



EAZA BEST PRACTICE GUIDELINES

EAZA Toucan & Turaco TAG

TURACOS

Musophagidae



1st Edition Compiled by

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Front cover;

Lady Ross's chick. Photograph copyright of Eric Isselée-Life on White, taken at Mulhouse zoo.

<http://www.lifeonwhite.com/>

<http://www.zoo-mulhouse.com/>

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Preamble

Right from the very beginning it has been the concern of EAZA and the EEPs to encourage and promote the highest possible standards for husbandry of zoo and aquarium animals. For this reason, quite early on, EAZA developed the “Minimum Standards for the Accommodation and Care of Animals in Zoos and Aquaria”. These standards lay down general principles of animal keeping, to which the members of EAZA feel themselves committed. Above and beyond this, some countries have defined regulatory minimum standards for the keeping of individual species regarding the size and furnishings of enclosures etc., which, according to the opinion of authors, should definitely be fulfilled before allowing such animals to be kept within the area of the jurisdiction of those countries. These minimum standards are intended to determine the borderline of acceptable animal welfare. It is not permitted to fall short of these standards. How difficult it is to determine the standards, however, can be seen in the fact that minimum standards vary from country to country.

Above and beyond this, specialists of the EEPs and TAGs have undertaken the considerable task of laying down guidelines for keeping individual animal species. Whilst some aspects of husbandry reported in the guidelines will define minimum standards, in general, these guidelines are not to be understood as minimum requirements; they represent best practice. As such the EAZA Best Practice Guidelines for keeping animals intend rather to describe the desirable design of enclosures and prerequisites for animal keeping that are, according to the present state of knowledge, considered as being optimal for each species. They intend above all to indicate how enclosures should be designed and what conditions should be fulfilled for the optimal care of individual species.

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Introduction

The information in this Best Practice Guideline has come from several sources; other literature, and personal experiences from both the author (EAZA sub-group leader for turaco species) and personal communication with other holders.

Some aspects of husbandry are still a work in progress; there are always new opportunities to improve our knowledge and husbandry of captive turaco species. There are certainly areas of turaco husbandry that are in need of further research, namely: nutrition, mate aggression, group dynamics, analysis of health issues and mortality rates.

In general turaco species are very gratifying additions to our aviaries adding diversity, colour and character. They can be mixed with other species; any African themed exhibit would not be complete without the iconic turaco territorial calls and flash of red as they fly from perch to perch.

This Guideline has been reviewed and approved by other turaco TAG members.

Edited by Jess Borer.

Key husbandry points:

1. Most important aspect of husbandry starts with nutrition, not enough research has been done in this area yet to give decisive recommendations, but would advise a high fibre diet and limit amounts of sweet commercially grown fruits.
2. The two most common causes of mortality for captive turaco species are Yersinia and mate aggression. Good hygiene practices, pest control and astute behavioural observations essential. Certain species considered more prone to mate aggression. Research is currently being conducted to try to get a better understanding of this behaviour.
3. Suitable aviary design - very well planted & plenty of horizontal perching to enable natural locomotion.

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SECTION 1. BIOLOGY AND FIELD DATA

A: BIOLOGY

1.1 Taxonomy

Class: Aves

Order: Musophagiformes

Suborder: Musophagae

Family: **Musophagidae** – 3 subfamilies – 6 genera – 23 species – 38 taxa

Family: Musophagidae

Subfamily: Corythaeolinae

Genus: Corythaeola

Species	Common Name	Other common names	Distribution	IUCN Listing (*)	CITES Listing	RCP
<i>Corythaeola cristata</i>	Great blue turaco	Great turaco (Great) blue plantain-eater	Equatorial Africa from Guinea Bissau, Guinea, Liberia and Ivory Coast E to Nigeria, Central African Republic, Cameroon, Bioko, Gabon, N Angola, Congo, Democratic Republic of the Congo, S Sudan, Uganda, Rwanda, Burundi, NW Tanzania and W Kenya	Least concern	NA	Mon-P

BirdLife International Factsheet <http://datazone.birdlife.org/species/factsheet/great-blue-turaco-corythaeola-cristata>

Subfamily: Musophaginae

Genus: Tauraco

Species & Subspecies	Common Name	Other common names	Distribution	IUCN Listing	CITES Listing	RCP
<i>Tauraco persa</i>	Green turaco	Green lourie Guinea/Green-crested turaco	Ivory Coast and Ghana E to Mt Cameroon and Bamenda Highlands	Least concern	II EU Annex B	Mon-P
BirdLife International Factsheet http://datazone.birdlife.org/species/factsheet/green-turaco-tauraco-persa						
<i>T. p. buffoni</i>	Buffon's turaco		Senegal & Gambia to Liberia.			Mon-P
<i>T. p. zenkeri</i>	Zenker's turaco		S Cameroon, Gabon, N Angola, Congo and NW DRC.			Mon-P
<i>Tauraco livingstonii</i>	Livingstone's turaco	Livingstone's lourie	Highlands E of the Rift in Malawi and adjacent N Mozambique, S to E Zimbabwe.	Least concern	II EU Annex B	
BirdLife International Factsheet http://datazone.birdlife.org/species/factsheet/livingstones-turaco-tauraco-livingstonii						
<i>T. l. reichenowi</i>	Reichenow's turaco		Nguru and Uluguru Mts SE to Dabaga and Njombe Highlands, Tanzania			
<i>T. l. cabanisi</i>			Coastal lowlands of Tanzania S of R Mligasi through Mozambique to NE Zululand			
<i>Tauraco schalowi</i>	Schalow's turaco	Long-crested turaco	W, C & E Angola, S DRC and Zambia to Zimbabwe, Malawi and W Tanzania from Ufipa to Gombe Stream National Park; smaller population in SW Kenya and N Tanzania from Mara Game Reserve and Loita Hills S to N & W Serengeti National Park, Crater and Mbulu Highlands and Mt Hanang, and W to Mwanza District.	Least concern	II EU Annex B	
BirdLife International Factsheet http://datazone.birdlife.org/species/factsheet/schalows-turaco-tauraco-schalowi						
<i>Tauraco corythaix</i>	Knysna turaco	Knysna lourie	Natal, W Zululand and S Swaziland to S & E Cape Province.	Least concern	II EU Annex B	

BirdLife International Factsheet <http://datazone.birdlife.org/species/factsheet/knysna-turaco-tauraco-corythaix>

Species & Subspecies	Common Name	Other common names	Distribution	IUCN Listing	CITES Listing	RCP
<i>T. c. phoebus</i>			E & N Limpopo and NW Swaziland			
<i>Tauraco schuetti</i>	Black-billed turaco		DRC E to Ituri basin, S to Angolan border.	Least concern	II EU Annex B	
BirdLife International Factsheet http://datazone.birdlife.org/species/factsheet/black-billed-turaco-tauraco-schuetti						
<i>T. s. emini</i>			S Sudan, E DRC, Uganda and W Kenya to NW Tanzania, Burundi and Rwanda			
<i>Tauraco fischeri</i>	Fischer's turaco		S Somalia, coastal Kenya, and NE Tanzania from E Usambaras S to R Wami	Near threatened	II EU Annex B	ESB
BirdLife International Factsheet http://datazone.birdlife.org/species/factsheet/fischers-turaco-tauraco-fischeri						
<i>T. f. zanzibaricus</i>			Zanzibar			
<i>Tauraco macrorhynchus</i>	Yellow-billed turaco		Sierra Leone E to Ghana	Least concern	II EU Annex B	
BirdLife International Factsheet http://datazone.birdlife.org/species/factsheet/yellow-billed-turaco-tauraco-macrorhynchus						
<i>T. m. verreauxii</i>	Verreaux's turaco		Nigeria, Cameroon and Bioko S to Gabon, SW Congo, W DEC and N Angola			
<i>Tauraco leucolophus</i>	White-crested turaco		SE Nigeria, N Cameroon E across S Chad and N Central African Republic to SW and S Sudan, NE DRC, N & C Uganda and W Kenya	Least concern	II EU Annex B	
BirdLife International Factsheet http://datazone.birdlife.org/species/factsheet/white-crested-turaco-tauraco-leucolophus						
<i>Tauraco bannermani</i>	Bannerman's turaco		Bamenda-Banso Highlands of NW Cameroon	Endangered	I EU Annex A	
BirdLife International Factsheet http://datazone.birdlife.org/species/factsheet/bannermans-turaco-tauraco-bannermani						

Species & Subspecies	Common Name	Other common names	Distribution	IUCN Listing	CITES Listing	RCP
<i>Tauraco erythrolophus</i>	Red-crested turaco	Pink-crested turaco, Pauline turaco	W & C Angola from lower R Congo S to Chingoroi area, and E to Malanje and upper R Cuanza	Least concern	II EU Annex B	ESB
BirdLife International Factsheet http://datazone.birdlife.org/species/factsheet/red-crested-turaco-tauraco-erythrolophus						
<i>Tauraco hartlaubi</i>	Hartlaub's turaco		Kenyan Highlands, extending into E Uganda at Mts Morongole, Moroto, Kadam, Debasien and Elgon, and into N Tanzania at Loliondo, Longido, Mt Meru and Mt Kilimanjaro, North and South Pares and W Usambaras	Least concern	II EU Annex B	Mon-P
BirdLife International Factsheet http://datazone.birdlife.org/species/factsheet/hartlaubs-turaco-tauraco-hartlaubi						
<i>Tauraco leucotis</i>	White-cheeked turaco		Ethiopian Highlands from SW Arussi, Shoa and Sidamo Provinces, W to the Boma Plateau in SE Sudan, and N to Eritrea	Least concern	II EU Annex B	Mon-P
BirdLife International Factsheet http://datazone.birdlife.org/species/factsheet/white-cheeked-turaco-tauraco-leucotis						
<i>T. l. donaldsoni</i>	Donaldson's turaco		SC Ethiopian Highlands in N Harrar, Arussi and N Bale			
<i>Tauraco ruspolii</i>	Ruspoli's turaco	Prince Ruspoli's turaco	Restricted to S Ethiopia around Arero, Bobela, Sokora, Neghelli and Wadera.	Vulnerable	II	
BirdLife International Factsheet http://datazone.birdlife.org/species/factsheet/ruspolis-turaco-tauraco-ruspolii						
<i>Tauraco porphyreolophus</i>	Purple-crested turaco	Violet-crested turaco Purple-crested lourie	Zimbabwe and Mozambique S to E Limpopo and Natal.	Least concern	II EU Annex B	
BirdLife International Factsheet http://datazone.birdlife.org/species/factsheet/purple-crested-turaco-gallirex-porphyreolophus						
<i>T. p. chlorochlamys</i>			Kenya through Tanzania, Burundi and Rwanda to Zambia, Malawi and N Mozambique.			

Genus: Ruwenzorornis

Species	Common Name	Other common names	Distribution	IUCN Listing	CITES Listing	RCP
<i>Ruwenzorornis johnstoni</i>	Ruwenzori turaco	Johnston's turaco	Ruwenzori Mts in NE DRC and SW Uganda; also E Zaire at Mulu and Mt Kabobo	Least concern	II EU Annex B	

BirdLife International Factsheet <http://datazone.birdlife.org/species/factsheet/ruwenzori-turaco-gallirex-johnstoni>

<i>R. j. kivuensis</i>	Kivu turaco		Montane forests of Kivu Highlands of E DRC, Virunga volcanoes and Nyungwe Forest of Rwanda and Burundi, and SW Uganda.			
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Genus: Musophaga

<i>Musophaga violacea</i>	Violet turaco	Violaceous turaco Violet plantain-eater	S Senegal & Gambia and Guinea E to N Nigeria and NW Cameroon, extending S to Ivory Coast, Ghana and Togo; also an isolated population in extreme S Chad and N Central African Republic.	Least Concern		ESB
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BirdLife International Factsheet <http://datazone.birdlife.org/species/factsheet/violet-turaco-musophaga-violacea>

<i>Musophaga rossae</i>	Ross's turaco	Ross's lourie Lady Ross's turaco/Plantain-eater	NE & E DRC, S Sudan, Uganda, W Kenya, NW Tanzania, Rwanda and Burundi to S Zaire, N & E Angola and N Zambia; isolated populations in NE Gabon, Cameroon, N Central African Republic.	Least concern		Mon-P
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BirdLife International Factsheet <http://datazone.birdlife.org/species/factsheet/rosss-turaco-musophaga-rossae>

Subfamily: Criniferinae

Genus: Corythaixoides

Species	Common Name	Other common names	Distribution	IUCN Listing	CITES Listing	RCP
<i>Corythaixoides concolor</i>	Grey go-away-bird	Grey lourie	S Malawi and N Mozambique S to E Limpopo, E Swaziland and E Zululand	Least concern		
BirdLife International Factsheet http://datazone.birdlife.org/species/factsheet/grey-go-away-bird-corythaixoides-concolor						
<i>C.c. molybdophanes</i>			N E Angola through S DRC, Zambia and N Malawi to S Tanzania and N Mozambique			
<i>C. c. pallidiceps</i>			W Angola S to Namibia, extending seasonally to W Botswana.			
<i>C. c. bechuanae</i>			S & SE Angola and NE Namibia through Botswana to SW Zambia, the Zimbabwe Plateau, and N & W Limpopo			
<i>Corythaixoides personatus</i>	Bare-faced go-away-bird	Black-faced lourie	Ethiopian Rift Valley from Dire Dawa and Ankober S to L Abaya and Yavello	Least concern		
BirdLife International Factsheet http://datazone.birdlife.org/species/factsheet/brown-faced-go-away-bird-corythaixoides-personatus						
<i>C. p. leopoldi</i>			S Uganda, Rwanda, Burundi, SW Kenya and Tanzania S to N Malawi, NE Zambia and SE DRC			

Species	Common Name	Other common names	Distribution	IUCN Listing	CITES Listing	RCP
<i>Corythaixoides leucogaster</i>	White-bellied go-away-bird		E & NE Africa; NW, C & S Somalia, Ethiopia, S Sudan, NE Uganda, N & E Kenya and S through to Tanzania.	Least concern		
BirdLife International Factsheet http://datazone.birdlife.org/species/factsheet/white-bellied-go-away-bird-criniferoides-leucogaster						
Genus: Crinifer						
<i>Crinifer piscator</i>	Western grey plantain-eater	Grey plantain-eater	S Senegal & Gambia, Sierra Leone coastal Liberia E to Central African Republic, Congo and DRC.	Least concern		
BirdLife International Factsheet http://datazone.birdlife.org/species/factsheet/western-plantain-eater-crinifer-piscator						
<i>Crinifer zonurus</i>	Eastern grey plantain-eater		Eritrea, Ethiopian Rift Valley, S & W Sudan, N & NE DRC S through Uganda and Rwanda to SE DRC, W Burundi, NW Tanzania E to Mwanza, Serengeti, W Kenya, SE Chad and N Central African Republic	Least concern		
BirdLife International Factsheet http://datazone.birdlife.org/species/factsheet/eastern-plantain-eater-crinifer-zonurus						

(*) IUCN 2013. IUCN Red List of Threatened Species. Version 2013.2. <www.iucnredlist.org>. Downloaded on **14th May 2015**.

