

EAZA Best Practice Guidelines

Rufous-fronted Laughingthrush *Garrulax rufifrons*



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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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Summary

These guidelines aim to give basic information on the housing and husbandry requirements of the Rufous-fronted Laughingthrush. The guidelines will be based on experience acquired by Cikananga Conservation Breeding Centre (CCBC) based in West Java, Indonesia, which holds the largest population of Rufous-fronted Laughingthrush, and Prague Zoo in the Czech Republic which has successfully bred the species in the past. Most of the parameters, especially for successful housing and breeding, are based on the experience of CCBC which is located in a tropical country. Housing condition must consequently be adapted to the holding facility environment (for instance in temperate countries). These guidelines will be reviewed and adjusted in the future when more experience with the species is gained.

Rufous-fronted Laughingthrush is under-represented in captive institutions and there is an urgent need to include this species in future RCP because of its degree of endangerment, threats and rapid decline in the wild.

Although the current holding institutions are in low numbers, guidelines are needed for future holders since this species, although hardy, is difficult to breed. The breeding condition must be optimal and, considering the species status (Critically Endangered) and its under-representation in zoos, the author encourages future holders to keep the breeding pairs in off-show aviaries to enhance the chance of success.

Like other Laughingthrush species, the Rufous-fronted Laughingthrush is a social species with similar Housing and Husbandry. However, secure environment and privacy around the nest is paramount and can be achieved by visual barriers from human view (including keeper). Breeding recorded by CCTV camera above the nest provides very valuable breeding biology information without disturbing the birds, increasing significantly the chance of success.

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Section 1: Biology and Field Data

A. Biology

1.1. Taxonomy

Order:	<i>Passeriformes</i>
Family:	<i>Leiotrichidae</i>
Genus:	<i>Garrulax</i>
Species:	<i>Garrulax rufifrons</i>
Common name(s):	Rufous-fronted Laughingthrush, Javan Laughingthrush

The Rufous-fronted Laughingthrush is endemic to Java and is divided into two subspecies: *Garrulax rufifrons rufifrons* from West Java and *Garrulax rufifrons slamatensis*, found only in Mount Slamet in Central Java. They can be differentiated primarily by the colour of the throat, which is dull brown in the nominate species and strongly chestnut in *G. r. slamatensis*.



Plate 1: *Garrulax rufifrons rufifrons* (left) and *Garrulax rufifrons slamatensis* (right)

Taxonomy research is currently under progress to determine the genome of these two subspecies and determine whether they must be considered as two separate Conservation units (two different sub-species) or whether the colour of the throat is considered as a gradual cline from West Java population (grey throat) to Central Java population (Rufous throat) and,

consequently the two subspecies must be treated as a single Conservation unit. The results of the taxonomy research will be taken into account and described in future versions of the Guidelines.

1.2. Morphology

Weight

From a study of 10 adults (six males and four females, all more than two years old) carried out at Cikananga Conservation Breeding Centre (CCBC) in Java, there is no significant difference in the body weight between males and females. Both sexes (adult birds) have an average weight of 100g, with a range of 91g to 112g. When the juveniles are removed from the parents at around 2 months old, they weigh an average of 85g and reach adult weight at 4-5 months old.

Length

The morphometric data were taken in the past at Prague Zoo and other biometric researches started for the birds at CCBC. The following table shows the pooled results from the two institutions.

	Wing length	Tail length	Tarsus length	Tarsus diameter
Male	133-137mm (n=2)	120-128mm (n=2)	48.0-48.5mm (n=4)	4.9mm (n=3)
Female	132-136mm (n=3)	118-125mm (n=3)	46.0-49.0mm (n=4)	4.9mm (n=2)
Juvenile	122-126mm (n=5)	118-122mm (n=5)	-	-

Plate 2: Morphometric data available for the Rufous-fronted Laughingthrush (modified from Pithart, 2009)

Coloration

Rufous-fronted Laughingthrushes are greyish-brown with chestnut forehead and lores. *Garrulax rufifrons rufifrons* has greyish-white throat and chestnut chin while *Garrulax rufifrons slamatensis* has bright chestnut throat and chin. Underwing primary feathers have chestnut coloration (visible in flight). The bill is black and the legs are dark greyish-brown. There is no morphological difference between males and females. The iris coloration is changing over time for both sexes (see below). Juveniles are slightly darker than the adults with dark brown coloration.



Plate 3: Full view and underwing coloration of *Garrulax rufifrons rufifrons*

The iris colouration changes depending on the life stage and possibly the breeding status of the birds. A study to determine this effect is under progress at CCBC. Initial findings suggest that the iris colour is black at hatching. At around 2 months old, the iris changes to grey and becomes lighter between 2 months and 4-5 months old. The bird has a white iris from 4-5 months old until 1 year old, when it starts to change to orange (coinciding with the sexual maturity). However, variations were observed at the adult stage from dull yellow to bright yellow and bright orange. This appears to be linked with the breeding status of the bird (no difference between males and females), but the link is still unclear.



18 days old, after hatching



2 months old, grey coloration



5 months old



Adult, more than 2 years old

Plate 4: Change in the iris coloration depending on the age

The moulting pattern was studied using 15 birds at CCBC; 7 of the 11 adults moulted in March, which falls outside the breeding seasons (the birds breed from July to January in the breeding centre in Java). One pair also moulted in-between two clutches in November. Juveniles were observed having their first moult at 6 months old. Based on the experience of Prague Zoo, the birds are moulting in autumn in Western countries which coincides with the end of the breeding season (Pithart 2009). Although it looks like the moulting pattern is similar to other songbirds, the moulting description and evolution remain unclear for this species and need more assessment.

Vocalisations

The typical vocalization of the Rufous-fronted Laughingthrush is horse-like with descending regular notes “hi-hi-hi-hi”. The call lasts from 2 seconds until 6 seconds for the longest one recorded and can be repeated several times. Voice recordings are available on request to the author.

