

Husbandry Manual for



Southern Leaf-Tailed Gecko

Phyllurus platurus

Reptilia : Gekkonidae

Compiled by Andrew Iezzi

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Captive Animals, Cert III, 1068

Graeme Phipps / Jacki Salkeld

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1 Introduction

The Southern Leaf-tailed Gecko *Phyllurus platurus* is an innocuous, moderately sized species of lizard. It has a flat body (ideal for sheltering in sandstone crevices) with a distinctive broad leaf- or heart- shaped tail. This nocturnal gecko has granular and spiny skin, well suited as camouflage amongst its sandstone habitat (see Figure 1.1). Its diet is insectivorous.

The Southern Leaf-tailed Gecko is only found in the Sydney Basin area of NSW. It is commonly found in caves, sandstone outcrops and escarpments. It is not considered threatened with extinction.

These geckos are easily kept in captivity. Since they are primarily arboreal by nature, the vivarium height is more important than floor space. They readily consume live insects that are commercially available (such as crickets, mealworms and cockroaches).

The Southern Leaf-tailed Gecko unlike some other species should be handled with great care as they are easily stressed and can autotomise their tail. The health of these geckos needs to be regularly monitored and ensure that their vivariums are kept clean.

In captivity well-fed females can lay up to three clutches of 2 eggs per year. Commercially available reptile incubators can be used for hatching these eggs.



Figure 1.1 - *The Southern Leaf-tailed Gecko at home on a sandstone outcrop.*

Occupational Health & Safety

1. Species Risk

There is a risk of zoonotic disease from the excreta of a gecko (e.g. Salmonella). That risk can be reduced by wearing gloves.

2. Dusting Powder

The dusting powder that is sprinkled over the food insect before being feed to the Southern Leaf-tailed Gecko is actually Calcium Carbonate. When handled in large quantities it is recommended that you wear Personal Protective Equipment (PPE) **code E** as specified in the Material Safety Data Sheet (MSDS) (see Appendix A). In particular wear goggles, gloves and mask. (see Figure 1.2).



Figure 1.2 - *Personal Protective Equipment*

First Aid measures (as per MSDS) are listed below:-

1. Eye Contact

Check for and remove any contact lenses. Immediately flush eyes with plenty of water for at least 15 minutes.

2. Skin Contact.

Wash with soap and water. Cover the irritated skin with an emollient.

3. Inhalation

If inhaled, remove to fresh air. If not breathing, give artificial respiration.

3. Transport Container

Lifting large heavy wooden transport containers (especially with multiple compartments) can pose an ergonomic hazard and contribute to back injuries. To reduce this hazard obtain assistance or preferably use lifting equipment.

4. Parasites

Geckos can harbor internal parasites, so if a gecko is in quarantine you will need to wear protective clothing including disposable gloves and face mask.

5. Terrariums

Keeping a Gecko cage clean may involve the use of disinfectants (such as bleach). Ensure that suitable protective clothing such as gloves are used.

6. Electrical Equipment

Terrariums are often fitted with electrical equipment such as heaters and lights. Always follow the following safeguards to avoid electrical accidents:-

- Keep all lamps away from water or spray mist.
- Disconnect the main electrical plug before you begin any work in a terrarium containing water or touch any equipment.
- Check for any damage to electrical plugs and cords.
- Before using any equipment in water, check the label to make sure it is suitable for underwater use.

1.1 ASMP Category

(www.arazpa.org.au/About-the-ASMP/default.aspx)

The Australian Species Management Program (ASMP) provides the framework to assist member institutions (e.g. zoos, sanctuaries & wildlife parks) to manage their animal collections cooperatively. In respect to the Southern Leaf-tailed Gecko, there is currently a Taxon Advisory Group (TAG) that covers Gekkonidae.

1.2. IUCN Category

(www.iucn.org)

The Southern Leaf-tailed Gecko is not on the IUCN Red List of Threatened Species. According to the Wikipedia Encyclopedia (www.wikipedia.org) its conservation status is in the lower risk subcategory of “Conservation Dependent”, as shown in Figure 1.3



Figure

1.3 **Conservation Dependent (LR/cd)**, the focus of a continuing taxon-specific or habitat-specific conservation programme targeted towards the taxon in question, the cessation of which would result in the taxon qualifying for one of the threatened categories below within a period of five years.

1.3 EA Category

(www.environment.gov.au)

Environment Australia (EA) is an Australian Government Department of the Environment, Water, Heritage and the Arts. According to its web site the Southern Leaf-tailed Gecko is

- Not on their database of threatened fauna.
- Is not a CITES species.
- A permit is required to export these Australian native species.

1.4 Wild Population Management

There are a number of organizations and councils that take an active role in monitoring the wild population of the Southern Leaf-tailed Gecko. For example “Bushcare”

(www.northsydney.nsw.gov.au).

1.5 Captive Management (Species Coordination & Studbook Holder)

If you wish to keep the Southern Leaf-tailed Gecko, you must get a Class 1 Licence from the National Parks & Wildlife Service (www.environment.nsw.gov.au/nationalparks.htm).

The NPWS reptile licensing and record-keeping system allows them to monitor what reptile species are being kept, bred and traded amongst enthusiasts.

People who hold a licence can obtain captive-bred Southern Leaf-tailed Geckos from other people who legally hold them, but they are not allowed to be sold through pet shops and must not be taken from the wild.

The NPWS recommends that all reptile enthusiasts join a reptile keeper organisation (a herpetological society). This will put you in touch with other people who:

- have similar interests and who may have animals that they can trade with other licence holders
- can give you the benefit of their animal care and husbandry knowledge, experience and expertise
- may be able to give you the opportunity to participate in field observation and research activities.

Various organizations for example The Australian Reptile Park (www.reptilepark.com.au) keep the Southern Leaf-tailed Gecko in captivity for public display.

2 Taxonomy

2.1 Nomenclature

Class: Reptilia
Order: Squamata
Suborder: Sauria
Family: Gekkonidae
Genus: *Phyllurus*
Species: *platurus*

2.2 Subspecies

None

2.3 Recent Synonyms

Northern Leaf-tailed Gecko

2.4 Other Common Names

The Southern Leaf-Tailed Gecko is also known as the Broad-Tailed Gecko (www.reptilepark.com.au) and the Broad-Tailed Rock Gecko (Swanson 2007).

3 Natural History

3.1 Morphometrics

3.1.1 Mass and Basic Body Measurements

The Leaf-Tailed Gecko is a moderately large species of lizard. It grows to a total length of around 15cm. The body length (snout-vent) is up to 10cm, while the tail is up to 7cm (Greer 2006) (see Figure 3.1).



Figure 3.1 – A *Southern Leaf-tailed Gecko*

3.1.2 Sexual Dimorphism

Among adults, females are larger than males on three different criteria (Greer 2006)

1. Snout-vent length at maturity (females 77mm compared to males 70mm)
2. Mean snout-vent length (females 86.2mm compared to males 82.2mm)
3. Maximum snout-vent length (females 97mm compared to males 95mm)

Females are also heavier than males

3.1.3 Distinguishing Features

The Southern Leaf-Tailed Gecko has a large head and broad leaf or heart-shaped tail constricted at the base. The limbs are long and spindly with long slender, bird-like, clawed digits. The skin is granular and spiny, particularly on the tail and flanks. It is well camouflaged to blend into its sandstone habitat (see Figure 3.2), and its pale grey to rich reddish-brown above, covered with dark brown and black speckles and blotches (www.reptilepark.com.au).

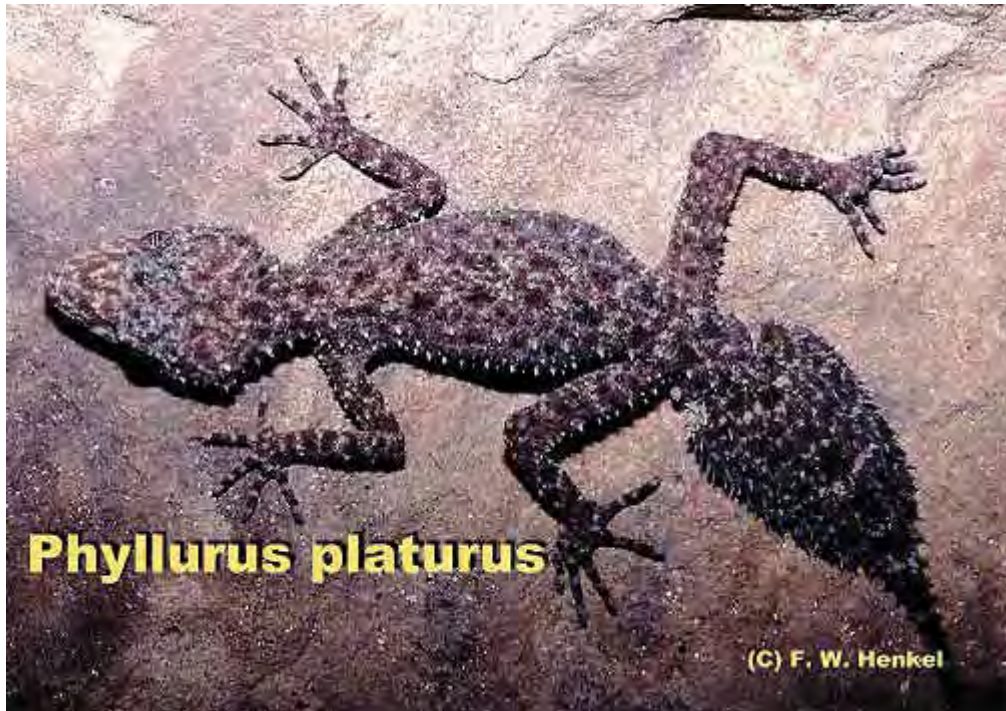


Figure 3.2 – *This Gecko uses camouflage to hide from predators.*

3.2 Distribution and Habitat

Distribution

The Leaf-tailed Gecko is only found in the Sydney Basin area of New South Wales (see Figure 3.3). From near Nowra in the south, to the southern edge of the Hunter Valley in the north. A population is known from the limestone outcrops around Jenolan Caves which appears to be the western limit of its distribution (Greer 2006).

