

## **DRAFT**

### **Toucan Husbandry Manual for the AZA Piciformes TAG**

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#### **1. ACQUISITION AND ACCLIMATIZATION**

*Status of the wild population* - Despite what most people believe, only 10 of the 41 ramphastid species/subspecies currently have any conservation status at all. None of them is Appendix I or Endangered, but 6 are Appendix II, and the remaining 4 are Appendix III. Does this mean that we do not have to be concerned about our relatively dismal captive breeding record and seemingly unlimited appetite for wild-caught birds? While no toucan species is known to be facing extirpation in the wild, it is a well-known fact that they, like virtually all other groups of birds, are becoming increasingly difficult and expensive to obtain from the wild. Even if that were not the case, we have a moral obligation to make the best use of the wild-caught birds that we already have in captivity. Indeed, the primary goal of this workshop is to point us down the road towards a captive self-sustaining population for select members of this important family of birds.

*Status of the captive population* - While nearly half of the 41 species have been bred at one time or another in captivity, there has been precious little sustained, predictable, multi-generation breeding at *any* location, including Riverbanks Zoo. This is particularly true with the larger *Ramphastos* genus. Historically, most breeding pairs of large toucans have produced offspring for only a single year before disaster strikes one or both parents, and production comes to an end. Ironically, if an institution is fortunate enough to keep a single pair of birds going long enough to breed multiple times - as we have been able to do recently with a pair of both Toco and Keel-billed toucans - it is extremely difficult to find unrelated candidates to pair with their offspring. Very few locations breed these birds on a regular basis.

*Sources of birds & acclimatization procedures* - Most imported birds tend to be quite tame and acclimated to humans. We believe this can be attributed to the fact that a majority of them were collected from the nest cavity and hand raised. Although this tameness unfortunately makes them more attractive to the general public as pets, it probably eases their behavioral adjustment to life in captivity. Ironically - and contrary to what one might expect - parent-reared captive raised ramphastids can be extremely nervous and flighty.

*Feeding wild caught birds, getting newly acquired birds onto captive diet* - A major downside to acquisition of imported ramphastids is that one has no idea what they have been fed since capture. Only a few months on an iron-rich diet is sufficient time to cause permanent damage to their liver. Excessive iron accumulation in the liver (AKA iron storage disease, or hemosiderosis) will be addressed later.

#### **2. HOUSING, ENCLOSURE, & ENVIRONMENTAL REQUIREMENTS**

*Temperature / humidity* - Although many species of ramphastids are native to tropical lowlands, there are some - the mountain toucans (*Andigena* spp.) - that routinely encounter near-freezing temperatures. Over the years, we have found that our ramphastids can endure overnight temperatures around 20° Fahrenheit with no ill effects, assuming four important caveats:

1. They must be in excellent physical condition.
2. They must be sheltered from strong winds (*See Shelter section below*).
3. They must have access to a modest heat source.

4. The daytime temperature should not stay below freezing.

Cold rain with temperatures in the mid-thirties is much more of a threat to their well-being than a dry, cold night.

*Natural light* – With the genus *Ramphastos*, natural light is virtually essential to maintain good condition and thus encourage breeding. With the toucanets and aracarís, natural light seems to be less important, since several species have been bred without it.

*Water quality*- Most wild ramphastids rarely descend to the ground. Some field researchers have speculated that these birds frequently drink rainwater trapped in the crotch of a tree. Since the water is often heavily stained by tannins from the bark of the tree, there has been some further speculation that these compounds help reduce iron absorption and thus the incidence of iron storage disease. Riverbanks has completed data collection in a study on the efficacy of tea in reducing iron absorption in European starlings. At this time, the analysis and write up is still pending.

*Air filtration* – This is of course an issue only for birds kept indoors. No special filter media (as with penguins, for instance) are required, although as previously mentioned, large ramphastids almost never breed indoors.

*Sewer, waste disposal* – Because of the large amount of fruit contained in a typical diet, the floor and water pool of any ramphastid enclosure should be cleaned thoroughly on a daily basis.

Ideally, the floor should be a well-drained concrete slab. Since these birds spend very little time on the ground, a smooth, easily cleaned surface is the most practical. Nevertheless, in a display situation, aesthetic issues may dictate a soil substrate. In that case, good drainage is essential. Standing water should never be tolerated, since it provides a breeding ground for bacterial and fungal organisms.

#### **Quarantine (isolation) cage set-up**

Quarantine or hospitalization is likely to be one of the most stressful and dangerous times of a bird's life. Reducing that stress by providing a suitable environment will help protect against common ramphastid problems such as bill damage and internal parasites like *Capillaria* and *Coccidia*. The following is adequate only for short-term accommodation of up to 8 weeks.

#### **Wire mesh**

The ideal material for any toucan cage is ZooMesh™ see above, General housing considerations. ZooMesh™ is a non-rigid, cloth-like, material which prevents beak damage if the birds accidentally fly into it. However, in a small (quarantine) cage, a bird is unlikely to develop the speed achieved in a large aviary; and in practice, a standard welded mesh such as 1 inch x 1 inch or ½ inch x 2 inches is suitable. See below, Seclusion.

#### **Cage size**

Many specimens are nervous and therefore need an aviary that is long enough for them to retreat into if they perceive danger. In practice, quarantine cages are unlikely to be perfect, although for short periods, such as 4 – 8 weeks for quarantine or hospitalization, they can be made adequate.