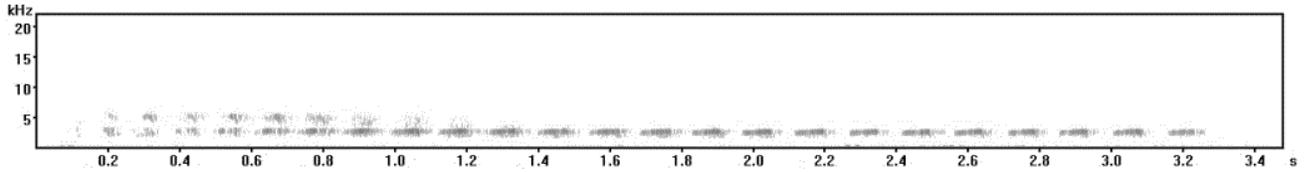


Plate 5: Spectrogram of Rufous-fronted Laughingthrush typical call (captive individual)

1.3. Physiology

The normal temperature for adults is an average of 40.8 degree Celsius (based on the record of 9 individuals in CCBC). No other physiology data are currently available for this species.

1.4. Longevity

The average life expectancy in captivity is difficult to state with rigor since not enough individuals are present in captivity and most of them were acquired at an adult stage. Currently, one institution holds 1 male that is wild-caught and is already 13 years in captivity. It cannot be said if the male is still able to breed since no female is present in this institution. To date, the oldest male to have reproduced is minimum 4 years old (wild-caught, unknown date) and the oldest female is minimum 5 years old (wild-caught, unknown date). But these numbers can not reflect the true reproductive life span of the species and future versions of these guidelines could refine the question by having more aging captive-bred birds. There is no information coming from wild population.

B. Field Data

1.5. Conservation status/Zoogeography/Ecology

The Rufous-fronted Laughingthrush is found in broadleaf evergreen forest, at an altitude of between 900m and 2500m above sea level.

Although *Garrulax rufifrons slamatensis* seems to be extremely isolated and almost extinct in the wild, few individuals from the nominate species remain in West Java. Observations occurred in Gede-Pangrango National Park where 15 individuals were recorded by the author in October 2013 and 2 birds were observed in Ciremai National Park in February 2015. Although no rigorous field survey was implemented yet, it is thought that the population should not exceed 200 birds (Birdlife International, 2016).

Recent surveys showed 15 individuals on sell in illegal markets in Java, Indonesia: 13 *Garrulax rufifrons rufifrons* and 2 *Garrulax rufifrons slamatensis*. The sudden high number of birds present in bird markets reflects the new interest of this species from traders and it is likely that the stakes of the Central Javan subspecies is critical.

Like many songbirds in Indonesia, the main threat for the Rufous-fronted Laughingthrush is intensive catching for the songbird trade.

The species is listed as Critically Endangered within the IUCN Red List (Birdlife International 2017), and no differentiation is made between the statuses of the two subspecies. The species is also protected by Indonesian law under the Wildlife Act no. 5, year 1990 and Indonesian Government Regulation no.7, year 1999.

1.6. Diet and Feeding Behaviour

Its diet is composed of invertebrates (beetles, mantids, caterpillars, locusts and weevils among others), small vertebrates (frogs and lizards), berries and various wild fruits (Collar & van Balen 2013). It normally forages in groups of up to 15 individuals (Tritto & Owen pers. obs 2013) and historically could be seen in mixed flocks, including the Javan Green Magpie *Cissa thalassina*, Javan Warbler *Phylloscopus grammiceps*, Javan Fulvetta *Alcippe pyrrhoptera*, Rufous-tailed Fantail *Rhipidura phoenicura* and Spotted Fantail *Rhipidura perlata* (Van Balen 1992). While foraging, the birds are noisy, making the typical “horse whinnying” vocalisation.

1.7. Reproduction

Only few information are available from wild populations. Rufous-fronted Laughingthrushes breed in May-June and September in West Java in a cup-shaped nest, placed in horizontal branch fork not far above the ground. Clutches are made of 2-3 bright blue eggs. No other information on sexual maturity or offspring number and survival are available (Collar et al. 2018).

1.8. Behaviour

The best information available for Rufous-fronted Laughingthrush suggests that the breeding season in the wild begins in May-June and ends in September. At CCBC in Java (same island as the wild population and in the Southern Hemisphere), the breeding season was observed to be from July to January, but only the chicks that hatched from August to December survived. Based on historical data, the Rufous-fronted Laughingthrush bred in European temperate climate in May, September and October (interspecific foster-reared for the latter).

Section 2: Management in Zoos and Aquariums

2.1. Enclosure

2.1.1. Boundary

Strong wire mesh should prevent rodents or other pests and predators from entering the aviary. A commonly used wire mesh has a grid of 1x1cm and should go for a minimum of 50cm below the ground then bend horizontally for about 30cm to act as anti-dig barrier for rodents. Rufous-fronted Laughingthrushes appear to be prone to stress. Therefore, visual barriers must be provided around the cage. In CCBC, shade netting is used to seclude the cage without impairing air circulation. Shade netting must be set up on the outside borders of the cage to prevent the birds from trapping their claws on it and getting injured. It is better to not house two pairs close to each other because of their territorial vocalizations that could impair breeding.

Visual barriers (with vegetation) must be offered to the birds inside the aviary so they can retreat from the view of the keepers and visitors to prevent the birds from becoming overly stressed.



Plate 6: Shade netting on the front of the aviary (the net is outside the aviary, along the wire mesh to prevent the birds from being trapped in it).

2.1.2. Substrate

Natural substrate is recommended to allow trees to grow and sand, grass and soil are commonly used in outside aviaries. However, they must be regularly raked, especially below

perches and favourite trees to avoid the accumulation of droppings. Natural soil can be host for parasite (especially nematodes such as *capillaria* and *syngamus*) so regular disinfection should be scheduled. A layer of concrete on the front of the aviary where the food is delivered allows better cleaning.

