



# Guthega Skink

*Liopholis guthega*

## Husbandry Manual



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# 1. Introduction

## 1.1 Description

This species was formally described in 2002 (Donnellan, et al 2002) when it was separated from the *Egernia whitii* group. The name *Liopholis* (Fitzinger, 1843) was resurrected in a later paper (Gardner et al., 2008). *Liopholis* means *Lio* 'smooth' and *pholis* 'scales', *guthega* comes from Guthega Dam in the NSW alps., the dam was named for John Guthrie of Bega (a road contractor on the hydroelectric scheme). So we have John Guthrie's (from Bega) skink with shining scales. The Guthega Skink (*Liopholis guthega*) belongs to the reptile family Scincidae, the skinks. This genus is represented in Victoria by four other species – *L. inornata*, *L. montana*, *L. multiscutata* and *L. whitii*. The Guthega Skink is a moderate sized lizard that is diurnal and viviparous. It is pale grey or fawn above, usually with a pale brown or russet vertebral stripe bordered on either side by dark brown or blackish zones and enclosing series of small, white, cream or yellow spots (Cogger 2014). Juveniles are darker in colour than adults, with more prominent spots but less pronounced stripes. Guthega Skinks are known to be colonial, living in extensive warren systems (Green & Osborne 1994; Michael & Lindenmeyer 2010; Wilson & Swan 2003).

Scientific name: *Liopholis guthega*

Common name: Guthega Skink

Other names: Snowy Mountains Rock Skink

## 1.2 Distribution

The Guthega Skink is endemic to Victoria and New South Wales above 1600m in the Australian Alps in the vicinity of Bogong High plains, Victoria and Mt Kosciuszko, NSW.

## 1.3 Status

The Guthega Skink is listed nationally as endangered under the Environment Protection and Biodiversity Conservation Act 1999.

In Victoria it is listed as Vulnerable under the Flora and Fauna Guarantee Act 1988. The species is also listed as Critically Endangered under the Victorian Department of Sustainability and Environment advisory list of threatened fauna

# 2. Housing

## 2.1 Design

### INSIDE HOUSING

Guthega Skinks are housed in glass based terraria (photo.1) with sheet metal 'hoods' and an aluminium framed insect screen door and lid. They measure 110cm W by 55cm D by 65cm to 80cm H. Lighting and heat is provided via fluorescent UVB emitting tubes and mercury vapour basking lamps.

Individuals may also be housed short term (less than 4 months) in smaller all glass terraria with a plastic framed insect screen top (photo 2). They measure 50cm W by 26cm D by 27cm H. Lighting and heat is provided via fluorescent UVB emitting tubes and halogen dichroic 'down lights'.

In the warmer months (October to April) this species is maintained at an ambient temperature of 16°C, though the temperature is raised to 20°C for 6 hours during the day (12 noon to 6pm). At 16°C They have hot spots for basking that range between 28°C and 32°C, and at 20°C their basking spots range from 32°C to 34°C .During the coldest months (May –September) this species is maintained at an ambient temperature to 16°C 24 hours a day. During this period they still have hot spots for basking that range between 28°C and 32°C. The photoperiods and basking periods are also adjusted during the year to simulate the natural changes that occur in the wild. (Appendices 11.7)

A single breeding pair are housed in glass and metal terraria. The terraria consists of a substrate of sand and peat mix provided at two depths to create a hill side of around 50mm at the shallow end and 250mm at the deep end. The deep end also consists of 3 large granite boulders that are half to three quarters submerged in the substrate and touching the base of the terraria, preventing the lizards from digging underneath and dislodging. Shelter is provided via small flat pieces of granite on the surface of the deep end, and the skinks are able to construct their own burrow system. Fresh water is provided in a shallow plastic dish and replaced three times per week.



Photo 1 - Large indoor enclosures





Photo 2 - Small temporary holding indoor enclosures

#### OUTSIDE HOUSING

The outdoor skink enclosures are made from large corrugated metal rings to create a lizard pit (photo.3). Each ring is 105cm high and 300cm diameter. Inside the enclosure consists of a large mound of dirt (surface area between 1 and 2m<sup>2</sup>) and a ring of rocks to hold the dirt in the centre of the pit. The mound also consists of some other large granite rocks and some small grass tussocks and other alpine plants (Appendix 11.8). Around the mound a thick (5 to 10 cm) layer of pebbles (10 to 20mm Ettamogah Red) are laid loosely. This creates a safe space for the keeper to walk and also discourages the skinks from digging close to the edge of the pits.



Photo 3 - Outdoor enclosure

## 2.2 Position

All inside enclosure are housed in a temperature controlled fridge unit where the ambient temperature of the room can be set. The temperature within the room only fluctuates within a few degrees Celsius. The temperature control unit also allows the temperature to be adjusted in 4 different time brackets over a 24 hour period e.g. 12am to 6am, 6am to 12pm, 12pm to 6pm and 6pm to 12am. The room also has 4 small windows which allow the natural outside photoperiods to be sensed.