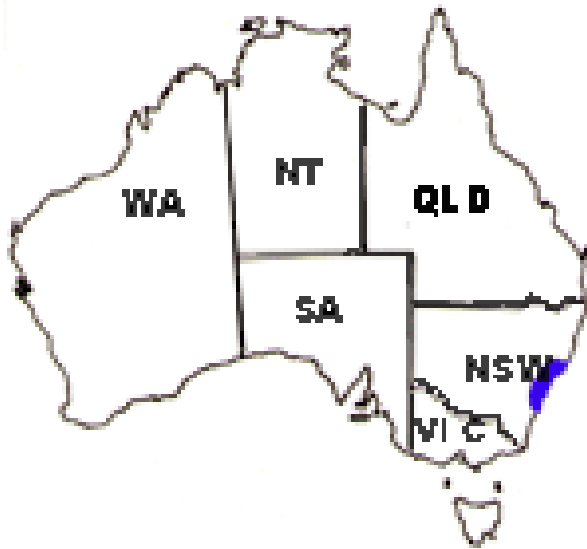



Figure 3.3 – This species occurs only in eastern central NSW.

Living Harbour: Southern Leaf-tailed Gecko



Figure 3.4  Distribution of Southern Leaf-tailed Gecko, *Phyllurus platurus* (www.livingharbour.net)

Habitat

This Gecko is found almost exclusively in sandstone outcrops and escarpment. It lives in cracks (both vertical and horizontal crevices) or under large slabs in sandstone outcrops and in caves. In these areas, especially suburbs around the harbour (see Figure 3.4) it often makes the transition to houses, sheds and garages where it shelters (Greer 2006).

3.3 Conservation Status

The species will probably not be threatened with extinction for some time. Its sandstone habitat is difficult to destroy on a large scale and is generally only degraded with residential development. Even then, the species seems to cope well. Cats probably take Geckos close to the ground (www.reptilepark.com.au).

A search was done on the *UNCN Red List of Threatened Species* web site (www.iuncredlist.org) but this Gecko (*Phyllurus platurus*) was not in the database.

3.4 Diet in the Wild

This Gecko is insectivorous - eating a wide variety of arthropods including spiders, cockroaches, crickets, moths, flies, beetles, centipedes and millipedes. They also eat soft-bodied worms.



Figure 3.5 – Some of the insects consumed by this gecko.

3.5 Longevity

3.5.1 In the Wild

Life span from 7 to 9 years (average 8 years) (Greer 2006).

3.5.2 In Captivity

Life span quoted from 10 to 20 years (Seufer 1991).

4 Housing Requirements

4.1 Exhibit/Enclosure Design

Precautions:

- These Geckos are arboreal, and need plenty of objects to climb on.
- Geckos need somewhere to hide. If there is no adequate place for them to hide they can become stressed.
- Ensure there is easy access to the enclosed for cleaning, feeding and for the provision of fresh water.

Things to Avoid;

- Do not have a lot of activity and noise around the enclosure or even the room that the enclosure is in – this can create a significant amount of stress for the Gecko.

4.2 Holding Area Design

If you're looking to add new geckos to your collection, then it is important to first quarantine them for a 3 month period to ensure the health, safety and integrity of your existing colony.

Each new gecko would be housed in a separate Holding Area, a 40 litre tank design (see Table 4.1) would be suitable. Setup identical tanks for each gecko to the following design:

- Paper Towel or newspaper substrate
- Moist Hide (to help with shedding and to prevent dehydration)
- Dry Hide (so they've somewhere to sleep out of the light in the daytime)
- Water Bowl (appropriately sized for each of your new additions)

4.3 Spatial Requirements

When choosing the most appropriate sized enclosure for your Leaf-tailed Gecko always its overall quality of life in mind – the larger the enclosure the better.

Some standard size guidelines used in the reptile keeping community (Bartlett 2006) include :

- Height is more important than floor space because Leaf-tailed Geckos are primarily arboreal by nature.
- A single gecko will keep in a minimum of 40 litre enclosure but a 80 litre is recommended
- The length of the enclosure should be at least 4 times the total length of the gecko and at least 1.5 times the total length of the gecko for the width
- Should you decide to house multiple geckos together then you should add 20 litres for each additional gecko to the minimum of 40 litres for the first gecko.

For example:

	Enclosure	Dimensions (cm)
1 lone gecko	40 litre	40Hx30Wx30D
2 geckos	60 litre	60Hx30Wx30D
3 geckos	80 litre	60Hx45Wx30D
4 geckos	100 litre	60Hx50Wx30D
etc	etc	etc

Table 4.1 – *The recommended enclosure size for this Gecko*

4.4 Position of Enclosures

Do not position the enclosure in the direct path of sunlight. This can cause the tank to heat up very quickly which means the gecko may overheat (and even die).

4.5 Weather Protection

If you use sand as a substrate, you DO NOT want to get your sand wet (Bartlett 2006) . Sand can get stuck on prey items and be eaten, sand can also stick to the mouths and feet of geckos and when they clean themselves also become eaten. This can lead to impaction (blockage of the digestive system) – something often not noticed until it's too late to treat. Consequently the enclosure is to be kept undercover, protected from the weather.

4.6 Temperature Requirements

Geckos are ectothermic (don't generate body heat to thermo-regulate). They need an external heat source to help them digest their food as well as regulate other bodily functions.

To heat the cage;

1. A blue or red spotlamp can be placed at one end of the vivarium. This will provide a gradient temperature from one end to the other or,
2. A heat-mat placed under the substrate or under the tank itself.

Temperatures should not exceed 30°C and temperature of 25-38°C should be maintained throughout the vivarium (www.reptilesdownunder.com).

4.7 Substrate

Substrate is the general name of the material placed on the floor of Gecko enclosure. There are many different types of substrates that you can use in an enclosure (www.reptilesdownunder.com/reptile/reptiles/reptilesaspets/enclosure/substrate/).

For Example;

- Paper
- Recycled paper pellets
- Gravel
- Sand
- Leaves / Bark

However, the final decision on which substrate is best for your situation should take into consideration;

- The ease of cleaning and/or replacing
- Availability and cost
- Looks and what occurs in the Gecko's natural environment
- Its ability to absorb liquids and odours

4.8 Nestboxes and/or Bedding Material

Leaf-tailed geckos lay their eggs in rock crevices and under logs on rocky ridges so no nestboxes or bedding material is required, provided rock crevices are available (see *Enclosure Furnishings*).

4.9 Enclosure Furnishings

Enclosure furniture is used to make an enclosure more interesting for both the Gecko and the audience.

The design of the interior of the enclosure should take into consideration the basic needs of the Gecko (www.reptilesdownunder.com);

- Water to drink (spray daily)
- Hiding Areas (e.g. Hide Box, rocks)
- Activity Area (e.g. branches for climbing)
- Basking Area (e.g. rocks, branches)
- Natural Habitat (e.g. plants, rock walls)

Use firmly bedded flat rocks stacked on top of each other. This will enable the Gecko to climb as well as find places to hide in.

5 General Husbandry

5.1 Hygiene and Cleaning

The regime that will be used to clean the Gecko enclosure will now follow (Bartlett 2006) .

1. Enclosure Cleaning

The enclosure will be regularly cleaned. Faecal deposits and the dead skin shed by the Gecko will be removed as soon as they appear.

All the insides of the enclosure will be washed with a mild detergent and/or bleach solution. The enclosure should be well rinsed and dried before the Gecko's are returned.

2. Water changing / Cleaning

The water bowl should be emptied and cleaned with bleach every three to five days or sooner if it becomes dirty. If the Gecko defecates in the water bowl, the water should obviously be changed as soon as this occurs.

3. Substrate washing

If you are using a washable substrate such as gravel, sand or leaves/bark, the substrate should be removed regularly, washed, dried and replaced. Washing is best done in hot water, with a small amount of bleach in the first wash to kill any organisms. The substrate should be washed until the water coming off is clear, and no smell remains. To dry the substrate, place it in shallow trays in the sun, or in the oven if you wish to dry/disinfect further.

4. Rocks and Branches

Rocks and branches should be thoroughly cleaned before addition to the enclosure, and also regularly as part of the enclosure cleaning process.

Branches and rocks should be soaked in hot water to ensure that any organisms in/on the item are killed. After two or three days, the item should be rinsed by soaking in hot clean water for a further two or three days, changing the water every 12 hours. This should be done until no chlorine (bleach) smell remains. The items then need to be dried thoroughly in the sun or an oven if they fit, before being added to the enclosure.

As part of the regular cleaning process the branches and rocks should be removed and scrubbed with a detergent and/or bleach mixture, rinsed and dried.

Routine Maintenance Activities

DAILY	<ul style="list-style-type: none">✓ Water changes✓ Mist spray✓ Spot clean✓ Check out health of gecko
WEEKLY	<ul style="list-style-type: none">✓ Two feeds per week✓ Full scrub of water bowl✓ Enrichment
MONTHLY	<ul style="list-style-type: none">✓ Full detail clean of enclosure✓ Substrate washing✓ Rocks & branches cleaned

5.2 Record Keeping

It is important to keep detailed logbooks to observe the gecko's diet, feces, routines, normal behaviour, problems. These daily and monthly observations can help prevent and detect diseases and disorders early enough to allow to take appropriate action (www.drgecko.com).