2.1.3. Furnishings and Maintenance

The vegetation in the aviary should be abundant in order to offer birds a chance to retreat from human view. Evergreen trees and bushes are the best to ensure that the density of the vegetation will not vary throughout the year. The back of the aviary must be furnished with perches and their position along the aviary should allow a flight corridor for the birds. Lower and leaning perches can also be added in case birds are moulting (it seems that their flight can sometimes be impaired for a couple of days) or if new fledglings are present in the aviary. Vertical perches (or small tree trunks) are recommended since this species likes to perch and hold on to vertical branches. In CCBC, evergreen trees used include Rasamala (*Altingia excels*), Ambarella (*Spondias dulcis*) and Yucca trees (Asparagaceae family). In Prague Zoo, bamboo (*Sasa palmate*, *Fargesia rufa*), yews (*Taxus baccata*), spruce from the Pinaceae family and perennial shrubs (*Lonicera nitida*) are used in the aviaries.

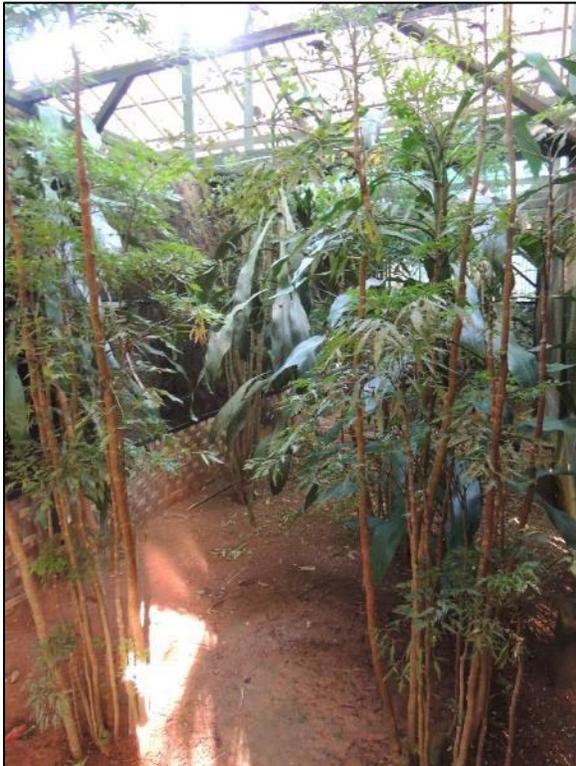


Plate 7: Example of two aviaries in the Cikananga Conservation Breeding Centre

Like any bird species kept in captivity, the feeding area must be kept clean and tidy to prevent the birds from getting diseases. The food bowls and water baths are changed daily and disinfected. Perches should be regularly changed, although regular intrusion to the back of the aviary (retreat place for the birds) could disturb them from breeding. If the birds are moving to a new aviary, it is recommended to change all the perches beforehand and disinfect the floor.

The aviary must be regularly checked for the presence of pests (rats, snakes, wild birds) that could be disease carriers, injure the birds or disturb their breeding.

During moulting or after fledgling, it should be checked that the bird can reach its food and fly. If the bird cannot fly for a number of days, leaning perches would help it to reach the highest perches.

After the breeding season, the nest should be removed as it could be dirty and infected by mites. If a basket is used as a base, it should be changed and thoroughly disinfected.

2.1.4. Environment

Although this species should be quite resistant to weather (this species is living at around 2000 meters above sea level in its natural geographical range where temperatures can drop to below 10°C), the aviary should have indoor access in temperate countries with heaters in case of harsh winter weather. However, the birds were observed in the outside aviary in the Czech Republic when the temperature was around 0°C. For breeding Rufous-fronted Laughingthrush in tropical countries, it is not necessary to have indoor aviaries, as long as they are provided with adequate shelter from rain and retreating places for the birds to hide from human view.

2.1.5. Dimensions

A pair of Rufous-fronted Laughingthrush can be housed in an outside aviary of minimum 5m long by 2.5m wide, heavily furnished to offer to the birds a place to retreat from visitors and build the nest. A minimum height of 3m is recommended as it allows the birds to perch high and feel secure. In temperate countries, an indoor accommodation should be provided so the birds can retreat from hard wind and cold temperature, although this species has been observed visiting the outside exhibit at a temperature of 0°C. The indoor accommodation is minimum 3m long by 2m wide, south facing and maintained at a temperature of about 15°C (Pithart 2009). The indoor accommodation could be furnished with simple natural nesting and cut branches of evergreen and coniferous trees.

2.2. Feeding

2.2.1. Basic Diet

Considering the small number of institutions housing Rufous-fronted Laughingthrush, to date there is no specific diet formulated. Nevertheless, the suitable diet appears to be similar to other laughingthrushes. A use of softbill/insectivore pellets with fruits, chopped eggs, vegetables and live food is appropriate. In Prague Zoo, the diet is composed of a mix of fruits and vegetables, T16 pellets for fruit-eating birds, egg mix (during the breeding season only), universal dry food for insectivorous birds, boiled rice and cooked pulses, insects (mealworms, Zophobas crickets) and mix of grains (Pithart 2009). Nutritional research in CCBC showed that on average, one individual eats 7g of pellets and between 6 to 12g of fruits.

Vitamin supplements are also given on a regular basis. In CCBC, Omnivit® and Optibreed® (Oropharma/Versele laga) are given once a week, the first one in the drinking water, the second mixed with the pellets.

When chicks are newly hatched and until they fledge, calcium supplement (mix Calci-lux/Omnivit) is sprinkled on the first feeding of the day to promote good bone development. After fledging, cuttlefish bone powder is spread in the first feeding of the day.

Live food is provided in the afternoon and is spread on the aviary floor or in a large bucket accompanied with leaves so the birds can search into it. The live food consists of crickets, mealworms, grasshoppers or other insects depending on availability. Wax moths should not be given on a daily basis because of their high fat content. An increase of live food before the breeding season will encourage the pair to breed.

2.2.2. Special Dietary Requirements

At the beginning of the breeding season the amount of insects provided to birds is increased. Different insects are offered: crickets, grasshoppers, mealworms, etc. After the first egg is laid or when the female is observed spending a lot of time in the nest, the live food should decrease significantly. One day before the estimated hatching date, the amount of insects can increase again and only live food edible to the chicks should be offered.

