

Husbandry Manual  
for  
Tiger Snakes



*Notechis spp*  
(Peters 1861) sl  
Reptilia:Elapidae

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# Occupational Health and Safety

**WARNING**  
This Snake is  
**DANGEROUSLY VENOMOUS**  
**CAPABLE OF INFLICTING A POTENTIALLY**  
**FATAL BITE**

**ALWAYS HAVE A COMPRESSION BANDAGE WITHIN REACH**

## FIRST AID FOR A SNAKE BITE

- 1) Apply a firm, broad, pressure bandage to bitten limb, and if possible, the whole length of limb, firmly.
- 2) The limb should be immobilized by a splint and kept as still as possible.
- 3) Keep the patient still and call for ambulance.

Immobilization and the use of a pressure bandage reduces the movement of venom from the bite site.

This restriction of venom will allow more time to transport the patient to hospital.

The patient should remain calm and rest.

If possible, transport should be brought to the patient, rather than patient to transport.

**Fig 1**



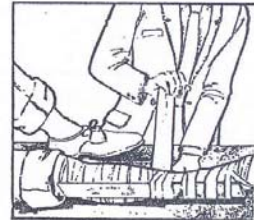
1 Apply a broad pressure bandage over bite site.



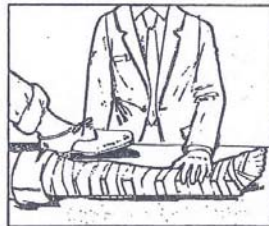
2 Apply bandage firmly.



3 Extend bandage as high as possible.



4 Immobilise the limb.



5 Limb immobilised with pressure bandage in place.

(Mirtschin, Davis, 1992)

# **Tiger Snake Antivenom**

## **What is Tiger Snake Antivenom?**

Tiger snake antivenom is an injection designed to help neutralize the effect of the poison (venom) of the tiger snake. It is produced by immunizing horses against the venom of the tiger snake and then collecting that part of the horse's blood which neutralizes this poison. The antivenom is purified and made into an injection for those people who may need it after being bitten by a tiger snake. Tiger snake antivenom is also the appropriate antivenom if you are bitten by a copperhead snake, a rough scaled snake or a member of the black snake family.

## **When is Tiger snake antivenom used?**

Tiger snake antivenom is given to people who become ill after being bitten by a tiger snake. Not every one who is bitten needs to have the antivenom as some people have only mild effects from the bite, or none at all. However, some people can become extremely ill after being bitten and in these people it is essential to use an appropriate amount of antivenom to counteract the effects of the poison. Several people die in Australia each year from inadequately treated snake bite.

## **Who should not have the antivenom?**

As there are sometimes unpleasant and dangerous reactions to the antivenom (See side effects of Tiger snake antivenom), it should not be given to people who have no effects from the bite. However, as tiger snake antivenom can be an emergency life-saving product, it should not be withheld from anyone who needs it.

## **Before you have tiger snake antivenom**

Before you have the injection, you should tell the doctor if

- You are an asthmatic
- You suffer from hay fever
- You suffer from any other allergies
- You have ever received injections containing horse serum (snake bite and other antivenoms)
- You had an anti-tetanus injection before 1974
- You are suffering from any other illness
- You are taking any medicines and what they are
- You are pregnant
- You are breast feeding.

**When medicines are produced in animals and injected into you, it is always possible that viruses or other substances could be present in the medicine and cause an illness. These could be viruses or other infectious agents which have not yet been discovered.**

## **SIDE EFFECTS OF TIGER SNAKE ANTIVENOM**

As with any medicine, some side effects may occur.

As the injection is made from horse serum, side effects occur more commonly in those who have allergies, particularly if they have ever had injections before which were also prepared from horses. Allergic reactions such as rashes, low blood pressure, wheezing and palpitations occur commonly. Headaches and fever are also common. Less commonly, localized swelling, muscle and joint pains, abdominal pain, vomiting, chest pain and blue discoloring of the skin can occur. These allergic reactions can be very severe and can cause death, but these complications can be treated by a doctor.

An illness consisting of a rash, swollen glands, joint pains and fever may occur about a week after the injection.

Always tell your doctor if you have any unpleasant effects after receiving the injection.

## **THE DOSE OF TIGER SNAKE ANTIVENOM**

The dose for both adults and children is one vial (3,000 units) which is considerably diluted and given slowly as a drip into a vein. The dose can be repeated as necessary. Your doctor will take precautions to counteract any allergic reactions if they should happen.

## **OVERDOSE**

There is no information on overdose.

## **WHAT DOES TIGER SNAKE ANTIVENOM CONTAIN?**

Tiger snake antivenom contains 3,000 units of antivenom in about 10 mL of liquid. Each injection also contains phenol as a preservative, sodium chloride and substances found in horse blood.

The Australian Registration Number is Aust R 74895

## **HOW TO STORE TIGER SNAKE ANTIVENOM**

**TIGER SNAKE ANTIVENOM SHOULD BE PROTECTED FROM LIGHT AND STORED AT 2-8°C (IN THE REFRIGERATOR). IT MUST NOT BE FROZEN.** It should not be used after the expiry date.

**This information comes with each vial of tiger snake antivenom**

(CSL Limited, 2000)

**Fig 2**

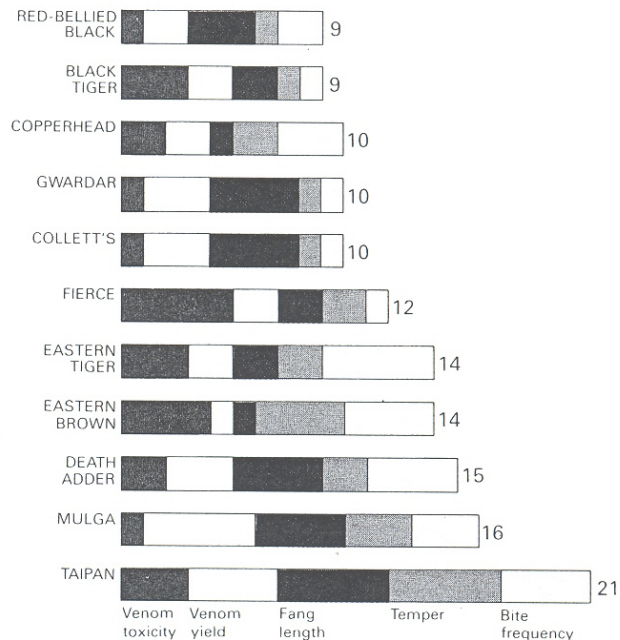
## Rating the risks

*Eleven of our most dangerous snakes  
have been 'ranked'  
by Queensland Museum staff.*

The most fearsome of the dangerous snakes, in practical terms, is whichever one you step on. Comparing the menace of different species is difficult because so many factors are variable. The fierce snake, for example, has the most potent venom — but it isn't especially fierce and hardly anybody goes where it lives.

Queensland Museum staff, however, have attempted a ranking. They scored snakes 1-5 points on each of five criteria: venom toxicity, venom yield, fang length, temper, and frequency of attacks on people. By their reckoning the taipan comes out well ahead, with 21 points out of a possible 25.

Scale 0 1 2 3 4 5



(Sutherland, S.1995)

## Zoonotic Hazards

People working with reptiles should be aware of Zoonotic Hazards. Zoonosis is diseases that can be transmitted from animals to humans.

These can include:

- Bacteria
- Protozoa
- Fungi
- Viruses
- Parasites, internal and external.

Ways of contacting Zoonotic diseases are:

- Reptile skins, feathers from feed animals.
- Excreta (faeces/urine), bodily discharges, vomit.
- A body part or sample taken from a reptile, eg, swab, blood or tissue sample.
- Equipment or bedding that has been in contact with a reptile, eg, needle, hoop bags, jiggers and substrate.
- During medical procedures, eg, blood, wastes, bodily fluids.

# TABLE OF CONTENTS

<b>1</b>	<b>INTRODUCTION.....</b>	<b>9</b>
<b>2</b>	<b>TAXONOMY .....</b>	<b>10</b>
2.1	NOMENCLATURE.....	11
2.2	SUBSPECIES.....	11
2.3	RECENT SYNONYMS.....	11
2.4	OTHER COMMON NAMES .....	12
<b>3</b>	<b>NATURAL HISTORY .....</b>	<b>13</b>
3.1	MORPHOMETRICS.....	13
3.1.1	<i>Mass And Basic Body Measurements .....</i>	<i>Error! Bookmark not defined.</i>
3.1.2	<i>Sexual Dimorphism.....</i>	<i>Error! Bookmark not defined.</i>
3.1.3	<i>Distinguishing Features.....</i>	24
3.2	DISTRIBUTION AND HABITAT .....	25
3.3	CONSERVATION STATUS .....	28
3.4	DIET IN THE WILD .....	26
3.5	LONGEVITY .....	28
3.5.1	<i>In the Wild .....</i>	28
3.5.2	<i>In Captivity.....</i>	28
3.5.3	<i>Techniques Used to Determine Age in Adults.....</i>	28
<b>4</b>	<b>HOUSING REQUIREMENTS.....</b>	<b>29</b>
4.1	EXHIBIT/ENCLOSURE DESIGN .....	29
4.2	HOLDING AREA DESIGN.....	31
4.3	SPATIAL REQUIREMENTS .....	32
4.4	POSITION OF ENCLOSURES .....	33
4.5	WEATHER PROTECTION.....	33
4.6	TEMPERATURE REQUIREMENTS .....	33
4.7	SUBSTRATE .....	35
4.8	NESTBOXES AND/OR BEDDING MATERIAL .....	36
4.9	ENCLOSURE FURNISHINGS .....	37
<b>5</b>	<b>GENERAL HUSBANDRY.....</b>	<b>38</b>
5.1	HYGIENE AND CLEANING .....	38
5.2	RECORD KEEPING .....	40
5.3	METHODS OF IDENTIFICATION .....	41
5.4	ROUTINE DATA COLLECTION .....	41
<b>6</b>	<b>FEEDING REQUIREMENTS.....</b>	<b>43</b>
6.1	CAPTIVE DIET .....	43
6.2	SUPPLEMENTS .....	43
6.3	PRESENTATION OF FOOD .....	44
<b>7</b>	<b>HANDLING AND TRANSPORT .....</b>	<b>45</b>
7.1	TIMING OF CAPTURE AND HANDLING .....	45
7.2	CATCHING BAGS .....	45
7.3	CAPTURE AND RESTRAINT TECHNIQUES .....	48
7.4	WEIGHING AND EXAMINATION .....	61
7.5	RELEASE .....	<b>ERROR! BOOKMARK NOT DEFINED.</b>
7.6	TRANSPORT REQUIREMENTS.....	61
7.6.1	<i>Box Design.....</i>	67
7.6.2	<i>Furnishings.....</i>	69

7.6.3	<i>Water and Food</i> .....	69
7.6.4	<i>Animals per Box</i> .....	69
7.6.5	<i>Timing of Transportation</i> .....	69
7.6.6	<i>Release from Box</i> .....	69
<b>8</b>	<b>HEALTH REQUIREMENTS</b> .....	<b>70</b>
8.1	DAILY HEALTH CHECKS .....	70
8.2	DETAILED PHYSICAL EXAMINATION.....	70
8.2.1	<i>Chemical Restraint</i> .....	73
8.2.2	<i>Physical Examination</i> .....	74
8.3	ROUTINE TREATMENTS .....	75
8.4	KNOWN HEALTH PROBLEMS .....	75
8.5	QUARANTINE REQUIREMENTS.....	90
<b>9</b>	<b>BEHAVIOUR</b> .....	<b>93</b>
9.1	ACTIVITY .....	93
9.2	SOCIAL BEHAVIOUR.....	95
9.3	REPRODUCTIVE BEHAVIOUR .....	96
9.4	BATHING .....	97
9.5	BEHAVIOURAL PROBLEMS .....	97
9.6	SIGNS OF STRESS.....	97
9.7	BEHAVIOURAL ENRICHMENT .....	97
9.8	INTRODUCTIONS AND REMOVALS .....	100
9.9	INTRASPECIFIC COMPATIBILITY .....	100
9.10	INTERSPECIFIC COMPATIBILITY.....	100
9.11	SUITABILITY TO CAPTIVITY .....	101
<b>10</b>	<b>BREEDING</b> .....	<b>102</b>
10.1	MATING SYSTEM.....	104
10.2	EASE OF BREEDING .....	104
10.3	REPRODUCTIVE CONDITION .....	105
10.3.1	<i>Females</i> .....	105
10.3.2	<i>Males</i> .....	106
10.4	TECHNIQUES USED TO CONTROL BREEDING .....	106
10.5	OCCURRENCE OF HYBRIDS.....	107
10.6	TIMING OF BREEDING.....	107
10.7	AGE AT FIRST BREEDING AND LAST BREEDING .....	107
10.8	ABILITY TO BREED EVERY YEAR.....	107
10.9	ABILITY TO BREED MORE THAN ONCE PER YEAR .....	107
10.10	NESTING, HOLLOW OR OTHER REQUIREMENTS.....	107
10.11	BREEDING DIET.....	107
10.12	INCUBATION PERIOD .....	108
10.13	CLUTCH SIZE.....	108
10.14	AGE AT WEANING .....	108
10.15	AGE OF REMOVAL FROM PARENTS.....	109
10.16	GROWTH AND DEVELOPMENT.....	109
<b>11</b>	<b>ARTIFICIAL REARING</b> .....	<b>111</b>
11.1	INCUBATOR TYPE.....	<b>ERROR! BOOKMARK NOT DEFINED.</b>
11.2	INCUBATION TEMPERATURE AND HUMIDITY .....	<b>ERROR! BOOKMARK NOT DEFINED.</b>
11.3	DESIRED % EGG MASS LOSS.....	<b>ERROR! BOOKMARK NOT DEFINED.</b>
11.4	HATCHING TEMPERATURE AND HUMIDITY .....	<b>ERROR! BOOKMARK NOT DEFINED.</b>
11.5	NORMAL PIP TO HATCH INTERVAL .....	<b>ERROR! BOOKMARK NOT DEFINED.</b>
11.6	DIET AND FEEDING ROUTINE .....	111
11.7	SPECIFIC REQUIREMENTS .....	111
11.8	DATA RECORDING.....	112

11.9	IDENTIFICATION METHODS .....	112
11.10	HYGIENE .....	113
11.11	BEHAVIOURAL CONSIDERATIONS .....	113
11.12	WEANING.....	<b>ERROR! BOOKMARK NOT DEFINED.</b>
<b>12</b>	<b>ACKNOWLEDGEMENTS.....</b>	<b>114</b>
<b>13</b>	<b>REFERENCES.....</b>	<b>115</b>
<b>14</b>	<b>BIBLIOGRAPHY .....</b>	<b>119</b>
<b>15</b>	<b>GLOSSARY .....</b>	<b>121</b>
<b>16</b>	<b>APPENDIX.....</b>	<b>122</b>
<b>17</b>	<b>SUPPLY</b>	
	<b>COMPANIES.....</b>	<b>6</b>



# 1 Introduction

The Australian Tiger Snake complex is comprised of two very closely related species, as well as four sub-species, and is the only members of the genus *Notechis*.