All outside enclosures are located in an area that receive full sun and all the natural elements and environmental conditions. The pits are enclosed in a secondary mesh, aviary like, structure to protect the skinks from predators. The enclosures receive no artificial lighting or heating.

## 2.3 Base

Inside tanks have a glass base.

Outdoor enclosures corrugated iron ring pit is 15 to 20cm deep into the ground and a thick layer of weed mat is under each pit. Inside the pit the base consists of a layer of coarse gravel around the outer, and a mound of loam in the main centre area.



## **2.4 Substrate**

Indoor enclosures substrate consists of peat moss and brick sand. Brick sand contains clay which allows it to hold its structure. The sand and peat is mixed two parts peat to one part sand. This is mixed when moist until it clumps and holds together when squeezed in the hand. This substrate is provided at a depth of up to 25cm, and is tightly compacted. This allows the skinks to excavate their own burrows. The substrate is kept moist by sprinkling water (on average) three times per week.

## **2.5 Weather protection**

Indoor enclosures are temperature controlled and protected from all outdoor weather conditions.

Outdoor enclosures are exposed to all the natural weather conditions. Some wind protection is offered from the walls of the pit.

## **2.6 Water**

Drinking water is available at all times, fresh water and bowls are replaced three times a week. Indoor enclosures also have water added to the substrate three times weekly to create a moist (not wet) substrate. The amount of water added to the substrate is usually about two to three litres over the course of the week. The most important thing to maintain is the structural holding capability of the substrate. If necessary this can be tested by the method described above (2.4). If in doubt it is better to have a dryer rather than wetter substrate. Outdoor enclosures receive the natural rainfall and the plants are watered weekly during the drier times of year.

## **2.7 Heating/cooling**

Indoor enclosures are housed in a room that in the warmer months (October to April) is maintained at an ambient temperature of 16°C, though the temperature is raised to 20°C for 6 hours during the afternoon (12 noon to 6pm). During the coldest months (May –September) this species is maintained at an ambient temperature to 16°C, 24 hours a day. Indoor enclosures also have heating provided by two different types of basking lamp. In the larger enclosures high wattage mercury vapour lamps (Ultravitalux© 300W or Megaray© 120W) are utilised with the aim being to provide a basking site of around 35°C. The smaller aquaria are provided with a low wattage 12 volt dichroic halogen lamp, again aiming for a basking site of 35°C (usually on rocks, tiles or carefully stacked pavers). The mercury vapour lamps emit high levels of UVB, in addition to this overhead fluorescent lights (Zoo Med T8 ReptiSun 10.0 UVB) are provided to give additional UVB. UVB emitting fluorescent lamps are provided for all enclosures. The 12 volt basking lamps are not known or expected to produce UVB.

This species has been cooled/overwintered two times at different regimes, but both have not been very successful. Winter one (2012) was a four week cool down period to 2°C. In winter two (2013) two different regimes were followed. Regime one had a 7 week cool down period to 5°C. Regime 2 was anticipated to mimic winter air temperatures in Healesville. Unfortunately some health issues arose with skinks at both regimes (refer to 10.2), so they

had to be heated up to 16°C for veterinary treatment. All of these cooling regimes to date have been conducted by removing the skinks from their enclosures and placing them into small ClickClack® containers with a few centimetres of peatmoss and a tile to hide under. The last two winters (2014 & 2015) the Guthega skinks did not get cooled/overwintered. They were maintained at 16°C 24/7, but their photo and basking periods were adjusted to the lighting schedule (Appendix 11.7).

At the time of writing (March 2015) a pair of skinks had been moved to an outside enclosure where they could construct their burrow system. They will be left to naturally cool/overwinter in the Healesville conditions. No additional heating or lighting is provided.

## **2.8 Video points**

Cameras have been used successfully to remotely observe and record activity for this species. Battery operated remote Scoutguard© cameras were suspended inside of the roof of larger enclosures and successfully picked up skink activity. They have also been successfully used in the outdoor pits. Cameras were set to record 15 to 20 second films on either Normal or high sensitivity mode.

## **2.9 Shelter sites**

In the wild Guthega Skinks are known to be a colonial burrowing species that have extensive burrow systems. In captivity we always try to give them the option to make their own burrows as shelter sites. The larger indoor enclosures have a deep layer of substrate (up to 25cm) with large granite rocks spaced amongst it (Photo 4). We also place some smaller flat granite rocks flat on the surface of the substrate. On the initial set up of an enclosure we will make a small burrow under this flat rock to give them an immediate retreat. This, usually within a few weeks, becomes the start of their burrow system. We have dissected four burrow systems, both from the same pair of animals (Photo 5) both burrow systems were quite complex for the area of space they had and weaved around the granite rocks.