Different food for the chicks could be provided such as ant eggs or moulted mealworms (white). Mature, rough-skinned mealworms are preferentially avoided because of the difficulty for the chicks to digest the exoskeleton and consequently cause impaction. Some zoos had also bad experiences with living mealworms eating the digestive walls of some chicks. Wax moth larvae can also be used but in moderation considering the high fat content. Food should be delivered several times daily, starting early morning (at around 6am) until sunset. A minimum of five food

provisions per day is recommended. Around four days after hatching small crickets can be given as food for the nestlings. The crickets can be delivered in the bucket where the parents will catch and tear them apart for the chicks. Parents prefer living insects and have been observed to avoid dead crickets or dead grasshoppers (frozen live food).

2.2.3. Method of Feeding

The food (pellets, fruits) should be delivered in food bowls at a height of around 2m so the birds feel secure, especially if the food is delivered close to the entrance of the aviary (in a location that frequent disturbance from keepers could occur). If rats are an issue, the food bowl could be placed in a table mounted on a pole away from walls and trees so that rats cannot jump into it. The food is usually given daily in the morning. At CCBC the fruit is delivered in one piece and spiked on the perch, using a cut transversal branch from the perch. However, the perch must be changed regularly to prevent the deposit of fungi. If fruits are chopped into small cubes, it is recommended to check the food in the afternoon and change to two feedings per day if the food is quickly spoiled.



Plate 8: Piece of papaya spiked on the perch and food/water bowls

2.2.4. Water



Water is provided in two different ways:

- In a shallow water bowl made of ceramic, stainless steel or plastic, hang up on the mesh of the aviary or on a platform. The bowl diameter is usually small to prevent the bird to bath in it.
- In a tray made of plastic, on the floor with a water depth of few centimetres (about 5cm) where the bird will bath. Some naturalistic aviaries can also be composed of a small running stream of few centimetres depth. Attention must be paid to remove the bath tray, stop the stream or lower the depth if new fledglings are present since they can easily drown in the water the first days after fledging.

The water is changed daily and provided ad-libitum.

Plate 9: Water tray for bathing

2.3. Social Structure

2.3.1. Changing group structure

Rufous-fronted Laughingthrush is a social bird that lives in large groups in the wild. Nevertheless, captive birds were observed to be quite aggressive towards each other when kept in single-sex groups, probably due to the close proximity with breeding pairs. Prague Zoo had unsuccessful experience by housing two males in the same aviary or housing two pairs in the same aviary during the quarantine period (one female was attacked by the three other birds), but CCBC had successful experience housing two adult males (siblings) in the same aviary, away of about 20m from the next breeding pair. Once removed from parents, juveniles can form a social group until they reach sexual maturity, as long as they are of similar age and introduced at the same time to a new aviary. Successful adoptions of juveniles by an unrelated single male or unrelated single female were experienced.

2.3.2. Sharing Enclosure with others

There are few records of Rufous-fronted Laughingthrush being kept with other species. In the wild, this species is observed in mixed-flocks with other passerines (see section “information on wild population”). Nevertheless, it is recommended to keep breeding pairs in separate aviaries to prevent any aggression from other species towards chicks or from a breeding pair towards other species. Aggression was observed from Rufous-fronted Laughingthrush towards smaller birds such as fruit doves, and aggression has been observed from bowerbirds (*Ailuroedus melanotis*) towards Rufous-fronted Laughingthrush. However, Prague Zoo did not observe any negative interaction while housed with the Common Hill Myna (*Gracula religiosa*) and White-bellied Go-away-bird (*Criniferoides leucogaster*), although Rufous-fronted Laughingthrush destroyed the nest or clutch of the pigeons (Pink Pigeon *Nesoenas mayeri* and Green Imperial pigeon *Ducula aenea*).

2.4. Breeding

2.4.1. Mating

Rufous-fronted Laughingthrush become sexually mature at around one and a half years old for the female. No information is currently available for the male because the breeding males were acquired at the adult stage, but it is likely to be similar than the female.

Even if it was proved from past experiences that a new pair can move together in a new breeding aviary without prior introduction, it is better to ease the first contact with the help of an introduction cage to prevent aggression.

When setting up a new pair with the help of an introduction cage, the two birds are housed closed to each other in cages that allow sight and vocal contact. When the birds are observed perching close to each other, the slide door that links the two cages is opened and the birds can move to the breeding cage after a few days. Intensive monitoring is needed when the slide door opens to ensure that the birds are separated as soon as possible in case of incompatibility. The incompatibility of a pair is demonstrated by direct attack or by chasing until one of the birds is observed on the ground and trying to hide from the cage mate.

If soft-introduction is not used, it is better to move the newly-formed pair to a neutral aviary. Aggression occurs more often when one of the pair members is moved to the aviary of the other.

When the new pair sets up in the breeding aviary, the disturbance should be kept to a minimum. In zoos, it may be better to house breeding pairs in off-show aviaries. Aggression between the male and female of a proven breeding pair was also observed later on so regular observations are needed. Common pair-bonding behaviours for this species are: perching close to each other (at a distance of less than a wing length), allo-preening, wing-shivering (display), food offering (usually the male towards the female) and intensive calling.



Plate 10: Male gathering mealworms to offer to the female (seen on the back)

2.4.2. Egg laying and Incubation

Rufous-fronted Laughingthrush builds a cup-shaped nest, lined with twigs; materials used include coconut fibre, long pine needles, dry bamboo leaves, long weeds or dry leaves. To facilitate nest building, baskets made of bamboo, wicker or plastic can be offered in different places within the aviary, at a distance from the entrance (to avoid disturbance) and a minimum height of two metres. The nest should be covered with hanging leaves (ideally pine tree branches) to offer seclusion for the birds. It is essential not to disturb the nest since this species is prone to egg or chick abandonment so, whenever possible, nest monitoring using CCTV is preferred. Nest access should be facilitated with leaning perches so the parents can climb slowly to the nest or for when the chick fledges so that it can return to the nest easily. If the breeding aviary is outside, a piece of plastic on the ceiling of the aviary should be installed to prevent the nest getting wet in heavy rain.