The minimum dimensions suggested for a ramphastid hospital / quarantine cage are 2 feet wide x 6 feet long x 6 feet high (50 cm wide x 1.8 m long x 1.8 m high). For aracarís and toucanets, this space would be comfortable. For large (*Ramphastos*) species such as the toco, keel-billed and chestnut-mandibled toucans, it would be ideal to use a longer cage. However, if the bird is calm, even this small space is acceptable for short periods of time.

#### **Seclusion**

Toucans are comparatively nervous and clumsy birds that can injure themselves in a small aviary. This is particular so with the larger species. The aviary should be located where people are unable or unlikely to approach from the side. It will be designed with the door at the narrow (2 feet) end which will allow the bird to fly the maximum distance (6 feet) away from people servicing it.

The aviary can be secluded and made more calming for the bird by wrapping an opaque material around it such as burlap or black plastic sheeting. Burlap or a similar material can also be draped over the aviary door to help prevent the bird from escaping when the door is opened. Branches or leaves can be fixed on the wire within the aviary to help create a more natural environment, but they should be minimized to ensure that the bird can fly unhindered.

#### Substrate and perching

The floor of the quarantine aviary should be quick and easy to thoroughly sanitize so as to disturb the birds for the minimum period. Smooth concrete that slopes to a drain is preferable. Disposable floor coverings such as newspaper can also be used, although they are more awkward to replace and can therefore cause more disturbance to the bird.

For quarantine, it is important to provide toucans with very simple, straight perches that they can easily negotiate: minimum diameter of 1 inch (2.5 cm); maximum diameter of 2.5 inches (6.25 cm). Complex arrangements of branches and twigs are not necessary. Indeed, they get in the way when one is trying to catch the bird for examinations etc., making the process unnecessarily prolonged and stressful for the bird.

Perches should be made of natural, bark-covered wood, rather than smooth wood such as a dowel. The uneven surfaces of bark are healthier for the birds' feet. The toucan's beak is also kept in good condition, free of dirt and food, as the bird rubs it against the bark after feeding and bathing. One perch should be securely fixed at the front of the aviary approximately 18 inches (45 cm) below the roof, depending somewhat on the species of toucan. And one perch should be fixed at the back of the aviary, slightly higher above the ground than the front perch. When frightened, the bird will then be able to retreat to the back of the aviary, the higher perch providing reassurance.

#### Food and water set-up

It is preferable to provide food and water pans that are raised above the ground, and secured in racks/brackets to the side of the cage. They should be located near the perch at the front of the aviary, close to the door, so they can be serviced with the minimum of disturbance to the bird. Locating the pans at perch level will make it easier for the bird to reach the food. This is important for specimens that have damaged or spoiled flight feathers (such as newly imported birds) that may find it difficult or impossible to reach food located on the aviary floor.

#### Misting and bathing

For birds that are in good condition, an additional water dish on the floor of the aviary may encourage bathing and further improvements in overall condition. For all toucan species, the water dish should be a minimum of 10 inches x 8 inches (25 cm x 20 cm). (see Nutrition/Drinking Water below.)

Toucans may be misted carefully from a water hose or a plant sprayer, raining fine water droplets down onto them. For a bird that is in good health (lively, feeding well, active and bites hard), this will enhance its physical and emotional condition. Since quarantine aviaries do not usually have access to direct sunlight, the bird should be rained upon for only about 2 seconds to prevent it from getting cold; and it should be misted only once or twice a week.

If the bird is in poor condition, wetting it will make things worse and should be avoided. *Consult with the zoo's veterinarian before misting any newly arrived toucans.*

#### Lighting

Natural lighting is not necessary in the quarantine environment. Bright, artificial light is sufficient and should be set on a timer to provide 12 – 13 hours of illumination. Dim lighting should be provided during the night to act as a night-light (equivalent to moonlight).

### Special needs

Because toucans are rarely bred, we are less familiar with the soft nature of the young bird's beak. Up to about 4 months of age, the toucan's beak is easily, and on the whole permanently, damaged by anything that assaults it. If a young bird is being moved to any type of new aviary – large or small – think carefully about the hard surfaces and the size of the mesh openings that it might encounter. Likely impact points are areas of exposed mesh on the sides of the aviary, especially exposed wire mesh at the top of a side panel (not the roof, but the side wall). When panicked, the bird will fly high and fast, and not recognize the mesh as a barrier until it is too late. Parent-reared toucans are obviously more likely to be nervous in a new enclosure than birds that have been partly/completely hand reared. For such new arrivals, it may therefore be a good idea to carpet dangerous surfaces, and generally pad as much of the enclosure as possible.

Toucans that have been hand reared are obviously much calmer than parent reared birds and need little, if any, modifications to their aviary to protect against bill damage. At Riverbanks, we have found that toucans hand reared from about 3 weeks of age, mature into birds that are both calm and successful breeders. Being hand reared appears to make no difference to their ability to breed and rear chicks.

### **Breeding Enclosure Setup**

#### *Enclosure Size –*

1. For toucanets and aracarís, a floor area of only 50 ft<sup>2</sup> is perfectly adequate. We think the minimum height should be 8 feet.
2. For the larger ramphastids, like Keel-billed toucans, minimum floor area should be around 200 ft<sup>2</sup>, but the long dimension must be at least 20 ft. For Tocos, the long dimension should be no less than 25 ft. Again, we think the minimum height should be 8 feet. In a display or exhibit situation, more height is always desirable to provide privacy.