Photo 4 - The substrate is compacted around large granite boulders allowing the skinks to construct their own burrow systems





Photo 5- Plaster showing the structure of a pair of Guthega Skinks burrow once the substrate is removed (black line indicates substrate level)



## **2.10 Mixed species enclosures**

This species has currently not been housed with any other species

## **2.11 Things to avoid**

# **3. Transport**

## **3.1 Design**

If transportation is 24 hours or less this species may be transported in small calico bags, which can then be placed in a small ClickClack® container or esky that has ventilation. The animals should be kept at approximately 15 to 25°C and out of direct sun. Longer transportation times would require the animal to be housed in a small ClickClack® container where it would be able to move around and have access to drinking water. Paper should line the bottom of the container to allow the animals to hide under as well as to absorb any soiling of the container. Water may be offered by having a small shallow dish that contains damp to wet sphagnum moss.

When collecting in the field ZV staff have utilised small ClickClack® containers with clear ventilated lids. A 40mm layer of damp peat/sand mix substrate with a tile to hide under and shallow water dish. The water dish is removed while the animals are in transit.

## **3.2 Nest material**

As above

## **3.3 How many in box**

Only one animal should be placed in each calico bag, but multiple bags may be placed in a small ClickClack® container or esky. There should only ever be enough bagged animals in one container to allow good air movement. Shredded paper that is fluffed up may also be used to keep bagged animals from being too compact. If animals are being transported unbagged in containers with substrate as described above then it is best to do singly.

## **3.4 Identification**

VIE (Visible Implant Elastomer) tags have been used for this species at HS with varying degrees of success (i.e. readability has decreased over time). These can be read with the use of small hand held ultra violet torches. Some of the skinks have dark pigmentation at the site of the tags (under hind limb) which can make the reading difficult sometimes (photos 6 and 7).

In the field Trovan Nanotransponders are used in adult skinks (3 years and older). They are implanted in the lower flank and a small drop of tissue glue used to initially seal the insert point (photo 8). VIE tags are used on new born as Nanotransponders are too large for this sized skink. In these sized skinks there is also lack of reliability to be able to read the tags after 12 months.



Photo 6 - VIE tag being implanted into a juvenile skink in the field



Photo 7 - Orange VIE tag visible under the skin of left front leg



Photo 8 - Nanotransponders are placed in the lower flank. Arrow shows lump of the chip. The tip of the needle indicates the point of incision to deliver the microchip just under the skin.

Video of microchipping a Guthega skink in the field:

<P:\LIFE SCIENCES\Threatened Species Programs\Threatened Species\Alpine Skinks\New folder\Microchipping Guthega.MOV>

### **3.5 When to transport**

Always avoid transporting animals in temperature extremes. If transporting in a vehicle always use the vehicle heating and cooling systems to maintain a temperature of approximately 15 to 25°C, and avoid direct sun.

### **3.6 How long in box**

Animals should be fine for up to 24 hours if housed as described above (3.1)

Animals collected in the field and brought back to HS by ZV staff have spent up to four days kept in the plastic tubs enclosures as described above (3.1)

### **3.7 Water and food**

Water should be provided at any time an animal is kept in a 'stable' (non-moving) environment where it can move freely about. Food and water are not necessary during transport (if the transport duration falls within times mentioned above).

### **3.8 Release from box**

New animals arriving into the collection are set up in a quarantine area. Animals are gently removed from boxes or bags by hand. At this time they are inspected by vets and keepers to assess their arrival condition. This species may drop its tail when being handled, so experienced handlers should be used for this process.

## **4. Handling**

### **4.1 Handling bags**

Small calico bags or ClickClack® containers are used for short transfers within the sanctuary grounds. In the field researchers have used small plastic 'zip lock' bags for short term holding of this species for weighing or collecting other morphometric data. At the sanctuary we don't use 'zip lock' bags for general handling, but they have been used for short term handling in medical procedures such as x-raying.

### **4.2 Nets**

As this species is held in enclosures with natural burrows the safest and most consistent way to capture an animal is using a noose. The noose is a 700mm clear plastic tube with a fishing line loop at the end that can be pulled tight when required by an inner plastic rod that runs inside the tube. The noose can be used for capturing the skink as well as holding the bait to tempt the skink out the burrow.

### **4.3 When to handle**

Animals that are hotter are more likely to autotomise their tails than cooler animals. Cooler animals are also much easier to capture, handle and restrain. Therefore capturing and handling animals when they are cool is the preferred option. On a number of occasions caudal autotomy has occurred in this species. Confident and firm handling around the body of these lizards minimises tail loss.

