

CONVENTION ON INTERNATIONAL TRADE IN ENDANGERED SPECIES
OF WILD FAUNA AND FLORA



Thirty-first meeting of the Animals Committee
Geneva (Switzerland), 13-17 July 2020

Interpretation and implementation matters

Regulation of trade

Captive-bred and ranched specimens

CAPTIVE BREEDING OF SRI LANKAN AGAMIDS

1. This document has been prepared by the Secretariat.

Background

2. At its 18th meeting (CoP18, Geneva, August 2019), the Conference of the Parties adopted Decisions 18.174 and 18.175 on *Captive breeding of Sri Lankan agamids* as follows:

18.174 Directed to the Secretariat

The Secretariat shall prepare a report to the 31st meeting of the Animals Committee on possible species-country combinations of Ceratophora stoddartii, Ceratophora aspera and Lyriocephalus scutatus for review under Resolution Conf. 17.7 (Rev. CoP18) on Review of trade in animal specimens reported as produced in captivity.

18.175 Directed to the Animals Committee

The Animals Committee shall review the report of the Secretariat and consider whether to select species-country combinations of Ceratophora stoddartii, Ceratophora aspera and Lyriocephalus scutatus for review under Resolution Conf. 17.7 (Rev. CoP18) on Review of trade in animal specimens reported as produced in captivity.

3. Thanks to a contribution from the United States of America, the Secretariat requested the World Conservation Monitoring Centre of the United Nations Environment Programme (UNEP-WCMC) to produce a report on captive-breeding of Sri Lankan agamids (*Ceratophora stoddartii*, *Ceratophora aspera* and *Lyriocephalus scutatus*) that would cover the following: breeding biology of the species, breeding in captivity, prevalence in zoos, evidence of commercial breeding and a list of countries where evidence indicates that the species are bred, as well as the outcomes of the consultations with Species360 and trade associations. This report is presented in the Annex to the present document.

Recommendations

4. The Animals Committee is invited to consider the report in the Annex to the document and determine whether any species-country combinations should be selected for review under Resolution Conf. 17.7 (Rev. CoP18) in accordance with paragraph 2 c). Should any species-country combination be selected, the Animals Committee is invited to prepare a brief explanation of the reason for each selection; and draft general or specific questions for the countries selected for review.



CAPTIVE BREEDING OF SRI LANKAN AGAMIDS

UNEP-WCMC Technical Report

Captive breeding of Sri Lankan agamids

Prepared for
CITES Secretariat

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UN Environment Programme World Conservation Monitoring Centre (UNEP-WCMC)
219 Huntingdon Road, Cambridge CB3 0DL, UK, Tel: +44 1223 277314
www.unep-wcmc.org

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Overview

This report provides assessments of three agamid lizard species endemic to Sri Lanka that were listed in Appendix II of CITES at CoP18 subject to zero quotas for commercial trade; *Ceratophora stoddartii*, *C. aspera* and *Lyriocephalus scutatus*.

Concerns about the feasibility of captive-breeding of these species and potential illegal trade in wild specimens from the only range State highlighted within CoP18 Prop. 24 (*Ceratophora* spp.) and CoP18 Prop. 26 (*Lyriocephalus scutatus*) led to the adoption of Decisions 18.174-175 at CoP18. The UN Environment Programme World Conservation Monitoring Centre (UNEP-WCMC) was requested by the CITES Secretariat to assist with implementation of Decision 18.174, namely, to identify possible species-country combinations for review under Resolution 17.7 (Rev. CoP18) on *Review of trade in animal specimens reported as produced in captivity*.

CITES trade data is not yet available for these three lizard species which were listed in the Convention only on 26/11/2019. The first full year of trade data (2020) will not be available until at least October 2021, in line with the annual report submission date. Accordingly, no specific countries can at this time be identified based on reported trade in captive-produced specimens. It was therefore decided in consultation with the CITES Secretariat, that a report to support Decision 18.174 should focus on the feasibility of breeding in captivity, prevalence of specimens in zoos and evidence of commercial breeding. This report therefore provides an overview of captive-breeding of *Ceratophora stoddartii*, *C. aspera* and *Lyriocephalus scutatus* based on a literature review and through consultation with Parties, breeders and commercial trade associations in countries for review by the Animals Committee.

No evidence was found to indicate that any of the three species are present in zoos globally (Conde, pers. comm to UNEP-WCMC, 2020)¹. Our focus then shifted towards engagement with private individuals (such as hobbyists) or commercial entities that were identified as potentially breeding the species. UNEP-WCMC and the German CITES Scientific Authority (Federal Agency for Nature Conservation) compiled a questionnaire relating to the keeping, breeding and husbandry requirements of the three agamid lizard species. Questionnaires were distributed to herpetological specialists and organisations within a number of countries where some evidence² indicated that the specimens may be present or bred (Czech Republic, Germany, United Kingdom of Great Britain and Northern Ireland and United States of America). It was made clear that all responses would be anonymised. CITES Scientific Authorities of a number of Parties were also consulted, including Austria, France, Japan, Sri Lanka and the United States of America.

The German Society for Herpetology and Terrarium Science (Deutsche Gesellschaft für Herpetologie und Terrarienkunde, DGHT) and the Austrian Association of pet owners (Österreichischer Dachverband Sachkundiger Tierhalter, ODST) provided support by distributing the questionnaire.

Six questionnaire responses had been received at the time of writing (May 2020). Three related specifically to *Ceratophora stoddartii* (the three respondents were private breeders, one from the Czech Republic, one from Germany and one from the UK). Two responses were received relating to *Lyriocephalus scutatus* (one respondent each from the Czech Republic and Germany). The final

¹ Based on ZIMS database maintained by Species 360 (see <https://www.species360.org/products-services/zoo-aquarium-animal-management-software-2/>)

² For example, previous online advertisements for sale (CoP18 Prop. 24), based on United States LEMIS data, pers. comm. with breeders.

questionnaire, compiled by a German breeder, included information on all three species. Further questionnaire responses received by AC31 will be summarized as an information document to the meeting; additional countries will also be contacted based on online adverts for the three species, which may imply they are held or bred in other countries.

