

EAZA Best Practice Guidelines

Sumatran Laughingthrush

Garrulax bicolor



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EAZA 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

This is first edition of the Best Practice Guidelines for the Sumatran Laughingthrush is based on the husbandry experiences of a number of dedicated aviculturists and institutions.

This species has only been in aviculture for a relatively short time, (since the early 2000's) and has only officially been a managed ESB species since 2011. This was upgraded to an EEP in September 2016. The basis of the current EEP captive population is derived from a small number of wild-caught founders, which were sourced from private aviculturists by a few EAZA institutions between 2004 and 2006.

Many of the husbandry techniques contained herein have been developed by the author and contributors working with this and other species of Laughingthrushes. The experiences of private breeders are highly valuable and as such have also been incorporated into these guidelines. Some aspects of these guidelines have been taken or modified from Dave Coles' excellent Laughingthrush breeders manual produced in 1990.

The taxonomy used in this document follows: del Hoyo, J. & Collar, N.J. (2016) *HBW and BirdLife International Illustrated Checklist of the Birds of the World*. Volume 2: Passerines. Lynx Edicions, Barcelona.

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All photographs by Andrew Owen, unless otherwise stated.

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Section 1: Biology and field data

Biology

1.1 Taxonomy

Class:	Aves
Order:	Passeriformes
Suborder:	Oscines
Family:	Leiotrichidae (Laughingthrushes, Liocichlas & Hwamei)
Genus:	<i>Garrulax</i>
Species:	<i>bicolor</i>
Subspecies:	None

This species was re-categorised during a taxonomic revision of the Asian babblers (*Timaliidae*) in 2006 and was split from the White-crested Laughingthrush *Garrulax leucocephalus* with which it was formally regarded as a subspecies (Collar 2006).

English synonyms

Black-and-white Laughingthrush, Sumatra White-crested Laughing Thrush, White-crested Laughingthrush.

1.2 Morphology

Body size

Bill (tip to gape)	Sex	Skull	Tail	Wing	Tarsus
31.5 mm	Male	57.9 mm	49.1 mm	137 mm	132 mm
31.0 mm	Male	57.6 mm	49.2 mm	134 mm	130 mm
30.7 mm	Male	56.9mm	48.9 mm	134 mm	129 mm
32.1 mm	Male	57.7mm	48.8 mm	136 mm	131 mm
28.6 mm	Female	54.2 mm	49.0 mm	122 mm	127 mm
29.2 mm	Female	55.3 mm	48.8 mm	124 mm	128 mm

Morphometric measurements of six captive Sumatran Laughingthrushes *Garrulax bicolor*

Weight

There are no weights recorded for adult birds in the wild.

In captivity the average weight for adult males is 113.5g with a variation of 95-148g calculated from 95 samples from five EAZA institutions.

The average weight for adult females is 107.6g with a variation of 95-130g calculated from 21 samples from five EAZA institutions. However these weights do not take into

consideration the issue of obesity to which this species is particularly susceptible in captivity. The weights taken at Cikananga Conservation Breeding Centre (CCBC) in West Java, where normal healthy body condition scores were also taken may give a more accurate reflection of what normal healthy weights should be for this species.

Weights based on 'Normal healthy' body condition scores from 38 adult birds at Cikananga Conservation Breeding Centre. (see appendix 1: Body condition scoring).

Males

Average: 106g

Range: 97-116g

Females

Average: 103g

Range: 90-112g

Description

24-28cm. The head, throat, neck and breast including the upper lore's, are white, with glossy black on the forehead and over nares and joining via lower lore's, forming black "goggles" and distinctive "teardrop" over the lower ear-coverts behind the eyes. White feathers on crown are frequently raised to form a low crest. There is a faint pale grey wash on the nape and the rear of the crest, the rest of the plumage is glossy brown-black. The iris is dark reddish- brown, the bill is black, the legs and feet including toes are blackish or greyish-black. The sexes are visually indistinguishable from each other.

Juveniles are similar to adults, but with much white inter-mixed with dull brownish-black under-parts. The eyes are paler brownish than the adults.



Adult Waddesdon Manor 2005



Juvenile 5 weeks old Prague zoo (Antoín Váidl).



Juvenile Chester zoo – note yellow gape flanges and paler reddish-brown eye

1.3 Vocalisation

This species is very vociferous, with male and females making a variety of different calls including the typical loud explosive maniacal laugh for which the family gets its name. Contact calls between a pair of birds are fairly quiet single “wah” notes uttered by both sexes.

A study on the vocalisation of this species in captivity at Cikananga conservation breeding centre (Tritto unpublished report 2013) found that the vocalisation of the male includes two different calls. The first call is mainly heard in the morning is a fairly loud melodious series of notes and tones and appears to be either female-directed or outsider-directed.

The second call starts quietly and always occurs before a duet or appears to be a “request” to the female to duet. It starts low and slow and becomes louder and faster, building to an explosive melodic series of flute-like notes with the female joining the duet with what can be described as a high pitched machine-gun like chattering “Trriiii” which lasts for several seconds. A wing-shivering behaviour was also observed when the female was calling. The male appears to almost always be the instigator of the duet. If the female does not join the duet, the male will stop and start again from the beginning.

Females were normally quiet apart from when they joined the duet with the male. On the rare occasions when females called alone, they used the same vocalisation pattern that is heard during the duet.

Duets were often heard when there was some disturbance around the birds’ environment such as keeper disturbance, a dog barking or a motorcycle passing by and one pair of birds’ duet may trigger other pairs to explode into duets. These duets may be considered “alarm duets” and lasted longer (up to 14 seconds) than those performed in a quiet environment.

The study found that birds were more vocal in the morning and that vocalisations were more frequent when several pairs were kept in relatively close proximity to each other and had vocal or visual contact with con-specifics. These pairs may be affirming their territories and strengthening pair-bonds by performing frequent duets.

The study also found that newly established pairs or pairs that had recently been moved to new aviaries were more vocal than those that were bonded and were settled in an established environment or territory.

Nesting pairs remain silent, even if other pairs can be heard.

Although the purpose of the duets is not fully understood, it can be hypothesised that they may be used for:

- Mate-guarding – performed to advertise the mated status of the pair to potential intruders and avoid rivals being attracted by a solo song.
- Alarm/Distress – often performed after a disturbance. The aim could be to defend a territory, alert a partner and confuse predators or as mutual reassurance after a disturbance.
- Pair-bonding – whilst duets seem to be linked with strengthening long-term pair bonds, at Cikananga they seemed to be linked with the formation of the pair bond. Newly formed pairs duet more than established pairs and this may be a measurement of individual quality. The duet would thus be a criterion for pair- selection.
- Reproductive synchrony – the duet may give the indication of the reproductive status of the birds and their readiness to breed. By answering its partner, the bird would

convey information on its breeding cycle and its willingness to put effort into parental care, territorial defence and other aspects of a partnership. When this synchrony is achieved, the number of calls will decrease as the birds invest effort into breeding behaviours such as nest building, incubation and rearing the young.



Male vocalising with bill partially open

1.4 Longevity

There are no longevity records for this species in the wild. The oldest living birds in captivity have attained a minimum age of 17 years. Six wild caught adults (four males, two females) imported into Europe in 2000 were still alive in May 2017. One of these males (paired to a younger captive-bred female), raised young at an age of at least 16 years. The oldest breeding female was known to be at least 14 years of age.

Field Data

1.5 Zoogeography and Ecology

Distribution

The Sumatran Laughingthrush was originally distributed along the length of the mountainous spine of Sumatra, Indonesia, from Aceh in the north to Lampung in the south (van Marle and Voous 1988), and was reportedly common. Recent evidence suggests that it has undergone a considerable decline. It was known to be present at a small number of sites scattered across Sumatra, including Bukit Barisan Selantan National Park, Danau Ranau (South Sumatra) (R. Thomas *per* C. R. Shepherd *in litt.* 2012), Batang Toru (North Sumatra) and Ulu Masen (Aceh) (N. Brickle *in litt.* 2007), and a single locality in Kerinci Seblat National Park (S. Högberg *in litt.* 2006), although recent surveys there have failed to find it (N. Brickle *in litt.* 2007). A small group of three birds was camera trapped in Batang Toru (G. Fredriksson *per* C. R. Shepherd *in litt.* 2012).

It has been photographed in the wild in the Alas Valley, Aceh, December 2010 by James Eaton in the Gayo Highlands, Aceh, December 2013 and Leuser Ecosystem, Aceh, February 2015 by Agus Nurza (Oriental Bird Club Images 2015).

It is frequently seen in local wild bird markets (e.g. in Jambi and Medan in 2007, Shepherd 2007, N. Brickle *in litt.* 2007). It is also frequently seen in the larger bird markets in Jakarta, Java (Shepherd 2007 and Owen 2008, 2011, 2012, 2013, 2014 *pers obs.*) and Denpasar, Bali (Owen 2013 *pers obs.* R. Switzer *in litt.* 2015) although numbers have declined in recent years. Local traders and hunters report that it has become rarer (Shepherd 2007, 2011, N. Brickle *in litt.* 2007).

From preliminary market surveys it is suspected that birds may still occur in the mountainous areas of Sumatra including Aceh, Dairi, Riau, Tanah Karo and Sumatra Barat, however population may be low due to uncontrolled harvesting (T. Busina *in litt.* 2015).

Habitat

This species is known from broadleaf evergreen montane forest from 750 – 2000m (with unsubstantiated reports of a lowland population in Berbak Game Reserve, Jambi). Due to trapping pressure it appears to be being pushed to more inaccessible areas and higher altitudes. It lives in flocks in the middle and lower storeys of forest sometimes coming to the ground.

Robinson & Kloss (1918) described it as ‘very common in secondary jungle or in patches of cultivation on the edges of old jungle’ although it ‘did not appear to frequent the primeval forest’, travelling ‘in parties of seven or eight from tree to tree’ and being ‘very restless’, giving a continual ‘harsh, screaming note’.

Chasen & Hoogerwerf (1941) elaborated a little further, indicating the confinement of the species to ‘jungle from 800 to 2000 m, usually in the lower vegetation, never alone and sometimes congregating with other species, the whole forming a rather boisterous company’, but while ‘very lively’ the species ‘usually keeps hidden in the dense bush’.

A study in 2015 of a population around Gunung Sinabung volcano in North Sumatra province by Tomas Busina, found the species occurred in primary broadleaf evergreen montane forest at altitudes between 1300 – 1600m above sea level.

The common trees of this lower montane forest habitat are represented by the following families: *Fabales*, *Sterculiaceae*, *Moraceae*, *Melastomataceae* and *Malvaceae*. Tree ferns and epiphytes are also common in this environment. This rugged habitat is steeply shaped by deep valleys with small rivulets and streams and is densely covered by trees with a closed canopy with tree heights up to 35m.

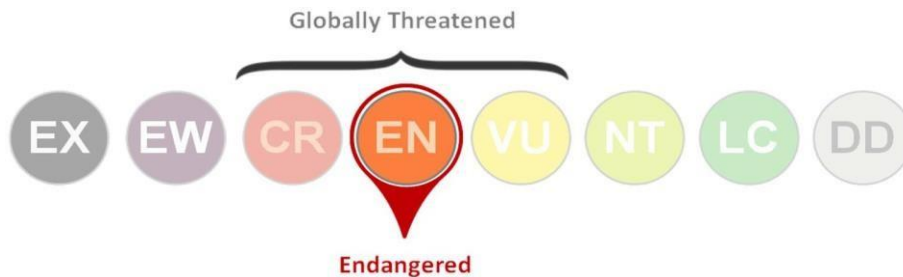
Very low levels of sunlight penetrate to the forest under-storey and forest floor. A thick shrub storey is very dense and is often impassable. Humidity is high and average temperatures during a 10 day period in January 2015 were 13.2°C at 0700 in the morning, 16.1°C at 1300 and 15.3°C at 1900 in the afternoon. Maximum/minimum temperatures were 16/9°C in the morning, 17/15°C at noon and 16/13°C in the evening (T. Busina *in litt.* 2015).



Typical habitat of broadleaf evergreen montane forest. Gunung Sinabung, N. Sumatra. (Tomas Busina).

1.6 Population and conservation status

Red List Category



Criteria: A2cd+3cd+4cd

Population size: 2500-9999

Population trend: Decreasing

Distribution size (breeding/resident): 218,000 km²

Country endemic: Yes

Attributes

Realm – Indomalayan

IUCN Ecosystem -- Terrestrial biome

Justification of Red List Category

The species has suffered a very rapid, ongoing population decline due to trapping for trade compounded by habitat loss. Local extinctions have been observed across much of the range within the past 10-15 years concurrent with price increases and reduced availability in the market. For these reasons Sumatran Laughingthrush is evaluated as Endangered.

Population justification

The species was reportedly common and widespread in 1988 but is now known to occur at few sites throughout the range where only very small numbers have been located in the wild recently. More than 45 km of transects in suitable habitat in 2013 returned only a single record of the species (Eaton *et al.* 2015). Trappers in West Sumatra stated in 2015 that it remained in forests three days walk from a road (Eaton *et al.* 2015). The largest extent of remaining habitat is in Aceh province, where the species is still relatively widespread though highly localised and heavily trapped (Eaton *et al.* 2015). Recent bird tours to this area have located groups by the roadside, indicating that trapping pressure is lower in this culturally separate region of Sumatra (Eaton 2014). The paucity of records from the majority of the range indicates that the species now has a small population size.

For these reasons it is believed to have a small population and is placed in the band 2,500-9,999 mature individuals.

Trend justification

Numbers in trade have been falling coincident with a rapid increase in the price per bird from \$8-15 in 2007 to \$90 in 2014 (Chng *et al.* 2014, Harris *et al.* 2015), and this data is coupled with an expert review of the status of the bird in the wild concluding that it was 'Severely Declining' (Harris *et al.* 2015). In the wild the species appears to have disappeared from several sites where it was being regularly recorded only a decade ago.

Threats

The principal threat to this species is the illegal trade for the cage bird industry at a national level (Eaton *et al.* 2015, Harris *et al.* 2015, Shepherd 2006, 2007, 2011). Prior to 2005 the widespread sister species *G. leucolophus* was preferentially traded but international imports of wild birds were stopped in that year due the avian flu risk (Owen *et al.* 2014), which appeared to drive a sudden surge of domestic bird trapping within Indonesia and *G. bicolor* was the ready replacement at hand in Sumatra (Owen *et al.* 2014, Shepherd *et al.* 2006). Numbers observed in markets increased and 20-30 were regularly seen between 2008-2013, but in 2016 only 5 birds were observed and prices had increased to two birds for *ca* US\$100 (A. Owen *in litt.* 2016). As no quota has ever been set on the species, all trade in the species is illegal under Indonesian law. The vast majority of this trade is illegal and unregulated (Shepherd 2007, 2011). It may also have declined owing to deforestation within its range, though perhaps principally through increasing the percentage of the species range that is accessible for trapping.