### **4.4 Capture from nest**

Generally Guthega Skinks quickly retreat to their burrow once they see you approaching. They return, usually within a few minutes, to the entrance to see if you are still there. Set your noose up so the loop is hard up against the entrance to the burrow and then drop a Mealworm a few centimetres from the burrow. Once the skink has its head out the burrow and all the way through the noose loop you can quickly but gently pull the loop tight. Gently and quickly pull the skink from the burrow and restrain in your hand to remove the noose from their neck. This process can be done with one person, but can be slightly easier with two people. When using two people one concentrates on noosing the skink and the other uses another noose to hold the Mealworm in the right position to tempt the skink out of its burrow. The person who is holding the Mealworm can also quickly grab the skink once it is noosed to minimise the time the noose is around the animal's neck.

Video of noosing a Guthega Skink in the field:

<P:\LIFE SCIENCES\Threatened Species Programs\Threatened Species\Alpine Skinks\New folder\Noosing Guthega.MOV>

### **4.5 Net capture**

Not applicable.



## 4.6 Weighing

At the sanctuary we weigh skinks by placing them in a small plastic container on digital scales, our digital scales weigh to the 0.1g. Capturing from natural burrows can be unpredictable at times, but we currently aim to weigh them monthly or whenever they are in hand.

In the field hanging spring scales are used. The skink is placed in a 'zip lock' bag and clipped to the hanging scales.

## 4.7 Restraint

Guthega Skinks are best restrained by placing your thumb and index finger each side of the skink's neck, just behind the ears. The other three fingers can then be used to grip the body of the skink (photo 9). You may use your other hand then to adjust your grip if required. Do not grab the tail to restrain or adjust your grip as caudal autotomy may occur. In general this species is not a species that will bite when being restrained and if they do they don't break the skin, but caution should always be taken.



Photo 9 - Restraining a skink

## 4.8 Measurements

Morphometric data such as snout-vent and tail length are recorded when animals enter the collection. In the field the following data are collected; snout vent, tail, head width, fore and hind leg (photos 10 to 16). Once breeding commences in the captive animals this data will also be collected on a regular basis so that growth curves can be developed for this species in comparison to the wild animals. Measurements are taken with a small desk rulers and/or calipers.



Photo 10. Snout vent – Measure from the tip of the snout to the middle of the cloaca (vent)

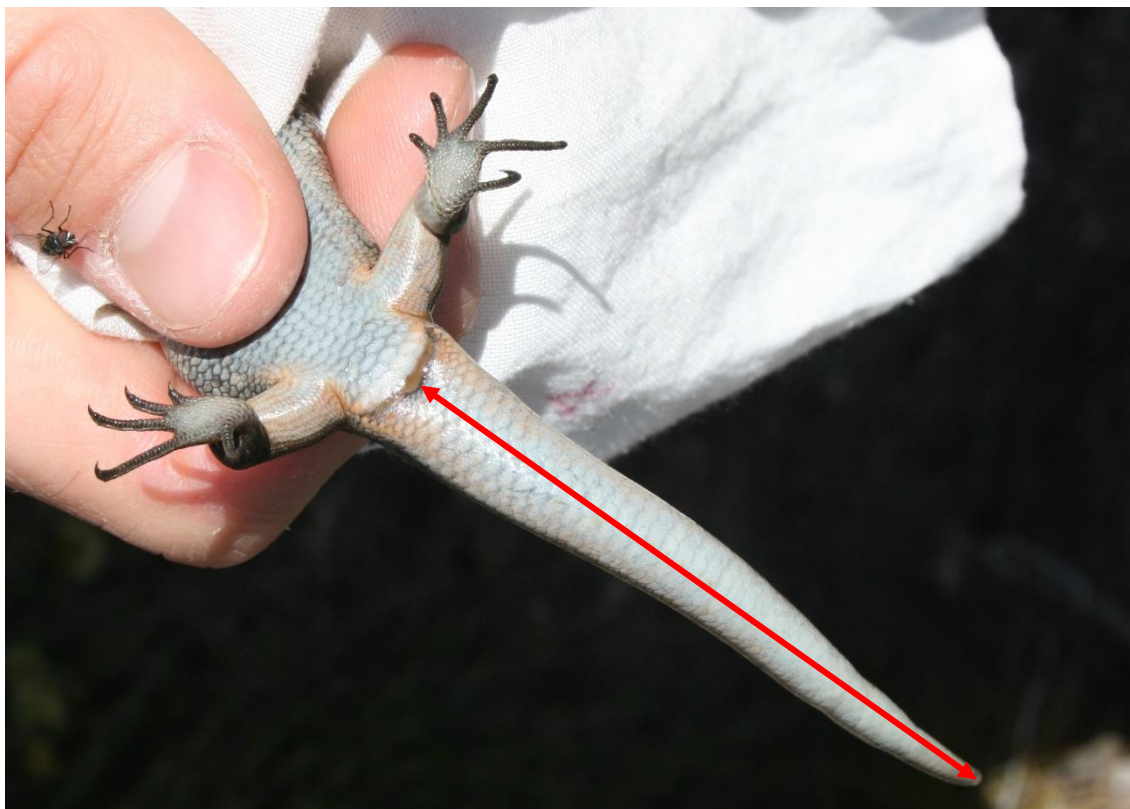


Photo 11. Tail – Measure from the middle of the cloaca (vent) to the tip of the tail





Photo 12. Hind limb – measure on the inner side of the leg from the base of the foot to the junction of the leg and the body.