They represent one of the best studied groups of snakes in Australia with a considerable published knowledge based on their morphology, ecology, natural history, diet, behavior, and distribution. They also represent one of the most famous examples of insular body size variation with both dwarf and giant forms.

Tiger Snakes are very closely related to the endangered Broad headed Snake *Hoplocephalus bungaroides*.

The Eastern Tiger Snake is found in a broad range of habitats, from rainforests in the north to dry, open sclerophyll, and river floodplains in the south. (Cogger H)

They are viviparous

In New South Wales, the Eastern Tiger Snake is protected by the National Parks and Wildlife Act.

In Tasmania, the Eastern Tiger Snake is protected, and their status is secure, although some Island populations may decline if offshore activities threaten mutton-bird colonies. (Tas. NPWS)

The Flinders Range population (as *N.s.ater.*) is listed as vulnerable (Commonwealth IUCN red list) and the Chappell Island population (as *N.s.serventyi*) is vulnerable. (Wilson, Swan)

The Tiger Snakes are probably the best known of Australian snakes, having been responsible for a significant proportion of snake bites in this country.

Tiger snake antivenin was the first to be developed in Australia. (Cogger, 2000)

The venom of the tiger snake complex has been intensively studied in Australia and a large number of scientific papers have written on the complexities of the venom.

**(See appendix 1)**

The venom from Tiger Snakes is extremely neurotoxic, it has a powerful coagulant and it is Myotoxic as well.

There are many other toxins in this venom, some of which enhance the action of the main toxins. The venom is used in neuromuscular research and it is important venom for antivenin production. There are other diagnostic uses where the venom is used to detect various blood disorders in humans. The Venom of the Tiger Snake has 3 main toxic proteins which are Neurotoxins, Coagulants and Myotoxins.

(Mirtschin, P)

## Taxonomy

### *Notechis scutatus*

Derivation of name. From Greek *notios* (southern) + *echis* (snake)

From Latin *scutatus* (bearing a shield), in reference to the large shield-shaped frontal scale.

From Latin *Ater* (black)

From Latin *Nig,* = *er* (black, dark)

From Latin *occident-tal* (western)

The Tiger Snakes are a member of the Australian Terrestrial front fanged snakes or Proteroglyphs and have been described by;

**Notechis** Boulenger, 1896

**Notechis scutatus** (Peters, 1861)

*Alecto curta* by Dumeril (et al) in 1854: 1252-1254 (in part; non *Naja curta*. Schlegel, 1837)

*Hoplocephalus curtus* by Gunther in 1858: 216 (in part).

*Naja (Hamadryas) scutata* by Peters in 1861: 690

*Notechis scutatus*. By Boulenger in 1896: 351 (in part) – Rawlinson 1969: 122

*Notechis scutatus (scutatus)* by Kinghorn in 1956: 141-142  
67 specimens were examined.

**Notechis ater** (Krefft, 1866)

*Hoplocephalus ater* by Krefft in 1866: 373

*Hoplocephalus fuscus* by Steindachner in 1867: 82

*Alecto fasciolata* by Jan & Sordelli in 1873: liv. 43, pl.6, fig.4

*Notechis scutatus* by Boulenger in 1896:351 (in part)

*Notechis ater* by Kinghorn in 1921: 143 -- Rawlinson 1967: 215—Cogger et al 1983: 229

*Notechis scutatus niger* by Kinghorn in 1921: 145

*Notechis scutatus ater* by Kellaway & Thomson in 1932: 35-48

*Notechis scutatus occidentalis* by Glauert in 1948: 139—Storr 1982:235

*Notechis ater ater* by Worrell 1963b: 130

*Notechis ater serventyi* by Worrell in 1963c:3

*Notechis ater humphreysi* by Worrell in 1963c:5

74 specimens were examined.

## **Nomenclature**

<b>Kingdom</b>	Animalia
<b>Phylum</b>	Chordata
<b>Subphylum</b>	Vertebrata
<b>Class</b>	Reptilia
<b>Order</b>	Squamata
<b>Family</b>	Elapidae
<b>Subfamily</b>	Elapinae
<b>Genus</b>	<i>Notechis</i>
<b>Species</b>	<i>scutatus</i> <i>scutatus scutatus</i> <i>scutatus ater</i> <i>scutatus occidentalis</i> <i>scutatus niger</i> <i>scutatus serventyi</i> <i>scutatus humphreysi</i> (Smith,L and Johnstone,R: 2002)

## **Subspecies**

At this present time, the taxonomy of the tiger snake is still under review, as some scientists say that there are two species of tiger snake, with four subspecies, and some say that there is just a single species with a series of regional and island subspecies. What they actually say is “probably a single species with two or three moderately well differentiated subspecies.

I don't think that anyone can confidently separate the taxa in *Notechis* without ultimately depending on geographic information. (Cogger,H, pers comms. 5/6/06 Email)

## **Recent Synonyms**

*Naja (Hamadryas) scutata*  
*Alecto curta*  
*Hoplocephalus curtis*  
*Notechis scutatus*  
*Notechis scutatus scutatus*  
*Hoplocephalus ater*  
*Hoplocephalus fuscus*  
*Alecto fasciolata*  
*Notechis ater*  
*Notechis scutatus niger*  
*Notechis scutatus ater*  
*Notechis scutatus occidentalis*  
*Notechis ater ater*  
*Notechis ater serventyi*  
*Notechis ater humphreysi*

## **Other Common Names**

Common or Eastern Tiger Snake  
Kreffts Tiger Snake  
Peninsula Tiger Snake  
Western Tiger Snake  
Chappell Island Tiger Snake  
Tasmanian and King Island Tiger Snake  
Black Tiger snake (Mirtschin, Davis, 1992)  
Yellow Belly Black Snake

There is little agreement about the number of species and subspecies, despite the enormous variation in size, body form, colour pattern and toxins/toxicity. Until a solid phylogeny/taxonomy based of molecular data is complete (I'm pretty sure that Steve Donnellan and Mark Hutchinson at the South Australian Museum are working on it) my preferred position is that of Laurie Smith and Ron Johnstone in their 2002 revision of Storr, Smith & Jonstone's "Snakes of Western Australia". They treat all tiger snakes as a single species (*Notechis scutatus*) with a series of regional and island subspecies. What they actually say is "probably a single species with two or three moderately well differentiated subspecies".

Certainly I'm not convinced that anyone can confidently separate the taxa in *Notechis* without ultimately depending on geographic information. In your husbandry manual I think my approach would be to recognise a single species and list the names applied in the literature to various geographically delineated populations, cite their published diagnoses and point out that the taxonomic status of each (whether as subspecies or distinct species) awaits further work. (Cogger, H: pers comms 5/6/06. Email)

### 3 Natural History

Tiger snakes inhabit the southern areas of Australia, including Tasmania and the Bass Strait Islands. There are two species, and several sub-species in the complex. Their names are derived from the banded form of the mainland Tiger snake.

Tiger snakes are generally placid and not easily aroused unless harassed. This is one group that can flatten out the neck to a considerable degree, giving it an almost cobra-like appearance. The coloring of Tiger snakes is extremely variable, they may be black through chocolate to tan or yellow and with or without cross bands and regional variations can occur.

The Tiger snakes on Chappell Island in Bass Strait can reach a size of almost 2.5m and are extremely bulky. The snakes on these Islands feed predominately on the chicks of Mutton birds. They feed to excess for a few months of the year and starve for the rest of the time. (Swan, G)

Tiger snakes are ideal for keeping outdoors as they are very hardy, easy to get feeding, and become relatively docile quite rapidly under captive conditions. These attributes, along with their large size, long life spans and readiness to breed, make them suited to long term captivity in outdoor enclosures. (Fearn,S)

This depends on the climate, and the license held.

Unlike most other Australian elapids, Tiger snakes climb well on both vegetation and human constructions. They may occur as high as 10m above the ground. (Greer, A)

Tiger snakes throughout Tasmania are limited to around five months of activity each year in which to grow and reproduce, due to the highly seasonal climate, latitude and cold conditions.

Snakes begin to emerge from winter torpor and commence some limited basking in September but don't generally begin feeding until October when day length increases and temperature begin to rise.

Being adapted to a cool climate has resulted in tiger snakes being extraordinarily efficient at maintaining high body temperatures when air temperatures are low.

Field work has demonstrated that tiger snakes can maintain body temperatures of 30°C when air temperatures are less than half that by basking in sheltered sites in full sun, as well as utilizing warm substrates, such as rock, radiate heat and which cool very slowly. As black objects warm much faster in sunlight than lighter colored ones, it is probably no surprise that predominately black populations of Tasmanian tiger snakes are found on offshore islands and in the very coolest parts of Tasmania with short and unpredictable summers.

While overall climatic conditions are probably the greatest selective factor for melanism (black skin pigmentation) in populations on the Tasmanian mainland, efficient digestion plays a greater role on offshore islands.

Summer temperatures can be sufficiently high for such extended periods that finding tiger snakes out and about can be very difficult. During the warmest parts of the year, on

clear days (December to March) tiger snakes are generally only basking and foraging in the open for a few hours in the morning and again from about 4-30pm until dark. While it is common for mainland tigers to be active after dark, it is a rare event in Tasmania and limited to a few very warm nights each summer.

During the warmest parts of the day, the tiger snakes forage in cooler shaded situations, occasionally moving back into the sun to maintain a constant body temperature of between 28°C and 31°C. As day length and temperatures begin to drop in autumn, tiger snakes select a suitable overwintering site, usually well underground or beneath large objects such as boulders or large logs.

Such sites are selected to avoid freezing during heavy frost or snow. Periodic basking (depending on conditions) just outside such retreat sites may continue into April.

By May no more tigers are to be seen until the following spring.

(Fearn, S)

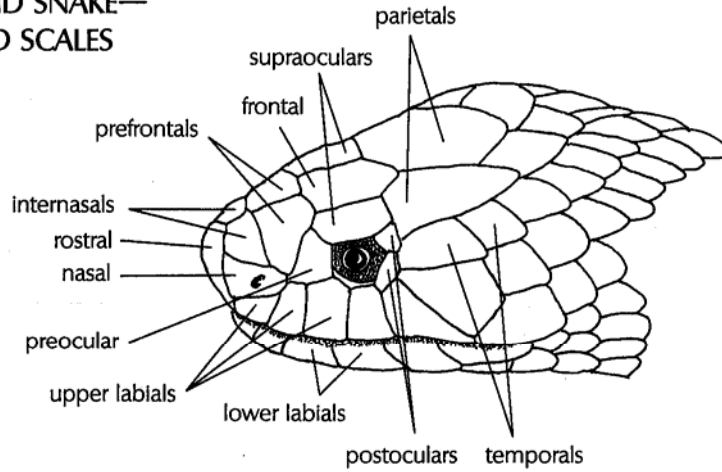
Bounties were actually paid for the tails of snakes that had been killed. Lady Jane Franklin (whose husband, Sir John, was the governor of Tasmania from 1836 to 1843) actually offered the princely sum of one shilling for every snake brought in. The resulting slaughter was so expensive to Lady Franklin that she had to drop the reward to four pence halfpenny, but even so she paid out more than £600 before she returned to England.

Bounty hunting continued for much longer periods in other areas, particularly the Islands of Bass Strait.