1.2 Morphology

With the exception of the larger great blue turaco, turaco species are medium sized birds, ranging in length from 40 to 75 cm, with long tails and short rounded wings. They are visually stunning, in particular the species that make up the subfamily *Musophaginae*, all brightly coloured gems of the forest. When they take flight they display their trademark bright red primary wing feathers. Only the species from the subfamily *Criniferinae* (plantain eaters and go-away-birds) have a more monochromatic grey and white plumage.

Turaco are not built for flying distances or sustained flight, their flight appears weak and quite arduous. They are much more at home running along tree branches and hopping through vegetation, they are equipped with semi-zygodactylous toes, giving them impeccable arboreal locomotion.

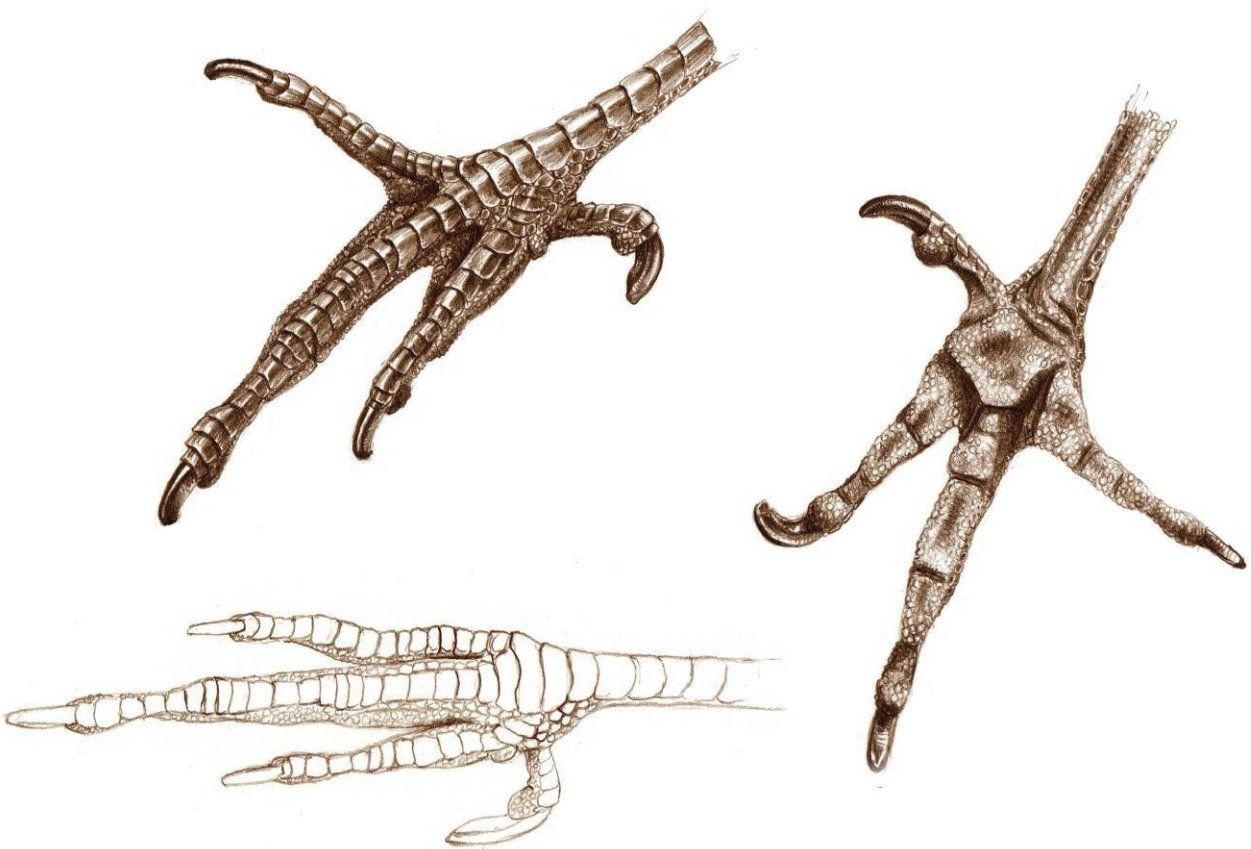


Image reproduced by kind permission from The Unfeathered Bird by Katrina van Grouw. <http://www.unfeatheredbird.com/>

The majority of turaco are furnished with a feathered head crest (the longest being that of the Schalow's turaco). The crests are generally held erect but can be adjusted at will and can signify various emotions, from excitement to fear.

They have strong and generally brightly coloured de-curved beaks capable of tearing soft flesh from fruit and vegetation.

Unique to turaco is the presence of two copper pigments: Turacin which is responsible for the red colouration and Turacoverdin which is responsible for green. All of the species in the subfamily *Musophaginae* have both of these present. Turacin gives this subfamily their trademark red wing feathers, which are generally hidden away unless sun bathing or flying. Only the genus *Crinifer* and the white-bellied go-away-bird are completely lacking both copper pigments.



White-Cheeked Turaco Wing Feathers by CabinetCuriosities on deviantART

Turaco species are sexually monomorphic, with the only exception to this rule being the white-bellied go-away-bird, where the female has a yellow beak in comparison to the male's black beak.



Sex difference in white-bellied turaco.
Image reproduced by kind permission from
Howard Robinson & International Turaco Society

1.3 Anatomy

Turaco species have a broad back to accommodate the musculature required to clamber about in treetops; the back is slightly decurved, with a marked dip in the middle. The forest turacos have a dysfunctional wishbone: the two halves do not meet in the middle like other avian species but are separated by a distinct gap, weakening the effect of their wingbeats. Birds of the subfamily *Criniferinae* are stronger fliers and their wishbone is complete, the two halves articulate in the midline but are not fused together into a solid curve. (K.van Grouw. 2013).



Image reproduced by kind permission from The Unfeathered Bird by Katrina van Grouw. <http://www.unfeatheredbird.com/>

Selection of turaco skulls from www.skullsite.com



Violaceous turaco



Livingstone's turaco



Green turaco

1.4 Physiology

Turaco species have little or no ceca, a distensible esophagus with no crop, a thick muscular proventriculus and a thin-walled ventriculus, a relatively larger liver for their body size, and a short intestinal tract. (Fowler, 2012).

Transit time of food through the digestive system is quite quick, in a timed experiment by the author the time taken for food to pass from beak to excretion was 20 minutes.

1.5 Longevity

Wild: Unknown

Captive: Generally late teens to early 20's would be expected but there are documented cases of some individuals getting into their 30's, one documented case of a white-cheeked turaco female reaching 37 years and still producing fertile eggs at the age of 34.

Field data

1.6 Conservation status/Zoogeography/Ecology

Distribution: Endemic to sub-Saharan Africa.

Habitat: Forest, woodland & savannah.

Conservation status: IUCN Red List of Threatened Species list all species as Least concern with the exceptions of:

- Bannerman's turaco which is listed as Endangered.
- Ruspoli's turaco which is listed as Vulnerable.
- Fischer's turaco which is listed as Near Threatened.

However the population trend is decreasing for three other species:

- Red-crested turaco
- Hartlaub's turaco
- Purple-crested turaco

Habitat destruction being the main threat to populations, other threats include trapping of birds for export.

CITES lists all species in the subfamily *Musophaginae* as CITES II EU Annex B, with the exception of the genus *Musophaga* which are not listed and Bannerman's turaco which is listed as CITES I.

Subfamily *Corythaeolinae* & *Criniferinae* species are also not CITES listed.

Turacos in culture: Turaco species feature heavily in African culture, the bright red wing feathers and great blue turaco tail feathers were coveted by African royalty and elders. The feathers were used to adorn headdresses, including that of a Zulu King.



African Mask featuring feathers of great blue turaco.

Turacos were also hunted for food and apparently made for very good eating. There are records of early explorers in Africa commenting on how superior the meat was compared to that of the game birds they were used to eating.

There are several birds that are now recognised as national birds:

Purple-crested turaco is the national bird of Swaziland.

White-cheeked turaco is the national bird for the Ivory Coast.

Red-crested turaco is currently being considered for national bird status for Angola.

1.7 Diet and feeding behaviour

Subfamily: *Corythaeolinae*

Diet: Primarily frugivorous, also takes buds, shoots, leaves and flowers. Favours fruits of *Musanga*, *Cissus*, *Polyalthia*, *Heisteria*, *Ficus*, *Dacryodes*, *Pachypodanthium*, *Uapaca*, *Strombosia*, *Trichilia*, *Drypetes*, *Viscum*, *Beilschmiedia*, *Coelocaryon*, *Croton* and *Pycnanthus*.

Feeding strategy: Forage in small flocks, several birds often gather at fruiting trees. Leaves are readily eaten throughout the day, but leaf-eating particularly pronounced in the evening. Regurgitated leaves fed to nestlings. Also observed feeding on algae in pools of stagnant water.

Subfamily: *Musophaginae*

Diet: Almost exclusively vegetarian, feeding mainly on wild and cultivated fruits and to a lesser extent on foliage, flowers and buds. In addition, caterpillars, moths, beetles, snails, slugs and termites are also eaten by several species, particularly during the breeding season. Throughout the West and Central African forest zone, fruits of the parasol tree (*Musango*) and waterberry tree (*Syzygium*) are particularly favoured. *Polyalthia* and *Cissus* species along with *Musango* are a staple food for most forest turaco.

Feeding strategy: Clamber through fruiting trees to get to ripe fruit. Smaller items generally swallowed whole, but can tear flesh from larger ripe fruit

Subfamily: *Criniferinae*

Diet: Go-away-birds have a more varied diet: not only fruit, but also acacia buds, leaves and pods and Aloe and Erythrina flowers as well as termite alates are readily eaten.

Feeding strategy: Go-away-birds will spend time on the ground to hunt for insects.

Further reading:

Chin Sun, Anthony R. Ives, Hans J. Kraeuter, Timothy C. Moermond. *Effectiveness of three turacos as seed dispersers in a tropical montane forest. Oecologia. September 1997, Volume 112, Issue 1, pp 94-103.*

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Sun, C., Moermond, T.C. & Givnish, T.J. (1997). *Nutritional determinants of diet in 3 turacos in tropical montane forest. The Auk, 114(2), pp200 - 211.*

1.8 Reproduction

Developmental stages: Chicks hatch at a fairly advanced state. They grow quickly and within two to three weeks begin to leave the confines of the nest to explore the area. At this stage they are incapable of flight and quite clumsy. Within four to five weeks of age they should be capable of flight.

They remain dependant on their parents for several months after fledging.

Development stages white-cheeked turaco

All photos courtesy of David Jones, International Turaco Society.



Hatching white-cheeked turaco.

- Eyes open
- Covered in thick down



White-cheeked turaco

9 days old

- Pin feathers starting to emerge



White-cheeked turaco

Foster rearing Schalow's turaco chicks

14 & 15 days old

- Wing feathers coming through
- Will start exploring environment
- Close to fledging



White-cheeked turaco

Approx 6 weeks old

- Fully feathered
- Drab juvenile plumage, beak & orbital ring
- Has fledged



White-cheeked turaco

10 weeks old

- Plumage taking on adult colour
- Beak & orbital ring still faded



White-cheeked turaco

Adult

Age of sexual maturity: There is no data for age of sexual maturity in wild turaco, in captivity most species are physically capable of reproducing after their first year, but it is rare for them to achieve success at this age (in captivity).

Seasonality of cycling: Forest species generally begin breeding at the start of the rainy season, whereas savannah species can breed all months of the year.

Incubation period: Incubation is shared jointly by both parents. The longest incubation period is that of the great blue turaco – 29-31 days.

For the subfamily *Musophaginae* the shortest incubation period is for the Hartlaub's turaco at between 16-18 days. The majority in this subfamily range between 20–23 days with the exception of the Knysna turaco ranging between 23-26 days and the violet turaco at 25-26 days.

For the subfamily *Criniferinae* three species are described as ranging between 26-28 days.

Clutch size: The majority of species lay 2 eggs per clutch, *Criniferinae* species usually lay 2-3 eggs.

