

# EAZA Best Practice Guidelines

## Mount Omei Liocichla *Liocichla omeiensis*



**1<sup>st</sup> Edition: May 2023**



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## **Preamble**

Right from the very beginning it has been the concern of EAZA and the EEPs to encourage and promote the highest possible standards for husbandry of zoo and aquarium animals. For this reason, quite early on, EAZA developed the “Minimum Standards for the Accommodation and Care of Animals in Zoos and Aquaria”. These standards lay down general principles of animal keeping, to which the members of EAZA feel themselves committed. Above and beyond this, some countries have defined regulatory minimum standards for the keeping of individual species regarding the size and furnishings of enclosures etc., which, according to the opinion of authors, should 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.

## Summary

This is the first edition of the EAZA Best Practice Guidelines for the Mount Omei Liocichla (*Liocichla omeiensis*). These guidelines aim to give basic information on the captive care requirements of the species to zoo professionals who are interested in working with it. Cotswold Wildlife Park and Gardens (CWP) has been successful in breeding this species and these guidelines are based on the data collected at CWP with additional information gathered from EEP holders. These guidelines will be reviewed and adjusted in the future, when more research studies are complete and more experience gained. Holders of the species are encouraged to share their experiences with the studbook-keeper for inclusion in future editions.

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 Editions, Barcelona. The species English vernacular name is slightly altered to adopt the more commonly used term “Mount Omei” rather than “Mount Emei” or “Emei Shan”.

## Acknowledgements

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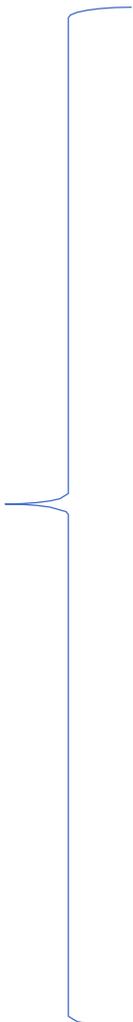
## Section 1: Biology and Field Data

### A: Biology

#### 1.1 Taxonomy

The Mount Omei Liocichla (*Liocichla omeiensis*) or sometimes referred to as Emei Shan Liocichla (HBW) or Mount Omei Babbler (ZIMS) is one of five species of *Liocichla* in the family Leiothrichidae, which used to be included in the Timaliidae family. Most members of the Leiothrichidae family occur in East, South and South-east Asia with a few exceptions from Central Asia, the Middle East and Africa. The Liocichlas are the basal lineage of the clade they share with the genera *Leiothrix*, *Minla* and *Leioptila*. The inner taxonomy of the family is still much debated which may still result in future changes in genus and species names.

The family Leiothrichidae / Laughingthrushes and allies include about 150 species divided on the following genera:



- Acanthoptila* / Spiny Babbler
- Actinodura* / Barwing
- Alcippe* / Fulvetta
- Argya* / Babbler and Chatterer
- Chatarrahaea* / Babbler
- Chrysominla* / Minla
- Cutia* / Cutia
- Garrulax* / Laughingthrushes and Babax
- Grammatoptila* / Laughingthrush
- Heterophasia* / Sibia
- Ianthocincla* / Spotted Laughingthrushes
- Kupeornis* / Mountain-babbler
- Laniellus* / Crocias
- Leioptila* / Sibia
- Leiothrix* / Leiothrix and Mesia
- Liocichla* / Liocichla
- Melanocichla* / Black Laughingthrushes
- Minla* / Minla
- Montecincla* / Chilappan
- Phyllanthus* / Capuchin Babbler
- Pterorhinus* / Laughingthrushes
- Sibia* / Barwing
- Siva* / Minla
- Trochalopteron* / Laughingthrushes
- Turdoides* / Babbler

Kingdom: Animalia  
Phylum: Chordata  
Class: Aves  
Order: Passeriformes  
Family: Leiothrichidae  
Genus: *Liocichla*  
Species: *omeiensis*



Figure 1: Illustration of the five species of *Liocichla* (Layla Richardson)

The European Studbook (ESB) for Mount Omei *Liocichla*, which was approved in July 2005, had replaced and absorbed a British and Irish Association of Zoos and Aquaria (BIAZA) Joint Management of Species Programme (JMSP) studbook which was established in 1998 to secure a captive population which had a short history and without further cooperation a short future. A number of non-EAZA institutional and private participants have been instrumental in establishing the founder population, and many UK-based private aviculturists are still cooperating with the studbook today. The ESB was handed to Cotswold Wildlife Park in October 2014.

November 2021 the programme was approved as a “new style” EAZA Ex-situ Programme (EEP) coordinated by Chris Green, Cotswold Wildlife Park.

## 1.2 Morphology and Physiology

*Liocichla omeiensis* is a medium sized laughingthrush, measuring between 19 to 20.5cm in length (Collar *et al.*, 2020), and weighing 30g to 35g. Its colouring is mostly olive green above and grey below with a pale belly, and areas of orange, yellow and red on its wings and tail.

This species is unusual amongst laughingthrushes and babblers due to obvious sexual dimorphism, where sexes are distinguished by tail and wing plumage. Flight feathers

are mainly black with yellow leading edges in both sexes, where the bases are orange, which is brighter and much more distinctive in males. Orange areas at the tips of secondaries are also brighter and larger in males. Tail feathers are a dark olive colour, barred black above and yellow at the tip. Males also have narrow 'frayed' tips to the four central tail feathers. Under tail-coverts are tipped yellow in females and have long, frayed orange tips in males.

The bird's eyes are dark with a broad white eye ring (Collar *et al.*, 2020). Its bill is greyish brown in colour, whilst the legs are flesh-brown to slaty-brown (Collar *et al.*, 2020). Juvenile plumage is similar to the adults, although duller, with all sexual characteristics present upon fledging. Identifying the listed characteristics is the most reliable method for sexing captive birds (Hewston, 2001).



Figure 2: study skins from the collection of the NHM at Tring, male bird bottom, female top (Hein van Grouw)



Figure 3: study skins from the collection of the NHM at Tring, male bird bottom, female top (Hein van Grouw)



Figure 4: study skins from the collection of the NHM at Tring, male bird bottom, female top (Hein van Grouw)



Figure 5: *Liocichla omeiensis* male bird on the left, female bird on the right  
Bristol Zoo 2020 (Lucy Bradford)



Figure 6: *Liocichla omeiensis* male bird showing the distinctive orange under tail-coverts (Gary Ward)

### 1.3 Longevity

Life expectancy for the *Liocichla omeiensis* is 8 to 10 years. At the time of publication the oldest confirmed bird in an EAZA collection is a living female residing at Walsrode, in Germany, which hatched in 2012 (11 years at time of publication).

## B: Field Data

### 1.4 Conservation Status, Geographic Range and Ecology

The most recent assessment by the IUCN lists the species as vulnerable, as of 2017, where the restricted fragmented population is in decline (BirdLife International 2016). *Liocichla omeiensis* is endemic to China, distributed through only a few mountainous forest ranges in south-central Sichuan and has also been found in north-east Yunnan Province (Fu *et al.*, 2013). Despite being rare on a country-wide scale, it is found to be locally common in the Liaoliangshan and Daxiangling ranges. The number of mature individuals in the wild was estimated at 1,500-7000 as of the species' latest assessment by the IUCN in 2017. However, the species has only been identified in a small number of localities where it appears to be highly localised and therefore the total population may be smaller than estimated (BirdLife International 2001).