Recent reports suggest that it may also be a target for recreational rifle hunters in some areas of its range (T.Ouhel *in litt.* 2012).

Conservation actions

Conservation Actions Underway

The species currently receives no legal protection within Indonesia, however there is a zero harvest quota, meaning that the species may not be removed from the wild.

Captive breeding of this species has been successful on a small scale and is increasing in Europe for which an EAZA European Studbook (ESB) was formally established in 2011 and upgraded to an EEP (European Endangered Species Programme) in September 2016. A regional ex situ captive breeding population was initiated in Java, Indonesia in 2008 by the Cikananga Conservation Breeding Centre and as part of this regional programme, birds were transferred to Taman Safari, Bogor in 2015. In 2015 3.3 unrelated birds were transferred to Chester zoo to strengthen the genetic diversity of the European population. (Owen *et al.* 2014, C. R. Shepherd *in litt.* 2012).

In addition, since 2008, ZGAP (Die Zoologische Gesellschaft für Arten-und Populationsschutz e.V - Zoological Society for the Conservation of Species and Populations), Waddesdon Manor, Chester zoo and other EAZA institutions have provided technical and financial support to the conservation breeding programme for this species at the Cikananga Conservation Breeding Centre. Since 2008, Chester zoo has provided technical husbandry and veterinary advice to CCBC, which was formalized in 2015 with the signing of an MOU partnership agreement between the two organizations.

Conservation Actions Proposed

- Review the species' status in trade and consider listing under CITES.
- Support measures to regulate the cage bird industry nationally in Indonesia and internationally.
- Surveys are urgently required to determine whether additional sub-populations still persist within the historical range. The species is currently only protected due to lack of a harvest and trade quota being established for it, and the absence of trapping permits being granted.
- Grant full legal protection for the species under Indonesian law. Support the development of captive breeding programmes with the aim of future reintroduction.

CITES Status

The Sumatran Laughingthrush is listed in CITES appendix II, which means regulated international trade is permitted, provided it is done in accordance with national legislation. No Indonesian Laughingthrush species are currently listed in the appendices of CITES. Indonesia has been party to CITES since 1978. International trade in birds with Indonesia has been forbidden since 2005 due to the risk of avian influenza (this ban remains in place for wild-caught birds from Indonesia) under the National Strategic Plan for Avian Influenza Control in Indonesia, Ministry of Agriculture (Shepherd 2010).

Recommended citation

BirdLife International (2017) Species factsheet: *Garrulax bicolor*. Downloaded from <http://www.birdlife.org> on 21/05/2017

Contributors

Brickle, N., Hogberg, S., Shepherd, C., Owen, A., Eaton, J. & Chng, S.

1.7 Behaviour

Group composition

Little is known about the group composition of wild Sumatran Laughingthrushes, Robinson & Kloss (1918) described it as 'very common in secondary jungle or in patches of cultivation on the edges of old jungle' although it 'did not appear to frequent the primaeval forest', travelling 'in parties of seven or eight from tree to tree' and being 'very restless', giving a continual 'harsh, screaming note'. Robinson & Kloss (1924) said much the same thing, adding that in habitat it was 'also, but rarer, in old forest', which was perhaps intended to revise their earlier proposition of its absence from 'primaeval forest', giving a flock size range of 6–10 (N. Collar *in litt.*)

A study area on Gunung Sinabung was occupied in January 2015 by one Sumatran Laughingthrush flock, which was made up of five individuals of unknown gender or relationship. Given the nature of related species being cooperative breeder, it may be speculated that these flocks may be extended family groups. Observations in August 2015

confirmed two additional flocks (unknown number of individuals) surrounding the study area and presumptive home range of the “local” flock (T. Busina *in litt.*).

1.8 Diet and feeding behaviour

Food preference

This species has been seldom observed in the wild and there is little information on its food preferences, although they are probably much as for other montane Laughingthrushes.

Other Laughingthrushes of the same genus feed mainly on insects and other invertebrates, including beetles (Coleoptera, of many families), moths and caterpillars (Lepidoptera), crickets and grasshoppers (Orthoptera), cockroaches (Dyctyoptera), mantises (Mantidae) and spiders (Araneae). Berries and seeds and also small reptiles and amphibians are eaten opportunistically. The stomach contents of five Sumatran Laughingthrush specimens contained fruit seeds and insect remains, including of the families Buprestidae (jewel beetles), Elateridae (click beetles), Rutelidae (scarab beetles) and Passalidae (bess beetles), with one cerambycid (longhorn beetle) Chasen & Hoogerwerf (1941).

Feeding

Garrulax Laughingthrushes are considered arboreal and terrestrial omnivores. Although invertebrates form the bulk of the diet, berries, fruits and seeds are probably exploited mainly opportunistically and seasonally (Collar & Robson 2007).

This species, like many other Laughingthrushes is a bird of the middle and lower storey of the forest.

During the study of a flock of five birds in the Sinabung volcano area of North Sumatra, Tomas Busina (*in litt.* 2015) observed them searching for insects and other invertebrates among the vegetation of the mid, lower and occasionally, upper storey of broadleaf evergreen forest. During the study period, they were never seen to eat any fruit or berries and the individuals observed were never seen foraging on the ground.

It forages, often in sociable flocks at the mid and low-storey and on the ground (although it was not observed on the ground by Busina), where it moves in bounding hops, pecking at earth and rotten logs and tossing leaf litter aside in search of invertebrates. Laughingthrushes have strong legs and feet and are able to grasp and clamp food items such as large insects and small vertebrates for further processing by the bill.



Sumatran Laughingthrush foraging for invertebrates in forest mid-storey Gunung Sinabung, North Sumatra (Tomas Busina).

At Cikananga Conservation Breeding Centre in Java, this species is occasionally offered small frogs which are quickly dispatched with repeated blows to the head, with the bird standing high on its legs to give it more power on each strike. Once killed the frog will be grasped in one foot and pulled apart with the bill and consumed.

This behaviour was also observed by Schofield (2001) in a captive Lesser-necklaced Laughingthrush *Garrulax monileger* (Coles 2005).

Laughingthrushes often associate with other species (including other Laughingthrushes) in mixed species flocks which move through the forest in search of invertebrate prey.

Although the Sumatran Laughingthrush was mostly observed by Tomas Busina in single- species flocks it was occasionally seen in mixed-species flocks or bird-waves, which were represented by Black Laughingthrush *Garrulax (Melanocichla) lugubris*, Spectacled Laughingthrush *Garrulax (Rhinocichla) mitratus*, Sumatran Trogon *Apalharpactes mackloti* and Sumatran Drongo *Dicrurus sumatranus* (T. Busina *in litt.* 2015).

1.9 Reproduction

Sexual maturity

No data are available from the wild. In Prague zoo a parent-reared male bird paired with an older female successfully reared young at nine months of age (Vaidl *pers. comm.*)

Similarly, at Chester zoo, Newquay zoo and at Cikananga conservation breeding centre, Sumatran Laughingthrushes have successfully reared young at 12 months of age.

Seasonality of breeding

December – April (Collar & Robson 2007). No further information available from the wild (see seasonality of breeding in captivity page 43).

Courtship behaviour

Courtship behaviour and mating has not been documented in this species in the wild.

Courtship feeding has been observed in the White-throated Laughingthrush *Garrulax albogularis* in captivity with the female approaching the male in a slightly crouched posture, with the feathers fluffed and wings shivering as she was fed by the male. (Coles 2005).

A similar behaviour has been seen in captive White-crested Laughingthrush *Garrulax leucocephalus*. (Owen *pers. obs.*).

Copulation in Sumatran Laughingthrushes was observed taking place on a fully constructed nest at Chester zoo (Woolham *pers. comm.* 2017.)

Nesting

No nesting behavioural data is currently available for this species in the wild. (See page 44 for nesting behaviour in captivity).

For most babblers the roles of nest construction, incubation of the eggs and brooding of the young are shared between the male and female, although the relative proportions vary with the species and individuals and also with time. Nests of Laughingthrushes are an open cup lined with roots and fine stems. The limited evidence available suggests that after the nest is completed there may be a short lull, as there is with other passerines, of up to 3 days before the first egg is laid.

The nest of the closely related White-crested Laughingthrush is a large, shallow, rough cup, made of coarse grasses, bamboo and other dead leaves, twigs, roots, moss, creeper, plant twigs, stems and tendrils, lined with rootlets (often black), coarse roots, plant flower stems and leaf stalks, placed 1.6 – 6 m in a bush, shrub or low tree. Incubation period c.14 days; nestlings fed by all group members, leave the nest long before fully grown (Collar & Robson 2007).

From observations of captive birds, after hatching nestlings are intensively brooded for the first few days – normally for 8-10 days in this species.

Adults provision the nestlings with food several times every hour. The food offered to the young is primarily small invertebrates, larger prey items are offered as the chicks develop.

Nestlings normally fledge at 13 days old (Owen. *Pers. obs.*)

Co-operative breeding

Co-operative breeding is known to occur in a number of Laughingthrush species in the wild and in captivity and although co-operative breeding is suspected in this species, no wild nesting behaviour of *Garrulax bicolor* has been observed. Co-operative breeding was recorded in Thailand in the closely related White-crested Laughingthrush *Garrulax leucolophus* with at least five birds forming the extended family group.

Two well-grown nestlings were provisioned with food (invertebrates) by at least four of the five birds observed. During an early morning period of 47 minutes the nest was visited 15

times and during a ten minute period there were no fewer than eight visits to feed the nestlings (including three feeds by three different individuals within one minute). A fourth individual that was seen to feed the nestlings was identified as a juvenile from an earlier brood, by its yellow gape markings (Round 2006).

Although it was assumed that the Sumatran Laughingthrush was also likely to be a cooperative breeder, this could not be substantiated until a trial was carried out at Chester zoo in 2016, when the two juveniles reared from a first brood were left in the aviary with their parents and were seen to brood and provision the nestlings of a second brood. The older chicks were 50 days old when they were first seen caring for the second brood. Once fledged, the young from the second nest continued to be fed by the older juveniles. (Kaldis and Morris *in litt.* 2016)

Section 2: Captive Management

2.1 Enclosure

Outdoor aviary

Sumatran Laughingthrushes are normally kept in outdoor aviaries. This species lives in the wet montane forests of Sumatra, where temperatures fall to 8 °C at night and possibly to lower temperatures at higher altitudes. They are therefore very hardy once acclimatised and are able to tolerate temperatures below freezing (minimum temperature recorded -15°C). They should always have access to dry frost-free indoor accommodation where they can be confined at night or during prolonged cold periods; however they may still choose to roost outside unless “encouraged” inside.

The aviary should be as large as possible to give these active birds sufficient room to fly and exercise. A minimum size for an outdoor breeding aviary should be 2.5m wide, 2.8m high and 5m long, however larger aviaries are preferable.

Higher aviaries (3m or more) give the aviary plants more space to grow, without growing through or damaging the aviary netting.

The aviary perimeter should have a predator/vermin anti-dig barrier a minimum of 50 cm below ground. This can be made from a sturdy wire-mesh with holes no larger than 12mm which will prevent mice, small rats and small mustelids from entering.

For best results a 50 cm deep and 50 cm wide trench should be dug around the aviary perimeter and the mesh bent at a 90° angle outwards a further 30 cm. Once firmly affixed to the aviary frame or concrete foundations, this will deter even the most persistent rodent or predator.

Alternatively the anti-dig barrier can be made from deep concrete foundations.

The aviary frame should be constructed from a metal (steel or aluminium) or treated timber frame built onto a low (40-60 cm) brick or concrete block-work wall. This wall will keep timber frames (if used) off damp ground, preventing rotting, it will also allow some security from outside predators and will allow a deep layer of substrate to be placed inside the aviary.

The aviary should be covered in a strong heavy-gauge galvanised or stainless steel wire mesh which should have squares no greater than 12mm, which will keep out all predators and vermin including small mice.

20mm square mesh is not to be recommended as mice, young rats, weasels and small birds can access the aviary. To improve visibility into the aviary, the mesh should be painted with a matt black paint.

Fine stainless steel Zoo mesh has been used successfully by a number of institutions. However care should be taken to prevent climbing plants or zoo visitors from damaging this lighter material.

Laughingthrushes are extremely fast birds and keeper access to the aviary should always be via a lockable safety porch or corridor. Alternatively it may be entered from the indoor accommodation; however this is not ideal, as birds may become stressed if the keeper has to enter the indoor accommodation once birds have been shut inside.

Part of the aviary roof at one end should be covered (above the netting) to provide the birds with some protection from heavy rain. Translucent plastic or polycarbonate sheeting is a suitable material to use, as it still lets some light enter, allowing aviary plants to grow beneath. Screening on the back and sides of the aviary will give the birds some seclusion and protection from strong winds.

This can be made from Bamboo or willow screening, timber planks, shade cloth or polycarbonate sheeting firmly fixed on the outside of the aviary mesh walls.

Electric “hot” wires may be fixed around the aviary perimeter at varying heights to prevent mammalian pests and predators (cats, rats, squirrels, martens, civets depending on location) from climbing onto the aviary roof. This is especially important at the top edge of the aviary. Over-hanging trees should be avoided if possible, as they will allow roosting wild birds to defecate into the aviary and predators to gain access above the aviary roof.



Electric “hot wire” predator prevention

Aviary divisions need to be nothing other than normal wire netting as there seems to be no aggression between pairs of different species in adjacent aviaries, even when young are present. Sumatran Laughingthrushes should however, not be kept in adjacent aviaries or in close visual or vocal contact with conspecifics or aggression or stress will occur.

Perching

Laughingthrushes spend a good deal of time in the natural vegetation and on the aviary floor, where they forage amongst the substrate. Consequently, if the aviary has sufficient established trees, shrubs and bushes additional perching need only be minimal. If natural perches are used, they should be of varying thicknesses and should be firmly fixed to the frame of the aviary using thick wire or cable ties. Many different types of branches can be used. One corner of the aviary should be clear of perches as this makes catching easier.



Off-show breeding aviary at Chester Zoo



Heavily planted Laughingthrush breeding aviaries.



Breeding aviary at CCBC. Note dense planting and leaf-litter on the aviary floor and screening prevent visual contact with birds in adjacent aviaries.



On-show aviary Prague Zoo, note stand-off barrier and anti-predator electric wire along the top of aviary. (Antoňín Váidl).

