial birds such as ducks imprint basically on what ever moving object they see first. As a precocial species young Plumed Whistling Ducks can look after themselves if required, the foster parent is really only needed for the incubation process. Although the foster parent may teach the young ducklings how to search for food and also can assist in protecting the young ducks from predators.

### **11.16 Weaning**

Plumed Whistling Ducks don't require traditional weaning because they are a precocial species, however, in captivity they are usually fed chick starter for the first few months. Waterfowl mix should be slowly introduced into the chick starter, increasing the amount until waterfowl mix is the full diet. The Ducks should be fully feathered at this time (refer to table 3, section 6).

### **11.17 Rehabilitation Procedures**

The process of rehabilitation depends on what is wrong with the bird. Although most procedures are consistent, the ducks should be placed in a dark, quiet and warm place. Mostly birds requiring rehabilitation will be from the wild and thus may become stressed from human contact/ interaction.

It is best to seek veterinary advice, as the rehabilitation process is usually case specific. Keepers need to ensure that the Plumed Whistling Duck in care has a secure safe environment, warmth, and clean water and food; as a flighty species a visual barrier from its surroundings may also reduce stress and hence improve the recovery process.

When releasing young ducks, it should be done at a safe and secure location, where there are ducklings of approximately the same age as the ducks to be released. Retain from releasing the ducklings where ducks are nesting or if there are still young ducklings around as this will result in aggression form other ducks trying to protect their young.

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- Ravi Wasan, bird department supervisor, Sydney Wildlife World.
- Michael Gill, waterfowl breeder of over 15 years

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## **Glossary:**

**Altricial:** Chicks which are hatched with eyes closed, with little or no down, and are incapable of departing from the nest, they also depend on their parents for food and warmth.

**ARZPA:** (Australasian Regional Association of Zoological Parks and Aquaria) It was established in 1990 to link zoos and aquariums in Australia, New Zealand and the South Pacific in a cooperative regional network for wildlife conservation.

**ASMP:** (Australasian Species Management Program) Provides coordinated management and planning recommendations for species residing in ARZPA's member institutions. They plan and manage animal collections cooperatively, in ways that promote sustainability and contribute to species conservation.

**Brooder:** A heated chamber used to keep young chicks warm

**Candling:** A method used in to study the growth and development of an embryo inside an egg. The method uses a bright light source behind the egg to show details through the shell.

**Caudally:** Toward the posterior (tail) end of the body.

**Copulation:** The physical act of mating.

**Cranially:** Towards the top (head or cranium) end of the body.

**Courting:** The act of attracting individuals of the opposite sex.

**Dabble:** To partially wet (something) by splashing or dipping.

**Double clutching:** It refers to the practice of removing the first clutch and encouraging the hen to replace them with more eggs if she is inclined.

**Dimorphism:** Two different forms of the same species, males and females look different.

**Egg Tooth:** The egg tooth is a growth at the tip of the duckling's beak; a duckling uses their egg tooth to break out of their shell.

**Flanks:** located at the sides of something or somebody, between the ribs and the leg.

**Fledging:** Fledge is the stage in a young bird's life when the feathers and wing muscles are sufficiently developed for flight.

**FFF:** Stands for -Fright, Flight, Fight.

**HANZAB:** Handbook of Australian, New Zealand and Antarctic Birds

**IATA:** (International Air Transport Association) IATA ensures that both safety and animal welfare are addressed in all regulatory issues pertaining to transportation of live animals by air.

**Incubator:** the process by which birds hatch their eggs, and to the development of the embryo within the egg.

**Innate behaviour:** instinct; behaviour determined by the "hard-wiring" of the nervous system.

**Monomorphic:** having the same or an essentially similar type of structure; males and females look the same.

**Precocial:** hatchling that is covered with down and having eyes open; capable of leaving the nest within a few days.

**TAG:** (Taxon Advisory Group), they are responsible for outlining recommendations for species- including housing, breeding and management.

**Vagrant:** An individual bird that is observed in a region that lies outside of the range that is currently known for that species.

## **Appendix:**

### **Suppliers:**

<b>Item</b>	<b>Supplier</b>	<b>Contact Details</b>
Fruit and Vegetables	Vege's Side Serve	(02) 9763 2002
Waterfowl pellets, Cracked Corn, Budgie Blue, feeding equipment and supplies	Aviculture Accessories	Address: 91 Vine West Street   Marsden Park NSW 2765 Phone: 298381256
F10	Vet-N-Pet Direct	Address: PO Box 193, BEAUDESERT QLD 4285, AUSTRALIA Email: support@vetnpetdirect.com.au Telephone: 1300 726 966 Fax: 07 3337 9777
Wormout gel, Avicleanse	Vetafarm	Address: 3 Bye Street, Wagga Wagga, NSW Australia 2650 Postal Address: PO BOX 5244, Wagga Wagga, NSW Australia 2650 Email: vetafarm@vetafarm.com.au Phone: (02) 6933 0400 Fax: (02) 6925 6333
Mealworms and crickets	Pisces Enterprises Pty Ltd	Address: PO Box 200, Kenmore QLD, Australia 4069 Email: info@piscesenterprises.com Phone: 1800 351 839 Fax: (07) 3374 2393

## F10 SC Veterinary Disinfectant #17043

<http://www.vetnpetdirect.com.au/product.php?productid=17043&cat=390&bestseller> (viewed 12/11/08)



F10SC is a total spectrum disinfectant that, unlike other strong disinfectants on the market, has no adverse side effects on people, animals, or on equipment and surfaces. It is ecologically friendly and biodegradable, and carries a wide range of registrations and approvals from around the world.