Plate 11: Bamboo baskets and CCTV cameras set up in the direction of the nest to record breeding



Plate 12: Nest covered with leaves to provide seclusion (left), nest and eggs (right)

The incubation period of Rufous-fronted Laughingthrush ranges between 14 and 16 days. Up to three bright blue eggs will be laid. The egg size will be on average 28.91x21.96mm. Incubation is carried out by both parents, with one constantly sitting on the nest.

2.4.3. Hatching

One or two chicks hatch after the incubation period. Although some birds lay three eggs, three hatched chicks have not been recorded to date. Immediately after hatching, the parents will start feeding the hatchlings. Both parents will feed, clean and brood the chicks.

During this period the nest should not be approached as this species tends to reject the chicks if there is disturbance around the nest. Recording with CCTV can facilitate effective monitoring of the rearing process without disturbing the parents.

2.4.4. Development and Care of Chicks

The parents will feed the chicks all day long with the first feeding occurring directly after the keepers deliver the first feeding of the morning. Based on a recording by CCTV in CCBC, the parents fed constantly the chicks during the first 3 days with a maximum of 47 minutes latency between two feedings. During the first three days, the parents alternate in the brooding of the clutch and the nest is left alone no more than a maximum of 14 minutes. The older the chick gets, the fewer the parents feed it and the more alone the nest is left.

The chicks fledge at 15-18 days old. The fledglings sit at the edge of the nest before flying out. It is likely that the fledglings will not come back again to the nest and will perch on low branches on the back of the aviary. Chicks are unable to fly well for the first couple of days after fledging. In case fledglings do want to return to the nest, a leaning perch should be installed from the ground to the nest at the same time the nest basket is set up before the breeding season.

After fledging the juveniles should remain for approximately one month with the parents before being independent and removed. Although this species is highly social and cooperative breeding may occur in the wild, the parents in captivity tend to be aggressive with the juveniles when they start a new breeding cycle. Good observation and monitoring should be implemented to remove the juveniles if chasing or aggression is observed.

As the nest is not checked by the keepers during the rearing period, the juveniles can be ringed and micro-chipped when they are separated from the parents. If the parents raised two juveniles successfully, they can be kept in the same aviary after being removed from the parents. The offspring must be separated when they reach one year old as they will be close to reaching sexual maturity and can begin breeding or being aggressive if they are from the same sex.

2.4.5. Hand Rearing

Whenever possible, parent-rearing should be preferred for this species to produce stronger offspring that will go into reproductive state faster than their hand-reared counterparts. Experiences from Prague Zoo showed great success in hand-rearing Rufous-fronted Laughingthrushes.

Diet was composed of a mix of crickets (without legs and wings), white mealworms, Orlux Handmix. After the age of 6, the chicks start to receive soaked Nutribird T16 pellets. Several supplements are given to the chicks such as OroDigest Oropharma or Supervit D Nutrimix. The

chicks are fed with tweezers and the food solution is freshly prepared every 3 hours and warmed at a temperature of 37.5°C.

Chicks are ideally kept together in the same nests as they are highly social and keeping the clutch cohesion will decrease the risk of having a tame bird.

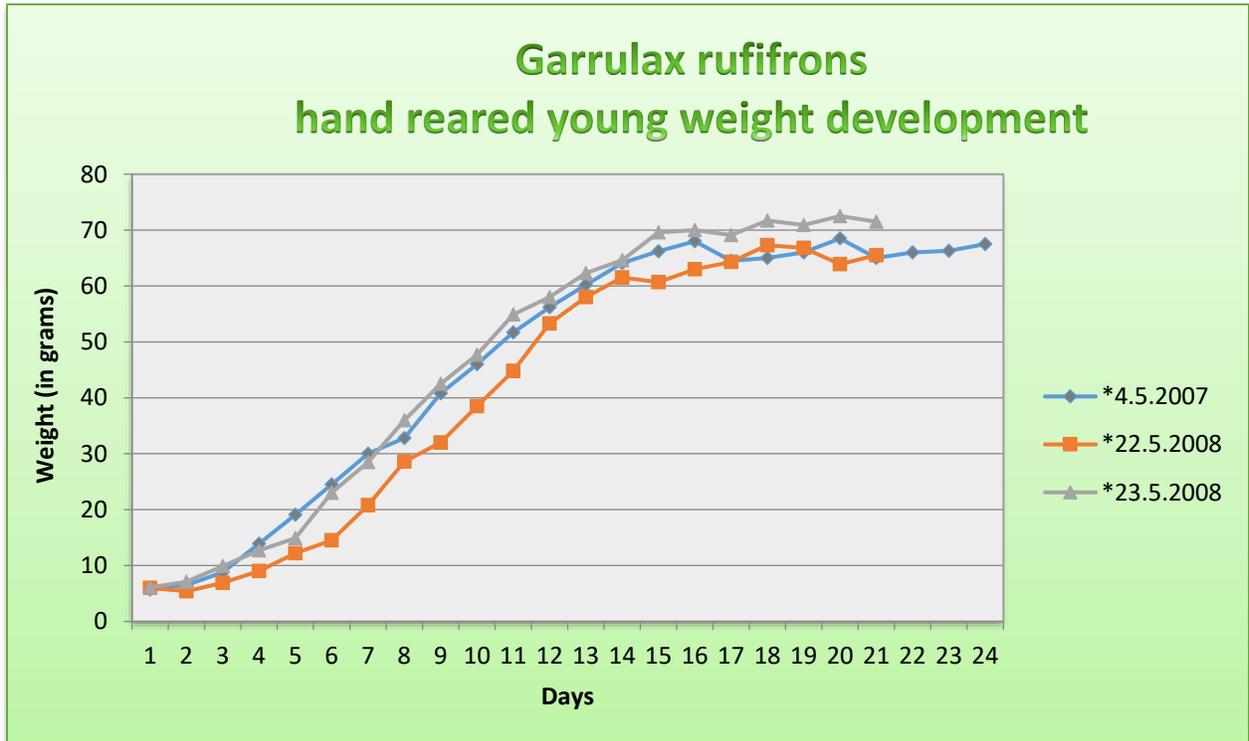


Plate 13: Weight chart for three Hand-reared Rufous-fronted Laughingthrushes in Prague Zoo