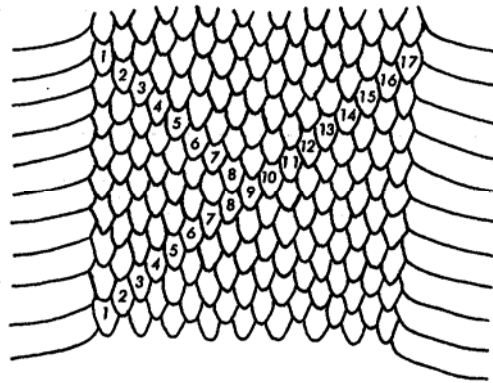
(Shine, R 1991).

### 3.1 Morphometrics

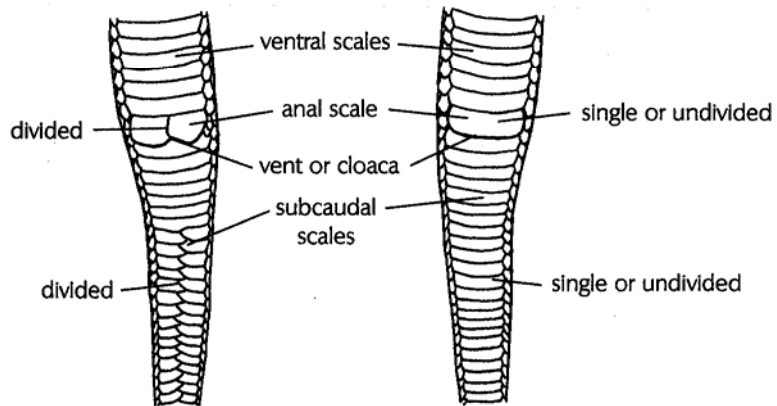
#### 10. ELAPID SNAKE— HEAD SCALES



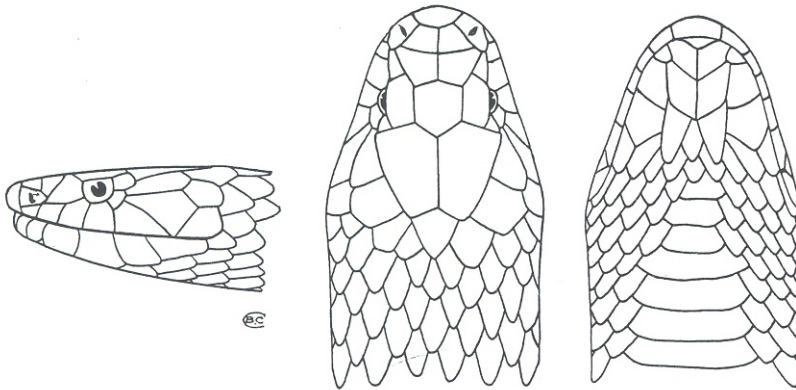
#### 11. SNAKE BODY SCALES SHOWING DIAGONAL COUNTS



#### 12. SNAKE—DIVIDED OR UNDIVIDED ANAL AND SUBCAUDAL SCALES

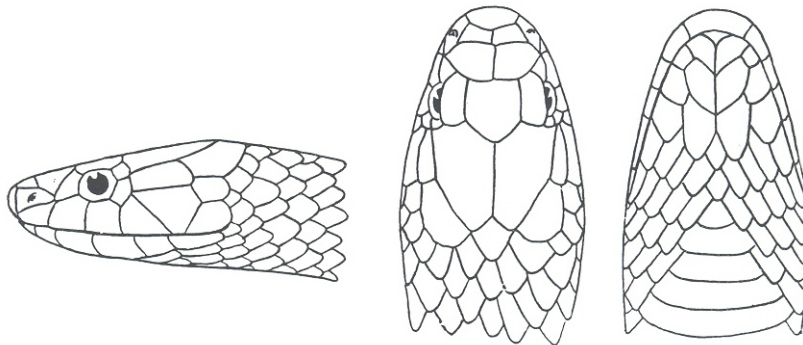


**FIG 3 #10, #11, #12**



**Fig 4 Head of *Notechis scutatus***

Note: *Notechis scutatus* has 6 supralabials.



**Fig 5 Head of *Notechis scutatus ater***

Note: *Notechis scutatus ater* only has 5 supralabials



### 3.1.1 Mass and Basic Body Measurements

#### The Genus *Notechis*

The genus *Notechis* is characterized by a large, squarish frontal shield, not, or scarcely, longer than the broad; the temporal is large and about as long as or longer than the frontal; scales smooth, in 17 to 21 rows at midbody; sub oculars absent; internasals present; ventral's more than 140; anal scale single; subcaudals single; four or five solid maxillary teeth followed by the fang (length approx 3.5mm).

(Cogger, H)(Refer fig 2)

Male Tiger Snakes reach a greater size than females and have larger heads.

(Tas.NPWS)

The genus, represented by the two following species, is confined to Australia and Tasmania.

- 1) Six upper labials, the third and fourth entering the eye; lower anterior temporal largest and wedged between the fifth and six upper labials.....*scutatus*  
(See fig 4)
- 2) Five upper labials, the second and third entering the eye, upper posterior temporal largest, the lower anterior temporal wedged between the fourth and fifth upper labials.....*ater*
- 3) (Waite,ER.1929)  
(See fig 5)

#### Species *Notechis scutatus*



Range of *Notechis scutatus*

Moderately large, muscular, robust bodied snake which can grow to more than 1.5 to 1.8 metres.

The head is moderately wide, flat and blunt and slightly distinct from the neck.

Body scales are smooth and semi-glossy in appearance.

Eyes medium in size with round pupils.

Capable of flattening entire body when basking or disturbed.

Scales around the neck appear like overlapping shields.

(White,J)

### **Head Scales**

Head scales typical of genus with 9 supracephalic shields, frontal shield length about equal to width, internasals present, singular preocular in contact with nasal, 2 post oculars, sub oculars absent, 6 upper labials (5<sup>th</sup> and 6<sup>th</sup> the largest, 3<sup>rd</sup> and 4<sup>th</sup> in contact with eye) Large lower temporal scale and temporals 1+3.

(See Fig 3 #10 and Fig 4)

Minimum mid body scale rows; 17  
Modal mid body scale rows; 17  
Maximum mid body scale rows; 19

(See Fig 3 #11)

**Anals** single  
Minimum ventral's 140  
Maximum ventrals; 190  
Minimum subcaudals 35  
Maximum subcaudals 65  
Single/ divided/mixed; single

(See Fig 3 #12)

Dentition;

Front fangs located at anterior end of maxillary bone (proteroglyphous), 4or 5 maxillary teeth following the fang. Fang length approximately 3.5mm (varies between 2.0 to 5.5mm) (White, J)

### ***Notechis scutatus occidentalis***



Range of *Notechis scutatus*  
*Occidentalis*

Minimum midbody scale rows: 17  
Modal midbody scale rows: 17  
Maximum midbody scale rows: 19

(See fig 3 #11)

<b><u>Anal</u></b>	single
Minimum ventrals:	140
Maximum ventrals:	190
Minimum subcaudals:	35
Maximum subcaudals:	65
Single/divided/mixed:	single

(See fig 3 # 12)

Dentition;

Front fangs located at anterior end of maxillary bone (proteroglyphous).

4-5 maxillary teeth following the fang. Fang length approximately 3.5mm (varies between 2.0 to 5.5mm)

(White, J.)

***Notechis scutatus ater***



Range of *Notechis scutatus ater*

Moderately large, muscular, robust bodied snake which can grow to more than 2 metres. The head is moderately wide, flat and blunt and slightly distinct from the neck. Body scales are smooth and semi-glossy in appearance.

Eyes medium in size with round pupils.

Capable of flattening entire body when basking or disturbed. Scales around the neck appear like overlapping shields. (White, J.)

**Head scales.**

Rostral broader than deep, the portion visible from above about half as long as its distance from the frontal. Frontal as long as broad, twice as broad as the supraocular, and a little longer than its distance from the rostral.

Five upper labials, the second and third entering the eye, temporals 2+2, the upper posterior largest, the lower anterior wedged between the fourth and fifth upper labials and reaching the lip. Seven lower labials, the first three in contact with the anterior chin shields. (Waite, ER.1929)

(See fig 5)

Supralabials 5

Minimum midbody scale rows: 17  
 Modal midbody scale rows: 17  
 Maximum midbody scale rows: 19  
**(See fig 3 #11)**

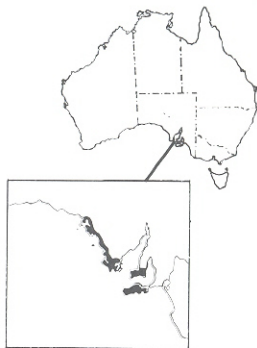
**Anals** single  
 Minimum ventrals: 155  
 Maximum ventrals: 190  
 Minimum subcaudals: 40  
 Maximum subcaudals: 60  
 Single/divided/mixed single

**(See fig 3 #12)**

Dentition:

Maxilla extending forwards as far as the palatine, with a pair of large grooved poison fangs followed by four or five small, feebly-grooved teeth, anterior mandibular teeth longest and feebly grooved. (Waite, ER 1929)

***Notechis scutatus niger***



Range of *Notechis scutatus niger*

Supralabials: 6  
 Minimum midbody scale rows: 17  
 Modal midbody scale rows: 17  
 Maximum midbody scale rows: 19  
**(See fig 3 #11)**

**Anals** single  
 Minimum ventrals: 163  
 Maximum ventrals: 184  
 Minimum subcaudals: 45  
 Maximum subcaudals: 54  
 Single/divided/mixed single

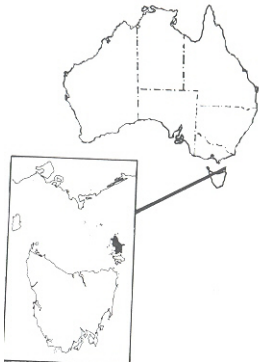
**(See fig 3 #12)**

(Worrell, E: 1952)

Dentition:

Maxilla extending forwards as far as the palatine, with a pair of large grooved poison fangs followed by four or five small, feebly-grooved teeth, anterior mandibular teeth longest and feebly grooved. (Waite, ER 1929)

**Subspecies** *Notechis scutatus serventyi*



Range of *Notechis scutatus*  
*Serventyi*

Supralabials	6
Minimum midbody scale rows:	17
Modal midbody scale rows:	17
Maximum midbody scale rows:	19
<b>(See fig 3 #11)</b>	
<b>Anals</b>	single
Minimum ventrals:	160
Maximum ventrals:	171
Minimum subcaudals:	47
Maximum subcaudals:	52
Single/divided/mixed	single

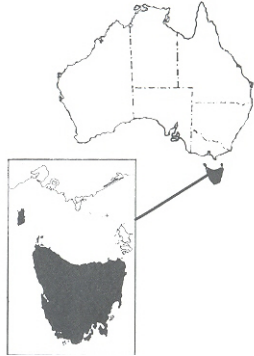
**(See fig 3 #12)**

(Worrell, E: 1952)

Dentition:

Maxilla extending forwards as far as the palatine, with a pair of large grooved poison fangs followed by four or five small, feebly-grooved teeth, anterior mandibular teeth longest and feebly grooved. (Waite, ER 1929)

*Notechis scutatus humphreysi*



Range of *Notechis scutatus  
Humphreysi*

Supralabials	6
Minimum midbody scale rows:	15
Modal midbody scale rows:	17
Maximum midbody scale rows:	19

(See fig 3 # 11)

<b>Anals</b>	single
Minimum ventrals:	161
Maximum ventrals:	174
Minimum subcaudals:	48
Maximum subcaudals:	53
Single/divided mixed	single

(See fig 3 #12)

(Worrell, E, 1952)

Dentition:

Maxilla extending forwards as far as the palatine, with a pair of large grooved poison fangs followed by four or five small, feebly-grooved teeth, anterior mandibular teeth longest and feebly grooved.

(Waite, E.R, 1929)

*Notechis scutatus serventyi*

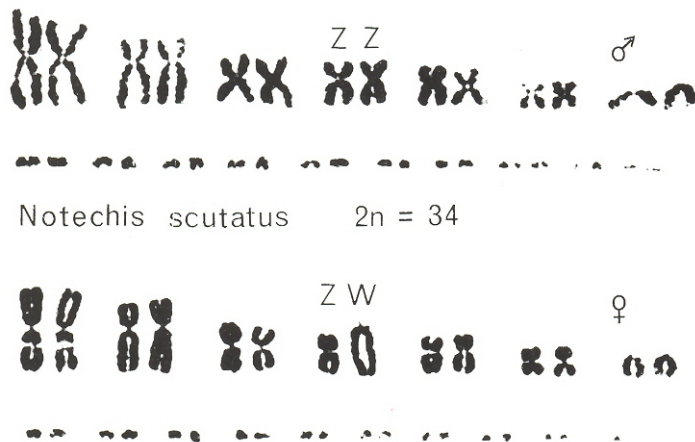
Mt Chappell Island tiger snakes have been reliably measured up to 2.4 metres and weighing up to 3 kg.  
(Fearn, S)

*Notechis scutatus humphreysi*

The largest 2 wild tiger snakes examined were 1.78 metres (2.2kg) and 1.8 metres (2kg), both were males. The largest female was 1.5 metres (1.4kg)  
(Fearn, S)

**3.1.2 Sexual Dimorphism**

Fig 6



J. J. BULL

All tigersnakes *Notechis scutatus* have 34 chromosomes, but the sex chromosomes differ between males ('ZZ') and females ('ZW').