Hatching details & rearing: Chicks from all species are hatched at a relatively advanced stage, eyes are either open or on the verge of opening. Chicks are covered with thick dark down, ranging from black to grey or brown in colour. Most species have a vestigial wing claw on the alula which disappears as the chick grows.

Both parents share rearing responsibilities and will regurgitate food directly to the chicks. After hatch the adults will generally eat the remaining egg shell and will also eat any faeces produced by the chicks.

There are accounts of a couple of species where pairs have helpers that get involved with rearing chicks, these are generally presumed to be offspring from previous clutches. This behaviour has been witnessed in great blue turaco and grey go-away-birds.

Nest details: Turacos build flimsy nests out of sticks and twigs, the nests are usually placed in thick foliage in trees or shrubs between 5-20 meters above ground. Species from the subfamily *Criniferinae* tend to nest more openly, generally in acacia trees.

1.9 Behaviour

Activity: The forest dwelling species are primarily arboreal and only descend to the ground to drink or bathe. A large part of the day is spent feeding, broken up by short rest intervals spent preening or basking in the sun. At dusk they will return to their favourite roost.

The subfamily *Criniferinae* tend to go down to the ground much more frequently hunting for food and water.

Locomotion: Generally poor fliers, tending to move from tree to tree by gliding or with a few fast wing beats. Move short distances with a series of short hops, or by running along tree branches.

The subfamily *Criniferinae* are generally better fliers, but less agile running along branches, they will more readily take to the wing and can cover greater distances in flight.

Social behaviour: Turaco species are territorial and usually stay in pairs or in small family groups. Great blue turaco are more sociable throughout the year and have been observed in groups of up to fifteen. Go-away birds and plantain-eaters will on occasion gather in groups at a good food source such as a fruiting tree.

Turaco have several vocalisations: the loud drawn out calls most often heard at dawn and dusk are generally territorial calls which will be responded to by neighbouring birds, and the quieter shorter vocals are used as contact calls and when showing excitement or aggression.

Sexual behaviour: Courtship behaviour usually begins with calling and chasing from tree to tree, followed by mutual feeding, gentle beak clapping and head bobbing. If receptive the female will lower her body allowing the male to tread her.

In plantain-eaters, males are reported to rise vertically from the top of a tree and then descend in a tumbling dive to their mate - females remain perched with outstretched wings and tail.

SECTION 2. MANAGEMENT IN CAPTIVITY

2.1 ENCLOSURE

Historically, turacos have generally been held in single species aviaries or mixed with one or two different avian species. More recently there is a trend towards holding them in larger immersive exhibits, tropical houses or public walkthrough exhibits mixed with multiple species including mammals. Reproductively they tend to do better in the more traditional aviaries but breeding success is being achieved in the larger exhibits.

2.1.1 Boundary

Maximum gauge of mesh to be used on exhibits should be 2.5cm x 2.5cm. Although in order to prevent access to wild birds and mammals smaller gauge would be recommended. Under floor wiring will also help prevent any potential rodent problems.

Ensure that any adjoining aviaries have double mesh between them to prevent possible aggression from or towards neighbouring species.

The walls of the house should be constructed from an easy to clean material.

The roof can be either netted or meshed – ensure there are some covered areas where birds can nest/shelter from inclement weather.

An enclosure access safety area should also be incorporated into the design of the aviary to prevent escapes.

When new birds introduced into an exhibit, caution should be taken to mask any windows until the birds are used to the idea they are solid obstacles.

2.1.2 Substrate

Bark, grass, gravel and sand are all suitable substrates for the outside aviary. A concrete or tiled floor inside the house will allow for easier cleaning.

Sand or wood shavings are ideal as a substrate inside the house, although it must be ensured that there is adequate ventilation if they produce too much dust. Dust free bedding materials are also available but are generally more expensive.

Great blue turaco have been observed eating wood shavings from enclosure floors, if birds display this behaviour it would be advisable to consider changing to an alternate substrate. There are no documented cases of this causing health issues but there would be concern that if enough was ingested it could result in a digestive system impaction.

2.1.3 Furnishing and Maintenance

Naturally planted aviaries offer the best environment for all species. A well-planted aviary provides cover against the elements and can also provide perching and nesting options.

By adding well thought out perching to the exhibit in the form of ropes or branches natural locomotion and activity can be encouraged. Turaco species tend to hop from branch to branch, have short flights between perches and also run along branches. Having some perches open to the elements allows the birds the opportunity to sun-and rain-bathe.

Annual re-branching is recommended for environmental stimulation and enrichment.

Being frugivorous turaco species are very messy and enclosures benefit from being cleaned regularly. Daily cleaning around feeding stations is highly recommended, weekly or twice weekly cleaning of outside and inside aviary should be sufficient.

2.1.4 Environment

Turaco can withstand temperatures as low as 10°C comfortably. To maintain activity levels through the winter, access to heated areas is recommended when temperature drops below 10°C. Deny access to the outside in extremes of cold weather - birds will roost outside through poor weather conditions if you do not shut them in. Activity levels will drop dramatically if birds are cold. Extremities, feet and toes are very susceptible to frost bite.

Can withstand temperatures as high as 36 degrees centigrade - ensure adequate shade and bathing areas are supplied during the hottest months. Birds will pant heavily with an open beak when overheating, if this behaviour persists, increase areas of shade in the enclosure.

2.1.5 Dimensions

For one pair of birds the minimum size requirement is 6 x 2 x 2.5 meters high (20 x 6.5 x 8 feet high).

Being predominantly arboreal species there is no limit to maximum height requirements, but 2 metres should be the minimum height.

The indoor housing should be large enough to incorporate a feeding and roosting area, with enough room for easy servicing.

2.2 FEEDING

Only a few studies have been produced on wild diets and feeding habits of turaco species. There is limited information regarding the nutritional composition of natural diet items, making it difficult to recommend a specific nutritionally balanced captive diet. This is an important area for further research; more scientific evidence is required to enable confidence in the nutritional value of diets fed in captivity.

Historically captive turaco diets have been heavily fruit based, understandable when wild fruits account for the bulk for their natural diets. However, commercially grown fruits rarely represent the nutritional value of wild grown fruits. Since the 1990's our knowledge of captive avian nutrition has advanced, although most nutritional data is based upon poultry we do now have a variety of pelleted diets available, many developed for frugivorous species. In the absence of having baseline information on wild diets we should at the very least be assessing what we do feed. By feeding a pellet we know exactly what our birds are consuming and can be reassured that the diet offers a broad and well balanced nutrient basis, to which fresh food items may be added. Many zoos now have nutritionists or have access to databases such as zootrition where the nutrient analysis of what we offer our birds can be calculated.

Faeces consistency of captive turaco species fed on an average fruit based diet tends to be very loose, sweet smelling and has the appearance of some items being undigested. Increasing the fibre content of a diet has resulted in a much more pellet like consistency which lacks the sweet smell and has the appearance of being fully digested.



Red-crested fed on standard fruit based diet



Red-crested fed on increased fibre diet

We need to ascertain which of the above images is most similar to wild turaco faeces.

Attention to this aspect of nutrition was drawn after a talk on toucan nutrition by Laura Gardner (BWG meeting, Flamingoland, November 2009). Wild toucan faeces was gathered and compared with captive toucans. (Consistency of wild faeces was very different from captive; better formed pellets). Preliminary findings included;

- That gram –positive organisms dominate the intestinal flora of wild toucans whilst the intestinal flora of captive toucans appears to be gram-negative.
- The fact that captive toucans frequently suffer from gram- negative infections which are mostly fatal may suggest that the captive diet predisposes the birds to this.
- Hadlow college student began preliminary investigation at Leeds Castle into the impact upon toucan gut flora of high sugar/low fibre foods, and low sugar/high fibre foods

- Preliminary findings indicate that high sugar foods create a gram-negative gut flora whilst low sugar/high fibre create a gram-positive gut flora
- If substantiated this would radically change how we feed toucans in captivity
- A more appropriate captive diet and perhaps the preparation of a suitable probiotic designed to deter the overwhelming growth of gram-negative bacteria in the gut of captive toucans would greatly improve the health and management of these birds within our collections in the future.

This research has implications not just for toucan and turaco but all frugivorous bird species in our care and should be considered when composing captive diets.

Diet review & research update. Red-crested turaco ESB

During 2012 Andy Beer (Sparsholt College Hampshire and RZSS) has analysed the faeces from several captive species of turaco at Cotswold Wildlife Park. All of these birds with the exception of one individual are fed on a standard zoo soft bill diet, a mix of; pellets, fruits and a few greens.

The one exception being a young red-crested turaco (who goes by the name of Tori) who has been trialled on a slightly different diet; with emphasis on increasing fibre content in the diet, addition of par-boiled sweet potato and carrot and raw peas to a diet which already contained T16 pellets, seasonal berries, greens and a decreased amount of soft fruits. An approximate ration of 50% vegetable's, 35% soft fruits & berries & 15% T16 pellets.

Visually the consistency of the faeces produced by this bird are better formed, less watery, and look more thoroughly digested.

Looking at the results of the analysis there is a noticeable difference between the results for the bird on a separate diet to the others. It is apparent that there is less water content within the faeces, an increase in the amount of crude protein and a decreased amount of all three fibres.

The potential implications are that:

- 1) The faecal protein content is increased through the formation of microbial protein as the population of fermentative organisms in the hind gut surges. The faecal crude protein is composed of undigested dietary crude protein, non-protein nitrogen (mainly ammonia, ammonium and nitrates and uric acid) and microbial protein. The dietary crude protein is assumed to have a high digestibility and as the protein content of the diet is low, the higher faecal level must arise from microbial sources.
- 2) Fibre digestion is effective as is seen by the decrease in the three types of fibre. As the main location for fibre fermentation is presumed to be the caecum, the increase in fibre digestion is due to a rise in the microbial population. If this is the case, it can be assumed that an increase in fibre content in the diet of these birds has a positive effect on gut bacteria and the digestive system. NDF is a measure of the cell wall content of plants and particularly of cellulose and hemicellulose. These are the substrates fermented by bacteria in the hindgut and this could explain why the NDF levels in the Red Crested Turaco (Tori) reduced slightly on the higher fibre diet (see table 1). Firm conclusions are not possible because of the small data set.

This is just a starting point for our research; the initial analysis is taken from such a small sample size it would be premature to jump to conclusions. Work is now underway to change all of our turaco diets, collect and analyse the faeces and compare with the previous results. We still need to find wild turaco faeces to analyse as a comparison; the results of such would help give us an indication that we are moving in a positive direction regarding the nutrition of our captive turaco populations.

Table 1; A resume of data from the faecal analysis of Red Crested Turacos at Cotswold Wildlife Park

	Ash	Crude Protein	Crude Fibre	NDF	ADF	ADL
Red Crested Turaco Tori different diet	9.11	12.66	13.19	30.84	16.86	5.21
Red Crested Turaco Tori different diet – 2 nd sample	8.97	12.24	15.57	31.74	18.68	5.48
Red Crested Turaco female	6.40	5.96	34.31	50.76	40.99	10.71
Red crested Turaco (Male 1)	7.63	9.19	23.72	40.88	28.16	7.78
Red Crested Turaco (Male 2)	7.32	8.86	24.97	40.32	30.26	8.42

2.2.1 Basic Diet

Subfamily: *Corythaeolinae*

More research has been done on wild feeding habits of great blue turaco than any other species and yet this seems to be one of the most difficult species to cater for in captivity.

In a five year study done by Mhorag Candy starting in 1976 in Kenya a list of tree and plant species that the turaco ate were listed. Leaf-eating occurred throughout the day but was more pronounced in the evenings, as well as fruit and leaf eating they were also observed feeding on buds, shoots and flowers.

In 1991 a further study took place looking at the nutritional determinants of diet in three turaco species. The results of the study showed that 73% of the great blue turaco diet consisted of fruits, 0.9% flowers and 25% as leaves. When fruit is less available leaf consumption can increase up to 50% of the diet. Leaf content of the diet never dropped below 9%. The fruit pulp was also analysed and of the 12 fruit species great blues were observed eating all had fairly high fibre content, with the highest being 56.7% dry mass & the lowest 9%.

Great blue turaco have also been observed feeding on aquatic plants containing high levels of sodium, one theory suggests that they eat these high in sodium plants to help detoxify plant secondary compounds. (Chin Sun. 1997). The author has observed a captive great blue turaco hunting out and consuming algae that was growing on waterfalls and in ponds of the enclosure. The behaviour was excited, determined and the act of consumption appeared relished. It was an extraordinary behaviour to have observed.

More research is required in this area to greater understand the captive nutritional requirements of this species before any diet can be recommended, although it is fairly easy to theorise that emphasise should go towards feeding vegetation in the diets along with ingredients high in fibre.

The diet below was taken from the Avian Nutrition Resource website <http://www.aviannutritionresource.co.uk/> and has been reproduced by kind permission from Diane Klat of Old House bird Gardens, Harehatch. The diet includes offering browse and lists various species which have been used.