In summary, on the basis of the information compiled, it appears that:

- breeding of *Ceratophora stoddartii* in captivity is feasible by experienced breeders, and whilst specimens are not bred on a commercial scale, information available suggests the species can be bred regularly to multiple generations (at least F5);
- captive breeding of *Lyriocephalus scutatus* appears to be feasible by experienced breeders; however, this species remains rare in captivity. Whilst breeding to second generation (F2) has been achieved, published literature from 2007 notes that it is difficult to maintain breeding populations in captivity.
- *Ceratophora aspera* is among the rarest of all *Ceratophora* in captivity. Some evidence indicates that it is feasible to breed the species in captivity, however little additional information could be obtained in the time available to compile this report (April-May 2020).

An overview of Sri Lanka's national protection for agamid lizards is provided below, followed by the three species assessments.

National protection of agamid lizards in Sri Lanka

All three agamid lizard species are currently protected within Sri Lanka. Section 30 of the Seventh amendment to the Fauna and Flora Protection Ordinance of Sri Lanka (FFPO) in 1993 states that all reptiles, except five highly venomous snakes, are protected species; collection, even outside of protected areas, is prohibited (Parliament of the Democratic Socialist Republic of Sri Lanka, 1993). Ranching and breeding of reptile species is not permitted (Somaweera *in litt.* 2013 in CoP18 Prop. 24). Section 40 of the FFPO prohibits the export from Sri Lanka of any reptile, dead or alive, including eggs and any part, without a permit from Director General of the Department of Wildlife Conservation (Parliament of the Democratic Socialist Republic of Sri Lanka, 1993). Permits may only be issued for the promotion of scientific knowledge (Parliament of the Democratic Socialist Republic of Sri Lanka, 1993). The genus *Ceratophora* was classified as strictly protected in the 2009 amendment of the FFPO (Act, No. 22), resulting in higher penalties for any trade in these species (Parliament of the Democratic Socialist Republic of Sri Lanka, 2009).

Exports of *Ceratophora stoddartii*, *C. aspera* and *Lyriocephalus scutatus* from Sri Lanka previously took place legally (see "History of Exports" sections within each assessment).

Ceratophora aspera

COMMON NAMES	Sri Lanka horned agama, Rough-nosed horned lizard (EN)
IUCN:	VU
CITES listing	Appendix II, zero export quota for wild specimens for commercial purposes
SUMMARY	Published accounts of keeping and breeding this species in captivity are very limited. <i>C. aspera</i> is not found in zoological collections and is rarely kept by private individuals. Whilst breeding in captivity is feasible by experienced keepers, it is unclear if the species can be bred to second or subsequent generations based on available information. <i>C. aspera</i> is not bred on a commercial scale.



Ceratophora aspera by Buddhika Mawella ©
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Species characteristics: *Ceratophora aspera* is a lowland and sub-montane species found between 60-900 m above sea level (Manamendra-Arachchi and Liyanage, 1994; Bahir and Surasinghe, 2005). It has been described as “ground dwelling” and “semi-arboreal” and was reported to be restricted to undisturbed dipterocarp and lowland rainforests forests in the Sabaragamuwa hills, in Sri Lanka’s south-western wet zone (defined by rainfall in excess of 2500 mm) (Manamendra-Arachchi and Liyanage, 1994;

Pethiyagoda and Manamendra-Arachchi, 1998; Somaweera and de Silva, 2010). There have been some observations of the species in home gardens adjacent to forested areas (Bandara 2018, pers. comm. in CoP18 Prop. 24).

C. aspera is the smallest of the Sri Lankan agamids. Based on a sample of museum specimens, females (n= 26) averaged a snout-vent length (SVL) of 32.1 mm \pm 3.41, with males (n=28) averaging a SVL of 29.6 mm \pm 4.66 (Johnston *et al.*, 2013). The species is sexually dimorphic with females attaining slightly larger sizes than males (Johnston *et al.*, 2013). *C. aspera* was noted to most frequently be found in pairs (Manamendra-Arachchi and Liyanage, 1994).

Both sexes have a large rostral appendage which is larger in males (Manthey, 1981; Pethiyagoda and Manamendra-Arachchi, 1998; Krvavac *et al.*, 2015), and absent in juveniles (Pethiyagoda and Manamendra-Arachchi, 1998; Johnston *et al.*, 2013). Both males and females are cryptically coloured; males are dark brown or brick red both dorsally and laterally, while females are similar to males or lighter and duller (Pethiyagoda and Manamendra-Arachchi, 1998). Some individuals have four diamond-shaped markings and black spots or longitudinal lines on the dorsum, and some mature males have yellow or yellowish-range labials and gular spots; the colour of juveniles is similar to that of adults (Pethiyagoda and Manamendra-Arachchi, 1998).

Data from three wild-caught females and one wild-caught male have indicated a modal clutch size of two eggs (Krvavac *et al.*, 2015), which supports information found in a 1981 account of the species in the wild (Manthey, 1981).

Status and trends in the wild: *C. aspera* was categorised as Vulnerable in a 2009 global IUCN assessment (Somaweera and de Silva, 2010) but was categorised as nationally Endangered in both the 2007 (Somaweera and de Silva, 2010) and the 2012 National Red Lists of Sri Lanka (Ministry of Environment, 2012). The national categorization was based on an extent of occurrence of <5000 km² and an area of occupancy of <500 km², a severely fragmented habitat/occurrence at fewer than five sites, and a continuing decline in the area, extent and/or quality of habitat (Ministry of Environment, 2012). It has been estimated that only 5% of the original extent of rainforests in Sri Lanka's wet zone survives, and that remaining forests are heavily fragmented with habitat loss continuing as a result of demand for agricultural land (Bahir and Surasinghe, 2005).

It was noted in CoP18 Prop. 24 that the impact of any illegal collection of *Ceratophora* spp. for the international pet trade is unknown.

History of exports: Until the 1980s, exports laws were less strict and specimens of *Ceratophora* were exported for commercial purposes (Karunaratne, 1986 in CoP18 Prop. 24). Somaweera *in litt.* (2013 in CoP18 Prop. 24) remarked that individuals may have been legally exported from Sri Lanka in the past when export regulations were less restrictive, possibly for other purposes and later used as pets. One breeder of Sri Lankan agamids noted that *C. aspera* was first imported to Germany in the seventies and the species was legally imported in large numbers until the early 1980s.

