

# Husbandry Manual for Frilled Lizard



*Chlamydosaurus kingii* Gray, 1825

## Reptilia: Agamidae

Compiler: Tim Brooks

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Western Sydney Institute of TAFE, Richmond

Captive Animals Certificate 3 1068

Lecturers: Graeme Phipps

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# 1 Introduction

Otherwise known as the ‘cloaked-lizard’, the Australian Frilled Lizard (*Chlamydosaurus kingii*) is truly a unique creature. Its spectacular frill is used for defence and communication. This distinctive reptile loves the sun and is a member of the dragon family (agamidae). Like most lizards it is active during the day. The energy absorbed from the sun warms its body allowing it to feed and run quickly ( ARAZPA 2002 ).

“Chlamys” comes from the Greek language and means “cape” or “cloak”. The species name refers to Philip King Parker (1791-1856), an admiral in the British navy (STORR et al. 1983). *Chlamydosaurus* is a monotypic genus. For many years the question has been asked whether there is really only one species of Frilled Lizard. Are the significantly differently coloured and marked populations of Indonesia not an entirely different species?. Whether a thorough examination of the status of these lizards would result in three species or two species is uncertain but both variants are possible (Hauschild & Bosch 2004).

The Frilled Lizard qualifies for the descriptive word bizarre, as there is no other species on earth with a frill. The Frilled Lizard is one of 300 old world “chiseled –toothed” lizards of the Agamidae family that occurs throughout Africa, Asia and New Guinea, of which 65 species call Australia home. Unlike skinks and geckos, agamid lizards are unable to drop parts of their tail and if broken do not grow back or regenerate (Clifford & Dawn Frith 1987).

It seems somewhat ironic that the one reptile Australia is particularly famous for, the fascinating Frilled Lizard. Many travelers through southern regions regularly report seeing a “Frilled Lizard” in the wild, but in reality, have spotted a Bearded Dragon with its “beard” displayed. A decade ago not many zoos or individuals kept “frillies”, as captive breed stock was hard to obtain and quite difficult to keep.

The Frill-necked Lizard, or Frilled Lizard also known as the Frilled Dragon, is so called because of the large ruff of skin which usually lies folded back against its head and neck. The frill is supported by long spines of cartilage, and when the lizard is frightened , it gapes its mouth showing a bright pink or yellow lining, displaying bright orange and red scales. The frill may also aid in thermoregulation.

The frilled lizard spends 90 percent of its time in the trees. It is a ‘sit-and-wait’ predator which surveys the ground, leaping on food such as ants, termites and other invertebrates when they show themselves. Studies have shown that in the dry season when food is scarce, a frilled lizard will climb up into the canopy of a tree and stay there for up to three months as its metabolism drops by as much as 70 percent. The lizard is aestivating – the equivalent, in a hot climate, of hibernation. By dropping its energy requirements, it can thus survive a period of food shortage. To lower its metabolic rate the lizard must also

keep cool so, instead of basking in the sun it keeps in the shade, shifting around the trunk of the tree if necessary to avoid the sun

[www.epa.qld.gov.au/register/p00820al.pdf](http://www.epa.qld.gov.au/register/p00820al.pdf)

- Care must be taken when handling this species as they have sharp claws as well as strong jaws and it is the only known species of reptile to have canine teeth, which can inflict a painful bite.
- The lizards may also lash with the tail with enough force to draw blood from a human hand (Bedford, 1995).

### **P.P.E (Personal Protective Equipment).**

- Face mask – To stop the inhalation of dust particles that may be present in the substrate when exhibit is being cleaned.
- Thick work pants – To protect against claws if the animal climbs persons leg seeking the highest point.
- Hat – To prevent animals from climbing onto persons head.
- Anti-septic Hand wash – For use after handling animal(s).To prevent the spread of disease. (See Appendix)
- Gloves – For handling protection.

## 2 Taxonomy

### 2.1 Nomenclature

Class: Reptilia  
Order: Squamata  
Suborder: Sauria  
Family: Agamidae  
Genus: Chlamydosaurus  
Species: kingii

### 2.2 Subspecies

None Described.

### 2.3 Recent Synonyms

None Found.

### 2.4 Other Common Names

King's-cloaked Lizard, Frilled Dragon, Frilly, Bicycle Lizard, Frilled-neck Lizard, Blanket Lizard.

## **3 Natural History**

### **3.1 Morphometrics**

#### **3.1.1 Mass And Basic Body Measurements**

Compared to females, males have larger frills, longer jaws, and wider heads for a given snout vent length (SVL) + are more than twice as heavy.

Adult male (SVL) – 290mm  
Mass – 870g

Males have hemipenal bulges located at the base of the tail, just behind the vent. Males also have enlarged preanal pores in an inverted V-shaped row just in front of the vent. In mature males, these pores will secrete a waxy substance (Repashy 2006).

Adult female (SVL) – 235mm  
Mass – 400g

Female Frilled Dragons do not have the hemipenal budes seen in the male. The area directly behind the vent is more of a smooth mound without the visual division. Females also have the V-shaped row of pores but they are small (Repashy 2006).

Total body length for both sexes is 90 – 95cm

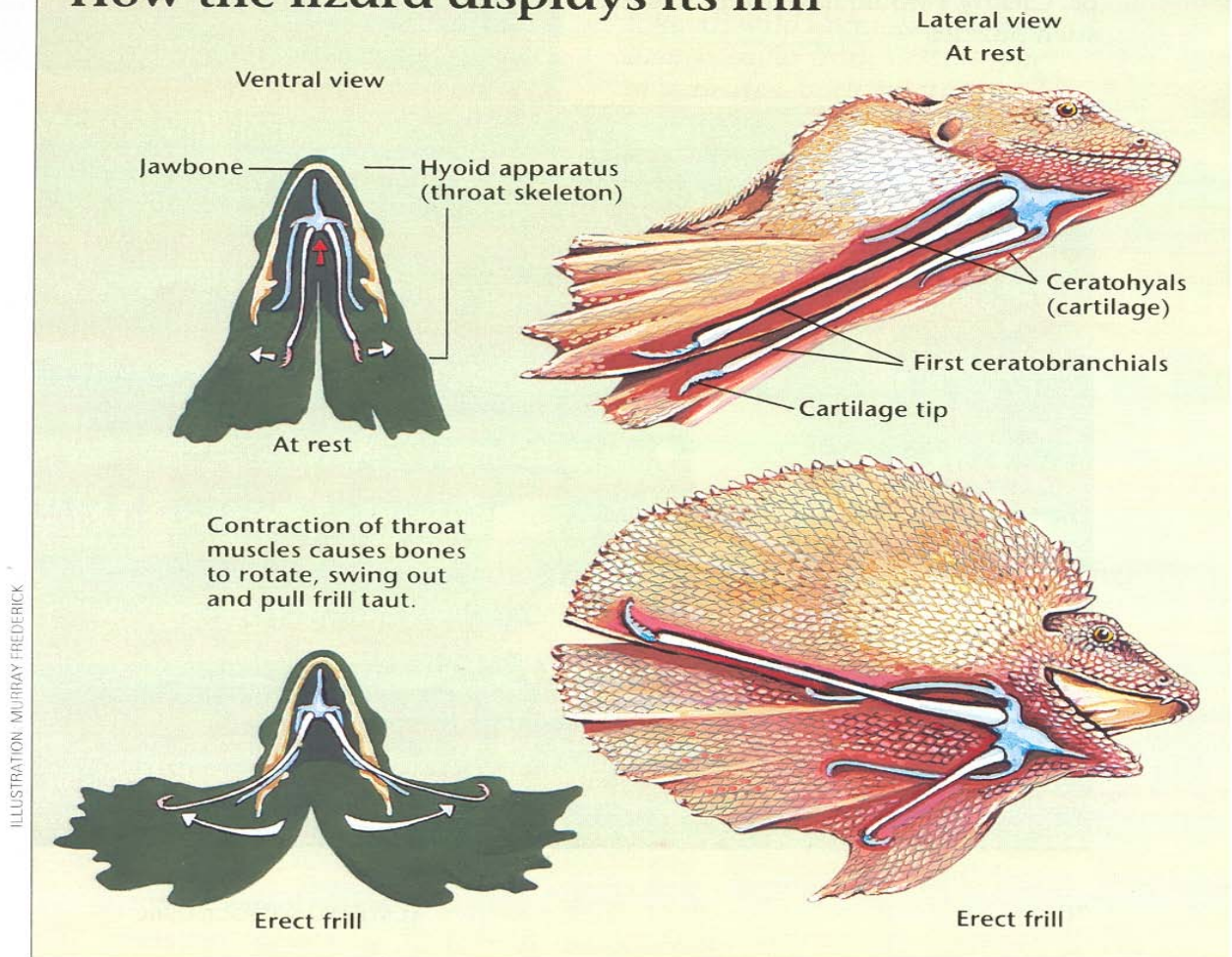
Frilled Lizards from the Northern Territory are larger in numbers and size than conspecific males from Queensland, but females from both these areas are similar in body size (Toro 1999).

#### **3.1.2 Distinguishing Features**

The Australian animals differ in both colour and markings from those in New Guinea. The populations found in Queensland also differ in colour from those found in the Northern Territory. The brightest colours are found on animals from the north and northwest. The Queensland populations tend more to a somber brown or grey (HOSER 1989). The populations in the Northern Territory are larger than those in Queensland (Hauschild & Bosch 2004).

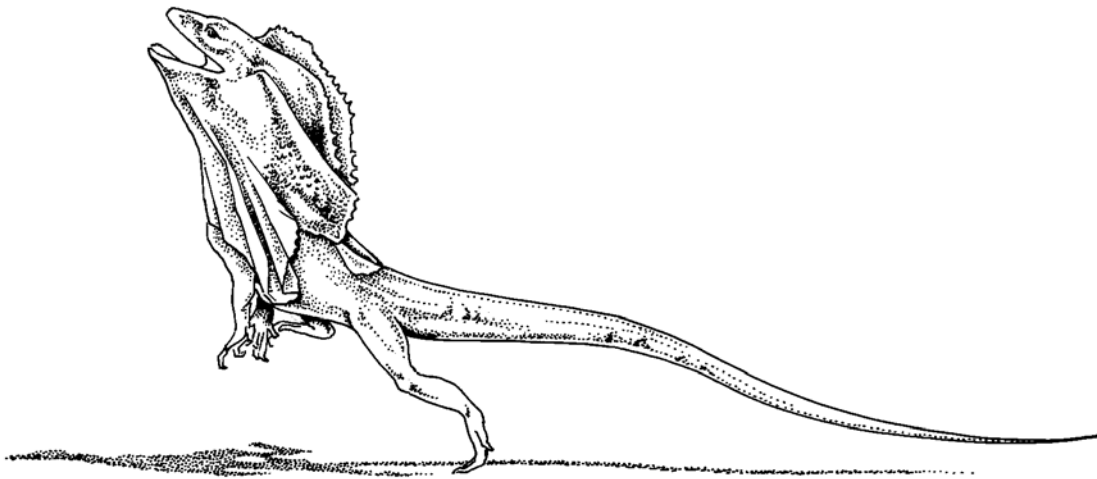


## How the lizard displays its frill



Picture from Australian Geographic Number 28 OCT – DEC 1992 Page 69.

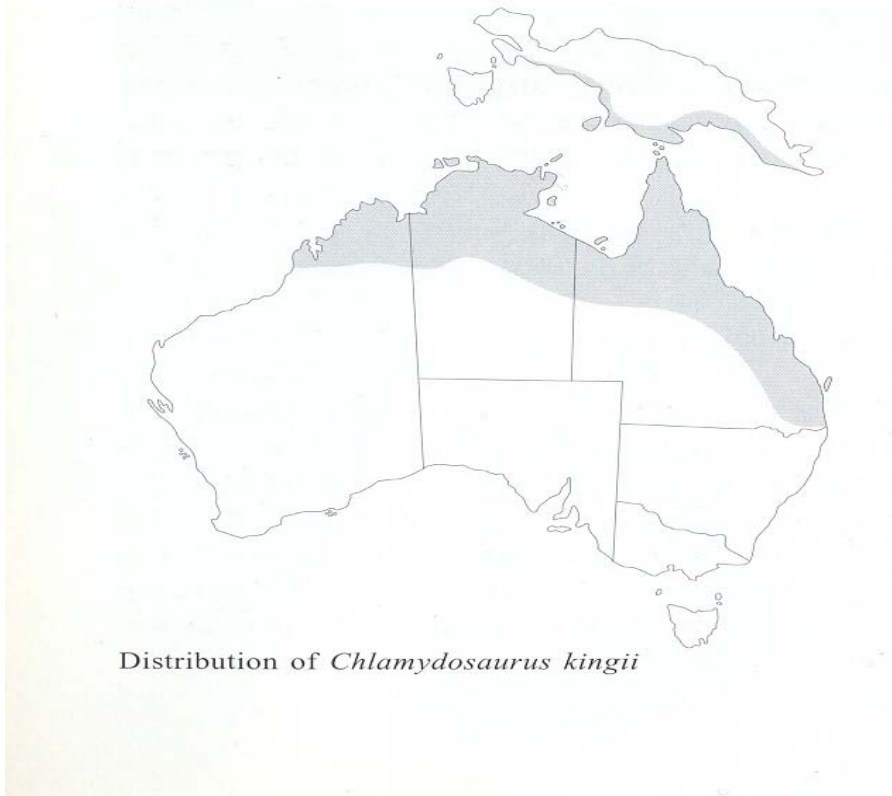
If the animal is startled it opens its mouth and flexes the muscles running from the hyoid apparatus (throat skeleton), through the neck frill like the spokes of an umbrella. (Refer to top left picture) (Hauschild & Bosch 2004).



Bipedal running gait of *Chlamydosaurus kingii*. (After photo by J. Weigel/ANT) [R. Plant]

### **3.2 Distribution and Habitat**

Distribution: *C. kingii* is found across the northern end of Australia, including the Kimberley in W.A, the north of the Northern Territory, Cape York Peninsula and eastern Queensland. They also extend to southern New Guinea (Cogger 1992; Toro 1999).



Habitat: Frilled Lizards are a diurnal lizard which favour tropical to warm temperate dry forests, woodlands and savanna woodlands, usually with an open shrubby or tussock grass understorey. (This reptile chooses to dwell in trees) (ARAZPA 2000).

Microhabitat: Most of the time is spent on trunks and limbs of standing trees. Frequently descends to the ground after rain. (Wilson & Knowles 1988).

### **3.3 Conservation Status**

Possibly secure, but threatened by land clearing and predation by feral cats and foxes (CRONIN 2001).

Common in Brisbane area until 1960s; population from south of Gympie have since declined dramatically and are probably endangered (Wilson 2005).

### **3.4 Longevity**

#### **3.4.1 In the Wild**

The lifespan of a Frilled Lizard in the wild is unknown (ARAZPA 2000).

#### **3.4.2 In Captivity**

In captivity it is about 20 years (ARAZPA 2000).

#### **3.4.3 Techniques Used to Determine Age in Adults**

Once the animal has reached maturity, there is no way to distinguish the age of the animal.

Sexual Maturity In Males: 190mm SVL (snout vent length).

Females: 175mm SVL (snout vent length).

(Peter Harlow, Michael Mcfadden pers.comm.).

## 4 Housing Requirements.

### 4.1 Exhibit Design.

#### 1) Temperature

The desired temperature at the hot end of the exhibit should be around 35° to 38°C and a cooler end at around 24° to 27°C. If night time temperatures fall below 18°C a night heat lamp or ceramic heat emitter can be used to provide enough heat to keep the animals warm on cold night as these heating elements give off little light.