ZooMesh covered breeding aviary

During the breeding season, males of the large species may become quite aggressive towards the females. Vigorous bouts of “bill fencing” and chasing are common. If the male is particularly persistent, the female may need a “hide box” or heavily planted area where she can escape his attentions. We actually lost a breeding female Toco toucan to stress and physical injury inflicted by her mate in just such a situation. As with other types of birds, if the male comes into breeding condition prior to his mate, the female can be put at grave risk. There is a very fine line between normal “jousting” and potentially injurious pursuit.

*Containment barriers* – Welded wire mesh is certainly the most common containment barrier for enclosures. In the case of ramphastids, the wire size openings are critically important. After many years of experience holding and breeding ramphastids in a multitude of enclosures covered with this material, we have reached the conclusion that it is not acceptable.

Anyone who works with ramphastids (and hornbills, for that matter) should be aware that, despite its durable appearance, their beak is extremely vulnerable to damage. Indeed, in the case of the toucans it consists only of a thin keratin shell surrounding spongy, blood-filled tissue. As evidence of this fact, we have all seen many captive toucans with part of their upper or lower mandible missing. Even within the confines of a “Sky Kennel” shipping crate, it is possible for severe, irreparable damage to occur if the bill is jammed through the holes in the welded wire door.

Young ramphastids that have just fledged are at even greater risk. The keratin layer covering their mandibles is soft and eminently damageable. As mentioned above, having been parent-reared, they are likely to be extremely nervous, and quite clumsy as well. If frightened or chased, they will fly headlong into any enclosure barrier. When this barrier is rigid welded wire of *any size opening*, it will invariably result in damage to the upper - and sometimes lower - mandible as well.

We have found Zoomesh™ to be a far better barrier material for several reasons:

1. It is resilient, and does little or no damage to the beak even when a collision occurs at full speed.
2. It excludes snakes, mice, rats, and other vermin.
3. It is almost invisible when painted flat black.

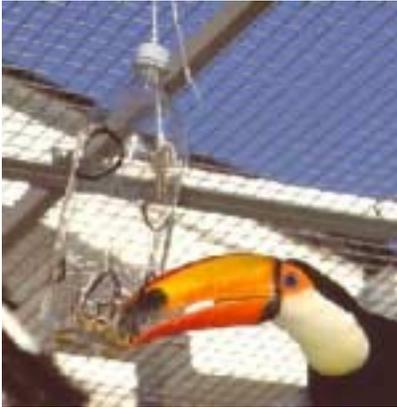
As a solid barrier, glass does not represent the same “penetration” hazard as welded wire mesh, but it can still cause severe beak and head trauma if impacted. High-tension (piano) wire probably represents the second best alternative, although there is still ample risk of impact injury with this medium. Additionally, piano wire is very expensive from an engineering standpoint and impractical for use around all four sides of an enclosure.

*Capture and handling systems* – We have never utilized dedicated shift or trap cages to manage our ramphastids at Riverbanks. These heavy-bodied birds tend to fly in a relatively straight line, and as such they are not difficult to net if you are quick-of-hand. All of our enclosures have been designed or modified to accommodate their tendency to fly into barriers and to minimize the potential for damage. However, the possibility of injury during catch-up still exists. Our policy is to catch them up only when absolutely necessary, and to minimize the time taken to do so.

*Shelter requirements* – As already stated, ramphastids are much more cold hearty than commonly thought. Nevertheless, they must have access to a sheltered space to protect them from rain, wind, and prolonged, below-freezing cold weather. We suggest roofing at least 25% of the top of the enclosure, preferably with transparent or translucent panels, to allow light penetration. Toucanets and aracarís often roost in their nest log, which should be located under a roof. The larger ramphastids do not exhibit this behavior, and in our experience they often spend the night on relatively exposed perches, as long as it is not raining. We provide “heat boxes” with thermostat/rheostat controlled 250-watt infrared heat lamps in all of our outdoor aviaries. Perhaps due to our birds’ excellent overall condition, they are rarely used.

## Enrichment program - Jay Robinson / Riverbanks Zoo

Enrichment devices have proven to be an excellent tool in combating boredom in toucans, and are particularly useful when a toucan is housed alone. Such devices are intended to encourage natural behaviors and simulate feeding techniques that they would acquire in the wild. In a planted aviary these devices also help to direct any destructive attention away from delicate plants.



Soda Bottle Device – One enrichment device is a clean, 2 liter soda bottle filled with brightly colored pellets and hung from the ceiling or a branch. When a curious toucan taps it with his beak, the device rattles. Another similar device has a set of keys dangling from the top of the bottle. Large holes are cut into the bottle just big enough for the toucan to grasp the keys with his beak. This device is very stimulating for the birds as it simulates the natural behavior of picking fruit amongst the vegetation of a tree. These bottles only work for a limited time, so they need to be removed and changed routinely by adding different colored or textured ingredients in order to maintain the birds interest.