Escapes

The most common cause for escapes are due to the lack of a safety porch, plants growing through and damaging the aviary mesh or keeper error (not securing safety doors properly). If an individual from a well-bonded pair does manage to escape, it is likely to remain in the vicinity of the aviary and may be re-captured. A method used to re-capture the escapee is to catch up its mate and place it in a cage within the aviary directly below the hole in the netting or to create a small hole in the netting on the aviary roof. Normally this is enough to entice the escaped bird back into the aviary, although the provision of a food dish and additional live insects is added encouragement to entice the bird back into the aviary. Once inside it should be shut into the aviary shelter and the damaged netting can be repaired. Very few non-bonded Laughingthrushes that escape remain in the vicinity long enough for any attempt to be made at recapture (Coles 2005).

Aviary substrate

Laughingthrushes are very active birds, often poking about amongst the substrate of the aviary floor.

Some individuals are prone to overgrown beaks and providing ample material and a substrate of an abrasive nature helps keep them in trim.

Course sand, bark chippings, grass or soil have all been used in outdoor aviaries. A deep layer of sharp sand may be the most suitable option as this substrate helps to prevent the spread of nematodes such as *capillaria* or *syngamus*, often prevalent in soil. A well-composted bark material has been used successfully by many institutions and is probably the most aesthetically pleasing and natural looking substrate to use, particularly for on-show aviaries as it most closely resembles the forest floor. Care should be taken with this type of substrate however, as if it is used in poorly ventilated areas there may be a risk of *aspergillosis*.

Only well-rotted compost or bark chippings should be used, as fresh or non-rotted material will produce large amounts of fungal spores as it decomposes.

Well-rotted compost or bark has the added advantage of allowing the Laughingthrushes to perform natural behaviour such as digging and foraging. If leaves, fallen from the aviaries' trees and shrubs are present, the birds will spend a lot of time working through these and turning them over in search of invertebrates. Leaves can be collected from the surrounding environment however care should be taken where they are collected as they may be contaminated by wild bird droppings. A good option is to collect large quantities of freshly fallen leaves in autumn and store them in plastic bin bags or create a compost heap. Once fully rotted, this leaf-litter provides a very natural and enriching resource for the birds which will break down over time, providing nutrients to the aviary plants.



Sumatran Laughingthrushes spend a lot of time foraging on the ground for invertebrates.



Digging in a coarse sandy substrate helps to prevent overgrown beaks. (Florian Richter)

Outdoor furnishing, planting and maintenance

Aviary planting is a very important consideration for this species and the provision of natural vegetation is perhaps the major contributory factor to continued and sustained breeding success with Laughingthrushes (Coles 2005).

Outdoor aviaries should be planted with a variety of different plants, climbers, shrubs and trees. These will provide cover and nesting opportunities for the birds.

A variety of different plants have been used in which Sumatran Laughingthrushes have nested successfully (see page 44 nesting in captivity).

Bamboos, evergreen shrubs, ferns, tree-ferns, palms and climbers all help to make the aviary enriching for the birds and attractive and aesthetically pleasing for zoo visitors. In on-show aviaries, taller vegetation should be planted to the rear and along the sides of the aviary, while lower or more structural plants such as palms or tree-ferns can be grown more centrally or towards the front of the aviary.

An open space towards the front of the aviary will resemble a forest clearing and birds will spend a lot of time on the aviary floor, turning leaves over in search of invertebrates. Rotten or moss-covered logs will help to achieve a natural effect, but will need to be replaced regularly as the birds will soon tear them apart.

Living shrubs and trees will provide most of the perching opportunities required, but one or two thoughtfully placed natural branches will enhance the natural feel of the aviary.

A shallow pool at the front or a small stream (on a circulation pump) flowing through the aviary will complete the natural effect and provide bathing opportunities.

A tap and garden hose placed discretely at the back of the aviary will help facilitate cleaning and is also useful for watering the plants when necessary.

Maintenance of the outside aviary should be minimal and substrates should be raked or dug-over and any soiled furnishings washed once or twice a week, apart from periods when birds are nesting, when disturbance should be kept to a minimum.

An over-head sprinkler system attached to the roof of the aviary and connected to a simple timer clock can be used during hot weather. The rain shower the sprinkler provides will stimulate the birds into activity during hot periods.

Indoor accommodation

It is fair to state, that given the opportunity to roost outside, Laughingthrushes will do so without hesitation. However, a shed or similar indoor accommodation with supplementary lighting and heat should adjoin any outdoor aviary and be available for the birds to use should they desire. Birds soon learn to use pop-holes into the indoor accommodation and after a few days, soon become used to being shut in if considered desirable, especially if some foliage (cut pieces of conifer placed in a top corner) is provided for them to hide amongst.

By feeding the birds inside the shelter, they are normally easily encouraged inside with the use of a treat, such as a favoured insect.



Indoor accommodation connected to outdoor aviary Chester zoo



Indoor accommodation Chester zoo

Indoor substrate

Concrete floors are the preferred indoor substrate, to which a layer of sharp sand, wood shavings or similar animal bedding has been applied. There are pros and cons to all of these substrates, sharp sand is useful for the birds feet and it does not produce fungal spores, which may lead to cases of *aspergillosis*, however this substrate must be sieved frequently (normally once a week) to remove any faecal matter and spilt food, the process of sieving

causes dust, therefore good ventilation is required and a good quality face mask should be worn. Wood-shavings or similar wood-based animal bedding needs to be spot-cleaned daily and changed regularly (at least once a week). If these materials become damp, they may produce fungal spores, which may lead to *aspergillosis* in the birds.

Indoor furnishing and maintenance

As the indoor accommodation is primarily used for feeding and roosting, the internal furnishings need to be kept to a minimum. Two simple straight perches, firmly affixed to the walls above head-height at either end using sturdy wooden, metal or plastic brackets should be sufficient. Perches should be replaced annually or sooner if necessary. Some cut conifer branches such as *Leylandii* placed in one corner of the shelter will give the birds a secure place to hide or roost behind.

As the indoor accommodation may also be the best location to catch the birds, cluttered, twiggy branches are not recommended as they will impair the swift capture of the birds.

If the Laughingthrushes are sharing the aviary with other species such as pheasants or partridges, it is necessary to provide some form of cover or shelter in one corner of the aviary shelter floor, where the galliformes can feel secure. This may be a low wooden lean-to type structure or a wigwam of fresh conifer branches tied together and placed on the floor in the corner. If the latter type of shelter is used, it will need to be replaced with fresh branches as old ones dry out.

Food dishes should be replaced and water bowls thoroughly cleaned daily. Any spilt food should be removed and substrates sieved or changed at least once a week.

Indoor environment

Sumatran Laughingthrushes are hardy birds and once acclimatized; do not require a high temperature, however indoor accommodation should be maintained at approximately 15°C during winter. Various heating methods have been used successfully including radiators, hot water pipes, radiant panel heaters and tubular electric heaters fitted with a thermostat. Whichever method of heating is used, exposed heaters should be protected with a sloping cover and wire mesh sides to prevent the birds perching on or gaining access to the heater.



Electric heater with mesh protection and sloping metal cover

A mesh covered skylight will provide some natural daylight, however artificial lighting fitted to a timer and dimmer should be employed during the winter months in Europe. Extending the day length to 12-13 hours closely replicates the photo-period in the wild and allows the birds' additional time to feed during the shorter winter months. Additional lighting fitted with dimmers to extend light levels into the evening will also encourage the birds to roost in the indoor accommodation.

Indoor dimensions

The indoor accommodation does not need to be particularly large if the Laughingthrushes are not sharing the aviary with other species. 2.5m wide, 2.5m deep and 2.5m high is adequate for one pair of birds. The indoor accommodation can be of brick or timber construction and should be insulated and lined with smooth interior walls to allow for easy cleaning.

Pop-holes should be 20cm x 20cm connected to the outside aviary and should be positioned as high as possible to encourage the birds to enter the shelter. Pop-holes on the corner or edge of the aviary will be more useful when attempting to shut birds inside than centrally positioned pop-holes. They can be manually operated sliding doors, which can be adjusted to keep the gap as small as possible or by a cable pulley system.

A slightly larger pop-hole at ground level is required if ground dwelling species are to share the aviary. The Laughingthrushes will also use this lower level access point.

There should always be a safety-porch or corridor adjoining the indoor accommodation to prevent escapes. Door self-closers and internal bolts attached to the safety-porch and aviary door will further minimize the risk of escapes.

Indoor only accommodation

Although Sumatran Laughingthrushes are considered hardy birds and the preferred option is to give them access to outside aviaries, at least one pair has been maintained in a tropical indoor aviary at Chester zoo for a number of years without any issues and has successfully

reared young on a number of occasions. The temperature in this enclosure ranges seasonally from a minimum of 18°C to a maximum of 35°C.

2.2 Feeding

Method of feeding

In a captive environment Laughingthrushes should be fed in stainless steel bowls, heavy ceramic dishes or plastic D cup type food dishes. These should be placed off the ground in such a position to prevent any rodents (which may have circumvented the anti-rodent defences) from accessing the food. Dishes should be attached to a smooth surface such as a wall or a sheet of smooth plastic or polycarbonate sheeting which will prevent any mice from climbing to the dishes. If dishes are attached to aviary netting without any preventative sheeting, mice may be able to access the food. Jump distances for rodents should also be taken into consideration, as there is no point in going to great effort to provide a mouse-proof feeding area if perches are placed too close, as mice are capable of jumping distances of 60 cm or more.



Stainless steel dish attached to a smooth plastic sheet to prevent rodents from accessing and contaminating the food.

Alternatively a free-standing food platform on a smooth metal pole with a plate or baffle below the dish will prevent any determined mice from gaining access to the dish.

Each bird, even those in an established pair should have its own food dish and additional feeding points should be provided for new introductions into an aviary either as a temporary measure until birds are settled or to help eliminate any possibility of conflict around feeding sites.

An essential consideration in the welfare of captive animals is to provide a balanced diet that meets the natural feeding ecology as closely as possible. Healthy nutrition plays a big role in longevity, disease prevention, growth and reproduction.

The natural diet for *Garrulax bicolor* has not been well studied and this is an area of research that required further work. What is known suggests that its diet and feeding habits are similar to those of other *Garrulax* Laughingthrushes and comprises primarily of invertebrates, with berries, fruit and small vertebrates being eaten opportunistically.

However this species, more than any other Laughingthrush is very prone to becoming fat or obese in captivity. Although the reasons for this are currently not entirely clear, great care should be taken to ensure birds are not over-fed or allowed to pick larger amounts of favoured items such as sugary fruits, pellets or insectivorous mixtures than are needed to maintain a healthy weight and body condition. (See Appendix 1. Body condition score).

It is prudent to weigh the amounts of food being offered and to weigh and note the proportion of uneaten food and if necessary, adjust the quantities offered accordingly.

Normally one would expect to find only a few pieces of food left over in the dish the following day.

Traditionally zoos and private aviculturists have offered their birds a “typical” softbill diet comprising a proportion of formulated insectivorous mixture, sometimes with additional items added such as grated carrot or hard-boiled egg, a fruit salad of diced mixed fruits, a ‘softbill’ pellet and a portion of insects complete the diet. This is usually dusted with a multi- vitamin and mineral powder.

Some institutions offer seeds as part of the Laughingthrushes diet, although it is not clear how much of this is actually eaten, as Laughingthrushes do have a habit of storing or burying such food items.

Meat is also included in the diet of some institutions. This is not necessary and is not recommended as part of this species’ captive diet.

Although these somewhat generic diets do not seem to have an adverse effect on other Laughingthrush species, they are not appropriate for Sumatran Laughingthrushes due to their predisposition to put on weight.

Some private aviculturists specialising in keeping Laughingthrushes feed very different diets, giving their birds very simple diets comprising primarily of a formulated pellet diet (either a softbill pellet or pheasant pellet), limited and small amount of fruits and insects only provided prior to and during the birds’ breeding season. Some have found that their birds appear to be in very good condition and do not show the subcutaneous fatty deposits that have been encountered in this species in other institutions.

A diet trial carried out at Chester zoo comprising of 10g Orlux Rimiline pellets and 7.5g of diced fruit (apple, pear, papaya or blueberry) offered in the morning and 3-4 crickets or 2 adult locusts given in the afternoon per bird showed little or no reduction in the amounts of subcutaneous fat the birds had. In some instances, the birds became fatter. During the breeding season, nesting pairs included in the trial were offered more insects (crickets,

locusts, mealworms) to feed their young, some of which will have been consumed by the adult birds.

The diet fed to Sumatran Laughingthrushes at a rehabilitation and reintroduction programme in Sumatra comprised per bird:

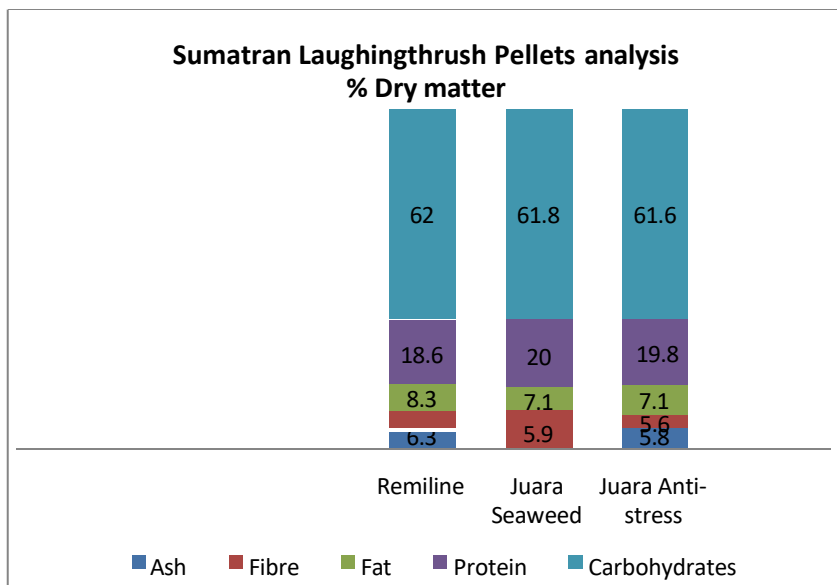
- Morning: 7g mixed pellets (Juara seaweed, Juara anti-stress) + 7g of insects or larvae (Morio worms, mealworms, crickets or cockroaches)
- Midday: if pellets had been eaten, a further 7g pellets were given + 10 – 15 medium sized insect (wild grasshoppers, locusts etc.)
- Late afternoon: if pellets had been eaten, a further 7g pellets + 10-15 grasshoppers were given
- No fruit was given as the birds did not eat it

None of the birds from the Sumatran reintroduction programme showed any visible subcutaneous fat.