[www.blognow.com.au/reptiletrader/40808/Care\\_Sheet\\_-\\_Frimled\\_Neck\\_Lizards.html](http://www.blognow.com.au/reptiletrader/40808/Care_Sheet_-_Frimled_Neck_Lizards.html)

- a) Frilled lizards are ectothermic and maintain their preferred body temperature by positioning themselves in relatively warmer or cooler positions as required/desired. Consequently it is critical that an appropriate 'thermal gradient' exist within enclosure so that Frilled Lizards can regulate their body temperatures sufficiently by shifting between appropriately warmer and cooler positions in the enclosure. In the case of arboreal species such as this one, this thermal gradient must be present at elevated positions (E.A.P.A. 2004)
- b) Light globes must be designed and positioned so that they prevent injuries to the animal(s) (E.A.P.A. 2004)
- c) Temperature readings should be taken regularly at the site where the animal(s) spends substantial amounts of time, or be constantly monitored using a maximum – minimum thermometer or thermostat to ensure that extremes of temperature are prevented (E.A.P.A. 2004)

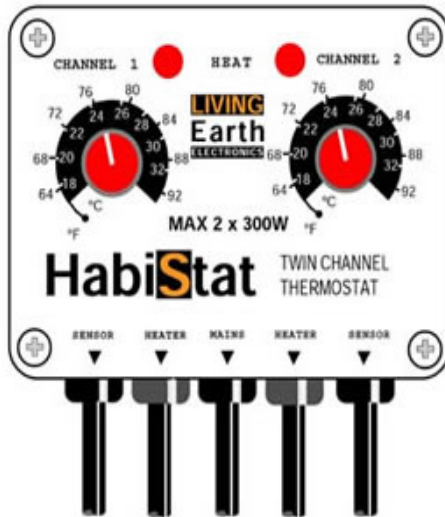


#### **PE-3 Temp Gun**

See website for more details:  
[www.tempgun.com/specs.html#pe3](http://www.tempgun.com/specs.html#pe3)

## Twin Channel Thermostat

See website for more details  
[www.herpsshop.com.au/pdf/TwinOz.pdf](http://www.herpsshop.com.au/pdf/TwinOz.pdf)



### **2) Ventilation**

Ventilation is usually dealt with when Frilled Lizards are housed in indoor enclosures. Respiratory infections may be caused from cold air or draughts as a result of ventilation being over done. If ventilation is inadequate, in hot areas, particularly during summer, enclosures may over heat. For the purpose of ventilation a greater area should be provided.

Enclosures should have vents located on the rear wall, which faces the wall of a room. Vents located on the lid of an enclosure can lead to greater heat loss. Ventilation should never be eliminated or ignored but should be kept to a minimum in cooler areas of Australia. (Green & Larson 2001).

Adequate ventilation, sufficient to allow movement of air without causing excessive draft, is essential in reducing humidity, and consequently excessive fungal and bacterial activity as well as high temperatures. (E.A.P.A 2004)

### **3) Humidity**

Humidity levels for Frilled Lizards should be maintained between 50 - 70% and this can be provided by supplying lizards with a large shallow bowl. Respiratory infection may occur if humidity levels become too high.

[www.blognow.com.au/reptiletrader/40808/Care\\_Sheet -  
Frilled Neck Lizards.html](http://www.blognow.com.au/reptiletrader/40808/Care_Sheet_-_Frilled_Neck_Lizards.html)

#### 4) Lighting

Photoperiod helps stimulate the control of activity, reproduction, and other physiological functions in Frilled Lizards.

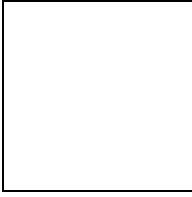
Full spectrum lighting is specially manufactured for reptiles and provides them with beneficial light waves similar to that of the sun. Fluorescent lighting is the cheapest light source to run over long periods. BUT ANY OLD FLUORO WILL NOT DO. It should produce high levels of UVB wavelengths which help prevent Metabolic Bone Disease and strengthen and improve growth in lizards as well as producing high levels of UVA wavelengths which help to increase appetite and normal behaviour, eg. Reproductive behaviour. An example of full spectrum lighting is Zoo-med Reptisun 10.0 UVB and Exo-Terra Repti Glo 10.0. These should be placed no more than 300mm above the lizard, as its effectiveness is greatly reduced with distance. Full spectrum lighting should be replaced approximately every 12 months, as their effectiveness diminishes with age (ie. with long term use).

(Green & Larson 2001)

##### Note

Most reptiles benefit from a seasonal shift in daily photoperiod. This can be provided within the indoor enclosure by adjusting the daily commencement of 'dawn' and 'dusk' in order to mirror what is happening naturally outside. (E.A.P.A 2004)

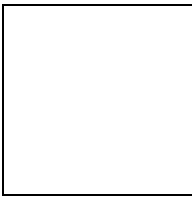




**SOLARMETER**

**MODEL 6.2 UV METER**

<http://www.solarmeter.com/model62.html>



**4.2 General principles**

- 1) Frilled Lizards must be kept in conditions that ensure temperatures, humidity and light cycles are appropriate to the species and allow normal physiological functioning and behaviour. *(E.A.P.A 2004)*
  
- 2) Different species of reptile may be kept together within an enclosure provided that relevant factors, including feeding habits, relative sizes and interspecific compatibility are adequately taken into account. *(E.A.P.A 2004)*
  
- 3) Frilled Lizards must not be kept in areas with excessive noise or vibration, or which are subject to excessive temperature fluctuations. *(E.A.P.A 2004)*
  
- 4) Care must be taken when introducing Frilled Lizards to an enclosure, including consideration of any effects this may have on the introduced animal, as well as on any reptile currently occupying the enclosure. Further, all introductions must be carefully monitored. *(E.A.P.A 2004)*
  
- 5) Enclosures for this species must be constructed and landscaped to allow safe access of the entire enclosure and its inhabitation by the keepers.



*(E.A.P.A 2004)*

### **4.3 Holding Area Design.**

### **4.4 Spatial Requirements.**

For this species a good size enclosure would consist of the following dimensions: 238cm (L) x 238cm (W) x 240cm (H) for a single pair of Frilled lizards. (EAPA Standards 2004).

Area should be increased by 20% for each additional specimen over one or two specimens. (EAPA Standards 2004).

### **4.5 Position of Enclosures.**

Reptile enclosures must face north if they are kept outdoors. Indoors, position doesn't matter.

### **4.6 Weather Protection.**

In lower states, all enclosures must be kept indoors. Hence they are protected from the weather. In northern states, if kept in aviaries, waterproof a quarter to half of the aviary roof, this should provide sufficient shelter (Michael McFadden pers. com.).

### **4.7 Heating Requirements.**

See section 4.1

#### **4.8 Substrate.**

Below is a list of substrates that can be used for Frilled Lizard exhibits:

Melbourne Zoo uses just plain river sand (Mike Swan pers. com.)

Taronga Zoo uses a sandy soil mix with eucalypt leaves scattered on top. (Michael McFadden pers. com.)

Sydney Wildlife World uses eucalyptus mulch (pers. obs.)

- a) Whilst a sterile – type setting, e.g. paper substrate, is adequate for off - exhibit holding areas, this is not a suitable substrate for the exhibition of reptiles (E.A.P.A 2004)
  
- b) The substrate must keep the reptiles dry, and therefore must be deep enough to achieve this. (E.A.P.A 2004)

#### **Note**

A variety of substrates may be used, including gravel, sand, peat, exfoliated bark and leaf litter. Soil is not recommended for indoor exhibits. When choosing a substrate an exhibitor should consider the possibility that small particulate substrate may be consumed with the diet and cause serious internal problems. Materials that swell when they are swallowed should not be used. (E.A.P.A 2004)

- c) Where practical natural substrates must be chosen which reflect the known habitat of the species in the wild. (E.A.P.A 2004)
  
- d) Hatchling Frilled Lizards can be kept on newspaper. Newspaper is inexpensive and easy to clean and stops young Frilled Lizards from ingesting sand when they grab feeder insects (Repashy 2006).

#### **4.9 Nest Boxes or Bedding Material.**

Not required for this species as it will choose to sleep on branches at elevated positions ( Michael McFadden pers. comm.).

#### **4.10 Enclosure Furnishings.**

- a) The interior design and landscaping of enclosures must portray appropriate aspects of the habitat of the species, and where practical

**Note**

The purpose of the visual barrier is to allow this species to ‘feel’ hidden. The visual barrier should allow the reptile to be at least partially obscured from visitor’s view and allow it to rest in a position where it cannot see the visitors, but which, however, still allows the reptile(s) to be seen by visitors. At least one high visual barrier must be provided for Frilled Lizards (E.A.P.A 2004).

must include furnishings that encourage natural behaviour.  
(E.A.P.A 2004)

- b) To allow natural behaviour, sun – basking species, held indoors, must be provided with a ‘basking’ site such as a rock slab or log, upon which a radiant light/heat source must be directed for appropriate periods of time, at an appropriate intensity. Supportable applications for exemptions from this requirement will be considered by the General – Director.  
(E.A.P.A 2004)
- c) At least one visual barrier must be provided (not at the low end of the temperature range). (E.A.P.A 2004)
- d) Climbing branches must be provided for Frilled Lizards as they are an arboreal reptile species. (E.A.P.A 2004)

## **5 General Husbandry**

## **5.1 Hygiene and Cleaning**

- 1) Faecal and urine wastes and uneaten food must be removed daily, and the substrate regularly cleaned or replaced should be provided that a small amount of faeces can be left each time the cage is cleaned, as the pheromones which are released mark the cage with the animal's own scent. (E.A.P.A 2004)
- 2) Hard surfaces of enclosures, perches, and water ponds/bowls must be cleaned regularly to prevent the accumulation of faecal matter and urine. (E.A.P.A 2004)
- 3) Presenters must advise members of the public to thoroughly wash their hands after touching this species (E.A.P.A 2004).

### **Note**

Unless hands are thoroughly washed, bacteria (particularly *Salmonella* spp.) and other pathogens associated with reptiles may be ingested after contact either directly from the hands or via food that is consumed. Though any individual is potentially susceptible to disease as a result of such exposure, it has a high potential to cause disease in individuals with weak immune systems.  
(E.A.P.A 2004)

## **5.2 Record Keeping**

Detailed records of the following activities and parameters should be kept for this species:

**5.2.1 General Information** - Place of origin; wild caught or captive bred; date of hatching if available; date of arrival; body weight and length (both total and snout-vent lengths) at time of arrival.

**5.2.2 Feeding** – For those animals fed less frequently than daily, records should be kept of feeding dates, quantities and food type. Also record the environmental temperature at the time of feeding. It is also helpful to keep record of the dates of defaecation and appearance of faeces and urates.

5.2.3 Measurements – Record body weight and lengths every 6 months, or more frequently if possible. Should be recorded monthly for juveniles under 12 months old.

5.2.4 Ecdysis – Record date of occurrence and any problems encountered.

5.2.5 Observations – Behavioural notes, breeding, disease conditions and treatments.

SPECIES _____	ID _____
NAME _____	ACC _____
ORIGIN _____	SEX _____
ARRIVED _____	CLASSIFICATION _____

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Above is an example of a animal card used at Taronga Zoo.

**5.3 Methods of Identification**

- Micro chipping.
- Sexual differences.
- Photo Identification.
- Digit Removal.

**5.4 Individual Characteristics**

- Patterns.
- Size.
- Colouration.

### **5.5 Routine Data Collection**

- Length of the animal; SVL (snout - vent length).
- Weight.
- Feeding Regime; (volume & type of food given).
- Vet checks / medication.
- Soft or hard stools.
- Courtship displays (mating, egg laying).

## 6 Feeding Requirements

### 6.1 Wild Diet

Frilled Lizards are “sit-and-wait” hunters and will watch carefully for any suitable passing prey (Hauschild & Bosch 2004).

In the wild mainly arthropods insects (e.g. termites, grasshoppers, caterpillars, beetles & cicadas which are caught on trees) and arachnids like centipedes, spiders etc are consumed by Frilled Lizards. Also Frilled Lizards will eat small mammals should they come within striking distance (Hauschild & Bosch 2004).

Small prey like ants, beetles and termites are hunted actively and devoured by Frilled Lizards by the hundreds or even thousands in one sitting, particularly when insects are swarming or hatching during the wet season. (Hauschild & Bosch 2004).

The Frilled Lizard hunts in the trees for spiders and insects like cicadas. It goes to the ground looking for ants, grasshoppers, small mammals and small lizards. (ARAZPA 2000).

### 6.2 Captive Diet

#### Taronga Zoo:

- Feed frilled lizards predominantly House Crickets (*Acheta domesticus*), but add in other invertebrates such as African Migratory Locusts (*Locusta migratoria*) and Speckled Roaches (*Nauphoeta cinerea*). Insects are coated in calcium or multivitamins.
- Feeding increases in Spring and Summer throughout the breeding season to ensure the females have sufficient energy to replenish energy used during breeding.
- The varied diet ensures the animals get a range of prey which may be beneficial in terms of nutrition and also in terms of enrichment.
- Lizards are fed 3 times a week (Michael McFadden pers. comm.).

#### Melbourne Zoo

- Insects (Grasshoppers, Crickets etc).
- No breeding / non- breeding diet.
- No alternative diets used.
- Lizards are fed 3 times a week.

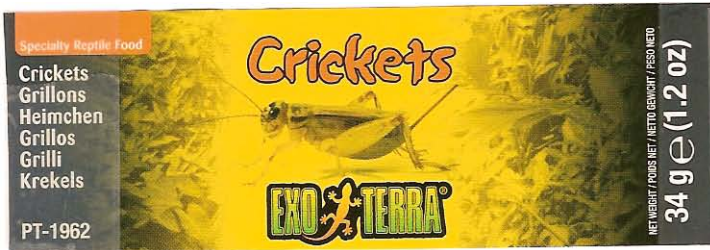
(Mike Swan pers. comm.).

### Australian Reptile Park

- Frilled Lizards fed pinkies, Crickets and Greens.  
Greens Include: Endive, spinach, Bok choy and Choy sum or other dark leafed asian vegetables & fruit are suitable.
- Food is increased for the breeding season and supplemented more with calcium.
- Diet kept as natural as possible.
- Lizards are fed 3 times a week.

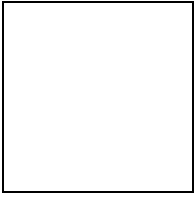
(Sam Chatfield pers. comm.).

Other live insects that can be fed to Frilled Lizards are silkworms & silkworm moths (*Bombyx mori*) as well as commercially prepared insects. See below:

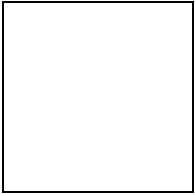




### 6.3 Supplements



**Rep-Cal Calcium with Vitamin D3**



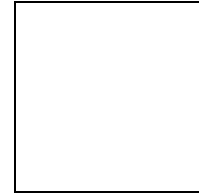
***Phosphorous - Free Ultrafine powder***

Rep-Cal Ultrafine (fine grind) is an excellent source of calcium for all reptiles and amphibians. Scientifically formulated from 100% natural Oyster Shell phosphorous-free calcium carbonate with added Vitamin D3 to aid in the absorption of calcium.

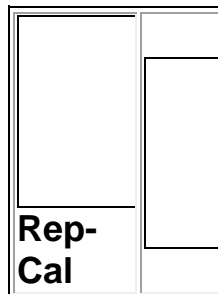
**Dosage:** We ask that you mix Rep-Cal with our vitamin supplement Herptivite. If we premixed the products, the "beadlets" of beta carotene in Herptivite may possibly be damaged during manufacturing by the calcium in Rep-Cal. Mix with vegetables, fruits, and pastes approximately 1/2 tablespoon Rep-Cal with 1/2 tablespoon Herptivite per pound of food.

**Before feeding insects:**

- 1) Thoroughly mix a 1:1 ratio of Rep-Cal and Herptivite in a plastic bag.
  - 2) Place insects in the bag.
  - 3) Shake slowly until they are completely covered.
- No other supplementation is required.