This species will cast well-formed pellets of indigestible plant material. (Todd 1998)

Common name: Great Blue Turaco	Scientific name: Corythaeola cristata	Year first used: 2008	Diet last updated:	Institution: Old House Bird Gardens, Harehatch, UK
Number of individuals diet fed to: Two		Have birds bred whilst on this diet? YES		
Diet Ingredient	Amount per day (g)	Or standard measure	Preparation	
RIPE Papaya		2 Tablespoons	Chopped	
Banana		2 inch piece		
Dried Figs		6 in total	Steam to rehydrate	
Scenic Tropical Bits (pellet)		3/4 cup		
ZSSD hornbill fruit mix		2 cups	Cut into 1/4 inch squares	
Frozen Peas		1/4 cup	Thawed	
Broccoli		4 pieces	Steamed	
ZSSD chopped greens		4 cups	(another pair that successfully reared a chick consumed 1/2 "head" Romaine lettuce daily when feeding a chick)	
Scenic Paradise bird pellet (apple flavoured)		3/4 cup		
Marion Zoological Leafeater pellet		1/2 cup	Broken in half	
Mazuri Seaduck pellet		1/4 cup		
Soaked lam weight control Dog Chow		1/4 cup		
Watermelon	40g	2 pieces		
Browse either Eugenia spp. (new leaf tip and fruit) or Ficus benjamina...new leaf		4 pieces per bird approx 2 foot long X 1/2inch stem width cuttings.	Other browse was offered but rarely consumed. Listed in order of preference: Nasturtium, ficus nitida new leaf.. Gruia..leaf and flower	
Notes: Ficus fruits (listed in order of preference): ficus rubiginosa spp. rusty leaf fig ficus nitida ficus elastica f. benjamina f. carica f. bengalensis f. macrophylla - bay fig f. watkinsiana Eugenia/Syzygium spp. berries were also fed and readily consumed. they do however contain a larger seed and were not fed out until the chicks were over approx. 3 weeks of age. Although the new growth of F. benjamina and F. nitida were offered, the birds only consumed the leaves of F. benjamina when other browse had recently been of poor quality. F. nitida leaves were barely touched even when they were unfurling from the stipule. The favoured browse species was Eugenia/Syzygium. spa.				
Additional food items when chicks are present (total per day.) Day 1-3 100 g ring of RIPE papaya 1/2 to 3/4 cup fresh ficus fruit 1 gm molted mealworms Day 3 introduce 0.5 g fly pupae Day 4 increase to 3 g mooted mealworms increase to 1g fly pupae Day 10 Reduce papaya to 70g papaya strip reduced to 30g post fledge of chick/s				
FOOD PRESENTATION TIPS.....VERY IMPORTANT sprinkle tropical bits over all diet items to guarantee consumption Insert larvae into ficus fruit or into papaya strip. Slice exoskeleton of insects when doing this otherwise they may pass through undigested. Soften pellets with water to improve palatability.				

* ZSSD – Zoological Society San Diego

Subfamily: *Musophaginae*

There are many variations on captive diets for this subfamily. They are highly frugivorous and historically most captive diets have been heavily fruit based. When creating a diet always remember that commercially grown fruits rarely represent the nutritional value of wild grown fruits. Feeding a largely fruit based diet is not recommended – consider a combination of a third fruit & berries to a third of vegetables & greens and a third of a pelleted commercial diet. This should provide all the nutrients required for a healthy balanced diet.

Some species will take live food more readily than others; the white-cheeked turaco for instance has been reported as actively hunting slugs and swallowing them whole. In the authors experience Violaceous turaco tend to be disinterested in live food the majority of time but when breeding their appetite for live food increases fairly dramatically.

The table below was put together from a survey sent out in January 2007 to red-crested turaco holders, the results were printed in the EAZA Best Practice guidelines for red-crested turaco. This is not a recommended diet but merely lists some of the ingredients used by holders.

Diet ingredients used by Red-crested Turaco holders (some diets used for mixed aviary species)	
Fruits	Apple, pear, grape, banana, Paw paw, tomato, pomegranate, kiwi, strawberry, blueberry, melon, mango, apricot, plum, nectarine, seasonal fruits & berries.
Vegetables	Cucumber, cauliflower, broccoli, carrot.
Greens	Lettuce, watercress, cabbage.
Commercial Diets	Mynah pellets, Nutribird pellets, Aves fruitmix, soaked dog pellets, Aves meat mix, Insectivorous diet, Witte Molen Insectivore mix, Witte Molen softfruit mix, soaked Mazuri Diet A.
Misc	Dried figs, canned peaches, sultanas, boiled eggs, brown bread, boiled vegetables.
Meat, insects	Mincemeat, mealworms, dried insects, crickets, wax moth, flour beetle.
Supplements	Nutrobal muti vit/min Produced by Vet Ark. Calcivit. SA37. Breedmax. Korvimin ZVT.
Enclosure vegetation	Leaves and berries taken from Elder tree in enclosure. Leaves taken from various plants/trees in tropical house (banana, mango, papaya growing in exhibits, fruits, leaves and possibly flowers), actively feed on fruiting <i>Hamelia patens</i> (Rubiaceae)

Subfamily: *Criniferinae*

This family are more similar in feeding habits to the great blue turaco than *Musophaginae*, they also cast well-formed pellets, and will eat a larger portion of leafy material than forest species. They will spend more time on the ground hunting for insects etc.

When nesting their appetite for leafy material increases intensely and in the case of Western grey plantain-eaters one pair devastated a crop of rose bay willow herb *Epilobium angustifolium* that was growing in their enclosure, it was later suspected that this may have been a factor in the breeding success of this pair. (Crockford. 1999). Other collections that have achieved breeding success with this family have also stated similar experiences regarding the importance of foliage in their diets, Houston Zoo felt it was crucial to successfully rearing chicks.

Diet sheet for Western grey plantain-eater *Crinifer piscator* from Brno Zoo, Czech Republic. This pair are breeding.

Food item	Amount (g) per 1 ex	Frequency	Technics	Notes
pellets Nutribird T16	25	daily		
AllPet	25	daily		
fruits and vegetables	170	daily	cut; we don't offer figs and citruses	
apple	20	daily		
banana	20	daily		
kiwi	20	daily		
grapes	20	daily		
prune	20	daily		
tomato	20	daily		
lettuce	20	daily		
spinach leaves	20			
rice	10	daily	boiled	
leaves of dandelion (Taraxacum sp.)		if accessible, then daily		normally +- 3 x per week
tree branches		necessary as a priority		
Total amount	220			

Nesting season (February - July)				
Nutribird T20	25	daily		
AllPet	25	daily		
mealworms	4.5	daily	30 mealworms	if they eat them
egg mixture	10	daily		
fruits and vegetables	140	daily	cut; we don't offer figs and citrus	
apple	20	daily		
banana	20	daily		
kiwi	20	daily		
grapes	20	daily		
prune	20	daily		
tomato	20	daily		
lettuce	ad libitum	daily		vegetable of leaves can be substituted during the nesting season
spinach leaves	10	daily		
chinese cabbage	ad libitum	daily		
rice	10	daily	boiled	
leaves of dandelion (Taraxacum sp.)		if accesible, then daily		normally +- 3 x per week
sprouted wheat	10	supplement only		if we serve them spinach leaves, it helps them to break down iron
sprouted watercress	10	supplement only		
tree branches		necessary as a priority		
Total Amount	224.5			

General – all species

A well-researched diet should contain all of the nutritional requirements for a species, use of dietary supplements without an understanding of how they work and the correct amount to administer could have a detrimental effect; too little will be ineffective, too much can cause health issues. Always ensure that any vitamin and mineral supplementation of diets is done to make up for any known deficiencies within the diet you are feeding. Also be very aware of the storage and use by dates of the supplements.

2.2.2 Special Dietary Requirements

Many institutions offer seasonal fruits & berries and increase protein levels of the diet slightly during the breeding season.

2.2.3 Method of Feeding

The diet should be chopped into fairly small pieces, even though turaco will attempt to swallow large items it can be quite a struggle and an uncomfortable experience. By feeding smaller items all components of the diet can be mixed together which helps to avoid individuals from picking favoured items and ensuring a more nutritionally balanced intake.

Intake amount will vary significantly through the year, monitoring the amount of diet left uneaten each day and adjusting the diet amount offered accordingly will help reduce food wastage. Turaco species have a very short digestive system being without food for a long period of time is not recommended; ensure the diet is available early in the morning, especially if the birds are raising chicks.

The diet should be fed off the ground, out of reach of wild rodents. The feeding area should be either inside or undercover out of direct sunlight and rain. The cover will also prevent wild birds or aviary inhabitants from defecating on the food. The feeding area should be built from materials that are easy to keep clean.

In hot weather fruit will begin to spoil/ferment quickly, to ensure the diet is kept as fresh as possible offer a second feed during the warmer months.

Diet enrichment

- Whole fruits spiked on branches.
- Browse for great blues and Criniferinae species.
- Fruiting shrubs or trees in the exhibit.

2.2.4 Water

Turacos will drink several times a day; as such access to clean water is essential, ideally a small water bowl next to their food bowl, off the ground and too small for them to bathe in, this will ensure they have access to clean uncontaminated drinking water.

Turaco will bathe daily for which a shallow pond is ideal. Avoid placing any ponds or bowls under perches to prevent contamination from faeces. They also enjoy rain bathing so having a sturdy perch open to the elements will allow this behaviour. Alternately, a slow flowing waterfall will present an irresistible opportunity to get wet & clean.

2.3 SOCIAL STRUCTURE

2.3.1 Basic Social Structure

In captivity generally kept in pairs.

In recent years some institutions have begun maintaining single sex groups of turaco in large mixed species immersive exhibits. Initial indications show a higher mortality rate for this dynamic, each situation will have a different set of variables; as such more research needs to be gathered from these experiences to establish any trends and address any management issues, or advise against this dynamic.

Subfamily: *Corythaeolinae*

In the wild great blue turaco pairs have been observed nesting in the same tree. On occasion a pair has been observed with a third 'helper' bird, this is presumed to be a family member from an earlier clutch.

Certainly great blue turaco appear quite gregarious and will gather at good food sources without aggression, however the captive population has always been quite small, and generally only ever held in pairs.

In the wild where Lady Ross's and great blues are seen together, either nesting or feeding, aggressive encounters occur, usually instigated by the Lady Ross's turaco.

Subfamily: *Musophaginae*

Generally live in pairs through the year, or in small family groups. Highly territorial.

Subfamily: *Criniferinae*

Tend to be slightly more gregarious. Family groups stay together longer.

Groups of up to 50 grey go-away-birds not an uncommon sight in Zimbabwe.

2.3.2 Changing Group Structure

Care must be taken with all turaco introductions, there is always a risk of aggression and possible resulting death if not planned and monitored closely. Certain species are more difficult to introduce than others; Livingston's, Hartlaub's & Fischer's have all been documented as being prone to intraspecific aggression and difficult to introduce.

Before any introduction it is important to consider fitness and health of all individuals as well as any age differences or psychological aspects (rearing method or lack of socialising), all of these factors could have an influence on the results of any introduction.

Ensure the enclosure you intend to introduce the birds to is set up in a way to give individuals the opportunity to get out of sight from each other or escape any pursuit; areas of cover, baffle boxes (something as simple as a cardboard box with an entrance & exit, or drainage pipes etc.) on the enclosure floor around the perimeter of an aviary. Perching can also be utilised, place a couple of short perches, that will only enable a single bird to perch; these could give a pursued individual a chance to catch their breath.

Introducing birds is never predictable, as a general rule introduction on neutral territory is usually advisable; however, if this is not practical, introduce what potentially would be the most aggressive of the pair (in most cases the male) into the established territory of the least potential aggressor (generally the

female). Closely monitor behaviour, expect to see excited birds running around vocalising on introduction, any mutual displays are highly encouraging signs. Add additional areas of shelter or feeding stations if an individual is being prevented access to housing or food. Please note turaco species do not cope well with stress, any prolonged chasing is rarely resolved over time and if a pursued individual is displaying increasing signs of stress/panic the introduction should be stopped and tried again at a later date.

In the event of a particularly difficult pair a softer approach can be attempted by allowing the birds to see each other from adjacent aviaries or by partitioning off part of the enclosure placing one bird either side. Once positive behaviour is observed gradual access can be granted.

Wing clipping has been used with more aggressive turaco species; by “slowing down” the aggressor this enables more time for the subordinate to retreat.

It is possible to crèche immature turaco species together for a period of time, this is a good option to help socialise individuals and a far better option than keeping young birds solitary, however, as the birds mature aggressive conflicts will occur if they are of mixed sexes.

It is possible to keep pairs of more than one species in larger exhibits, but one species will generally be more dominant over the other and may have an effect on breeding results. The species must be introduced to the enclosure at the same time, any attempt to mix new species into an already established territory will probably fail.

There are examples of institutions holding sibling single sexed birds together for long periods of time without any signs of aggression, but introducing new birds to this established group would undoubtedly fail. More recently some institutions have begun gathering unrelated single sexed groups of mixed turaco species to introduce to large exhibits. Again introducing birds all at the same time rather than to established territories would be ideal, more research, data needs to be gathered before more informative guidelines can be produced.

2.3.3 Sharing Enclosure with Other Species

Subfamily: *Corythaeolinae*

In terms of interspecies interaction, in captivity there are few documented reports, a mix between a pair of great blue turaco and grey-winged trumpeter *Psophia crepitans* failed when the turaco pair started showing breeding behaviour, they displayed escalating levels of aggression towards the trumpeter, which ultimately had to be removed from the exhibit.

In a mixed species Tropical House an elderly pair of great blues have been observed on several occasions actively pursuing recently fledged passerine species.

An attempt to mix three turaco species; great blue turaco, violaceous turaco & white-bellied go-away bird, resulted in failure with most aggression occurring during feeding or defending nest sites, in most cases the aggression was instigated by the go-away bird or violaceous. (Valuska. 2013)

Subfamily: *Musophaginae*

Turaco have been mixed with many different avian species in various exhibit types, although they will share enclosure space without issues for the majority of the year caution must be shown during breeding season. A breeding pair will display aggression to any species that get too close to the nest site and will on occasion actively pursue & attack other species.

Turaco chicks fledge before they can fly, their clumsiness often attracts inquisitive onlookers, they are at their most vulnerable on the exhibit floor and there have been cases of fledged birds being attacked and even killed by other species.