Captive breeding: Henkel and Schmidt (1997) outlined aspects of keeping and breeding the species, but no prior literature on breeding the species was located. Henkel and Schmidt (1997) noted that females bury two eggs in a hollow and after egg laying, and the provision of hiding places was necessary. Krvavac *et al.* (2015) observed three wild-caught females and one wild-caught male in captive conditions for three months. Krvavac *et al.* (2015) noted that females prefer moist soils without leaf litter in which to excavate a hole of ~25 mm depth and 20 mm width to deposit their eggs. Krvavac *et al.* (2015) observed that the incubation periods for two clutches (of two eggs each) that successfully hatched in captive conditions were 38 days and 46 days. Based on one observed mating, females appeared to be able to store sperm inside the body (Krvavac *et al.*, 2015). Krvavac *et al.* (2015) noted that mating coincided with periods of heavy rainfall and/or mist cover, typically accompanied by high (80-100%) ambient humidity, despite in-terrarium humidity being maintained at >90%. Rainfall and the availability of waterbodies and terrestrial sites with high humidity were argued to be "probably the most important environmental factors influencing *C. aspera* oviposition behaviour" (Krvavac *et al.*, 2015).

Ease of breeding in captivity: No information was located on the ease of breeding the species, however, given specific husbandry requirements it is anticipated that breeding could be achieved only by experienced breeders.

Extent of breeding in captivity: It is unknown if this species is held in any zoos or aquaria globally; no specimens are currently held in institutions registered to use the ZIMs (Zoological Information Management Software) database managed by Species 360, which covers more than 1200 institutions globally in 99 countries on six continents (Conde, *pers. comm.* to UNEP-WCMC, 2020). Captive breeding of *C. aspera* has been documented, although records are sparse. Henkel and Schmidt (1997) noted that hatchlings are very small (35 mm) but did not provide further details of hatching success or whether the species can be bred to F2 or subsequent generations. It was noted that the species was kept in private hands in Germany by a breeder in another EU Member State.

Two breeders of Sri Lankan agamids remarked on the rarity of *C. aspera* in captivity; one noting that it was the rarest of the three species (*C. aspera*, *C. stoddartii* and *L. scutatus*), and another stating

that it is among the rarest of *Ceratophora* in captivity. However, both breeders were aware of instances of the species being kept and bred in captivity in the past.

Husbandry requirements: According to Henkel and Schmidt (1997), it was recommended that several pairs could be maintained together in captivity, noting that territory sizes in the wild are small and that the species is not aggressive. It was noted that dense planting seemed appropriate, along with potted soil covered by leaves and a fog or spray system (Henkel and Schmidt, 1997). It was recommended that temperature should not exceed 25°C during the day and soil should be cooled to less than 20°C at night. In terms of diet, it was reported that *C. aspera* would only accept small food items such as worms, wax caterpillars, house flies, house crickets and *Drosophila*. Henkel and Schmidt (1997) also stated that a terrarium of 0.15 m³ was sufficient for one pair.

Krvavac *et al.* (2015) kept three wild-caught females and one male in captivity for three months. After one month, all three were housed in the same enclosure (71x21x21 cm) with a substrate layer approx. 5-10 cm deep of humus-rich forest topsoil and sand, and with approx. a quarter of the floor area covered with a 2 cm layer of leaf litter (Krvavac *et al.*, 2015). Bromeliads and local shrubs were potted in the terrarium and relative humidity maintained at >90% (Krvavac *et al.*, 2015). The individuals were fed grasshoppers and termites (Krvavac *et al.*, 2015).

Utilization and trade: *Ceratophora* species were reported to be used and traded only as live specimens for the pet trade (CoP18 Prop. 24). Between September 2016 and October 2018, a survey of three Facebook groups and classified reptile websites found 12 individuals advertised for sale, all in Germany (Janssen and de Silva, 2019). The species was reported to have been advertised for sale in 2014, and in 2016 by a German seller for EUR 2500 per pair (CoP18 Prop. 24). A brief web search in April/May 2020 did not find any adverts for *C. aspera*.

No records of seizures of *C. aspera* were located in TRAFFIC's wildlife seizure and incident database³.

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Ceratophora stoddartii

SYNONYMS	<i>Ceratophora hoddartii</i> Kelaart, 1854
COMMON NAMES	Rhino-horn lizard, Mountain horned agama (EN), Rhino cornes lézard (FR)
IUCN	Not assessed
CITES LISTING	Appendix II, zero export quota for wild specimens for commercial purposes
SUMMARY	Published accounts of keeping and breeding this species in captivity are limited. <i>C. stoddartii</i> is not found in zoological collections, but it appears that it can be regularly bred by specialists, with one breeder maintaining the species for 15 years and another noting that it is “extremely productive” if kept in suitable conditions. Breeding beyond F2 is possible in suitable conditions and breeding to multiple generations (F5) was reported to have been achieved. The species has been maintained in captivity in several countries, and it seems plausible that the captive population (in Europe at least) is self-sustaining. <i>Ceratophora stoddartii</i> does not appear to be bred on a commercial scale.



Rhino-horned Lizard by Vidu Gunaratna / Adobe Stock

Species characteristics: *Ceratophora stoddartii* (Rhino-horn lizard) is a relictual agamid lizard, endemic to Sri Lanka and largely restricted to the tropical montane cloud forests of the central highlands of Sri Lanka between 1200-2200 m above sea level (Bahir and Surasinghe, 2005). *C. stoddartii* is a slow-moving subarboreal species (Pethiyagoda and Manamendra-Arachchi, 1998) that inhabits microhabitats with high vegetation cover, shade and low amounts of bare soil (Jayasekara *et al.*, 2018).

C. stoddartii can reach a maximum SVL of >8 mm (Bartelt, 1996; Johnston *et al.*, 2013) and a total length of 230 mm (Bartelt, 1996). The species is distinguished from other *Ceratophora* by the presence of a horn-shaped rostral appendage restricted to the rostral scale (Pethiyagoda and Manamendra-Arachchi, 1998), which is longer in males (<20 mm; Bartelt, 1995) than females (<10 mm; Bartelt, 1996). The

species' colouration differs by sex; males are dark brownish-green with a white chin and throat, and a white rostral appendage (Bartelt, 1995), while females are predominantly dark brown, with a short brown rostral appendage (Bartelt, 1995; Pethiyagoda and Manamendra-Arachchi, 1998). Males were reported to change to bright green with brown spots when excited (Bartelt, 1995).

C. stoddartii is oviparous and clutch sizes of 6-13 eggs were recorded from observations of three females from the wild (Pethiyagoda and Manamendra-Arachchi, 1998).