Size	Item #	UPC #
<b>Calcium with Vitamin D3 Ultrafine Powder</b>		
4.1 oz	200	7-88286-00200-9
7 lbs	210	7-88286-00210-2



<b>Herptivite Multivitamin</b>	Size	Item #	UPC #
	<b>Herptivite Multivitamin</b>		
		300□7	7-882
		6	
		310□7	7-882
<b><i>Vitamin A requirement from Beta Carotene</i></b>			
Rep-Cal's HERPTIVITE is a superior multi-vitamin, multimineral and amino acid food supplement developed from the latest findings in reptile and amphibian nutritional			

research.  
Its  
formulation  
contains  
all  
natural  
source  
ingredients with  
a base of  
"sea  
vegetation."  
Unlike  
other  
companies which  
use non-  
nutritional  
"bases,"  
Rep-  
Cal's  
"sea  
vegetation" base  
is rich in  
essential  
trace  
elements  
and  
minerals  
. Further  
more,  
**HERPTI  
VITE**  
contains  
precise  
levels of  
vitamins  
and  
minerals  
combined in

perfect balance to ensure correct utilization of protein and other essential nutrients for growth, reproduction, maintenance and many aspects of your reptile's bodily functions.

**HERPTIVITE** is the first reptile vitamin without Vitamin A.

Instead we use Beta Carotene which is an antioxidant that is converted into Vitamin A in a

regulate d way, so there is no threat of Vitamin A toxicity. Make Rep- Cal's HERPTI VITE the dietary supplem ent of choice for your reptiles.	
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**Dosage:** We ask that you mix Rep-Cal with our vitamin supplement Herptivite. If we premixed the products, the "beadlets" of beta carotene in Herptivite may possibly be damaged during manufacturing by the calcium in Rep-Cal. Mix with vegetables, fruits, and pastes approximately 1/2 tablespoon Rep-Cal with 1/2 tablespoon Herptivite per pound of food.

**Before feeding insects:**

- 1) Thoroughly mix a 1:1 ratio of Rep-Cal and Herptivite in a plastic bag.
- 2) Place insects in the bag.
- 3) Shake slowly until they are completely covered.

No other supplementation is required. Contains no added starch, sugar, soy preservatives, artificial coloring, flavoring, or fragrance. Consult your veterinarian for any special nutritional problems or advice.

#### **6.4 Presentation of Food**

Live insects can either be fed off forceps or scattered around the exhibit or off exhibit holding area, for lizards to enhance behavioural enrichment (Pers Com Adam Skidmore).



## **7 Handling and Transport**

### **7.1 Timing of Capture and Handling**

Preferably capture and handling should occur before public access and during the cooler time of the day when Frilled Lizards are least active. Attempts to handle at night may frighten or startle the animal(s) (Michael Mcfadden pers. comm.).

### **7.2 Catching Bags**

Animals must be enclosed in strong cloth bags of a material that allow the passage of air. Bags must be of robust construction, using double – stitching with special attention to corners, in a manner that avoids loose threads at internal seams that could entangle limbs, tail or claws. The animals must have sufficient space within the bag to achieve some movement, including righting itself if upturned. Bags containing animals must be tied and secured within the container. The bags/animals must be packed so they are neither stacked nor overcrowded within the container/compartments. Shredded paper or similar material should be packed around the bags to reduce bag movements and to act as insulation.

(TAG Reptile Transport Standards 2005)

More than one bag containing specimen(s) may be packed in a single container/compartments, provided all specimens are compatible (e.g. none are venomous, none are inclined to regard another as a potential prey item, and are of similar size and weight). More than one specimen may be packed in a single bag, provided all are compatible and of similar size. Different species must not be mixed in a single bag, but may be transported in separate bags in the same container. Specimens over 300mm total length must be packed in individual bags. Each bag must be clearly labeled with the species name and the number of specimens enclosed.

(TAG Reptile Transport Standards 2005)

Small specimens should be provided with bedding material within the bags to cushion and protect them during travel.

(TAG Reptile Transport Standards 2005)

### **7.3 Capture and Restraint Techniques**

Hand behind the head with the other hand around the base of the tail.

#### **7.4 Weighing and Examination**

First weigh the bag and record the weight, then place the lizard on the scales inside the bag. Deduct the weight of the bag from the second figure to obtain the correct weight of the lizard (Adam Skidmore pers.comm.).

Weighing your Frilled Lizard on a regular basis, for example once a month would be sufficient, providing the keeper with an actual weight of the lizard. This information is useful to veterinarians who may need to give medication and is another example of keeping good records ( Green & Larson 2001).

#### **7.5 Release From Box**

Take out by hand and place on a branch.

#### **7.6 Transport Requirements**

#### **DIMENSIONS AND STOCKING DENSITY.**

The acceptable dimensions and proportions of an approved shipping container will depend upon the contents. It must in general allow the animal(s) within to lie in a natural manner with sufficient space to ensure that 'stacking' is avoided, i.e. one or more animal positioned atop another. Balancing this requirement however, it is also important to keep the amount of free 'floor' space available to each specimen to a comfortable minimum to reduce excessive activity and possible injury. Restricting movement can also serve to greatly reduce abrasion injuries caused by the occupant trying to escape, but should be applied so as not to cause undue discomfort. The appropriate height of the container is influenced by the requirement that sufficient ventilation is achieved as well as the intention to avoid stacking of animals.

*(TAG Reptile Transport Standards 2005)*

#### **VENTILATION.**

The container, and all animals holding compartments within must be adequately ventilated on at least three sides. There are exceptions to this requirement, which are stated in the specific container requirements for particular species.

*(TAG Reptile Transport Standards 2005)*

Generally, the ventilation openings must be small enough to prevent the animal escaping and to minimize the risk of occupants exposing parts of their body (e.g. tail and legs) outside the container and, hence, being injured during transport. However, this may not be practical when transporting extremely small specimens, e.g. hatchlings. In this case,



and in all cases where ventilation holes have a diameter greater than 5mm, the use of an open weave mesh (e.g. flyscreen) is required to ensure security. The mesh must be of very strong construction and properly fixed in a manner that precludes the possibility of escape, including being placed on the inside of the container to prevent the mesh being easily pushed out from the inside by the animal.

***(TAG Reptile Transport Standards 2005)***

Where inner and outer containers are used, openings must be configured in such a fashion that precludes blockages of any of the openings to the multiple layers of the container. A strip of material must be fixed to each ventilated side of the container in such a manner as to ensure that if the container is pressed against a smooth surface (e.g. another container), ventilation will not be retarded.

***(TAG Reptile Transport Standards 2005)***

Frilled Lizards are (ectothermic) animals with lower oxygen requirements than (endothermic) mammals and birds. They do, however, require adequate ventilation, and oxygen requirements increase proportionately with body temperature – which will reflect the surrounding temperature. To guard against excessive body temperature fluctuations, it is appropriate to provide less ventilation for reptiles or amphibians shipping containers than might be the case for mammals and birds. Additionally, the use of insulation can be helpful in reducing the influence of change in surrounding temperature during shipment and transshipment. Care must always be taken to ensure that shipments are not exposed to extreme cold or heat. In circumstances where warm conditions cannot be avoided, e.g. hot weather, special care must be exercised. An approved strategy is to include an appropriate quantity of ice (not dry ice) in a leak – proof bag / container, positioned in such a manner that no contact with transported animals is possible. One solution is to wrap the leak – proof bag containing ice in a towel. Additionally, in cold climates, chemically activated heat pads can be used in the same manner to raise the shipping box temperature.

***(TAG Reptile Transport Standards 2005)***

In very cold weather, thermal packs may be used as a source of gentle heat for the container. In all cases, the thermal requirements of the occupants must be clearly on the outside of the container and the shipper informed well in advance so that any special arrangements can be made. Always consider the conditions that the container will be exposed to from the start to the end of its journey, which may be overseas in a completely different climate. If the animal needs to be transferred between flights during the journey, ensure that precautions are taken to minimise time spent sitting on the tarmac exposed to local weather conditions.

***(TAG Reptile Transport Standards 2005)***

## LABELLING AND MARKING

The container must be correctly labelled and marked with the name, address and contact telephone/mobile number of both the consignee (receiving party) and the consignor

(sending party), as well as the common names and numbers of the contained animals. Labels must not block ventilation holes, especially on small containers.

***(TAG Reptile Transport Standards 2005)***

The shipper or his authorised agent must complete, if appropriate, a Shipper's Certification for Live Animals for each shipment. For the purpose of these Regulations, an authorised agent is a person expressly authorised in writing by the shipper to execute the Shippers Certification for Live Animals, except that this must not include IATA Cargo Agents, consolidators, forwarders and surface carriers. It may also be advisable to attach import and/or export permits, etc. to the outside of the container and, where this is done, for these to be easily accessible and labelled as such.

***(TAG Reptile Transport Standards 2005)***

The container must be marked "LIVE ANIMAL" and have "This Way Up" labels affixed to all four sides. "Reptile", as appropriate, must be noted on the "Live Animal" label. The container must also be labelled with "Keep Cool", "Keep Out Of Sun", "Keep Away From Heat", "Avoid Temperature Extremes", or similar as appropriate.

***(TAG Reptile Transport Standards 2005)***

#### SPECIFIC PATHOGEN FREE (SPF) ANIMALS

When animals are carried in SPF conditions, the shipment must at least comply in all aspects with the species container requirements in this section. Special measures must be taken to ensure that ventilation rates are maintained within the container. An inspection window must be provided on the container.

***(TAG Reptile Transport Standards 2005)***

#### PREPARATION BEFORE DISPATCH

Refer 7.6.2

#### SPECIAL CARE

Temperature during transportation should be maintained between 18-24°C. If extremely hot weather (e.g. over 33°C) is encountered, the shipment should be postponed until more favourable conditions are present, or special arrangements made to ensure that shippers protect containers from temperature extremes. Or specific arrangements can be made with the transport company to ensure that appropriate temperatures are maintained. As described above, the appropriate use of insulation and/or ice packs can assist in maintaining relatively cool conditions. Containers must never be placed in direct sunlight, near heat sources nor in excessively draughty positions, such as near air-conditioning outlets. The same philosophy applies for cold climates.

***(TAG Reptile Transport Standards 2005)***

## Insulation

Refer to figures 1 and 2 for types of insulation that can be used.

### **7.6.1 Box Design**

### **7.6.2 Water and Food**

Animals should not be fed for at least 48 hours prior to shipment. Food must not be provided for this species in the shipping container  
(TAG Reptile Transport Standards 2005).

All animals must be well hydrated prior to transportation. Ideally, animals should be relatively cool at the onset of shipment, ie. room temperature (20-24°C) to reduce the initial level of activity  
(TAG Reptile Transport Standards 2005)

### **7.6.3 Animals per Box**

1 animal per box.

### **7.6.4 Timing of Transportation**

The prefer timing for transporting Frilled Lizards is best achieved during the cooler part of the day preferably in the morning when they are at there least active.  
(Michael McFadden pers. comm.)

## 8 Health Requirements

### 8.1 Daily Health Checks

Manipulate enclosures as necessary to observe appearance and behaviour of animals.

Examples of conditions which may be observed and should be reported include:

- Excessive weight loss/emaciation or weight gain/obesity.
- Unusual growths or swellings.
- Unusual posture, activity, lethargy.
- Skin irritation, lacerations, lesions or ulcers.
- Bleeding or discharge from an orifice.
- Unusual faeces.
- Difficulty breathing.
- Unusual locomotion.
- Convulsions/seizures.
- Dehydration (sunken eyes, loss of skin elasticity).
- Abnormal skin shedding.
- Eyelid swelling.
- Vomiting.

#### 8.1.1 Environment Check

Primary exhibits and hold cages should be evaluated for the following:

- Temperature extremes.
- Inadequate supply of food, water, or applicable nutrients.
- Decreased food, water, or nutrient consumption.
- Lack of faeces or urates.
- Broken enclosure.
- Excessively soiled enclosure.
- Unusual odours.
- Humidity extremes.
- Photoperiod abnormalities.
- External heat source.
- Basking area.

<http://www.ucuca.umich.edu/forms/UM%20Program%20for%20Daily%20Hlthck%20-%20Non-Mammals.pdf>

## **8.2 Detailed Physical Examination**

### **Nose/breathing**

Check the animal's nose for signs of abrasions, damage or infection (e.g. mucous). An abrasion on a reptile's nose is a sign that an animal has been trying to escape from an enclosure (they damage their nose on wire enclosures or if the area is too small and they constantly pace along a glass window trying to push their way out).

How does the animal's breathing sound? Healthy reptiles will make no noise or hiss in defence. If the animal clicks as it breaths, then it may have a respiratory infection. Healthy animals breathe through their nose, never through their mouth. There is something wrong (probably a respiratory infection) if a reptile breathes through its mouth or gasps.

### **Mouth**

The mouth should be free of swellings, food, scabbing or lumps.

The mouth area may normally have a slight yellow tinge. If an animal's gums look red, it may have canker. Dragons that have been hit by cars often have a fracture along the symphysis of the jawbones, which causes free and independent movement.

To open the mouth of a Frilled Lizard, hold on to the animal's head and gently pull on the loose skin under their jaw.

### **Eyes**

The eyes should be clear, bright and responsive to light (pupils dilate and contract). An animal that constantly keeps its eyes closed may be sick or dehydrated. If the eyes are cloudy, they could be damaged. Check the eyes for discharge or swelling (some captive specimens may get swollen eyes due to a Vitamin A deficiency — this is unlikely to occur with wild reptiles).

### **Body**

The body should be free of abrasions, lacerations, scratches and hard or soft swellings. The colour of the animal should be within the normal range for the species (most reptiles look duller just before they are going to shed).

Is the animal in good condition? For some lizards, if the bones of the tail and pelvis are prominent, then it is in poor condition. The spine is normally quite prominent in these animals.

### **Legs and feet**

Legs should be of a similar length without enlarged bumps in the joints or muscle tissue. Feet and toes should not be swollen. Some animals survive without all of their toes.

## **Cloaca**

The cloaca should be clean and free of faecal matter. If the cloaca is swollen, enflamed or has internal body tissue extruding from the vent (prolapse), the animal will require veterinary care. It is quite normal for male animals to extrude their hemipenis when defecating. If the hemipenis stays out of body for a significant amount of time it can dry out and become infected.

## **Tail**

Normally the tail should be free of abrasions, lesions and swelling or signs of infection. Note: Frilled Lizards do not lose their tails.

## **Faeces**

The normal appearance of reptile faeces differs between species.

Generally, the faeces should be firm and brown. Urates should be white to off-white. The reptile should not strain while defecating. The reptile is sick and needs veterinary care if the faeces become loose, watery or bloody, or the urates become bright yellow or tinged with red.

## **Dysecdysis**

This condition occurs when a reptile does not properly shed its skin. It will occur when the animal is dehydrated, sick or stressed. In lizards, the unshed skin remains attached to the toes, tail, head and legs and can constrict the animal's movement or cause it to lose an appendage, particularly toes.

The skin is also irritating, causing the reptile to hurt itself by rubbing the area continuously

[http://www.epa.qld.gov.au/nature\\_conservation/wildlife/caring\\_for\\_wildlife/carers\\_kit/reptiles/diseases/](http://www.epa.qld.gov.au/nature_conservation/wildlife/caring_for_wildlife/carers_kit/reptiles/diseases/)

### **8.2.1 Chemical Restraint**

Would only be required for veterinary procedures eg. surgery, x rays (not always) and other invasive procedures (Larry Vogelneust pers. comm.).

### **8.2.2 Physical Examination**

Refer 8.2

### **8.3 Routine Treatments**

Faecal samples submitted twice a year to determine if the animals have parasites or not and need to be treated. (Michael McFadden pers. comm.)

Not often required but would primarily be worming or mite treatments if this was a problem but parasites in this species are not usually a problem in captivity in my experience. (Larry Vogelnest pers. comm.)