(Shine, R. 1991, © Shine, R, reproduced with permission)

Male tiger snakes grow considerably larger than females as a result of male combat for access to reproductive females. When two or more males converge on a female, combat may result especially when males are large and evenly matched in length and weight. Larger, stronger males would therefore be at an advantage in obtaining more matings by defeating rivals in prolonged wrestling matches.  
(Fearn, S).

The Chappell Island population of males, reaches prodigious lengths, up to 2.1 metres has been recorded. (*N.s.serventyi*)

The Roxby Island populations (*N.s.niger*) are dwarfs, less than half the size of the black tiger snakes on Reevesby Island.

(Martin, V)

Moderately large, muscular, robust bodied snake which can grow to more than 1.5 to 1.8 meters.

(Fearn, S)

### 3.1.3 Distinguishing Features

*Notechis scutatus:*

Extremely variable, dorsal surface base colors include grey, brown, olive, green and reddish with distinctive irregular paler cross banding of similar but paler color, usually greenish white or grey, brownish white or grey, or yellowish brown. Cross banding diminishes in intensity toward the tail. Some specimens are unbanded. Head dorsum usually uniform in color, similar to dorsal color, grey or brown. Ventral surface usually yellow or cream.

(White, J)

*Notechis scutatus ater:*

Head and body black or very dark brown, sometimes (especially in juveniles) with faint darker or lighter cross bands visible.

Belly light to very dark grey.

(Cogger, H)

With the endless variations in color as well as scale size and shape, one never encounters two specimens that are the same. Mid-body scale counts can range from as low as 13 on black specimens from high altitudes, to as high as 19 on some Bass Strait Islands. This wide variation in scale counts reflects the enormous variations in scale size and shape across Tasmania and the 40 or so offshore islands known to support tiger snake populations.

Some specimens (especially from the Tasmanian highlands) have scale rows that are so chaotically jumbled and varied in individual scale size that rows can range from 14-18 on the same snake. Color variation in Tasmanian tiger snakes is remarkable, ranging from predominately yellow through to jet black.

While completely unbanded specimens can be found in a variety of hues, the majority of snakes encountered will have banding to some degree, ranging from boldly decked out in yellow, orange or white bands on dark specimens to a more subtle greys and browns on lighter snakes.

Some tan to brown snakes has darker banding reduced to splotches, speckles or confusing swirl patterns. On some dark snakes, banding is so obscure that it can only be seen in



strong sunlight or reduced to yellow or white edging at the base of the dorso-lateral scales.

Band width in Tasmanian tiger snakes is low; usually half to two scales wide, although rare specimens are encountered with band widths of 3-4 scales wide.

(Fearn, S)

### **3.2 Distribution and Habitat**

The Eastern Tiger Snake is restricted to the wetter parts of southern and eastern Australia.

In Queensland, Tiger Snakes are patchily distributed in the southeast, with records from Carnarvon Gorge National Park, the Bunya Mountains, Beerwah and Caloundra.

They are more continuously distributed in the eastern half of New South Wales, occurring at higher altitudes north of the Hunter Valley, and along the coast and ranges to the south, although they are uncommon around Sydney, but are common in the Blue Mountains. Populations also extend west along the Lachlan, Murrumbidgee and Murray River systems.

In Victoria, the species is only absent from the dry north-west of the state. Tiger Snakes are present over much of Tasmania and on many Bass Strait islands. In South Australia, they are patchily distributed, occurring in the southern Flinders Ranges, southern Mt Lofty Ranges, southern Yorke and Eyre Peninsulas, on Kangaroo Island, along the Murray River, and in the extreme south-eastern corner of the state, as well as on several small islands around Eyre Peninsula.

Western Australian populations are restricted to the south-west, from Jurien south-west to Point Malcolm, with island populations on Carnac and Garden Islands.

(Shea, G)

Tiger snakes occur all over Tasmania in a wide range of habitat types, from coastal dunes and heath through forest habitats of all types as well as mountains and plateaus above 1000 metres that typically receive heavy snow falls through winter.

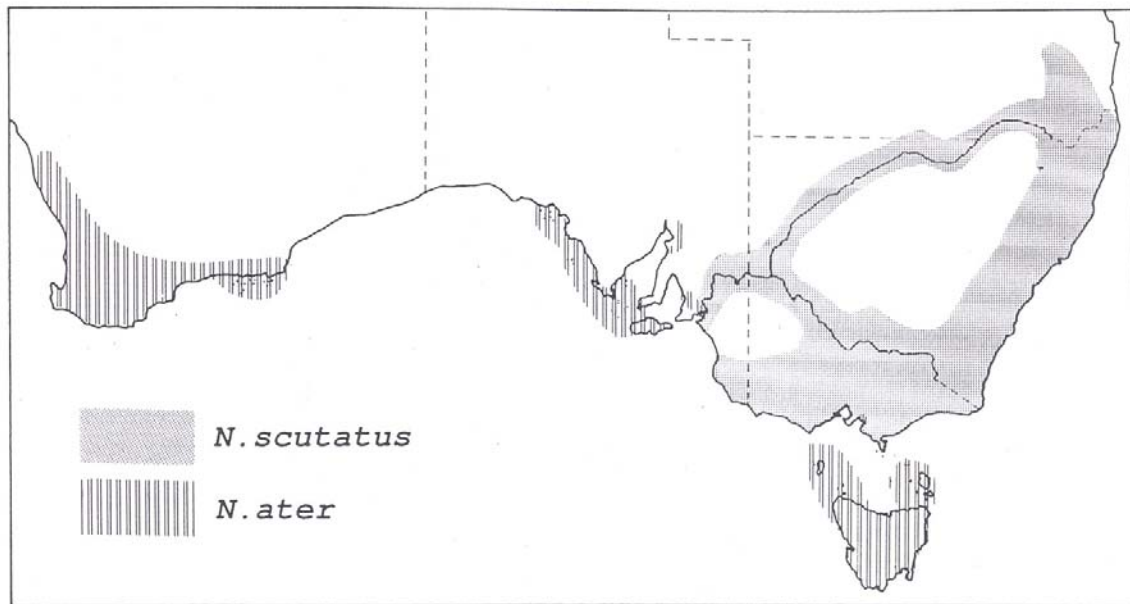
Tasmanian tiger snakes can form very high densities around swamps and lagoons with high frog populations, but destruction of wetlands for farming as well as an increasing apparent and alarming decline in Tasmania's rainfall, has resulted in some significant wetlands populations declining over the last 30 years.

The only places where tiger snakes are rare or absent are in closed rainforests or alpine moorlands above the winter snowline.

Fortunately, tiger snakes have thrived in many areas disturbed by human activity, particularly agriculture which often provides resources for very high rodent densities (introduced mice, rats and rabbits) that in turn provide a valuable food resource for snakes.

It is the Tiger snakes large size and very broad diet that owes a great deal to its success in invading such a diverse array of habitats.

(Fearn, S)



**Fig 7 Distribution of *Notechis***  
(Rawlinson, P.A 1991)

### 3.3 Conservation Status

The Flinders Range population in South Australia (as *N.s.ater*) is listed as vulnerable (commonwealth IUCN red list) and the Chappell Island population in the Bass Strait (as *N.s.serventyi*) is vulnerable.

(Wilson,Swan)

The Eastern Tiger Snake (*N.scutatus*) in New South Wales is classed as a protected species by the National Parks and Wildlife Act.

The King Island and Tasmanian Tiger Snake (*N.s.humphreysi*) are classified as a protected species.

(Tas.NPWS)

### 3.4 Diet in the Wild

In the wild, Tiger snakes eat fish, tadpoles, frogs, lizards, birds and mammals. This species is also cannibalistic. The species appears to eat carrion, including “fly-blown” fledgling sparrows.

(Greer, A)

Tiger snakes habitually raid birds nests and have been found climbing trees to a height of 8 metres.

Juvenile Tiger snakes will use constriction to subdue struggling skinks, a principle food of smaller snakes.

Adult Tiger snakes are also known to use constriction on larger prey as well.

Tiger snakes are important predators of introduced rodent pests and readily enter the burrows of mice, rats and rabbits in search of their quarry.

(TAS NPWS)

Tiger snakes forage underwater, at least for tadpoles and presumably fish. They can stay submerged for as long as 9 minutes.

Tiger snakes can drink from the moisture on wet grass in the rain.

(Greer, A)

*Notechis scutatus humphreysi*

New born and juvenile tiger snakes predate mainly on skink lizards and, when available, small frogs. Adults will consume almost any vertebrate small enough to swallow, up to the size of juvenile bandicoots and rabbits.

Such is the breadth of the gastronomic tendencies of these snakes that they will climb high into trees and roof spaces to eat nestling birds, greedily gobble up flyblown carrion, and during hot weather, enter streams, rivers and lakes where they forage for and eat fish up to the size of 20cm trout.

*Notechis scutatus serventyi*

Juvenile Chappell Island tiger snakes have to grow very rapidly on a diet of lizards, to get to a size where they can swallow a hatchling mutton-bird chick (*Puffinus tenuirostris*) often heavier than themselves. Island tiger snakes may have as little as five weeks to eat as many hatchling birds as they possibly can.

So critical is this brief feeding period for fat accumulation, that even a few days lost could be the difference between starving the next 10 months without food or starvation and death.

(Fearn, S)

*Notechis scutatus occidentalis*

(Carnac Island WA)

The main prey consumed by tiger snakes on Carnac Island is Sea gull chicks 83%, mice 15%, and lizards 2% respectively.

(Bonnet, X; Pearson, D; Ladyman, M; Lourdas, O; Bradshaw, D; 2002)

*Notechis scutatus niger*

Reevesby Island

The tiger snakes of Reevesby Island feed predominantly on white faced storm petrels (*Pelagodroma marina*) during the warm summer months, before the main food supply dries up by the end of march, then wait out the seven or so months till the return of the white faced storm petrels.

(Martin, V: 2003)

*Notechis scutatus niger*

Roxby Island

All the Tiger snakes of Roxby Island have to eat are skinks and a few small birds. Their lack of size (dwarfs) seems directly related to the size of their prey.

*Notechis scutatus ater*

These Tiger snakes mainly feed on frogs, tadpoles, small mammals and occasionally birds, including the black duck.

(Mirtschin, P)

### **3.5 Longevity**

#### **3.5.1 In the Wild**

It has been found that Chappell Island Tiger Snakes (*Notechis scutatus serventyi*) are the oldest snakes in the world. A marked recapture of these tiger snakes over 17 years have shown these to be the oldest in the world.

(Schwaner, T)

#### **3.5.2 In Captivity**

One female was kept in captivity for 13 years and 4 months.

(Greer, A)

Another female was kept in captivity for 14 years.

(Fearn, S)

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

There is no known way to determine the age in adults. There are of course estimates of growth rates which can be obtained in two ways.

One way is to capture, individually mark and release hundreds of snakes, and then try to recapture the same individuals at a later date to measure growth rates. The age at maturity can be recognized from the reproductive behaviour of marked snakes, or dissection.

Although this is the most reliable method, it requires a great deal of time and effort.

Another method is quicker but less reliable. Large collections of animals from a small area can be measured, and an attempt made to distinguish cohorts of the same age based on body sizes. This technique only works for young, rapidly growing snakes (in which year classes do not overlap in body size), and only in cool climates where breeding is highly synchronized and seasonal. (So that each cohort is born a year apart).

## 4 Housing Requirements

According to New South Wales National Parks and Wildlife Act, Dangerous Venomous Snakes may only be kept in lockable, sealed, escape-proof containers/ cages within a lockable and sealed, escape-proof room. Outdoor pits are not appropriate or acceptable for the holding of these Dangerous Reptiles. The individual containers and the room itself must be locked when the licensee is not present in the room, to prevent both unauthorized entry and/ or tampering with containers/ cages and the escape of snakes. (N.S.W N.P.W.S).

### Outdoor housing for snakes

Ideally, snakes can be housed in a suitable outdoor enclosure. This would benefit the snake by providing a more natural environment in terms of temperature, sunlight access, fresh air and natural light cycles. (WIRES, 2004)

In a zoo or wildlife park in N.S.W, there are standards set down by the N.S.W Department of Primary Industries (Exhibited Animals Protection Act) governing the housing requirements for housing of reptiles.(Standards for Exhibiting Reptiles in New South Wales)

### **4.1 Exhibit /Enclosure Design**

All captive reptiles must be kept in conditions that ensure temperatures; humidity and light cycles are appropriate to the species and allow normal physiological functioning and behavior. All reptile enclosures must be constructed and landscaped to allow safe access of the entire enclosure and its inhabitants by the keepers, without endangering the keeper. (E.A.P.A).

It is recommended that with dangerously venomous snakes, that only one snake be kept in each enclosure, with the exception of breeding. (Q.L.D. E.P.A.)

Each enclosure containing venomous reptiles should be marked, stating that there is a venomous snake inside, what species, and which antivenin to be used if bitten by that snake, and compression bandages within reach.