Status and trends in the wild: *C. stoddartii* has not yet been assessed by the IUCN Red List. The species was listed as nationally Endangered in both the 2007 (IUCN Sri Lanka and the Ministry of Environment and Natural Resources, 2007) and 2012 National Red List of Sri Lanka (Ministry of

Environment, 2012). The 2012 assessment was based on the species' extent of occurrence (< 5000 km²), area of occupancy (< 500 km²), and that its range was severely fragmented and in continuous decline (Ministry of Environment, 2012). *C. stoddartii* inhabits only a small portion of its former range, with the majority of the lower elevations (<1800 m) of the Central Massif having been cleared for tea cultivation (Pethiyagoda and Manamendra-Arachchi, 1998). Habitat loss and fragmentation from deforestation were considered the primary threat to the species, as well as rainwater acidification and climate change (Bahir and Surasinghe, 2005).

History of exports: Until the 1980s, export laws were less strict and specimens of *Ceratophora* were exported for commercial purposes (Karunaratne, 1986 in CoP18 Prop. 24). Somaweera *in litt.* (2013 in CoP18 Prop. 24) remarked that individuals may have been legally exported from Sri Lanka in the past when export regulations were less restrictive, possibly for other purposes and later used as pets. One breeder noted that agamids were often legally exported from Sri Lanka during the 1960s and 1970s and that *C. stoddartii* had been available in Europe from that time, with some breeding since. Bartelt (1996) noted that at the time, specimens of *C. stoddartii* were still being exported to Europe, despite the ban on exports. The author noted that due to its “bizarre” appearance the species was sometimes reported as “by-catch” with aquarium fish imports (Bartelt, 1996).

Some concerns have been expressed that adult specimens observed recently in trade may be wild caught rather than originating from captive stock (Altherr, 2014; Auliya *et al.*, 2016; Janssen and de Silva, 2019). The basis for these concerns were the increasing numbers seen for sale and that adults and not juveniles were being offered, with Janssen and de Silva (2019) concluding that this suggested ongoing smuggling. Illegal trade of wild specimens for the international pet trade was considered to pose a threat to the species, especially considering its restricted distribution and specific habitat and climatic requirements (Altherr, 2014) as well as the ease of collection and high demand, as indicated by the high prices (CoP Prop. 24). However, the impact of any illegal collection of *Ceratophora* spp. for the international pet trade was considered unknown (CoP18 Prop. 24). The life span of wild specimens after transport was reportedly very limited (Bartelt, 1996).

One breeder noted that juveniles seen at reptile fairs such as in Hamm (Germany) and Houten (Netherlands) were homogenous in size for each trader that offered them, indicating that the specimens for sale had been captive bred by each trader.

Captive breeding⁴: Bartelt and Janzen (2007) recognised no clear reproductive season for *C. stoddartii* in captivity and remarked that reproduction appeared possible year-round; however, the authors emphasized that terrariums lack a dry season. The species can lay multiple clutches per year (<10), with clutch sizes of 3-12 eggs recorded. Reports of age at sexual maturity were variable and ranged between six and 16 months. Egg laying occurs ~30 days or 4-5 weeks after mating. Gravid females dig a hole approx. 10 cm deep and bury eggs after deposition (Bartelt, 1996). Bartelt (1995) remarked that males appeared to demonstrate egg-guarding behaviour for three days after oviposition. Incubation length depends on temperature and can vary between 80-120 days. One breeder suspected that sex determination depends on temperature; however, another reported that offspring produced had equal sex ratios with no obvious temperature-dependent sex determination

⁴ Based on information from the literature where specified (Bartelt, 1995, 1996; Bartelt and Janzen, 2007); otherwise based on responses from three breeder questionnaires received April/May 2020 (see Appendix 1, Table 1).

(TSD). Sexes of neonates were reported to be immediately distinguishable by pattern (Bartelt, 1995). Hatching success in captivity is high (80-100%), as is survival to sexual maturity.

Ease of breeding in captivity: *C. stoddartii* was described by breeders as relatively easy to breed by experienced keepers if appropriate conditions are provided (e.g. temperature and humidity) and suitable husbandry practices followed. Two breeders noted that the species bred frequently in captivity under suitable conditions, with one describing the species as “extremely productive” if suitably kept. One breeder produced 80-100 offspring between 2013 and 2020, another bred approx. 200 over five years. All three breeders successfully bred *C. stoddartii* to second generation (F2); one achieved F5. One author reported successfully keeping and breeding *C. stoddartii* specimens in captivity for almost 15 years and had successfully bred the species to F4 (Bartelt and Janzen, 2007).

Extent of breeding in captivity: It is unknown if this species is held in any zoos or aquaria globally; no specimens are currently held in institutions registered to use the ZIMs (Zoological Information Management Software) database managed by Species 360, which covers more than 1200 institutions globally in 99 countries on six continents (Conde, *pers. comm.* to UNEP-WCMC, 2020).

Only a few published accounts of captive breeding of *C. stoddartii* (Bartelt, 1995, 1996; Bartelt and Janzen, 2007) could be located. Two breeders noted that few people breed *C. stoddartii* in captivity, and one stated that specialist breeders able to reproduce this species probably give the offspring only to other experienced breeders via personal contacts, to ensure a stable breeding stock. The responses received to date indicate that this species is being bred in Germany and has been bred – at least in the past – in the Czech Republic and the United Kingdom; it is unknown if the species is still being bred in these countries today.

Husbandry requirements⁵: According to successful breeders, *C. stoddartii* should be housed in well planted enclosures with clean water and opportunities for climbing (e.g. branches, cork walls). Humidity should be high, and temperatures kept relatively low. Diet comprises a variety of invertebrate prey supplemented with multi-vitamins and calcium.

Sexually mature males should be housed separately due to aggressive behaviour (Bartelt, 1995). Juveniles were hatched and reared separately from adults (Bartelt, 1995). Bartelt (1995, 1996), kept *C. stoddartii* in pairs and noted that once breeding pairs had been established, individuals could not be exchanged. It is recommended that housing with other lizard species should be strictly avoided, as their presence stresses *C. stoddartii* (Bartelt, 1996; Bartelt and Janzen, 2007). Husbandry requirements are summarised in Appendix 1, Table 2.

Utilization and trade: *Ceratophora* species were reported to be used and traded only as live specimens for the pet trade, with *C. stoddartii* reported to be the species of the genus most commonly observed in trade (CoP18 Prop. 24), and the most frequently kept in captivity (Bartelt and Janzen, 2007).