## **8.4 Known Health Problem**

### **8.4.1 Non-Infectious Diseases**

#### **Environmental Diseases**

##### **“Maladaptation“ Syndrome**

##### **Description**

Many deaths in captive reptiles result from a non-specific physical deterioration in the absence of any identifiable disease process. It has been proposed that these deaths, which usually occur during the first two years in captivity, are related to maladaptation to the captive environment. Thus the syndrome is basically one of chronic stress. In such a situation, most available energy is consumed in coping with the stress, the expense of functions such as growth, reproduction and resistance to infection. There are many aspects in the environment to which the reptiles may not adapt: temperature gradient, humidity, odours, noises, lack of shelter, climbing or bathing facilities, unsuitable substrate, enclosure size, enclosure mates (of same or different species), human handling. The syndrome is not necessarily associated with poor husbandry – some individuals are unable to adapt to conditions in which other reptiles of the same species thrive.

##### **Clinical Signs**

Anorexia, emaciation despite feeding well. Sometimes skin ulcerations occur on contact points due to increased fragility of tissue. Often there is other evidence of environmental stress: rostral abrasion & necrotic stomatitis. Often concurrent disease is present due to lowered resistance to infection.

##### **Treatment**

Treat emaciation. Treat any concurrent disease process. Attempt to identify stressor(s) and eliminate.  
(McCracken 1994)

## **Rostral Abrasions**

### **Description**

Consists of abrasions of epidermal and dermal tissue of rostrum due to constant pushing and rubbing on enclosure wall in apparent attempt to escape. Most commonly seen in newly captured reptiles or in cases of overcrowding.

### **Treatment**

Gently cleanse wound with povidone scrub. Apply topical ointment (eg. Betadine). Give no further topical treatment unless obviously indicated – to avoid stress of frequent handling. In cases of very extensive soft tissue injury, anaesthesia and surgical debridement may be required. Hydrocolloid dressings held on with Fixomull strips may be very helpful in accelerating healing of such injuries. Alter environment: place visual barriers, eg . newspaper or black plastic on enclosure walls: avoid abrasive walls eg . wire mesh. Melbourne Zoo's veterinary staff have successfully used a long – acting neuroleptic agent, fluphenazine decanoate (Modecate, Bristol – Myers Squibb) at 2 mg/kg IM to “quieten” down animals with such injuries to permit healing and prevent deterioration of the wound. The effect lasts for approximately 14 days. This must be used in conjunction with environmental change.

(McCracken 1994)

## **Dysecdysis**

### **Description**

Common condition in captive reptiles. Definition: complete or partial failure to shed the outer skin of epidermis in the normal sloughing (ecdysis) cycle. Causes: low humidity environment, lack of suitable abrasive substrate to assist shedding, ectoparasites, dermatitis, scars from old injuries, systematic disease. Possible consequences: bacterial or fungal infections under retained “slough”, avascular necrosis of tail tip or digits due to constriction by retained pieces of skin.

### **Treatment**

- (i) Complete slough retention: Lizards – soak in water or apply damp compresses, then gently list off retained scales.



(ii) Partial slough retention: soak affected body parts in warm water for 5 – 10 mins, then manually remove slough. Amputation maybe necessary if avascular necrosis has occurred.

(iii) General: identify underlying cause of problem and correct.  
(McCracken 1994)

## **Hyperthermia & Thermal Burns**

### **Description**

Quite common in captive reptiles due to poor husbandry. Causes: high intensity overhead lamps too close to basking sites; exploding light bulbs due to splashing water during cleaning of enclosure. Reptiles do not appear to move away from the heat source when burning and therefore may suffer serious injury.

### **Clinical Signs**

**Hyperthermia:-** Collapsed or dead

**Burns:-** Focal areas of blistering and ulceration, often with complete lose of epidermis. Secondary infection may occur.

### **Treatment**

**Hyperthermia:-** Promptly bath in cool water and give parenteral fluid therapy.

**Burns:-** Gently cleanse lesions with povidone iodine scrub, dry well and apply antibiotic ointment. Eg. Ceftazidime (fortum) or Enrofloxacin (Baytril). Then cover lesion with Opsite transparent dressing – this appears to assist healing by preventing abrasion and contamination, while allowing constant observation of the wound.

Give parenteral antibiotic fluid and vitamin therapy. Keep animal on non – abrasive, substrate changed daily, eg. Newspaper. Burns heal slowly, generally leaving a scar which will impede subsequent ecdysis.

(McCracken 1994)

## **Electrocution**

### **Description**

Caused by faulty connections in heating appliances or use of improperly shielded electric cables in enclosure.

### **Clinical Signs**

Burns (often star – like) and petechial haemorrhages. If electrocution occurred very recently, animal would be rigid but in most cases it is limp and unconscious.

### **Treatment**

If electrocution occurred less than 1 hour before presentation, even “lifeless” animals may be resuscitated by IPPV with oxygen. Treat burns. Poor prognosis.  
(McCracken 1994)

## **Hypothermia**

### **Description**

Caused by failures in heating apparatus or inadvertent freezing of reptiles for handling purposes. “Fridging” of Frilled Lizards to facilitate handling is not recommended, but is still a widely used technique. Consequences: Respiratory disease with ocular and nasal discharges; tympanic colic due to fermentation of gastrointestinal contents in the absence of digestive enzyme activity; occasionally frost bite of distal appendages.

### **Treatment**

Slowly warm animal to preferred body temperature over 2 – 3 hours. Monitor carefully for the next 7 – 10 days. Treat any sequelae appropriately.  
(McCracken 1994)

## **Traumatic Conditions**

### **Soft Tissue Injuries**

#### **Causes**

- Frilled Lizards may be bitten by live insects provided as prey – may cause extensive skin damage.
- Bites from cage mates due to territorial, sexual or feeding competition. In hatchlings sometimes resulting in lose of digits if housed in groups and not fed appropriately.

#### **Treatment**

Skin, subcutaneous tissue and muscle damage: Cleanse with povidone iodine scrub, flush liberally with 0.9% NaCl and aqueous antibiotics; if possible, close wound for primary intention healing; if insufficient skin, leave open to granulate. Give parenteral antibiotic

fluid and vitamin therapy. Wounds often leave scars which impede subsequent skin sloughing.

- Eye injuries: May involve exposure of intraocular contents – enucleation indicated. Corneal ulceration and keratitis in lizards are quite common, possibly secondary to mite infection in many cases. Fluorescein is used to conform corneal ulcerations – these are managed with temporary tarsorrhaphies and antibiotic ophthalmic preparations; if the ulcers are very superficial only the later is used. For keratitis, both prednisolone (Sterofrin 0.5%, Alcon labs Pty Ltd) and antibiotic ophthalmic preps are used.
- Limb and tail injuries: May require amputation. Tail amputations in Frilled Lizards are best performed as a clean cut perpendicular to the skin and left open to allow healing. These usually heal with partial tail regeneration and this is impeded by skin closure using mammalian tail amputation techniques.

(McCracken 1994)

### **Prevention**

- Avoid over crowding of enclosures
- Feed only amount edible within a 2 – 3 minute period. Remove any uneaten crickets.

### **Limb Fractures**

#### **Description**

Caused by bites from cage mates or falls during jumping etc. Fractures often predisposed to by nutritional osteodystrophy. Fractures generally simple and closed (rarely open due to tough skin).

#### **Diagnosis**

Lameness, palpation and radiography.

#### **Treatment**

- Long bone fractures of most lizards: External fixation is rarely well tolerated in otherwise strong, healthy lizards, therefore internal fixation is preferred. Needle shafts IV catheter stilettes make useful intramedullary pins for small lizards. Leave pins in situ for 2 – 3 months – monitor progress by radiography.
- Long bone fractures in hatchling lizards: Use lightweight splint of plastic drinking straw and tape, or tape alone. Micropore (3M) tape is useful as it does not damage scales when removed.

- Digital fractures: Pack cotton wool against palmar / plantar aspect of foot while holding digits in normal anatomical position. Strap in place with gauze and Miropore (3M) tape or Vetwrap bandage (non-sticky, self-adhesive bandage).
- General: Keep animal in enclosure with no climbing materials. After callus formation, commence physiotherapy to restore muscle tone and function: at least ten full flexions and extensions of joints proximal and distal to fracture, twice daily. Ca:P and ensure correct exposure to UV light.

**Note:** Fractures in reptiles can take up to 6 – 18 months to completely heal.  
(McCracken 1994)

## **Crushing Injuries**

### **Causes**

Stepped on or crushed by collapse of poorly supported cage / exhibit furnishings eg. Branches.

### **Diagnosis**

Radiograph to assess extent of damage.

### **Treatment**

- Limb fractures:
- Vertebral fractures or dislocations: These have a better prognosis in reptiles than in mammals because the spinal cord of reptiles retains a considerable degree of autonomy from the brain by possessing locomotor control centres. With retention of these reflexes, minor spinal cord injuries may only cause minor disability. With stabilization and conservative therapy (corticosteroids, diuretics and forced feeding) there is a reasonable prognosis. Lizards – Apply simple splint and firm, lightweight dressing from axillary to inguinal regions.

(McCracken 1994)

## **Nutritional Diseases**

### **Metabolic Bone Disease**

#### **Cause**

Seen in young reptiles on diets that are:

- Low in calcium
- Low in vitamin D
- Lack of exposure to natural sunlight or UVB

### **Clinical Signs**

- Fractures, Swollen legs
- Non-union of fractures,
- Paralysis; weakness; death

### **Treatment**

- Feed diet supplemented with calcium
- Give Calcium Sandoz at 1ml / kg for 1-3 months
- Exposure to sunlight for 20 mins twice weekly
- Change the UVB light every 6 months. The light must be within 20cm of the lizard for it to work. This is done by encouraging the lizard to bask closer to the UVB light by bringing the light closer to the lizard
- Restrict movement to allow healing (no climbing)

(Fowler 2005)

## **Inanition & Protein Deficiency**

### **Causes**

- Inadequate diet eg. Not varying types of insects or other food fed out
- Anorexia due to unsuitable environment (incorrect temperature, photoperiod, humidity), interspecific competition, excessive handling, disease, parasitism or “maladaptation”.

### **Consequences**

Frilled Lizards can survive for months without eating but eventually their energy stores and body fat and muscle are depleted.

### **Clinical Signs**

Emaciated lizards with palpable and visible bony prominences and generalised muscle atrophy. Usually depressed and inactive. The disease maybe primary or secondary to malnutrition.

## **Treatment**

If this species has not eaten for several months, commence with only parenteral fluid and vitamin therapy for 4 – 5 days, as the gastrointestinal tract is often incapable of handling food. Then commence feeding a supplementary formula by stomach tube 2 – 3 times weekly. Monitor body weight regularly. After 1 – 2 weeks, if condition improving, offer or force feed with solid food. Once eating solids, continue the supplementary feeding once weekly for several weeks (until condition is much improved). Lizards with profound anaemias may benefit from blood transfusions. Investigate for and treat any underlying disease (including parasitism), or husbandry problem.  
(McCracken 1994)

## **Obesity**

### **Cause**

This occurs in Frilled Lizards when fed more frequently than is required for their level of energy expenditure.

### **Treatment**

Radically decrease feeding frequency (to below that suggested for this species until desired weight is reached). Continue to provide *ad libitum* drinking water with added electrolytes.

## **Vitamin C Deficiency**

### **Description**

It has been proposed that this deficiency is a major predisposing factor in the development of necrotic stomatitis and spontaneous skin ruptures. Controversial issue. As Vitamin C is synthesised by the normal internal flora, antibiotic therapy may precipitate a deficiency. Therefore, parenteral Vitamin C is given as an adjunct to parenteral or oral antibiotic therapy.

### **Treatment**

Vitamin C IM at 10 – 20mg / kg sid (empirical dosage).  
(McCracken 1994)

## **Nutritional Osteodystrophy**

## **Description**

Common condition in Frilled Lizards, especially juveniles if captive husbandry is substandard. This is caused by diets low in calcium. Diets for Frilled Lizards consisting of insects such as crickets and speckled roaches which contain negligible calcium. Such mineral imbalances are often exacerbated by Vitamin D deficiency due to insufficient exposure to U.V. radiation (due to lizards lacking or being too far away from suitable artificial sources of UV light). This combination of imbalance and deficiencies results in decalcification of the skeleton and consequently bony deformities and pathological fractures.

## **Clinical Signs**

- In lizards: Non-union long bone fractures, limb deformities, shortened mandibles, kyphoscoliosis, thigh swellings due to disposition of fibrocartilage matrix around the weak bone cortex in the body's attempt to strengthen the bones.
- Tetanic spasms may occur in terminal cases due to hypocalcaemia.

## **Diagnosis**

Radiography- often ingested bones in the gut are denser than the lizard's skeleton. Bone cortices very thin. Pathological fractures may be detected.

## **Treatment**

Give 10% calcium borogluconate SC (1ml/kg) 2-3 times weekly for 3 weeks. Correct diet. Increase exposure to U.V light by setting up enclosure outside or using artificial sources of U.V light. Attempts should not be made to internally or externally fix badly displaced comminuted fractures in bone with thin cortices in small lizards (<500g) because such procedures may result in further fractures. Such fractures have healed well with absolute cage rest and removal of all climbing structures, once Ca supply and UV source was corrected. In larger lizards, fracture stabilization should be attempted using tape on splints. Restrict cage size and access to stronger lizards to prevent further fractures. Radiograph every 4-6 weeks to monitor progress. Calcitonin also appears to be useful adjunct to therapy as it counteracts parathyroid hormone and inhibits bone resorption. However, it must not be used until serum calcium has reached normal levels as it may include hypocalcaemic tetany and death in a hypocalcaemic lizard. Either measure calcium levels or give calcium supplementation for at least 7 days prior to calcitonin. Give 50 IU/kg IM of Salmon calcitonin (100 IU/ml) once a week for 2 treatments.

(McCracken 1994)

## **Reproductive Disorders**

### **Dystocia**

#### **Causes**

Abnormal size or shape of egg; malnutrition or dehydration; maternal metabolic disturbances such as calcium deficiencies; environmental influences eg. Incorrect temperature or photoperiod or lack of suitable site / substrate for oviposition; oviductal infection; spinal or pelvic injury.

#### **Clinical Signs**

- Prolonged gestation period (difficult to assess as mating date usually not precisely known and gestation period varies significantly with environmental temperature)
- Lizard is most commonly presented 24 hours after having laid only part of the clutch. Other eggs can be palpated in the coelomic cavity (or should be delivered in close succession)
- Less commonly a gravid lizard is presented with distended cloaca +/- straining +/- nest building (lizard) - has been so for some time without producing eggs.

#### **Diagnosis**

- Palpate eggs
- Radiograph to demonstrate and count eggs. X-ray will also reveal any problems (eg. Spinal or pelvic injury, collapsed egg) which may indicate immediate caesarean.

#### **Treatment**

- If egg(s) close to cloaca, attempt non-invasive manipulative technique: Insert lubricated speculum into cloaca and, applying external digit pressure to egg, attempt to grasp and extract egg with Allis tissue forceps. After egg extraction, cannulate and irrigate oviducts with 0.9% NaCl.
- If (above) not possible or not successful, attempt medical treatment. Give 10% calcium borogluconate at 0.5ml/kg SC, isotonic fluids SC (2% of body weight) and place lizard in warm water bath.
- If no response to (above) after 72 hours, elect surgical treatment: coeliotomy and salpingotomy. Procedure is as for caesarean section in mammals. Incise over one egg and attempt to “milk” others towards this incision for removal. If dystocia is



of several days standing, eggs may be adhered to oviduct, necessitating separate incisions over each one. Close oviducts with double layer of continuous, inverting pattern- use ophthalmic instruments and suture material as this is very friable tissue. Because this tissue is delicate, some surgeons leave it unsutured without apparent problems. Parenteral antibiotic, fluid and vitamin therapy post-op. (McCracken 1994)

## **Prolapsed Oviduct / Hemipene**

### **Description**

Caused by parasitic, bacterial or fungal infection of cloaca or specific organ involved; straining due to constipation or dystocia.