Bamboo Feeder – Another successful device that can be made easily is a Bamboo or PVC feeder. Drill a dozen half-inch holes in a foot-long piece of Bamboo or PVC. and insert a favorite food item such as grapes or soaked Science Diet dog kibble in each hole. Hang the feeder near a perch with a small piece of rope. Once the toucans discover the item, it will not take long for them to empty it, either by whacking the device so the food items drop to the ground or dexterously removing each individual piece with their beak. This device is easily mastered, and thus should only be used occasionally.

### Mixed species exhibits

Mixed species aviaries can work with the smaller ramphastids (toucanets and aracarís) and even the larger (*Ramphastos*) species. However, such arrangements are always precarious, and become very dangerous if/when the toucans start to breed. However, if the toucans are post-reproductive, or for other reasons cannot achieve breeding condition, the outlook for the other birds in the enclosure is good.

Toucanets and aracarís can be kept with robust birds of a similar, or preferably larger, size. However, ramphastids must be matched very carefully with their companions since they will watch for an opportunity to kill or injure unsuspecting birds; and chicks of any species will be regarded as food. Small toucans could probably be accommodated with birds such as boat-billed herons, motmots, sun bitterns, and troupials.

The larger ramphastids, such as toco and keel-billed toucans, should not be kept with any other birds except very large, tough species such as seriemas and curasows. Even these combinations should only be attempted in the knowledge that the toucans will try to dominate the aviary, considerably reducing the breeding prospects of any other species. Exceptionally large enclosures, of the kind only found in a few zoos, could hold multiple pairs of ramphastids and other avian species. But again, one should not be surprised if the toucans eventually use their serrated bills and aggressive nature to prey upon the other birds. Toucans are semi-predatory. They should be accommodated with other specimens very carefully indeed, or given sole occupancy of an aviary.

#### **4. REPRODUCTION**

##### **Aggression / Setting up pairs**

It is very important that the breeding aviary is large, as described under “Housing and enclosure requirements”. Often, the male will achieve breeding condition ahead of the female, and she will need space in which to escape his aggression, especially where the large, *Ramphastos*, species are concerned. In addition to a large aviary, the female should be provided with hiding opportunities. It is suggested that the aviary be planted with at least two substantial bushes/trees. These should be of tough, evergreen, varieties such as holly, privet, or juniper, so they can tolerate having their leaves damaged or eaten by the birds.

##### **Courtship**

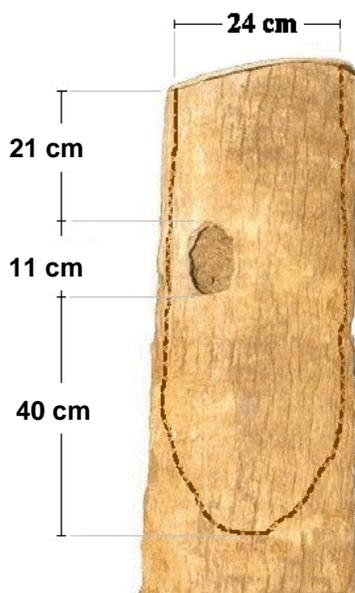
Male toucans (e.g. toco, keel-billed and green aracaris) tend to achieve breeding condition ahead of the female in a normal breeding season. Males tend to spend time in the nest log, cleaning it of the previous years debris, and generally trying to encourage the female to it. During this time, the male frequently makes a rapid gurgling sound (of frequency similar to a woodpecker), often with a favorite food item in his bill that is a gift or enticement to the female. In the diet listed below, preferred “courtship” foods are grapes and soaked Hills Canine Maintenance Kibble. The other diet items are sometimes used as offerings to the female, but only after the above foods have been depleted. Such foods tend to be given to the female immediately prior to copulation. The male holds the food item at the end of his bill, and while making his enticing (gurgling) sound, he passes the item to the female. She may swallow it or immediately pass it back to him. The male will re-present it until eaten by the female. If she remains beside the male during the feeding, copulation may follow.

##### **Bill-fencing**

Bill Fencing prior to breeding is sometimes highly vigorous to the point of being aggressive. The bill of one or both birds may even be visibly scratched after such an encounter. However, this behavior appears to be an important part of ramphastid courtship, and provided the birds have a large aviary, neither bird should come to any harm.

##### **Nest Log**

The trunks of palm trees seem to be the best nest sites for toucans, perhaps because their fibrous structure allows the birds to modify them, and to easily climb up and down them. If palm trees are not available, any other species of tree would probably be adequate. Tall plywood nest boxes have also been used successfully in Europe and by facilities such as Sea World in the United States. If a plywood nest box is used, it is strongly suggested that wire mesh or a similar material be added to the interior of the box to allow the birds to climb up and down it safely.



Trunks that have been decomposing for several years may be soft enough for the birds to excavate themselves. But normally, the most practical approach is to hollow out a palm trunk yourself using a chainsaw.

For large species such as toco and keel-billed toucans, select a length of trunk about 12 inches (30 cm) wide and 40 inches (1 m) long. Using a chainsaw, excavate the log from both ends until the interior has been cut away. Cut an entrance hole 4-5 inches in diameter (10 – 12.5 cm), located a few inches below the top of the log. Seal the cavity by screwing and gluing a disc of plywood to the top and bottom of the log. The internal cavity should be approximately 10 inches wide (25 cm), and it

should descend to anywhere from 16 – 30 inches below the entrance hole (40 cm – 75 cm). Presumably, deeper logs would be beneficial for nervous pairs; and the larger diameter chambers would help chicks remain cooler than if forced together by a narrow log. For large clutches of 4 chicks, the extra space provided by a 10 inch diameter log could be essential in preventing over-heating. For aracaris and toucanets, a slightly smaller cavity can be made.