According to the United States LEMIS (Law Enforcement Management Information System) database, over the 10 years 2010-2019, 47 live captive-bred specimens were imported into the US from EU Member States (Germany and Poland), and from Canada 2013-2019 (Table 1). In addition,

⁵ Based on information from the literature (Bartelt, 1995, 1996; Bartelt and Janzen, 2007) and from three questionnaire responses.

six live, wild-caught individuals of *C. stoddartii* were reported directly imported in 2016 and 2019, all originating in Germany (and thus the source code of these records may be erroneous).

Table 1: Direct imports of live *Ceratophora stoddartii* by the United States of America from 2013-2019. No imports reported 2010-2012.

Wildlife Description	Source	2013	2014	2015	2016	2017	2018	2019	Total
Live	Captive	2		8	4	8		25	47
	Wild				3			3	6

Source: LEMIS database, USFWS, United States. Provided to UNEP-WCMC on 30/04/2020.

In Europe, offers for *C. stoddartii* on a range of online pet trade websites and in Facebook groups were reported to have increased since 2013 (CoP18 Prop. 24), including offers made by British, French, German, Italian, Malaysian, Russian, Spanish and Swiss nationals (with one advert specifying wild origin; CoP18 Prop. 24). *C. stoddartii* has also been observed for sale in a Japanese Facebook group and in adverts posted by US nationals (CoP18 Prop. 24).

The price for *C. stoddartii* specimens recorded at European reptile fairs in 1998 was EUR 176 each (Auliya, 2003). By 2014, reported prices had increased to as much as EUR 2200-2500 per pair on European online platforms (Altherr, 2014). Since then, however, prices appeared to have declined on online European platforms, with prices of approx. EUR 1000 per pair (USD 1120) reported by Auliya *et al.* (2016) and of EUR 750-1200 per pair cited in CoP18 Prop. 24. According to one breeder (in April 2020), *C. stoddartii* is no longer as expensive to buy and prices range from EUR 500-600 for pairs and EUR 150-200 for juveniles, with males reportedly cheaper to buy than females.

In July 2018, a brief web search by UNEP-WCMC found subadults on sale for USD 235 and adult pairs for USD 765 (dated Oct. 2017) on the German website www.terrariumistik.com. Multiple advertisements showed no price information, with personal notices expressing interest in buying specimens. Further online sales were advertised on www.faunaclassifieds.com, where an adult pair was offered for USD 1200 in 2015, and the same vendor reporting new stock of the species on 14 April 2018. The website featured sales occurring in California, United States, of specimens imported from Europe for USD 450.

Janssen and de Silva (2019) conducted online monitoring of three Facebook groups as well as classified reptile websites between September 2016 and 31 October 2018. *C. stoddartii* was among the most commonly encountered species (n=57), observed in 2017 (44 individuals) and 2018 (13 individuals) (Janssen and de Silva, 2019). The majority of individuals were advertised as bred in captivity, however, three were reported to be of wild origin (Janssen and de Silva, 2019). The average price for individuals was EUR 312 (approx. USD 350), and the cheapest was EUR 60 (Janssen and de Silva, 2019). The offers were made by individuals from Germany, Slovakia, the United States and Canada (Janssen and de Silva, 2019).

A brief web search in April/May 2020 found only two adverts for *C. stoddartii*, both on the German website www.terrariumistik.com. According to one breeder, these species are now only available for sale in closed Facebook groups and internet forums, through word of mouth, and at reptile shows.

No records of seizures of *C. stoddartii* were located in TRAFFIC's wildlife seizure and incident database⁶.

⁶ <https://www.wildlifetradeportal.org/>

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Lyriocephalus scutatus

SYNONYMS:	<i>Iguana clamosa</i> Laurenti, 1768, <i>Lacerta scutata</i> Linnaeus 1758, <i>Lyriocephalus macgregorri</i> Gray, 1835, <i>Lyriocephalus margaritaceus</i> Merrem, 1820
COMMON NAMES	Hump Snout Lizard (EN)
IUCN:	Near Threatened
CITES LISTING	Appendix II, zero export quota for wild specimens for commercial purposes
SUMMARY	Although <i>Lyriocephalus scutatus</i> is not found in zoological collections, there does appear to be some reliable information on captive breeding successes for this species (both through published literature and based on breeder accounts). However, the species is rare in captivity, and can only be bred by experienced breeders. Whilst breeding to second generation (F2) has been achieved by several breeders and F3 was achieved by one, it is noted to be difficult to maintain breeding populations in captivity. <i>L. scutatus</i> is not bred on a commercial scale.



Lyriocephalus scutatus by meky1313 / Adobe Stock

Species characteristics:

Lyriocephalus scutatus (Hump snout lizard) is a relict agamid lizard representative of a monotypic genus (Karunarathna and Amarasinghe, 2013). The species occurs in the intermediate zone and the south-western wet zone of Sri Lanka (Karunarathna and Amarasinghe, 2013). Whilst mainly found in lowland areas, it can occasionally be found in sub-montane habitats; Karunarathna and Amarasinghe

(2013) gave a maximum elevation for the species of 900 m above sea level, although earlier accounts suggested occurrence at up to ~1600 m above sea level (Manamendra-Arachchi and Liyanage, 1994; Karunarathna and Amarasinghe, 2010). *L. scutatus* inhabits closed canopy forests but has adapted to occur in plantations and gardens (Karunarathna and Amarasinghe, 2013). Individuals reside on tree trunks in shaded areas (Vidyalankara and Bandara, 2004 in CoP18 Prop. 26) with a dense canopy (Manamendra-Arachchi and Liyanage, 1994; Karunarathna and Amarasinghe, 2010).

L. scutatus is diurnal (Karunarathna and Amarasinghe, 2010), with a natural diet consisting of moth larvae, small spiders, earth worms, beetles, centipedes, mole crickets and dragonflies (Karunarathna and Amarasinghe, 2013). The species is territorial over other individuals of the same sex and displays site fidelity behaviour, with the males displaying only on their territorial tree (Bandara, 2012). The size of territories has been found to depend on sex and age, with females occupying larger territories (mean $264 \pm 59.8 \text{ m}^2$) than males (mean $174 \pm 32.3 \text{ m}^2$); subadults occupy territories

179 m² in size (Bandara, 2012). A study of 12 individuals found that female territories always overlapped with male territories, suggesting that a single male may have access to more than one female (Bandara, 2012).