### **Clinical Signs**

- Male lizards: one or both hemipenes prolapsed. Organs often swollen and traumatised by substrate.
- Female lizards: more commonly partial than complete oviducal prolapse. If complete, usually severely traumatized.

### **Treatment**

- Non or mildly traumatised cases: gently cleanse exposed tissue with povidone iodine scrub; lubricate with antibiotic ointment; replace organ using cotton bud. If organ too swollen to replace, use glycerine or 10-50% dextrose solution to shrink. May need to make linear incision in cloacal margin to assist organ replacement. Place non-absorbable purse-string suture around cloacal or hemipenal pocket opening - leave large enough opening in cloaca for passage of wastes. Parenteral antibiotic therapy.
- Severely traumatised cases: amputation of organ under anaesthesia.
- Hemipene: Place one or more through and through mattress sutures (absorbable) through living tissue proximal to proposed point of amputation; after transaction, allow clean, ligated stump to retract back into hemipenal pocket. Give parenteral antibiotic therapy. Reproductive future is OK with only one hemipene.

**Note:** The lizard hemipene is simply a solid intromissive organ for semen transport – it has no internal ducts.

- Oviduct: Do salpingectomy. Some authors advocate that the ovary must also be removed otherwise yolk peritonitis may develop when ovarian cycle begins. However, it is difficult to remove the ovaries of lizards because they are not pedunculated, others have removed only the oviduct without any untoward sequelae. Give parenteral antibiotics.

- General: Attempt to identify cause of prolapse and treat.  
(McCracken 1994)

## **Infected Eggs**

### **Description**

Usually involves Gram negative bacilli eg. *Aeromonas* or *Pseudomonas* spp., possibly introduced to oviduct by male at mating. May result in septicaemia.

### **Clinical Signs**

Gravid female with palpable eggs, not laying as expected. Anorexia and lethargy.

### **Diagnosis**

- Radiography: infected eggs generally more radiodense than normal eggs, in which usually only the shell is clearly visible.
- Needle aspirate - make smears for smearing with Gram and Diff Quik (Lab Aids), and submit sample for C + S.

### **Treatment**

Anesthesia and surgical removal of eggs. Flush purulent material from oviducts. Parenteral antibiotic fluid and vitamin therapy pre and post operatively.  
(McCracken 1994)

## **Neoplastic Diseases**

A wide variety of neoplasms have been recorded but no specific predilections occur in reptiles currently kept in Australia.

Unfortunately, to date no detailed studies have been carried out. In such a situation the only humane solution is to put the animal painlessly to sleep.

(Hauschild and Bosch 2004)

## **8.4.2 Infectious Diseases**

### **Bacterial Diseases**

#### **Abcesses / Granulomas**

### **Description**

Very common in lizards because lizards respond to most microbial infections by producing heterophilic granulomas. These start as heterophil accumulations at the site of infection which undergo necrosis and attract microphages with connective tissue elements. At reptile autopsies it is not uncommon to find at least one chronic granuloma indicating a past infectious assault. These chronic granulomas are generally benign and do not cause any problems, but they may be obstructive, space occupying or unsightly masses requiring removal. They are usually discrete, round, and encapsulated by fibrous connective tissue. Contents are usually solid, laminated caseous material but occasionally liquid pus is seen.

### **Common Presentations of Abscesses**

- Discrete, sometimes ruptured, swellings on the toes of lizards – possibly secondary to overcrowding, poor hygiene, excess humidity.

Abscesses on limbs of lizards should be treated immediately and aggressively as they can result in osteolysis of the underlying bones.

Aetiology of abscesses: wide range of bacteria but most commonly Gram negative bacilli +/- anaerobes.

Predisposing factors: local trauma from ectoparasites; enclosure substrate or bite wounds; poor hygiene – excessive contact with faeces and moisture; and malnutrition. Internal abscesses / granulomas may also occur as a result of parasitic migration or attachment.

### **Clinical Signs**

Internal: palpable internal mass; signs relating to disruption of organ function, e.g. Anorexia, regurgitation.

### **Diagnosis**

- Needle aspiration (using 18 – 20 G needle) for culture and sensitivity (C+S) and direct smears stained with Gram and Diff Quik (Lab.Aids). Due to hardness of pus, often nothing is aspirated.
- Radiographs are advisable for limb abscesses, especially if they are chronic +/- or extensive, as these may indicate more aggressive therapy than abscess drainage.

### **Treatment**

- Liquid pus: drain, flush with 3% hydrogen peroxide and sterile saline +/- irrigate with aqueous antibiotics
- Hard pus: surgically remove lesion including capsule; flush and irrigate as above; suture, leaving drainage hole and flush daily for at least 7 days. It seems to be very important to remove the entire capsule because when remnants are left

- behind, infection almost always recurs, frequently more extensively than the initial abscess
- Parenteral antibiotics.
- (McCracken 1994)

## **Necrotic Gastroenteritis**

### **Description**

Aetiology: wide range of bacteria, transmitted via faeces.

Predisposing Factors: stress, e.g. wild caught or transport.

### **Clinical Signs**

Anorexia, lethargy, emesis, soft faeces + / - mucous or blood, + / - intestinal prolapse.

### **Diagnosis**

Insert dry cotton bud to collect sample of cloacal contents. Do Gram stain and direct wet preparation slide on sample – must distinguish between this disease and amoebic enteritis.

### **Treatment**

Parenteral antibiotics, replacement fluid and vitamin therapy. Kaolin–pectin suspension by stomach tube. May use oral neomycin (2.5mg / kg sid for 3 days). For treatment of intestinal prolapse.  
(McCracken 1994)

## **Cloacitis**

### **Description**

Usually occurs as secondary infection to cloacal calculus as urates or gravel. Mixed bacteria and fungal flora involved. Possible Sequelae: ascending infections of intestinal, urinary or reproductive tracts.

### **Clinical Signs**

- Mild – slight oedema and ulceration of cloacal lips, rubbing of cloaca on substrate of enclosure

- Severe – massively swollen cloaca +/- bloody discharge, sensitive to touch, +/- hemipenal / oviductal prolapse, +/- dehydration.

### **Treatment**

Thoroughly and gently cleanse with povidone / iodine scrub (Betadine Surgical Scrub, CSL). Apply broad spectrum antibiotic and steroid ointment, e.g. Panalog (Squibb) daily. Place on non-abrasive, non-adherent substrate, e.g. newspaper, changed daily. If severe, or if ascending infections are suspected (very likely if cloacitis has been present for more than 2-3 days, give parenteral antibiotic, fluid and vitamin therapy. If suspect ascending colitis, give oral neomycin (2.5mg / kg sid for 3 days). (McCracken 1994)

## **Ocular Infections**

### **Conjunctivitis**

#### **Description**

Usually occurs as a consequence of physical damage to surface of eye, e.g. self trauma due to mite infestations.

#### **Clinical Signs**

Uni/bi-lateral ocular discharge +/- adherence of eyelids.

#### **Diagnosis**

Take swab of discharge for C & S.

#### **Treatment**

Gentamicin (Gentocin Ophthalmic Solution, Essex / Heriot) or chloramphenicol eyedrops (Chloromycetin Eye Drops, Parke Davis) bid- tid 5 days. Change according to C & S if necessary.

(McCracken 1994)

### **Dermatitis**

#### **Necrotic dermatitis (Skin Rot)**

## **Description**

Focal necrosis of superficial +/- deep (depending on severity) layers of keratin. Lesions usually in ventral areas and spread rapidly. Can result in loss of digits or entire limbs in lizards (via osteolysis).

Aetiology: Mixed bacteria; fungi may also be involved.

Predisposing Factors: Poor environment e.g. excessively humid atmosphere, continually moist substrate, poor temperature control or poor cage sanitation.

## **Clinical Signs**

- Mild-areas of discoloured skin
- Severe-haemorrhagic skin with aedema and necrosis. Affected areas may slough full or partial thickness of skin, exposing subcutaneous tissue, dermis or deep layers of epidermis

## **Diagnosis**

Submit exudate or snipped-piece of affected scale for C+S treatment.

## **Treatment**

- Debride and clean affected areas with povidone iodine scrub – may require anesthesia as is a painful procedure. If only superficial epidermis loss, clean daily with povidone iodine and sparingly apply antimicrobial ointment such as silvazine cream (1% silver sulfadiazine, Smith and Nephew) or Oftentral (miconazole, polymixin B, bacitracin, Boehringer Ingelheim) until resolved. In severe cases, it is best to dress affected areas with Silvazine or Oftentral, covered by a non-stick dressing such as Telfa (Kendall Co.), held in place with adhesive dressing. Change dressing and clean with Povidone scrub every 3 days until infection appears to have resolved. Then dress wounds with DuoDerm (ConvaTec) or Opsite (Smith and Nephew) to promote healing and prevent further trauma and contamination. Note the new skin forming over such lesions is usually smooth not scaled and maybe sites for dysecdysis in the future.
- Severe cases should also receive parenteral antibiotic, fluid and vitamin therapy
- Amputate necrotic digits or limbs if indicated
- Keep on clean non-abrasive substrate, e.g. newspaper, change daily. Prevent bathing as water is a potential source of infection
- Identify cause of problem and correct

(McCracken 1994)

## **Dermatophilosis**

### **Description**

Causes cutaneous nodular hyperkeratotic lesions +/- associated subcutaneous abscesses.

Aetiology: *Dermatophilus congolensis*.

Predisposing Factors: excessive humidity, moist substrate, poor temperature control, unsanitary conditions.

### **Clinical Signs**

Lesions usually on ventral body and limbs. If untreated, death results from septicaemia or visceral abscessation.

### **Diagnosis**

Submit crusts or nodule aspirates for M,C+S.

### **Treatment**

- No uniformly successful treatment, but the following has been used with some success:
- Local debridement, daily application of 1% povidone iodine and keratolytic agents e.g. Otoderm Multicleanse solution (Beecham). If lesions are wide spread on body, bathe lizard for 5 minutes daily in “weak tea” povidone iodine solution
- Give ampicillin and amikacin (or gentamicin) for 12 days
- Before commencing treatment, thoroughly disinfect with 5% sodium hypochlorite all enclosures, utensils, etc. in contact with affected animals. Repeat this when treatment completed
- Identify predisposing problem and correct
- Potential zoonosis, so advise owner regarding hygiene

(McCracken 1994)

## **Salmonellosis**

### **Description**

This species are non-symptomatic carriers of *Salmonella* and *Arizona* spp. This disease is of major zoonotic importance – young children are especially at risk. Clinical disease occasionally occurs in reptiles, generally associated with stress, concurrent disease or heavy parasitism.

### **Clinical Signs**

Diarrhoea, anorexia, listlessness due to enteritis. Usually die from septicaemia, pneumonia, peritonitis or hypovolaemic shock. In some cases, intestinal granulomas form. These may be asymptomatic for some time until they reach an obstructive size. Presenting signs are anorexia, constipation and a palpable abdominal mass.

## **Diagnosis**

Submit cloacal swab or faeces (in selenite broth) for C+S. Contrast radiography is used in the case of suspect internal granulomas.

## **Treatment**

Ethically dubious for pets because of serious zoonotic risk. Few treatment regimes have been successful in eliminating *Salmonella* from carriers or clinical cases. May attempt treatment with oral +/- parenteral antibiotics depending on C+S results. If treatment is attempted, instruct owner about strict hygiene – children should not handle lizard or anything in contact with it. After treatment, must obtain several successive negative faecal cultures to be sure of elimination. Obstructive intestinal granulomas may be surgically removed.

(McCracken 1994)

## **Prevention**

Quarantine and faecal testing of all new arrivals to collection.

## **Septicaemia**

### **Description**

Mostly caused by Gram negative bacilli, *Aeromonas* and *Pseudomonas* spp.

Pathogenesis: sequel to localised infection; via infection of oral and skin wounds.

*Aeromonas hydrophila* transmitted by the mite *Ophionyssus natricis* (in lizards); or precipitated by environmental stress and debilitation.

### **Clinical Signs**

Several disease patterns seen:

- Sudden death with no premonitory signs
- Presented lethargic with decreased muscle tone – death occurs within 24 hours of onset with terminal convulsions and writhing
- Chronic condition (usually in association with localized infections, e.g. pneumonia, necrotic stomatitis): red colouration under scales. Death occurs usually after several weeks

## **Diagnosis**



Collect blood for C+S and Giemsa straining of smears to look for bacilli in mononuclear cells and plasma. Collect specific samples for culture from associated localized infections. Often diagnosed at post mortem with findings similar to those seen in mammals with septicaemia.

### **Treatment**

Often treatment is too late for the affected lizard but C+S at PM is important for treatment of in-contact lizards if they develop similar signs. In chronic cases, give parenteral antibiotic, fluid and vitamin therapy and treat any associated localised infection. Identify and correct any environmental stresses present.  
(McCracken 1994)

### **Mycobacterial Infections**

#### **Description**

Aetiology: several species involved – *Mycobacterium chelonae*, *M.avium*, *M.themnopheos*, *M.ulcerans*. All should be considered potential human pathogens. They cause multifocal granulomatous lesions in the skin and internal organs (usually liver and spleen).

#### **Clinical Signs**

Non specific: Lethargy, weight loss, sometimes visible / palpable abscesses, eventually death.

#### **Diagnosis**

Needle aspirate or excision of abscess material for microbacterial culture and for demonstration of acid fast organisms on smears and histopathology. Usually diagnosed at PM.

#### **Treatment**

Not practical or advisable due to zoonotic risk. Euthanise. Thoroughly disinfect enclosure and all contact items after death.  
(McCracken 1994)

#### **Viral Diseases**

## **Fungal Diseases**

Most commonly, infections are of the respiratory and integumentary systems. These diseases are usually associated with certain predisposing factors: low temperature, high humidity, malnutrition, unsanitary environmental conditions, stress and intercurrent disease.

### **Respiratory Tract Mycoses**

#### **Description**

Caused by a wide variety of organisms, including *Aspergillus*, *Pencillium*, *Candida* and *Mucor* spp. These produce granulomatous lesions at all levels of the respiratory tract, with lung consolidation and necrosis.

#### **Clinical Signs & Diagnosis**

As for bacterial pneumonia. Most commonly diagnosed at PM as clinical signs are often subtle and not detected.

#### **Treatment**

No successful treatment is reported in literature but try systemic antimycotics, e.g. ketoconazole (Nizoral, Janssen Pharmaceutica Pty. Ltd.) at an oral dose of 15mg / kg sid for 2-4 weeks.

**Note:** This dose is empirical – it has not been determined by pharmacokinetic studies in reptiles. Give parenteral fluid and vitamin therapy.  
(McCracken 1994)

### **Skin Mycoses**

#### **Description**

Wide variety of organisms involved, including *Basidiobolus*, *Geotrichium*, *Paecilomyces*, *Trichophyton* and *Aspergillus* spp. Reptile skin is usually resistant to fungal attack unless traumatized, macerated by moisture, or compromised by retained “slough”. Lesions are most commonly ulcerative dermatitis, caseous subcutaneous nodules.

#### **Diagnosis**

Take scrapping or aspirate of lesion for direct examination and culture. May also take skin biopsy for histopathology (including PAS staining to demonstrate fungi).

#### **Treatment**

Thoroughly cleanse with povidone scrub. Debride necrotic tissue and excise abscesses. Then once to twice daily soaking in dilute povidone iodine followed by topical application of anti fungal solution preferred over ointments e.g. Parderm (Parnell); tolnaftate (Tinaderm, Plough) mixed with a little dimethylsulphoxide (DMSO); or miconazole nitrate (Daktarin, Jansen Pharmaseutica). In cases of progressive digital necrosis, amputation is indicated.  
(McCracken 1994)

## **Protozoal Diseases**

In captivity, the protozoal burden may reach quite high levels and this, if coupled with poor husbandry (particularly overcrowding), may lead to disease.