Nutritional analysis of these three pellets (Orlux Rimiline, Juara Seaweed and Juara anti- stress) showed that their % dry matter constituents were very similar and the main difference in diets was the provision of fruit for the Chester zoo birds.



Pellets fed to Sumatran Laughingthrushes at Sumatran release programme and Chester zoo



Nutritional analysis % dry matter of three different pellets fed to Sumatran Laughingthrushes

The following diet regime based more closely on the species' natural diet and comprising mostly of gut-loaded insects or insect larvae with a small proportion of low-sugar berries only given three days a week and small quantity of Orlux Rimiline pellet has been trialled on a number of birds at Chester zoo. This has shown positive effects in reducing subcutaneous fatty deposits in some individuals.

Great care should be taken using this diet to ensure the birds receive sufficient food, as they metabolise most of these food items faster than a pellet-based diet.

During the trial, carried out over a four month period outside of the breeding season, all birds were weighed and a body condition score was taken once a week to ensure they did not lose weight too quickly.

Once an appropriate weight and body condition score has been achieved, a weekly weight can be attained by encouraging birds to hop onto digital scales, thus avoiding the need to catch the birds.

Day	Time	Food Items offered
Monday	0800	8g Adult black crickets
	Midday	5g Berries
	1600	10g Adult crickets 1 adult locust 2.5g pellets
Tuesday	0800	8g Adult black crickets
	Midday	5g mealworms or cockroaches
	1600	10g Adult crickets 1 adult locust 2.5g pellets
Wednesday	0800	8g Adult black crickets
	Midday	5g Berries
	1600	10g Adult crickets 1 adult locust 2.5g pellets
Thursday	0800	8g Adult black crickets

	Midday	5g mealworms or cockroaches
	1600	10g Adult crickets 1 adult locust 2.5g pellets
Friday	0800	8g Adult black crickets
	Midday	5g Berries
	1600	10g Adult crickets 1 adult locust 2.5g pellets
Saturday	0800	8g Adult black crickets
	Midday	5g mealworms or cockroaches
	1600	10g Adult crickets 1 adult locust 2.5g pellets
Sunday	0800	8g Adult black crickets
	Midday	5g mealworms or cockroaches
	1600	10g Adult crickets 1 adult locust 2.5g pellets

8g adult black crickets = 11 crickets. 10g adult black crickets = 15 crickets

2.5g Orlux Rimiline pellets = 2.5ml scoop

All insects and larvae must be properly gut-loaded with Pro-Grub and suitable vegetables prior to feeding.

Crickets and cockroaches should be offered in smooth-sided deep dishes to prevent escapes. 20 cm stainless-steel dishes and plastic washing-up bowls are preferable.

A pair of birds should have two separate dishes, spaced as far apart as possible to avoid one bird dominating the food, for example a steel dish off the floor at one side of the indoor accommodation and a large plastic bowl on the floor on the other side of the room.

Berries should be low-sugar varieties and can be Redcurrants, Blackcurrants, Blackberries, Raspberries, Elderberries, Blueberries, or Cotoneaster. These are normally offered whole, although large berries may be chopped. Food consumption is recorded.

During the breeding season when birds have chicks, they will receive an *ad-lib* supply of small insects. The adult or large hard-bodied insects and larvae will be replaced with small soft-bodied insects such as small crickets and cockroaches at this time.



Digital weighing scales. A few insects provided in the deep food bowl with perch attached will encourage the bird to use the scales and regular weights can be collected.

Recommendations

- Weigh, body score and photograph your birds at least twice a year – before and after the breeding season
- Measure the amount of food consumed
- Keep your birds in large planted aviaries
- Feed lower fat insects such as crickets, Locusts and Cockroaches
- Gut-load all insects
- Do not feed minced meat
- Avoid offering sugar-rich fruits
- Avoid insectivorous mixes and pellets with added honey, syrup or sugar

In an effort to reduce subcutaneous fat at Cikananga Conservation Breeding Centre, Sumatran Laughingthrushes receive their pellets in a small dish attached to a swinging vertical perch. The birds have to work hard and suspend themselves in an almost upside-down position in order to access the food.



A feeding dish fitted to a wooden branch requires the bird to hang upside down to feed (Anaïs Tritto)

Water

Fresh water should be available at all times. A small bowl off the ground and adjacent to a perch in the aviary shelter is suitable for drinking. Laughingthrushes are avid bathers and will take a bath even during the coldest winter days, as soon as the ice is broken and fresh water is replenished, the birds will immediately come down for a bath. A large shallow dish 5 cm deep made from stainless steel, ceramic or sturdy plastic can be used for bathing, however a shallow concrete pool or water feature such as a small stream will be more aesthetically pleasing for an on-show aviary.

2.3 General behaviour

Basic Social Structure

Sumatran Laughingthrushes are usually maintained in pairs for breeding purposes. However, they may be kept in single-sex pairs or small single-sex groups of 3-4 individuals. Juveniles of either sex can be grouped together in spacious aviaries with individuals from broods from different pairs for up to a year, before being paired for breeding.

Pair formation

New pairs should be formed as early as possible prior to the onset of the breeding season. In Europe where Laughingthrushes normally commence nesting in March or April, it would be

prudent to ensure birds are paired together and established in their breeding aviary by January. Care should be taken when forming new pairs, even single-sex pairs.

Ideally new pairs should be introduced to each other in a neutral environment out of vocal and visual contact of conspecifics.

If a neutral aviary is not possible, it is better to allow the female to become established in the breeding aviary, before introducing the male.

Close observations should be made of the birds for several days after introduction to ensure they have bonded. If chasing or fighting is observed, the birds should be separated immediately. However aggression seems to be rare within pairs of Laughingthrushes and no fatalities have been recorded between male/female pairings. The introduction of a male into an established males' territory has resulted in the death of the newcomer, however this male pair was housed approximately 20 metres from an established breeding pair and the aggression between the two males, may have been redirected aggression towards each other due to them being able to hear the female in the near-by aviary.

Regular duets, perching close together and occasional mutual preening are signs that the pair has bonded.

Interactions between different pairs

Distance between pairs of Sumatran Laughingthrushes is an important factor considering the highly territorial nature and sensitivity of this species.

Pairs should not be housed in adjacent aviaries as direct aggression through the aviary mesh is likely to occur.

If more than one pair is kept, this should be as far apart as possible, out of sight of each other and ideally at a distance great enough to not cause vocal distress between pairs.

The amount of disturbance varies between pairs and those that are mature or established may be less affected than newly-established pairs.

At Chester zoo, two established pairs housed in large aviaries separated by a distance of approximately 15m and with obscured visual contact, both successfully raised young in 2013, where as in 2014, due to the death of one individual, one of the established pairs was replaced by a young recently-formed pair. The mature pair successfully raised young, while the young pair called and duetted frequently but failed to successfully rear any young.

Intra-specific tolerance

Due to the rarity of the species, unrelated groups of mature birds should not be housed together in the same aviary.



A group of 5 (of 7) juvenile Sumatran Laughingthrushes housed together at CCBC

Inter-specific tolerance

At CCBC a group of seven juvenile Sumatran Laughingthrushes from three separate pairs lived compatibly in a very large planted aviary with three male Spectacled Laughingthrushes *Garrulax (Rhinocichla) mitratus* for a period of six months.

Parent/sibling tolerance

Due to the rarity of the Sumatran Laughingthrush and the importance of each individual young bird to the breeding programme, young are normally removed from their parents' aviary once they are fully independent. This is normally at approximately 40-50 days old.

At CCBC where aviary space was at a premium, young from one pair were left in the breeding aviary with their parents in an attempt to stop the parent birds re-nesting (Stephan Bulk *Pers. Comm.* 2014). However the parent birds continued to nest and successfully raised a further brood of young. No aggression was noted towards the older juveniles however it was not clear if the young from the first brood assisted with the care of their younger siblings. Co-operative breeding and understanding the role of extended family groups of birds in our care is an area requiring further study and as breeding rates improve within the population, may be carried on well-represented pairs in the future.

Coexistence with other species

The general rule is not to house this species with other birds unless it is essential. Although some Laughingthrush species can be tolerant of other birds, even smaller species than

themselves, especially in large planted aviaries and outside the breeding season, it is not advisable with this species.

Even if direct aggression towards other aviary occupants is not seen, there is evidence to suggest that larger Laughingthrushes may eat the eggs or chicks of other species, if given the opportunity. The likelihood of similar sized or smaller species successfully rearing their own young in the same aviary as a pair of large Laughingthrushes is unlikely or at least runs the risk of egg or chick predation or nesting birds coming into conflict with the Laughingthrushes. Coles (2005).

If Sumatran Laughingthrushes are kept with other species, it is normally with a pair of pheasants. Although little direct aggression has been noted from the Laughingthrushes towards adult pheasants outside the breeding season when housed in large planted aviaries, and in fact they often seem to co-habit with little interaction, there is always the risk that the Laughingthrushes may predate the eggs or even small recently hatched pheasant chicks. If pheasants can be encouraged to nest under thick cover or to nest in an aviary shelter, there is a chance that well-brooded eggs will avoid the attentions of the inquisitive Laughingthrushes. This has been achieved at Chester zoo, when a pair of Cabot's Tragopan *Tragopan caboti* successfully reared their young in an aviary shared with a single male Sumatran Laughingthrush. Once the eggs had hatched the female tragopan was confined to the aviary shelter with her young for several weeks, until they were large enough to not be considered at risk from the Laughingthrush.

If a pair of Laughingthrushes is to share an exhibit with a pheasant species, the pheasants should be of low breeding importance (un-like the Cabot's Tragopans above) or a single male. This has been achieved successfully at Chester zoo with a breeding pair of Laughingthrushes sharing their aviary with a single male Salvadori's pheasant *Lophura inornata* during 2015, however during 2016 the same breeding pair ruthlessly attacked the pheasant, requiring its immediate removal from the aviary before serious injury occurred.

At Bristol zoo during 2013, a breeding pair of Sumatran Laughingthrushes shared their aviary with a breeding pair of Palawan peacock pheasants *Poyplectron napoleonis*. Just prior to the pheasant eggs hatching, a wire cage was placed over the incubating pheasant and she and the subsequent chicks remained protected from the attentions of the Laughingthrushes. After approximately eight weeks the chicks were deemed to be large enough for the cover to be removed. At this stage, no aggression was noted and the pheasant chicks were reared successfully.

During 2015, the same pair of Sumatran Laughingthrushes viciously attacked two year-old Palawan peacock pheasants when their chicks hatched and the pheasants had to be removed from the aviary to avoid injury or worse (Povey *in litt.* 2015).

The other important issue with Sumatran Laughingthrushes sharing their aviaries with other species is their propensity to easily become over-weight if not feed a controlled and well-balanced diet. Sharing their aviary with pheasants or other species will give the Laughingthrushes access to additional and inappropriate food, as it is almost impossible to devise a feeding area for the pheasants to which the smaller, faster and very inquisitive Laughingthrushes cannot access.

A poultry treadle feeder has been tried at Bristol zoo to feed the pheasants while preventing the Laughingthrushes from accessing the food.

A metal flap opens, exposing the food as the pheasant stands on a metal plate. Once the pheasant steps off the plate, the flap lowers and covers the food. This device is designed in such a way that only the heavier species standing on the plate will raise the flap.



Sharing an aviary with Salvadori's pheasants *Lophura inornata* Waddesdon Manor 2005

2.4 Breeding

The Sumatran Laughingthrush was bred for the first time in captivity at Waddesdon Manor Aviaries (The Rothschild Foundation) in Buckinghamshire, England in 2005 (Owen 2006).

Although it has now been bred by several institutions and private aviculturists, it has proven to be by no means an easy Laughingthrush species to breed. This is in part due to its rather nervous disposition when nesting, with some pairs seemingly abandoning chicks at an early stage of development at the first signs of disturbance. Poor breeding success initially may also be due to the limited number and quality of some of the individuals available to the breeding programme. As early attempts to parent-rear often failed, it was felt necessary to remove eggs or chicks for hand-rearing. The subsequent hand-reared young may have taken longer to reach breeding maturity and some initially, were less than model parents.

As more parent-reared birds have been produced, so has the number of good young breeding birds able to rear their own offspring.

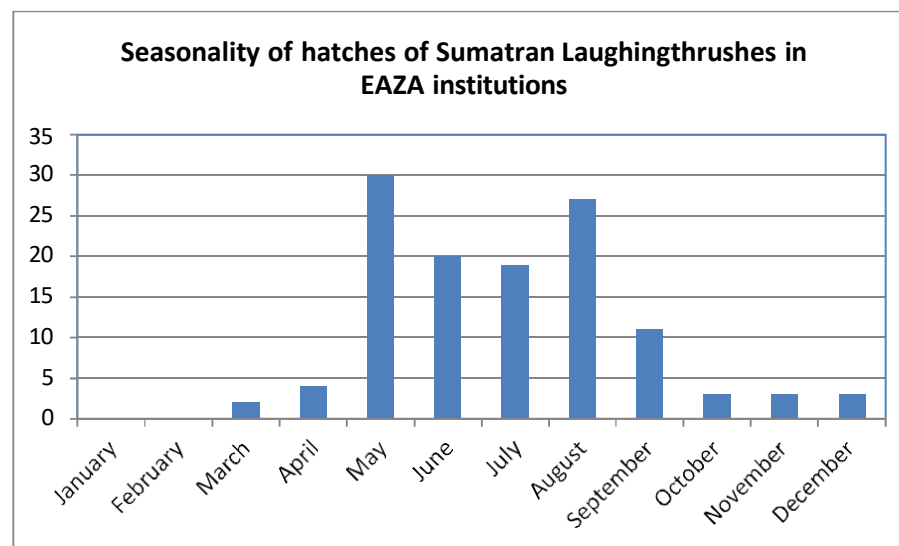
Seasonality of breeding in captivity

In Europe where birds are normally housed in outdoor aviaries, breeding is seasonal and coincides with the increased day length and temperature of the European spring and summer months. Most nesting activity takes place between the months of March and September with a peak in nesting in the months of May, June, July and August.

Occasionally pairs will continue to nest into the autumn or winter months, particularly if the weather remains mild. One pair at Waddesdon Manor laid eggs in December 2007 (Owen *pers.obs.*), however due to the decrease in temperature and day length these late clutches invariably fail unless removed for artificial incubation and hand-rearing.

The breeding season may be prolonged if birds are kept indoors and extended if abundant supplies of rich foods, particularly insects are available throughout the year. This is to be discouraged, as birds may lay multiple clutches with the potential for females to exhaust their calcium levels and become “burnt out” potentially resulting in a shortened reproductive life.