Locate the nest log in a high, sheltered place, away from direct sun and rain. It can be helpful to leave about 12 inches (30 cm) between the top of the log and the aviary roof: toucans spend some time perching on top of the log as they start to get into breeding condition.

In the wild, toucans usually have to excavate their nest cavities in soft, rotten tree trunks. In captivity, encouraging the same behavior can help the pair to bond, somewhat, and reach breeding condition together. To give the birds the illusion that they are excavating their own cavity, in the Spring, the log can be packed with a loose mixture of mud, wood shavings and sphagnum moss. This is beneficial for new pairs, although for pairs that breed regularly, aggression seems to be comparatively low, and this device is not as important.

The breeding season is approximately April to September. One clutch is the norm for *Ramphastos* species, although a settled pair in prime condition can fledge two, or rarely 3, broods unaided in a single year. The small ramphastids are generally more prolific.

Eggs: 2-4 white; incubation about 16 days for the small species, about 18 days for the large species.

#### Air Quality

Since the 1970's, Riverbanks Zoo has kept keel-billed, toco and chestnut-mandibled toucans indoors in air-conditioned / heated exhibits. But none of these species ever bred until they were moved to aviaries outside. *Ramphastos* species can be bred indoors, but it is far more difficult. Fresh air, sun and rain seem to be important for the large species to achieve optimal health. Small species such as green aracaris, saffron toucanets and emerald toucanets, however, seem to breed regardless of whether they are inside or outside.

#### Chicks

Toucans lay their eggs in an unlined cavity; both sexes incubate, and rear the young. Chicks fledge at 5-7 weeks depending on the species, and start to look out of the nest cavity a week or so before fledging. Instead of using their feet to move around in the nest cavity, young ramphastids have interesting, ridged heel pads upon which they rest in the nest cavity. These disappear a few months after fledging.

For the first 4 – 7 days, the chicks are fed only live food by the parents. The best live food appears to be 1 inch long crickets. The crickets should be offered in a smooth sided container, fixed to a stout perch. If the container is 12 inches deep (30 cm) the crickets are unable to escape, and remain available for the parent toucans. The cricket feeder should be checked frequently and never allowed to become empty during the rearing period.

In as little as 4 days after hatching, the young toucan may start receiving other foods from its parents. One of the most favored (stage 2) foods is soaked Hills Science Canine Kibble, followed by the fruits and other pellets of the adult diet. One or 2 pinkie mice can also be provided per chick per day until the bird is self-feeding at about 10 weeks of age. It is very important to provide plenty of all of these rearing foods, although the pinkie mice should be moderated until a better understanding of iron storage disease is established.

Occasionally we have allowed Keel-billed chicks to remain in with a breeding pair through part of a subsequent breeding cycle. However, this practice would not normally be recommended.

#### Age to maturity

Captive-raised Toco toucans have laid eggs at Riverbanks when 2 years old. Keel-billed toucans have laid at 3 years. Green aracaris have been documented to lay at 1 year of age.

### **5. ARTIFICIAL INCUBATION AND HAND REARING**

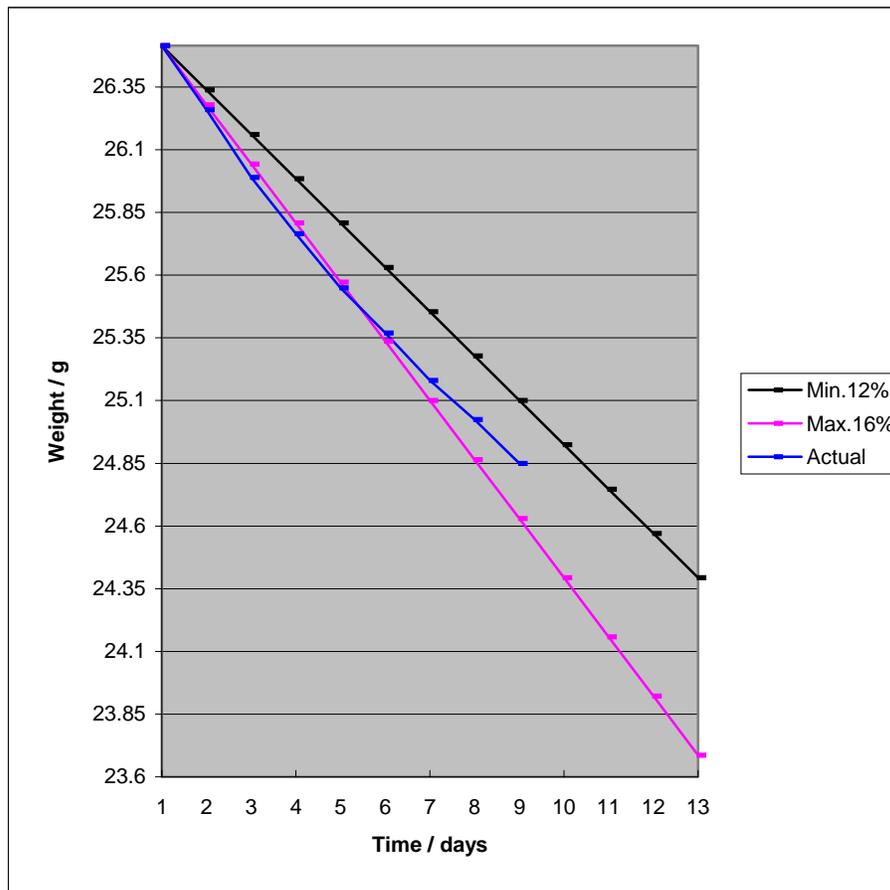
#### **Notes from Riverbanks Zoo**

A very good quality incubator, such as a Grumbach, is recommended. Eggs of the *Ramphastidae* should be incubated at 99° Fahrenheit (37.2° C) with a relative humidity of roughly 65%.