The species' body colour varies from brown to green (Karunarathna and Amarasinghe, 2013). Males have a white underside that sometimes appears bluish, in females the belly is brownish-yellow (Bartelt *et al.*, 2004; Karunarathna and Amarasinghe, 2013). Juveniles are duller in colour than adults (Karunarathna and Amarasinghe, 2013). *L. scutatus* possesses the ability to change colour, switching between cryptic colouration to match the ground to dark or light green when disturbed or interacting with mates (Karunarathna and Amarasinghe, 2013). Morphologically, *L. scutatus* is characterised by the smooth-scaled rostral knob on the snouts of adult specimens, which is larger in males (Karunarathna and Amarasinghe, 2013). Males also have a more developed and prominent gular sac (yellow with green to black scales) and were reported to be slightly larger than females, measuring on average 146 mm SVL versus an average 141 mm (Karunarathna and Amarasinghe, 2013). Adults can reach 25-32 cm, making this Sri Lanka's largest endemic agamid (CoP18 Prop. 26).

L. scutatus is oviparous (Karunarathna and Amarasinghe, 2013). Sexual maturity is reached at an age of 10-12 months according to CoP18 Prop. 26. Similar clutch sizes for *L. scutatus* of 3-14 eggs, 1-16 eggs, and c. 10 eggs were reported in three respective accounts: Manthey (1981); a 2009 field guide (Somaweera and Somaweera, 2009 in Karunarathna and Amarasinghe, 2013); and a 2013 thesis (de Alwis, 2013). Karunarathna and Amarasinghe (2013), however, reported a much narrower clutch size range of 2-4 eggs. Hatchlings in the wild were reported to emerge after 65-71 days (Karunarathna and Amarasinghe, 2010). Reports of the frequency and timing of laying are variable: Karunarathna and Amarasinghe (2013) found that eggs were laid in February-April and October-December, Somaweera and Somaweera (2009) reported that clutches were laid in June, September and October, and de Alwis (2013) reported that the species laid its eggs "during the rainy season from March to May".

Status and trends in the wild: *L. scutatus* was assessed as Near Threatened in the IUCN Red List in 2010 (Somaweera and de Silva, 2010). Whilst the global categorisation was consistent with Sri Lanka's 2007 national Red List assessment (IUCN Sri Lanka and the Ministry of Environment and Natural Resources, 2007), the species was listed as Vulnerable in the 2012 National Red List of Sri Lanka on the basis of extent of occurrence (<20 000 km²), a severely restricted range/occurrence in a limited number of locations, and continuous decline of habitat (in area, extent and/or quality) (Ministry of Environment, 2012). The species extent of occurrence was considered to be < 17 400 km² (Somaweera and de Silva, 2010).

The primary threat to *L. scutatus* was reported to be habitat loss (IUCN Sri Lanka and the Ministry of Environment and Natural Resources, 2007; Somaweera and de Silva, 2010; Karunarathna and Amarasinghe, 2013). The species adaptation to gardens, plantations and degraded habitats (Somaweera and de Silva, 2010), was considered to cause overexposure to human disturbance and predators such as domesticated cats, common coucals (*Centropus sinensis*) and Toque macaques (*Macaca sinica*) (de Silva pers. comm. in Somaweera and de Silva, 2010). Karunarathna and Amarasinghe (2013) recorded two accounts of predation on the species by domestic cats in home gardens. In Kosgama lowland forest (a small forest fragment to the east of Colombo), the population was reported to be "almost zero" due to intensive logging activities (de Silva pers. comm. in Somaweera and de Silva, 2010). It was considered likely that collection of wild specimens for the pet trade posed a threat to the species (Somaweera and de Silva, 2010). De Silva (pers. comm. 2010 in

Somaweera and de Silva, 2010) commented that in the previous three decades (1980-2010), approx. 500 specimens had been collected from many locations.

History of exports: Prior to the prohibition of trade in *L. scutatus* in 1993, “some” specimens of the species were reported to have been legally exported from Sri Lanka for commercial purposes in the 1980s (Karunaratne, 1986 in CoP18 Prop. 26; Somaweera *in litt.* 2014 in CoP18 Prop. 26). One breeder noted that the species was legally exported to Germany in the 1970s.

Captive breeding: Contrary to CoP18 Prop. 26, there does appear to be reliable information on captive breeding successes for this species. One breeder provided a quote from Rogner (1997)⁷, who stated in relation to *L. scutatus* that, “although is very rarely available commercially it has been bred several times in captivity”. Published literature and breeder accounts provide further details of how captive-breeding success has been achieved.

This species can be maintained in captivity individually or in pairs (Bartelt, 2003; Bartelt *et al.*, 2004). According to the Reptile Care Database⁸ groups are not possible as males are territorial and females do not tolerate others, although Henkel and Schmidt (2010) noted that with a sufficiently large jungle terrarium, a male could be kept with several females. It was noted by one breeder that the stimuli for reproduction is a seasonal temperature curve, with increased temperature and irrigation. According to the Reptile Care Database, two to five clutches may be laid annually; breeders also reported up to four clutches annually (Table 3, Appendix 1). Clutch sizes are around 8-16 eggs according to Bartelt (2003) and Bartelt *et al.* (2004); with eggs needing a moist substrate (Henkel and Schmidt, 2010). Bartelt (2003) removed eggs from the terrarium and put them in plastic containers filled with peat and sand mixture that was “only slightly moist”.

Hatching was reported to occur between 100-170 days depending on temperature (Bartelt, 2003; Bartelt *et al.*, 2004). Two individual breeders conferred that hatchling size is around 3-3.5 cm body size (but individuals were sold before reaching sexual maturity). One breeder noted that there is a slight variation of the duration of incubation and the size of hatchlings; it was also reported that temperature dependant sex determination is likely since most juveniles are male. Bartelt *et al.* (2004) considered that sperm storage was possible, as several fertilized clutches were produced without the male present. This was confirmed by one breeder.

It was recommended that hatchlings should be raised separately or in small groups otherwise they may suffer from stress and die (Reptile Care Database). One breeder noted that juveniles need daily misting (such as sprinkling with a sprinkler system for 10 minutes a day) and provision of food and water 2-3 times a day in the spring-autumn season, but in the winter, only every two to three days. Bartelt (2003) separated young animals after 2-3 months into large and densely planted terrariums. In captivity, sexual maturity was noted as 10 months by Bartelt (2003), although two breeders reported sexual maturity at around two years. Life expectancy in captivity was reported by two breeders at around six years.