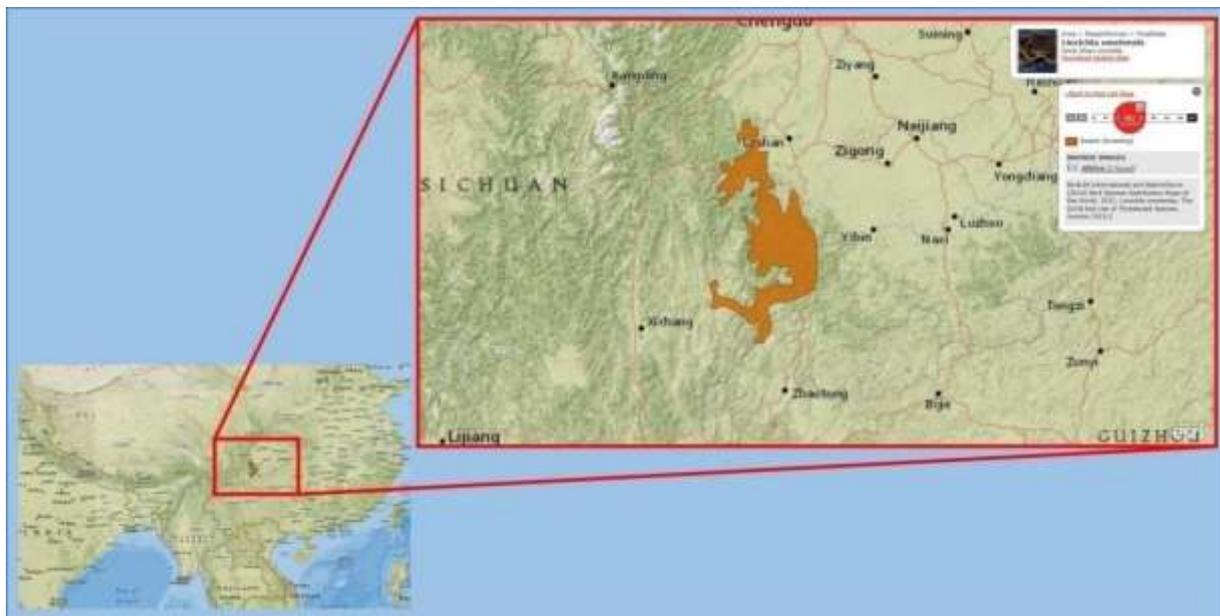


Figure 7: Distribution of *Liocichla omeiensis*

The species prefers to live in the gaps and along the edges of evergreen broadleaf forests (Fu *et al.*, 2013). The lack of tree cover in these areas is conducive to the growth of bamboo, which may be a key reason why the *Liocichla* inhabit them (Fu *et al.*, 2016). The species moves through the dense vegetation, scrub and bamboo thickets (Collar *et al.*, 2020) where it can forage at up to around 4m above ground for invertebrates and fruit. Within the species range broadleaf forests have been commonly replaced in the past by non-native coniferous forests and tea plantations (Fu *et al.*, 2011). These modified habitats have been found to not contain any Mount Omei *Liocichla* and cause a significant threat to the survival of the species (Fu *et al.*, 2011).



Figure 8: Broadleaf forests of central China (Sichuan Basin), natural habitat for *Liocichla* (One Earth 2022)

The main threats to the species include habitat loss and fragmentation of forest within its range, much of which has already been cleared or degraded, through logging and conversion to agriculture. Remaining areas of forest are under pressure from localised wood cutting and logging, although there has been a recent ban on large scale commercial logging in this part of China, and the species has proven to be tolerant of secondary forest habitats. Minor threats include disturbance from bamboo shoot collectors and other forest products, livestock grazing and the trapping of individuals for the pet trade. There is also evidence to suggest that *Liocichlas* are sensitive to human disturbance which may result in nest abandonment (Fu *et al.*, 2011).



Keeping cage birds in Southeast Asia is a traditional pastime deeply embedded in the culture. In Indonesia, this activity is particularly prevalent. Hugely popular songbird contests are held weekly throughout the region where the prizes can be worth many times the average yearly income. As the human population continues to expand, so does the trade in wild-caught birds and this has now reached an unsustainable level. Bird trappers have become motivated and coordinated, targeting bird species in previously isolated areas, thus driving small island endemics and other restricted

range species close to extinction. A Mount Omei Liocichla was discovered in a live bird market in Medan, Indonesia in 2015 (Bruslund, *pers. comm*).

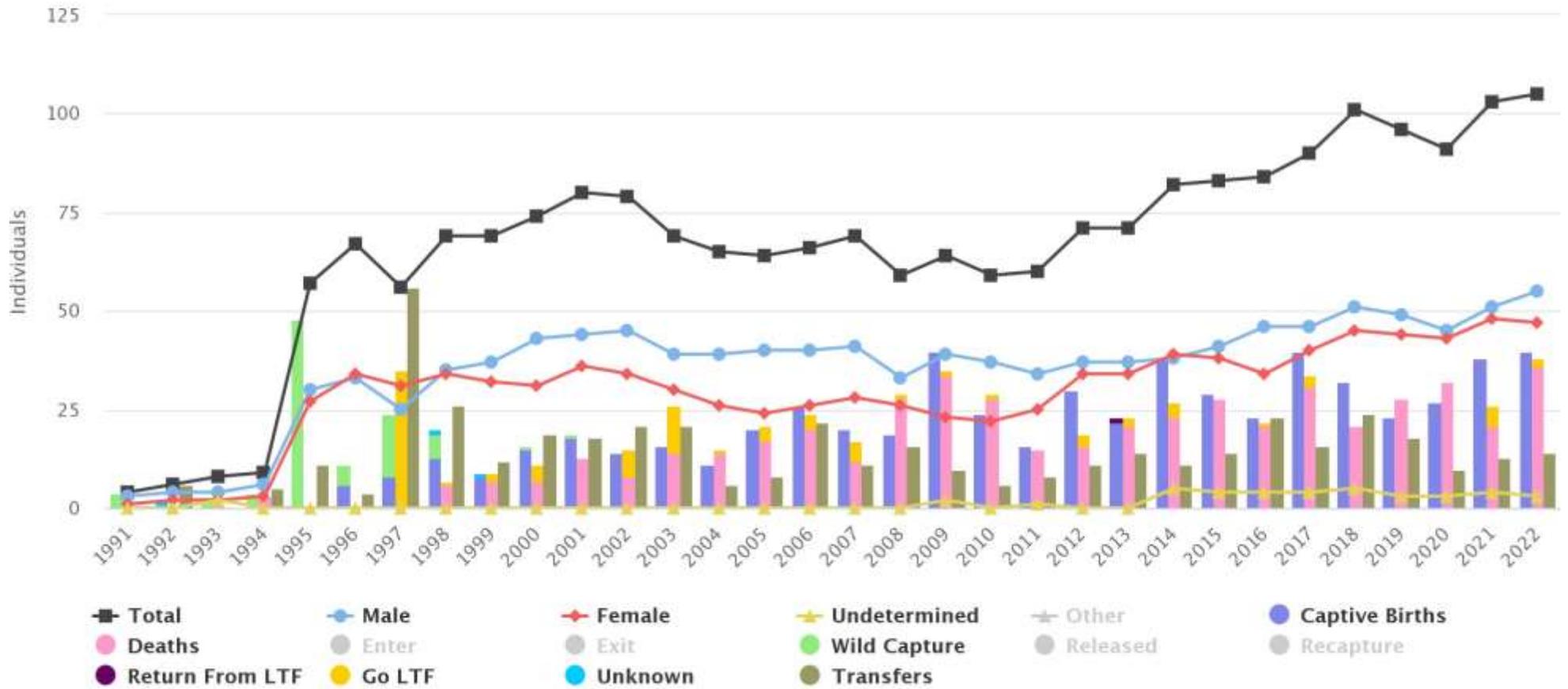
*Liocichla omeiensis* is a protected species in Sichuan and on the national list of protected species in China. Internationally it is protected through the Washington Convention (CITES Appendix II). Since 1999, the export of wild birds from China has been banned, but this legislation may be difficult to enforce. It occurs in or near several protected areas, including the Emei Shan Protected Scenic Site, Mabian Dafengding, Mamize, Heizhugou and Laojun Shan nature reserves. Emei Shan is a sacred mountain and has therefore only been subject to limited forest clearance but a fair amount of tourism. Laojunshan, Mamize and Heizhugou nature reserves have received support to train and equip staff and to encourage alternative livelihoods and sustainable management practices amongst local communities through the Sichuan Forest Biodiversity Project, collaboration between the Sichuan Forest Department, Chester Zoo and Liverpool John Moores University (S. Dowell *in litt.*, 2007; Jie Wang *in litt.*, 2007).