### **Flagellate Enteritis**

#### **Description**

Intestinal flagellate protozoans including *Trichomonas* spp. They are suspected of causing diseases when present in large numbers or when in association with other parasites or pathogenic bacteria. Mode of transmission is by ingestion of organisms voided in urine and faeces.

#### **Clinical Signs**

Diarrhoea, swollen cloaca, +/- necrosis, polydipsia, inappetance.

#### **Diagnosis**

Make direct wet preparations (with 0.9% NaCl at 37°C) of fresh urates and faeces and examine for motile organisms. As reptile defaecate infrequently, and as the faeces are often dry, saline enemas are useful to obtain samples for diagnosis. Trichomonads have only one recurrent flagellum. Commonly seen in faeces of healthy reptiles. Assumed to be of pathogenic significance only if seen in large numbers in animals with clinical disease.

#### **Treatment**

Oral dimetridazole or oral or injectable metronidazole at doses given 100mg / kg p.o. or 20 mg / kg SC, repeated after 14 days. Also give supportive fluid and vitamin therapy.  
(McCracken 1994)

## **Amoebiasis**

### **Description**

The most significant species of amoebae found in reptiles is *Entamoeba invadens*. This organism is common and highly pathogenic (e.g. Lizards). These lizards can act as reservoirs of infection for other lizards sharing their enclosure. *E. invadens* is transmitted by ingestion of infective cysts passed in faeces. It primarily causes an ulcerative, haemorrhagic colitis. In chronic cases there is granulomatous thickening of the colonic wall, sometimes resulting in luminal occlusion +/- severe local peritonitis. In most cases there is concomitant bacterial infection, usually with gram negative organisms.

### **Clinical Signs**

These are usually only seen in the terminal phase of disease: firm, swollen cloaca +/- body in region of terminal colon, mucoid diarrhea, +/- vomiting, anorexia +/- polydipsia, weight loss, lethargy. Often results in death after 1-2 weeks.

### **Diagnosis**

Make direct wet preparations of fresh faeces (with 0.9% NaCl at 37°C) and examine for motile amoebae (with pseudopodia). Also examine faeces for cysts using the following technique: mix one drop of faeces with equal volume of 1% of aqueous eosin solution. Then add one drop of Lugol's iodine (4% KI +2% iodine in distilled water). Cysts will stain dark with iodine while everything else will stain pink with eosin.

### **Treatment**

Oral dimetridazole for 8 days or oral or SC metronidazole. Also give parenteral antibiotic, fluid and vitamin therapy. Treatment is often unsuccessful. (McCracken 1994)

## **Ciliates**

### **Description**

Ciliate protozoans, principally *Balantidium* spp., commonly occur in the intestines of lizards. They may be pathogenic in large numbers or in association with other parasites or pathogenic bacteria. Transmission is by ingestion of cysts pasted in faeces.

### **Clinical Signs**

Possibly diarrhoea, anorexia.

### **Diagnosis**

Make direct wet preparations (with 0.9% NaCl at 37°C) of fresh urate and faeces and examine for motile organisms. As reptile defaecate infrequently, and as the faeces are often dry, saline enemas are useful to obtain samples for diagnosis.

### **Treatment**

The drug of choice is metronidazole (Flagyl S oral suspension, May & Barker, Metrin injectable solution, Parnell Labs) at a single dose of 100mg/kg p.o. or 20 mg/kg SC, repeated after 14 days. Oral dosing is probably more effective. Always give Flagyl suspension mixed with equal volumes water and ensure that lizard remains well hydrated following treatment. Metronidazole toxicity (CNS signs) has been reported at higher doses. The doses given here appear to be safe and effective. Alternatively, give dimetridazole (Emtryl Soluble Powder 40% w/w, May and Barker) at dose of 40mg/kg daily for 7 days. To use, mix 1g powder with 9ml water, and give at rate of 1ml/kg. Give by direct oral dosing or mix calculated dose in 1L water and use as bath for 14 days. Also give supportive fluid and vitamin therapy.  
(McCracken 1994)

### **Endoparasites**

In captivity, parasite burdens may reach very high levels due to lowered host resistance (due to stress and/or inadequate nutrition) and constant reinfection in a small, confined environment. All captive lizards should be checked (by faecal floatation) at least bi-annually for endoparasites and treat accordingly, even in the absence of clinical disease, in order to keep parasitism at a minimum.

#### **Cestodes**

**Cestode infections are quite common in this species. Lizards may be definitive, intermediate or paratenic to cestodes and, therefore, may be infected with adult or larval forms. Infection is acquired by ingestion of paratenic's such as reptiles or ticks. Cestodes are generally non or only mildly pathogenic in lizards, except in cases of heavy infestation.**

#### **Adults :**

## **Description**

Most commonly members of the orders *Proteocephalidea* and *Pseudophyllidea*.

## **Clinical Signs**

Occasionally regurgitation of partly digested food and parts of strobilae; anorexia and weight loss; occasionally death.

## **Diagnosis**

Proglottides in faeces or identification of eggs on faecal flotation. Eggs characteristically have six hooklets in the oncosphere; pseudophyllidean eggs are operculate.

## **Treatment**

Oral praziquantel (Droncit, Bayer) at a single dose of 7.5mg/kg, repeated 14 days later. (McCracken 1994)

## **Nematodes**

Intestinal: *Strongyloides* spp.

## **Description**

Common, occasionally pathogenic, parasite of lizards.

## **Clinical Signs**

Diarrhoea, anorexia, weight loss.

## **Diagnosis**

Faecal floatation: free larvae or larvae in thin-shelled eggs.

## **Treatment**

- Fenbendazole (Panacur 2.5, Hoechst) orally at dose of 50-100mg/kg (adulticide and ovide - therefore reduces chance of reinfection).
- Mebendazole (Telmin RLT Drench, 50mg/ml, SmithKlein Beecham) orally at dose of 20-25mg/kg.
- Ivermectin (Ivomec liquid for sheep, or Ivomec injection for cattle MSD AgVet) p.o. or SC at 0.2mg/kg.

Note: General – for all drugs, give as single dose repeated after 14 days.

(McCracken 1994)

## **Oxyurids**

### **Description**

Very common, generally non-pathogenic, parasite of lizards.

### **Clinical Signs**

Rarely occur. May result in death.

### **Diagnosis**

Faecal flotation: thick-shelled, ellipsoid, asymmetrically flattened eggs +/- operculum.

### **Treatment**

- Fenbendazole (Panacur 2.5, Hoechst) orally at dose of 50-100mg/kg (adulticide and ovide - therefore reduces chance of reinfection).
- Mebendazole (Telmin RLT Drench, 50mg/ml, SmithKlein Beecham) orally at dose of 20-25mg/kg.
- Ivermectin (Ivomec liquid for sheep, or Ivomec injection for cattle MSD AgVet) p.o. or SC at 0.2mg/kg.

Note: General – for all drugs, give as single dose repeated after 14 days.

(McCracken 1994)

**Lungs:** Rhabdias spp.

### **Description**

Common, potentially severely pathogenic, parasites of lizards. The worm lives in the lung, causing loss of respiratory epithelium and fibrosis pulmonary tissue. Secondary bacterial infection may occur.

### **Clinical Signs**

Gasping, rapid breathing with mucus expelled from mouth: anorexia and weight loss: possibly death.

### **Diagnosis**

- Faecal flotation: demonstrate free larvae.
- Examination of oral mucus or lung washing: visualise free larvae or thin-shelled eggs with many blastomeres.

## **Treatment**

Levamisole hydrochloride (Injectable Levamisole 60mg/ml, Young's Animal Health) at dose of 10mg/kg IP. Give as single dose repeated in 2 weeks.  
(McCracken 1994)

Blood: Filaroids

## **Description**

Have been reported in Frilled Lizards. Transmitted by blood sucking arthropods e.g. mosquitoes or ticks. Occasionally pathogenic – heavy burdens of filariae may cause vascular occlusion and subsequent necrosis of organs/limbs/tail tip.

## **Clinical Signs**

Rarely seen. Occasionally evidence of avascular necrosis as above.

## **Diagnosis**

Examine for microfilaria in saline preparations of fresh blood. Usually diagnosed at PM.

## **Treatment**

Non reported.  
(McCracken 1994)

## **Ectoparasites**

### **Mites**

#### **Description**

Most commonly seen species is *Ophionyssus natricis*, the snake mite. Heavy infestations occur on this species in dirty, crowded environments and may result in severe anaemia



and death; ocular trauma due to rubbing because of irritation; transmittal of *Aeromonas hydrophila* and subsequent pneumonia or septicemia or roughened skin dysecdysis. Mite infestation is a potential zoonosis causing papular vesiculobullous dermatitis.

### **Clinical Signs**

Mites may be visualised between body scales and in the periocular sulci. As they are very small, they may be more readily identified by brushing the lizards body over a white sheet. May also see signs related to the sequelae listed above.

### **Treatment**

- Suspend dichlorvos impregnated strip (Shelltox Pest Strip, Shell Chemical Australia Pty Ltd) in inhabited vivarium for 3-4 days. Use 0.6cm of strip per 0.28 cubic metre of vivarium space. Remove water bowls during treatment. Then empty vivarium, clean thoroughly, and suspend strip in it for 10 days to kill hatching larval mites. Continually suspend strips in the room containing vivaria (use 1 strip per 100 cubic metres of room space).
- **Warning:** Dichlorvos poisoning can occur when either a larger recommended piece of Shelltox strip is used, or when the lizards are allowed to come into direct physical contact with the strip. Signs of poisoning range from ataxia in inco-ordination to paralysis to death. The treatment is thorough bathing, transferred to a fresh, uncontaminated enclosure, maintenance at PBT and subcutaneous fluid therapy. Most animals recover fully after 24-48 hours.
- Dichlorvos resistance may develop. An effective alternative is trichlorfon (Neguvon soluble powder, Bayer), Made up to a 0.15% solution. The enclosure is thoroughly cleaned, then sprayed with a 3% bleach solution, and all cage furniture either discarded or soaked in same solution. The enclosure is then sprayed with Trichlorfon and allowed to dry and air out before replacing the lizard. The lizard is then lightly but thoroughly sprayed with Trichlorfon, and returned to the enclosure set up with just a paper substrate. Water is withheld for 24 hours to prevent soaking and accidental ingestion of Trichlorfon. Repeat this treatment 10-24 days later. When treating lizards, first put ophthalmic lubricant on the eyes to prevent contact with Trichlorfon. The enclosure can then be set up with cage furniture as normal.
- Alternatively, use Ivermectin p.o. or SC (see below for dose rate), in combination with environmental treatment with Trichlorfon as described above.
- Fenbendazole (Panacur 2.5, Hoechst) orally at dose of 50-100mg/kg (adulticide and ovide - therefore reduces chance of reinfection).
- Mebendazole (Telmin RLT Drench, 50mg/ml, SmithKlein Beecham) orally at dose of 20-25mg/kg.
- Ivermectin (Ivomec liquid for sheep, or Ivormec injection for cattle MSD AgVet) p.o. or SC at 0.2mg/kg.

Note: General – for all drugs, give as single dose repeated after 14 days.

- Give specific treatment for any sequelae of mite infestation.

(McCracken 1994)

## **Ticks**

### **Description**

Species of the genera *Amblyomma*, *Aponomma*, *Hyalomma* and *Ornithodoros* are most common. They rarely occur in such heavy burdens as mites but are potential pathogens, causing anaemia, ulcerative skin lesions and acting as vectors for filariae.

### **Clinical Signs**

Ticks visualized at certain sites on lizards include; axillae, cranial aspect of elbow, between toes, in nostrils and around cloaca.

### **Treatment**

- Manual removal; or
- Dichlorvos strips (see treatment for mites) – Ticks are more resistant to this treatment than are mites – a minimum of 4 days exposure is required for successful treatment; or
- Alternatively, use Ivermectin p.o. or SC (see below for dose rate), in combination with environmental treatment with Trichlorfon as described above.
- Ivermectin (Ivomec liquid for sheep, or Ivormec injection for cattle MSD AgVet) p.o. or SC at 0.2mg/kg.
- Large lizards may be treated by dipping or spraying with 20% maldison (Fleetick rinse, Apex) at a dilution of 20ml in 1L of water. Use with care as potentially toxic.

(McCracken 1994)

## **Flys and Mosquitoes**

### **Description**

Sand fly's, horse fly's, midges and mosquitoes will all feed on lizards. Their significance lies in their transmission of viruses and filariae to their reptilian hosts. Wounds, the cloacal region and loose skin folds are commonly infested sites. Myiasis also occurs in lizards.

### **Treatment of myiasis**

Surgical removal of maggots: cleanse wounds with povidone iodine scrub; parenteral antibiotic, fluid and vitamin therapy.

(McCracken 1994)

## **Miscellaneous Diseases**

### **Shock**

#### **Description**

Both circulatory and hypoglycaemic shock have been reported in reptiles. Positive diagnosis is difficult in reptiles because of the difficulty in obtaining the parameters used to assess mammalian patients. Presumed circulatory shock is most commonly seen after stressful procedures, traumatic injury or surgery.

#### **Clinical Signs**

Circulatory shock: lethargic or comatose, pale mucus membranes, cold extremities, decreased RH and RR (may only breathe once every few minutes).

#### **Treatment**

Circulatory shock: parenteral fluid therapy, increase environmental temperature, intubate and give oxygen by IPPV if necessary.  
(McCracken 1994)

### **Dry Gangrene of Extremities**

#### **Description**

Common problem of tail tip or digits of captive lizards. The tail tip may be affected by crushing or retain slough but most commonly there is no apparent cause. A primary vascular lesion is suspected. Digital gangrene similarly often has no identifiable cause. In these cases, ingested mycotoxins from food are suspected for their vasoconstrictive properties.

#### **Treatment**

Anesthesia and immediate amputation of the affected body part as the gangrene is often progressive. Parenteral antibiotic therapy. Investigate possibility of mycotoxicosis (ie. Question re feeding practices and hygiene)  
(McCracken 1994)

## ***8.5 Quarantine Requirements***

If the animal(s) come from a reputable institution or private breeder where there has been good quarantine, preventative medicine practices and husbandry the following applies:

30 day quarantine period in isolation from other reptiles.  
3 faecal samples one week apart to check for parasites.  
If positive, the animal may be treated but depends on what parasites are found.  
Animal(s) would only leave quarantine after 2 consecutive negative samples (unless any parasites that may be found are deemed non-pathogenic).  
Clinical examination and sexing.  
Blood samples for routine haematology and biochemistry.  
Any other treatments or testing as indicated by the animal's history or findings on examination.  
(Larry Vogelneust pers. comm.. )

## **9 Behaviour**

### **Habits**

Most of foraging behaviour among Frilled Lizards occurs in the early morning & late afternoon (Shine & Lambeck, 1989).

Frilled Lizards in the wild go into a state of torpor commonly referred to as aestivating—the equivalent of hibernation in a hot climate (Martin 2003).

Group sizes consist of one male and three or four females depending on the size of the enclosure (Repashy 2006).

### **Social Behaviour**

The male is extremely territorial and becomes aggressive towards other males or rivals (ARAZPA 2006).

#### **9.1 Reproductive Behaviour**

The male display consists of gently flapping his frill slightly open and closed while bobbing and swaying his head (Middleton, Fitzgerald & Pye 1996).

The female response with head swaying, frill flapping and waving of her front limb (Middleton, Fitzgerald & Pye 1996).

Breeding occurs around the months of August to December (Bedford et al. 1993; Ehmann 1992; Frauca 1973; Christian et al. 1995; Griffiths et al. 1996).