Ease of breeding in captivity: *L. scutatus* was described as very difficult to keep or breed in captivity (Manthey, 1981; Bartelt *et al.*, 2004) and is only suitable for experienced keepers. Three breeders successfully bred *L. scutatus* to second generation (F2). One author bred 20 individuals between 1997-1999, achieving second generation (F2) (Bartelt in Bartelt *et al.*, 2004). Another author

⁷ This reference could not be accessed online and due to the current COVID situation, it was not possible to access a physical copy to verify the information.

⁸ <http://www.reptile-care.de/species/Iguania/Agamidae/Lyriocephalus-scutatus.html> [Accessed 22/5/2020]. This reference is based on work by Bartelt (2003); Bartelt *et al.* (2005) and Kiehlmann (2005).

achieved F3 (de Bitter & de Bitter in Bartelt *et al.*, 2004). However, Bartelt *et al.*, 2004 were only partially successful in breeding the species and concluded that the species had a low survival rate in captivity.

L. scutatus was reported to require specific conditions (including sufficient water, high humidity and temperatures not too high) and regular care. Pregnant females were reported to be particularly difficult to maintain. Bartelt (2003) reported that a common problem was female egg laying failure, noticeable by emaciation and weakness, but this was resolved by regular exposure of pregnant females to UV (Bartelt, 2003; Bartelt *et al.*, 2004). The species was reported to be prone to deficiency problems and requires vitamin and mineral supplements (Reptile Care Database). A brief web search in July 2018 by UNEP-WCMC found one online advert from Japan which listed the species as rare, due to the difficulty in breeding and low reproductive success.

Extent of breeding in captivity: It is unknown if this species is held in any zoos or aquaria globally; no specimens are held in institutions registered with Species 360's ZIMs (Zoological Information Management Software), which covers more than 1200 institutions globally in 99 countries on six continents (Conde, *pers. comm.* to UNEP-WCMC, 2020).

Only a few published accounts of captive breeding of *L. scutatus* (Bartelt, 2003; Bartelt *et al.*, 2004) could be located and/or accessed online. According to two breeders, this species has been kept and bred in captivity for a number of years (incl. in France and Germany) but keeping and breeding was noted as rare.

One breeder in the Czech Republic noted that there were several keepers of *L. scutatus* in the country, with at least one successfully breeding the species; it was further noted that the species had been successfully bred in the United States (no questionnaire responses were completed by US breeders). A breeder in the UK noted that whilst there were several breeders of *L. scutatus* operating a few years ago, most do not have current breeding groups.

Husbandry requirements⁹: According to successful breeders, *L. scutatus* should be housed in planted enclosures that provide shade, clean moving water (for drinking and bathing) and opportunities for climbing. Humidity should be high and temperatures ranging from 22-28°C during the day and 17-18°C at night. Exposure to UV was reported to be particularly important for pregnant females (Bartelt, 2003; Bartelt *et al.*, 2004). Diet comprises insects and worms, supplemented with vitamins and minerals. Husbandry requirements are summarised in Appendix I, Table 4.

Utilization and trade: According to the United States LEMIS (Law Enforcement Management Information System) database, 18 live captive-bred specimens of *L. scutatus* were imported into the US 2013-2019 (Table 1), predominantly from EU Member States (Germany and the Netherlands) with one specimen imported from Canada. The source code of the two wild specimens reported as direct imports from the Netherlands in 2016 may be erroneous.

⁹ Based on information from the literature (Bartelt, 2003; Bartelt *et al.*, 2004) and from two questionnaire responses.

Table 1: Direct imports of live *Lyriocephalus scutatus* by the United States of America from 2013 to 2019. No imports reported 2013-2014 or 2018.

Wildlife Description	Source	2013	2014	2015	2016	2017	2019	Total
Live	Captive			4	2	8	4	18
	Wild				2			2

Source: LEMIS database, USFWS, United States. Provided to UNEP-WCMC on 30/04/2020

According to CoP18 Prop. 26, *L. scutatus* has been offered for sale online since 2011 with trader nationalities including British, Czech, French, German, Italian, Japanese, Malaysia, Polish, Russian, Spanish and US. High prices were reported in online adverts; in 2013 and 2014, prices for *L. scutatus* were up to EUR 2500 a pair on European online platforms, with some indicating wild origin (CoP18 Prop. 26). Auliya *et al.* (2016) reported adult pairs being sold for EUR 1600. According to one breeder, juveniles had previously been on sale for approximately EUR 300-400, and up to twice as much for a mature female. In the US, adult breeding pairs have been offered for between USD 2200 and USD 5500, which was suggested to indicate high demand (CoP18 Prop 26). Between September 2016 and October 2018, a survey of three Facebook groups and classified reptile websites found 25 individuals advertised for sale (six in 2017 and 19 in 2018) in Germany and the Czech Republic (Janssen and de Silva, 2019). A brief web search in April/May 2020 did not find any adverts for *L. scutatus*.

No records of seizures of *L. scutatus* were located in TRAFFIC's wildlife seizure and incident database¹⁰.

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¹⁰ <https://www.wildlifetradeportal.org/>

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Appendix I: Summary of literature review and breeder questionnaire responses

Table 1: Information on captive breeding of *Ceratophora stoddartii* (based on information from Bartelt (1995, 1996) and Bartelt and Janzen (2007) and information compiled from three questionnaires)

Breeding aspect	Bartelt (1995, 1996) and Bartelt and Janzen (2007)	Respondent 1	Respondent 2	Respondent 3
Age at sexual maturity	6-8 months	12 months (10-12 cm total length)	6-10 months	Typically, 14-16 months (earliest 11 months)
Life expectancy	"Fairly low"	-	-	6-7 years
Clutch size	<8	3-7 (can vary within breeding season)	3-12	3-6
No. clutches/ year	<6 (producing approx. 30 offspring)	4-5 per season	6-10	1-2 (occasionally unproductive)
Incubation duration	90-100 days, incubation takes longer (up to 120 days) at lower temperatures	80-110 days, depending on temperature	100-120 days	Varied, but typically 3 months (c. 90 days)
Incubation temperature	25°C (and >80% humidity)	17-20°C, 23°C maximum	22-24°C day / 15-20°C night (approx. 12/12hrs)	22-25°C
Hatching success		Nearly 100%	80-100%	80%
Mortality rate in hatchlings/ juveniles		Low, with suitable husbandry	<30% depending on condition of the female	35-50%
No. specimens that reach sexual maturity		High	High (for individuals that survive for 2-4 weeks)	50-60% with provision of a wide variety of small insects as well as suitable temperatures and humidity
Hatchling size	25 mm SVL and 40 mm total length (one individual)	~3.5-4 cm total length	-	-
Growth rate		-	-	Full size reached by 10-12 months
Sex ratio		50:50	Sex ratio varied between seasons and TSD suspected	50:50, no obvious TSD