1 day old



12 days old

Plate 14: Pictures of hand-reared Rufous-fronted Laughingthrush chicks in Prague Zoo

2.4.6. Population Management

To date, only three institutions are keeping Rufous-fronted Laughingthrush in their collection. The main population of the nominate species (*Garrulax rufifrons rufifrons*) is at CCBC in Java, where 16 individuals are held as of February 2018; these birds have been breeding since 2013. The additional two institutions are in the Czech Republic (Prague Zoo and Plzen Zoo) and hold two male birds in total. Prague Zoo has bred the species successfully in the past. To date, the total number is of 9.8.1 (18) with a genetic diversity of 0.842.

Regarding the historical studbook, 51 individuals are included from 4 institutions (the three institutions stated above and Hong-Kong Zoological & Botanical Garden being only historical and not keeping this species anymore). Until recently, all the individuals acquired from bird markets were recorded as funders and unrelated. Further genetic researches on the funder population are strongly recommended.

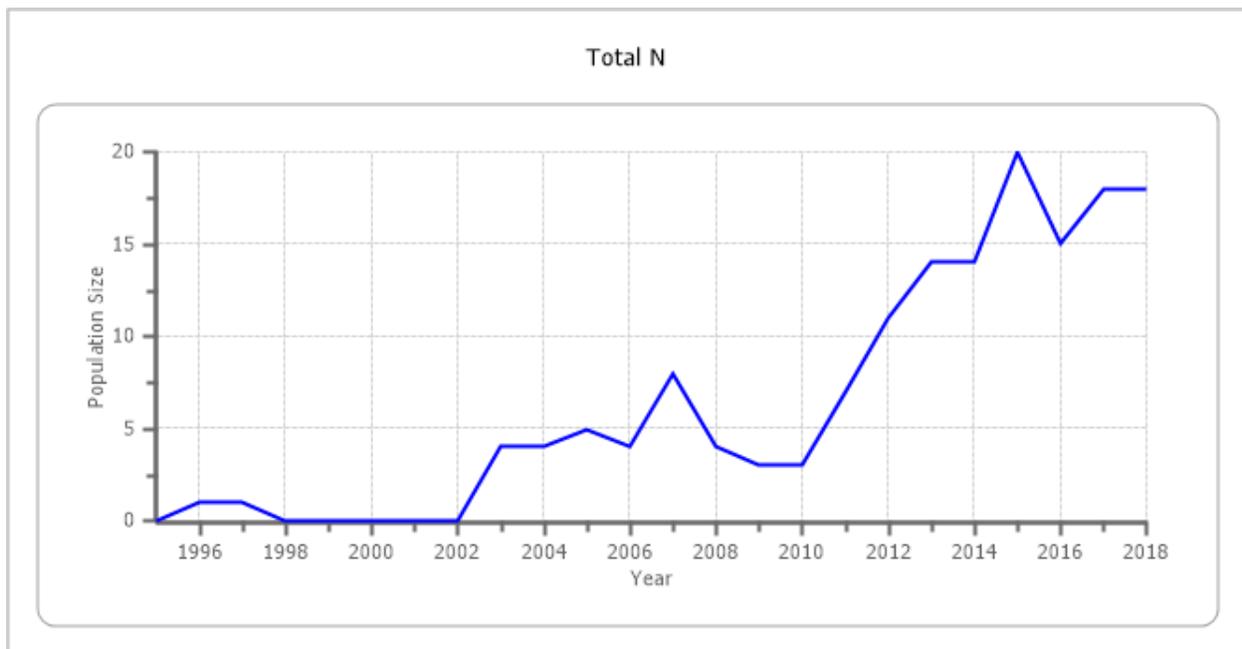


Plate 15: Evolution of the population size of the *Garrulax rufifrons rufifrons* over the year (4 institutions)

Considering the status of this species in the wild and the small number of birds present in captivity, there is an urgent need to acquire new funders and include this species into Regional Collection Plans.

The subspecies *G. r. slamatensis* is very rare in captivity with only three individuals known in CCBC in Java: one female present in CCBC since 2012 and two birds (unknown sex at the date of the report) recently donated to CCBC by a private holder.

2.5. Behavioural Enrichment

Rufous-fronted Laughingthrushes like flicking through the leaves in search for insects. A small tray filled with dry leaves and hidden insects provide a good behavioural enrichment. Spreading also crickets or mealworms into the aviary encourage the birds to look for them. Rufous-fronted Laughingthrushes like perching horizontally on branches so trees with small trunk could be added into the vegetation selection.



Plate 16: A *Garrulax rufifrons slamatensis* perching horizontally on a Yucca tree (Asparagaceae family).

2.6. Handling

2.6.1. Individual Identification and Sexing

The birds should be individually identifiable for management purposes. Aluminium identification rings (with individual number) are used. The rings have an inside diameter of 5.5mm. Split rings are currently used since this species is prone to abandon the chicks if manipulations are done inside the nest. Juveniles are ringed once removed from the parents. A plastic colour ring is used on the opposite leg for easy identification.

In addition, a microchip is used to permanently identify the bird. At CCBC a microchip of 8.5x1.4mm is used and implanted below the left pectoral muscle, subcutaneously to preclude the use of deep invasive techniques. The location of the microchip should be recorded within the file of the bird.

These identification tools should be used simultaneously to allow a direct differentiation between the individuals without catching and a long-term identification (via micro-chipping).

Rufous-fronted Laughingthrush is a monomorphic species. The sex of individuals can only be differentiated using DNA sexing or laparoscopy, although the latter option has not been attempted for Rufous-fronted Laughingthrush. It has been shown that the earliest suitable time to collect feathers or a drop of blood on newly-hatched birds is when they are removed from the parents, preventing nest abandonment through disturbance of the nest.