The EAZA “Silent Forest” Campaign which ran from 2017 to 2019 was aimed at raising awareness of the issues surrounding the trapping and removal of wild birds from their natural habitats within EAZA collections and the wider public. Another aim was to promote the holding of Asian passerines by its members, especially those of conservation importance and in managed programs.

The work of the campaign continues through the Silent Forest Group which under the auspice of the EAZA Songbird TAG continues to promote songbird programmes and projects. See [www.silentforest.eu](http://www.silentforest.eu) for further information.

# Census

No restrictions by location or UDF  
 Restricted to *Liocichla omeiensis* / Mount Omei babbler  
 Census taken on January 01 of each year.



As of 22.8.2022  
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Figure 9: *Liocichla omeiensis* studbook population data from 1991 to 2022 with “sex” and “transaction details” indicating demography

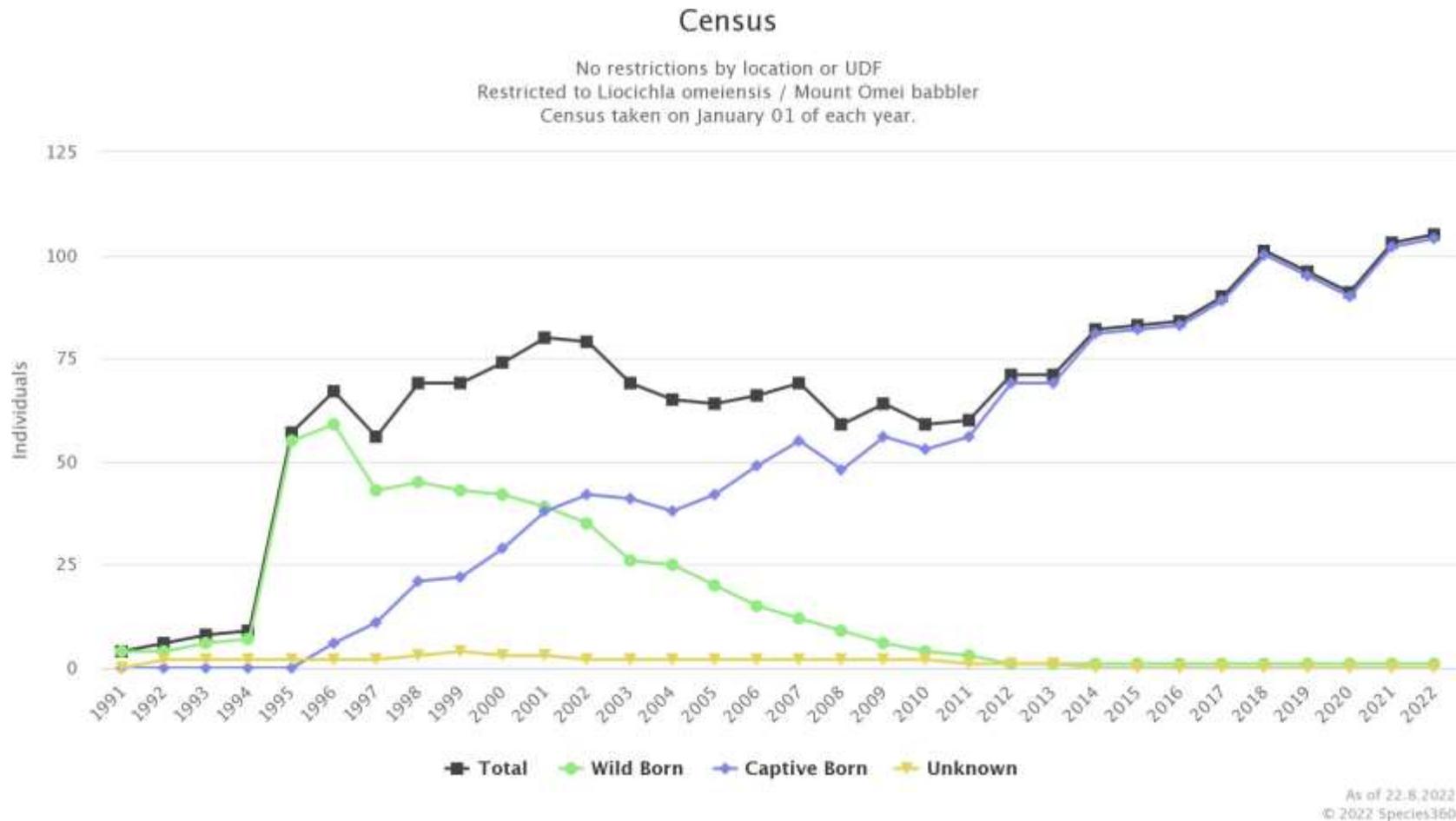
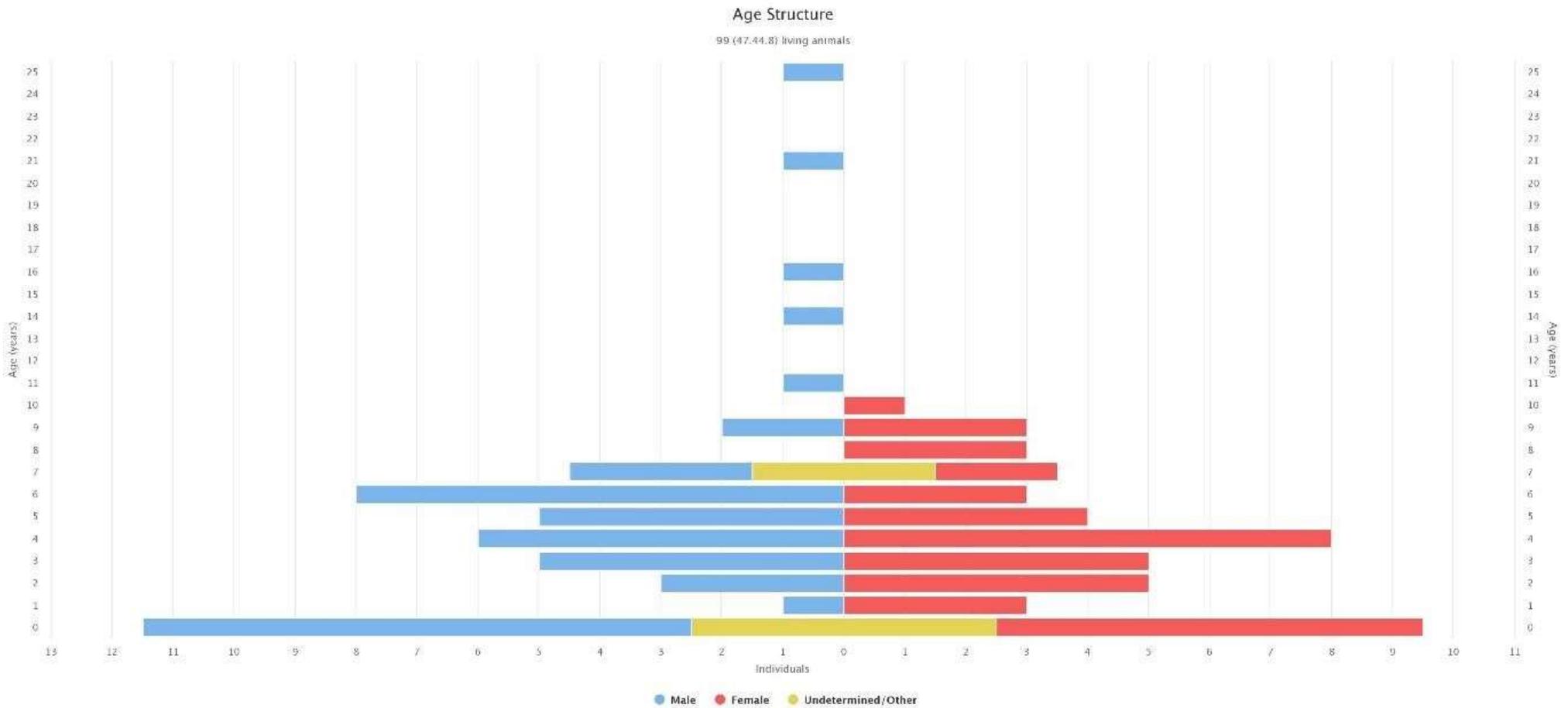


Figure 10: *Liocichla omeiensis* studbook population data from 1991 to 2022 with “birth-type” indicating origin.