Potential Problems to Watch Out for

When updating your logbook for your gecko, refer to the checklist below to check for common signs of illness and problems:

- Reduction in food consumption
- Any change from daily routine
- Discharge from mouth, nose or vent
- Stool changes (i.e. runny, loose, discoloured, presence of worms, smelly etc...)
- Slight or dramatic limping
- Swollen limbs or trunk
- Muscle weakness, tremors or paralysis
- Changes in sleeping, eating, body colour, alertness, energy level, weight or general appearance.

It is critical that you report any changes in your gecko's normal routine to your veterinarian. Keep detailed notes from any veterinary visits, diagnostic results (i.e. fecal exam results), and medications administered (www.drgecko.com).

5.3 Methods of Identification

When there are several leaf-tailed geckos within the one enclosure, each can be identified using a photograph.

5.4 Routine Data Collection

Keep a detailed logbook of daily and monthly observations

Daily Log (www.drgecko.com)

Here is a list of things that you may want to take note of on a daily basis:

Defaecation	Size (appearance)
(faeces)	Consistency
	Time
	Where deposited
Food	Time
	Amounts given and eaten
	Dietary supplements
	Eating enthusiasm
Water	Bowl cleaned?
	Fresh water added?
Recreation time	Duration
	Unusual experiences
Shed	Start and finish date
	Areas that did not shed properly
Miscellaneous observations	

Monthly Log (www.drgecko.com)

Here is a list of things that you may want to take note of on a monthly basis:

Body measurements	Snout-vent length
	Total length
	Diameter of tail base
	Body weight
	Other
Overall attitude/impressions	
Overall health	
Miscellaneous	

6 Feeding Requirements

6.1 Captive Diet

The Southern Leaf-tailed Geckos are insectivorous but observations on feeding both in the wild and in captivity show the species eat a variety of invertebrates that are often shunned by other lizards, such as soft-bodied “worms”, “chewy” slaters, generally noxious centipedes and millipedes (Greer 2006).

A list of diets used successfully in captivity include

- Crickets
- Mealworms
- Cockroaches
- Grasshoppers and Locusts
- Wax worms
- Silkworms

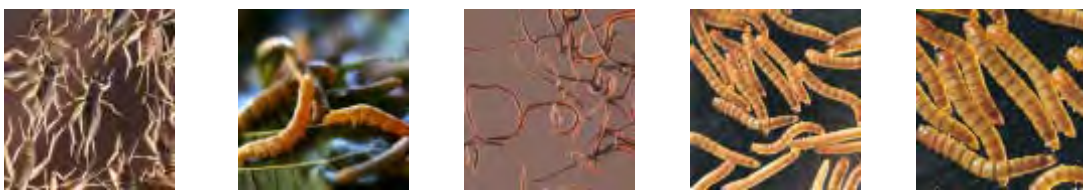
The range of diets that is fed by two institutions follows:-

a) Pisces Enterprises

Pisces Enterprises is the Australian leader in the breeding and cultivation of insects (www.piscesenterprises.com). They have a large range of live food for geckos (see Figure 1) including:-

- Crickets (baby, medium and large)
- Silkworms
- Earthworms
- Mealworms
- Superworms

Figure 1



b) The Herp Shop

The Herp Shop breeds the Speckled Feeder Roach (see Figure 2) and ships them all over Australia. This large roach, growing to almost 30mm in length (see Figure 3), has been used as a reptile/amphibian food item for several years in Australia. The Herp Shop (www.herpshop.com.au) considers these insects to be the perfect feeder roach for the insectivorous herpetologist because they are:-

- Easier to keep and breed
- Live longer
- Just as acceptable to reptiles & amphibians as other foods
- Perfect for Dragons, Geckos, Skinks, Monitors and frogs
- Unlike crickets, they almost 'thrive on neglect'

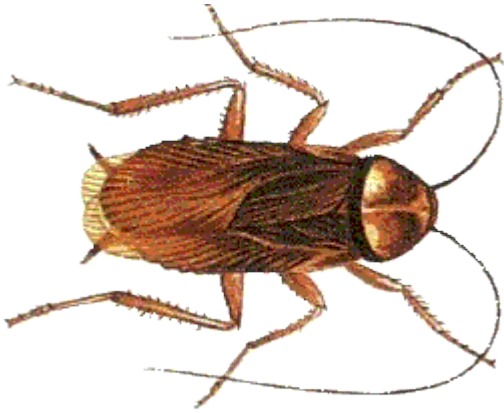


Figure 2
Speckled Feeder Roach
(*Nauphoeta cinerea*)



Figure 3

6.2 Supplements

For the healthy development of the Southern Leaf-tailed Gecko it should be given the following supplement to ensure strong bones and to prevent reproductive problems arising from a vitamin deficiency (Seufer 1991).

- Calcium
- Vitamins (especially D₃)
- UV exposure

There are three ways to ensure the presented food is enriched and palatable for the Gecko (Bartlett 2006 and Seufer 1991):-

1. Gut-loading
2. Dusting
3. Drinking Water

1. Gut-loading

Gut-loading means that before offering them to the gecko the feeding insects are feed a highly nutritious food containing protein, fat, fibre, calcium and vitamins.

2. Dusting

Calcium can be given by sprinkling a powdered supplement over the slightly dampened food insect before giving them to the gecko.

3. Drinking Water

Vitamins can be mixed into the water spray before misting the terrarium.

Ensure that the insects are lively to bring out the hunting instinct of the Gecko. Only feed enough insects that can be eaten immediately.

6.3 *Presentation of Food*

The presentation of **live** insects to the Gecko enclosure is very successful for feeding. Mechanical feeders or insect dispenses work well with these Geckos.

7 Handling and Transport

7.1 *Timing of Capture and Handling*

According to Smith 2004 a good way to get your gecko used to your presence is to put your hand in the terrarium, slowly, for a couple of minutes each day. This way the gecko should realise that you are not a threat. One can also build up the trust level by periodically hand-feeding the gecko.

Now is the idea timing to capture and handle the gecko because it has become accustomed to your presence and consequently will be less stressed.

7.2 *Catching Bags*

Not applicable to Geckos.

7.3 *Capture and Restraint Techniques*

It is best to shepherd the gecko into a cardboard tube, jar, glass or other such receptacle rather than to manually grasp them.

Geckos, particularly younger animals should be handled with great care and it is important not to hold onto their tails. Their tails are easily autotomised and although they grow back, it is obviously stressful to the animal to lose its tail (therefore its fat reserve), and also leaves the animal open to infection.

7.4 *Weighing and Examination*

Use a set of electronic weighing scales fitted with removable plastic holding cup on top to prevent the gecko escaping (see Figure 4). Zero the scales and place the gecko gently in the holding cup.



Figure 4 - Scales

While handling the gecko perform an examination of the following:-

- Eyes
- Mouth & Jaw
- Nose
- Vent
- Overall body condition

7.5 Release

Release the gecko as soon as possible because it may become stressed due to excessive and unnecessary handling. Leave the Gecko alone after handling .

7.6 Transport Requirements

7.6.1. Box Design

There are two basic types of box designs for transporting the Southern Leaf-Tail Gecko, both of which conform to the IATA requirement for reptiles and amphibians CR41-47, see Appendix B.

1. Reusable Container

These containers are strongly constructed from non-toxic materials which can be easily cleaned and disinfected. It is made from weatherproof material. (e.g. plywood, plastic) There should be no sharp edges or projections on the inside surface of the container that could injure the Gecko.

There should be a lid completely covering the container and fitted with secure fastening devices.

The container must be adequately ventilated with holes which must be small enough to prevent the escape of geckos.

Geckos can be harmed if subjected to extreme temperature fluctuations, so the container may need to be lined with suitable insulation.

The container must be marked “Live Animal” and have “This Way Up” labels affixed.

2. Disposable Container

These containers are ideal for transporting small non-venomous reptiles such as the Southern Leaf-Tail Gecko. They are made with cardboard boxes lined with Styrofoam insulation. (see Figure 5)

They are commonly used by Reptile Breeders to send live reptiles by land or air couriers to Customers/Reptile Shops.

These containers can be easily manufactured. A step by step procedure is available from Davenport 2007.



Figure 5 – A disposable container used to transport Geckos.

7.6.2. Furnishings

Some form of bedding or other material should be used inside the container to cushion the gecko from being jostled about and to absorb any faecal matter that may be passed on route. For example paper towel, wood shavings and shredded newspaper. Any empty space should be padded (e.g. with crumpled or shredded paper) to prevent excessive movement within the container during transit.

7.6.3. Water and Food

For transportation of long duration (more than 4 hours) and during periods of excessive heat (air temperature greater than 25 C) appropriate spill proof water containers should be provided (VHS 2006)

Reptiles must have access to drinking water (spraying) prior to transport to prevent dehydration.

Reptiles must not be transported unless they have been maintained for a sufficient time prior to departure at a temperature that will ensure complete digestion of any ingested food. No feeding should be necessary during transport (VHS 2006).

7.6.4. Animals per Box

Due to the territorial nature of male geckos the container may comprise of a number of compartments, provided that the overall size of the container is such that it may be handled without difficulty.

Each compartment can contain up to one male and two female geckos.

7.6.5. Timing of Transportation

Geckos should not be placed in transport enclosures more than two hours prior to departure and transport times should be kept to a minimum (VHS 2006).

During summer the transportation should be timed during the cooler periods of the day e.g. early mornings preferred or late evenings.

7.6.6. Release from Box

On arrival open the box and place inside the new enclosure (if possible). This will allow the Southern Leaf-Tail Gecko to climb out of the transport box when it is ready.