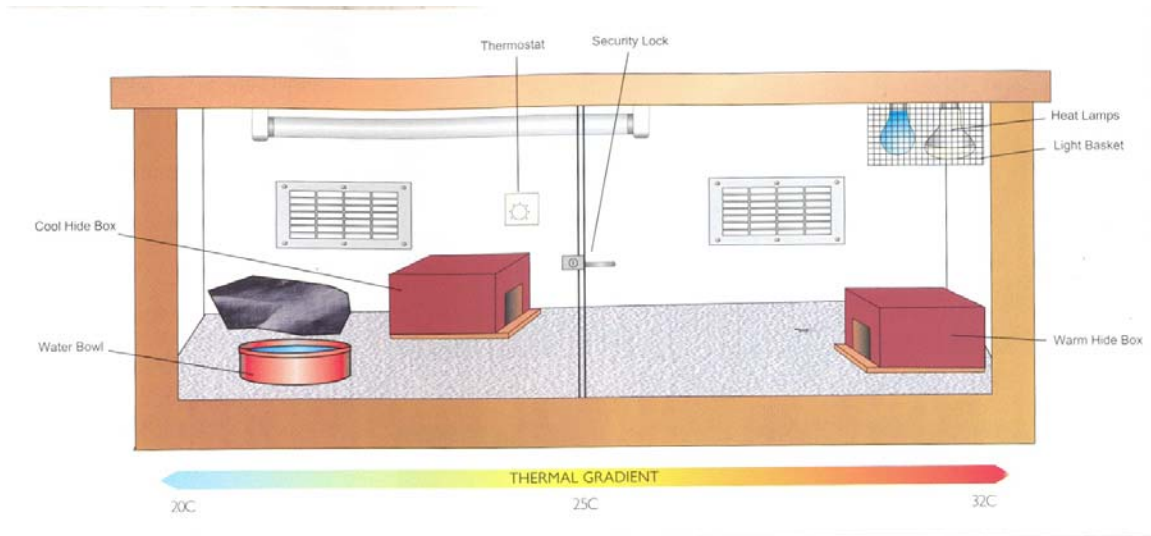
### **Indoor Enclosures**

The design of the enclosure should be that it can be opened from the top, thereby minimizing the danger of a strike by the snake, when the enclosure is opened.

Front opening enclosures should never be used with venomous snakes due to this reason of safety.

It is suggested that the enclosure be made of wood (e.g. Mdf, pine, marine ply), and that the front panel be of glass. It is suggested that wooden enclosures be lacquered or fiber glassed to allow for easy cleaning.

Enclosures made completely of glass do not allow the retainment of heat in the enclosure.



(Reptiles Australia Magazine, © reproduced with permission)

Snakes are best in solid sided, lidded enclosures that have smooth sides and no cracks or open joints. Such enclosures are easy to clean and disinfect.

Enclosures with cracks and open joints, where water and dirt can accumulate, are more likely to harbor bacteria and viruses. Glass, fiberglass or plastic tanks, aquaria or terraria are easier to clean than wood.

Some natural substrates such as pine chips, and some artificial substrates such as synthetic carpet or grass, can retain moisture that harbors bacteria and parasites and so they should not be used.

Natural substrates can be difficult to keep clean and should not be used by inexperienced snake keepers.

### **Outdoor Enclosures**

The enclosure must be both escape proof and predator proof. This usually means totally enclosing the structure.

Good protection from the elements is essential. Provide both protection from the sun and totally dry areas protected from rain. This includes places to hide.

If earth flooring is used then ensure that it is burrow proof. (Bury the walls to a depth of at least 50 cm and have metal mesh flooring).

Ensure that there is good drainage available.

Wire mesh walls may potentially be abrasive to snakes trying to escape. Try to construct “non-accessible” walls out of smooth non-climbable materials.

(WIRES,2004)

Outdoor enclosures can be constructed from a variety of materials, but it is vital that interior wall surfaces are smooth. Any uneven surfaces (particularly around corners or joins) will allow snakes to gain purchase to scale walls.

### **Enclosure layout**

The correct internal layout of outdoor enclosures is vital to the long term success and the health of captive snakes.

The most important considerations are:

- A range of micro-habitats, including areas of total shade, must be present to allow snakes to thermo regulate effectively.
- There should be a raised, central mound of earth in the enclosure to allow rain runoff.
- Dry, clean and dark retreat sites should be present, where snakes can take shelter over winter.
- Clean drinking water should be available at all times.

(Fearn,S)

## **4.2 Holding Area Design**

### **Holding Bins:**

Holding bins are tall, round plastic containers with clip on lids, a.k.a. garbage bins that may be used for short term holding of specimens while a cage is cleaned or for feeding. Some keepers routinely feed their snakes in holding bins rather than in their cages so that the specimens do not expect food when the cage is opened. Also, if the snakes are usually kept together they should be split up during feeding to avoid mishaps.

It is good practice to put some crumpled paper on the bottom of the bin to provide cover and a sense of security for the snake. Do not use towels in a feeding bin.



Elapid holding bin as used at Sydney Wildlife World  
(Photo, D.Kirshner, J.Mostyn, SWW)

### 4.3 Spatial Requirements

The following formulae refer to the minimum floor area applicable for an enclosure containing a **single specimen up to 4m long**. “L” refers to the extended length (snout to tail tip) of the longest specimen housed in the enclosure.

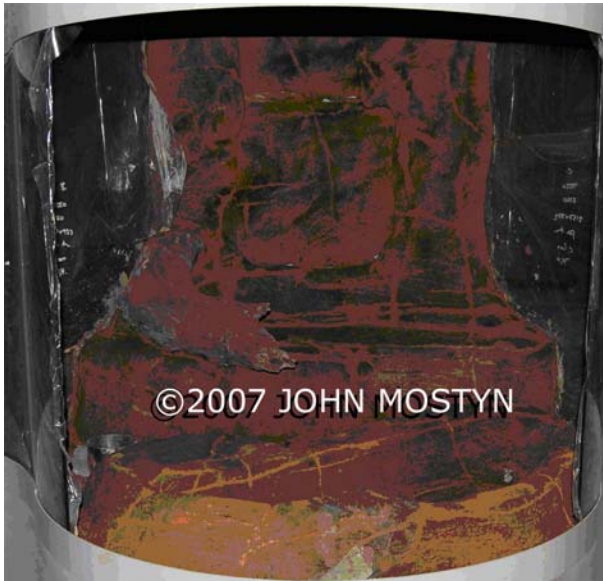
#### **Animal Display Establishments and Home Base for Exhibitors authorized to Exhibit at Temporary Establishments.**

Minimum enclosure dimensions must provide a floor area greater than or equal to  $.3L^2$  (E.g.  $0.6L \times 0.5L$ ), but with no dimension less than  $0.3L$ .

Minimum height required is  $0.5L$ .

Example; for an indoor exhibit containing a single tiger snake with an extended length of 1000mm, the minimum floor area is 1.00m<sup>2</sup> and can be any shape as long as no dimension is shorter than 300mm. (e.g. 1000mm x 1000mm; or 1200mm x 830mm; or 1670mm x 600mm, etc.)

If the enclosure is to house three specimens, and the largest is 1000mm, then a 40% increase (20% for each specimen beyond the first) to the floor area provided is required; making minimum floor area 1.4m<sup>2</sup>. (e.g. 1700mm x 830mm; or 1000mm x 1400mm; or 600mm x 2300mm).



Tiger snake enclosure under construction Sydney Wildlife World August 2006, as per EPA standards for 2 tiger snakes. (Photo, J. Mostyn, and SWW)



## **B) Medium Term Holding Enclosures (holding less 90 days) and Display Enclosures at Temporary Establishments.**

Minimum enclosure dimensions must provide a floor area greater than or equal to  $.17L^2$ . E.g.  $0.45L \times 0.35L$ .

Minimum height required  $0.35L$ . (E.A.P.A)



Off exhibit holding enclosure at Sydney Wildlife World, as per EAPA standards for 2 tiger snakes.(Photo, D.Kirshner, J.Mostyn, SWW)

## **4.4 Position of Enclosures**

### **Outdoor Enclosures**

Ideally position any enclosures facing a north easterly direction to take advantage of maximum sun exposure.

(WIRES, 2004)

Outdoor enclosures should be positioned so that reptiles have access to direct sunlight for at least eight hours during spring and summer. Enclosures need to be erected in an open area; preferably with a north easterly aspect that allows basking opportunities from approximately 8-30am to 7-00pm during the summer months, in line with the reptile's natural activity patterns and photoperiod. This is particularly important for proper digestion of food, and embryonic development in gravid females. Because enclosure walls for these large elapids need to be at least 1.3metres high, such walls cast considerable shade in early mornings and evenings when the sun is low in the sky.

(Fearn,S)

## **4.5 Weather Protection**

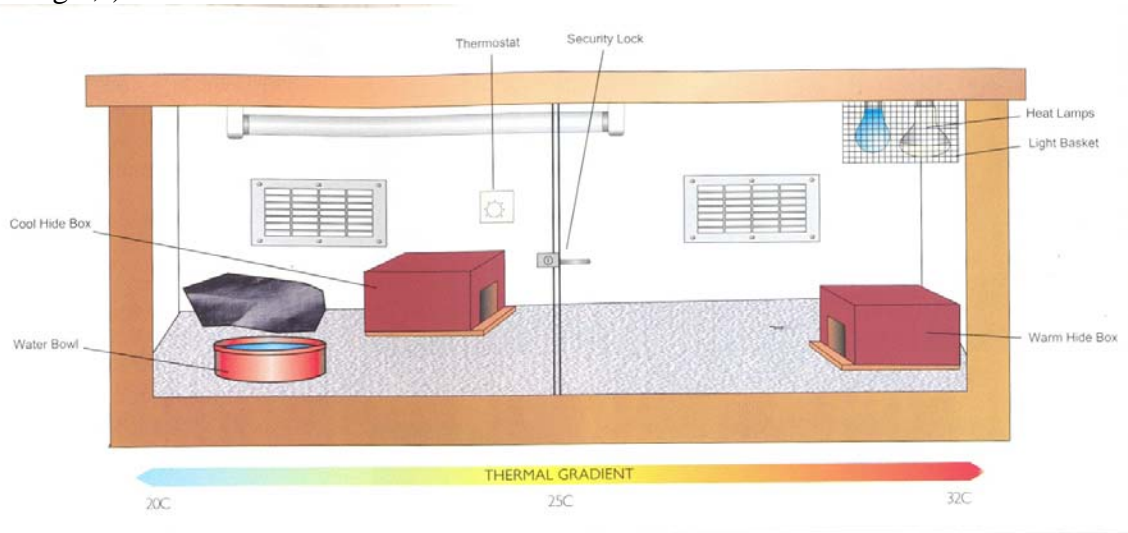
When keeping tiger snakes outdoors good protection from the elements is essential. Provide both protection from the sun and totally dry areas protected from the rain.

## **4.6 Temperature Requirements**

*Notechis* are a temperate species so they require relatively cool enclosures.

(Eipper, S).

The Enclosure must be heated by day, and this is best accomplished by including a radiant heat source (i.e., reflector globe, infra red heat lamp) towards one end of the enclosure to allow basking. The temperature readings from the middle of the enclosure should be intermediate and maintained between 24 and 28°C. During the night, all heating devices should be turned off and the enclosure temperature allowed to drop considerably. Night time temperatures should not be allowed to drop significantly. (Weigal, J).



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Table 7.8. Field body temperatures (FBT) for Australian elapids.

Species	FBT (°C)				Reference
	Range	Mean	sc	n	
<i>Austrelaps ramsayi</i>	30.8–33.5	—	—	1/13	Shine 1979 (as <i>A. superbus</i> )
<i>superbus</i>	19.6–36.4	28.5	—	2	Rawlinson 1974b
<i>Drysdalia coronoides</i>	24.8–37.7	31.1	—	4	Rawlinson 1974b
	—	23.5	—	—	Heatwole 1976
	—	31.1	—	—	Heatwole and Taylor 1987
<i>Notechis ater ater</i>					
land	22.5–33	28.6	±0.77	19	Mirtschin and Bailey 1990
water	21–28	24.6	±0.30	29	Mirtschin and Bailey 1990
<i>a. niger</i>					
spring	16.6–33.7	25.5	±0.09	87	Schwane 1989
summer	20.2–34.5	28.5	±0.10	77	Schwane 1989
autumn	15.4–33.0	25.1	±0.24	143	Schwane 1989
winter	11.9–32.4	23.6	±0.21	94	Schwane 1989
<i>scutatus</i>	11.2–35.0	—	—	3/119	Shine 1979
	25.0–33.8	29.3	—	—	Heatwole 1976
<i>Parasuta dwyeri</i>	19.1–28.2	23.4	—	—	Heatwole 1976; Heatwole and Taylor 1987 (as <i>Urechis gouldii</i> )
<i>Pseudechis australis</i>	—	30.7	—	—	Heatwole 1976
<i>porphyriacus</i>	20.5–33.0	—	—	2/37	Shine 1979
	14.8–35.6	28–31	—	—	Shine 1987d
	31.6–34.5	30.3	—	—	Heatwole 1976
spring	15.7–29.2	—	—	15	Shine and Lambeck 1990
summer	19.1–27.6	—	—	12	Shine and Lambeck 1990

Fig 8 (Greer, A.1997)

Table 7.9. Preferred body temperatures (PBT) for Australian elapids. <sup>(o)</sup> = outdoors or indoors in natural light; <sup>(i)</sup> = indoors with artificial heating source.