Aggression has been recorded from pheasant species with chicks, becoming increasingly protective and eventually attacking a turaco species that had co-habited happily in an aviary for years without any previous sign of aggression.

Whenever mixing species for the first time always look at aviary size; is it large enough to allow species to establish their own territories? Is there adequate cover to allow specimens to get away from each other? Are there sufficient feeding stations to prevent any territorial disputes that may stop species from feeding?

Occasionally new behaviours are reported about turaco species in mixed species exhibits, and among one of the strangest and certainly unexpected observation came from Leipzig zoo; their crowned pigeon adults began leaving their hatchling and eventually threw it out of the nest, when the keepers returned the squab back to the nest a male red-crested turaco was observed feeding and brooding the pigeon squab for a day. The adult pigeons took over parental responsibilities the next day. At the same time the pair of red-crested turacos had an egg of their own.

This type of behaviour has been documented in other avian species but never to my knowledge for turaco species, it may be that it was just a one off, but perhaps with the increasing trend towards keeping turaco in mixed species exhibits we may encounter similar behaviours in the future?

The table below lists various avian & mammalian species turaco have shared enclosures with and any problems associated with these mixes. Please note this list is not definitive and does not mention the exhibit size.

Common Name	Taxonomic name	Turaco species mixed	Problems associated with mix
Galliformes			
Common piping guan	<i>Aburria pipile grayi</i>	Red-crested turaco, white-cheeked turaco	
Congo peafowl	<i>Afropavo congensis</i>	Red-crested turaco, Violaceous turaco	Red-crested turaco 20-day-old specimen attacked and killed. (Recently fledged).
Brown-breasted hill partridge	<i>Arborophila brunneopectus</i>	Red-crested turaco, white-cheeked turaco	
Argus pheasant	<i>Argusianus argus</i>	Red-crested turaco, Livingston's turaco, white-cheeked turaco	Livingston's turaco – occasional minor aggression
Jungle fowl	<i>Gallus gallus</i>	Red-crested turaco, Lady Ross	Lady Ross – Jungle fowl male shows aggression towards turaco if at ground level, frequency increases when jungle fowl have chicks – Not serious enough to warrant intervention.
Crested wood partridge	<i>Rollulus rouloul</i>	Red-crested turaco, Fischer's turaco, Lady Ross, Violaceous turaco, white-cheeked turaco, white-crested turaco	Violaceous turaco observed chasing male partridge.
Temminck's tragopan	<i>Tragopan temminckii</i>	Red-crested turaco	Pheasant attacked female turaco during pheasant breeding – resulted in death of turaco
Yellow-necked spurfowl	<i>Francolinus leucoscepus</i>	Fischer's turaco, white-cheeked turaco, red-crested turaco	
Guineafowl species	<i>Acryllium & Numida & Guttera sp.</i>	Violaceous turaco, white-cheeked turaco, red-crested turaco	
Pheasant species	<i>Catreus, Lophophorus, Syrmaticus, Polyplectron, Chrysolophus, & Pavo sp.</i>	Violaceous turaco, Lady Ross, red-crested turaco, green turaco	
Blue-eared pheasant	<i>Crossoptilon auritum</i>	White-cheeked turaco	Blue-eared pheasant with chicks attacked White-cheek resulting in death.

Common Name	Taxonomic name	Turaco species mixed	Problems associated with mix
Anseriformes			
African pygmy geese	<i>Nettapus auritus</i>	Red-crested turaco	
Various duck species	<i>Anas</i> , <i>Aix</i> , <i>Dendrocygna</i> , <i>Callonetta</i> & <i>Oxyura</i> sp.	Fischer's turaco, green turaco, Lady Ross, white-cheeked turaco, Violaceous turaco, red-crested turaco, white-crested turaco, Livingston's turaco	
Ciconiiformes			
Ibis species	<i>Eudocimus</i> , <i>Geronticus</i> & <i>Plegadis</i> sp.	Red-crested turaco, white-cheeked turaco	
Hamerkop	<i>Scopus umbretta</i>	Violaceous turaco	
Cattle egret	<i>Ardeola ibis</i>	Violaceous turaco, white-cheeked turaco	
Striated heron	<i>Butorides striata</i>	Red-crested turaco	
Pelecaniformes			
African darter	<i>Anhinga rufa</i>	Red-crested turaco, white-cheeked turaco	
Falconiformes			
Secretarybird	<i>Sagittarius serpentarius</i>	White-cheeked turaco	
Gruiformes			
Rail species	<i>Aramides</i> & <i>Rallus</i> sp.	Red-crested turaco, white-cheeked turaco	
Black Crane	<i>Amaurornis flavirostra</i>	Hartlaub's turaco	
Crowned crane	<i>Balearica</i> sp.	Violaceous turaco, white-cheeked turaco, red-crested turaco	

Common Name	Taxonomic name	Turaco species mixed	Problems associated with mix
Charadriiformes			
Curlew species	<i>Burhinus sp.</i>	Red-crested turaco, Fischer's turaco	
Black-winged Stilt	<i>Himantopus himantopus</i>	Red-crested turaco	
Wattled Jacana	<i>Jacana jacana</i>	Red-crested turaco, Violaceous turaco	Violaceous turaco – Aggression towards turaco when breeding, territorial over food and water stations. No action required – large aviary and several feeding stations.
Gull species	<i>Larus sp</i>	Green turaco, white-cheeked turaco	
Northern Lapwing	<i>Vanellus vanellus</i>	Green turaco	
Black Oystercatcher	<i>Haematopus bachmani</i>	White-cheeked turaco	
Columbiformes			
Pigeon species	<i>Caloenas, Chalcophaps, Columbina, Gallicolumba, Geopelia, Geotrygon, Ptilinopus & Goura sp.</i>	Red-crested turaco, Violaceous turaco, white-cheeked turaco, Lady Ross, Fischer's turaco	Red-crested male injured newly fledged Nicobar Pigeon
Pink Pigeon	<i>Columba mayeri</i>	Red-crested turaco, white-cheeked turaco	Red-crested turaco chased pink pigeon
Imperial pigeon species	<i>Ducula sp</i>	Red-crested turaco, Violaceous turaco, white-cheeked turaco, Livingston's turaco	Red-crested Turaco put green imperial pigeons off breeding
Crested Pigeons	<i>Ocyphaps lophotes</i>	Red-crested turaco	Red-crested stopped pigeons from breeding
Pheasant pigeon	<i>Otidiphaps nobilis</i>	Red-crested turaco, Lady Ross, Violaceous turaco, white-cheeked turaco, white-crested turaco	Aggression from red-crested during breeding season

Common Name	Taxonomic name	Turaco species mixed	Problems associated with mix
Socorro dove	<i>Zenaida macroura graysoni</i>	Red-crested turaco, Lady Ross, Violaceous turaco	Red-crested turaco – Problems associated with mix
Psittaciformes			
King Parrots, Moluccan Lories, hanging parrot, Grey-headed Parrot, Macaw	<i>Alisterus amboinensis, Eos bornea, Loriculus vernalis, Paradoxornis gularis, Ara species</i>	Red-crested turaco, white-cheeked turaco, Schalow's turaco	
Cuculiformes			
White-cheeked turaco	<i>Tauraco leucotis</i>	Red-crested turaco, Fischer's turaco	Highly dominant behaviour and male leucotis interest in female erythrolophus Fischer's turaco – White-cheeks showed highly dominant behaviour – low frequency through the year – Multiple feeding stations throughout enclosure alleviate dominant behaviour.
Strigiformes			
Burrowing owl	<i>Athene cunicularia</i>	Livingston's turaco	
Coliiformes			
Speckled mousebirds	<i>Colius striatus</i>	Red-crested turaco, Fischer's turaco, Lady Ross, white-cheeked turaco, white-crested turaco	
Coraciiformes			
Roller species	<i>Coracias sp</i>	Red-crested turaco, Violaceous turaco, white-cheeked turaco, black-billed turaco	Red-crested turaco chased roller sp. Breeding pair of lilac breasted rollers attacked black-billed turacos
Bee-eater species	<i>Merops sp</i>	Red-crested turaco	Red-crested observed chasing nesting adults and fledgling rollers. (<i>Merops sp.</i>)

Common Name	Taxonomic name	Turaco species mixed	Problems associated with mix
White collared kingfisher	<i>Todiramphus chloris</i>	Violaceous turaco	
Upupiformes			
Green wood hoopoe	<i>Phoeniculus purpureus</i>	Red-crested turaco	Family of hoopoe suspected as aggressive towards turaco pair, resulting in turaco deaths (behaviour not witnessed).
Bucerotiformes			
Von der Deckens hornbill	<i>Tockus deckeni</i>	Red-crested turaco, Violaceous turaco	Red-crested turaco – Can be aggressive and competitive around feeding platform. Violaceous turaco – Inquisitive with occasional aggression – more prevalent during breeding season. Occasionally house hornbill inside until aggression subsides.
Crowned & African grey hornbill	<i>Tockus alboterminatus & nasutus</i>	Violaceous turaco	
Piciformes			
Barbet species	<i>Lybius & Trachyphonus sp.</i>	Red-crested turaco, Violaceous turaco	Barbet dominant over feed station – chases RCT – no action required
Passeriformes			
Red-rumped cacique	<i>Cacicus haemorrhous</i>	Red-crested turaco, white-cheeked turaco	
Hooded Siskin	<i>Carduelis magellanica</i>	Red-crested turaco	
Leafbird species	<i>Chloropsis sp.</i>	Red-crested turaco, white-cheeked turaco	
Starling species	<i>Coccycolius, Cosmopsarus, Creatophora, Scissirostrum, Spreo, Lamprotornis & Sturnus sp.</i>	Red-crested turaco, Violaceous turaco, white-cheeked turaco, Hartlaub's turaco	

Common Name	Taxonomic name	Turaco species mixed	Problems associated with mix
White-rumped Shama	<i>Copsychus malabaricus</i>	Red-crested turaco	
Robin Chat species	<i>Cossypha sp.</i>	Red-crested turaco, white-cheeked turaco	
Spangled cotinga	<i>Cotinga cayana</i>	Red-crested turaco, white-cheeked turaco	
Red-legged honeycreeper	<i>Cyanerpes cyaneus</i>	Red-crested turaco, white-cheeked turaco	
Azure-winged magpie	<i>Cyanopica cyana</i>	Red-crested turaco	
Red fody	<i>Foudia madagascariensis</i>	Red-crested turaco, Violaceous turaco, white-cheeked turaco	
Laughing thrush species	<i>Garrulax & Dryonastes & Trochalopteron sp.</i>	Red-crested turaco, Lady Ross, Livingston's turaco, white-crested turaco	Livingston's turaco – occasional minor aggression White-crested turaco ate eggs from blue crowned laughing thrush nest Aggression between white-crested turaco & red-tailed laughing thrush – enclosure large enough for it not to be a problem.
Pekin Robin	<i>Leiothrix lutea</i>	Red-crested turaco, Violaceous turaco	
Bali Mynah	<i>Leucopsar rothschildi</i>	Red-crested turaco, Lady Ross, Violaceous turaco	Aggression from red-crested during breeding season
Fairy bluebird	<i>Irena puella</i>	Red-crested turaco, Violaceous turaco, white-cheeked turaco	No aggression observed but turacos clumsy around bluebird nest resulting in eggs falling out of nest.
Yellow-crowned Gonolek	<i>Laniarius barbarus</i>	Red-crested turaco	
Bulbul species	<i>Hypsipetes & Pycnonotus</i>	Red-crested turaco, Lady Ross, white-cheeked turaco, white-crested turaco	
Golden breasted Mynah	<i>Mino anais</i>	Red-crested turaco	Aggression from red-crested during breeding season
Sunbird species	<i>Nectarinia sp.</i>	Red-crested turaco, White-cheeked turaco	
White-headed Munia	<i>Lonchura maja</i>	Red-crested turaco	
Screaming piha	<i>Lipaugus vociferans</i>	Red-crested turaco	

Common Name	Taxonomic name	Turaco species mixed	Problems associated with mix
Oriole species	<i>Oriolus sp.</i>	Red-crested turaco, Violaceous turaco	
Sparrow species	<i>Padda sp.</i>	Red-crested turaco, white-cheeked turaco, Violaceous turaco	
Black-capped babbler	<i>Pellorneum capistratum</i>	Red-crested turaco, white-cheeked turaco	
Weaver species	<i>Ploceus & Dinemellia sp.</i>	Red-crested turaco, Hartlaub's turaco, white-cheeked turaco, Violaceous turaco	
Long-tailed Finch	<i>Poephila acuticauda</i>	Red-crested turaco	
Tanager species	<i>Ramphocelus & Thraupis sp.</i>	Red-crested turaco, white-cheeked turaco, Violaceous turaco	
Seedeater species	<i>Sporophila sp.</i>	Red-crested turaco, white-cheeked turaco	
Chestnut-backed thrush	<i>Zoothera dohertyi</i>	Red-crested turaco, Fischer's turaco, Violaceous turaco, white-cheeked turaco	
White-eye	<i>Zosterops sp.</i>	Red-crested turaco, white-cheeked turaco	
Red-billed Chough	<i>Pyrrhonorax pyrrhonorax</i>	Green turaco	
Blue-faced Honeyeater	<i>Entomyzon cyanotis</i>	Hartlaub's turaco, Violaceous turaco	Attacked turaco at introduction – species split up
Red-billed Oxpecker	<i>Buphagus erythrorhynchus</i>	Violaceous turaco	
Hooded Pitta	<i>Pitta sordida</i>	Violaceous turaco, white-cheeked turaco, red-crested turaco	
Blue-throated Magpie-jay	<i>Calocitta collieri</i>	White-cheeked turaco	
Red-billed quelea	<i>Quelea quelea</i>	Red-crested turaco	

MAMMALIA			
Common Name	Taxonomic name	Turaco species mixed	Problems associated with mix
Oriental small-clawed otter	<i>Amblonyx cinereus</i>	Red-crested turaco, white-cheeked turaco	
Bat species	<i>Epomophorus, Rousettus & Pteropus sp.</i>	Red-crested turaco, white-cheeked turaco	
Rock hyrax	<i>Heterohyrax sp</i>	Red-crested turaco	
Capybara	<i>Hydrochaeris hydrochaeris</i>	Red-crested turaco, white-cheeked turaco	
Green Acouchi	<i>Myoprocta pratti</i>	Red-crested turaco	
Cotton-top Tamarin	<i>Saguinus oedipus</i>	Livingston's turaco	
Kirk's dik dik	<i>Madoqua kirkii</i>	Violaceous turaco	
Lemur species	<i>Lemur, Eulemur & Varecia sp.</i>	White-cheeked turaco	Turaco went into enclosed space with Lemur sp and lost some tail feathers
Colobus	<i>Colobus guereza</i>	Red-crested turaco	
Aardvark	<i>Orycteropus afer</i>	White-cheeked turaco	
Gorilla	<i>Gorilla gorilla</i>	Red-crested turaco	
Blue duiker	<i>Philantomba monticola</i>	Red-crested turaco	

Subfamily: *Criniferinae*

Will share enclosure space without issues for the majority of the year caution must be shown during breeding season. A breeding pair will display aggression to any species that get too close to the nest site and will on occasion actively pursue & attack other species.