As you can see from the two graphs above the population in European collections has fluctuated over the past thirty years from the original birds brought in from the ‘WILD’ in the 1990s to the now completely captive-bred population in 2022 with the last wild capture to be added to the population in 2000. In both Zoological and private collections, the population has grown and there are currently (16/06/2021) one hundred and five individuals living in this studbook. This is definitely a testament to everyone’s efforts in hopefully securing a future for this species in aviculture.



As of 5/6/2021  
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Figure 11: *Liocichla omeiensis* studbook data showing demographics.

The longevity of *Liocichla* in captivity is estimated between 12 to 14 years it is highly unlikely that the 20 and 25-year-old males are still alive. Having not received any information to confirm this, these birds remain in the studbook. More collections are now keeping and successfully breeding the species evidenced by the number of young captive-bred birds shown on the graph above. There is also a healthy number of breeding age birds within the studbook.

## 1.5 Behaviour

*Liocichla omeiensis* is not a typical social laughingthrush and is found singly, in pairs or in small flocks of 3 to 4 birds (Fu *et al.*, 2013). The species does not join flocks of other birds and remains territorial year-round (Fu *et al.*, 2013), which is also unusual for babblers and laughingthrushes. This species is particularly secretive and difficult to observe in the field (Fu *et al.*, 2011). However, they are very good singers, and can be located by their song usually out of a hidden location. Playback of male songs has been used in field research to locate male birds and nest sites (Fu *et al.*, 2013). This species is extremely active and vocal, singing frequently throughout the day. Their song is described as high pitched, weak, nervous, shrill whistled phrases repeated after a pause of 3 to 8 seconds (Collar *et al.*, 2020) which are given repeatedly by the male. The female has a loud, monotonous whistle (Fu *et al.*, 2013). Whilst both males and female birds alarm call using an anxious continuous sound (Fu *et al.*, 2013; Collar *et al.*, 2020).

The Mount Omei *Liocichla* resides at elevations of between 500 and 2400 m undertaking a seasonal vertical migration (Fu *et al.* 2013). During the autumn and winter, *Liocichla omeiensis* moves to lower elevations at around 500 to 1350 m (Fu *et al.*, 2013) to cope with the cold weather, often selecting sunny slopes. During the breeding season the birds move higher to elevations of 1400 to 2400 m (Fu *et al.*, 2013).

## Section 2: Management in Zoos and Aquariums

### 2.1 Enclosure

#### Outdoor Aviary

A good viewing distance from the perimeter of the enclosure is 1.2 meters to 1.8 meters, depending on how densely it is planted. If the enclosure is too deep and the vegetation is quite dense, it will be difficult to locate the birds in the environment. A lesser dimension may be practical for surveillance and keeping the birds in view, but not advisable in order to respect the flight distance. This is the comfort zone which keeps the birds from becoming frightened and take flight or cover when approached. The flight distance is different from bird to bird based on level of trust and psychological make-up.

*Liocichla omeiensis* are by nature secretive when it comes to choosing a nest site and caring for the nestling. While birds become tame enough to take meal worms from a hand, they will “freeze” when they are near their nest and do not move until the keeper has left. If the enclosure is frequently visited, the birds may either get used to the intrusion or, much more likely, abandon their nest or young. If the aviary depth is 1.8 meters to 2.4 meters, for example, the length could be up to twice that. To have the aviary much larger is not advantageous unless it is a walk-through aviary. An aviary measuring 1.8 x 2.4 x 2.1 meters (WxDxH) will allow sufficient “wild” habitat for the birds to breed and raise their brood. The bird’s breeding habitat mainly consists of scrub and bamboo, while its winter habitat is dominated by scrubs and herbs. The outdoor enclosure should provide individuals with the option of thick bamboo/scrub and trees. A mini landscape depicting the bamboo forest setting with some conifers, evergreen bushes and a small “water courses” is not difficult to establish. *Liocichla omeiensis* also love to bathe. A simple way to offer fresh moving water is a slow drip of water into a shallow bowl although this isn’t always possible in a zoological environment.

A safety porch or double-door system is useful when keeping these birds in small aviaries, as, although *Liocichla omeiensis* spend most of the time hiding in foliage, they can be very quick if disturbed. Safety porches should be large enough to take the largest item (e.g., lawnmower) that is likely to be taken into the aviary so that one door can be shut before the other is opened.

Cleaning regimes should be governed by the number of occupants in the aviary and can be judged over time on the number of droppings produced. Care should be taken that there is no build up beneath favoured perches. Bushes used for roosting and nesting are liable to be prime spots and should be checked and cleaned or removed regularly. Aviaries can be raked or dug over periodically and hosed down to remove droppings, which, if done following rain, will make the task easier. Any regime should be altered to reflect any breeding taking place as disturbance during this critical time

needs to be kept to a minimum. However, *Liocichla omeiensis* are fairly tolerant if the usual pattern of daily cleaning and feeding is followed.

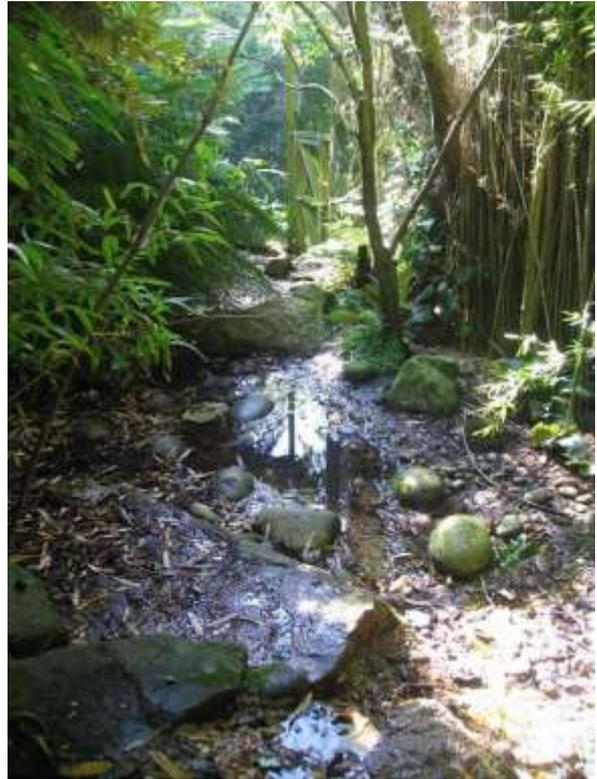


Figure 12, 13 & 14: Outdoor aviary, Jersey Zoo (Gary Ward)



Substrate should include soil and/or bark, with rocks, branches and other natural items. The ground must be well-drained to allow for run-off of water following periods of high rainfall. Wire mesh should be of small diameter maximum 10mm squared and a thick enough gauge to prevent predators damaging or breaking into the aviary. Ideally 1.6mm wire mesh on external areas and thinner 0.7mm mesh on internal panels.

### Indoor Aviary

Given the opportunity to roost outside, *Liocichla omeiensis* will do so without hesitation and indoor accommodation isn't necessarily required for this species. However, shelter from rain and wind is required and could be achieved with a partially solid (non-mesh) roof and flight and thick planting. 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. Minimum size for indoor aviaries is 1 x 2 x 2 meters (WxDxH), but can be much larger if required, with some keepers providing indoor accommodation of 5 x 2 x 3 meters (WxDxH). 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 preferred insect.

*Liocichla omeiensis* are hardy birds and once acclimatized; do not require a high temperature, however indoor accommodation should be maintained at approximately 15°C during the 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 direct access to the heat source.

*Liocichla omeiensis* adapt easily to the humidity in the UK as there is a little difference between the humidity in the UK, at 73% (World Weather and Climate Information 2010-2022b) and 83% in Sichuan, China (World Weather and Climate Information 2010-2022a). No alterations need to be made to accommodation to account for the difference in humidity.