This area needs further research and investigation, as it is actually rather difficult to prevent a determined pair of birds from attempting to nest. At CCBC where the climate remains at a fairly constant and warm temperature, staff found that even when some of their over-represented pairs had their nest baskets and nesting material removed and were put on a basic maintenance diet, some determined pairs still attempted to nest.



Seasonality of hatches in EAZA institutions.

At Cikananga Conservation Breeding Centre in Java, this species has nested throughout the year with nesting recorded every month of the year.

Nest-building

Early nest construction can prove to be a long, drawn out affair, particularly if the birds cannot settle on a suitable nesting site or if there is insufficient nesting material available, such efforts may be abandoned before completion.

Both sexes build the nest, although the male normally plays a greater role in nest construction. The breeding pair becomes very quiet and secretive during the nesting period, making observations of nest building challenging.

Disturbance, such as aviary cleaning and maintenance should be kept to a minimum at this time. Nests may be built in natural vegetation, either a dense shrub, small tree or amongst thick climbing vegetation or built in a wicker or wire nesting basket. Nests are normally built 1.5 –

2.5 metres above ground level however this may be due to the fact that most aviaries for these birds are seldom higher than 3 metres.

A variety of nesting material is used in construction, including fine twigs, plant stems, rootlets and fibres, bamboo leaves, long pine needles and coconut fibres.

It is important to provide the birds with an abundant fresh supply and variety of these materials prior to and throughout the breeding season. They can be placed around the aviary in clumps at different levels and scattered on the aviary floor. If sufficient nesting material is provided, nest construction is usually completed within 4-5 days. Inclement weather such as strong winds or heavy rain may delay completion of the nest for several days.

The exterior of the nest is built using the thicker twigs, rootlets and fibres and the nest cup is usually lined with finer material such as bamboo leaves and coconut fibres.

One pair at Chester zoo lined their nests with the fine black stems of the Rata vine *Metrosideros perforata* which grew profusely in their aviary.

A pair at Bristol zoo took over and re-built in an old nest of Chestnut-naped Imperial pigeons *Ducula aenea paulina*.



Nest built within the foundations of an old Chestnut-naped Imperial pigeon *Ducula aenea paulina* nest. Bristol zoo (Casey Povey).



Nest built in wicker basket Chester zoo. Fine twigs form the outer wall of the nest, coconut fibre and dry bamboo leaves are used to line the cup.

Natural nests have been built in the following plant species:

Bamboo *Phyllostachys aurea*

Phyllostachys bambusoides

Elaeagnus x ebbingei

Loricera nitida

Ivy *Hedera* spp.

Clamatis armandii

Viburnum tinus

Yew *Taxus baccata*

Rata Vine *Metrosideros perforata*

Tree fern *Dicksonia antarctica*

Ficus benjamina (in tropical environments)

Dracaena fragrans at CCBC

Fish-tail palm *Caryota mitis* (in tropical environments)

Artificial nest sites

A Variety of different receptacles of varying dimensions including wicker or wire mesh baskets or wooden trays lined with wire mesh have been used by this species to build its nest.

Wicker baskets appear to be the most appropriate and should be approximately 15cm in diameter and 10cm deep.

Baskets should be fixed firmly to the plant or structure using cable ties.

As wicker baskets rot quickly and their bases may fall out, they normally only last for one season and should be replaced annually.



Wicker nest basket

Positioning of nest baskets is crucial to the birds accepting them. Laughingthrushes favour a secluded location in a tree, shrub or climbing plant at the back or sides of the aviary, where they feel secure. However they also like a clear view of the surrounding aviary allowing them sight of approaching keepers, whilst still feeling hidden. If nest baskets are not placed in or

amongst living plants, they need to be camouflaged with some form of cover, conifer branches being the most ideal as it keeps its colour for a longer period than most other cut foliage.



Wicker nest basket attached to a clump of mature ivy stems 1.8 m above the ground.

Mating

Mating in Laughingthrushes has seldom been observed.

Hewston observed mating in a pair of White-browed Laughingthrushes which took place on the aviary floor, both birds standing side-by-side with tails vertical and heads lowered just before copulation. Coles (2005).

One pair of Sumatran Laughingthrushes at Chester zoo were observed via CCTV mating on the edge of a newly constructed nest. Copulation lasted 3 seconds and was followed by a bout of calling from both birds (Woolham *pers. comm.* 2017).

Incubation period / egg laying sequence

The first egg is normally laid within 3-5 days of completion of the nest and additional eggs are laid daily until completion of the clutch. Incubation normally starts with the laying of the second egg. The incubation period is 14 days and is carried out by both parents. Observations of a pair at Waddesdon Manor indicated that the female incubated mainly during the day whilst the male sat at night, although the amount of time and time of day each bird spends incubating seems to vary greatly between individuals. Incubating birds are very quiet and normally only leave the nest occasionally to feed, bathe and defecate. Male birds have been observed delivering food (insects) to incubating females.

Egg Description

The eggs of Sumatran Laughingthrush are white in colour and the normal clutch size is three. Occasionally only one or two eggs are laid and clutches containing four eggs are rare (only one record).

Egg Length (mm)	Egg Breadth (mm)
32.8	21.9
30.4	22.6
30.4	22.2
30.4	22.6
29.4	22.6
30.0	23.7
29.7	22.9
29.4	20.7
29.1	21.4
29.0	23.1
28.6	22.8
28.6	22.9
28.7	22.9
28.7	22.6
26.8	20.5

Biometric data for 15 *Garrulax bicolor* eggs

Average 29.4mm x 22.3mm (range 32.8 x 21.9 – 26.8mm x 20.5mm). The shading denotes individual clutches.

Hatching

Eggs hatch after a 14 day incubation period. Indication of hatching is normally detected by the behaviour of the parent birds who may be observed carrying food items (insects or their larvae) in their bills or the presence of eggshell fragments (normally half shells from hatched eggs), removed from the nest by the adult birds and deposited at the furthest point from the nest. This is often at the front of the aviary, as nests are often situated at the rear of the aviary, but may be found in the birds' indoor accommodation or in a food dish. Through nest camera observations of two separate nesting attempts at Chester zoo, each containing two eggs, the brooding parent (male in one case, female in the second), were seen to peck at the hatching eggs. Before each chick had fully emerged from the egg the parent was seen to peck at and consume small fragments of egg shell. In one observation, the brooding male ate the broad end of the egg while still on the nest. Once the chick had fully emerged, the female bird replaced the male on the nest and began brooding. She attempted to consume the remaining large part of the hatched egg, but as she was unable to swallow it, she removed it from the nest.

In one nest a second chick hatched seven hours 30 minutes after the first.

One chick was seen to receive its first feed eight hours after hatching. The second chick received its first feed three hours after hatching.

Clutch Recycling

Sumatran Laughingthrushes are multi-clutched and will lay a replacement clutch if earlier eggs fail or after earlier broods have fledged. Recycling can be very rapid, with replacement clutches being laid as little as 10 days after the failure of an earlier nest.

Number of clutches

Laughingthrushes are multi-brooded and unsuccessful attempts can be repeated many times. Up to five clutches have been laid in a single season for this species.

Nest inspection

Most established breeding pairs will tolerate some monitoring of the nest, however this should be kept to a minimum to avoid disturbance. Nests may be quickly and quietly checked by an experienced aviculturist when the incubating or brooding bird leaves the nest. To avoid disturbance, a closed-circuit camera may be used to record nesting behaviour if the camera can be installed above a reliable nesting site. This has been used with great success at CCBC and Chester zoo and allows nests to be monitored closely without disturbing the nesting birds.

Closed ringing of parent-reared chicks has to date not been attempted. Given the rarity of the species it is currently felt that it is not necessary to carry out this procedure due to the potential risk of birds throwing out or abandoning chicks. Young birds can be fitted with split leg rings and micro-chip transponder at a later date.



Nest built in a typical wicker basket, Chester Zoo. The CCTV camera allows nesting behaviour to be monitored without causing disturbance.

Development and care of the young

Young are naked on hatching. Both parents take their turn at feeding chicks when the other is on brooding duty. Food (insects and their larvae) is taken whole to the chicks. Some birds will take only one item at a time, normally when the nestlings are young. After a few days, the parents carry larger quantities of food at each feed to their growing brood.

The brooding parent will stand on the edge of the nest while it feeds the chicks. Faecal sacs are either eaten by the parents or removed from the nest as it leaves. The parent birds will usually continue to brood the nestlings until they are 10-12 days old. CCTV has revealed that brooding duties are shared by both parents and the length of time each bird broods varies greatly, with birds brooding for only a few minutes to more than two hours.

Nestlings develop rapidly and normally leave the nest at around 13 days of age.

Food provision during nesting

Live insects should be offered regularly or *ad-lib* throughout the day to Laughingthrushes which have nestlings. A considerable number of chicks have been lost before they are 7 days of age. This may be due to gut-compaction from being fed tough-skinned invertebrates or their larvae that are too tough to digest. It is recommended that only small soft-bodied insects such as 3rd instar crickets and small soft cockroaches should be provided for the first week of life. Soft-bodied white mealworms that have recently shed their skins, medium-sized crickets, cockroaches, small locusts and soldier fly larvae can be offered once the chicks are over a week old. Before this age gut compaction from tough insects or their skins may be a cause of death in young chicks.

Wax moth larvae should not be offered to Laughingthrushes with newly hatched chicks, as there is a risk of these tough-skinned larvae causing impactions in the nestlings' gut. See photo below of a 5 day old chick that was killed by its parents. Post mortem revealed that its gut was filled with numerous undigested wax moth larvae.

Crickets and cockroaches should be offered in deep, smooth sided containers or bowls to avoid escapes



Stomach contents of 5 day old Sumatran Laughingthrush, showing undigested wax moth larvae (Javier Lopèz).

Ensure all insects have been gut-loaded with a nutritionally balanced insect gut-loading formula and have been dusted with a multi-vitamin powder.



Female delivering food (locust hoppers) to large nestling



Male removing faecal sac

Chick loss

Insufficient or inappropriately sized live food during the critical chick rearing period are possible causes for chick loss as is disturbance from staff or zoo visitors. Cold or wet weather conditions may also be a problem, although by encouraging birds to nest in dense vegetation or under cover, losses will be reduced. Heavy parasite burdens, coccidia or toxoplasmosis may also be a factor affecting chick survivability, although more research is needed in this area.

Unfortunately young dead chicks are often too decomposed for an accurate post mortem diagnosis.

Fledging

Sumatran Laughingthrushes normally fledge at 13 days old. Any sooner may be due to disturbance around the nest.

Fledglings move little in the first few days after leaving the nest and if they do, disturbance is the usual cause. The result is frequently a crash landing but fledglings are able to clamber well. Their bodies appear to be only half the adult size whilst the feet and legs give the appearance of almost being fully developed. Fledglings will occasionally flutter towards parents as they approach with food. This behaviour increases as they become more confident in their surroundings and controlled flights usually occur seven to ten days after fledging, becoming stronger and longer as time passes.

Independence is gained between 3-4 weeks after leaving the nest at about 35-45 days of age, although by then young will have been partially feeding themselves for some time and have grown to almost adult size.



Fledglings 13 days old at Chester zoo. On leaving the nest, fledglings normally sit quietly together in dense cover and only move if disturbed.

2.5 *Artificial incubation*

If passerine eggs are to be artificially incubated, they should be set in an incubator as soon as possible and should not be cold-stored prior to incubation. If eggs are laid during cold temperatures it may be beneficial to bring them to approximately 20°C for an hour prior to setting in the incubator.

Prior to setting, weight, length and breadth measurements should be taken for each egg.

Eggs should be carefully set in a reliable incubator at a temperature of 37.5-37.8°C and at a relative humidity of approximately 50%.

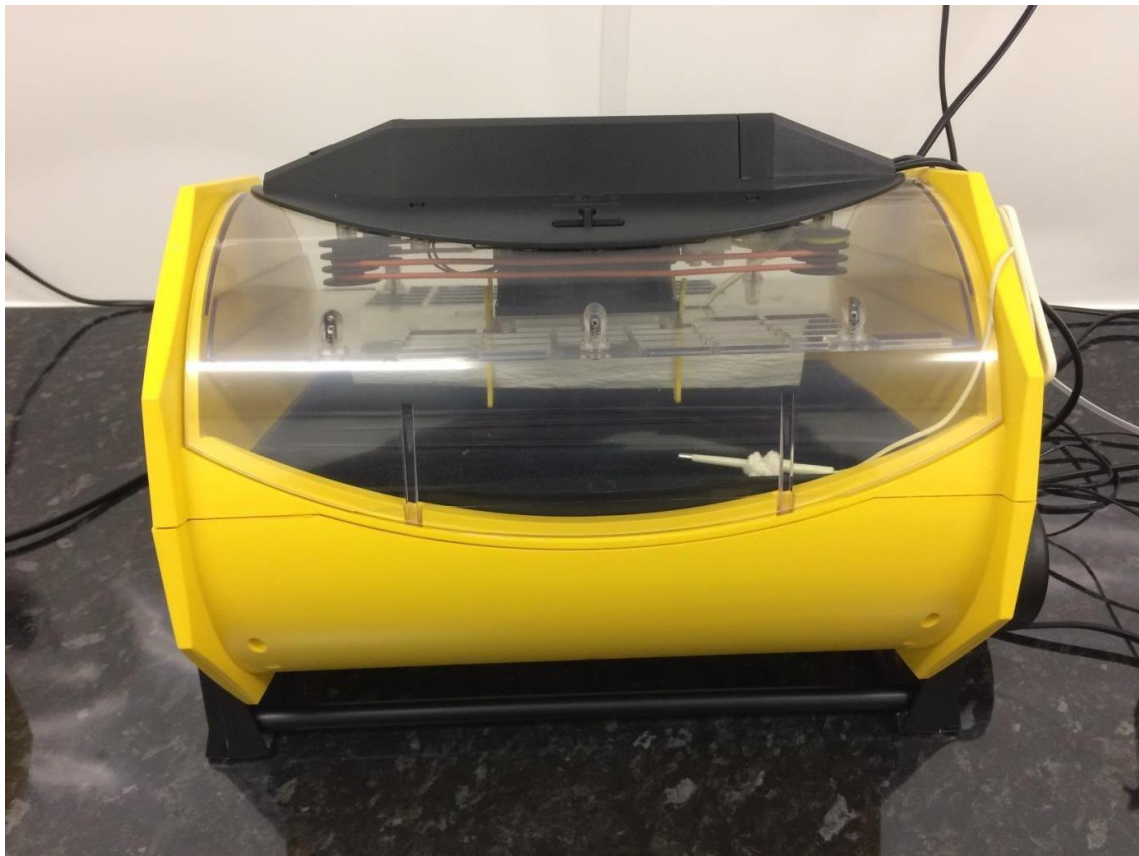
The eggs should be turned a minimum of 5 times a day. This is normally done using an automatic turning system within the incubator, however eggs may be turned by hand and many aviculturists choose to turn the eggs an additional 3-5 times a day even if an automatic turner is used.