Turaco chicks fledge before they can fly, their clumsiness often attracts inquisitive on lookers, they are at their most vulnerable on the exhibit floor and there have been cases of fledged birds being attacked and even killed by other species.

Aggression has been recorded from pheasant species with chicks, becoming increasingly protective and eventually attacking a Turaco species that had co-habited happily in an aviary for years without any previous sign of aggression.

2.4 BREEDING

Inexperienced pairs may need several attempts before they successfully rear chicks. It is vital that holders give inexperienced pairs the opportunity to learn; avoid intervention where possible for the first 2-3 clutches. If pairs continue to fail, conditions may not be fully conducive - consider and adapt husbandry, even subtle changes can influence the outcome. Once turaco have bred successfully, they generally tend to have repeated success.

2.4.1 Mating

Turaco have pre mating displays, which include, mutual feeding, bowing, head bobbing, hopping along perches or over female. Adequate perching should be in place to allow for these displays, and sturdy enough to allow the pair to mate. The perch needs to be long enough to enable both birds to perch adjacent to each other as the male will mount the female from this position, after a series of chasing, feeding, calling and mutual head bobbing and beak clapping.

The Western-grey plantain eater male is reported to rise vertically from the top of a tree and then descend in a tumbling dive to its mate - female remains perched with outstretched wings and tail.

2.4.2 Egg Laying and Incubation

It is important to give new pairs a choice of nesting options, they will choose which they prefer and generally return back to that nest for subsequent clutches.

Turaco will show interest in the nest for a few days in advance of laying, birds in captivity have been observed sitting a day or two in advance of egg laying - eggs usually laid every other day.

Turacos build very flimsy nests, providing them with an appropriate nest choice is important for success. Basket, wood or wire frames with approximate nest dimensions of 33cm x 20cm x 7.5cm. A substrate on the floor of the nest will prevent eggs from rolling or the chicks' legs from splaying; astro-turf, carpet or similar work well, or lining the nest with small twigs, but be sure to clean or replace between clutches. For added security artificial or natural foliage can be placed around the nest, take care to ensure the birds have a direct route to and from the nest.

There are cases of turaco building their own nests in captivity, but it is rare that the nests are sturdy enough. Below are images of rare exceptions, a Livingston's turaco (left) and a Schalow's turaco (right) on self-built nests.



Images all courtesy of David Jones, International Turaco Society.



Buffon's turaco in artificial nest.



White-cheeked turaco chicks, substrate added by keeper.

Turaco will play at nest building and may add twigs to the nest, by providing them with nesting material you are allowing them to carry out natural behaviours.

Nest placement must be considered carefully. Too high and you will be unable to monitor the nest, too low and the turaco will not feel secure. It must be in a sheltered position from the weather and away from any keeper access doors in a position that allows the birds to view a large part of the aviary to ensure the birds have a sense of security. Once a site has been successfully used by a pair they will continue to use it for subsequent clutches, at this point it is worthwhile making it part of the routine to check the nest once daily. Turaco quickly become conditioned to this routine and over time you may be able to get close enough to slightly raise incubating birds to gain a look at the eggs or chicks, or to offer supplementary feeds if there are problems. The turaco will defend the nest by hissing and attacking with their beak, so be aware that eggs or chicks may get between your hand and the attacking beak! Do not attempt this unless you know your birds well, it takes time to build up this type of relationship, and any mistake could result in trampled eggs or chicks.

It is good practice to remove all nests at the end of the season; this can discourage some species from extended breeding during winter months, and will give the birds the opportunity to regain condition. Introducing nests at the start of the breeding season can actively stimulate breeding behaviour. If your pair of turaco are particularly bad at incubating or rearing and you have another steady reliable pair of turaco (*Tauraco spp*), adding eggs or chicks is feasible for foster incubation/rearing.

2.4.3 Hatching

Both adults will take part in incubating, brooding and feeding (feed via regurgitation). Adults generally consume eggshell once the chicks have hatched. Adults are very protective of nests and will generally remain sitting eggs/chicks whilst attacking any threat.



Image courtesy of David Jones, International Turaco Society.

Newly hatched chicks are covered in dense black down, with visible small wing-claws. Eyes are either open or on the point of opening. Parents will consume the chicks' faeces as soon as it is expelled.

Generally for the first week to 10 days after hatching adults will rarely be observed off the nest for any length of time, any extended time away from the nest could indicate a problem. Watch for signs of mate aggression on the point of fledging chicks - oversexed young males may be in a rush to breed again, they can turn on both fledglings and or the female.

2.4.4 Development and Care of Young

The chicks grow rapidly and by two weeks they may start to explore their surroundings. At this age turaco chicks cannot fly and may fall to the floor; it is important to prepare for fledged youngsters in advance of nesting. When putting up nests, always ensure there is a network of branches from the floor up to the nest.

Chicks will come and go from the nest at this age - providing a natural ladder for chicks to return to the nest if they drop to the floor can save lives, especially in bad weather. Keep a close eye on the enclosure on the point of fledge - ensure there are no deep water bodies for clumsy chicks to fall into. Monitor any

other bird species in the enclosure that may pose a threat to awkward and clumsy chicks. Even pheasant species will out of curiosity cause harm to stranded turaco chicks.

Generally the chicks are able to fly from four to five weeks, but will remain dependent on parents for several months after leaving the nest.

With the exception of a few species, adults do not tend to tolerant young from previous clutches, pairs will harass, pursue and even attack juveniles, especially when adults are ready to nest again. If offspring are not removed in a timely fashion injury or death may occur. It is vital that both adult and juvenile behaviour are monitored closely at this time, subtle clues will allow you to make the correct decision at the right time, warning signs are; increased distance between juvenile & adults, less positive interaction, increasing levels of chasing or harassing (best to remove juveniles at this point), eventually escalating into physical aggression. Beware that if you remove juveniles too soon they may not be fully independent, in this situation closely monitor food intake.

Good quality aftercare for juvenile turaco is as essential as all other stages of the breeding process, these juveniles will be the next generation of breeders, it is vital that birds are given the right quality of care at this stage. Avoid (where possible) isolating individuals in small holding aviaries where they cannot build up flight muscles, nor interact with other birds. Avoid (where possible) transferring juvenile birds to other collections for pairing before they are mature - or at the very least before they are six-eight months of age.

After removal of juvenile turaco from parents, they can be mixed with juveniles from previous clutches or other turaco species to form a crèche, this will keep juveniles stimulated and socialised, giving them time to mature before being transferred for pairing.

Utilize any large mixed species exhibits as potential playgrounds for juvenile turaco - these types of aviaries are becoming increasingly popular, and are ideal to build up flight muscles - resulting in fitter individuals. Young turaco bouncing around a large aviary will make an impressive display for visitors.

2.4.5 Foster rearing

If the option is available, foster rearing is a preferable alternative to hand rearing, and can be utilized as a tool to maximise offspring from genetically important pairs; it is more keeper time efficient than hand-rearing, and produces physically and psychologically healthier individuals.

The key to any successful foster rearing attempt is in knowing the fostering individuals. Any turaco species pair which has a proven track record is an ideal candidate for use as foster parents. If possible spend some time conditioning pairs to the presence of keepers in the proximity of nests. Ideally nests need to be easily accessible to facilitate any exchange of eggs or chicks, whilst causing minimal stress to the adults.

Once broody, reliable foster rearers will accept substitutions at any stages; eggs not too far into incubation can be replaced for eggs which are closer to hatching, pipping, or with newly hatched chicks. Alternatively, (provided they are due around the same time) you can add eggs to an existing clutch, or chicks to an existing brood.

When swapping eggs or chicks, extreme care must be taken; brooding turaco will puff themselves up, hiss and beak strike at any object which comes too close. Always fully protect any egg or chick with your hand,

divert the adults attention with your free hand whilst gently removing or adding the egg/chick. Work calmly and with slow movements, if the bird panics, it may result in damage to other eggs/chicks that are already in the nest. Step back and observe from a safe distance to ensure the bird has settled and accepted any substitution.

Turaco can be conditioned over time to tolerate nest inspection by keeping staff, allowing keepers to slightly raise brooding birds enabling inspection of eggs or chicks. Any individual chicks that do not appear to be thriving could be offered supplementary feeds.



White-cheeked turaco with Lady Ross' chick.



Schalow's turaco with white-cheeked chicks.

2.4.6 Hand-Rearing

With the right husbandry techniques the majority of turaco species are not difficult to breed. Artificial rearing should only be considered as a last resort - parent or foster rearing will result in physically and psychologically healthier individuals.

Turaco species will easily imprint on humans when hand-reared and although hand-reared turaco can go on to parent rear successfully, there can be behavioural problems. Hand-reared birds can prove more difficult to pair and may result in increased mate aggression. In a breeding situation hand-reared birds lose their fear of humans and can attack keepers. If the birds are housed in a public walkthrough enclosure this aggression could be taken out on passing visitors. The attack is usually focused towards the head and face, and could result in injury.

If a decision is made to hand-rear every effort should be made to minimise imprinting - if possible rear at least two birds together and minimise human contact. Socialise/crèche juveniles as early as possible with other juvenile turaco.

Artificial incubation – eggs should be placed in an incubator set at 37.5 degrees centigrade. Humidity should be adjusted to insure appropriate weight loss at 15%.

There are many different turaco hand-rearing diets several examples can be accessed via the Avian Rearing resource <http://www.avianrearingresource.co.uk/>

2.5 POPULATION MANAGEMENT

2.5.1 Population Status

There are few avian species that can fill a well laid out aviary quite as well as turaco species, going about their business, hopping from branch to branch, seductively teasing with a brief bright splash of crimson as they open up their wings. Vibrant colours, unique vocals and cheeky characters, they certainly engage attention from visiting public.

Most species are relatively easy birds to maintain in captivity, there are still a few aspects of husbandry which need to be perfected. Turaco species have proved popular both in zoos and private aviculture for many a decade. Of the 23 species, currently 18 species are represented in the European region. Of those 18 species three are managed as European stud-books (ESB) and five are currently being monitored (see table below).

All species are endemic to Africa, although the vast majority of species are not under threat the Bannerman's turaco *Tauraco bannermani* is listed as Endangered and the Ruspoli's turaco *Tauraco ruspolii* as Vulnerable. Of the 18 species represented in captivity in Europe the Fischer's turaco *Tauraco fischeri* is the only species listed as near threatened the rest are listed as least concern, but three species are documented as having a decreasing population trend; red-crested turaco *Tauraco erythrophus*, Hartlaub's turaco *Tauraco hartlaubi* & the purple-crested turaco *Tauraco porphyreolophus*.

Which species should we be investing in?

We should be concentrating on those whose wild population trends are decreasing; Fischer's (ESB), red-crested (ESB), Hartlaub's (Mon-P) and purple-crested turaco. Of those four species the purple-crested has a very small captive population size, a total of 9 birds and no breeding success over the last 12 months. Unless more individuals can be sourced this is not sustainable.

The largest and potentially most sustainable captive population is the violaceous or violet turaco *Musophaga violacea*. This is reinforced by the ESB holder of this species who is especially satisfied with the performance of this species, and states there are still a significant number of founders producing offspring.

Both the green turaco *Tauraco persa* and white-cheeked turaco *Tauraco leucotis* also have fairly large population sizes, and as such are worth maintaining. The white-cheeked is the easiest species to work with in terms of husbandry, certainly the hardiest of the species, and a good first species to work with.

In terms of diversity of species, there are also the grey species, whose husbandry is generally more difficult than the green turaco species, all have very small population sizes and potentially not sustainable. Of the four species in captivity the bare-faced go-away bird *Corythaixoides personatus* has 5 wild born founders still living, it would be interesting to see how many of this species are in the private sector and if there would be the potential to start a programme from scratch. Husbandry issues would also need to be researched and addressed if there is to be any chance of long term success.

The great blue turaco *Corythaëola cristata* has recently been upgraded to a monitored position, although this species is not of any conservational importance it is the most stunning of the turaco species and probably the most coveted by many aviculturists. This species is truly challenging and is the hardest of all turaco species in terms of husbandry, successes are very few. Nutrition may well be the key factor with this species; if this can be resolved there is certainly the potential to justify this species in our collections as an

ambassador for turaco. If we wish to maintain the great blue turaco all holders working with this species need to pool their knowledge and experience and work closely with each other to advance husbandry.