Photo 13. Fore limb – measure on the inner side of the leg from the base of the foot to the junction of the leg and the body



Photo 14. Skink head width and length being measured with calipers



Photo 15. Head length – measure from the tip of the nose to the back of the skull



Photo 16. Head width – measure the widest point between the ears and the end of the mouth



## **4.9 Releasing**

When releasing an animal from a bag gently pick the animal out of the bag and face the skink towards its burrow. Allow a minute for the skink to get its bearings again and slowly release your grip and the skink should retreat back into its burrow. When releasing from a container, the container can be gently tipped onto its side and the animal can leave the container by itself.

## **5. Field trapping**

### **5.1 Trap types**

Traps are not used to capture this species in the field. The noosing system referred to in 4.2 and 4.4 is used to capture them.

### **5.2 When to trap**

Activity times for this species are October to March. The rest of the year temperatures are generally too cold for this species to be active or there is a thick layer of snow. Snow cover can still be present some years in October.

### **5.3 Bait**

When noosing animals Mealworms are used as bait to encourage them out of their burrows.

### **5.4 Trap cover**

Not applicable

### **5.5 General check**

If the weather is warm enough you will usually see a skink active just outside the burrow or a head just peeking outside the burrow entrance. Once you know a skink is active and which burrow they are in they can be lured out with a mealworm and noosed as explained in 4.2 and 4.4.

### **5.6 Removal from trap**

Once a skink has been noosed it should be quickly and gently restrained by hand as explained in 4.7. Once confidently restrained the noose can be loosened and removed from the skink.

### **5.7 Restraint**

See 4.7

### **5.8 Measurements**

In addition to the measurements shown in 4.8 other data collected in the field include skink body temperature and environmental surface temperature where the skink is seen basking. A digital thermometer gun is used for both temperatures. A fine wire probe is attached to the gun and placed just inside the cloaca of the skink for the body temperature.

A selected sample of animals also have a critical thermal minimum (CTM) temperature test done on them. For this to happen the skink is taken back to a building. The skink is slowly cooled using a container on ice with various layers of rubber matting (The less matting, the cooler it gets). Once the skink gets to a temperature that when turned onto its back it can't right itself after three consecutive turns, this is the skink's CTM. A temperature probe is inserted just inside the cloaca of the skink to record the temperature (photo.17)