2.6.2. General Handling

Handling the bird must be done only by experienced aviculturists. Handling in one hand with the index and middle finger holding the head and the other fingers around the body allows a good checking position and prevents the bird from moving and getting injured. This handling is ideal to deliver medicine, check the pectoral muscles, abdomen, tail and wings and microchip the bird.



Plate 17: Handling of a Rufous-fronted Laughingthrush during medical check-up

2.6.3. Catching

Passerines are usually captured using a hand net of about 24cm diameter for this species and should be well padded to decrease the probability of the bird to be injured. Even with all precautions taken, catching birds is risky and should be carried out only by experienced people.

As a general rule, it is better to catch the bird in the early morning to prevent over-heating and accidental death. Catching should be carried out as fast as possible so the bird does not pant or get injured by flying around the aviary.

2.6.4. Transportation

As a general rule, each bird is always transported singly, no matter the time or distance of transportation.

a. Internal moves

For internal moves, small cloth bags securely tied can be used. The bird usually stays calm in the bag and the bag can be hung on a nail or perch in the meantime all the other birds are caught.

If the bird needs to be transported on a long distance or for a long period of time (for example going to one side of the zoo to the others, waiting for a long time that other birds are caught, injured bird waiting to be checked by the vet department, etc.), wooden transport box is preferred rather than cloth. The dimensions must ensure that the bird cannot move too much inside the box and injure himself. Compartment of 10 cm large, 30 cm long and 12 cm high are appropriate. Ventilation holes of 1 cm diameter must be done along the side of the box. The top of the box is covered with foam to prevent injuries on the head. No perch is needed for this short period of time. The box can hold several compartments to carry several birds at the same time.

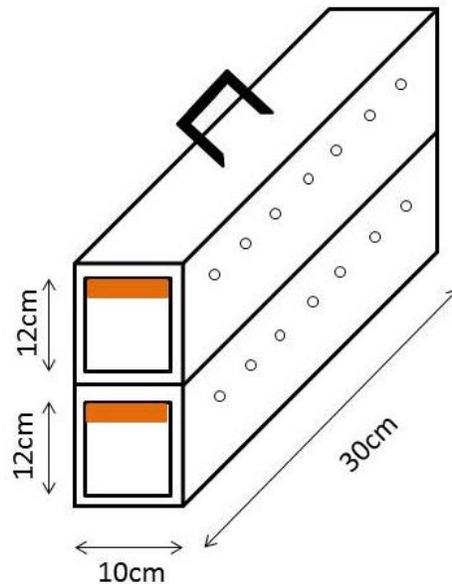


Plate 18: Example of transport box for internal moves (2 compartments) in CCBC

b. Inter-institution moves

Inter-institution moves means that the bird will spend a substantial amount of time into transport, therefore its welfare and safety must be carefully thought.

Like internal moves, the bird must be crated alone to prevent distress and injuries. The best time to transport Rufous-fronted Laughingthrush is at night (for short trips) because of the dark environment and lower temperature, keeping the bird quiet. As this species is easily stressed, effort must be made to keep the transport box in a quiet and secure environment and tie the box firmly to prevent it from moving, which could cause unwanted injuries.

Transportation into an air-conditioned vehicle is recommended if the temperature exceeds 25°C. For transportation by airplanes, the company must adhere to the IATA Live Animal Regulations where the crate and transport routine must follow strong requirement for the safety and welfare of the animal. These shipment conditions are highly recommended for all kinds of transportation as they are safest for the birds.

Transport box

The box should be made of plywood. Weld Wire mesh (grid of 1.2cm) covering the front viewing panel of the box allows the bird to be checked when needed. However during transit, this wire mesh should be covered with a clean hessian to keep the bird in semi-darkness, preventing it from seeing the surroundings. The roof must be padded with 2cm foam so the bird will not injure itself.

Each compartment of the box should house only one bird, the dimension allowing the bird to perch and stand without touching the compartment wall. Appropriate size for Laughingthrushes is 30cm long, 18cm high and 18cm wide. A 2cm diameter perch at a height of 4cm and 15cm from the back of the box allows the bird to comfortably perch during transport. The transport box should have ventilation holes of 1cm diameter every 5cm along both sides of the box at a height of 15cm from the bottom of the box. 1.5cm wooden spacer-bars fitted on the sides of the box allow good ventilation when several boxes are placed next to each other. The back of the box is made of a sliding door (10cm wide, 18cm high) securely closed with screws on the top.

Food and water bowl are placed at the front of the box for an easy check and fill. They are made of stainless steel or plastic with a size of 8cm long, 5cm wide and 4cm deep. The water bowl must be lined with sponge to prevent water spillage

All boxes must be labelled appropriately with the name of the species, contact of the shipper, “Live Animal” and “This Way Up” tags. Feeding and watering instructions as long as the medical records for the individual should accompany the box.

Feeding

The bird must be fed and watered before any shipment. For national transport that does not exceed 4-5 hours, it is not necessary to provide food or water if the bird can be kept in a cool environment. However, attention must be paid on potential delay and precautions have to be taken to ensure that the bird will receive food in case of unexpected delay. When offering food during transport, it is recommended to offer the diet from the sending institution. Change to a new diet should not start during transport. Favourite items such as insects or berries can be included in the food to encourage the bird to eat.

2.6.5. Safety

Aggression towards the keeper has never been observed in this shy species.

Attention must be paid for newly acquired birds on zoonotic diseases such as Avian Influenza and Newcastle disease. All newly acquired birds should follow the quarantine procedures determined by the receiving institution and country legislations.

2.7. Veterinary: Considerations for Health and Welfare

As any other bird species, an individual's activity and food consumption are good indicators of health. The general condition of the bird can be assessed in more detail when caught for routine medical check-up.