Lighting in an indoor aviary can be provided naturally through open pop holes and windows that the birds cannot access. Artificial lighting can be provided by strip lights or a bulb or series of bulbs, depending on the size of the indoor aviary. As with the heater, any lighting must not be accessible for the birds and/or covered where the birds could have direct access.

The UV requirements of captive species is of current research interest. At the time of writing, there is no information on whether *Liocichla omeiensis* requires exposure to additional UV lighting outside of its natural range. Research of Rufous-capped babblers (*Cyanoderma ruficeps*) in Taiwan (Fang, *et. al.*, 2022) identified the

adaptations between mountainous and lowland dwelling individuals. Whereby, individuals living at higher altitude have greater reflective feathers than those in the lowlands to withstand exposure to higher levels of UV. Although this research doesn't tell us whether birds living at high altitude in mountainous regions (such as *Liocichla omeiensis*) will be compromised by not having access to UV in a captive setting, it does identify the gap in our knowledge. Therefore, further research is required on the health and breeding benefits of providing UV lighting and the UV radiation level suitable for *Liocichla* before any recommendations can be made.



Figures 15, 16 & 17 : Showing the indoor aviary with lighting, natural light, perching and pop holes. (Harriet Whitford)



## Enclosure Dimensions and Coexistence with Other Species

Keepers of *Liocichla* species should keep their birds in as large an aviary as possible to allow these active birds opportunities to fly and exercise. However, small aviaries can be used for short periods, but they need to be comparatively well planted outdoors to ensure best practice. The smallest flights noted in a questionnaire were 2m x 1m x 2m. At this size, other occupants would need to be kept to an absolute minimum with no competing species. Such small aviaries should only be used for short periods so that animal welfare is not compromised. Mount Omei *Liocichla* will mix well with other similar sized species; however, care should be taken with fledglings when mixed with large ground birds such as pheasants. At the other end of the scale, many aviculturists have kept a varied collection of birds in aviaries measuring 9m x 9m x 2m, many of which have bred successfully. Although the larger the aviary, the more chance there is of keeping and breeding species successfully, especially with mixed collections. Regardless of breeding status, aviary size should be maximised to ensure the health and wellbeing of the residents. Conflict between species is also likely to decrease proportionally to aviary size if occupants have been carefully considered. Keepers of *Liocichla omeiensis* must be aiming to provide the highest welfare standards for their birds.

## Perching

Inside perching in shelters can be of dowelling rods, either 12mm or 18mm diameter. If shelters are well used, the provision of natural perching is preferable and the straight stems of hazel, willow or elderberry can be used as such material is more beneficial to birds' feet in the long term. Cut branches of fir are likely to be a more attractive alternative. Placed high in a corner, not only will it be used as perching, but the additional cover may also even persuade them to roost inside. Out of choice, birds will not roost on straight perches that are out in the open unless forced to do so.



Figure 18: Natural perching in an outdoor aviary

### Hygiene and Cleaning

Planted aviaries are generally quite good at self-cleaning. However, water and food bowls should be regularly cleaned, as well as the removal of spilled and spoiled food. Water that gets recycled through filtration systems should be replaced with fresh water on a regular basis. Cleaning for this species should be kept fairly minimal with excess faeces from branches and leaves removed once or twice a week and substrates can be turned over and or raked

## 2.2 Diet and Feeding Behaviour

Liocichlas forage for invertebrates and fruit in the wild (Collar *et al.*, 2020) and therefore these birds can be fed on a diet of good quality insectivore mix and a variety of fruit chopped into small cubes so the birds can easily swallow it. Adult birds should be given insects such as, but not limited to, mealworms, pinkies, flies, buffalo worms, wax moth larvae and small crickets. Insects should be well fed themselves prior to being fed out.

### **Suggested Feed For 1 Animal – Fed AM**

10g - Fruit mix (apple, pear, banana, grape and tomato) [OBJ]

5g - DK TOVO universal food (See Section 3: Appendix for product information)

5g - Carrot (grated)

5g - Lettuce (shredded)

5g – Live food (mealworms)



Figure 19: Presentation of food for Liocichla

**Supplements:** Nutrobal (See Section 3: Appendix for product information) is added to universal food mix, this is used under Vetark's instructions of a very small pinch ( $1/8^{\text{th}}$  of a teaspoon per kg of food).

**Diet presentation:** Diet fed in a shallow dish at a feed station in the exhibit. Live feed scattered daily to encourage foraging behaviours.

**Enrichment feeding:** Live insects scattered to encourage natural foraging, e.g. drosophila dusted with multivitamin powder. Crickets in a larger container with leaf litter is also good enrichment.

When feeding young, the addition of soft bodied insects such as buffalo worms, small brown crickets, white freshly shed mealworms and wax moth culture dusted with multivitamin powder will be necessary for successful chick rearing.

Providing this live food in a large plastic container with dry leaves where the parents have to spend time finding the insects helps preventing over-feeding of the chicks. Multiple feedings (4-6) a day during breeding is likely necessary with the first feeding as early as possible in the morning after sunrise.

### Water Provision

Drinking water should be provided in a shallow water bowl made of ceramic, plastic or stainless steel. This can be hung up in the aviary or on a platform. Use a small bowl to prevent the bird from bathing in it and keeping it clean. The ones used at Cotswold Wildlife Park are 20cm in diameter and 3.5cm in depth.



Figure 20: Shallow water bowl for use with Liocichla

For bathing a bath can be provided by placing a plastic tray or provision of a small concrete pond on the ground of the aviary. The water should only be a few centimetres in depth, no more than 5cm. The bath should be emptied when fledglings are present in the aviary to prevent them from drowning in the water. To prevent birds getting too wet and stuck in a water bath or bowl, a stone can be placed in the water, against the edge of the bath or bowl to create an exit point for the birds to climb out.

### **2.3 Social Structure**

Research suggests that *Liocichla* can be territorial in the winter (Fu *et al.*, 2013), although in captivity they appear to be tolerant of family members; and birds from different clutches will live together with their parents. Keepers of the species find that they can keep the species in pairs or small family groups without too many problems. Some keepers remove young birds for the winter and others find that increasing the amount of space allows for several pairs to be housed together without fighting.

It has been suggested (Collar *et al.*, 2020) more than one breeding pair within hearing range may cause disturbance and that it is likely that only the dominant pair will attempt to breed.

## 2.4 Breeding

### Establishing a new pair

For many small softbill species like the *Liocichla* the same process should be followed as for most birds. Introduce female first followed by the male once she has had time to settle. If it is possible, keep the new pair within sight of one another for a time before the introduction (this should be in adjoining enclosures if possible, or the male can be caged within female's aviary). It is essential that the birds are monitored for their reaction towards one another during the introduction period. Once the birds have been introduced, keepers should continue to closely monitor the pair for any signs of fighting. A camera trap can be placed in the aviary for keepers to check the interaction and behaviour of the pair when the keeper is not present. If you have the facilities, introduce the pair in an enclosure that allows for the birds to be easily separated. If keepers are attempting to re-pair a bird while its previous mate is still on the premises, the old mate should be out of sight and hearing range of the new pairing. In general, most keepers (pers comm.) have found them easy to pair with very few problems.

### Maturity

*Liocichlas* will breed at around twelve months old. Richard Cockerill who first bred this species had documented in 1993 that because of their long breeding season, birds raised in May/June may breed the following year while those reared in August/September may not, missing the following season before starting early the next (personal comment, N. Hewston). Many breeders rehome their young so evidence is lacking in many cases.

### Seasonality of Breeding

The breeding season is affected by the weather and the adult birds will start to arrive in the breeding areas in late March to early April (Fu *et al.*, 2013). The breeding season generally spans from April to August; however, nesting can occur as early as February and as late as September. Therefore, it is advised to provide nesting material over a longer period, so birds can nest as and when they choose to. Preferred nesting material of wild *Liocichlas* consists of fine stems of herbage and liana, moss for some nests, bamboo leaves and aerial roots from the exterior to the interior (Fu *et al.*, 2011).

### Courtship Behaviour

The species has been noted to begin occupying territory and singing around the middle of April. Male singing is observed to gradually increase, peaking mid-May as they enter the brooding period. Nests are a deep cup and are built mainly by the female, though males often display to females while carrying nesting material, inviting females to inspect prospective nest sites.