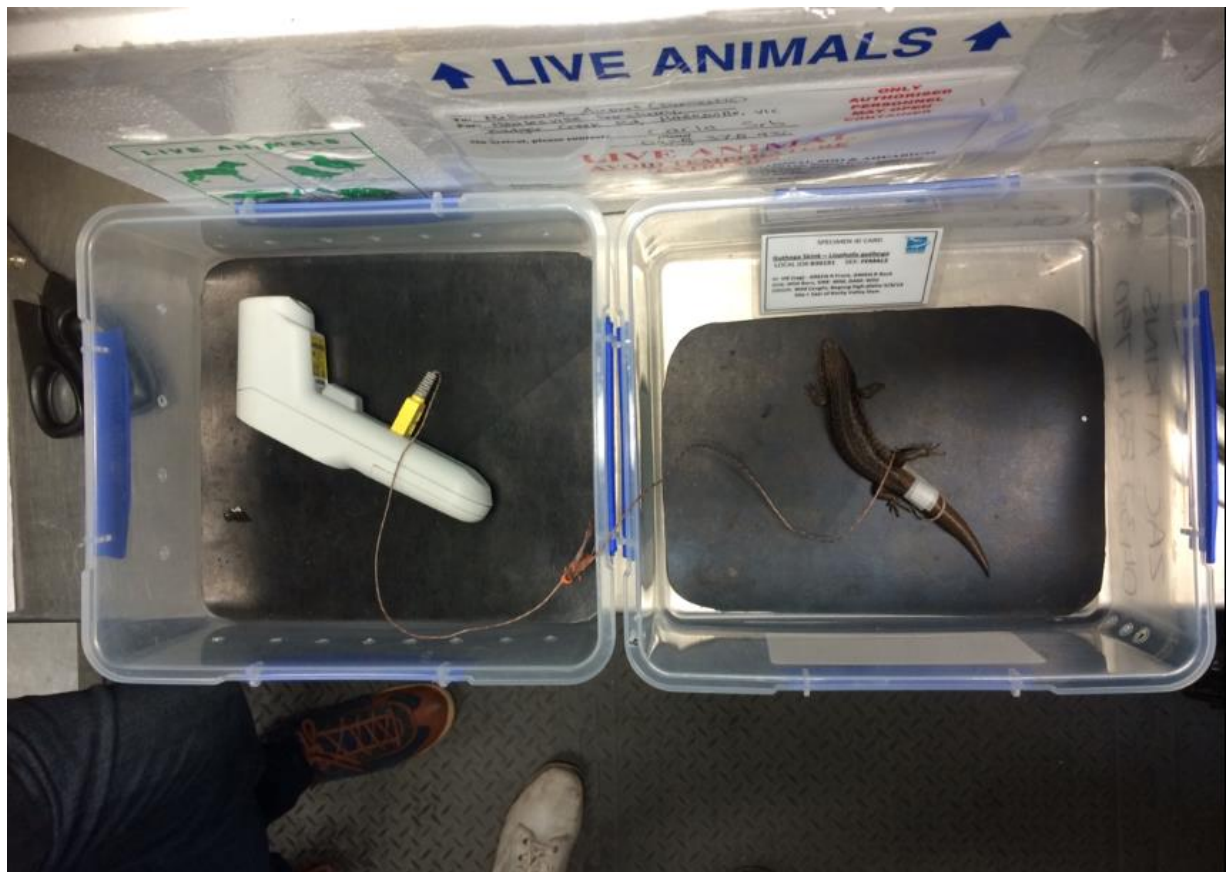


Photo 17 - A skink's Critical Thermal Minimum (CTM) temperature being taken.

## 5.9 Release

See 4.9

## 6. Husbandry

### 6.1 Cleaning routine

Indoor enclosures are cleaned 3 times per week. This entails the manual removal of faeces, uneaten food and any sloughed skin. Food that is removed and instances of skink sloughs are recorded.

Outdoor enclosures currently don't get cleaned, as there has been no obvious accumulation of waste to remove. This will be reassessed once they are kept in this set up long term. It will also be interesting to see if they do have a

communal defecation site in this set up as they do seem to defecate in one area the majority of the time in the inside enclosures. If this is the case it may be important to not remove this, as it may play a role in the social structure of the species.

## **6.2 Changing of materials**

Indoor enclosures have small grasses (*Poa* sp.) that don't live and grow in the enclosures, but are only put there to give some decoration and cover for the animals. Everything that an indoor enclosure is made up of e.g. substrates, plants, logs, etc. is frozen for 2 weeks (preferably 4 weeks). Rocks are not frozen but soaked and scrubbed in hot soapy water and air dried. This is done to decrease the risk of parasites, more specifically reptile mite.

## **6.3 Enclosure maintenance**

The peat/sand substrate is topped up in the larger indoor enclosures one to two times per year. Care must be taken when doing this to not collapse any of the burrow system. As mentioned above the skinks tend to use a defecation site in the large indoor enclosures. A thin top layer of substrate can be removed from the main defecation site and replaced a couple times a year.

The main maintenance in the outdoor enclosures is weeding and maintaining the plants. Weeds need to be manually removed by hand as sprays cannot be used when animals are in the enclosures. It is also best to remove these weeds when they are small and before they have a deep root structure. By doing this there is less chance of affecting the burrow system structure when pulling them out. The enclosure plants need to be watered once a week in the warmer months and pruned to keep under control.

## **6.4 Routine animal checks**

An observation is taken for each enclosure at least once a day. This, along with the time of the observation, are recorded on the animals'/group's observation sheet. The animals activity can be one of the following; B= Basking, A= Active, IU= Invisible unknown.

Each animal is weighed monthly or whenever in hand, except if the animal is hibernating. When we have the animal in hand we also give a quick general visual health check. Looking for any signs of injury or anything out of the usual.

# **7. Diet**

## **7.1 Current diet**

Outside of hibernation all animals are fed 3 times per week. Crickets for a large majority of their staple diet. Other insects are also offered more randomly or when available such as moths, Mealworms, cockroaches, flies, ants, cicadas. Insects are dusted with a 1:1 mix of Rep-Cal® and Herptivite®. Fruit and veg is also offered, but the fruit is kept seasonal being offered more around spring and early summer. Types used are; corn, apple, banana, grape, endive, broccoli, *Coprosma* berries, and other assorted berries such as strawberries, blueberries, raspberries. The fruit and veg is chopped into approximately 5mm cubes. The *Coprosma* berries are harvested from the

sanctuary grounds and the branch is put in the enclosure so the skinks need to pick them off themselves. Skinks in outdoor enclosures are also able to consume any wild insects that enter the enclosure.

## **7.2 Previous diets**

A previous diet consisted of mainly crickets dusted with a 1:1 mix of Rep-Cal© and Herptivite© 3 times per week in the warmer months, and 2 times per week in the cooler months.

## **7.3 Quantity**

Usually between 3 and 6 insects are offered.

## **7.4 Dietary changes**

The offering of fruit and veg is kept seasonal being offered more around spring and early summer. This includes corn, apple, banana, grape, endive, broccoli, *Coprosma* berries, and other assorted berries such as strawberries, blueberries, and raspberries. They are sometimes randomly offered outside of these times, but not on many occasions.