## **9.2 Bathing**

Large shallow water bowls should be provided to these lizards get enough water ( de Vosjoli, Mailloux, Donoghue, Klingenberg 2001).

## **9.3 Behavioural Problems**

Males are territorial so housing together will no doubt cause behavioural problems (Mike Swan pers. comm, Michael McFadden pers. comm.).

## **9.4 Signs of Stress**

Same with most lizards, pacing, lethargy, dehydration, loss of appetite and hiding rather than basking (Mike Swan pers. comm, Michael McFadden pers. comm.).

## **9.5 Behavioural Enrichment**

### **9.5.1 Exhibit Design**

For this species a good size enclosure would consist of the following dimensions: 238cm (L) x 238cm (W) x 240cm (H) for a single pair of Frilled lizards (EAPA Standards 2004).

### **9.5.2 Social Grouping**

In captivity Frilled Lizards should be housed as a single male to multiple females as males are territorial and tend to form a dominance hierarchy.

If multiple males are housed together, subdominant males may become stressed and start to decline (de Vosjoli, Mailloux, Donoghue Klingenberg 2001).

### **9.5.3 Feeding Strategies**

In captivity a varied diet consisting of crickets, locusts, roaches, silkworm & silkworm moths (Michael McFadden & Mike Swan pers. comm.)

Live insects can be scattered around the floor of the exhibit to encourage natural foraging behaviour (pers. obs).

Feeding Frilled Lizards too much too often will quickly lead to obesity (Hauschild & Bosch 2004).

#### **9.5.4 Exhibit Furnishings**

- The enclosure should contain stout climbing branches reaching from the floor to the roof. A substrate depth of 5cm consisting of coarse sand.
  - A large shallow water bowl.
  - Adequate temperature and light cycles.
  - Good ventilation.
  - Basking lights.
- (Hauschild & Bosch 2004).

#### **9.5.5 Human Interaction**

Frilled Lizards remain still and press close to the branch they are perched on whilst keep a watchful eye on the keepers presents at all times (pers. obs.)

#### **9.5.6 Training & Conditioning**

Feeding Frilled Lizards with forceps to initiate a feeding response when introducing a new food item to their diet (pers. obs.)

#### **9.5.7 Sensory Stimulation**

- Pre-recordings of sounds from their natural habitat i.e bird calls, insects etc.
- Regular changing of exhibit furnishings, ie substrate and branches to help stimulate sight, touch & taste (pers. obs.).

### **9.6 Introductions and Removals**

#### **9.7 Intraspecific Compatibility**

It is best to house single males in captivity as they are territorial and tend to form a dominance hierarchy when several are housed together (Toro 1999, de Vosjoli, Mailloux, Donoghue & Klingenberg 2001).

1 male & several females can be housed together. Multiple females are ok to house together. (pers. obs.)

### **9.8 Interspecific Compatibility**

The following reptile species are currently housed together with Frilled Lizards at Sydney Wildlife World: (pers. obs.)

*Egernia hosmeri*            Hosmer's skinks  
*Varanus tristis tristis*    Black - headed monitor

And at the Australian Reptile Park the following lizard species are housed with Frilled Lizards: (Lisa Harris pers. comm.).

*Tiliqua multifasciata*    Centralian Blue - tongue Lizards  
Shingle back Lizards

Below is a list of other compatible species of lizards that can be housed with Frilled lizards.

#### AGAMIDAE

*Pogona barbata*            Eastern Bearded Dragon.  
*Pogona microlepidota*    Kimberley Bearded Dragon.  
*Pogona vitticeps*          Central Bearded Dragon.

#### VARANIDAE

*Varanus acanthurus acanthurus*    Spiny – tailed Monitor.  
*Varanus acanthurus brachyurus*    Common Ridge – tailed Monitor.  
*Varanus acanthurus insulanicus*    Island Ridge – tailed Monitor.  
*Varanus baritji*                        Northern Ridge - tailed Monitor.  
*Varanus glauerti*                       Kimberley Rock Monitor.  
*Varanus pilbarensis*                  Pilbara Rock Monitor.  
*Varanus scalaris*                       Spotted Tree Monitor.  
*Varanus tristis orientalis*          Freckled Monitor.

#### SCINCIDAE

*Tiliqua occipitalis*                    Western Blue – tongue Lizard.  
*Tiliqua scincoides intermedia*      Northern Blue – tongue Lizard.  
*Tiliqua rugosa konowi*                Rottneest Island Shingleback Lizard.  
*Tiliqua rugosa rugosa*                South – west Shingleback Lizard.

<i>Tiliqua rugosa palarra</i>	Shark Bay Shingleback Lizard.
<i>Tiliqua rugosa aspera</i>	Common Shingleback Lizard.
<i>Egernia cunninghami</i>	Cunninghams Skink.
<i>Egernia depressa</i>	Pygmy Spiny – tailed Skink.
<i>Egernia stokesii</i>	Stoke’s Skink.
<i>Egernia stokesii aethiops</i>	Baudin Island Gidgee Skink
<i>Egernia stokesii badia</i>	Western Gidgee Skink.
<i>Egernia stokesii stokesii</i>	Houtman Abrolhos Gidgee Skink.
<i>Egernia stokesii zellingi</i>	Eastern Gidgee Skink.
(Michael McFadden, Stuart Kozlowski pres. com.).	

## **9.9 Suitability to Captivity**

Excellent, provided they receive the right conditions  
(Mike Swan, Michael McFadden pers. comm.).



## **10 Breeding**

### **10.1 Mating System**

Polygynous – Where a male has more than one female partner, during a single breeding season.

Males seek out females in the wild (pers. comm. Andrew Cammalerri)

### **10.2 Ease of Breeding**

Friiled Lizards are quite easy to breed with a ratio of 1:2:0 but a cooling period should be carried out prior to breeding season  
(pers. comm. Andrew Cammalerri)

### **10.3 Reproductive Condition**

10.3.1 Females: Increase food source, decrease fat and increase protein.  
This reduces the chance of obesity and increase humidity.

**NOTE:** Female Friiled Lizards calcium intake should be increased during the breeding season to prevent their bodies from taking the needed calcium from their skeletal system ( Repashy 2006 ).

10.3.2 Males: Increase food, temperature and humidity.

### **10.4 Techniques Used to Control Breeding**

- Separate sexes
- Maintain single sex groups (eg. females)

(Pers. comm. Andrew Cammalerri)

### **10.5 Occurrence of Hybrids**

No hybrids have bred in captivity to date 2007  
(Pers. comm. Andrew Cammalerri).

### **10.6 Timing of Breeding**

Breeding occurs around the months of August to December (Bedford et al. 1993; Ehmann 1992; Frauca 1973; Christian et al. 1995; Griffiths et al. 1996).

### **10.7 Age at First Breeding and Last Breeding**

Refer to 3.4.3

Age of last breeding in Frilled Lizards is unknown.  
(Adam Skidmore Pers. Comm)

### **10.8 Ability to Breed Every Year**

Yes if environmental cues are available and animals experience a period of torpor (cooling) (Pers. comm. Andrew Cammalerri).

### **10.9 Ability to Breed More than Once Per Year**

They are oviparous and multiple clutches of eggs are possible (2 per year). The number of clutches varies from year to year, presumably in response to factors such as food and resource availability (Toro 1999).

### **10.10 Nesting, Hollow or Other Requirements**

- The nest is constructed at a depth of 10 – 20 cm (Toro 1999).
- Female frilled lizards should be offered a tray that is 60cm long X 38cm wide and about 18cm deep with a laying medium of damp peat (de Vosjoli, Mailloux, Donoghue, Klingenberg, Cole 2001).

### **10.11 Breeding Diet**

Add a new food source e.g. You feed normal 60 % crickets, 10% roaches, 15% locusts, 15% pinkies. Change to 60 % locusts, 15% crickets, 20% pinkies, 5% roaches (Andrew Cammalerri (Pers. comm)).

### **10.12 Incubation Period**

Incubation periods for frilled lizards varies between 54 – 92 days in captivity (Toro, 1999).

### **10.13 Clutch Size**

- Average clutch size for frilled lizards ranges from 12 - 18 eggs (depending on the size of the female) (Repashy 2006).
- Egg masses range from 2.4g – 4.6g (Toro, 1999).
- Average egg measurements are 28.5mm long & 30 mm wide (Hauschild & Bosch 2004).

### **10.14 Age at Fledging**

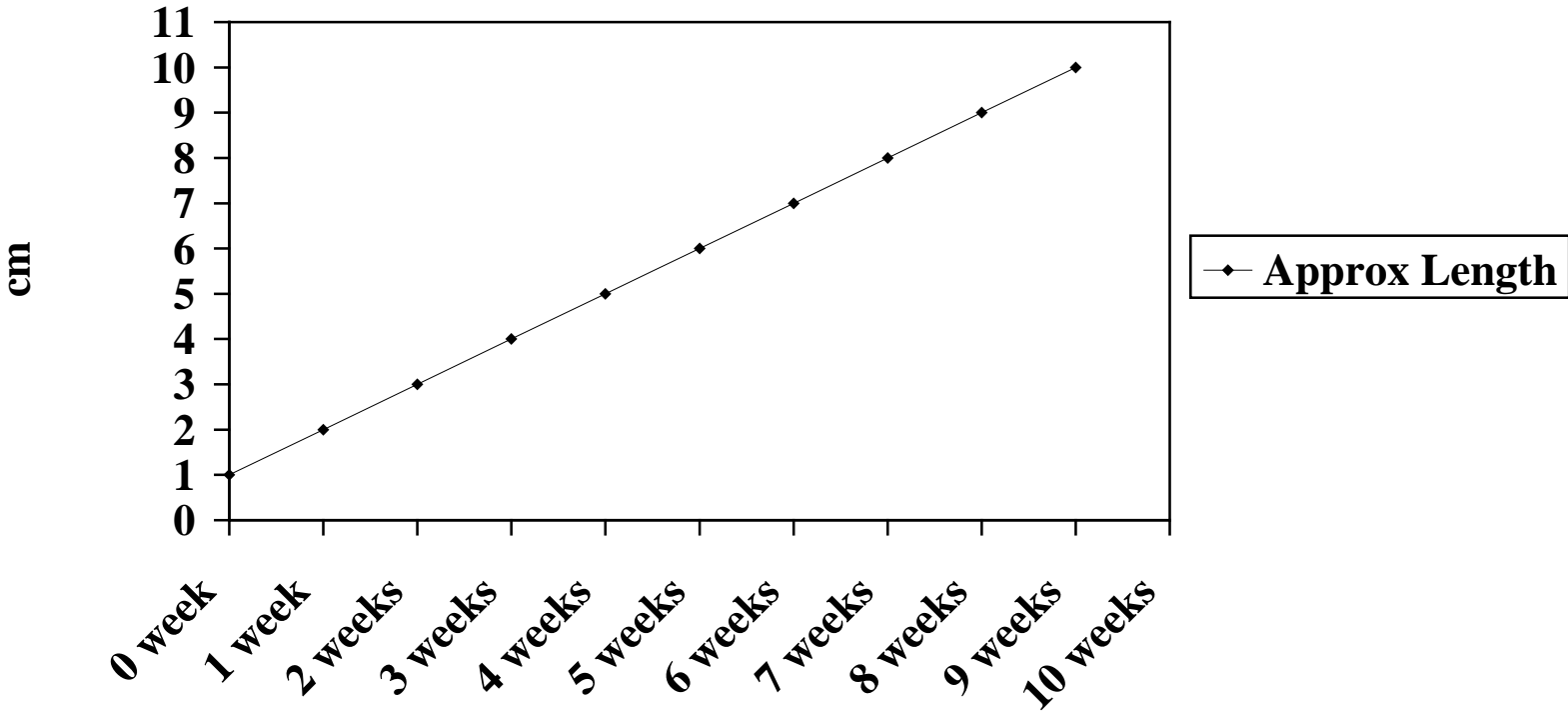
Not Applicable in this species.

### **10.15 Age of Removal from Parents**

Not Applicable in this species.

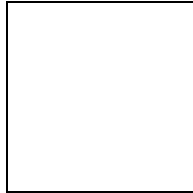
### **10.16 Growth and Development**

Growth chart for hatchling frilled lizard



# 11 Artificial Rearing

## 11.1 Incubator Type



## 11.2 Incubation Temperatures and Humidity

The incubation temperature of 29°- 30°C should be pre – set 24 hrs before the incubator is required in order to make sure that it maintains the desired temperature. The desired relative humidity of 100% can be achieved from using the following mix of Vermiculite to a ratio of 1:1, 150gm Vermiculite to 150gm or 150ml of water. Add water to dry Vermiculite mix. (Barnett 1998, Raftery 2002).

The sex of the hatchlings appears to be determined at least in part by the incubation temperature.

In Frilled Lizards eggs incubated at 29°- 32°C produce approximately equal numbers of males and females. Eggs incubated at relative low (26° C) and high (33 ± 5° C) temperatures produce exclusively females (Harlow and Shine, 1999).

## 11.3 Desired % Egg Mass Loss

Not Applicable in this species.

## 11.4 Hatching Temperature and Humidity

## 11.5 Normal Pip to Hatch Interval

In artificial incubation, the time between the eggs pipping and the emergence of the hatchling is 6 – 18 hours (Harlow and Shine, 1999).

## 11.6 Brooder Types/Design

Not Applicable in this species.

## 11.7 Brooder Temperatures

Not Applicable in this species.

## **11.8 Diet and Feeding Routine**

- Methods Used To Feed

Forceps can be used to feed hatchling Frilled Lizards as this gives the keeper a good idea of how much the young lizard is eating. The other method is by scatter feeding in which the keeper scatters a small amount of insect eg. Crickets, roaches etc. May have to stand and watch to see if young lizard is feeding (pers. Obs).

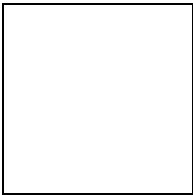
- Amount Of Food
- Frequency Of Feeds

Hatchlings Frilled Lizards should be offered small insects once or twice daily.

## **11.9 Specific Requirements**

### **11.10 Pinioning Requirements**

### **11.11 Data Recording**



### **11.12 Identification Methods**

### **11.13 Hygiene**

### **11.14 Behavioural Considerations**

### **11.15 Use of Foster Species**

Not Applicable in this species.

### **11.16 Weaning**

Not Applicable in this species.

**11.17 Rehabilitation Procedures**

Not Applicable in this species.

## 12. Therapeutics



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Lisa Harris – Volunteer keeper, Australian Reptile Park.

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## **16 Glossary**

### **Adaptation**

An inherited (genetically controlled) characteristic of an organism that helps it to survive and reproduce in the environment it inhabits. These are often interpreted as evolutionary changes in response to selection pressures in that environment.

### **Adult**

Sexually mature, full grown.

### **Aestivating**

To go into an inactive state during periods of drought or high temperatures.

### **Agamid**

Lizard belonging to the ‘dragon’ family (Agamidae).

### **Amniote**

An animal that produces an embryo within a sac that contains amniotic fluid. Amniotes include turtles, lizards, snakes, tuataras, crocodilians, birds and mammals.

### **Arboreal**

Dwelling in trees.

### **Axillary**

The area on the side and belly, behind or below the front legs. The “armpit” area.

### **Bask**

To lie in the warmth of the sun.

### **Bipedal Locomotion**

Literally, moving on two feet. Refers to running on the hind legs, which is seen in some very fast lizards, particularly on loose surfaces such as sand. Some tropical lizards can even run for short distances across the surface of water.

**Brumation**

Winter dormancy in ectothermic terrestrial vertebrates, analogues to hibernation in mammals.

**Cloaca**

The common chamber into which the urinary, digestive and reproductive systems discharge their contents and which opens to the exterior.

**Clutch**

A group of eggs that is laid in the same place at the same time (or nearly the same time), and will hatch at the same time.

**Cold – blooded**

An animal whose temperature varies with that of its surroundings.