8 Health Requirements

8.1 Daily Health Checks

Like most geckos, the Southern Leaf-tailed Gecko is slow to show illness until it is far advanced (unless trauma). The following check list of routine observations should be undertaken daily during cleaning and feeding

1. Reduction in food consumption.
2. Stool changes (i.e. runny, loose, discoloured, presence of worms, smelly.)
3. Discharge from mouth, nose or vent.
4. Slight or dramatic limping.
5. Swollen limbs or trunk.
6. Muscle weakness, tremors or paralysis.
7. Changes in sleeping pattern, eating, body colour, alertness, energy level, weight or general appearance.

8.2 Detailed Physical Examination

The Southern Leaf-tailed gecko should be handled very carefully as they will autotomize their tail easily. It is best to shepherd the gecko into a cardboard tube, jar, glass or other such receptacle rather than to manually grasp them.

8.2.1 Chemical Restraint

There are two types of chemical restraint used for geckos (Lee 2006):-

1. Injectable Anaesthetics

Injectable anaesthetics are relatively easy to administer, but once given the effects are prolonged and may be unpredictable. Induction may be prolonged, as well as recovery, which may take several days.

2. Inhalant Anaesthetics

This is the preferred method, as the depth of anaesthesia can be controlled and the gecko can be ventilated with oxygen. Recovery from inhalant anaesthesia is usually rapid.

The gecko is first placed in an anaesthetic chamber for induction. Then a face mask is fitted. (see Figure 8.1). Modern potent inhalants such as isoflurane, desflurane and sevoflurane are the preferred choice for both anaesthetic induction and maintenance.



Figure 8.1 - A reptile being induced with sevoflurane via a face mask

8.2.2 Physical Examination

While the gecko is under sedation the following detailed physical examination can be carried out:-

- Discharge from mouth, nose or vent.
- Swollen limbs or trunk.
- Changes in weight.
- Dystocia
- Skin shedding problem especially on toes and tail tips.
- Parasites.

8.3 Routine Treatments

The Southern Leaf-tailed Gecko will do well with weekly calcium supplementation and twice monthly reptile multivitamin supplementation. These should be dusted on the insects just before offering to the gecko.

8.4 Known Health Problems

According to www.thegeckospot.com/leohealth.html the known health problems of geckos are as follows.

1. Metabolic Bone Disease (MBD).

Symptoms: Signs of MBD include lethargy, distorted/swollen/rubbery/bendy limbs and/or a soft/flexible jaw.

Cause: This disease results from a calcium deficiency. Note, this does not necessarily mean that there has not been enough calcium in the diet. Calcium uptake is regulated by a number of factors; an imbalance in the relative amounts of these factors can be the cause.

Treatment: Appropriate supplementation of the food should prevent MBD. A qualified reptile vet should be consulted should MBD be suspected, they will be able to advise if the problem can be corrected by supplementation or whether calcium injections are required.

2. Incomplete Skin Shedding.

Symptoms: Unshed skin is particularly common around the snout, toes and eyes, and should be removed as soon as possible. If ignored, unshed skin can lead to a number of more serious problems such as infections, eye problems, and loss of toes (unshed skin restricts the blood flow to the toes).

Cause: A lack of access to a moist environment during shedding.

Treatment: Unshed skin should never be forced off; this may damage the gecko's skin, leaving it open to infection. Shedding problems can be avoided by providing a moist enclosure by misting.

3. Infection (esp. after tail is autotomized).

Symptoms: Skin discolouration.

Cause: Skin infections can occur anywhere that skin has been damaged/broken (e.g. if the gecko damages its snout, has problems shedding or when the tail (or part of the tail) is autotomized). Skin infections can be the result of damp/soiled substrate, such skin infections would particularly affect the stomach since it is in contact most with the substrate.

Treatment: If an infection is suspected it is best to seek veterinary advice. The vet may treat the infected area topically with betadine or neosporin/polysporin.

4. Impaction.

Symptoms: Some symptoms include a lack of appetite or lethargy

Cause: Impaction of the gut can be caused by ingestion of substrate, ingestion of food that is too big, or by parasites.

Treatment: To reduce the risk of impaction animals can be kept on suitable substrate, and food items should never be too large.

5. Eye Infection.

Symptoms: Symptoms of an eye infection may include swelling of the eye, discharge from the eye, cloudiness of the eye, difficulty in opening the eye.

Cause: Eye infections can be the result of any irritation to the eye (e.g. the gecko may get dust in its eye from the substrate, or scratch its eye on something while hunting).

Treatment: In all cases, eye infections should be investigated by a vet. Most likely they will take a swab from the eye, culture from the swab, then they can determine the best method of treatment once the culture has been identified.

6. Mouth Rot.

Symptoms: Symptoms include swelling of the jaw, loss of appetite and a discharge of pus from the mouth.

Cause: This is fairly rare in geckos. It can result from either fighting, or if the animal bruises its snout against something.

Treatment: A vet should be consulted, treatment may include cleansing the area with hydrogen peroxide and then swabbing with betadine or topical antibiotic. Severe cases may require antibiotic injection.

7. Respiratory Infection.

Symptoms: Symptoms may include gaping mouth, difficulty breathing.

Cause: Respiratory infections are normally caused by exposure to excessively cool temperatures, which will result in a suppression of the immune system.

Treatment: Mild cases may be cured by increasing the temperature of the vivarium, however, a veterinarian should be consulted.

8. Egg Binding (dystocia).

Symptoms: Symptoms of egg binding will include failure to lay eggs, in particular if you see the female straining (to lay eggs), or it is obvious that she is very ill. Other symptoms of dystocia can include lethargy, loss of appetite, bloated stomach, depression, non-responsiveness, weakness.

Cause: Lack of access to a suitable egg laying site may be a contributing factor to dystocia. Any obstruction, or physical deformity of the oviduct or cloaca will prevent the eggs from passing through as normal. Other possibilities could be due to the eggs being too large or stuck together or could also be the result of a calcium deficiency (since calcium is an important component of the egg shell, and is also thought to induce the egg-laying contractions).

Treatment: In cases of dystocia a vet should be consulted, since it is a serious problem. Limited success (in egg bound females, successfully laying their eggs) has been seen with oxytocin injection, if this fails the eggs can be removed surgically- however, this is a very risk procedure.

9. Parasites.

Symptoms: To find out if your reptile has parasites you will need to observe them closely. There are parasites that live on the outside of the body called ectoparasites, these are visible to the naked eye. Endoparasites live inside the body and can be identified by looking at their feces.

Cause: There are many different types of parasites infect geckos, in particular Pinworms, Coccidia & Tapeworms. For instance if some crickets that are infected with pinworms are feed to your gecko, it will then become infected with pinworms.

Treatment: Photos of some parasites isolated from reptile fecal samples are shown in Figure 8.2 and 8.3. If you suspect that your reptile has parasites you should seek the advice of a qualified reptile vet. Most parasites can be easily diagnosed and can be treated successfully and inexpensively.



Figure 8.2 - *This is a photo of an adult pinworm (as seen under a microscope) isolated from the fecal samples of a geckos.*

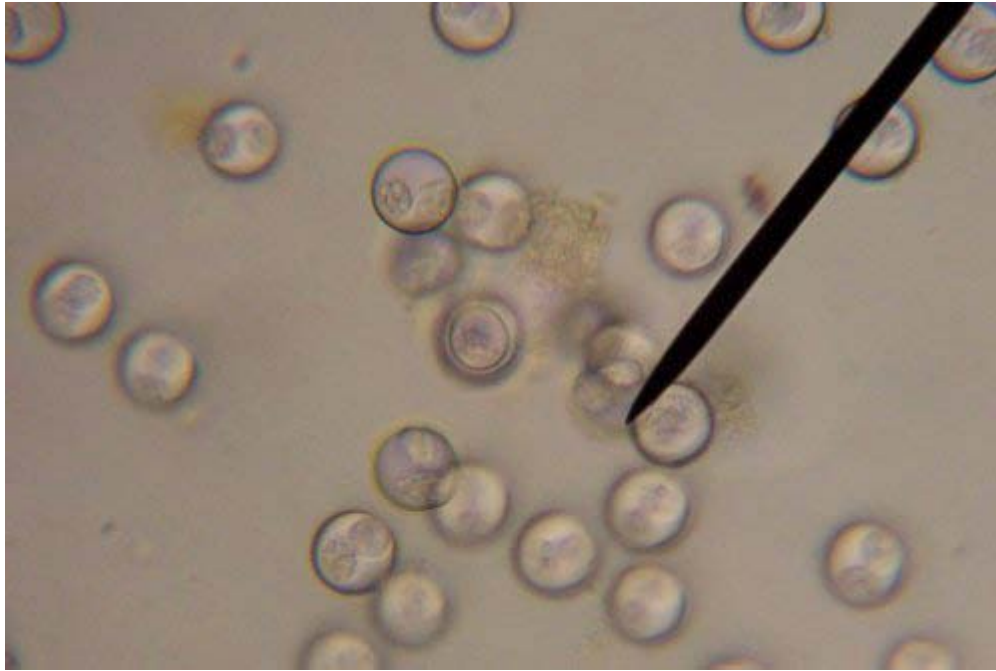


Figure 8.3 - This photo shows coccidia from a reptile (as seen under a microscope).

8.5 Quarantine Requirements

To prevent the spread of diseases and parasites between geckos, it is important that you quarantine new specimens for approximately a month. If problems develop with the gecko during the quarantine period this may need to be extended until the problem has been dealt with and eliminated.