## **7.5 Live food**

All insects are offered live whenever possible which is the majority of the time. Some of the more seasonal opportunistic insects such as moths and cicadas are offered dead in a bowl. This is done due to them being stored frozen and then defrosted before being offered. Cockroaches are always only offered dead, as they can take over the enclosure and become a pest if not eaten.

## **7.6 When to feed**

As this species is diurnal, food is offered during daylight hours. It is preferred that food is offered by midday or not long after, so that the skinks have time to feed, bask and start digestion before the basking lights go off.

## **7.7 Where to feed**

Live insects are placed in the enclosures and free ranging. Fruit and veg and dead insects are placed in a bowl as it is easier to see what has been consumed. *Coprosma* berries are still attached to the branches and either laying down or the stalk of the branch is poked into the ground and the branch standing up (care must be taken to not collapse a burrow when putting a branch in the ground).

# **8. Breeding**

## **8.1 Enclosure size**

Indoor enclosures that consist of a single breeding pair are 110cm W by 55cm D by 65cm to 80cm H. (refer to description in 2. Housing).

When a trio of 1.2 are housed together two of these enclosures are connected using a pipe (photo.18). Aggression has been seen in a trio that were housed in this set up, but this may have been more due to incompatible animals rather than size of enclosure.



At the time of writing, an outdoor enclosure with a surface area between 1 to 2m<sup>2</sup> (refer to description in 2. Housing) house a single adult pair. It is hoped that in the future these enclosures could hold a small colony of up to 4 adults plus offspring.



Photo 18 - Pipe joining two enclosures for breeding. Note logs used to create a bridge to the pipe.

## 8.2 Nesting sites

This species has quite complex burrow systems and the exact structure of these is currently not known. It is also not known if mating and birthing occurs above ground or in the burrow.

## 8.3 Cover

Both indoor and outdoor enclosures consist of live or dried plants to create some cover. Granite rocks and caps (small 5 to 10mm flat pieces of granite) are also provided and entrances to burrows usually start under one of these.

## 8.4 Introduction of animals

Ideally an introduction of new animals should take place in a completely new enclosure where there was no established territory. Animals should be monitored for the first few hours to view the first interactions between animals. We have also used Scoutguard© to monitor interactions and possible

copulating behaviours. We also complete an 'Animal Movement and Introduction Checklist' and get it approved before an introduction.

In our first breeding season we only had one male, so we rotated a female through his enclosure every 3 days. When doing this we found that a larger female was quite aggressive to the male, which led to him appearing to be a little depressed. After a week to recover alone we then left in a smaller female that he seemed to get along with. This pair has lived together since. This male was smaller than all the females in this rotating introduction strategy, and after further investigation it is believed he was not sexually mature. When introducing new animals to each other age and weight should be taken into account.

In our second breeding season we still only had the one male. He had a snout vent length of a sexually mature animal, but was still a year younger than a wild sexually mature animal. Instead of rotating females this time we connected the neighbouring female's enclosure using a pipe and gave her access. Initial interactions were not aggressive, but they slowly escalated over a couple of weeks and the single female not from the established pair received some more serious bites and lost the tip of her tail. The single female was separated after this. Camera footage showed both the other male and female being aggressive to her, but the majority of it come from the other female. Aggression included chasing and vigorous biting of the abdomen and tail. Also shaking of the skink when biting was noted on a few occasions. This supports observations made by La Trobe University Ph.D. student Zak Atkins (pers. comm.) suggesting that aggression between females may occur, but it may be less aggressive between related females.

## **8.5 Animal checks**

Initial introductions are watched for the first few hours to see initial interactions. Cameras are also used and review of the footage is done once a week or when anything of concern may be seen or suspected. Animal enclosures are also visually checked one to two times a day.

## **8.6 Aggression**

See 8.4

## **8.7 How long paired**

See 8.4

## **8.8 Age estimate**

It is suggested that wild Guthega Skinks are sexually mature at 4 years of age when they reach a snout vent length of >80mm SVL.

## **8.9 Weaning weight and age**

Not applicable

## **8.10 Timeline**

The breeding timeline of Skinks is currently not completely known. In the wild they are obviously gravid in early December and birthing in mid to late February.

## **9. Record keeping**

### **9.1 Identification**

See 3.4

### **9.2 Daily records**

Daily observations are made of all skink enclosures. The time and activity of the skink is recorded at least once a day at a random time. Additional comments are also noted for anything out of the ordinary in regards to the skink's condition. All food that is offered and removed is recorded as well as when a skink sloughs its skin. Animal weights are recorded 3 monthly or whenever in hand. Changes to room temperatures and basking light durations are noted in daily reports.

### **9.3 ZIMS report**

Reports are made daily.