**Conspecific**

An organism belonging to the same species as another.

**Cryptic colouration**

Colouring that conceals or disguises an animal's shape.

**Display**

A stereotyped pattern of behaviour involved in communication between animals.

**Diurnal**

Active during the day.

**Dorsal**

Referring to features on the back or along the spine of the animal.

**Ecdysis**

Shedding of the cuticle or skin; moulting.

**Ectoparasite**

A parasite that lives on the outer surface of an organism (e.g. ticks, mites etc).

**Ectothermic**

Dependant on external heat sources, such as the sun, for raising body temperature.

**Egg Tooth**

A small tooth in the front of a baby reptile's mouth, which helps it to break free from its eggshell.

**Endothermic**

Able to sustain high body temperature by means of heat generated within the body by METABOLISM.

**Endoparasite**

A parasite that lives within another organism (e.g. tapeworm etc).

**Epidermis**

The outer layer of skin.

**Genus**

(plural genera) a taxonomic category ranking below FAMILY and above SPECIES; contains one or more species.

**Gestation**

The period of time between mating and the birth of the young.

**Gravid**

Said of females when they are carrying fertilized eggs.

**Habitat**

The area where a species lives.

**Hatchling**

A young animal that has just emerged from its egg.

**Hemipenis**

Paired, vascular, eversible sacs which open into the posterior cloaca in snakes and lizards. The two hemipenes are brought together to act as a penis and are inserted into the cloaca of the female during copulation.

**Hibernation**

Along period of inactivity when all body processes are slowed down in very cold weather.

**Humid**

Moist, an area of heavy rainfall.

**Hyoid**

A U – shaped bone to which the larynx is attached.

**-idea or -id**

Suffixes for the name of an animal family. For example, the dog family is Canidae, and members of the family can all be called “canids” even if they’re not in the genus *Canis*, for which the family is named.

**Incubation**

The act of incubating eggs, i.e. keeping them warm so that development is possible.

**Inguinal**

The area on the underside in front of the hind legs, The “groin” area.

**Insectivorous**

Said of an animal which mostly eats insects.

**Internal Fertilization**

Fusing of eggs and sperm inside the female’s body.

**Iris**

The coloured, circular area surrounding the dark pupil of the eye.

**Intromission**

The act of inserting the males copulatory organ into the body of the female.

**Juvenile**

Not yet sexually mature.

**Keel**

A ridge down the center of a scale. Very sharp keeling may make an animal appear quite rough. In general, an animal with keeled scales will appear less shiny and lustrous than one with unkeeled scales, as the keeling causes the reflected light to scatter.

**Kg / bw**

Per kilogram of body weight.

**Keratin**

A tough, fibrous protein present in epidermal structures i.e. claws.

**Larynx**

A sound producing organ located at the upper end of the trachea (the windpipe).  
Containing the vocal cords.

**Lateral**

Referring to the side of the body.

**Monotypic**

The sole member of its group, such as a single species that constitutes a genus.

**Neonate**

The newborn or newly hatched animal.

**Oviparous**



Reproduces by egg laying.

### **Photoperiod**

The duration of light occurring in a 24 hour period.

### **Preanal Pores**

One or more pores located in front of the vent.

### **Quarantine**

Isolation to prevent the spread of infectious disease.

### **Savanna**

Open grassland with scattered trees and bushes.

### **Sclerophyll Forest**

A forest mostly comprising eucalypt (gum) trees which have hard stiff leaves.

### **Semi Adult**

The transition period from juvenile to sexual maturity.

### **Sexual Dimorphism**

Refers to a species where the males and females are different in appearance. This can be a difference in size, or in other visual features.

### **Sloughing**

Shedding skin. Lizards slough when a new layer of epidermis has grown beneath the old skin.

### **Snout-Vent-Length**

A standard measurement of body length. The measurement is from the tip of the nose (snout) to the anus (vent), and excludes the tail.

### **Species**

A group of animals that share the same characteristics and can breed with one another to produce fertile young.

**SVL**

Snout – vent – length. The length from the tip of the snout to the cloacal opening.

**Symphysis****Taxon**

(plural taxa) A taxonomic category of any rank (e.g. species, genus, family, order).

**Territorial**

Defending an area so as to exclude other members of the same species.

**Thermoregulation**

The control of optimum body temperature by cooling or heating.

**TL**

Total Length. The length from the tip of the snout, to the tip of the tail.

**TLL**

Tail Length. The length from the cloacal opening to the tip of the tail.

**Tympanum**

Eardrum, ear opening.

**Vent**

The cloaca of an animal; in reptiles this opening may also serve the reproductive organs. It is seen as a marker of where the body ends and the tail begins, which is hard to determine in some animals, such as snakes.

**Ventral**

Referring to the underside of an animal, the “tummy” side.

**Zoonosis**

Disease transmitted from animals to humans.



## 17 Appendix 1

(e.g. equipment details, suppliers and drug details)

### **F10SC super concentrate & F10 Hand Gel**

Chemical Essential Pty Ltd

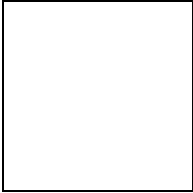
13 Abelia Street

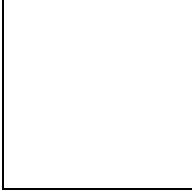
Doncaster East VIC 3109

Australia

Tel:03 9841 9901

Email: [chemicalessential@bigpond.com](mailto:chemicalessential@bigpond.com)





**Speckled Roaches, Rep-Cal Calcium and Multivitamin supplements, Vernier Calipers, Top Of Descent Insecticide aerosol &HabiStat Thermostat.**

**HERP SHOP**

16 Suspension Street  
Ardeer, Victoria, 3022  
AUSTRALIA

Phone: (03) 9363 6841

Fax: (03) 9360 5704

Email: [sales@herpshop.com.au](mailto:sales@herpshop.com.au)

Website: [www.herpshop.com.au](http://www.herpshop.com.au)

**Crickets, Silkworms (seasonal)**

Pisces Enterprises Pty Ltd

PO Box 200

Kenmore QLD 4069

AUSTRALIA

Phone: 1800 351 839

Fax: (03) 3374 2393

Email: [info@piscesenterprises.com](mailto:info@piscesenterprises.com)

Website: [www.piscesenterprises.com](http://www.piscesenterprises.com)

## **Canned Reptile Food & UVB Fluorescent Tubes**

Pet Pacific NSW (Head Office & Showroom)  
46 David Road  
Emu Plains NSW 2750

PO Box 481  
Penrith NSW 2751  
Phone: (02) 4728 6000  
Fax: (02) 4728 6060  
Toll Free Fax (for orders) 1800 353 736

Pet Pacific Victoria (Showroom & Sales Office)  
42 Jellico Drive  
Scoresby VIC 3179  
Phone: (03) 9764 9200  
Fax: (03) 9764 9744

Pet Pacific South Australia  
56b Byre Avenue  
Somerton Park SA 5044  
Phone: (08) 8294 0722  
Fax: (08) 8294 0733  
Mobile: 0427 311 600

Pet Pacific Queensland  
Account Manager  
Sean McAuslan  
Mobile: 0438 809 019

Pet Pacific Western Australia  
Account Manager  
Andrew Wilkinson  
Mobile: 0438 603 691

For Orders:  
Email: [orders@petpacific.com.au](mailto:orders@petpacific.com.au)

General:  
Email: [petpacific@petpacific.com.au](mailto:petpacific@petpacific.com.au)

### **Incubator**

Multiquip  
260 Tenth Ave & Kelly St  
Austral NSW 2171  
Phone: (02) 9606 9011  
Fax:(02) 9606 0557  
Email: [info@multiquip.com.au](mailto:info@multiquip.com.au)  
Website: [www.multiquip.com.au](http://www.multiquip.com.au)

### **25cm Tweezers/Forceps**

Ultimate Reptile Suppliers  
PO Box 11  
Enfield Plaza  
Enfield SA 5085  
Phone: (08) 8262 9162  
Fax: (08) 8262 9164  
Email: [sales@ultimatereptiles.com.au](mailto:sales@ultimatereptiles.com.au)  
Website: [www.ultimatereptiles.com.au](http://www.ultimatereptiles.com.au)

### **Latex Examination Gloves**

Livingstone International Pty Ltd  
106 – 116 Epsom Road  
Rosebury NSW 2018  
Phone: 1300 554 554  
Fax: 1300 725 725  
Email: [salesdental@livingstone.com.au](mailto:salesdental@livingstone.com.au)  
Website: [http://www.livingstone.com.au/search\\_result.aspx?cat=dental&search=gloves](http://www.livingstone.com.au/search_result.aspx?cat=dental&search=gloves)

### **Face Mask**

### **Heat Lamp**

### **Temp Gun Available From:**

Pro Exotics  
Unit C  
3911 Norwood Dr.  
Littleton Colorado USA 80125  
Email: [sales@tempgun.com](mailto:sales@tempgun.com)  
[wholesale@tempgun.com](mailto:wholesale@tempgun.com)  
Website: [www.tempgun.com](http://www.tempgun.com)

### **Solarmeter model 6.2UVsolarmeter**

Solartech Inc  
26-101Harbour Pointe Dr N  
Harrison Twp, Michigan  
USA, 48045  
Ph: (800) 790-3311 (toll free)  
Email: [information@solarmeter.com](mailto:information@solarmeter.com)  
Website: [www.solarmeter.com.au](http://www.solarmeter.com.au)

## **18 Appendix 2**

( alternative suppliers)

### **Bio Supplies (Crickets).**

PO Box 141  
Morisset NSW 2264  
Mobile: 0401 618 970

### **Speckled Roaches**

Pisces Enterprises Pty Ltd  
PO Box 200  
Kenmore QLD 4069  
AUSTRALIA  
Phone: 1800 351 839  
Fax: (03) 3374 2393  
Email: [info@piscesenterprises.com](mailto:info@piscesenterprises.com)  
Website: [www.piscesenterprises.com](http://www.piscesenterprises.com)

### **Calcium And Vitamin Supplements**

Ultimate Reptile Suppliers  
PO Box 11  
Enfield Plaza  
Enfield SA 5085  
Phone: (08) 8262 9162  
Fax: (08) 8262 9164  
Email: [sales@ultimatereptiles.com.au](mailto:sales@ultimatereptiles.com.au)  
Website: [www.ultimatereptiles.com.au](http://www.ultimatereptiles.com.au)

### **Face Mask**

### **Latex Examination Gloves**



## **Substrate**

## **Feeder Tweezers**

Australia Fauna Supplies  
PO Box 7034  
Wilberforce NSW 2756  
Phone/Fax: (02) 4576 3491  
Email: [bradw@ausfauna.com.au](mailto:bradw@ausfauna.com.au)

## **Incubator**

(Thermal foam Incubator)  
Brookfield Poultry Equip (& Rare Breeds)  
Brookfield QLD 4069  
Phone: (07) 3374 3031  
Mobile: 0420 775 313  
Email: [alec@smartchat.net.au](mailto:alec@smartchat.net.au)  
Website: [www.brookfieldpoultryequipment.com/gallery.html](http://www.brookfieldpoultryequipment.com/gallery.html)

## **UVB Lights**

## **Heat Lamps**

## **19 Appendix 3**

(Annual Cycle Of Maintenance)

**January**

**February**

**March**

**April**

**May**

**June**

**July**

**August**

**September**

**October**

**November**

**December**

# 20 MSDS

( Safety Material Data Sheets ).

## MATERIAL SAFETY DATA SHEET

### SECTION 1A PRODUCT IDENTIFICATION

Trade Name:

### SECTION B SUPPLIERS IDENTIFICATION

### SECTION B SUPPLIERS IDENTIFICATION

Name:

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### SECTION 2 HAZARDOUS INGREDIENTS

### SECTION 2 HAZARDOUS INGREDIENTS





**SECTION 7 PREVENTATIVE MEASURES**

**SECTION 7 PREVENTATIVE MEASURES**

Personal  
Protective

Equipment:  Not  
required  
Equipment:

Not  
required

Eye N/A  
Protecti  
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on:

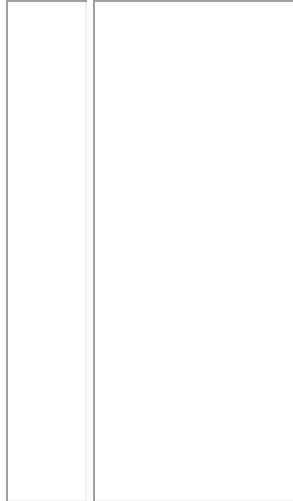
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**SECTION 8 FIRST AID MEASURES**

**SECTION 8 FIRST AID MEASURES**

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**MATERIAL SAFETY DATA SHEET**

**SECTION 1A PRODUCT IDENTIFICATION**

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SECTION B SUPPLIERS IDENTIFICATION  
SECTION B SUPPLIERS IDENTIFICATION

Name: Health and Hygiene (Pty) Ltd  
Address: P.O. Box 347  
Address: P.O. Box 347  
P.O. Box 347  
 Sunninghill  
 No: 021

**SECTION 2 HAZARDOUS INGREDIENTS**

**SECTION 2 HAZARDOUS INGREDIENTS**

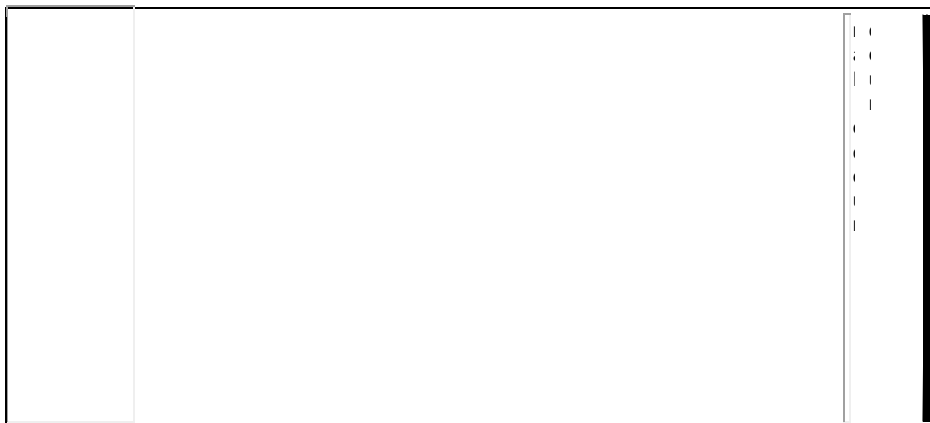
Hazardous Ingredients:

**SECTION 3 PHYSICAL DATA**

**SECTION 3 PHYSICAL DATA**

Physical State:

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**SECTION 4 FIRE & EXPLOSION DATA**

**SECTION 4 FIRE & EXPLOSION DATA**

Flammability:

**SECTION 5 REACTIVITY DATA**

**SECTION 5 REACTIVITY DATA**

Chemical Stability:

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**SECTION 6 TOXICOLOGICAL PROPERTIES**  
**SECTION 6 TOXICOLOGICAL PROPERTIES**

Exposure Route:	Degree of Hazard	<input type="checkbox"/> - Skin Contact: - Skin Contact:	Low: Concentration may act	<input type="checkbox"/> - Eye Contact:	Low: Will cause irritation but not serious damage	<input type="checkbox"/> - Inhalation hazard: - Inhalation:
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**SECTION 7 PREVENTATIVE MEASURES**

**SECTION 7 PREVENTATIVE MEASURES**

Personal Protective Equipment :	Not required	<input type="checkbox"/> Eye Protection: Eye Protection:	Avoid contact with eyes	<input type="checkbox"/> Leak & Spill Procedure: Leak & Spill Procedure:	Soak up onto inert material or may be flushed to drain with copious amounts of water	<input type="checkbox"/> Hand industrial Handling
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**SECTION 8 FIRST AID MEASURES**

**SECTION 8 FIRST AID MEASURES**

Inhalation:

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