In Australia, F10SC is registered by the APVMA for use in animal production and housing facilities, approved by AQIS for use in food export processing as a non-rinse disinfectant, and is also listed by the TGA as a Hospital Grade Disinfectant.

The benefits of using F10SC include:

Kills all types of pathogen – F10SC is bactericidal, virucidal, fungicidal, sporicidal.

Minimal chance of microbial resistance due to F10SC's unique benzalkonium chloride and polyhexamethylene biguanide combination of actives and mode of action.

\*Rapid kill times – less than 30 secs for gram positive bacteria, 60 secs for gram negative bacteria, Canine Parvovirus 20 mins.

Successfully tested against avian influenza (bird flu) viruses at a concentration of 1:500 in 10 mins.

Non-corrosive, non-toxic, non-tainting, non-irritating, aldehyde-free.

Highly cost effective.

Biodegradable & ecologically friendly.

Tried, tested, independently verified and documented, and approved around the world.

How to dilute F10Sc:

General disinfection of hard surfaces: dilute 1:500.

High level disinfection: dilute 1:250

For the most resistant viruses (eg parvovirus): dilute 1: 125.

How long will 200ml of F10SC disinfectant last?

If you use 2L of a workable solution per day for High Level Disinfection, you will have enough F10SC for 25 days.

Pack size: 200ml, 1L

### Details

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Weight	0.20 kg
Price:	<b>AUD\$25.60</b> (Approximate US \$ 20.48) incl GST

## AVI CARE CONCENTRATE 5L

<http://www.vetafarm.com.au/products/AVI-CARE-CONCENTRATE-5L.html> (viewed 9/6/09)

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Price: \$129.40 (including GST)

### Product Description

#### Directions:

avi care should be used as a general disinfectant in animal environments.

The concentrate is diluted with water 1 part avi care in 50 parts water (20 mLs per Litre). At this dilution avi care performs to the "Hospital B" standards of disinfection.

For all animal areas and equipment, remove gross contamination (faeces, leftover food, bedding etc) and wash with dilute avi care. Do not rinse, allow to dry.

Food and water containers should be washed in an avi care solution and rinsed and dried. avi care may be used in animal hospital areas, hospital cages, brooders and incubators.

To maintain hygiene on these hard surfaces simply spray with avi care and wipe away excess. Allow to air dry.

Examples of avi care use to maintain a healthy environment:

Birds – cages, perches, toys, food and water containers. Hand rearing equipment, incubators and brooders.

Dogs and Cats – food and water containers, brushes, combs and collars.

Rodents – houses and cages, food and water containers, exercise wheels etc.

Reptiles – herpavariums, tanks and enclosures. Food and water containers.

Horses – equipment, brushes, combs, clippers, dental equipment, leads and headstalls.

Do not use in fish tanks, ponds or fish equipment (nets etc).

## WORMOUT GEL 1L

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<http://www.vetafarm.com.au/products/WORMOUT-GEL-1L.html> (viewed 8/8/08)



Price: \$117.80 (including GST)

### Product Description

Soluble bird wormer.

Wormout Gel is a water dispersible gel suitable for the worming of non food producing birds.

Directions: Add 2 mL per 160 mL of drinking water, supply medicated water for 2 days. Remove all other sources of water during treatment. Most aviaries should be treated 4 times per year.

#### DILUTING WORMOUT GEL FOR CROP NEEDLE ADMINISTRATION.

Wormout Gel is ideal for crop needle administration however for ease of use it should be diluted in water.

Using a small container (preferably with a lid that can be secured), measure 9 mL of water using a 10 mL syringe or other accurate measuring device and add to the container.

Prime the Wormout Gel pump and add 1 mL of Wormout Gel to the 9 mL of water in the container. Check the Wormout Gel label for it's pump delivery! If your Wormout Gel pump delivers 2mL then simply measure 18 mL of water into the mixing container.

With the Wormout Gel in the container, secure the lid and shake well for 5 – 10 seconds. This will break up the Gel and give a uniform, yellow suspension ready for crop administration.

The dose of the diluted Wormout Gel mixture is 0.5 mL

(half a mL) per 100 grams body weight via crop needle.

Use a small syringe so you can measure the dose accurately. Remember that the crop needle will have an air space in it which may affect the dose that is actually delivered.

For instance, a Gauge 12 crop needle has an empty space of about 0.45 mL. You need to allow for the air space in whatever needle you are using.

You will also need to have some idea of the weight of the bird you are treating to give the suitable dose. Any good "bird book" will give average weights of various species.

Active Constituents: Praziquantel 20g/L, Oxfendazole 20g/L.

**Print  
off  
Bleach  
MSDS**