Eggs must be handled very carefully and candled 3 days into incubation to determine fertility. Care should be used when candling eggs to ensure they are not held close to a hot light, which may damage the developing embryo.

Candling is normally carried out every 2 or 3 days to evaluate chick development.

Once the egg has internally pipped, normally at day 12 or 13, turning should be stopped. The humidity may need to be increased to 70-80% which may aid hatching of the chick and prevent it from becoming stuck to the drying membrane of the egg.

Hatching times seem to be very variable, once externally pipped chicks may take between 1 to 8 hours to hatch.



Incubator

2.6 Hand-rearing

Wherever possible, parent-rearing is the rearing method of choice as this tends to produce better quality young birds which go on to breed sooner and more reliably than their hand-reared counterparts.

Parent-reared birds exhibit a full repertoire of natural behaviours, something that some hand-reared birds may not.

However parent-rearing is not always an option and particularly if breeding pairs have failed to hatch clutches of eggs or to rear their young on more than one occasion, if they are old birds, those that are un-represented in the population or if a clutch of eggs has been abandoned or laid late in the season, hand-rearing should be considered.

The general rule of thumb when hand-rearing any bird (that is intended to be a future breeding bird) is to keep human interaction with it to an absolute minimum, particularly after the chicks' eyes have opened.

Wherever possible it is always preferable to hand-rear a chick with nest mate/s or even with a chick or chicks of a different species.

As these birds are very intelligent, they can easily become tame and imprinted if too much time is spent with them during the rearing process, which can make them less suitable as breeding birds in the future.

In general for experienced aviculturists skilled in hand-rearing passerines, most Laughingthrushes are relatively straight-forward to hand-rear. However, *Garrulax bicolor* has proven to be more challenging to hand-rear with losses at an early age occurring inexplicably. Whether losses are due to health issues with the chicks or whether this species has different nutritional rearing requirements to other Laughingthrushes requires further investigation.

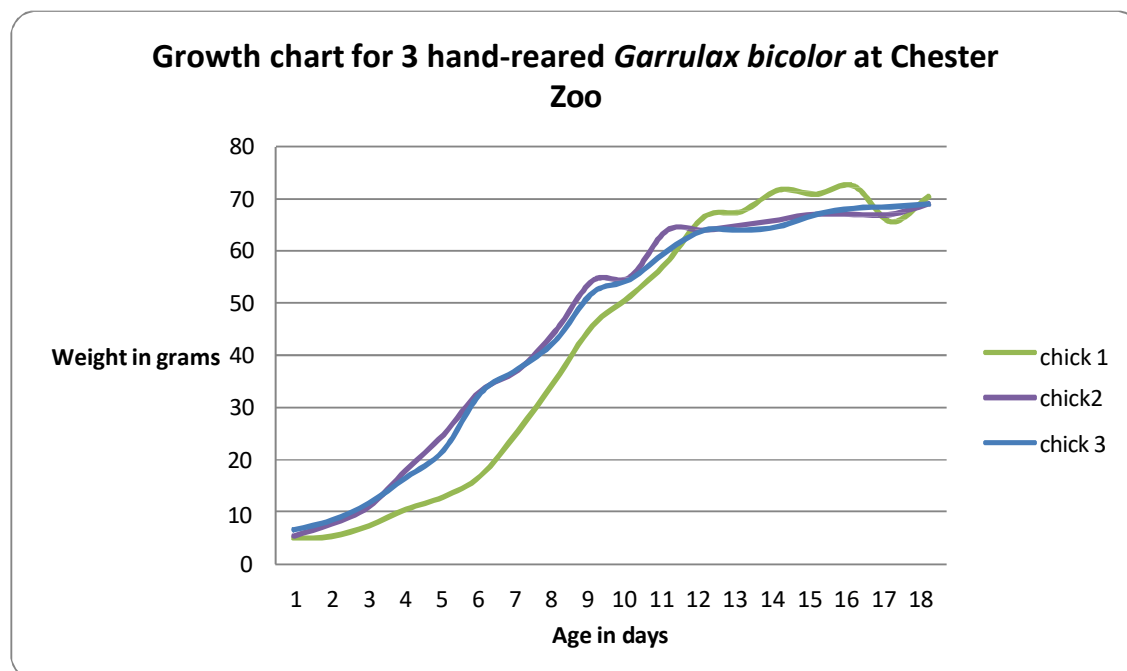
The following hand-rearing diet and regime has been used successfully to rear this species.

Age	Temperature °C and humidity R/H	Feed and Frequency	Rearing Notes
0	37°C - 36.8°C 60%RH maintained throughout the rearing period	No solid feed given for the first 8-10 hours after hatching. Fluids (0.01ml) such as electrolytes or cooled boiled water given every 1.5 hours to aid hydration. 8-10 hours after hatching, tiny amounts of pinkie mouse, chopped to a creamy consistency is offered on the tip of a pair of tweezers. Fed every 1.5 hours - 2 hours from 6am - 8pm. Chicks tend not to beg for food after this time	On hatching the chick is moved to a brooder and its navel is treated with a mild anti-biotic solution such as pevadine. Chick is placed in a small ceramic or plastic bowl lined with paper towel. A fine plastic mesh or coconut fibre lines the nest to prevent splayed legs

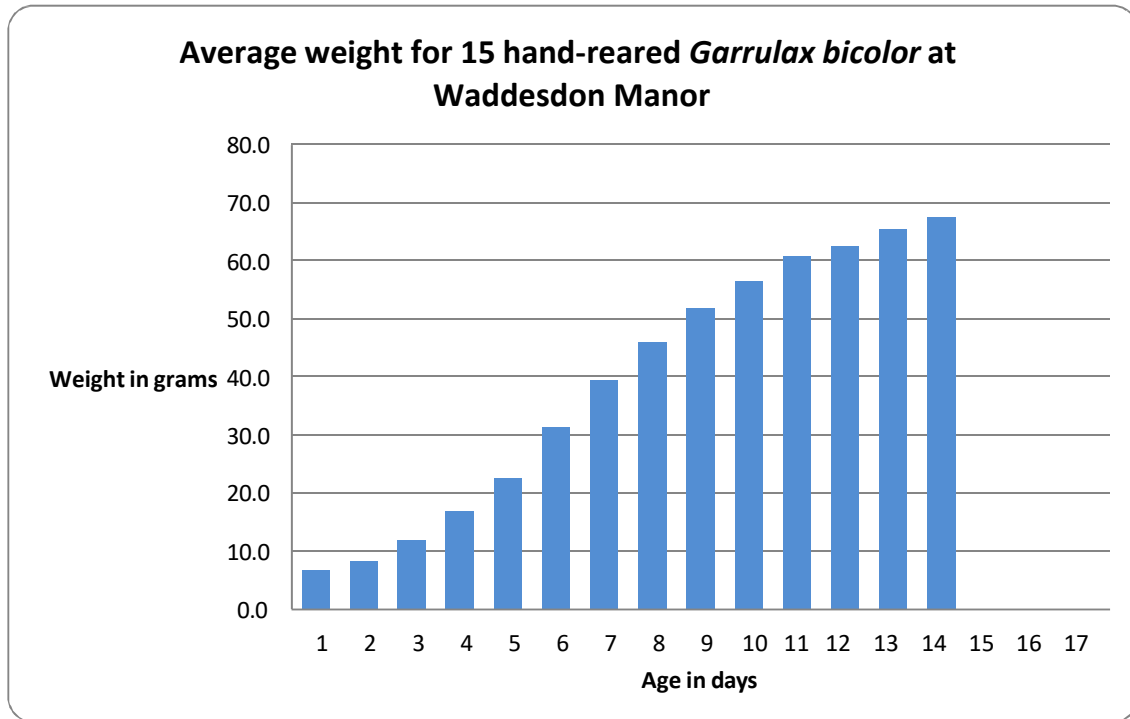
1	36.5°C	Fed at 1.5 - 2 hourly intervals. Continue to only feed very small amounts – 3-4 tweezer tips of food at each feed	Chicks are normally strong and vocal. They may be stimulated to beg by whistling or by gently tapping on the side of the nest. Faecal sacs are normally produced after the first morsel of food is given. These mucous-coated sacs can be removed from the nest after feeding
2	36°C	Fed at 2 hourly intervals	Slightly larger quantities of food can be given at each feed as long as faecal sacs are being passed regularly
3	35.8°C	Fed at 2 hourly intervals	Chicks should be fitted with a 4.55mm internal diameter (size N) closed leg ring. This can be difficult to do if left until day 4
4	35.5°C	Fed at 2 hourly intervals	Chicks normally have an increased appetite and larger quantities of a slightly courser consistency can be fed
5	35°C	Fed at 2 hourly intervals A small pinch of nutrobal or avimix multi-vitamin powder added to the mix once a day	Producing large faecal sacs after each feed
6	34.5°C	Fed at 2 hourly intervals Ripe papaya added to the diet 80% Pinkie (chopped more coarsely) and 20% papaya	Nest substrate replaced with small sticks to enable the chick to grip and prevent foot or leg abnormalities
7	34°C	Fed at 2.5 hourly intervals	
8	33°C	Fed at 2.5 to 3 hourly intervals. Insects (white-soft skinned mealworms, small crickets) added to the diet	White feathering appearing on breast. Primaries not shedding shafts yet
9	32.5°C	Fed at 3 hourly intervals	White feather on crown, feather shafts started to shed
10	32°C	Food becoming more varied, with approximately 60% pinkie 15% papaya, 20% insects, 5% soaked mynah pellet added	Starting to vocalise – trilling/laughing call
11	31.5°C		
12	31°C		Standing/stretching and preening a lot
13	30.5°C	Appetite decreased – smaller amount of food offered more frequently – at 2.5 hour intervals	Trilling more often and starting to become more active in the nest. Occasionally sitting on the edge of the nest. Chicks may leave the nest at this age
14	30°C		Normally fledging at day 14. Sturdy low perches provided in the brooder for the chicks

			to perch on as chicks are initially ungainly. Chicks stop producing faecal sacs and start producing smaller adult type faecals
15	27.0°C	6 feeds/day	Roosting on perch. Very vocal at times – trilling and chattering. Eye stripe developing. Observed bathing in shallow dish of water
16	27.0°C	In addition to tweezer feeds, chicks provided with a small dish of adult diet with numerous live insects to encourage self-feeding	Chicks observed inspecting food dish, though no self-feeding seen
17		Reduce to 5 feeds/day	Last feed 2000
18	25°C		Last feed at 1800 Chicks showing increased interest in food dish
20	Ambient ~20°C	Reduce to 4 feeds/day	Started to pick at food in dish
20-25	Ambient ~20°C	Tweezer feeds stopped once self-feeding confirmed. Chicks placed on adult diet	Moved to weaning cage

Hand-rearing protocols for two Sumatran Laughingthrush chicks Chester Zoo 2011



Growth chart for three hand-reared Sumatran laughingthrushes at Chester Zoo



Average weight for 15 hand-reared Sumatran Laughingthrushes reared at Waddesdon Manor

Chick Development

Sumatran Laughingthrushes hatch naked and blind (*nidificous*) and have pink skin.



One day old, naked and blind. Skin pink with dark grey developing feather follicles under the skin on back and wings. Bill pinkish with dark shading and white tip and egg tooth, gape flanges pale yellow. Inside of mouth pinkish-orange



Four days old Skin darkening, pins developing under the skin on head, back, wings and flanks.



Five days old. Eye slits starting to appear. Skin colour darkening, legs and feet greyish pink. Toe nails white. Pin feathers erupting on the wings.



Seven days old. Eyes partially open. Dark pins emerging on head, back, flanks, wings and tail.



Eight days old



**Nine days old. Eyes fully open. Gape flanges pale yellow.
White pin feathers emerging on crown. Legs bluish grey. Skin greyish.**



Twelve days old. Eyes reddish-brown. Feathers almost fully emerged. White on crown with a pale grey tinge on nape. Dark facial mask appearing around the eyes. Remainder of body plumage dark brownish black. Bill greyish horn with a white tip. Legs and feet bluish-black, toes nails white.



Fourteen days old fledged. Waddesdon Manor. First captive-bred Sumatran Laughingthrush reared to independence 2005.



Thirteen day old parent-reared fledglings Chester zoo 2013.



Adult feeding fledgling at Cikananga conservation breeding Centre 2013 (Florian Richter).



Three months old. Prague zoo (Anto  n V  dl).

2.7 Catching and Handling

Catching

Frequent catching of Laughingthrushes should be avoided to reduce stress and disturbance and should only be caught when necessary, such as when moving birds to a new enclosure, removing independent young birds from their parent's aviary or for health checks.

Health checks should be carried out at least one month before the start of the breeding season. Catching birds during the breeding season should be avoided unless it is essential. Only aviculturists experienced in catching passerines should attempt to catch Laughingthrushes.

Unless it is an emergency situation, catching Laughingthrushes should always be planned in advance, as a little preparation can make the process go more smoothly.

Laughingthrushes should be caught in a light-weight hand-held net with an approximate 30cm diameter opening. The bag should be made from a dark silk or smooth nylon material, a depth of 40-50cm is deep enough to be twisted around once the bird has been caught to prevent it escaping. A foam-padded rim will reduce the risk of injuries if the bird flies into it. Stitching on the outside of the bag will prevent injuries to claws as the bird is removed. Mesh nets should not be used as the birds can easily get their heads, bills, wings and legs caught in the mesh, risking injury and making removal difficult.

In taller aviaries, longer handled nets or those with extendable handles may be required.



Long and short-handled padded nets suitable for catching Laughingthrushes. (Gary Ward)

Laughingthrushes move quickly and can prove extremely difficult to catch, even in confined spaces.

If inside quarters are available with pop-holes, the birds can usually be encouraged to go inside with the offer of a favoured food item such as a few insects or alternatively, food may be withheld for an hour until the birds are hungry, making them more willing to enter the inside shelter. Once the birds are inside, quick reactions are needed and the pop-holes should be closed. Any hesitation and the birds may come out, making a second attempt to catch more difficult.

Some individuals can easily be encouraged inside, but not all birds are as co-operative.

In a relatively confined space of an indoor accommodation, normally one person is sufficient to catch the bird. If perches can be taken down this will make catching easier.