The quarantine should meet the following requirements:-

- Keep the gecko in a separate room. This will help prevent the spread of any parasites and other potential pathogens.
- Maintain a simple and easy to disinfect enclosure. Cage furniture should ideally be something that is disposable or easy to disinfect (i.e. not porous).
- Substrate should ideally be paper towel, newsprint or butcher paper. This makes it easy to replace and to monitor the stools on. It will also be easy to spot external parasites such as mites.
- Maintain a daily log. Monitor feeding, drinking, activity, shedding, bodyweight, behaviour etc.
- Practice proper hygiene to prevent the spread of pathogens to other reptiles or yourself.

9 Behaviour

9.1 Activity

The Leaf-tailed Geckos are exclusively nocturnal and will tend to hide and sleep throughout the daylight hours. At night they emerge to rest motionless, usually head-downwards, to ambush passing prey. Hence, they are relatively inactive lizards and thus do not need large amounts of space, so enclosure size can be quite small.

9.2 Social Behaviour

Leaf-tailed Geckos are not social creatures so they do not need companionship like other animals do. In captivity, leaf-tails occupy crevices by themselves significantly more often than crevices with another individual, regardless of sex. This result suggests a certain tendency to asocial behaviour.

9.3 Reproductive Behaviour

Head bobbing and nodding may indicate courtship when used by a male in the presence of a female.

9.4 Bathing

Does not need to be bathed, it absorbs moisture out of the air such as dew or water spray.

9.5 Behavioural Problems

Fighting.

9.6 Signs of Stress

If threatened (www.reptilepark.com.au) leaf-tails will raise themselves up, open their mouths and wave their tail rhythmically over their body. If touched they will lunge toward the threat and emit a loud rasping squeak, which can be quite a surprise. If this fails the lizard may then shed its tail which continues to wriggle and distract the predator while the reptile makes its escape.

9.7 Behavioural Enrichment

- Live food such as crickets.
- Enclosure design such as rock crevices can be enriching.

9.8 *Introductions and Removals*

Care should be taken when introducing geckos as pairs or trios. Ideally a male should have access to the enclosure prior to adding the female (s) to allow him to establish his territory. Careful monitoring should always be undertaken and the geckos should preferably be put together when persons are available to monitor their progress.

9.9 *Intraspecific Compatibility*

Males appear to be more nervous, highly strung lizards than the calmer females. Male geckos can be extremely aggressive towards each other. Consequently these geckos can be housed as pairs or trios of one male and two females all year round.

9.10 *Suitability to Captivity*

The Leaf-tailed Gecko has proven to be hardy and adapt quickly to captive conditions.

10 Breeding

10.1 Mating System

For captive breeding ensure only one male with one or more females.

Figure 10.1 shows how to differentiate between the sexes (Reptiles Australia 2007).

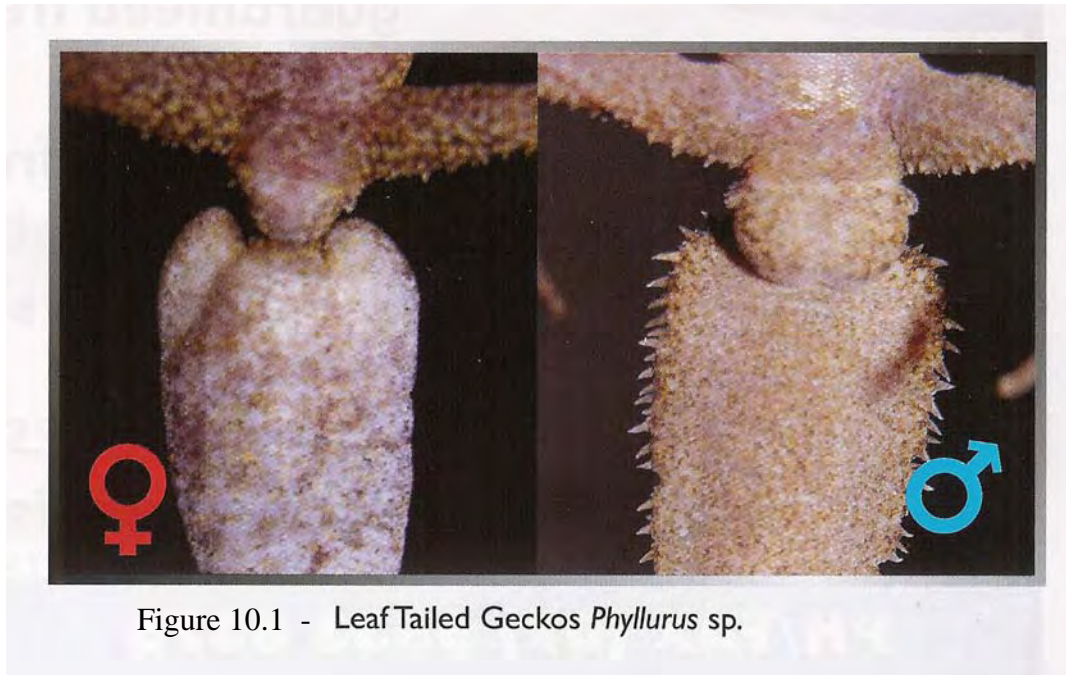


Figure 10.1 - Leaf Tailed Geckos *Phyllurus* sp.

10.2 Ease of Breeding

Southern Leaf-tail Geckos are not the easiest species to breed, so thought should be given to provide the proper conditions and requirements for the sexually mature pair, eggs and baby geckos.

10.3 Reproductive Condition

A full examination of the breeding geckos should always be done before, during and after breeding to pick up any reproductive disorders. Many gecko disorders, including reproductive ones, are due to poor husbandry practices in some way.

10.3.1 Females

The following reproductive problems are relatively common (www.redrobe.com)

1. Dystocia

Occurs most often in first-time breeding females, females who have previously retained eggs and female bearing infertile clutches.

2. Salpingitis

A bacterial infection of the reproductive track.

3. Cloacal disorders

10.4 Techniques Used to Control Breeding

Under natural conditions the life cycles of geckos are influenced by seasonal climatic changes. These factors can be controlled in a terrarium and so can be used to control breeding.

1. Photoperiod

Terrarium lights are turned on at dawn and off at dusk.

2. Temperature

Temperature, both daily and seasonal, can be altered with prudent use of lights and/or heating elements.

3. Humidity

Rainfall can be simulated and seasonally altered by expedient misting techniques.

Relative humidity within the terrarium can be altered by partially or completely covering it with glass, Perspex or sheet plastic.

10.5 Occurrence of Hybrids

Very rare

10.6 Timing of Breeding

A cooling down period is required for the Southern Leaf-tailed Gecko before breeding occurs. During the winter months the temperature should be allowed to drop around 4 to 6 °C, and feeding should also be cut down. After 2 months slowly increase the temperature and begin feeding your geckos. Mating should soon follow.

10.7 Age at First Breeding and Last Breeding

Most Southern Leaf-tailed Geckos reach sexual maturity around 2 to 3 years of age.

10.8 Ability to Breed Every Year

In the wild the Southern Leaf-tailed Gecko breed to a yearly cycle. They mate in May and females lay a clutch of 2 eggs (20mm x 11mm) deep within a rock crevice in well-drained soil during November and December. The eggs hatch from January to April and the hatchlings are about 6cm long.

10.9 Ability to Breed More than Once Per Year

In captivity, well-fed females can lay up to three clutches of 2 eggs per year for at least two successive years. (Greer, 2006)

10.10 Nesting, Hollow or Other Requirements

The eggs are laid in rock crevices and under logs on rocky ridges. This species often use a communal nesting site (one site was found to contained 24 eggs) and may use the same site every season.

Captive females have been observed to roll her freshly laid eggs around on the ground under her body with her rear legs (Doughty and Shine 1995). This resulted in the eggs being covered with the sand on the cage floor (substrate). What role this has in nature is unclear; perhaps the sand coating helps protect the eggs both from predators and from drying out as they lay unburied in the rock crevices.

10.11 Breeding Diet

Make sure the gecko is well-fed and be sure to provide plenty of calcium and vitamin D3. These additives are especially important at the time of eggshell formation by adult female geckos and for proper bone development during the growth of hatchlings and juveniles.

10.12 Incubation Period

The incubation periods at different temperatures are summarized in Table 10.1 (Greer 2006).

Table 10.1 - Incubation periods at different temperatures.

INCUBATION TEMPERATURE (° C)	INCUBATION PERIOD (DAYS)
Ambient	71 - 72
20 – 25	85 - 98
22 – 26	66
28	64

10.13 Clutch Size

Clutch Size is most commonly 2 eggs. The measurements and weights of freshly laid eggs are summarized in Table 10.2 (Greer 2006).

Table 10.2 - Egg size and weight. (*Phyllurus platurus*)

LENGTH (mm)	WIDTH (mm)	MASS (g)
18.6 – 25.5	9.0 – 15.9	1.0 – 3.1

10.14 Age at Weaning

Straight after hatching.- not weaned, born precocial.

10.15 Age of Removal from Parents

After eggs laid - independent straight after hatching.

10.16 Growth and Development

Hatchling sizes are shown in Table 10.3 (Greer 2006).

Table 10.3 – Hatchling size.

SNOUT-VENT LENGTH (mm)	TOTAL LENGTH (mm)	MASS (g)
30.3 - 41	48 - 64	1.1 – 1.7

Juvenile *Phyllurus platurus* growth rate is rapid; they attain a length of around 70mm (Snout-vent Length) in 12 months.

These geckos may reproduce as young as 2 years of age.

11 Artificial Rearing

11.1 Incubator Type

Incubator

Incubators are devices that maintain a constant temperature and humidity. Ideally it is well insulated (to cut down on temperature fluctuations) and that allows for easy visual inspection of the eggs.