### **9.4 Studbook**

No studbook developed for this species

## **10. Health and Vet care**

### **10.1 Quarantine**

Wild caught animals undergo a 30 day quarantine period. In this time they must have 2 consecutive negative faecal samples. If anything is noted during the faecal examinations it is treated as directed by veterinarians/AWHC staff, with the necessary associated extension of quarantine time.

### **10.2 Examination and health problems**

To date the most significant health issues identified in the Guthega Skinks are:

Fungal dermatitis: Nine out of 13 captive Guthega Skinks presented with signs of dermatitis during or shortly after hibernation in 2013. Five of these skinks died, with pathology identifying a mixed infection of the skin with the fungus *Lecanicillium sp.*, yeast *Candida guilleirmondi* and bacteria *Myroides odoratus*. The four remaining affected skinks received treatment with systemic and topical antifungal and antibacterial medications, and were treated with medicated baths (F10 1:250 dilution). These organisms rarely cause disease in their own right, and are typically considered opportunistic pathogens, suggesting the affected skinks had a depressed immune system which would be consistent with the process of hibernation.

Reptile mite infections: Mites have been seen on Guthega Skinks. Treatment using a synthetic pyrethroid (Top of Descent) was trialled on two animals to

assess for toxicity prior to treating the remaining animals. The two Guthega Skinks developed signs of acute toxicity, with neurological signs including muscle spasms, seizures, and difficulty righting. Both skinks were provided with supportive care – one skink recovered, whilst the other skink died a short time later with evidence of gout. The cause of toxicity in this situation is unclear – it may have been related to increased species sensitivity, the dose the animals were given, or the temperature of the animals at the time of treatment (synthetic pyrethroids are reportedly more toxic at cooler temperatures, and the skinks were cooling at the time of treatment). (Lancaster 2013)

### **10.3 Handraising**

Not applicable

## **11. Appendices**

### **11.1 Transport box designs**

Transport for this species has so far only been done utilising plastic ClickClack© brand containers. Opaque sides with transparent lids, and external clips that hold the lid in place and ventilation holes drilled into the lid. These were intended as both short-term (in the field) holding quarters and then transport containers.

### **11.2 Suppliers list**

Not applicable

### **11.3 Check list**

Not applicable

### **11.4 Growth curve**

Not known but will be established once the species breeds in captivity.

### **11.5 Participating institutions**

No other zoological institutions are currently holding this animal but all work and research done in consultation with staff at Arthur Rylah Institute.

### **11.6 Recommended reading**

Atkins, Z. et al. 2015, 'Does Shelter Site Selection Aid Persistence of a Threatened Alpine Lizard? Assessing *Liopholis guthega* Populations a Decade after Severe Fire in Southeastern Australia'. Journal of Herpetology, Vol. 49, No. 1.

<http://www.environment.gov.au/biodiversity/threatened/species/pubs/83079-conservation-advice.pdf>



## 11.7 AS 1. GUTHEGA SKINK ANNUAL LIGHTING SCHEDULE 2014/15

DATE	ROOM/ENCLOSURE LIGHTS ON	BASKING LIGHTS ON	BASKING LIGHTS OFF	ROOM/ENCLOSURE LIGHTS OFF	TOTAL ROOM/ENCLOSURE LIGHTS	TOTAL BASKING LIGHTS
January	7am	7:30am	7pm	7:30pm	12.5	11.5
February	7:30am	8am	6:30pm	7pm	11.5	10.5
March	7:30am	8am	6pm	6:30pm	11	10
April	8am	8:30am	5pm	5:30pm	9.5	8.5
May	8am	8:30am	4:30pm	5am	9	8
June	8:30am	9am	4pm	4:30pm	8	7
July	8:30am	9am	4pm	4:30pm	8	7
August	8am	8:30am	4pm	4:30pm	8.5	7.5
September	8am	8:30am	5pm	5:30pm	9.5	8.5
October	7:30am	8am	6pm	6:30pm	11	10
November	7am	7:30am	6:30pm	7pm	12	11
December	7am	7:30am	7pm	7:30pm	12.5	11.5

\*Light changes in skink facility. The timers will be set as Daylight Saving Time (DST) all year and will not be changed to reflect Australian Eastern Standard Time (AEST). Please make changes as listed in table.

## 11.8 Plant list

Mountain Plum Pine - *Podocarpus lawrencei*

Trigger Plant – *Stylidium graminifolium*

Periwort – *Sagina subulata*

*Dichondra micrantha*

Mini Mel – *Melaleuca linariifolia dwarf*

Shagpile – *Casuarina glauca prostrate*

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taxonomy of the Egernia group (Reptilia: Scincidae). Zoological Journal of the  
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[http://wikiski.com/wiki/index.php/Australian\\_Geographical\\_Name\\_Derivations](http://wikiski.com/wiki/index.php/Australian_Geographical_Name_Derivations)

Lancaster, M. (2013). ALPINE SKINK CAPTIVE BREEDING PROGRAM  
Review 2012-2013, Zoos Victoria internal document.