The catcher should closely watch the movement of the bird as it flies from one end of the shelter to the other. An experienced catcher can usually predict the birds' flight path and can quickly lift the net in front of the bird. As soon as the bird is in the net, the net bag should be held closed with the other hand.

Catching birds against the wire mesh should be avoided as there is a greater risk of injury.

Catching this species in a heavily planted aviary without thought and planning can be a long and frustrating process and quick reactions on the part of the catcher are needed.

In these situations, more than one person is needed. Normally two people are sufficient, however a third person may be helpful in chivvying the bird towards the catcher/s, particularly in large aviaries.

A clear space along one side of the aviary or one corner with less perches and plants will give the catcher an advantage. If the catcher positions him or herself at one end of the aviary, close to the open space, the second person can carefully encourage the bird to fly in their direction. Normally it is best to let the bird fly the length of the aviary at least once, so that

the catcher can pre-empt its flight path and swiftly lift the net in front of the bird as it passes.

This is often easier said than done and a great deal of skill, experience, quick reactions and a good deal of luck is needed to perfect this technique. If catching more than one bird, it is always better to place the first caught bird in a securely tied cloth bird bag before trying to catch the second bird.

Bagged birds remain calm when hung from a convenient perch or ideally on a nail or hook in the safety corridor. They should never be placed on the floor.



Cloth bird bags approximately 20 cm x 20cm securely tied with a draw string are best used to hold birds for weighing and prior to processing.

Handling

Sumatran Laughingthrushes have strong feet and sharp claws and care must be taken when removing the bird from a net or cloth bag to avoid injuries to the bird and the handler.

The bird should be grasped in one hand, with the sides of the neck placed between the index and middle fingers with its back resting against the palm of the hand. The thumb, ring and little fingers should gently, but firmly cradle the birds' chest. The hold should be firm, but never too tight as to restrict the birds' breathing. The legs and feet should be restrained using the other hand to prevent the bird from grasping and scratching the handler or injuring itself.



Correct handling method

When a bird is in the hand always:

- Check and record existing leg ring details
- Fit leg rings if bird has not been ringed. An aluminium size N (5.33mm) split ring on one leg and a coloured plastic ring size FC1 (5.5mm) on the other leg. Before carrying out this procedure, note ring colours already used for this species to avoid using the same coloured rings. This procedure should only be carried out by experienced personnel
- Ensure existing rings are fitted properly and are of the correct size
- If rings are too tight, too loose or ill fitting, carefully remove (using circlip pliers) and replace.
- Record any ring changes
- Check transponder and record micro-chip number.
- Fit micro-chip if bird does not have one (this procedure should only be carried out by trained personnel or an experienced veterinarian)
- Check legs and feet. Record any abnormalities, overgrown or missing claws
- Trim any overgrown claws (this should be carried out by trained experienced personnel only)

- Check eyes. Eyes should be open and bright and not cloudy, opaque or congested.
- Record plumage condition and moult pattern
- Take biometric measurements if it is a planned move and you have sufficient time (using accurate callipers and wing rule, record bill, skull, wing, tail and tarsus measurements)
- Check body condition (pectoral muscles and subcutaneous fat), take photographs and give scores for pectoral muscle and subcutaneous fat (see appendix 2: Body condition scoring)
- Record its weight. Place the bird carefully in a cloth bird bag, tie the bag securely, weigh the bird using a 300g Pesola spring balance
- If the bird has not been DNA sexed, remove feathers for DNA sexing. (this should only be carried out by trained experienced personnel)
- Medicate if necessary
- Blood or feather samples may be collected (by a qualified veterinarian) and stored in the EAZA Biobank for future genetic or research work



Birds should always be fitted with the correct size leg ring. The bird in this photograph had been fitted with a ring that is too small and had therefore not been properly closed. An open leg ring can lead to injuries or death if the bird gets trapped in aviary vegetation. Also note the loose piece of wire on the birds' perch, another potential hazard that should be avoided.

2.8 Behavioural enrichment

The best enrichment for Laughingthrushes is providing them with a large well-planted aviary. A deep layer of well-rotted mulch, bark chippings and or sharp sand as the aviary substrate will be used by the birds to dig and forage in. Leaf litter placed in well-ventilated aviaries, will be investigated and tossed about as the birds search for insects and other invertebrates. Some of the birds' insect ration can be scattered amongst the vegetation, encouraging them to forage. Rotten logs or those covered in moss will be investigated by the birds as soon as the keeper has left the aviary, and the moss and rotten bark will soon be ripped apart as the birds search for insects.

2.9 Transportation

It is recommended that Laughingthrushes should always be transported singly. They can be quite restless when placed in carrying cages or wooden boxes and there is a risk of injury during transit if care is not taken.

For short internal moves, carrying them in securely tied cloth bird bags is the preferred option. When the bag is held from the top, the bird remains still and calm. Bags also have the advantage over boxes of reducing the chance of injury when the bird is removed by hand. For journeys of more than one hour, it is recommended that wooden travel boxes are used. These should have 1 cm diameter ventilation holes along the sides of the box at a height of 15 cm from the floor and a fine wire mesh sloping front, which is covered on the outside with hessian sacking or similar material to darken the box, while still allowing air to flow. Failure to do this can result in birds damaging their bill and forehead in transit.

A 2 cm layer of sponge or soft foam padding securely glued to the internal roof of the box will also reduce the chances of head injuries.

Suitable dimensions for a single bird are 30 cm long at the bottom, 18cm at the top, 18cm wide and 18cm high. A 2 cm diameter perch should be firmly fixed 4 cm from the floor halfway along the length of the box. 2 cm wide wooden spacers should be screwed to the sides of the box to ensure good ventilation.

For journeys of over 3 hours, a small amount of food should be provided in case of delays. It is not necessary to provide water for these relatively short journeys, as this will inevitably spill and soak the box, however a small water dish should be fixed at the front of the box and water can be provided in the event of delays. A piece of clean sponge can be glued inside the water dish, which will soak up most of the water and help to prevent spillages.

Transportation by air is governed by IATA regulations, and these are enforced. Precautions as recommended above need to be taken, with the addition of a low perch. A perch placed too high in a confined space may inflict injury or cause the bird to become trapped.

Car or Van: Travelling boxes should be placed securely in the back of the vehicle and should be secured using rope ties or bungee straps. If the box is placed on a soft material such as an old clean duvet or sponge padding, this will avoid knocking and rattling and will give the bird a smoother journey.

Boxes should not be kept in the cabin of the vehicle, as noise (talking or radio) will cause disturbance. The vehicle should be climate controlled to avoid problems in extreme hot or cold temperatures.

Airplane: The International Air Transport Association (IATA) has made the IATA Live Animals Regulations (LAR). These Live Animal Regulations are a worldwide standard for transporting live animals by airlines. The objective of the IATA Live Animals Regulations is to ensure that all animals are transported safely and humanely by air, whether it is to transport a pet, an animal for zoological or agricultural purposes or for any other reason (*IATA, 2007*).

The IATA Live Animals Regulations are applicable to members of the International Air Transport Association according to the provisions of Cargo Services Conference Resolution 620 and to airlines being parties to the IATA Multilateral Interline Traffic Agreement-Cargo (*IATA, 2006*).

The IATA Live Animals Regulations are accepted by the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) and the Office International de Epizooties (OIE) as guidelines in respect to transportation of animals by air. These regulations have been used by the Council of Europe as a basis for its code of conduct for the international transport of farm animals. The European Union has adopted the IATA Live Animals Regulations as the minimum standard for transporting animals in containers. As an increasing number of countries adopted or accepted these regulations as a part of their national legislation, shippers are warned that shipping live animals in violation of the regulations may constitute a breach of the applicable law and may be subject to legal penalties.

Transport box / crate:

Material and dimensions: 1.5cm thick Plywood 30 long, 18 high, 18 wide. A sloping front viewing panel should be made of 1.2cm weld mesh. This should be loosely covered with a piece of clean muslin or hessian cloth while the bird is in transit.

1.5 cm wooden spacer-bars should be fitted along both sides of the box to aid ventilation.

Floor: A double layer of newspaper should be used to line the bottom of the box. Wood shavings or sawdust should be avoided as they may find their way into the birds' food and water dishes, preventing access to the food and water.

Perch: A smooth wooden perch 2cm in diameter should be firmly fixed 15cm from the back of the box and 4 cm from the floor

Roof: The roof should be lined with 2cm of sponge or soft foam material to avoid head injuries.

Doors: A sliding access door 10 cm wide and 18 cm high should be fitted to the back of the box. This should be secured using screws.

Ventilation: 1 cm holes drilled 5 cm apart along both sides of the wooden transport box 15 cm from the bottom of the box.

Feed and water containers: Small, shallow food and water containers must be fixed in the front of the box. They should be made of stainless steel or plastic and should be approximately 8 cm long, 5 cm wide and 4 cm deep.

The bird must be fed and watered before shipment. Birds can be provided with additional food items in small shallow dishes during transits of longer than 4-5 hours. Favoured items, such as insects or berries should be included as well as other food items. If additional feeding or watering is required due to an unforeseen delay, full instructions must be supplied by the shipper (IATA, 2006).



A suitable wooden travel box for a Laughingthrush (IATA 2006)



Side view



Rear showing sliding door



Internal view showing sponge padding and low perch

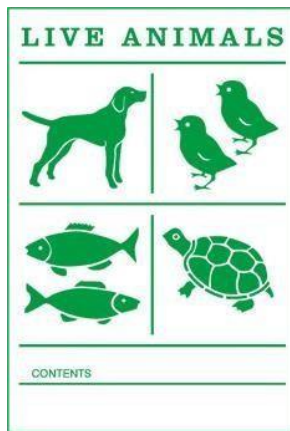
Labels on transport container: The labels on the transport box must be durable and printed or otherwise marked on or affixed to the external surface of the live animal container. They should be fixed in such a way as to not cover any air or ventilation holes. English must be used in addition to the language which may be required by the state of origin (IATA, 2006).

Unless otherwise specified in these Regulations, each live animal container must be marked, durably and legibly on the outside of the container, with each of the following:

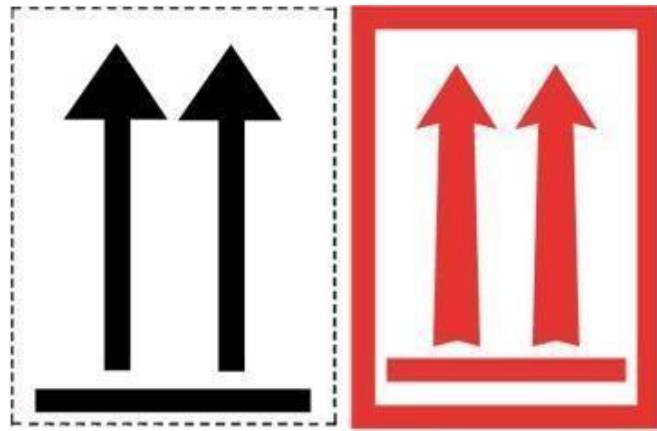
- The full name and address and contact number of the shipper, consignee and a 24- hour contact (if it is not one of the aforementioned persons responsible for the shipment).
- The scientific and common name of the animal(s) and quantity of each animal contained in the container, as shown on the shipper's certification.
- Affix special feeding and watering instructions to the container.
- A copy of the record must be attached to the documents relating to that shipment. Any further feeding and watering instructions must be included and accompany the shipment (IATA, 2006).

It is mandatory to attach at least one IATA "Live Animals" label or tag, properly completed, to each live animal container, unless otherwise stated in the individual container requirements. Animal containers may have the appropriate labelling imprinted (IATA, 2006). The label for live animals should have the following header "Live Animals", the colour should

be bright green on a light background. The minimum dimensions of the label are 10 cm x 15 cm and letters of 2.5 cm (IATA, 2006). In Figures below the label for live animals is shown.



Live animals label (IATA, 2006).



This way up label (IATA, 2006).

In addition to the "Live Animals" label, it is mandatory that the "This Way Up" labels or markings be placed on at least two opposite sides. Labels may be imprinted on the container. The label for "This way up" should be black or red on a contrasting background. The minimum dimensions of the label are 74 mm x 105 mm and letters (IATA, 2006).

Sumatran Laughingthrushes are often very stressed after transportation and may be reluctant to feed. On arrival in their isolation or quarantine cage or aviary the bird should be provided with some cover and several food dishes containing ample amounts of favoured food items, such as insects. Once the bird has settled, food dishes and quantities can be reduced.

2.10 Veterinary: Considerations for Health and Welfare

A Preventative Medicine Plan

Good health goes hand in hand with good husbandry and many of the components of a preventative health care plan are already taken care of in other parts of these Best Practice Guidelines. A summary of various components is given here.

Goals:

- Prevent disease entering animal collection
- Maintain health of collection
- Prevent dissemination of disease to other institutions / release programmes

Importance:

- Difficulty of diagnosis and treatment of overt disease
- Often too late once show signs of overt disease
- Difficulty in eliminating many organisms once established in the collection
- General improvement of condition / performance of stock

- Stock selection: Need for pre import husbandry, reproductive and medical history for individual and its group of origin
- Quarantine: Imports + isolation of resident sick animals (facilities, carers, duration)

Quarantine

In terms of disease transmission birds are at most risk from conspecifics. It goes without saying that the best way to prevent the spread of infectious disease from one bird to another is to isolate any affected birds. However the risks posed by apparently healthy birds are often neglected. Many diseases can remain dormant for long periods only coming to the fore at times of stress. Hence it is good practice to quarantine all new stock entering the collection even if it appears healthy and there has been no history of infectious disease at the collection of origin. A suggested protocol is given below:

Facilities: Quarantine areas should be well separated from the main collection. They must be able to provide a physical environment suitable for the holding of these birds and be secure from pest species (rodents, wild birds, and invertebrates) and be easily disinfected between batches of birds. Depending on the collection of origin certain legal requirement detailing the nature of the facilities required may be enforced. For example DEFRA requires that all birds imported into the UK from non EU (and in future all non-BALAI approved collections) must be quarantined in a DEFRA approved facility. DEFRA give detailed specifications as to the structure and running of these.

Staffing: birds in quarantine and birds already in the collection that are sick and are in isolation should be cared for by staff other than those looking after the healthy stock. Only dedicated protective clothing and footwear should be worn.

Duration: again the government of the importing country may stipulate these. A quarantine period of a minimum of 30 days is recommended irrespective of the source of the bird.

All birds should be wormed and subsequently test negative for parasites before release from quarantine.