Species	PBT (°C)			Reference
	Range	Mean	n	
<i>Acanthophis antarcticus</i>	27.2–38.5	32.9	1/72	Lillywhite 1980 <sup>(i)</sup>
<i>Austrelaps superbus</i>	—	29.4	—	Witten 1974
	—	31.4	—	Witten 1974
juveniles	25.8–35.3	31.0	2/38	Lillywhite 1980 <sup>(i)</sup>
adults	26.6–37.1	32.8	4/78	Lillywhite 1980 <sup>(i)</sup>
<i>Demansia psammophis</i>	—	30.8	—	Witten 1974
<i>Hemiaspis signata</i>	—	30.9	—	Witten 1974
<i>Notechis scutatus</i>	—	30.7	—	Witten 1974
neonates	23.0–34.0	29.6	8/69	Lillywhite 1980 <sup>(i)</sup>
adults	25.9–35.5	32.2	7/170	Lillywhite 1980 <sup>(i)</sup>
<i>Parasuta dwyeri</i>	26–32	28.7	—	Witten 1974 (range includes "most temperatures")
<i>flagellum</i>	24.0–36.2	30.1	3/51	Lillywhite 1980 <sup>(i)</sup>
<i>Pseudechis porphyriacus</i>	25.8–36.2	31.3	—	Witten 1969 (as cited in Heatwole and Johnson 1979)
	—	33.8	—	Witten 1974
	25.0–32.4	—	1/9	Heatwole and Johnson 1979 <sup>(o)</sup>
neonates	27.0–35.0	31.0	7/61	Lillywhite 1980 <sup>(i)</sup>
adults	28.1–36.3	32.7	3/60	Lillywhite 1980 <sup>(i)</sup>
	28–31	—	—	Shine 1987d <sup>(o)</sup>
<i>Pseudonaja affinis</i>	29.6–34.4	—	1	Saint Girons and Bradshaw 1981 <sup>(o)</sup>
<i>nuchalis</i>				
juveniles	30.2–33.8	32.0	1/11	Lillywhite 1980 <sup>(i)</sup>
adults	31.8–36.9	34.0	1/23	Lillywhite 1980 <sup>(i)</sup>
<i>textilis</i>	28.7–37.8	34.5	2/36	Lillywhite 1980 <sup>(i)</sup>
	—	34.3	—	Witten 1969 (as cited in Heatwole 1976)
	—	35	—	Webb 1973 <sup>(o)</sup>

Fig 9 (Greer, A.1997)

## **4.7 Substrate**

- some natural substrates such as pine chips, and some artificial substrates such as synthetic carpet or grass, can retain moisture that harbors bacteria and parasites and so they should not be used.
- Natural substrates can be difficult to keep clean and should not be used by inexperienced snake keepers.
- Terrestrial snakes can be kept on pelleted newspaper,(such as certain brands of kitty litter). Fine sand can also be used.  
(NSW. Dept of Environment and Conservation)

●Substrate used is newspaper for the adults and paper toweling for the juveniles. Colleague uses gravel with breeding success in the closely related Western Tiger snake, *Notechis ater occidentalis*, some keepers hate gravel as it seems to harbor mites and I also feel that you never quite get it clean.  
(Eipper, S)

- It has been found to be easy to keep Tigers on newspaper substrate, as it is easy to replace and sterile Problems found in doing this, is that the snakes tend to constantly hide under it, and as a result don't get desensitized to movement, making them more jumpy when handled.

These days some keepers use a natural leaf litter substrate; the Tigers are able to forage through it, which in itself is good behavioral enrichment. If they want to hide, they simply bury into it, but are still able to observe activities outside the cage. Some Keepers argue that natural substrate is less hygienic and a haven for mites, but if it is replaced regularly (i.e. weekly) this shouldn't be a problem.  
(Tristram, H)

## **4.8 Nestboxes and/or Bedding Material**

It has been suggested that inside your enclosures, that you make available at least two hide boxes for the snake. Each hide box should be at the opposite ends of the thermal gradient inside the enclosure. That way the reptile can seek solace in either the warm or cool ends of the enclosure, without being seen from outside the enclosure. The hide boxes should have a large enough hole for the snake to gain access to the hide box, as well as coil up inside, snugly. The top of the box should be hinged to allow keeper access, as well as having a sliding, locking Perspex lid, on the top of the box, underneath the lid, as well as sliding, lockable Perspex cover for the snake's access hole. That way, when the snake is in his hide box, it can be totally locked, preventing the snake exiting the hide box, to allow the keeper to clean the enclosure, change water, substrate, etc, without having to remove the snake from the enclosure. This can also come in handy when having to remove the snake from the enclosure, without having to handle the reptile. You can lock the access door, remove the hide box, and open the hinged lid, allowing sight of the snake through the Perspex lid, allowing for close examinations.

#### **4.9 Enclosure Furnishings**

Enclosure furnishings should include a large water container, large enough for the snake to totally immerse itself in without spilling. You should also include two hide boxes, each at opposite ends of the enclosure, therefore allowing the snake to retreat to a either warm or cool refuge. A large rough rock should also be placed in the enclosure to allow the reptile access to a rough object to rub against to slough properly. Plants inside the enclosure will also allow the snake to think that they are hidden, but also allowing the public the view the snake in a natural surrounding. Substrate should be as close as possible to what it would be in a natural environment, as per EAPA standards. Other hide spots such as a hollow log at either end of the enclosure can be placed in the enclosure, as well as an area for the snake to bask in. This could be anything from a piece of slate, to a heat pad or mat under the substrate.

## 5 General Husbandry

### 5.1 Hygiene and Cleaning

#### New snakes:

If an enclosure is to be used for a new or different animal, it should remain empty after disinfection for at least two weeks before being used. Before putting a new snake into a cage, ensure that the cage and all its associated equipment is clean and has been disinfected.

#### Routine cleaning:

Most disinfectants do not work well if there is dirt or other organic material contaminating the area or object to be disinfected.

Remove faeces or other solids daily.

Thoroughly clean each enclosure once a week using the following procedures;

- Remove the snake and put it temporarily into a lidded container (such as a smooth sided plastic garbage bin or plastic tub) that has been disinfected, preferably with F10, rinsed and dried out between each snake occupant.
- Remove and throw away the paper flooring by folding it in on itself so that bits of dirt or faecal material do not fall out.
- Dispose of soiled natural substrates in an enclosed rubbish bin. (Do not compost as this could spread disease).
- Thoroughly clean the enclosure and associated fittings with a brush and hot soapy water (remember that while soap or detergents help to clean by breaking up dirt and oils, physical scrubbing with a suitable brush is the best way to reduce the overall amount of dirt and contaminants).
- Throw away items such as branches or other material that cannot be cleaned.
- Thoroughly rinse off any soap or detergent as some soap residues can de-activate disinfectants.
- Thoroughly disinfect the enclosure and fittings with household bleach or a disinfectant as recommended by your vet.
- All materials and cages should be in contact with the disinfectant for at least 15 minutes.
- After disinfection, the materials and cages should be thoroughly rinsed with tap water to remove any residual chemicals as these can be toxic to reptiles.
- Rinse out and disinfect the scrubbing brush and leave it to air dry.
- Leave the cage to air dry before putting in clean substrate and cage furniture and, finally, the snake.

### **What disinfectant to use:**

- Use a freshly prepared solution of 0.15% or one in thirty dilution of sodium hypochlorite (household bleach), following the manufacturer's instructions.
- F10. F10 is effective against Bacteria, fungi, viruses and spores. It is safe for reptiles and people. It is non-toxic, non-corrosive and biodegradable.

When used according to the manufacturer's instructions, bleach is effective against many snake diseases but it is not effective against all diseases.

(See Appendix 5.1.1 for MSDS on bleach and 5.1.2 for F10)

### **Cages that have contained ill snakes:**

Cages that have contained ill snakes should be cleaned and completely disinfected immediately, rinsed and dried and left empty for at least 2 weeks before being used for other snakes.

### **Unused equipment:**

Snake housing and equipment that is not going to be used should be cleaned and disinfected as described above, thoroughly rinsed and left to dry as soon as the snakes are removed.

### **Cleaning equipment:**

- Use separate equipment for each snake. Also use a separate bucket or plastic container for each enclosure, to disinfect cleaning equipment and cage furnishings.
- Clean all water containers and soak in disinfectant weekly after emptying the dirty water into a separate container for disposal into an outside drain or sink.
- For snake bags and other carrying equipment, ensure that any faecal material is disposed of by turning the bag inside out over a garbage bin prior to washing the bag.
- Wash snake bags separately from any other items after first soaking for at least 30 minutes in diluted bleach, following the manufacturer's instructions.

### **Contact with other snake collections:**

- Do not use other people's equipment for your own animals.
- Do not let your snakes come into contact with other people's snakes or reptiles.
- If you are visiting other people with snakes or reptiles make sure you wash your hands thoroughly afterwards and change your clothes and shoes before handling your own snakes.

### **Personal Hygiene:**

- Always wash your hands with hot soapy water after touching or cleaning up after any animal, after cleaning enclosures and accessories and after coming into contact with any area of the house where reptiles are allowed to run free.
- Cover cuts and other open wounds before handling reptiles.
- If a cut or wound becomes contaminated with dirt or if a reptile bite or scratch breaks the skin, wash the area thoroughly with warm water and an antibacterial soap, dry well and apply an antibacterial skin treatment.

- Do not put your hands near or in your mouth, or eat, drink or smoke while handling a reptile or cleaning up after it.
- Do not kiss or put parts of a reptile in your mouth or share food or drink with a reptile.
- Keep reptiles and their cage accessories away from human food preparation and consumption areas, sinks and bathtubs and where infants are bathed.
- Do not use the kitchen sink, kitchen benches, bathroom sinks or bathtubs to bathe reptiles or wash their cages and accessories. Dispose of any waste water and faecal material in the toilet, not in the bathtub or household sink.

(NSW. Dept of Environment and Conservation)

## 5.2 Record Keeping

Record keeping is an integral part of zoo keeping husbandry for all animal species including reptiles. Recorded data can be useful for the compilation of workable husbandry manuals and for information for use in scientific papers, and is necessary for good animal management. The following information should be recorded on a daily basis.

**ACQ** = Acquisition into the centre or zoo

**B/H** = **B**irth or hatching

**D/30** = Death or euthanasia within 30 days of hatch, birth or acquisition

**D/E** = Death or euthanasia after 30 days of hatch, birth or acquisition

**DIS** = Disposition, escape, export, release or sale of an animal

**BRD** = Breeding in the centre or zoo, reproductive details or observations

**INT** = Internal movement, enclosure to enclosure, to vet, off exhibit

**TAG** = Tagging, IDs, micro chipping, tattoo

**W/L** = Weight, length

**RxTx** = medical treatment, medications, worming, pills

**VET** = Vet examination needed

**OTH** = other, behavior change to a animals routine, maintenance

**NVL** = No visible lesions

**NAD** = No abnormalities detected

### Why keep records:

- By keeping records,

You can discover more about the animals in your care, and at the same time you could make valuable contributions to science, conservation and wild animal husbandry.

- By keeping records,

You can yield a library of information on individual specimens and species kept in captivity.

- Fill the gaps in existing knowledge on specific species, especially those species that are considered endangered.

- Provides data for research and husbandry. Research depends on data, and the keepers record files can provide information increasingly referenced in developing and improving husbandry practices.

- Decrease the need to rely on 'hearsay', written records are more dependable than word of mouth information. (Brice,S)



- Monitor the health of your snake by keeping a written health record of each snake in a notebook or diary kept specifically for the purpose.

**Record significant details and dates such as:**

- Date of arrival and where snake came from, including feed, shedding, weight, vaccinations, worming records from previous owner.
- Date and weight each time snake is weighed;
- Date and time and what snake ate, or didn't eat.
- Date eyes went milky, indicating that it will shed soon.
- Date of sloughing.
- Date and nature of any treatments, e.g., treatment for snake mites or signs of sickness.
- Any visits to a veterinarian and resultant treatments.
- Any details what so ever, no matter how insignificant the details may seem.

### ***5.3 Methods of Identification***

For both health monitoring and breeding it is important to individually identify each snake. We can give each snake a number, code or name and identify them by

- Cage cards, with photograph, description, microchip number, and a warning that this species is highly venomous.
- Photo or description – illustrating distinguishing features, such as, individual markings, color patterns, old wounds or scars.
- Microchip – inserted sub-cutaneously, need scanner to read microchip number, access to database for registration numbers.
- Scale clipping.
- Scale counts, see section 3.1 and 3.1.1.