Although incubators can be home made, realistically purchasing an incubator is probably the safer option as there is a much lower chance of failure since the device has been specifically designed and tested for the purpose.

For example the commercially available Reptile Incubator shown in Figure 11.1 is suitable for hatching a wide variety of eggs, including geckos.

Incubator Medium

The substance that the eggs rest directly in as they develop is known as the Incubator Medium, the medium must (www.illreptile.com):-

- Retain water and maintain humidity within the egg container.
- Be sterile (or close to it)
- Not promote excessive growth of moulds or fungi.

There are a variety of products that have proven successful as incubator medium. Most breeders and hobbyists turn to either **perlite** or **vermiculite** as their medium of choice. Both substances are naturally occurring siliceous rock. When heated to a proper temperature, they expand to many times their original volume, producing a very light, absorbent material that naturally resists mould.

11.2 Incubation Temperature and Humidity

Incubation temperatures between 26° and 30°C are acceptable, with a constant 28°C being a safe choice (Weigel 2004).

The preferred humidity is 80 to 90 percent (Bartlett 2006). A saturated atmosphere, where the moisture condenses and drips onto the eggs is not desirable.

Figure 11.2 shows a commercially available **hygrometer** that measures both temperature and humidity.

JURAGON

Kemp's Reptile Incubators

Advanced Microprocessor Controlled Reptile Egg Incubator

Replicates Mother Nature With Daily High Temperatures And Lower Night Temps. Easy To Use!



Precision Temperature and Humidity Control



A Few of the Advanced Features

- * Microprocessor Controlled
- * Presets for Various Species
- * Manual Programming Also
- * Daily Temp Rise/Fall
- * Optimal Hatch Results
- * Durable Construction
- * Easy Cleaning
- * Large LCD Backlit Display
- * Humidity Reservoir
- * Low Water Alarm
- * Celsius or Fahrenheit
- * Relative Humidity in RH%
- * Counts Total Incubation Days
- * Easy to Use!

Product Specifications

Power Requirement is 100 to 120 Volt AC, 50/60 Hz
 Temperature Min= 68 F Max= 108 F
 Humidity Min= 40% Max= 95%
 Power Consumption Average is 48 Watts
 Boxed Weight Approx. 14 Pounds
 Size is 19.7" Wide x 16.2" Deep x 6.3" High
 Standard Fuse Rating is 250 Volt 2.0 Amp



Kemp's Reptile Incubators

Eugene, Oregon USA -- www.ReptileIncubator.com

For a Dealer Near You Call Us Toll Free At
(888) 901-2473

Figure 11.1 – A Reptile Incubator



Figure 11.2 – A digital hygrometer that measures both temperature and humidity.

11.3 Desired % Egg Mass Loss

The % Egg Mass Loss is a measure of change in mass of the egg during incubation.

$$\% \text{ Egg Mass Loss} = \frac{\text{Egg Mass during Incubation}}{\text{Egg Mass when Laid}} \times 100$$

Reptile eggs may either loose or gain mass during incubation, depending on incubation conditions. Virtually all the change is due to water exchange (e.g. water absorption).

During my internet searches, it did not yield any results for the desired % Egg Mass Loss for the Southern Leaf-Tailed Gecko.

11.4 Hatching Temperature and Humidity

The Hatching Temperature and Humidity is the same as during incubation. Leave the hatchlings in the incubator for up to 24 hours post-hatching, as this allows them to recover from the stress of hatching without the added shock of a significant temperature change (www.l11reptile.com).

11.5 Normal Pip to Hatch Interval

After pipping the geckos may remain in the egg for several hours or may emerge almost immediately. It is best to allow the geckos to emerge from their egg shells unassisted and undisturbed (Weigel 2004).

11.6 Diet and Feeding Routine

Just before hatching geckos absorb the remains of their yolk sac, it is for this reason that they do not need to eat for the first few days (www.thegeckospot.com). When the hatchlings do start eating it is important to offer them appropriately sized food. It should be no wider than the width of their head; small crickets are the best food for babies. All live food should be well gutloaded and should also be dusted with calcium powder.

For the feeding routine, feed the hatchling daily. It may start by eating just one cricket, then over the next few days the number of crickets eaten per feed will increase very quickly.

11.7 Specific Requirements

Hatchlings are best kept separately, this prevents competition for food, bullying and allows to monitor each one individually (www.thegeckospot.com).

11.8 Data Recording

Extreme care should be exercised when handling the Southern Leaf-Tailed Gecko to avoid stressing them, it is best not to handle them directly. A log of measurements such as weight and length can be kept.

11.9 Identification Methods

A photograph of each hatchling can be used for identification.

11.10 Hygiene

Practice the same hygiene protocol as for adult geckos – keep the enclosure clean.

11.11 Behavioural Considerations

A new hatchling is likely to be petrified of you, their first reaction will be fear because to them you are most likely a predator. So you need to be as calm as possible when dealing with them.

11.12 Weaning

The gecko hatchling will consume the same food as adults provided it is appropriately sized.

12 Acknowledgements

I would like to thank Chad Staples, my supervisor from Featherdale Wildlife Park for letting me have time to work on certain aspects of my husbandry manual and helping me find information.

I would also like to thank Brendan Shembry (a mate of mine) for taking photographs and letting me borrow his Southern Leaf-tailed Gecko.

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15 Glossary

Autotomize : the ability to break easily or voluntarily cast off (and usually regenerate) a part of the body, such as a tail.

Ectoparasites : parasites that lives on the outside of the body.

Ectothermic : animals that do not generate body heat to thermo-regulate (cold-blooded).

Endoparasites : parasites that live inside the body.

Dimorphism : The existence among animals of the same species of two distinct forms that differ in one or more characteristics, such as coloration, size, or shape. This is often sex-linked.

Dystocia : difficulty in bearing eggs, e.g. retained eggs or infertile clutches.

Morphometrics : studies the "form follows function" aspect of biology, mapping the changes in an organism's shape in regards to its function

Precocial : Born or hatched in a condition requiring relatively little parental care.

Salpingitis : a bacterial infection of the reproductive track.

Saxicolous : rock-dwelling

Vent : the external opening of the cloaca; the anus.

16 Appendix

Appendix A

Material Safety Data Sheet – Calcium Carbonate

Appendix B

IATA Live Animal Regulations

General Container Requirements for Reptiles and Amphibians (CR 41-47)



Health	2
Fire	0
Reactivity	0
Personal Protection	E

Material Safety Data Sheet Calcium carbonate MSDS

Section 1: Chemical Product and Company Identification

Product Name: Calcium carbonate
Catalog Codes: SLC1141, SLC4720, SLC4438, SLC1645
CAS#: 471-34-1
RTECS: FF9335000
TSCA: TSCA 8(b) inventory: Calcium carbonate
Cl#: Not available.
Synonym:
Chemical Name: Calcium Carbonate
Chemical Formula: CaCO₃

Contact Information:
ScienceLab.com, Inc.
 14025 Smith Rd.
 Houston, Texas 77396
US Sales: 1-800-901-7247
International Sales: 1-281-441-4400
Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
 1-800-424-9300
International CHEMTREC, call: 1-703-527-3887
For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Name	CAS #	% by Weight
Calcium carbonate	471-34-1	100

Toxicological Data on Ingredients: Calcium carbonate: ORAL (LD50): Acute: 6450 mg/kg [Rat].

Section 3: Hazards Identification

Potential Acute Health Effects:
 Hazardous in case of eye contact (irritant), of ingestion, of inhalation.

Potential Chronic Health Effects:
 CARCINOGENIC EFFECTS: Not available.
 MUTAGENIC EFFECTS: Not available.
 TERATOGENIC EFFECTS: Not available.
 DEVELOPMENTAL TOXICITY: Not available.
 The substance may be toxic to kidneys.
 Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:
 Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Cold water may be used. WARM water MUST be used. Get medical attention.

Skin Contact: Wash with soap and water. Cover the irritated skin with an emollient. Get medical attention if irritation develops.
Serious Skin Contact: Not available.

Inhalation:
 If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

Serious Inhalation: Not available.

Ingestion:
 Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention if symptoms appear.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Non-flammable.

Auto-ignition Temperature: Not applicable.

Flash Points: Not applicable.

Flammable Limits: Not applicable.

Products of Combustion: Not available.

Fire Hazards in Presence of Various Substances: Not applicable.

Explosion Hazards in Presence of Various Substances:
 Risks of explosion of the product in presence of mechanical impact: Not available.
 Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions: Not applicable.

Special Remarks on Fire Hazards: Will ignite and burn fiercely in contact with fluorine

Special Remarks on Explosion Hazards:
 When a mixture of calcium carbonate and magnesium is heated in a current of hydrogen, a violent explosion occurs.

Section 6: Accidental Release Measures

Small Spill:
 Use appropriate tools to put the spilled solid in a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and dispose of according to local and regional authority requirements.

Large Spill:
 Use a shovel to put the material into a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and allow to evacuate through the sanitary system. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Do not ingest. Do not breathe dust. Avoid contact with eyes. Wear suitable protective clothing. If ingested, seek medical advice immediately and show the container or the label. Keep away from incompatibles such as oxidizing agents, acids.

Storage: Keep container tightly closed. Keep container in a cool, well-ventilated area. Hygroscopic

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

Personal Protection:
Splash goggles. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Dust respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist. BEFORE handling this product.

Exposure Limits:
TWA: 10 (mg/m³) from ACGIH (TLV) [United States] Inhalation Total.
TWA: 10 STEL: 20 (mg/m³) [Canada] Inhalation Total.
TWA: 5 (mg/m³) from OSHA (PEL) [United States] Inhalation Respirable.
TWA: 15 from OSHA (PEL) [United States] Inhalation Total. Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Solid. (Powdered solid.)