Please note the data taken from SECIES360 species holdings is by no means definitive, there are several collections holding turaco species who are not ISIS members and many more birds held by private aviculturists.

Turacos in European institutions - info taken from ISIS species holdings 24/06/2015 & 30/01/2018					
Species	Scientific name	European Region () -number of institutions	EAZA status	Wild status	Captive future
Fischer's turaco	<i>Tauraco fischeri</i>	(18) 19.19.5 (18) 17.14.1 ↓	ESB	Near threatened - population trend decreasing	Most important turaco species to be working with based on wild status.
Red-crested turaco	<i>Tauraco erythrolophus</i>	(53) 61.57.10 (59) 67.77.12 ↑	ESB	Least concern - population trend decreasing	A worthwhile ambassadorial species, links to conservation project, worthwhile species to maintain
Violet turaco	<i>Musophaga violacea</i>	(70) 77.74.26 (77) 86.82.20 ↑	ESB	Least concern - population trend stable	This species is secure for the future
Green turaco	<i>Tauraco persa</i>	(14) 20.23.14 (20) 27.36.9 ↑	MON-P	Least concern - population trend stable	Good population size - worth maintaining
	<i>Tauraco persa buffoni</i>	(16) 9.14.1 (16) 11.9.1 ↓			
Hartlaub's turaco	<i>Tauraco hartlaubi</i>	(16) 14.11.4 (14) 10.10.5 ↓	MON-P	Least concern - population trend decreasing	With a decreasing wild population trend worthwhile maintaining
White-cheeked turaco	<i>Tauraco leucotis</i>	(61) 48.43.32 (58) 57.52.28 ↑	MON-P	Least concern - population trend stable	Good population size - worth maintaining
Lady Ross' turaco	<i>Musophaga rossae</i>	(11) 11.7.1 (11) 9.9.1 ↔	MON-P	Least concern - population trend stable	Worth maintaining if only with a view to backing up the American population
Great blue turaco	<i>Corythaeola cristata</i>	(5) 6.8.0 (6) 5.8.2 ↑	MON-P	Least concern	Unmistakably the most impressive of all turaco species. Husbandry knowledge is still lacking but if issues could be improved would make a good ambassador
Livingston's turaco	<i>Tauraco livingstonii</i>	(13) 15.7.5 (14) 12.7.2 ↓		Least concern - population trend stable	

Species	Scientific name	European Region () -number of institutions	EAZA status	Wild status	Captive future
Schalow's turaco	<i>Tauraco schalowi</i>	(6) 7.7.5 (7) 5.6.0 ↓		Least concern - population trend stable	With only 1 institution achieving breeding success, most birds either originate from that institution or were sourced from private aviculturists.
Knysna turaco	<i>Tauraco corythaix</i>	(2) 1.1.0 ↔ (2) 1.1.0 ↔		Least concern - population trend stable	Population not sustainable. (Birds not paired)
Ruwenzori Black-billed turaco	<i>Tauraco schuetti</i>	(6) - 6.6.0 (3) 1.2.0 ↓		Least concern - population trend stable	Population not sustainable. (Birds not paired) 1 bird at each institution.
White-crested turaco	<i>Tauraco leucolophus</i>	(12) 15.10.1 (13) 18.10.3 ↑		Least concern - population trend stable	Most birds originate from private aviculturists, origins difficult to trace.
Purple-crested turaco	<i>Tauraco porphyreolophus</i>	(5) 4.5.0 (5) 5.4.0 ↔		Least concern - population trend decreasing	Very small European population size. No breeding last 12 months. Potentially larger European population held by private aviculturists.
Bare-faced go-away bird	<i>Corythaixoides personatus</i>	(4) 5.1.0 (4) 4.2.0 ↔		Least concern - population trend stable	5 wild born founders living. No breeding last 12 months.
	<i>Corythaixoides personatus leopoldi</i>	(4) 5.4.0 (3) 4.1.0 ↓			
White-bellied go-away bird	<i>Corythaixoides leucogaster</i>	(7) 11.4.0 (6) 9.2.0 ↓		Least concern - population trend stable	3 wild born founders living. Small population size - no breeding in last 12 months. Only 2 institutions with females.
Western grey plantain-eater	<i>Crinifer piscator</i>	(5) 5.4.1 (8) 13.9.0 ↑		Least concern - population trend stable	Small population size -sire & dam info generally not documented on ISIS, difficult to trace pedigree.
Eastern grey plantain-eater	<i>Crinifer zonurus</i>	(1) 1.1.0 (1) 0.0.1 ↓		Least concern - population trend stable	Population Not sustainable

In-situ conservation links.

There are already established links with the red-crested turaco ESB and in-situ projects in Angola, there are several endemic avian species which are classified as endangered, that share the same habitat as the red-crested; Gabela bushshrike *Laniarius amboimensis*, Gabela Akalat *Sheppardia gabela*, Pulitzer's Longbill *Macrosphenus pulitzeri*, and Monteiro's Bushshrike *Malaconous monteiri*.

Work is underway to try to get red-crested turaco officially recognised as the National bird of Angola, with the potential for this species to become an important emblem for all future avian conservation in Angola.

In 2010 several red-crested turaco holders raised funds towards a survey of the wild population in the Kumbira Forest, Gabela, Angola led by Michael Mills. A total of £2250 was raised by holders and used to purchase a vehicle for future field work. Aimy Caceres is currently doing a PhD at the Centre of Biodiversity and Genetic Resources (CIBIO) of the University of Porto, Portugal, is using the vehicle whilst doing her PHD in Angola studying the effects of deforestation and forest degradation in the endemic birds of the central Angolan Scarp. The findings from the PhD may well establish the need for further conservation work in this area.

There are already conservation actions proposed by BirdLife International for the Fischer's turaco including; population surveys, monitoring rates of habitat loss and trapping, increasing the number of protected areas and creating plantations as a source of firewood. There are certainly many opportunities for EAZA members to get involved and contribute towards in situ conservation.

For the Bannerman's turaco, (the most endangered of the turaco) Birdlife International already has some conservation actions underway, but more is needed, they have proposed various other conservation actions including; Conduct surveys to improve knowledge about the species population size. Take measures to prevent forest fires (F. Maisels *in litt.* 1998) and educate communities about the magnitude of the forest fire problem (F. Maisels *in litt.* 1998). Protect as many as possible of the remaining forest fragments in the Bamenda Highlands (J. DeMarco *in litt.* 2000). Develop strategies for restoring larger blocks of natural forest and connecting corridors (J. DeMarco *in litt.* 2000) and establish captive breeding populations to assist in the recolonization of areas and the supplementation of existing populations.

Again all of the above offer opportunities for EAZA member involvement; utilising the birds we have in captivity as ambassadors to raise awareness and funding towards the proposed projects. But where we could excel would be to share our knowledge and experiences of captive husbandry to help establish an in-situ captive breeding population as and when this proposal comes into fruition.

Large multiple species immersive exhibits

Several institutions have begun holding single sexed groups of turaco species in large mixed species exhibits. The red-crested turaco ESB holder has taken this opportunity to monitor these situations to ascertain if this is a possible tool that can be utilised for any surplus birds.

Whilst there is little known about the wild habits of red-crested turaco, it is presumed they are similar to other forest turaco species; quite territorial and not very gregarious. Generally, in captivity breeding birds for this species are kept in pairs, any other long term dynamic would almost certainly lead to aggression.

Whilst there is not yet enough data to fully analyse how feasible holding single sexed groups of this species may be long term it does appear that introducing new turaco to an established group almost certainly does not work. Setting up single sexed groups that could be added to at a later date would not be advisable.

We need to continue to monitor behaviour and mortality rates of single sex groups before confirming whether this can be employed as a management tool for surplus individuals. From a visitor perspective it could certainly be an impressive vista and one that may inspire further interest in this species.

2.6 HANDLING

2.6.1 Individual Identification and Sexing

With the exception of white-bellied go-away-birds, turaco species are not sexually dimorphic; the only ways positively to sex turaco species are via non-invasive DNA sexing, either through toenail clippings or from feathers (the option frequently used), or through surgical sexing.

Identifiers used are microchips - can be inserted into the pectoral muscle tissue, or under the skin over the L scapula. Closed rings can be placed on the chicks at approximately 3 weeks of age, ring size S for white-cheeked, Hartlaub's, Fischer's, Schalow's, red-crested, purple-crested and green-crested, size T for violaceous and Lady Ross.

Alternatively split plastic or metal rings can be used and fitted at any age. Different coloured rings can allow identification of individuals from a distance.

2.6.2 General Handling

As with all bird species care must be taken whenever handling a turaco. A firm grip with two hands is recommended; they will struggle but take care not to hold too tightly.

Hold the wings firmly to the body of the turaco. When stressed turaco will regurgitate food, do not obstruct the beak or hold the bird on its back, if the bird is not able to expel the food material there is a risk of asphyxia.

2.6.3 Catching/Restraining

Catching turaco in a small enclosure is best done using soft catching nets, as turaco are quite clumsy fliers they are relatively easy to predict and catch mid-flight.

In a large mixed exhibit a catching cage can be used. By placing food inside a cage close to the normal feeding station, birds can be encouraged to enter, using a pulley system the door can be closed from a distance by a patiently waiting keeper. This can take time to achieve, but if the cage is a permanent fixture the birds will become conditioned to entering the cage, making the process more routine and quicker.

Anaesthetic protocol – Same as for other bird species. Careful manual restraint of the bird, using a mask and membrane attachment to the anaesthetic circuit. 2 litres/min oxygen flow with either isoflurane (4-5%) or sevoflurane (8%) induction. After induction, if the procedure is likely to be more than a few minutes, routine endotracheal intubation is carried out. Maintenance of anaesthesia is isoflurane (1-3%). On recovery, volatile anaesthetic agent is switched off and pure oxygen maintained until recovery.

A short interval of fasting is recommended before any anaesthetic, this will reduce the risk of inhalation of regurgitated food, and a 4 hour fasting period should be sufficient.

2.6.4 Transportation

For short journeys (in-house moves from aviary to aviary) a sky kennel or cardboard box can be used. Cover the container to keep the bird in the dark, but ensure there is still adequate ventilation (especially important in hot weather). Do not place the container in any draughts. Always crate individuals separately as stressed birds can become aggressive.

For longer car journeys follow the above routines but also place a perch in the crate. Foam attached to the roof of the crate will prevent any damage to the head if the bird panics and newspaper can be used as a substrate for the floor of the crate. If travelling in hot weather make sure that the vehicle is air conditioned. Food and water must be provided if the journey time exceeds 12 hours.

For journeys by air the IATA Live Animal Regulations must be adhered to. In the 31st edition container 11E (pages 176-183) is required.

2.6.5 Safety

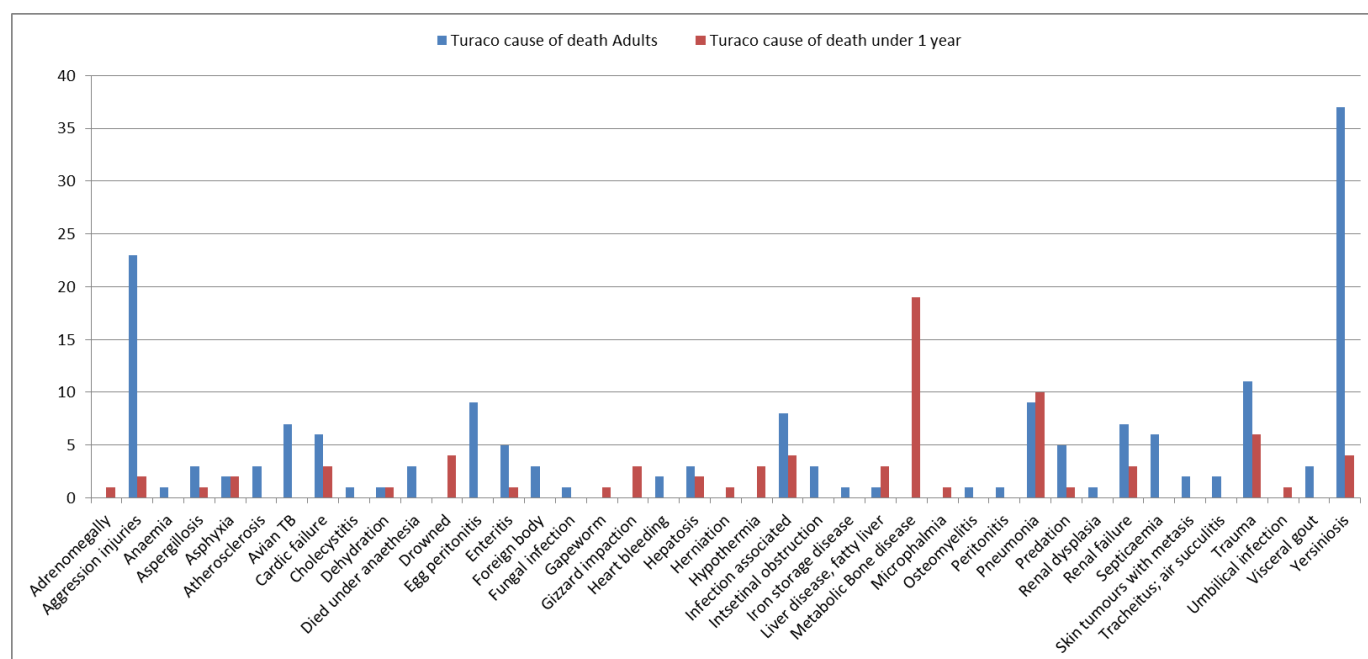
As with all bird species there are risks of zoonotic diseases, to date I have no information of an instance of this relating to turaco species and with good working practices and protocols any risks can be dramatically reduced. Good hygiene regimes should be practised in enclosures along with thorough personal hygiene routines. Routine faecal screening of birds can pre-empt any health issues.