### Nesting

Nests are a deep cup and are built mainly by the female. Nests are built at an average height of  $137.5 \pm 4.6$  cm above ground (Fu *et al.*, 2013). Around 80% of nests are built in bamboo (Fu *et al.*, 2013) although they will also nest build in shrubs, roses and a mix of bamboo and lianas (Fu *et al.*, 2011). Bamboo, small shrubs and lianas with a few large trees surround the nest (Fu *et al.*, 2013). Building nests in thick vegetation is believed to give some protection from nest predation, which accounts for around 50% of failed nests (Fu *et al.*, 2016). The main predators were found to be squirrels, snakes, raptors and wasps (Fu *et al.*, 2016). Over 60% of *Liocichla* nests fail in the wild, other contributing factors to this failure include abandonment and inclement weather (Fu *et al.*, 2016).

Once the nest is complete, there is a delay of 1 to 3 days before the first egg is laid (Fu *et al.*, 2011) with incubation starting after the last egg has been laid. The female will lay one egg per day in the morning (Fu *et al.*, 2011). Clutch size is generally 3-4 eggs, eggs are pale sky-blue to bright blue, irregularly marked with long reddish-brown to dark red-brown squiggles, lines and spots (Collar *et al.*, 2020). Both sexes participate in incubating the eggs for 13 - 14 days (Fu *et al.*, 2013). Chicks are fed almost entirely on invertebrates, at least until fledging at 13-14 days. Chicks are fed by both parents at the nest and after fledging (Hewston, 2001).



Figure 21: *Liocichla* nest and eggs

In the wild, *Liocichla omeiensis* switches between habitats as the seasons change. Habitats used during the breeding season consist of mostly scrub and bamboo, whereas in the winter habitats are dominated by scrub and herbs. This should be considered for captive groups as the seasons change during the year.

In captivity, Mount Omei *Liocichlas* do well in heavily planted aviaries with dense vegetation suitable for nesting. Plants such as bamboo, conifer and laurel are ideal and have the right structure to allow the birds to build their cup shaped nests. Other widely available shrubs which occur in the species' native range include *Viburnum*, *Lonicera*, *Hydrangea*, *Clerodendrum*, *Kerria*, *Ribes*, *Rhododendron*, *Euonymus*, *Cornus* and *Buddleia*, and climbers such as *Lonicera*, *Clematis* and *Actinidia*. For more detail on natural vegetation on Emei Shan see Lancaster (1989). Nest baskets can be provided for the birds to build their nests in, and they will use coconut fibre, washed fine roots and fine grasses as nest material. Some breeders of *Liocichla omeiensis* cover the aviary roof to provide further protection from the weather. This is however, not necessary if the aviary is densely planted with plenty of natural cover. Breeding pairs have been known to move their nest sites from year to year, so unless the whole roof is covered over, the nest could be built in an area of the aviary not protected, rendering the roof ineffective.

Institutional and private keepers reported at a meeting at CWP in 2005 that nests were built at heights of 1-4m in a variety of trees, shrubs and bamboo (none in baskets or other prepared sites). Some nests fell out of conifers, particularly coconut fibre nests in trees with flat, smooth fronds such as *Cupressocyparis lawsoniana*; juniper and trimmed *C. leylandii* support nests better. Coarse dry grass also anchors nests better in bamboo, which needs to be well-established and dense to support nests well. Once the outer nest is anchored, finer materials can be provided for lining. Raffia and sphagnum moss were also reported as used. One institution reported nests built higher each year in bamboo as plants grew. If the nest is inclined to fall down, it may be useful to secure it with wire which have been accepted by some pairs.

### Artificial Incubation and Hand Rearing

Hand rearing is generally only required for this species where eggs and chicks have been abandoned or if certain pairs are genetically desirable to the studbook. Before hand-rearing, keepers should discuss this option with the EEP coordinator. Where hand-rearing is necessary and agreed, the following procedures can be followed as per hand rearing guidelines of other passerine species.

Incubators should be set at a temperature of around 37.2°C and a humidity level of between 60-70%. Eggs should be routinely turned every few hours. Once internally pipped, eggs may be moved to a separate incubator for hatching. Similar species have been reported as hatching within 24 hours of the initial signs of pipping.



Figure 22: *Liocichla omeiensis* chicks; day 1, day 5, day 8 and day 14 respectively.

**Table 1: Incubation and hand rearing technique:** A Brinsea Octagon 20 egg incubator was used, set at 37.5°C with relative humidity set at 50% internally. Weight lost was aimed at 15% (actual egg loss was between 10-13%) and were hand turned 3 times a day. Eggs took 13 days to internally pip and 1 day to hatch. Once internally pipped the eggs are placed in a tub and put in a Brinsea Hatchmaker (set at 37.2°C and 70% relative humidity) to hatch.

Age	Brooder Temp	Freq. of feeds	Diet/Feeding method	Development Notes
Day 0	36.5°C, Humidity 50%	Every 2 hours	0.02ml Sodium Lactate up to 12 hours after hatch  Chick placed in small plastic tub, with tissue and Hatcher matting for grip.	
Day 1	36°C	Every 2 hours (x10)	40% pinkie mouse (no milk sac) and 60% papaya mixed to a runny consistency. <b>Supplements</b> - small pinch Avi-pro Plus.  Two separate tweezers are used, 1 for feeding and 1 to pick up faeces. All tweezers used, are washed after use and placed in a Milton solution (7.5ml:1000ml) until next feeding session (rinse with water before use).	
Day 2	35.5°C			
Day 3	35°C		Supplements - small pinch of Avimix and Nutrobal to every second batch of food	
Day 4	34.5°C	Every 2 hours (x 9)	50% pinkie mouse (no milk sac) and 50% papaya mixed to a runny consistency	
Day 6	33.5°C		50% pinkie mouse (no milk sac) and 50% papaya chopped more coarsely	Eyes open
Day 7	33°C			
Day 8	32°C			
Day 11	31°C			
Day 12	30°C		Chicks taking less food	Chicks preening
Day 13	29°C			Chicks fledge
Day 14	29°C	Last feed at 6pm	Small perches added to brooder	
Day 15	28°C	Fed 3 x daily, wean onto adult diet.	Small bowl of softbill food and water bowl added mealworms also added. Place tweezers in food bowl first to encourage self-feeding	
Day 16	26°C			
Day 17	24°C			
Day 18	22°C			
Day 19	20°C			
Day 20	Room Temp.	Self feeding	Adult diet, small chopped up fruit (apple, pear, banana, grapes and papaya) and insect mix (dry commercial insect mix with grated carrot and hard-boiled egg added), meal worms ab lib.  Chicks moved to a small cage	Fledglings refused food from tweezers.

## Chick Fledging

Liocichla chicks will fledge at around 12 to 14 days of age. Fledglings will become independent from their parents another 3 to 4 weeks later. Young birds should be removed and separated from the parent birds as soon as they are fully independent to avoid any possible aggression from the parents. Young birds will moult in early autumn

After 13 to 14 days, chicks will fledge the nest and both parent birds will continue to provision the fledglings (Fu *et al.* 2011). In the wild fledging success is around 70% (Fu *et al.* 2011). When chicks fledge it is important to ensure there are low branches available which they can perch on during the first days. In case of severely poor weather, especially rain it may be useful to move the chicks to a more sheltered area and monitor carefully if the parents continue to feed.

It is recommended that juveniles are removed before the next clutch hatches as the juveniles, although capable of self-feeding, have been known to successfully beg for live food from the parents. This could have a negative effect on the development of the next brood. Although anecdotal evidence from breeders also suggests that where young have been left with the parents, the youngsters have helped raise the brood.



Figure 23: Liocichla fledgling in dense scrub (Photo Credit: Eddie Bach)

## 2.5 Behavioural Enrichment

Enrichment can be provided for *Liocichla* in the form of invertebrates hidden in dry leaves. This can be provided in a tray filled with leaves. Scatter feeding live food such as mealworms and crickets around the aviary will encourage the birds to carry out normal foraging behaviours. Alternate feeding sites can stimulate exploratory behaviour. Basking light to elicit sunbathing behaviour indoors and moving water stimulates bathing behaviours.