Odor: Odorless.

Taste: Chalky

Molecular Weight: 100.09 g/mole

Color: White.

pH (1% soln/water): Not available.

Boiling Point: Not available.

Melting Point: 825°C (1517°F)

Critical Temperature: Not available.

Specific Gravity: 2.8 (Water = 1)

Vapor Pressure: Not applicable.

Vapor Density: Not available.

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: Not available.

Solubility:
Very slightly soluble in cold water.
Soluble in dilute acid.
Insoluble in alcohol.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Incompatible Materials

Incompatibility with various substances: Reactive with oxidizing agents, acids.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity:
Hygroscopic. Will ignite and burn fiercely in contact with fluorine.
Incompatible with acids, alum, ammonium salts, mercury + hydrogen, aluminum and magnesium

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Inhalation, Ingestion.

Toxicity to Animals: Acute oral toxicity (LD50): 6450 mg/kg [Rat].

Chronic Effects on Humans: May cause damage to the following organs: kidneys.

Other Toxic Effects on Humans: Slightly hazardous in case of skin contact (irritant), of ingestion, of inhalation.

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: Not available.

Special Remarks on other Toxic Effects on Humans:
Acute Potential Health Effects:
Skin: Causes skin irritation.
Eyes: Dust causes eye irritation.
Inhalation: Excessive inhalation causes respiratory tract and mucous membrane irritation. Low hazard for usual industrial handling.
Ingestion: Ingestion of large amounts may cause gastrointestinal tract disturbances with nausea and possibly constipation. Expected to be a low hazard for usual industrial handling.
Chronic Potential Health Effects:
Chronic ingestion may affect kidneys, and may cause hypercalcaemia with alkalosis.

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:

Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The product itself and its products of degradation are not toxic.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: Not a DOT controlled material (United States).

Identification: Not applicable.

Special Provisions for Transport: Not applicable.

Section 15: Other Regulatory Information

Federal and State Regulations: TSCA 8(b) inventory: Calcium carbonate

Other Regulations: EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada): Not controlled under WHMIS (Canada).

DSCG (EEC):

R36- Irritating to eyes.

S2- Keep out of the reach of children.

S16- If swallowed, seek medical advice immediately and show this container or label.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 0

Reactivity: 0

Personal Protection: E

National Fire Protection Association (U.S.A.):

Health: 1

Flammability: 0

Reactivity: 0

Specific hazard:

Protective Equipment:

Gloves.

Lab coat.

Dust respirator. Be sure to use an approved/certified respirator or equivalent.

Splash goggles.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

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GENERAL CONTAINER REQUIREMENTS FOR REPTILES AND AMPHIBIANS (CR 41-47) (See CR 51 for total aquatic amphibians)

Design and Construction

When constructing containers for shipment of reptiles and amphibians, the normal habits must be considered.

For general transport purposes, these species will be carried only in closed and adequately ventilated containers. The container must be well constructed and be able to withstand other freight damaging it or causing the structure to buckle or collapse. It must be constructed of non-toxic materials. Chemically impregnated wood may be poisonous and must not be used.

The container must be suitable to keep the species inside at all times and protect it from unauthorised access. The door or lid must be constructed so that accidental opening cannot occur, either from the inside or the outside.

The container must be rigid enough to prevent the animal escaping through gaps at the seams or joints.

The container must not cause injury to the animal. All inside edges must be smooth or rounded. There must be no sharp projections, such as nails, upon which the animal can injure itself.

The container must be clean and leak-proof. If it is to be reused, the container must be thoroughly cleaned and then either disinfected or sterilised prior to reuse. Absorbent bedding that is suitable for the species must be provided. Straw and other plant material like leaves or mosses are unacceptable as many countries prohibit their importation. All amphibians (other than the totally aquatic species) and a few reptiles require dampened bedding to provide the necessary moisture throughout the transport period.

The container must protect the handlers from being bitten by the animal. Handles and/or spacer bars must be provided to facilitate handling and preventing the ventilation openings becoming blocked by other freight. Spacer bars are necessary on the bottom to avoid contact of the container with too hot or too cold floor, but are not recommended on the tops of the containers. Spacer bars must be incorporated into the bottom and sides of the primary enclosure, in a way that ventilation holes are not occluded. For polystyrene boxes which are used inside cardboard-boxes, no spacer bars are necessary. If forklift spacers are required, they must be at least 5 cm (2 in) thick. Allowance for the extra height must be made when calculating the dimensions of the container.

Inspection of these containers is required to comply with CITES and some national government regulations. The containers must therefore be constructed in such a manner that the lid can be opened and closed readily. In the case of wooden containers screws must be used so that inspectors can remove and replace them easily. The material used must be able to withstand repeated opening and closing. Containers must not be taped, nailed, screwed or otherwise attached to other containers in the same shipment, with exceptions of the Farmed green iguana-boxes and the boxes for the hatchlings of sliders and map turtles.

If the primary enclosure is constructed of wood it must have a thickness of at least 0.6 cm (¼ in). Wooden boxes must not be tamped. If fibreboard or corrugated cardboard is used as a primary enclosure it must be treated in a way that it has a moisture barrier, and the cardboard must be reinforced.

If polystyrene boxes are used inside cardboard boxes the walls of the polystyrene boxes must have a minimum thickness of 2 cm (¾ in). If separate polystyrene panels are used they must be tightly fitted to each other within the primary enclosure with no gap to prevent escape and avoid injury. Spacer bars are not necessary on cardboard primary enclosures if these are so constructed that ventilation holes are not obstructed when the enclosure is pushed next to another vertical surface.

Metal must not be used in the construction of the inner container if it comes in direct contact with the animal. Metal outer/primary enclosure are not allowed due to the danger of overheating.

The floor of the outer/primary enclosure for turtles, tortoises, crocodiles and amphibians must be solid and water proof.

Any partition within a container must be securely attached to the base and/or sides of the container so that they do not collapse if the container is tilted or accidentally turned upside down.

Layering within the primary enclosure is allowed when each single layer is structurally sound and as long as the contents of the layer are easily inspected. A maximum of three layers is allowed and the floor counts as one layer. The layers must be fixed to the walls of the primary enclosure with screws. No nails are allowed.

Dimensions and Stocking Density

Dimensions of inner enclosures and/or outer enclosures shown in these Regulations are illustrative and therefore must be related to the actual size of the specimens for which the container is constructed. The container must in general allow the animal to lie in a natural manner with enough space that stacking is avoided. The height of the container must permit air flow over the animals but prevent stacking. In general a clearance of 3 cm (1¼ in) is recommended. This needs to be increased accordingly for larger species.

For stocking density see the special packing density tables for the different groups.

Ventilation and Temperature

The container must be adequately ventilated. As reptiles and amphibians are cold blooded animals with considerably lower oxygen requirements than birds and mammals, ventilation and the size of the ventilation openings depend on the ambient temperature. Shipments exposed to cold climates will need fewer ventilation openings than shipments exposed to hot climates.

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Live Animals Regulations

Many reptiles and amphibians are CITES listed species. It is a CITES prerequisite that all CITES listed species are packed and shipped in accordance with the IATA Live Animals Regulations. See Chapter 11 for CITES requirements. Many governments have incorporated the IATA Regulations into their national legislation regarding the shipment of live animals by air. Therefore care must be taken that compliance is evident at the time of live animal shipment acceptance.

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Container Requirements

CONTAINER REQUIREMENT 41

The illustrations shown in this Container Requirement are examples only. Containers that conform to the principle of the written guidelines for the species but look slightly different will still meet the IATA standards.

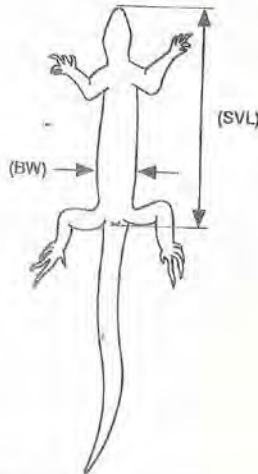
Applicable to Lizards and Tuataras

See *USG Exceptions in Chapter 2 and Exceptions CO-01 and UA-05 in Chapter 3.*

The following instructions must be complied with in addition to the principles laid down in the General Container Requirements for Reptiles and Amphibians.

Measurement

Lizards (including Chameleons) and tuataras should be measured by snout-to-vent length (SVL) and in body width (BW).



Specific Requirements

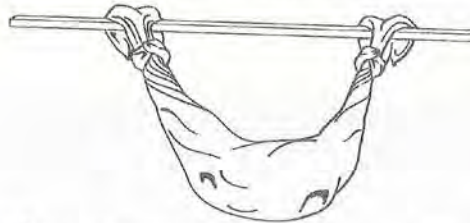
All containers and bags should have some kind of packing material (i.e. crumpled paper). Animals in the same containers or bags should belong to the same size class to avoid damage to smaller individuals.

The maximum number of animals per bag or container must not be increased even when larger bags or containers are used.

Packing Density for Lizards and Tuataras (not including Chameleons and farmed Iguana iguana):

Snout-vent-length (SVL)	Body-width (BW)	Maximum no. of animals per bag	Minimum bag size
≥ 20 cm (8 in)	≥ 5 cm (2 in)	1	Depending on the size of the animal
≥ 15 < 20 cm (6 < 8 in)	≥ 2.5 < 5 cm (1 < 2 in)	15	45 × 60 cm (18 × 24 in)
		10	30 × 45 cm (12 × 18 in)
≥ 10 < 15 cm (4 < 6 in)	< 2.5 cm (1 in)	30	45 × 60 cm (18 × 24 in)
		20	30 × 45 cm (12 × 18 in)
< 10 cm (4 in)	< 2.5 cm (1 in)	30	30 × 45 cm (12 × 18 in)

If the bag is suspended the bag must be suspended horizontally from opposite ends of the bag the maximum number of animals per bag should be divided by two.