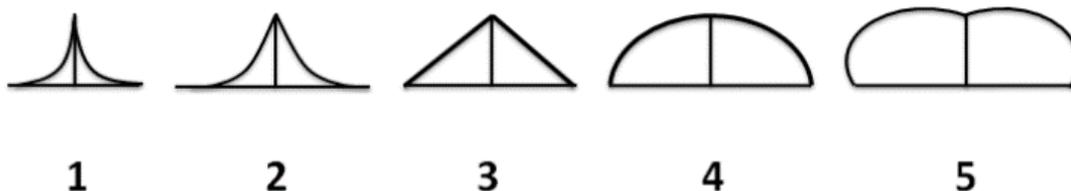
When the bird is in the hand, it is very important to record certain parameters that will help to ascertain the condition of the bird. The pectoral muscle score and the subcutaneous fat score are good parameters and cannot be dissociated since they will both represent the general condition of the bird. However, it is important that the scores are recorded with consistency between check-ups and different assessors.

Based on experience, no Rufous-fronted Laughingthrush was recorded with obesity issues. However, some birds could be underweight and the diet must be refined consequently.

2.7.1. Body condition

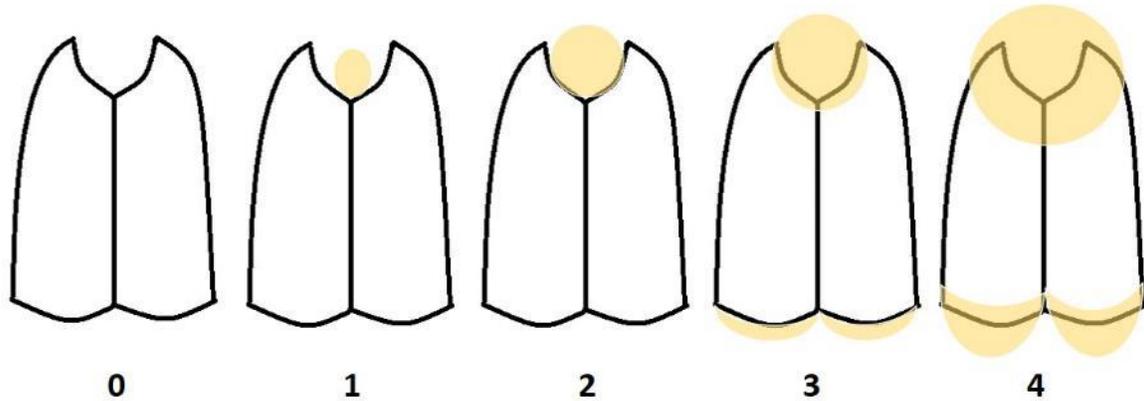
Pectoral muscle score

The pectoral muscle score is a good indicator of the physical condition of the bird. The pectoral muscle score ranges from 1 to 5. Though a high body score in mammals reflects an obese animal, a pectoral muscle score of 4 or 5 for a bird represents a healthy bird which has well-developed flight muscle.



Subcutaneous fat score

The subcutaneous fat score is a scale indicating the presence of visible fat and the potential obesity of the bird. The subcutaneous fat score records the amount of fat present in the inter-clavicular cavity (around the wishbone) and below the sternum. The subcutaneous fat score ranges from 0 to 4, 0 indicating an absence of fat and 4 being the presence of a big lump of fat in the inter-clavicular cavity and lumps of fat below the sternum. A bird is considered fat when the subcutaneous fat score reaches 3 and obese when it reaches 4.



A bird with good body condition will have a pectoral muscle score of 4-5 and a subcutaneous fat score of 1-2.



Pectoral muscle score: 4; Fat score: 1



Pectoral muscle score: 4; Fat score: 2

Plate 19: Two Rufous-fronted Laughingthrushes with different subcutaneous fat score

2.7.2. Routine health monitoring

The birds must be checked regularly by the veterinarian to ensure its good health. Routine measures include:

- Opportunistic tests: blood (basic haematology and biochemistry, serology), swab (bacteriology, serology)
- Faecal check for parasite management and preventive treatment
- Body condition (see above) and dietary review
- Full post-mortem examination on dead birds and dead but fertile eggs

2.7.3. Recorded Causes of Death in Captivity

The Rufous-fronted Laughingthrush population in captivity is very small and so far few deaths have been recorded for adult birds. The main cause of death is trauma or accident. Considering that this species is very sensitive to disturbance, trauma could easily occur. One case of stomach impaction due to the ingestion of coconut fibre by one female was also recorded.

Few deaths have been recorded for young birds; most are due to a rejection by the parents in the days after hatching, injuries (pecking) and bacterial infection of hand-reared juveniles.

In general, this species is not prone to disease as long as the Housing and Husbandry is kept to high standards.

However, good parasite management is required and important to ensure that the birds will not develop disease or parasite infestation. The type and frequency of preventative treatment will depend on the country and other diseases or parasites present in the collection. At CCBC in Java the following parasites were regularly found: Capillaria, Coccidia, knemidocoptes and Cestodes.

2.8. Specific Problems

Since this species is very sensitive, some breeding issues can be found and are usually a result of disturbance around the nest.

If the parent birds are disturbed, they may reject their eggs. When this occurs, parents will usually carry the eggs out of the nest and eat them on the ground. Small egg shells can be found opposite the nest or the eggs can be completely eaten by the parents.

Chicks can also be rejected in the days after hatching. Recording by CCTV allows a better understanding of the reasons for rejection. If the rejection by one of the parents is recurrent,

removing the problematic bird could help, though the second parent should be strongly monitored to prevent exhaustion.

2.9. Recommended Research

Owing to the fact that this species is uncommon in captivity, with a very small number of birds, lots of information on general biology, health and husbandry is missing. Some research could be beneficial to understand the species' needs and requirements:

- Moulting period and frequency
- Iris coloration for birds exceeding 2 years old and the reason of difference between yellow and orange iris
- Parasite screening and potential infestation by *Atoxoplasma*
- Potential difference of vocalizations between males and females and between the two subspecies

Moreover, research in remaining wild populations would allow a better understanding of the species situation (population trend) and ecology.

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