Disease Screening and Prophylaxis

This protocol applies to birds moving from other known collections within the EU. Additional testing may be required for birds from non EU or unknown sources. Before acquisition every effort should be made to get a full clinical history including diet sheet, medical history, worming regime and relevant diseases of note diagnosed in the sending collection in the last 5 years. This should be made available to the curator and consulting vet for comment. This history will help determine the quarantine protocols required to protect both the receiving collection and the incoming bird. EAZA and BIAZA require a certain amount of pre-export testing. Although this is mandatory it is rarely fully observed. If the pre-export testing is complete then quarantine requirements may be reduced from those set out below.

Pre-export screening:

- no cases of avian influenza within previous 30 days

- zoos must not be subject to or in an area that is subject to restrictions applied to combat Newcastle disease
- where requested tests for bacteriology and parasitology which may include Salmonellosis, Chlamydophila, toxoplasmosis should be carried out within 30 days prior to transportation
- Yersiniosis – the receiving institution must be notified when this disease has affected the sending institution within 60 days before transport
- the receiving institution should be notified if there is any clinical or pathological evidence within the last year of any of the following diseases: AvianTB, avian pox, avian diphtheria

Post-export screening:

- Main diseases of concern:
 - Chlamydia, Salmonella, Enteric parasites (additional disease screening may be indicated depending on the disease history at the animal's previous home)
- Samples which may be required:
 - Blood (heparin and serum), cloacal/choanal swab, 3 day pooled faecal sample, serum sample stored for future reference
- Tests required:
 - Physical Examination
 - Basic haematology and biochemistry screen: PCR Chlamydia (faeces)
 - Faecal culture and parasitology, non-infectious diseases:

Routine Treatments:

Routine health monitoring should include:

- Opportunistic health screening - testing (basic haematology and biochemistry, serology)
- Full post-mortem examinations on all dead birds and dead but fertile eggs, further diagnostic tests performed if there is any suspicion of infectious disease.
- Parasite control – worm and ectoparasite treatment before arrival, the frequency and type of parasite control required will depend on the individual collection however as a minimum faecal egg counts should be performed for each pair of birds at least on a quarterly basis. If parasites are present a worming programme can be instituted in consultation with the consulting veterinarian. Faecal sample once or twice yearly if no history of parasites. Control of intermediate hosts where appropriate.
- Preventative worming treatments for passerines.
- Beak and claw problems – investigate and reduce predisposing factors.
- Dietary records / evaluation.

Biosecurity

Keepers should be aware that disease agents could also be transferred to the birds with which they work on their hands, clothing, foot ware and any equipment they bring into the birds' enclosures. Where feasible it is recommended that anyone entering a bird's enclosure

or handling the birds in anyway should wear clothing and use equipment that has not come in contact with any other birds.

Zoonotic diseases

Zoonotic diseases are those transmissible to humans from other species. Diseases that can potentially cross between birds and humans include chlamydiosis (more commonly known as Psittacosis), Salmonellosis and, in immune-suppressed individuals, Avian Tuberculosis. Protection against exposure should take a two-pronged approach. Birds are most likely to shed potentially zoonotic organisms when they are stressed hence it is good practice to routinely screen all new birds during quarantine and any bird that is unwell (see preventative medicine section for more details).

Hygiene

This is the mainstay for prevention of disease transmission. All bird food bowls and cleaning equipment should be kept strictly separate from those used by humans (preferably have a separate kitchen for and dedicated equipment). Keepers should wash their hands thoroughly with soap and water after cleaning out or handling the birds and should not eat or drink in animal areas. If a bird is suffering or suspected to be suffering from Chlamydiosis special precautions should be taken.

This section briefly outlines any physical conditions or complaints commonly associated with the species. Requirements for behavioural as well as physical well-being are considered.

Symptoms, treatment and prevention of common diseases/conditions are outlined. Required vaccines may be specified, though the appropriate inoculation schedule should be left to the discretion of each collection's veterinary surgeon and not specified here. Common parasites, screening and treatments are outlined (again detailed information on medical procedures not included). Information on causes of adult mortality is also included.

Specific problems

As a group, Laughingthrushes generally appear to be relatively trouble-free and many seem to live a long and healthy life. As they are very active birds, their well-being benefits greatly from a large planted aviary with suitable furnishings to keep them active and occupied.

The few post-mortem reports to hand reflect a range of causes of death with no particular malady prominent, although *E. coli* is mentioned in several. A White-crested Laughingthrush was riddled with *E. fergusonii* which caused death.

A nematode was the cause of death in a White-crested Laughingthrush, when it perforated the duodenal wall causing peritonitis to set in. (Coles 1990).

There is enough evidence to suggest that internal parasites are a problem in Laughingthrushes and regular screening and a routine worming regime should be employed twice yearly.

The presence of internal parasites can be checked easily by sending a faecal sample to a specialised bird vet for analysis. Advice can then be sought on suitable treatment should it be necessary.

Atoxoplasmosis and Coccidia

Atoxoplasmosis does appear to be a considerable health concern for Laughingthrushes and this protozoan may be a significant factor in the cause of death for young birds, particularly in late nestling stage and fledged young. Further research is needed in this area.

Adult birds can be treated in the drinking water with the following:

Toltrazuril (Baycox)

25mg per litre of drinking water for 2 days with treatment repeated in 5 days' time.

Adult birds can be treated when they lay. Baycox does not affect the development of eggs.

Chicks can be treated pre-emptively whilst still in the nest with the first treatment at approximately 6 days old. The following dose rate applies:

Toltrazuril (Baycox) 12.5 mg per ml solution.

0.01 ml per 10g body weight given orally for 2 days with treatment repeated in 5 days' time.

Coccidia can be treated with Toltrazuril at the same dose rate as that given for *Atoxoplasmosis*.

Aspergillosis is an infectious but not contagious fungal infection (mycotic disease), primarily of the respiratory tract. Chronic disease is the most common form and often follows a stressful event or immunosuppression. Good hygiene and well-ventilated enclosures aid the prevention of this infection. Itraconazole is recommended for prophylaxis and may be of value prior to and after transportation.

Iron storage disease (*Hemosiderosis*) does not appear to affect Laughingthrushes and there does not appear to be the need to provide particularly low iron diets, however a recent case of *Hemosiderosis* was found in a recently post-mortemed Sumatran laughingthrush (Bruslund *in litt.* 2017).

Medical procedures

Blood collection:



Drawing blood from a wing vein should only be carried out by a qualified veterinarian



Inserting a micro-chip transponder sub-cutaneously, this technique should only be carried out under the supervision of an experienced veterinarian.

Section 3: References

- BirdLife International (2017) Species factsheet: *Garrulax bicolor*. Downloaded from <http://www.birdlife.org> on 21/05/2017.
- Chasen, F. N. & Hoogerwerf, A. (1941). The birds of the Netherlands Indian Mt Leuser Expedition 1937 to North Sumatra. *Treubia* 18 (suppl.).
- Coles, D.C. (1990) Laughingthrush Breeders manual. Avicultural Society.
- Collar, N. J. (2006) A partial revision of the Asian Babblers (Timaliidae). *Forktail* 22: 85-112.
- Collar, N.J. & Robson, C. (2007). Family Timaliidae (Babblers). Pp. 70-292 in: del Hoyo, J., Elliot, A. & Christie, D.A. eds. (2007) Handbook of the Birds of the World. Vol. 12. Picathartes to Tits and Chickadees. Lynx Edicions, Barcelona.
- Collar, N. J., Gardner, L., Jeggo, D. F., Marcordes, B., Owen, A., Pagel, T., Pes, T., Vaidl, A., Wilkinson, R. & Wirth, R. (2012) Conservation breeding and the most threatened birds in Asia. *BirdingASIA* 18: 50-57.
- Collar, N. J.; Butchart, S. H. M. 2013. Conservation breeding and avian diversity: chances and challenges. *International Zoo Yearbook* 48(1): 7-28.
- Davison, G. W. H. (1988) Breeding seasonality. Pp.35-36 in van Marler & Voous (1988).
- van Marle, J. G. & Voous, K. H. (1988) *The birds of Sumatra*. Tring, UK: British Ornithologists' Union (Check-list 10).
- MacKinnon, J.; Phillipps, K. (1993) *A field guide to the birds of Borneo, Sumatra, Java and Bali: The Greater Sunda Islands*. Oxford University Press, Oxford.
- Owen, A. (2008). Breeding the Black-and-white Laughingthrush *Garrulax bicolor*. Pp.70-79. Avic. Soc. Vol. 114. No.2.
- Owen, A., Wilkinson, R. and Sözer, R. (2014) In situ conservation breeding and the role of zoological institutions and private breeders in the recovery of highly endangered Indonesian passerine birds. *International Zoo Yearbook* 48: 199-211.
- Robinson, H. C. and Kloss, C. B. (1918) Results of an expedition to Korinchi Peak, Sumatra 2, birds. *J. Fed. Malay States Mus.* 8: 81–284.
- Robinson, H. C. and Kloss, C. B. (1924) On a large collection of birds chiefly from West Sumatra made by Mr. E. Jacobson. *J. Fed. Malay States Mus.* 11: 189–347.
- Round, P.D. (2006) Cooperative provisioning of nestlings in the White-crested Laughingthrush *Garrulax leucolophus*. *Forktail* 22: 139.

Shepherd, C. R. (2006). The bird trade in Medan, north Sumatra: an overview. *BirdingASIA*: 16-24.

Shepherd, C.R. (2007) Trade in the Black-and-white Laughingthrush *Garrulax bicolor* and White-crested Laughingthrush *G. leucolophus* in Indonesia. *BirdingASIA* 8: 49-52.

Shepherd, C.R. (2010) Observations on trade in Laughingthrushes (*Garrulax* spp.) in North Sumatra, Indonesia. Bird Conservation International, PP 1-6 BirdLife International.

Shepherd, C. R. (2011) Observations on trade in laughingthrushes (*Garrulax* spp.) in North Sumatra, Indonesia. *Bird Conservation International*. 21: 86-91.

Shepherd, C.R. (2013) Protection urgently needed for the endemic Sumatran Laughingthrush. *TRAFFIC Bull.* 25: 53-54.

Shepherd, C. R. (2013) Protection urgently needed for the endemic Sumatran Laughingthrush. *TRAFFIC Bull.* 25: 53-54.

Products mentioned in the text

Orlux Tropical Patee, Orlux Rimiline pellets and Uni Pate. nv ORLUX sa, Verbindingsstraat 20, B-8710 Wielsbeke-ooigem, Belgium. www.orldux.be

NutriBird T16 original. Versele-Larga NV, Kapellestraat 70, B-9800 Deinze, Belgium.

Avimix multi-vitamin powder. Vetark Animal Health, PO Box 60, Winchester, Hampshire SO23 9XN, UK

Section 4: Appendices.

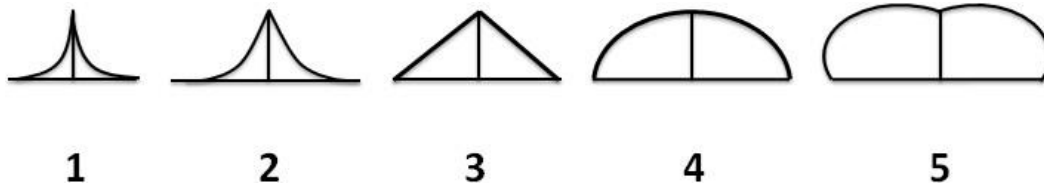
Appendix 1: Body condition scoring

Sumatran Laughingthrushes appear to be extremely prone to putting on large amounts of subcutaneous fat in captivity and therefore a body condition score should be recorded at least twice yearly (before and after the breeding season) and additionally opportunistically whenever a bird is the hand. As well as using the scoring system below, the birds' pectoral muscle and any fat should be photographed and an accurate weight should be taken for future reference. Moistening the breast feathers with damp tissue paper and gently brushing them away from the breast bone will make photographing the area easier.

There are no records of weights or body condition scores for this species in the wild, so it cannot be confirmed if this is a condition that is specific to captive birds.

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. A pectoral muscle score of 4 or 5 for a Laughingthrush represents a healthy bird which has well-developed muscle tone.



Score Class	Prominence of sternum	Pectoral muscle shape
1	Sternum sharp	Very thin. Very little muscle. Indicative of a sick bird
2	Sternum sharp. Easy to distinguish	Muscle depressed, concave in shape
3	Sternum easy to distinguish	Triangular in shape. Muscle neither depressed nor rounded
4	Sternum difficult to distinguish	Muscle slightly rounded, level where it joins sternum
5	Sternum difficult to distinguish	Muscle well-rounded and raised higher than sternum

Subcutaneous fat score

Small amounts of subcutaneous fat visible under the skin may be considered normal in most species.

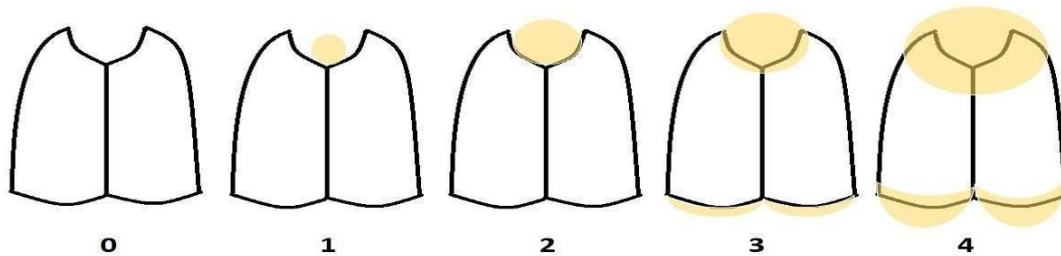
Larger amounts of subcutaneous fat may be seen in the V shaped cavity (inter-clavicular) between the clavical (wishbone) and may also be seen in the ventral cavity directly below the sternum.

The amount of subcutaneous body fat should be recorded when birds are handled.

Use the amount of fat present in the inter-clavicular area to gauge the condition of a bird and use the following five-step 0-4 scale.

- 0- No fat visible
- 1- Some fat visible in inter-clavicular area
- 2- Inter-clavicular area nearly filled with fat
- 3- Inter-clavicular area completely filled with a bulging pad of fat and fat deposits visible elsewhere - Fat
- 4- Large swollen mass of fat in Inter-clavicular, ventral cavities and other areas of the body - Obese

A bird is considered fat when the subcutaneous fat score reaches 3 and obese when it reaches 4.



Subcutaneous fat score

A bird with good body condition will have a pectoral muscle score of 4-5 and a subcutaneous fat score of 0-1.



**A bird with good muscle tone and no visible fat:
Pectoral muscle score: 5; Fat score: 0**



**A bird with good muscle tone and large amounts of fat:
Pectoral muscle score: 5; Fat score: 4 obese**



Juveniles rarely show any signs of fat: Pectoral muscle 5 fat 0