For lizards, rigid containers can be used instead of bags with a maximum of 25 animals, under the same conditions for the snake containers.

Arboreal geckos will be provided the use of the surface area of the floor and wall space of rigid containers.

Large Animals

Lizards whose length range from 90–120 cm (36–48 in) SVL require double bags for shipping.

Lizards of 120 cm (48 in) or more in length must follow the same primary enclosure requirements as crocodiles excluding the taping or banding of the mouth.

The direction of the head should be indicated on the outer enclosure.

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CONTAINER REQUIREMENT 41 (cont'd)

Lizard species that should be packed singly because they are either aggressive, cannibalistic or delicate:

- Malagasy leaf geckoes (*Uroplates* spp.)
- New Caledonian giant geckoes (*Rhacodactylus* spp.)
- Asian gliding agamid (*Draco* spp.)
- Sail-finned lizard (*Hydrosaurus* spp.)
- Angle-headed dragon (*Gonocephalus* spp.)
- Helmeted basilisks (*Corytophanes* spp.; *basiliscus* spp.)
— (except hatchlings and juveniles)
- Caiman lizard (*Dracaena* spp.)
- Emerald tree monitor lizard (*Varanus prasinus*)
- Black tree monitor lizard (*Varanus beccarii*)
- Solomon Island pre-hensile tailed skink (*Corucia zebrata*)

Venomous lizards that must be handled and packed like venomous snakes (see Container Requirement 44), these are:

- Gila monster, beaded lizard (*Heloderma* spp.)

Specific Requirements for Chameleons including African Dwarf Chameleons (*Rhampholeon*) and Malagasy Dwarf Chameleons (*Brookesia*)

All species with the exception of young and small specimens (see below) must be packed individually.

Chameleons 10 cm (4 in) or greater in SVL need to be packed in adequate space to rest naturally. The enclosure needs to conform to the body shape and size. Specimens should be packed one per inner enclosure. The inner enclosure may be cloth, woven material, or rigid container. Crushed or crumpled paper must fill at least 25% of inner enclosure.

Chameleons of 2.5–10 cm (1–4 in) in SVL must be packed one per inner enclosure. Inner enclosures may be fibrous woven tubes with each open end of tube securely enclosed in a manner that can be resealed, cloth, rigid container, or heavy gauge paper enclosures. Heavy gauge paper should be defined as a container that is sufficient to hold specimens without escape.

Inner enclosures must be easily opened and closed. If heavy gauge paper enclosures are used as inner enclosures, they must be secured to a frame of support bars in the primary or outer enclosure with tacks or nails with head diameter of at least 0.6 cm (1/4 in). No burlap (hessian) bags as inner enclosures are permitted.

Chameleons less than 2.5 cm (1 in) SVL can be packed with a maximum of 10 per 0.5 liter rigid enclosure. At all times, the specimens must be able to have full contact with the container floor. At least 50% of the inner enclosure must be filled with loosely crumpled paper.

Crushed or crumpled paper must be provided to ensure a foothold for the animal.

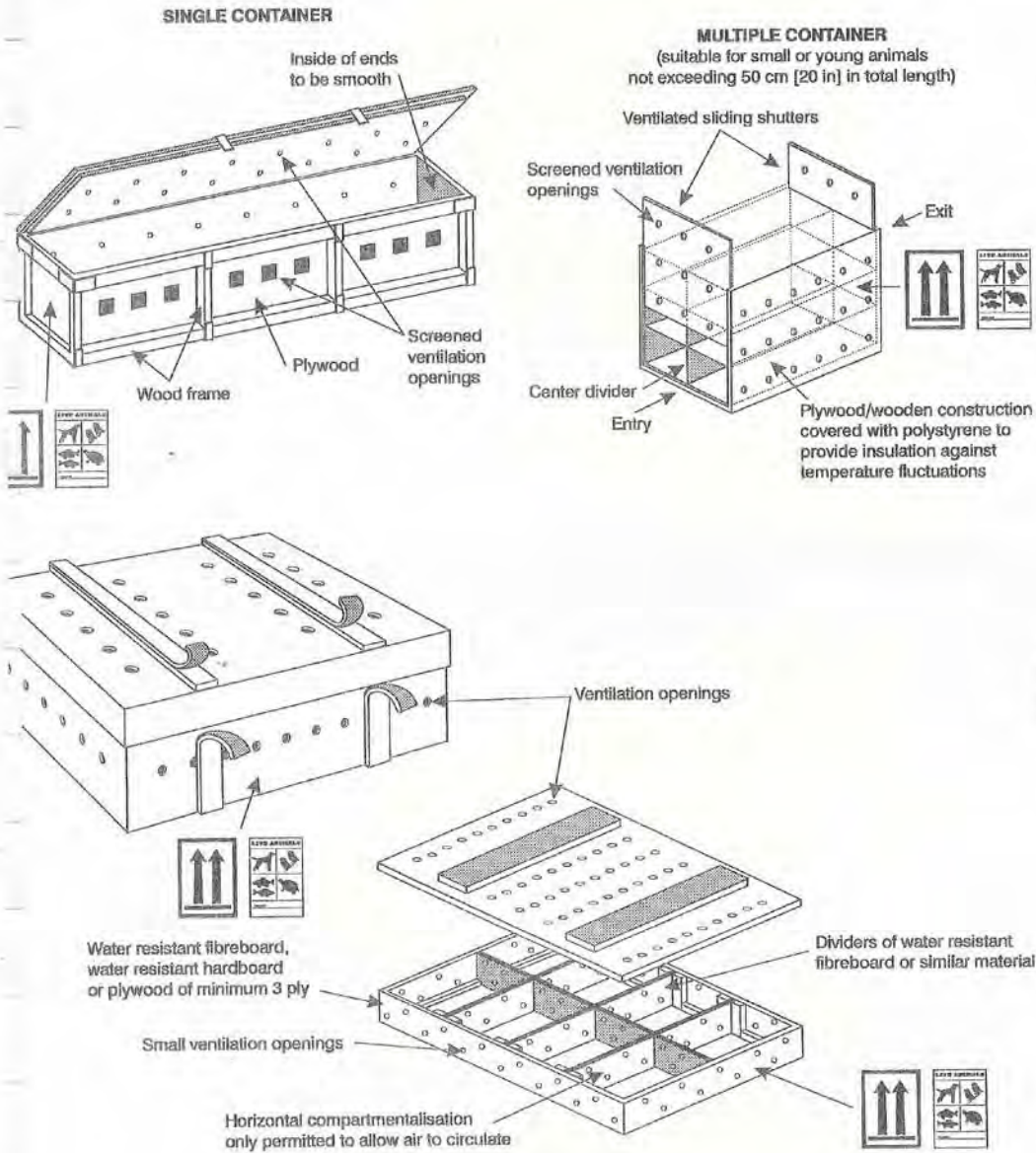
Packing Density for Farmed Green Iguanas (*Iguana iguana*)

Since farmed Green Iguanas (*Iguana iguana*) are usually in good condition, free of diseases and used to handling the use of following special packing density is allowed.

Snout-vent-length (SVL)	Maximum no. of animals per bag/box	Minimum bag size	Minimum box size
> 25 cm (10 in)	1	Depending on the size of the animal	—
> 20 cm (8 in)	6	45 x 85 cm (18 x 34 in)	—
> 17.5 cm (7 in)	6	30 x 60 cm (12 x 24 in)	20 x 40 x 9 cm (8 x 16 x 3 1/2 in)
> 12.5 cm (5 in)	20	30 x 45 cm (12 x 18 in)	20 x 40 x 6.5 cm (8 x 16 x 2 1/2 in)
> 10 cm (4 in)	30	30 x 45 cm (12 x 18 in)	20 x 40 x 4.5 cm (8 x 16 x 1 1/2 in)
> 8.75 (3.5 in)	40	30 x 45 cm (12 x 18 in)	20 x 40 x 4.5 cm (8 x 16 x 1 1/2 in)
0–8.75 cm (3.5 in)	50	30 x 45 cm (12 x 18 in)	20 x 40 x 4.5 cm (8 x 16 x 1 1/2 in)

CONTAINER REQUIREMENT 41 (cont'd)

EXAMPLE:

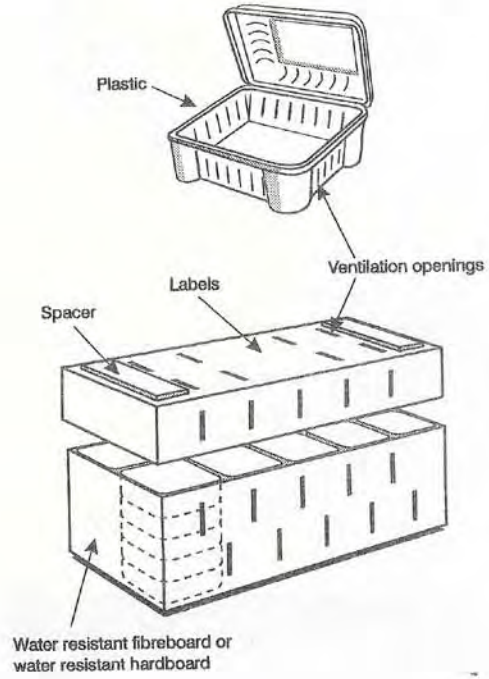


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CONTAINER REQUIREMENT 41 (cont'd)

MULTICOMPARTMENT CONTAINER



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