Hand reared birds when placed back into an aviary situation and paired can become quite aggressive towards keepers, flying at and brushing against keeper's faces. Take extra care when working around these birds and protect your eyes.

Enclosure escape – in the event of an escaped individual, provided the individual is not being harassed and they can see and hear other turaco species, escapees do not tend to venture too far out of the area. One documented case of an individual being at liberty for two weeks, feeding from local fruiting trees, constantly came back and sat on top of the enclosure calling to its mate. Food was placed in a live trap on top of the aviary daily and eventually when the fruiting trees had lost their appeal the individual was safely re-captured.

2.7 HEALTH & WELFARE

The following chart has been taken from a list of necropsy findings that have been gathered over many years for several captive turaco species. This is by no means a definitive list, but is useful to help establish the more common causes of mortality for this family and help us to better understand what aspects of husbandry we need to be improving. Further research is required to better establish which areas should be prioritised for study, but until that is in place the limited data set below can at least give us a starting point.



From the data in the above chart the five most common causes of death for turaco over 1 year of age are as follows;

1. Yersiniosis
2. Aggression injuries (mate aggression)
3. Trauma (including night fright)
4. Pneumonia
5. Egg binding/egg peritonitis

The five most common causes of death for turaco under 1 year of age are;

1. Metabolic bone disease
2. Pneumonia
3. Trauma – generally chicks thrown out of nests or fledglings attacked by exhibit mates.
4. Infection associated
5. Drowned – generally fledglings

Yersiniosis - or *Yersinia pseudotuberculosis* is a gram-negative bacterium that can cause tuberculosis-like symptoms and has virulence factors, allowing the bacterium to live as a parasite in the host. It is spread through the faeces of rodents and wild birds - both of which can contaminate food and water. It can infect humans zoonotically so personal hygiene precautions must be taken.

Yersiniosis is a significant cause of death in both toucans and turacos. Acute disease – from infection to death within 24 hours. Very difficult to treat as such a small window of opportunity.

Symptoms include dehydration, lethargy, diarrhoea, laboured breathing, weight loss, resulting in death which can occur quite rapidly giving little chance for treatment to be administered or enough time for them to work. If symptoms are noticed early enough treatment with antibiotics can be effective, however prevention through good husbandry practice is the best course of action. Always ensure that food and water dishes are under cover and off of the floor out of reach of rodents. Wherever possible when building new aviaries, design them to keep out wild birds and rodents.

From the data set above turaco species appear to be highly susceptible to Yersiniosis and should be a priority area to study. As mentioned previously in section 2.2 Feeding (page 24) there are theories that improvements to diet by feeding low sugar/high fibre diets may create a gram-positive gut flora that may reduce susceptibility to Yersinia.

Mate aggression - Turaco species are notorious for mate aggression in captivity; some species are considered more problematic than others; Hartlaub's, Livingston's etc. There is an absence of information about the causes of mate aggression, a situation which needs addressing.

Other than aggression during introductions, there appears to be two specific types of mate aggression; breeding season aggression and out of season aggression.

Breeding season aggression is by far the most common and the area which requires the most attention, why are certain species/individuals more prone than others? Generally the one commonality is the drive to procreate; the aggression is mostly led by the male towards the female and can occur either pre or post egg laying, whilst chicks are still in the nest or after chicks have fledged. It would be easy to assume that generally aggression levels are heightened when the female is not receptive to advances.

Key points to consider if faced with breeding season aggression;

- Pairing to young – Pairing a mature individual with an immature individual could lead to frustration and possible aggression.
- Pairing un-socialised individuals – hand-reared birds, or birds held by themselves for too long a period can be difficult to introduce to another bird.
- Physically fit birds – make sure they are equally fit and in the best possible condition before the start of the season.
- Diet – does this provide the right amount of energy for activity, and breeding condition? – How important are the shades of plumage colour to indicate health and physical attraction to each other? Is diet affecting hormone levels?
- Husbandry – provision of appropriate nest sites, perching and cover.

Out of season aggression, appears less common but generally more frustrating, a pair of birds could have been together for years and breeding successfully with no signs of aggression and then suddenly for no apparent reason the aggression starts. The aggression can be from either gender and can be quite vicious and if not caught in time result in death. In a small number of cases that have been investigated, on necropsy the victims had long-term health issues that would have brought about the eventual demise of the individual. More thorough study is required to build up a larger sample size of data for analysis

Trauma – There are several cases described as trauma relating to night fright for adult specimens. Turaco species are easily alarmed; they will panic and blindly take flight when disturbed. There is very little that can be put in place to prevent this behaviour from occurring other than to recommend some form of night lighting for enclosures.

There can be many circumstances as to why a young chick would be thrown out of the nest, chicks not thriving as a result of parental inexperience or health issues, nest disturbance etc. Autopsy results may give some constructive insight and aid in any husbandry changes.

The most hazardous period for chicks through their development is on the point of fledging. Chicks will start exploring their surroundings and leave the safety of the nest before they are capable of flying. They are extremely clumsy and will quite often fall to the floor attracting interest from other species in the exhibit. In extreme cases this can result in aggression towards the fledgling and possible mortalities. Equally, open bodies of water are potential death traps for clumsy fledglings.

Preparation is key to minimising any threats to newly fledged birds. Ensuring any open bodies of water near to the nest site are drained, and putting a natural ladder from the ground up to the nest site so that fledglings are able to clamber back up to the safety of the nest.

Pneumonia - an infection of the lungs that is caused by bacteria, viruses, fungi, or parasites. It is characterized primarily by inflammation of the alveoli in the lungs or by alveoli that are filled with fluid.

Symptoms include; respiratory distress, accelerated breathing, vocal changes, abnormal droppings, emaciation, regurgitation, poor appetite, diarrhoea, anorexia, increased thirst and nasal discharge.

Egg binding/egg peritonitis - The difficulty is identifying the problem especially in large mixed species aviaries as you may not always be aware of where birds are nesting.

There are multiple causes of egg binding; a malformed or large egg, if the bird is in poor physical condition caused by illness, stress, calcium deficiency, or over-weight. To treat the bird place in a dark, quiet, warm and humid area, if the egg has not been passed after a few hours seek veterinary help, they may be able to remove the egg with gentle massage and lubrication.

Egg peritonitis is when the peritoneum (the lining of the abdomen) becomes inflamed due to an infection from bacteria. Peritonitis can occur after prolapse or when yolk goes into the abdominal cavity, instead of going down the oviduct and out in the normal way.

Metabolic bone disease/splayed legs.

An umbrella term for many disorders (e.g. rickets, osteoporosis, hypocalcaemia etc.) that results in severe crippling or death when not identified early. It can be caused by calcium deficiency, excess or a poor calcium/phosphorus ratio. This issue can affect turaco chicks during development.

MBD can occur in both parent reared and artificially reared turaco. In the past it was much more prevalent in hand-reared birds, but since the demise of the paw-paw / pinkie hand-rearing diet it is less widespread. Pinkies are low in calcium and high in protein, resulting in rapid growth of chicks without the adequate levels of calcium needed for proper bone development.

There are still occasional problems with leg splaying in turaco chicks and if not identified early can result in fatalities. This is preventable in most cases by ensuring that the correct substrates are used to line the nests, both with parent and artificially reared chicks. Avoid items which can potentially trap their legs and excessively slippery surfaces on which they cannot gain a purchase. For parent-reared chicks pieces of carpet can be used to line the nests, this should be discarded after each clutch and the nest re-lined with fresh material. Astro-turf has recently been used for hand-reared chicks with great success. This is an easy material to keep clean and offers the chick much better purchase.

Another difficulty is over-feeding when hand-rearing chicks; turaco do not have a crop so visually it is difficult to judge the correct amounts to feed, it is always wise to weigh feeds out to avoid over-feeding and growth spurts.

Obviously in the case of parent-reared chicks we have much less control over what happens to them. Having said that, leg deformities with parent-reared turaco are infrequent. It is difficult to monitor what the chicks are being fed and even more so in a mixed aviary situation where multiple food items are available. Whether this is as a result of inexperienced birds or weak chick's remains to be seen.

Drowning

Turaco chicks leave the nest well before they are able to fly, at this stage they are clumsy and become stressed and panicked easily. Open bodies of water in an aviary may well result in fledgling deaths. Where possible, emptying pools and ponds for the first week of fledging would be advised. Where this is not possible, ensuring there are plenty of shallow areas or ladders that a fledgling can jump onto and scramble out is highly recommended.

Parasites

Turaco species do not appear to have many problems with internal parasites. As it is difficult regularly to examine individuals especially in large mixed aviaries, twice annual precautionary de-worming treatments are advised and should be carried out in conjunction with faecal parasitology screening; this way you can reduce the occurrence of any potential problems. It is recommended that treatments are given before and after the main breeding season.

Genetic deformities

There have been two documented cases of congenital defects in turaco species, a private aviculturist in America, hatched a lady Ross's turaco that lacked a tongue, subsequent fully developed embryo's from the same parents which failed to hatch lacked an eye and also lacked a tongue and adjacent structures. (Johnston G). Both parents have in their lineage at the P generation the same female founder bird. Additionally, at the F2 generation on the dam's side, the male was backcrossed to his own mother. (Johnston G).

Microphthalmia

In 2010 there were two pairs of red-crested turaco which produced chicks with varying degrees of microphthalmia (small eyes), after investigation it was suspected that recessive alleles were responsible.

The two pairs were stopped from any further breeding and since then no new cases have been reported. Research is still on-going, with the potential in the near future to identify the genetic basis of this

phenotype, with a view to removing all individuals carrying disease alleles from the current captive breeding population.

Although occurrences of these defects are relatively rare it is important to remain vigilant for any new incidences, always check embryo's which fail to hatch, photograph and preserve any specimens which appear to have defects and report to the TAG. Whilst we know most populations of turaco have very small founder numbers, it is very important that we manage any individuals that carry faulty alleles and remove them from the breeding population to maintain the genetic health of our captive populations.

Iron storage disease myth or fact?

Turaco species are often referred to as being overly susceptible to hemochromatosis or iron storage disease (ISD); occasionally they are lumped together with toucan species. Whilst it has been proven that the family *Ramphastidae* are highly susceptible to ISD, there is very little literature or evidence to prove that turaco are any more prone to ISD than any other animal. After an extensive search over several years only one documented case has been found; a post mortem paper published by ZSL vets in 1983 regarding four imported grey go-away birds that succumbed to the disease.

Of the thousands of turaco held in captivity over the last few decades you would expect there to be much more evidence to prove the case if they are indeed highly susceptible to ISD, regardless of advances in nutrition in the last decade or so, you would still anticipate some degree of evidence if only anecdotal. Certainly in the case of *Yersinia* there is no doubt, there is plenty of evidence to support that this is by far and away the biggest captive health issue for turaco both historically and currently.

Whilst the TAG is not suggesting that we should now take turaco off low iron diets, it is suggesting that health threats are put into perspective and that we concentrate our efforts trying to improve our knowledge and advance our husbandry techniques to resolving issues with both *Yersinia* and mate aggression, the two largest risks to our captive turaco.

III Health: behavioural indicators	
Lethargy	Birds are very good in masking a disease, usually when a bird is lethargic and staff can easily approach him – this is an end stage of a disease. Lethargy can be a symptom of CNS injury eg. after hitting the window.
Fluffed up	Hypothermia, non-specific. Occurs when bird is undergoing an infection or infestation – birds can't have fever and when fighting a disease will "shift" energy by saving body heat. If that is not environmental (too low temperatures in enclosure) provide an additional heat source eg. reptile heating lamp.
Wasting	Loss of weight may indicate Aspergilosis, fungal diseases or a GI tract, parasites, chronic bacterial diseases (including TB and <i>Yersiniosis</i>), liver insufficiency, metabolic diseases etc.
Sneezing	Infections (bacterial, fungal) of upper respiratory tract, sinus infections, gapeworm infection
Rapid breathing	Stress, fungal and bacterial diseases of respiratory tract, shock, also when peritonitis occurs (egg bounding), gapeworm

2.8 CONTACT ADDRESSES

DNA Feather Sexing

AVIAN BIOTECH website <http://www.animalgenetics.eu>

Mount Charles Rd., St. Austell Cornwall, PL25 3LB. England

- Telephone: 44 (0)1726247788
- Email: info@animalgenetics.eu

IATA Live Animals Regulations.

Available from Freight Merchandising Services, website www.fmslondon.co.uk

Unit 19, Shield Road,

Ashford Industrial Estate,

Ashford, Middlesex. TW15 1AU

England

Tel: 01784 240840 Fax: 01784 248615

International Turaco Society

Website www.turacos.org

Chairman David Jones

E-mail: david@turacos.org

2.9 RECOMMENDED RESEARCH

Nutrition	More research required into nutritional requirements of turaco to help improve health, longevity and production.
Mate aggression	What factors trigger mate aggression? Individual health, a lack of socialising, feather colour and or condition, environmental stresses, age/maturity differences, hormonal?
Juvenile care	Does the way we manage young birds influence their future? Are there ways to improve management of juveniles that will improve productivity as an adult? What effect does crèche management have on individuals?
Single sex groups	Investigate if holding birds in single sexed groups in large mixed species exhibits will work long term – start to compile husbandry information based on experiences and investigate mortality rates

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SECTION 4. Appendices.

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