Carefully weigh the egg throughout incubation to monitor the rate of weight loss. Adjust the relative humidity to achieve a weight loss of approximately 12-16% as shown below. Set the incubator to turn the eggs frequently (such as every 1 to 2 hours).

#### Toco toucan eggs:

In this case, three toco toucan eggs were returned to the parents shortly before hatch. They had accepted dummy eggs, which in fact were their own eggs from a previously failed clutch. The eggs were artificially incubated to protect them from what seemed to be a dangerously hot and dry summer that had killed fertile eggs earlier in the season. The 3 eggs hatched with the parents and were successfully reared by them.



Day 1 to day 6 or 7:

Keep the chick on a towel surface in a small dish at 99.0° F (37.2° C). Feedings must be very small and given every 1.5-2 hours from about 7AM to 11PM. As the chick grows, the time between feeds can be increased along with the amount per feed; the chick does not need to be fed through the night. Ramphastids do not have a crop, so judging when the bird is "full" needs some care.

A 1cc syringe can be used to feed young toucan chicks. A liquidy diet such as one of the proprietary hand rearing formulas originally developed for parrots is a good source of rounded nutrition. Kaytee Exact Original Formula is a suitable product for this purpose, although any of the other major brands are likely to be equally good. The very first feed should be mostly liquid (distilled water or an oral electrolyte such as Pedialyte™) with only a very light sprinkle of Kaytee. For all of the other feeds, the Kaytee must be prepared, (and progressively thickened) according to the manufacturer's instructions. Some keepers mix a small amount of pureed fruit with the Kaytee, which probably does no harm. However, the presence or absence of the pureed fruit seems to have no effect on chick development; and one would think that it is preferable not to add pureed fruit to the proprietary product.

Weigh the chick at the same time each day, and look for a daily weight gain of 10-15%. Adjust the bird's food intake if the weight gain is less than about 6% or more than 18% for 2 consecutive days. This can be done by changing the amount per feed and/or the time interval between feeds. Over a period of several days, you should see an average daily weight gain of at least 10%, especially when the bird is older than 8 days and eating solid foods.

After each feed, it is important to clean food residue from inside and outside the chick's mouth with a small piece of moistened cloth or a Q-Tip™. If this is not done, food residue may build up and help to give rise to the fungal infection *Candida*.

*Candida* and Nystatin™

For reasons which are not clear, toucan chicks seem to be highly susceptible to *Candida* overgrowth. Death from *Candida* is common in chicks up to about 8 days of age, in spite of careful hygiene. Nystatin™ is recommended for the first 2-3 weeks to protect against *Candida*. At Riverbanks Zoo, we use Nystatin for the first 3 weeks of a chick's life: 3 times a day for the first week; twice a day for the second week; once a day for the third week. **Dose:** weight in grams ÷ 400 = dose in cc.

Day 7 onwards:

Once the young toucan is 7 or 8 days old, a transition from the liquid diet to the adult diet can be made. Very small pieces of pinkie mice, soaked Hills Science Diet Canine kibble, fruit and pellets can all be fed. It is best not to feed crickets, even though the adults use them exclusively for hatchlings. Adults pulverize the crickets, and probably coat them with their own saliva as they are often, but not always, regurgitated to the young. Hand fed crickets tend to be defecated whole and add little if anything to a balanced hand feeding diet. Indeed, they may help to cause an impaction (obstruction) in the chick's digestive system.

**Toco toucans**





Green aracari growth chart

Day	Weight / grams
1	5.8
2	7.9
3	8.5
4	9.3
5	10
6	11.4
7	14.4
8	14.5
9	14.7
10	17.2
11	20.4
12	22.7
13	25.5
14	30.9
15	34.3
16	36.1
17	40.6
18	44.6
19	48.8
20	59.6
21	65.9
22	73.9
23	80.0
24	86.5
25	91.9
26	97.6
27	101.0
28	103.1
29	107.1

30	108.9
31	110.2
32	110.3
33	115.6
34	116.5
35	121.7
36	123.9
37	124.5
38	130.0
39	122.2
40	128.5
43	Starting to eat food unaided
50	Independent and moved to aviary

### **Notes from Sea World, Orlando**

In the 80's, several toco and red-breasted toucans were hand raised at Sea World, Orlando, as well as two species of barbet. All were raised on pinkies and fruit, and several of the red-breasted chicks were raised on soaked dog food, monkey chow and fruit.