## 2.6 Handling

### Catching and Handling

Woven nets work best for catching individuals, moving easier through the air than cloth nets and being less visible. Nets must be well padded around the rim to prevent injury to the birds if accidentally knocked with the net. Once caught, birds can be put into a pillowcase or light cotton bag – inside out to prevent damage to claws. This same method can be used to weigh individuals. During handling, birds should be gently cupped in the hand without applying pressure to breast and belly, as this can inhibit breathing.



Figure 24: Small bird net made from close weave dark material and padded rim.



Figure 25: Correct handling technique for Liocichla

### Identification

The tarsus width is approximately 2.8mm. For identification purposes 3.5mm (UK size J) size plastic or aluminium split rings can be used. These can be numbered, lettered or coloured. Coloured rings are easily identified from a distance. 3.8 mm (UK size K) can also be used, but this may be a little loose fitting.



Figure 26: Aluminium split ring must be closed fully to prevent the back toe getting caught in the ring (Photo Credit: Nat Horner).



Figure 27: Aluminium split ring in correct position and closed (Photo Credit: Nat Horner).



Figure 28: Bird with 2 coloured plastic split rings for easy identification (Photo Credit: Nat Horner).

### Transport and Quarantine

For short internal moves around the site, it is best to transport *Liocichla* individually in a cloth bird bag as these pose the least injury risk to the birds. The bag should be tied securely once the bird has been placed inside and held at the top, so that the bird remains calm and still. Alternatively, suitably sized, secure plastic carry cages or wooden boxes can also be used. Carry cages and boxes have the disadvantage of being more difficult to remove the bird by hand.

Transporting birds should be kept to a minimum as travelling can cause a great deal of stress. For short journeys off-site of up to 1 hour in duration, *Liocichla* should be transported in a wooden travel box. Transport boxes should not be too large but should allow enough space for birds to move around. These cages should be kept as dark as possible, with a dark cloth covering that does not restrict ventilation, hessian sacking or similar is ideal. To prevent head and bill injuries during transport a layer of sponge

or foam padding around 2cm thick should be fixed to the internal roof of the box. Temperature fluctuations should be kept under control. Box sizes of 22cm wide x 25cm tall x 27cm deep are ideal. A small perch no bigger than 2cm in diameter should be fixed securely inside the box, around halfway along the length. Food and water dishes can be fixed inside the transport box but shouldn't be needed unless the journey is longer (3 hours or over). Water can spill easily during transportation, so a clean piece of sponge can be placed inside the water dish to soak up the water and prevent too much from spilling.

When transporting *Liocichla* by ventilated car or van, the transport box should be securely fastened in the back of the vehicle rather than the cab. Any unnecessary noise can cause undue stress, so this should be reduced. Sitting the transport box on material of some kind, such as a foam pad will prevent the box from rattling too much and again help to reduce any stress caused by transportation.

When transporting *Liocichla* by air, the International Air Transport Association (IATA) Live Animals Regulations (LAR) must be adhered to. The IATA Live Animals Regulations are accepted by the Convention on International Trade in Endangered Species of Fauna and Flora (CITES) and the World Organisation for Animal Health (OIE) as guidelines in respect of transportation of animals by air. In addition, the European Union has adopted the IATA Live Animal Regulations as the minimum standard for transporting animals in containers, stalls and pens. Before preparing a live animal for transport by air, the person responsible for shipping must check and obtain full information well in advance. This will include the correct documentation regarding import/export, in transit permit, veterinary health certificate, and for CITES listed species CITES import permits will be required (IATA, 2017).

The most appropriate transport box for the *Liocichla* is Container Requirement 12 (IATA, 2017). The box dimensions can hold up to 35 *Liocichla*. For shipping individual birds or smaller groups, Container Requirement 23 can be used instead (IATA, 2017). Aggressive birds should be transported on their own.

Quarantine - During quarantine, equipment used for each aviary should be kept to that aviary or thoroughly disinfected before being used elsewhere. Contact between your birds and wild birds must be kept to a minimum. Visitors to quarantined birds should be strictly limited to prevent contamination of the area. The period of quarantine should be at least 30 days before new birds are introduced to an existing group.



Figure 29: Transport box with ventilation, food, water, perching and padded ceiling (Photo Credit: Gavin Harrison)

## 2.7 Veterinary Considerations for Health and Welfare

### Health Checks

Visual health checks should be conducted daily as part of a keeper's morning routine. Any changes should be reported and investigated if necessary.

Things to look out for in birds include:

- Their general appearance. Are their feathers looking unhealthy, fluffed up or different than usual?
- Are they alert? Sick birds often have half-opened eyes or lack of alertness. Sleeping at unusual times of the day can also be an indication something is not right.
- Respiratory distress “pumping” with tail tapping or an audible clicking sound as the bird breathes.
- Change in appetite. Food consumption should remain constant – a complete loss of appetite may indicate disease.
- Discharge from eyes or nasal passages or build up/clogging of faeces around the tail feathers.
- Faeces colour and consistency should be checked where possible.
- Other changes in their behaviour that seem unusual.



Figure 30: Weighing *Liocichla* using a cotton bag suspended from a hanging scale  
(Photo Credit: Nat Horner)

### Body Condition Score Guidelines

Regular and documented body condition scoring allows us to pick up on any changes or patterns. Body condition will change throughout the breeding season, but generally a score of 4 on the pectoral muscle and a 0 or 1 fat score (see below) is seen as healthy score.

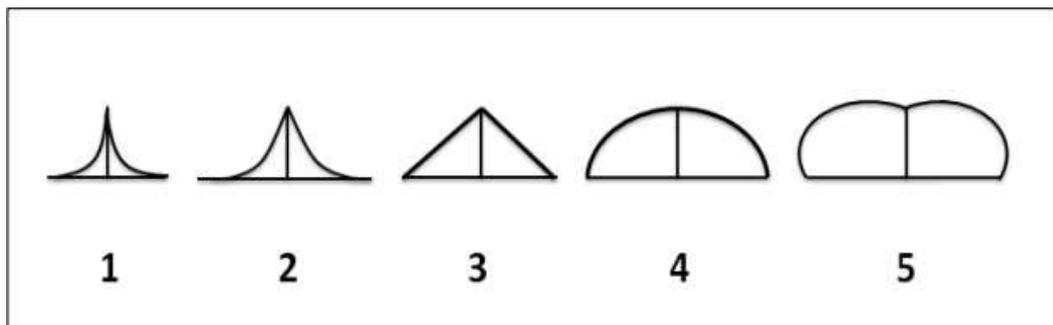


Figure 31: Pectoral muscle scoring index (body-score)

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

Table 2: Description of body-score classes

### 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 clavicle (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 and recorded. Bird ringers and ornithologists 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. The score of 4 – Obese is unlikely to be seen in a wild bird and would normally be associated with captive individuals.

Score Class	
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.
4	Obese

Table 3: Description of the fat score classes

## 2.8 Specific Problems

The cause of most *Liocichla* deaths in captivity are undetermined. However, a postmortem on an 8-month-old female found that the most significant finding was the presence of hepatic lipidosis. The bird was found to be obese with large quantities of subcutaneous fat, which could have contributed to its death, rather than other metabolic causes.

Holders are encouraged to always have a necropsy examination performed and when possible forward samples or carcasses to specialized avian pathologists and forward the results to the studbook keeper to gain a better overall understanding of common health issues.

## 2.9 Recommended Research

The first-year mortality of the species is quite high, both in the wild (Fu et al., 2011) and in EAZA. It has proven to be a recurrent problem in the population and is detrimental to the development of the insurance population. It seems that there are different causes of deaths related to different ages of the chicks, and that, for example, mortality between 0 to 10 days would be more related to weather whereas mortality after 10 days would be linked to infectious diseases. However, poor weather is likely to be correlated with infectious diseases observed in older chick mortality. In order to have a better understanding of the causes and timing of this issue, participants are asked to collect and share data with the coordinators, including **the exact day of death** of the chick, weather reports during this period and a necropsy report of the chick when possible. All this information will provide an understanding of nestling survival in the population and will hopefully help to improve it (Green, 2022).