Table 2: Husbandry requirements for *Ceratophora stoddartii* (based on information from Bartelt (1995, 1996) and Bartelt and Janzen (2007), and information compiled from three breeder questionnaires)

Husbandry requirements	Bartelt (1995, 1996) and Bartelt and Janzen (2007)	Respondent 1	Respondent 2	Respondent 3
Temperature and lighting	Just over 20°C during the day and approx. 10-15°C at night. Max. 28°C. Four fluorescent lamps used for 12 hrs daily (9am to 9pm).	20-23°C during the day, with higher parts of the enclosure heated to 25-28°C. 14-18°C at night. 35 wattage HID flood lamps used.	14-28°C during the day 10-18°C at night UV lamps used	20-24°C during the day, max 27°C. 16-18°C at night (min. 12°C) Small fluorescent light 12-14 hrs per day and a UVB 5% basking spotlight for 8 hrs per day.
Humidity	High	80-90%	High	>70% (near 100% at night)
Specific enclosure furnishing needs	Adult pairs housed in terrariums measuring (W x D x H) 150 x 50 x 80 cm, 100 x 50 x 80 cm and 70 x 50 x 125 cm, with a substrate layer approx. 15 cm high of peat, sand and leaves. A water basin was provided (10 litres) for drinking, regular bathing, and swimming, and these areas were “cleaned weekly in winter and daily in summer, as well as after excrement discharge”. The sides of the terrarium were clad in cork plates (3 cm wide) and covered with vine branches and bark to provide opportunities for climbing. Ferns, orchids, <i>Epipremnum</i> spp., <i>Ficus</i> spp. and <i>Aglaonema</i> spp. were planted in the tanks and sprayed with water daily and watered every two weeks.	Pairs housed in well planted enclosures (dimensions: 50 x 50 x 100 cm) with good ventilation.	Glass cage with good ventilation, densely planted with numerous branches and live plants.	Compost and beech wood soil, half covered by moss, used as substrate. Plenty of branches, cork bark wall for climbing, and living plants.
Dietary requirements	A wide variety of invertebrate prey, including earthworms, slugs, flies, and nymph crickets, supplemented with multi-vitamins and calcium.			
Susceptibility to disease	-	No	Not known	Minimal. Shedding and respiratory issues if humidity levels too low.
Stress with handling	Juveniles prone to stress	Minimal stress if responsibly handled for a short period of time	Highly thermosensitive	Easily stressed

Table 3: Information on captive breeding of *Lyriocephalus scutatus* (based on information from Bartelt (2003) and Bartelt *et al.* (2004) and information compiled from two questionnaires)

Breeding aspect	Bartelt (2003); Bartelt <i>et al.</i> (2004)	Respondent 1	Respondent 2
Age at sexual maturity	~10 months	2 years (~12 cm body size)	~1.5-2 years
Life expectancy		5-6 years	At least 6 years
Clutch size	8-16 (depending on age of female)	3-8 eggs	5-12 eggs
No. clutches/ year	Every six to eight weeks.	1-4	3-4
Incubation duration	100-170 days depending on temperature. Incubation duration at 23°C = 170 days; at 27°C = 100-125 days. Eggs incubated at 23°C resulted in more stable, strong young.	~85-100 days	Temperature dependent, 4-6 months (~120-180)
Incubation temperature	23-27°C	25.5-27°C (day), 20-23°C (night)	22-26°C
Hatching success	-	Clutch dependent, from 0-100%	~80-100%
Mortality rate in hatchlings/ juveniles	-	Noted low mortality in strong hatchlings	High when first started breeding, currently ~20%
No. specimens that reach sexual maturity	-	Unknown*	Unknown*
Hatchling size	6-6.5 cm total length (hatchlings smaller than 6 cm died within 4 months).	3-3.5 cm body size, ~6 cm total	~ 3-4 cm head-torso length
Sex ratio	-	Temperature dependent sex determination unknown but likely; most juveniles are male.	Unknown

Table 4: Husbandry requirements for *Lyriocephalus scutatus* (based on information from Bartelt (2003) and Bartelt *et al.* (2004) and information compiled from two breeder questionnaires)

Husbandry requirements	Bartelt (2003); Bartelt et al. (2004)	Respondent 1	Respondent 2
Temperature and lighting	~22°C during the day (max 27°C), 17-18°C at night. Four fluorescent lamps used 9am to 9pm.	22-28°C during the day, UVB important.	Seasonal. Winter temperatures minimum 14°C, summer maximum 28°C.
Humidity	Nebulizer used to increase humidity when needed. Daily misting of plants	High humidity, daily misting needed during rainy season.	High, 80-90%.
Specific enclosure furnishing needs	Enclosure 70x50x125 cm. Substrate layer of peat, sand and leaves 15 cm deep. Water was provided (10 L) and a pump was used to keep it in motion. Sides of terrarium covered by 3 cm thick cork plates that, along with vines, provide opportunities for climbing. Plants included ferns, orchids, <i>Scindapsus</i> sp., <i>Ficus</i> sp. and <i>Aglaonema</i> sp. and these were regularly watered.	Size at least 50x50x100 cm (50x50x130 considered better). Vertical branches and plants, including those which provide shade, considered important.	Vertical trunks
Dietary requirements	Worms, larvae, crickets, with mineral and vitamin supplements.	Earthworms. Mineral and vitamin supplements.	Need a lot of liquid. Prefer earthworms or dew worms as food, but some eat insects.
Susceptibility to disease	Pregnant females particularly susceptible.	Low in right conditions (susceptible if conditions not correct)	Not known
Stress with handling	Adults will hide when disturbed. Not aggressive when handled but may play dead due to stress.	Yes, keep handling to necessary minimum	Yes, but not problematic