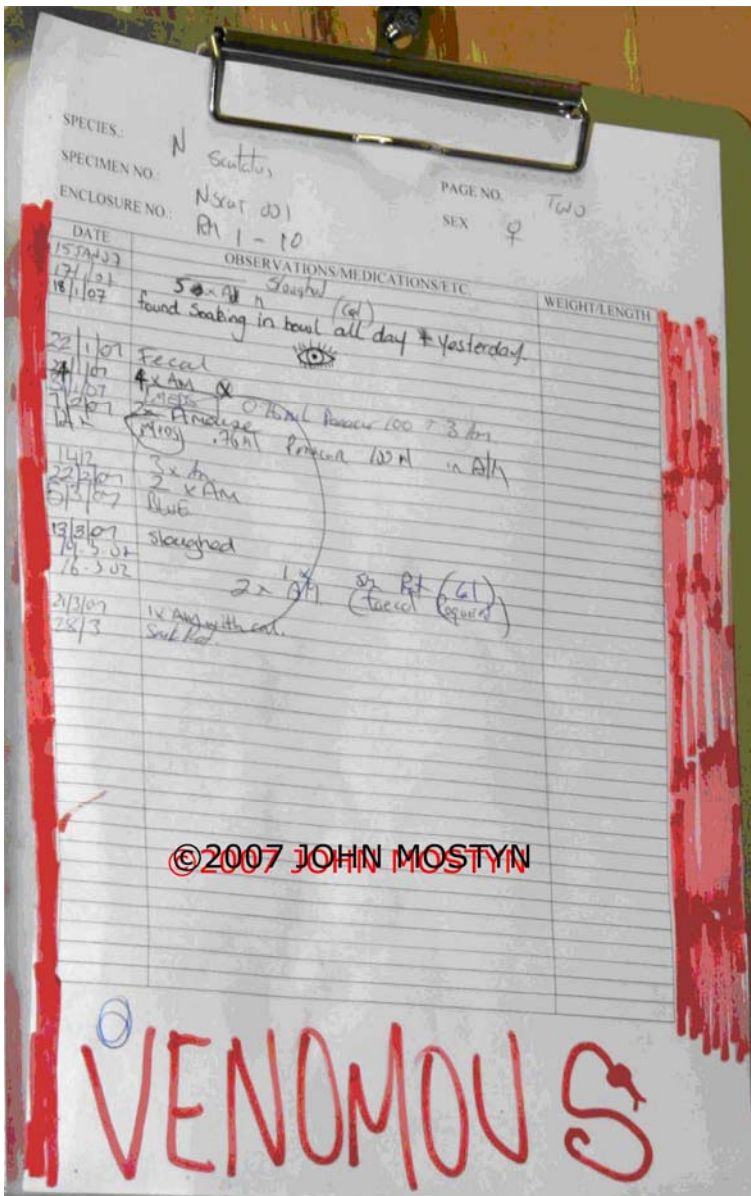
### ***5.4 Routine Data Collection***

Routine data collection is a must for captive reptiles.

- Monitor the health of your snake by keeping a written health record of each snake in a notebook or diary kept specifically for the purpose.

**Record significant details and dates such as:**

- Date of arrival and where snake came from, including feed, shedding, weight, vaccinations, worming records from previous owner.
- Date and weight each time snake is weighed; including the snout/vent length
- Date and time and what snake ate, or didn't eat.
- Date eyes went milky, indicating that it will shed soon.
- Date of sloughing.
- Date and nature of any treatments, e.g., treatment for snake mites or signs of sickness.
- Any visits to a veterinarian and resultant treatments.
- Date of fecals and results.
- Any details what so ever, no matter how insignificant the details may seem.



Record and observation sheet for 0.1.0 tiger snake off exhibit at Sydney Wildlife World.  
 (Photo, D.Kirshner, J.Mostyn)

## 6 Feeding Requirements

Feeding requirements for the tiger snakes at Sydney Wildlife World are two adult mice, (with repti-cal and repti-vite sprinkled on them) every two weeks.

### 6.1 Captive Diet

Tiger snakes are searching foragers, they actively roam the environment seeking out prey. Tiger snakes kept outdoors can be feed the usual dead animals such as mice, rats and day old chickens, during the summer months.

Some freshly caught snakes need to be enticed to take dead rodents and chickens. Tiger snakes generally adapt quickly to outdoor enclosures and become voracious feeders.

Tiger snakes can quickly get to the point where they can be individually handfed, either by dropping food directly in front of them, or offering food directly to them with long handled snake grippers.

(Fearn,S)

Tiger snakes have a reputation of being the “pigs” of the snake world. It has been reported that to curb the tiger snakes irrational striking behavior, to feed dead food, fresh or defrosted. Most tigers will accept this and it takes away the need for strike response.

Some keepers claim that tiger snakes need occasional live food, because the administration of venom serves to predigest the potential food item, this only working if the prey is alive to circulate the venom. Others dispute this and have maintained a large and varied collection of elapids, solely on a diet of dead mammals and birds.

The vast majority will eat a variety of vertebrates, including mice, chicks, small rats, finches and even fish. Some keepers manufacture “sausages” out of minced meat, (kangaroo or beef), vitamin supplements, and occasionally mutton bird oil. These sausages tend to encourage the snakes to put on size rapidly. A once a week feeding schedule, and offer an adult tiger snake 3-4 large mice.

(Tristham, H)

**(See supply companies for food suppliers.)**

### 6.2 Supplements

Food can be vitamin and calcium phosphate enriched, monthly. Juveniles need their calcium supplemented (Walls 1996, Watharow 2003). Care must be taken to avoid vitamin/mineral overdosing and to ensure correct dietary calcium – phosphorous ratios (DPI 2004). Commercially prepared mineral supplements, such as Repti-cal and multi vitamins designed for reptiles, such as Repti-vite can be sprinkled over food. Following the company directions will ensure adequate nutrition without overdose.

It has been reported, that great success has been achieved, with day old chickens and mice or rats being injected with 2ml of mutton-bird oil.

(Fearn, S)

Some keepers manufacture “sausages” out of minced meat, (kangaroo or beef), vitamin supplements, and occasionally mutton bird oil. These sausages tend to encourage the snakes to put on size rapidly. A once a week feeding schedule, and offer an adult tiger snake 3-4 large mice.

(Tristham, H).

### ***6.3 Presentation of Food***

Food presented to the Tiger snake should be totally thawed, and at a temperature of around 26-28 degrees c. The food item can be jiggled in front of the snake by using a pair of long handled tongs, so that you will not get bitten. They can also be placed inside the enclosure, or dragged around the enclosure, allowing the scent of the food item to make a scent trail for the snake to follow. You can even try scenting the food item with lizard maker, which is a man made pheromone which makes the food item smell like a lizard. This is often used when young neonates refuse to eat the pinkie mice. They must then be weaned off the scent of lizards.

## **7 Handling and Transport**

The Australian Government requires that all live animals, transported by air from any country, and internally, are to be transported in packaging and containers as specified in the latest edition of the Container Requirements of the I.A.T.A. Live Animals Regulations.

These Regulations are accepted by the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) (Convention Resolution 4.20) as guidelines in respect of transportation of animals by air. (I.A.T.A. Regulations 2000).

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

The capture of Tiger snakes should be done as early as possible in the morning, before the snake has a chance to warm up. The snake can then be placed into a collection bag and the collection bag placed into a plastic garbage bin with lockable metal handles with a venomous warning label on the lid.

Maintenance/cleaning of the enclosure can then be performed.

Once maintenance/cleaning are done, the snake can then be removed from the bin, and the snake can then be tipped carefully from the collection bag back into the enclosure.

### **7.2 Catching Bags**

#### **Collecting Bags:**

Bagging is an accepted secure and safe method of holding and transporting captured snakes in the field and in herptoculture. Every snake keeper must be able to competently and safely bag their charges. The term “collecting bag” is a firmly established one even though collecting is a rare event these days. Bags are used solely for the temporary holding of reptiles, for example, during transport or cage cleaning. Some keepers isolate specimen in bags for feeding. Bagging is the best method of restraining a snake for weighing. Simply weigh the bagged snake and subtract the weight of the bag.

Collecting bags can be made of any closely woven, light and durable fabric such as calico or even light canvas and are usually about twice as deep as wide, say 900 x 450 mm, but appropriate to the size of the animals. They should be deep enough that the snake placed in it cannot run straight back out the top before you tie the bag. That is, it should be more than two thirds the length of the snake. Pillow cases, used more extensively in the USA than in Australia, are shallow relative to their depth, but are adequate for many purposes. If you use pillow cases reinforce the seams with an extra row of stitching and turn the pillow case inside out.

#### **Animals may be placed in bags using different techniques:**

Fold the hem of the bag down to hold it open a little more rigidly and drop a tailed snake headlong into it. Rather than attempting this alone, it is preferable for an assistant to hold the bag but it is not as easy as it sounds and other methods are safer. The problem with this old fashioned technique is that it brings the snakes head too close to your hand.

Pin the snake and, holding it behind the head, place it well inside the bag before releasing the grip, withdrawing your hand, closing the bag and twisting the upper third ready to tie. This is generally a fairly routine procedure but a number of keepers have been bitten as they release the snake.

Place the bag on a smooth flat surface. Tail the snake and, holding the bag slightly open with a snake hook; introduce its head into the top of the bag. The animal will hopefully seek cover in the bag, and by using the handle of the snake hook to place pressure across all the bag width except the space the snake needs to pass through, it will be unable to double back. Tap the snake on the tail then close the bag when it is inside, again twisting the upper third before tying.

Use a hoop fitted to the bag (see hoop bags). Ordinary collecting bags of correct size can be fitted to a hoop.

Bags may have ties of cloth tape or strong elastic sewn to the edge towards the top. Otherwise a loose piece of string or rubber bands may be used for closing the bag. You may use rubber bands but only short term and in twos or threes, never singly, as they are prone to breakage. Always double over the neck of the bag before tying it, as otherwise the specimen may still squeeze through if the tie loosens. Bags may be knotted to close them; however snakes left in knotted bags have been known to work their way out over a period of time. Bags with drawstrings cannot be tied as securely and are difficult to open readily so they are not recommended. Be careful that there are no frayed edges inside the bag in which reptiles may become entangled and check all seams for strength before use.

To remove a snake from a bag, place the bag on the floor and a snake hook across the bag below the knot or tie. Undo the neck of the bag then gently tip the snake towards the opening, preferably using a hook in a corner loop so your fingers are clear of danger. When the snake is visible you can lift it with a hook or pin it and tail as you think appropriate for that individual and what you intend doing with it.  
(Titmuss, A)

### **Inverted cloth bags:**

This method works well for pugnacious non-venomous or mildly venomous snakes but is not recommended for large venomous species. Ideally the animal is coiled up, at rest. The keeper places his hand in a collecting bag, inside out and engulfs the snake in it, turning the bag right way out over the animal and tying the bag shut. Generally the snakes don't bite and are most efficiently bagged.

### **Hoopbags:**

The purpose of the handle is to keep your hand well clear of the snakes head and for the hoop to hold the bag open for efficiency of access. Traditionally these are slightly heavier cloth bags, larger and relatively deeper than collecting bags and are arranged on a landing net or insect net frame or a purpose built hoop. Attachment to the frame can be:

- A hemmed casing through which the frame is threaded.
- A folded over section may be held with fasteners or Velcro.
- A folded over section joined by closing a two-section heavy duty zipper, such as a sleeping bag zipper. This is generally the most secure easy to use system.

The frame handle should be about 60 cm long and the hoop perimeter slightly less than twice the width of the bag. There should be a tie, either of heavy-duty cloth tape or heavy

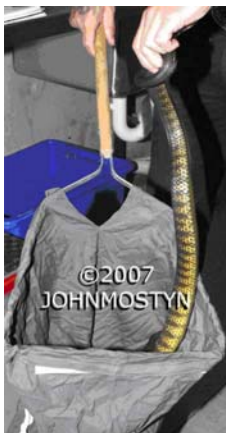
elastic attached at a point where the top of the bag can easily be gathered together, probably about 30 cm down. One design of deep hoop bag is divided at two places by wide elastic ties so that at least two specimens can be held in isolation in it at a time. The bottom corners of the bag should have a tag or a loop sewn to it so the bag can be tipped up to remove snakes without fingers coming into contact with the animal. Remember, snakes do bite through bags. The advantages of hoop bags is that the hand holding the bag is at a distance because of the handle and the mouth of the bag is open so it can be swept up over a tailed snake giving greater safety.(see fig 7.2)

The disadvantage of the traditional units described is that special bags are required and it is fiddly to change bags, especially when a series of animals is to be contained. Other hoop designs of hoop bag address this shortcoming:

- The hoop can be cut from the top 150mm of a polythene bucket of the type used to contain paint and other commercial liquids. A handle fashioned from solid metal strap is fitted and an elastic band of shock cord is made to fit the top. A bag of appropriate size is fed up through the hoop and the hem turned over the edge of the hoop, then tucked inside the shock cord band. Once a snake has been placed in it, the bag can be tied and removed from the frame then the next bag fitted.
- A further possibility is to fold the top of the bag over a hoop and hold it in place using spring back paper clips of the kind with folding wire handles that can be flipped out of the way.

These methods allow you to use ordinary collecting bags for hoop bagging so long as you standardize your bag and hoop sizes.

(Titmuss,A)



**Fig 7.2** Placing tiger snake in hoop bag  
(Photo, D.Kirshner, J.Mostyn, SWW)

## **7.3 Capture and Restraint Techniques**

### **Danger Potential.**

#### **Venomous Snakes Require Special Handling Techniques.**

Reptiles need to be handled and restrained for a variety of reasons. These reasons include medical examinations and treatments, cage cleaning, assist feeding, education, venom collection, identification and moving the reptile. Handling should be performed so as to ensure safety to the reptile and the handler.

The activity of the reptiles being restrained can be controlled chemically or thermally.

Chemical control includes sedation or anaesthesia and must be administered by a veterinarian. Chemical control is not practical on a day to day basis and if administered often would cause stress to the animal. Chemical control is used most often by the veterinarian for painful and invasive procedures, including surgery. (Titmuss, A)

Venomous snake handling skill is developed with experience, the keeper learning over time to select the correct technique and tools, and to expect particular handling behaviors from various species and specimens.

#### **Always expect the unexpected.**

Your complacency and being off guard is more likely to result in a bite than outright aggression by a snake.