## **6. NUTRITION**

### **Feeding mixed species enclosures**

Since the ramphastids are susceptible to iron storage disease, they should only be housed with birds whose diets do not usually contain high iron foods. Housing any of the toucans with meat-eating birds (such as herons, sunbitterns and motmots) can therefore be risky in the long-term. Each exhibit should be assessed on a case-by-case basis. It may be possible to substitute the meat and fish component of the non-toucan diets with equivalent, low iron, foods such dog kibble or flamingo pellets that would be safer if eaten by the toucans. Toucans are inquisitive birds, and will eventually sample all food pans in their enclosure.

Selective food pans could be designed to prevent the large toucan bill from entering, while admitting smaller bills of bitterns and motmots for example. Carefully selected wire mesh can be fixed over the food pan to achieve this. Although such solutions can work, they are awkward to manage and imperfect depending on the species involved. It would not work for boat-billed herons for example, and generally, anything that compromises normal feeding behavior needs to be regarded carefully.

### **Number of times fed per day**

For any fruit / insect eating bird, twice daily feedings are the ideal – at the beginning and near the end of each day. This is particularly important when chicks are being reared as the parents will need to have their food replenished frequently during the day.

### **Feeding locations**

For toucans housed outdoors - that are likely to encounter rats and mice – it is essential that the food be raised at least 2 feet (60 cm) above the ground. The food pan should be fixed on a smooth pole. This will help to protect it from mice and rats which may spread disease to the birds by defecating / urinating in their food. Yersiniosis (pseudo-tuberculosis), the most serious and common toucan disease, is most likely to be introduced this way.

### **Drinking water**

A metal water pan can be placed on the aviary floor. The dimensions of the water dish should be at least 8 inches x 10 inches (20 cm x 25 cm), with a depth of water appropriate for the bird.

Due to their oversized beak, drinking from a water pan presents quite a challenge to the large ramphastids. Given the choice, toucans prefer to take rain drops from roofing and plant leaves; or

they drink from puddles on the aviary floor before using the man-made water dish. This highlights the need for thorough aviary hygiene, and especially the need for good drainage. Otherwise, aviaries with natural substrate floors can give rise to pools of dirty water, very possible mixed with wild mammal feces and urine – a perfectly deadly combination, especially for toucans.

### **Diet and feeding**

The ideal toucan diet will contain proprietary avian pellets, which provide the necessary nutrition, plus a similar amount of diced fruits, which help to make the finished diet palatable.

#### Avian pellets

A fairly large, low iron pellet should be chosen for the toucan diet and offered in the same dish as the fruits. It is highly recommended that the diet also include a tiny pellet, such as those manufactured for finches and canaries. Although this is not a common practice for birds as large as toucans, it is beneficial because the tiny pellets stick to the fruit pieces, ensuring rounded nutrition with *every* mouthful. In climates where winter nights fall to the low 20's Fahrenheit, the need for good overall nutrition is important. Consumption of a substantial amount of (nutritious) pellets is essential for good health, breeding and longevity since the commonly used fruits are mostly water and, in themselves, not whole foods.

Examples of large pellets:

Red Apple Jungle pellets, Scenic range of pellets manufactured by Marion Zoological  
Kaytee Exact low iron pellets  
Soft bill Fare (Reliable Protein)  
Bird of Paradise Pellets (Zeigler Brothers)  
Harrison's Low Iron Maintenance Diet

Examples of small pellets:

Tropical Bits pellets, Scenic range of pellets manufactured by Marion Zoological

Dog kibble/pellets:

A measured amount of dog kibble is an important part of the diet. Many kibbles, however, are high in iron. Hills Canine Maintenance Kibble contains roughly 200 ppm of iron, although that probably varies somewhat from batch to batch. It is currently unknown how safe that level of iron is for iron-sensitive species. In practice, however, it does not seem to be detrimental at Riverbanks, and is one of the main foods fed to parent-reared chicks until about 5 weeks of age.

In the maintenance toucan diet, about 8 pieces of soaked kibble can be fed to one large (*Ramphastos*) toucan each day, depending somewhat on activity level and ambient air temperature. The dog kibble is fed to satiation when the adults are feeding chicks. See Reproduction / chicks.

**Diet** by weight; pellets and kibble measured by dry weight.

Quantities for one large *Ramphastos* toucan per day

Diced fruits, see below	315.0 g
Low iron pellets - preferably large size pellets such as Red Apple Jungle	35.0g
Low iron pellets - preferably very small size pellets such as Tropical Bits	80.0g
Dog kibble - Hills Canine Maintenance Kibble (soaked overnight in water)	6.6g

The exact composition of the fruit mixture is probably less important than achieving some variety: at least 3 types of fruit are strongly recommended. This diet is based on apples due to

availability and price. But if cheaper fruits are regionally or seasonally available, they too can be included:

Diced fruits – quantities for one large *Ramphastos* toucan per day

195g apple

37g grapes

44g banana

39g apple (or seasonally available food)

#### Diet preparation

The fruits should be diced 1/4 – 1/3 inch in size (6 mm – 8 mm). The fruits and pellets are mixed together and offered in the same dish. A few grapes can be included since they are a favorite food, and can represent a “courtship” food item described under Breeding. Each grape should be broken in half to provide the male with more offerings for the female, and to create a surface to which the smaller pellets can adhere.

Since the pellets are hard and dry when fresh, it is beneficial to prepare the diet several hours before use - preferably the day before – so the pellets have time to absorb the fruit juices and become soft.