Conduct further surveys and ecological studies of this and other threatened species in its habitat, to clarify its population, distribution and habitat requirements, with the aim of producing management recommendations for forests where it occurs (IUCN, 2022).

In particular identifying precise habitat requirements, both during the breeding season and other times of the year. The use of GIS would develop a greater understanding of how the species uses habitat and efforts to conserve it can be enhanced (Fu *et al.*, 2013).

Investigate if multiple breeding pairs do disturb each other with their song and determine the mean distance needed between successful pairs. This can be both important for ex-situ population management recommendations as well as help calculate the potential density of the species in the wild.

Whenever possible record the bodyweight together with the individual birds' condition in ZIMS for Husbandry.



### Section 3: Appendix – Example Diets

#### Example 1: Omei Shan Liocichla *Liocichla omeiensis* Diet Sheet

Diet consists of 30% Waddesdon Frugivorous mix and 70% Insectivorous mix (see below) given to appetite with just a few pieces of both mixes left the next day. A small pinch of mealworms is given 3 times a day (roughly 4 mealworms per bird 3 times daily.) Occasional wax moth larvae are also given 4-5 a week. In season crickets are also given approx. 4 a day. Nutrobal is lightly dusted over the diet every other day.

For adults rearing chicks' additional live food is given every 2 hours (5 times during the day), including mini-mealworms, white shed standard mealworms, "home grown" small wax moth larvae, and small black crickets. All dusted with Nutrobal.

##### Frugivorous Mix:

Contains 4 apples, 4 pears, 3 bananas, 4 tomatoes, 4 Kiwi fruit, 4 plums, 150g soaked currents, ½ of melon, 1 papaya, 1 mango, ¾ of a large bunch of grapes, T16 pellets. All fruit diced into small 1 cm cubes.

##### Insectivorous mix:

Contains 500g of Verselaga universal, 500g Beapher Universal low Iron softbill food, 1 large finely grated carrot, 1 level tsp of Spirulina, 300g soaked currents, 2 finely chopped apples, 3 hardboiled eggs put through a ricer and 100g of F16 pellets

#### Example 2: Species: **Passerines: Omei shan Liocichla**

##### Diet Sheet No. 06

Food type	Amount required	Presentation	Notes
Chopped mixed Fruit	5g per bird	In bowl	See diet sheet 42
Mealworms/crickets	5-6 per bird	scattered	2 feeds x per day
Waxworms	Ad-lib	In bowl/scattered	<b>When rearing chicks</b>
Mynah pellets	15g per bird	Dry in bowl	
Passerine mix	10g per bird	Added to bowl	See diet sheet 39

Passerine Mix = 5 g of finely grated hard-boiled egg, 1 grated carrot (120g), 250g insectivore mix, such as DK Tovo Universal.

Calcium, vitamin mix sprinkled over live food daily

Offer 4-5 insect feeds per day if rearing.

Products Listed

Product Name	Description	Producer	Address
DK TOVO UNIVERSAL	DK TOVO is a complete food for fruit-eating birds such as; Toucans, Leafbirds, Turacos, Barbets and Hornbills.	Kiezebrink UK Ltd	The Old Piggery Church Farm, Church Road Barrow, Bury St Edmunds Suffolk, IP29 5AX, United Kingdom
Nutrobal	<ul style="list-style-type: none"> <li>• Combined calcium, vitamin and mineral supplement with vitamin D3</li> <li>• Calcium:Phosphorus ratio of 46:1</li> <li>• Supports balanced diet to help prevent calcium deficiencies</li> </ul>	Vetark	Unit 2-3 Barfield Close, Winchester, SO23 9SQ, UK
T16 Pellets	Extruded pellets - Maintenance food for large fruit- and insect-eating birds Scientifically approved composition for e.g. mynahs, toucans, turacos and fruit doves. With fruit. Supports the intestinal flora and protects against intestinal disorders. Iron Storage Disease is a frequently occurring problem with frugivorous and insectivorous birds; that is why NutriBird T16 has such a very low iron content (max 85 ppm).	Nutribird, Versele-Laga	Kapellestraat 70 9800 Deinze Belgium
Versele-Laga Universal Mix	Universal Softbill Food Complete Feed For Fruit-Eating And Insect-Eating Birds	Nutribird, Versele-Laga	Kapellestraat 70 9800 Deinze Belgium
Beaphar Universal low iron softball food	Beaphar Universal Food is a highly palatable, complete food specially formulated for all softbill, fruit and insect-eating birds, such as mynahs, peking robins, starlings and other softbill birds.	Beaphar UK Ltd	Rook Tree Farm Withersfield Road Great Wratting Suffolk CB9 7HD UK
F16 Pellet	Extruded pellets - Maintenance food for fruit- and insect-eating birds Scientifically approved composition for e.g. fruit doves, thrushes and jays.	Nutribird, Versele-Laga	Kapellestraat 70 9800 Deinze Belgium

## Section 4 References

BirdLife International, (2001). *Liocichla omeiensis*. *The IUCN Red List of Threatened Species* 2017: e.T22715770A117063025. <https://dx.doi.org/10.2305/IUCN.UK.2017-3.RLTS.T22715770A117063025.en>.

BirdLife International, (2016). *Liocichla omeiensis*. *The IUCN Red List of Threatened Species* 2017: e.T22715770A117063025. <https://dx.doi.org/10.2305/IUCN.UK.2017-3.RLTS.T22715770A117063025.en>.

Cockrill, R. (1993). Breeding the Omei Shan Liocichla. *Beak and Claw*, 89, 8-10.

Collar, N., Robson, C., and de Juana, E. (2020). Gray-faced Liocichla (*Liocichla omeiensis*), version 1.0. In *Birds of the World* (del Hoyo, J., Elliott, E., Sargatal, J., Christie, D.A., and de Juana, E. Editors). Cornell Lab of Ornithology, Ithaca, NY, USA. <https://doi.org/10.2173/bow.gyflio1.01>

Fang, Y., Yao, C., Hsu, Y., and Hung, C. (2022). Elevational plumage divergence in the Rufous-capped Babbler (*Cyanoderma ruficeps*) on a mountainous island, *Ibis*, 164: 151-167

Fu, Y., Dowell, S.D., and Zhang, Z. (2011). Breeding ecology of the Emei Shan Liocichla (*Liocichla omeiensis*), *The Wilson Journal of Ornithology*, 123(4): 748-754.

Fu, Y., Dowell, S.D., and Zhang, Z. (2013). Emei Shan Liocichla: population, behaviour and conservation, *Birds of China*, 4(3): 260-264.

Fu, Y., Chen, B., Dowell, S. D. and Zhang, Z. (2016). Nest Predators, nest-site selection and nest success of the Emei Shan Liocichla (*Liocichla omeiensis*), a vulnerable babbler endemic to southwestern China, *Avian Research*, 7:18

Green, C. (2022). Emei shan liocichla (*Liocichla omeiensis*) Long-term Management Plan, *European Association of Zoos and Aquariums*, Amsterdam, The Netherlands.

Hewston, N. (2001). The Omei Shan Liocichla (*Liocichla omeiensis*), *Avicultural Magazine*, 107(3): 109-114.

IATA, (2017). *Live Animals Regulations 44<sup>th</sup> Edition*, International Air Transport Association, Montreal-Geneva

IUCN, (2022). Emei Shan Liocichla: *The IUCN Red List of Threatened Species*, Version 2021-3. <https://www.iucnredlist.org>

Lancaster, R., (1989). *Travels in China – A Plantsman’s Paradise*. ACC Art Books, Woodbridge, UK.

One Earth, (2022). Sichuan Basin & Central Mountain Forests bioregion <https://www.oneearth.org/bioregions/sichuan-basin-central-mountain-forests-pa51/>

World Weather and Climate Information (2010-2022a) Average humidity in Chengdu, Sichuan, <https://weather-and-climate.com/average-monthly-Humidity-perc,chengdu,China>

World Weather and Climate Information, (2010-2022b). Average humidity in London, Greater London, <https://weather-and-climate.com/average-monthly-Humidity-perc,London,United-Kingdom>