#### Color

Toucans can become disappointingly pale if their diet lacks the carotenes necessary for full color. The process is difficult to see because it is gradual; but after successive molts in captivity, toucans can lose the vibrancy of their red, orange and yellow feathers. The red vent feathers of the *Ramphastos* species slowly fade to an orange, and yellow feathers lose their full impact.

Natural pigment occurs in foods that are high in carotenes. The yellow carotenoid pigment is found in egg yolk and dark vegetables, while red pigment can be found in carrots, tomatoes, paprika, red peppers, sweet potatoes and red berries. It is not practical to regularly provide such foods. However, synthetic red coloring agents are available such as canthaxanthin, and synthetic yellow pigments are available from manufacturers such as Nekton. Both are needed for proper toucan coloration. Indeed, both red and yellow coloring agents are needed for the proper coloration of most of the beautiful birds seen in zoological collections.

Pellets such as Tropical Bits and Red apple Jungle already contain red and yellow carotenes, removing the need to add color foods like canthaxanthin to the diet. That, in turn, eliminates the possibility of creating unnatural plumage colorations that can be caused by over-feeding canthaxanthin.

#### Nutritional supplements

A calcium supplement is recommended, at least for the breeding season. Some of the complete Ca:P, D<sub>3</sub> supplements contain iron and may be better replaced with a lab grade calcium.

#### Nutritional toxicities

##### **Dietary Iron and Iron Storage Disease (hemosiderosis):**

Certain birds, such as toucans, seem to have evolved particularly efficient mechanisms for iron absorption and utilization. The reason for this is not clear, although it could simply be that the birds' natural foods are low in iron, and other minerals, because they tend to grow in nutrient-poor soils. The source of the iron may also be a factor. It is thought that so-called "heme" iron, from meats and animal products, may be in a more bioavailable form than iron from fruits and plants, and therefore more harmful to the bird. An excess of meat in the diet may therefore be damaging, since the natural diet is substantially fruit and low in iron, or at least low in iron bioavailability.

The captive diet should not contain meat, except possibly a small amount of pinkie mice for feeding chicks.

Most artificial diets probably provide far more iron than is available to the birds in the wild. The excess iron is stored in body tissues, particularly the liver, which is enlarged and damaged in the process. It is likely that the toucan liver starts absorbing iron from the first days of life, eventually causing hemosiderosis. Sooner or later all toucans seem to succumb to this disease, but with a low iron diet, the disease can be relegated to old age instead of being a major killer of young birds as it once was.

The current treatment for hemochromatosis is drug therapy combined with phlebotomies (blood letting) over approximately a 3 week period. This is normally a stressful treatment for a bird and tends to be a last resort.

The more one learns about iron, the more difficult it is to say definitively what "low iron" actually is. But generally, pellets at or lower than 150 ppm can be considered "low". Having said that, the toucans at Riverbanks, and other major toucan collections, have bred for many years on pellets that are approximately 200 ppm of iron. Simultaneously, iron storage disease has become a thing of the past. If you have any doubts about your current brand of food, it is well worth calling the manufacturer or having the food tested independently to determine its iron content. The cost for a laboratory analysis is usually very low indeed.

**Tea:** It is known that tannins (like those contained in ordinary tea) bind iron and other nutrients, making them unavailable to the body. It has been suggested that toucans in the wild drink from pools, or rain-filled hollows, where tannins from bark and fallen leaves leach into the water. Riverbanks Zoo routinely uses tannin (tea) in the diet, in the hope of reducing iron absorption. The efficacy of tea has not yet been studied in birds. But at worst, tea seems to be harmless, and at best it may be beneficial. A giant salt-shaker can be used to sprinkle a small amount of tea leaves directly onto the finished diet.

Tea not only binds iron, but also binds other nutrients. To prevent widespread nutrient depletion, we offer tea for one month, followed by a month without tea. This one-month-on / one-month-off

cycle is continued permanently, and hopefully finds a compromise between minimizing iron absorption and depleting the body of important nutrients.

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HEALTH ISSUES

Keith Benson D.V.M. / Riverbanks Zoo and Garden

Jan Raines D.V.M. / Dallas World Aquarium

**TO BE WRITTEN**

**7. TRANSPORT**

Shipping crate for domestic travel

The box or container should be of a size appropriate for the bird/s. It should have a perch so the bird might avoid damaging its tail. The floor should be covered with material such as Enkamat, carpet, Astro-turf or other matting. Wood shavings should be avoided because they can be kicked into the air and affect the bird's eyes or breathing.

The box should have plenty of ventilation. However, uncovered windows (of wire mesh etc) are not ideal because they can be peered into by people en-route, frightening the bird, or they can allow the bird to see activities outside the box which may also be unsettling. Toucans can be nervous travelers and are best shipped in a darkened environment. Windows on the box should be covered with an opaque, but air-permeable material such as burlap or cloth, to allow air-flow within the darkened environment. It should be partly taped down to prevent it from being pulled up en-route.

Feeding during shipment

Toucans will sometimes feed while traveling. A small dish or compartment should be installed in the corner of the box and filled with food, including an extra quantity of favorite items such as grapes and dog kibble. If food is available in the shipping crate, a water dish is not a necessary addition and is not recommended for journeys of less than 12 hours. A water dish is only likely to make a mess in the box.