Very little information has been written on actual handling techniques, and most of it is quite difficult to accurately describe. The method of restraint chosen will depend on circumstances and the personal preference of the operator. Generally, the gentlest, least stressful technique possible should be selected but the method with which you are most comfortable is probably the safest.

The following is a description of several techniques and items of equipment, which have been used and which will cover most situations.

#### **Free Handling:**

The least disruptive handling method for the animal is free handling where it is allowed to move gently through the handlers hands with no sudden movements and only slight restriction as the keeper runs the snake from one hand to the other, like a treadmill.

However, while this is suitable for pythons and many other non-venomous species, it is **not** recommended for handling venomous snakes. You may see photos of people free handling Tiger snakes and Black snakes but even with very quiet animals it may take nothing more than a whiff of a mouse on your hands to cause the snake to get excited and a serious situation to develop. Some people get away with incredible liberties in handling snakes- but not forever.

**DO NOT FREEHANDLE.**

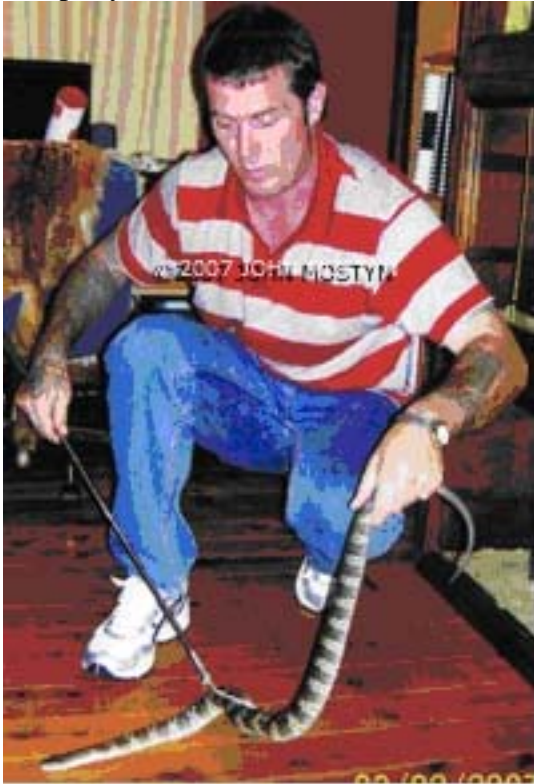
#### **Tailing.**

This involves grasping the snake near the vent and lifting the body clear of the ground. The animal may climb its body or swing up towards the hand holding it. This can be controlled by sharply rotating the wrist, throwing the snake off balance. The snake will



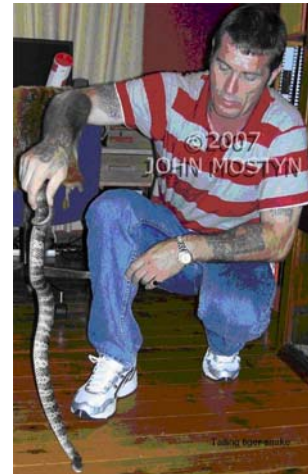
still be able to use the front part of its body and strike outwards so hold it away from your body so it cannot reach you. You may not be able to hold a long snake far enough away to be out of its strike radius, so use a snake hook (see fig above), to support and control the “sharp end” at a safe distance from you. If you hold the tail and keep the snakes body taut between your hand and the hook, the snake will not be able to get off the hook and will not be able to reach back and bite you. Never leave the animal dangling any longer than you have to. Place it in a hoop bag, cage or holding bin as soon as possible or else pin it down and hold it behind the head. If at any stage you feel you are not in control, put the specimen down and quietly retreat to regroup.

NB: Tailing is not suitable for animals such as death adders, which may react extremely rapidly. Use a snake hook to lift the snake into a bag.



A)

A) Author tailing tiger snake with hook.



B)

B) Author tailing tiger snake without hook, using floor. Control of snake is by twisting tail in direction wanting to go. (Photo. A.Titmus, J.Mostyn)

### **Pinning:**

This is done so that a snake can be safely picked up using a head hold. Alternative methods such as tubing or use of a trap box are preferable for most examinations. Pinning is stressful for the snake, involves some risk for the operator and should be done on an absolute need basis only. Real need may include health examination, giving medication, bagging, if no alternative is possible and, in venom laboratories, milking.

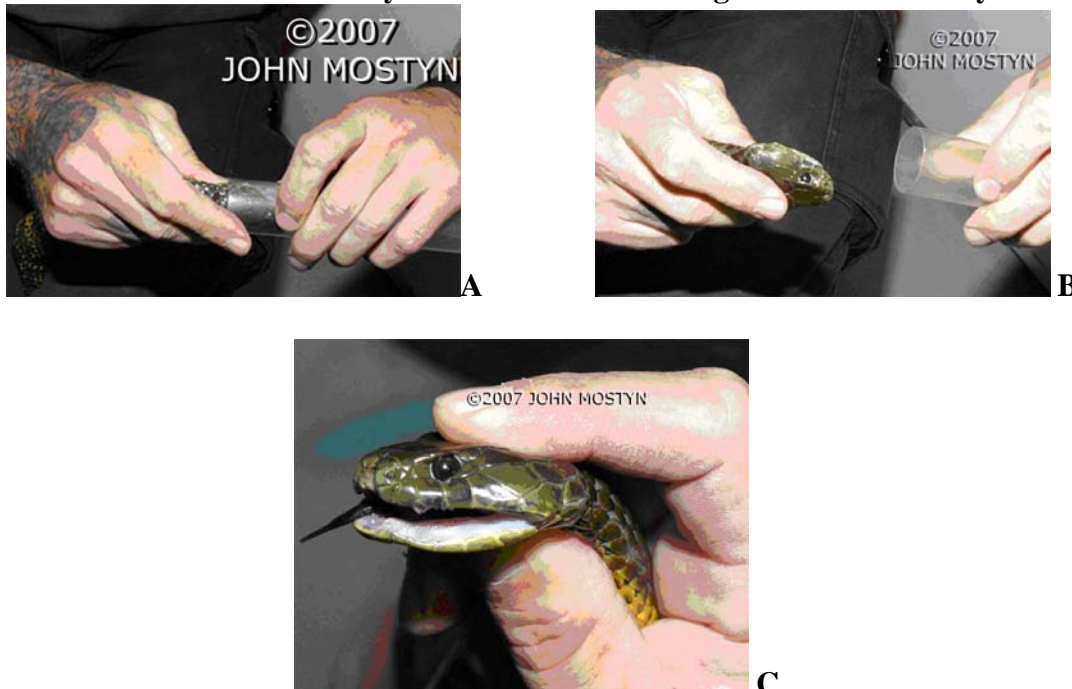
To pin it, the snake is usually tailed and either a jigger or padded dowel is used to hold the snake's head firmly, allowing finger access to achieve a secure hold. The hold is three-fingered. It is essential that thumb and third finger be in firm contact with the snake's neck touching the angle of the snake's jaws and with the index finger on top of the head. (See Fig 7.3) Other holds have been used but they are believed to be not as secure and involving more risk when releasing.

A number of keepers have been bitten bagging, head-held snakes. To bag a snake safely, put its body into a suitably deep bag held by an assistant, bring its head into the bag and wait till it relaxes slightly then release it so that it falls away from your fingers. To release it into a cage, place it on the floor of the cage, facing away from you, hold its body still with the other hand till it relaxes, get ready to close the door and release, smoothly withdrawing your hand and closing the door.

(Titmuss,A)

### FIG 7.3

**A safer way to head the snake is to use a restraint tube, and slowly back the snake out of the tube centimeter by centimeter and heading the snake that way.**



**Fig 7.1** A) Slowly back the snake from the tube, compressing the tube end over the head.

B) Place finger over top of head while still in the tube

C) Snake out of tube firmly held.

(Photos. D.Kirshner, J.Mostyn, SWW)

### **Jiggers:**

There may be some confusion regarding the term “jigger”. Some authorities apply the term to an “L” shaped snake stick, however the name is more frequently applied to an implement consisting of a long handle secured to the middle of a bow or “Y” shaped strip of metal with a leather or rubber strap stretched across it. Tension on the strap may be adjusted with a screw on some models. The resilient strap is taut enough to pin the head of a snake against flat surfaces but has sufficient give to prevent injury (see pinning above).

A more recent pinning device consists of a flat metal piece secured at the middle perpendicular to a long handle and with a firm plastic pad glued to the metal strip. The advantage of this is greater variation in the pressure that can be applied and that the snake cannot entangle itself in the jigger, as happens with the classic design. Harry Ehmann used the head of a potato masher fitted with a foam pad. His idea was to spread pressure and friction over a wider area to reduce the risk of injury.



Head Pinner

(Photo. D.Kirshner, J.Mostyn, Sydney Wildlife World)

### **Collecting Bags:**

Bagging is an accepted secure and safe method of holding and transporting captured snakes in the field and in herptoculture. Every snake keeper must be able to competently and safely bag their charges. The term “collecting bag” is a firmly established one even though collecting is a rare event these days. Bags are used solely for the temporary holding of reptiles, for example, during transport or cage cleaning. Some keepers isolate specimen in bags for feeding. Bagging is the best method of restraining a snake for weighing. Simply weigh the bagged snake and subtract the weight of the bag.

Collecting bags can be made of any closely woven, light and durable fabric such as calico or even light canvas and are usually about twice as deep as wide, say 900 x 450 mm, but appropriate to the size of the animals. They should be deep enough that the snake placed in it cannot run straight back out the top before you tie the bag. That is, it should be more than two thirds the length of the snake. Pillow cases, used more extensively in the USA than in Australia, are shallow relative to their depth, but are adequate for many purposes. If you use pillow cases reinforce the seams with an extra row of stitching and turn the pillow case inside out.

Animals may be placed in bags using different techniques:

Fold the hem of the bag down to hold it open a little more rigidly and drop a tailed snake headlong into it. Rather than attempting this alone, it is preferable for an assistant to hold the bag but it is not as easy as it sounds and other methods are safer. The problem with this old fashioned technique is that it brings the snakes head too close to your hand.

Pin the snake and, holding it behind the head, place it well inside the bag before releasing the grip, withdrawing your hand, closing the bag and twisting the upper third ready to tie.

This is generally a fairly routine procedure but a number of keepers have been bitten as they release the snake.

Place the bag on a smooth flat surface. Tail the snake and, holding the bag slightly open with a snake hook; introduce its head into the top of the bag. The animal will hopefully seek cover in the bag, and by using the handle of the snake hook to place pressure across all the bag width except the space the snake needs to pass through, it will be unable to double back. Tap the snake on the tail then close the bag when it is inside, again twisting the upper third before tying.

Use a hoop fitted to the bag (see hoop bags). Ordinary collecting bags of correct size can be fitted to a hoop.

Bags may have ties of cloth tape or strong elastic sewn to the edge towards the top. Otherwise a loose piece of string or rubber bands may be used for closing the bag. You may use rubber bands but only short term and in twos or threes, never singly, as they are prone to breakage. Always double over the neck of the bag before tying it, as otherwise the specimen may still squeeze through if the tie loosens. Bags may be knotted to close them; however snakes left in knotted bags have been known to work their way out over a period of time. Bags with drawstrings cannot be tied as securely and are difficult to open readily so they are not recommended. Be careful that there are no frayed edges inside the bag in which reptiles may become entangled and check all seams for strength before use.

To remove a snake from a bag, place the bag on the floor and a snake hook across the bag below the knot or tie. Undo the neck of the bag then gently tip the snake towards the opening, preferably using a hook in a corner loop so your fingers are clear of danger. When the snake is visible you can lift it with a hook or pin it and tail as you think appropriate for that individual and what you intend doing with it.

(Titmuss,A)

### **Inverted cloth bags:**

This method works well for pugnacious non-venomous or mildly venomous snakes but is not recommended for large venomous species. Ideally the animal is coiled up, at rest. The keeper places his hand in a collecting bag, inside out and engulfs the snake in it, turning the bag right way out over the animal and tying the bag shut. Generally the snakes don't bite and are most efficiently bagged.

### **Hoop bags:**

The purpose of the handle is to keep your hand well clear of the snakes head and for the hoop to hold the bag open for efficiency of access. Traditionally these are slightly heavier cloth bags, larger and relatively deeper than collecting bags and are arranged on a landing net or insect net frame or a purpose built hoop. Attachment to the frame can be:

- A hemmed casing through which the frame is threaded.
- A folded over section may be held with fasteners or Velcro.
- A folded over section joined by closing a two-section heavy duty zipper, such as a sleeping bag zipper. This is generally the most secure easy to use system.

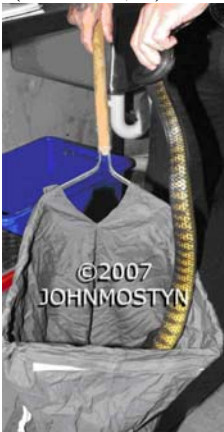
The frame handle should be about 60 cm long and the hoop perimeter slightly less than twice the width of the bag. There should be a tie, either of heavy-duty cloth tape or heavy

elastic attached at a point where the top of the bag can easily be gathered together, probably about 30 cm down. One design of deep hoop bag is divided at two places by wide elastic ties so that at least two specimens can be held in isolation in it at a time. The bottom corners of the bag should have a tag or a loop sewn to it so the bag can be tipped up to remove snakes without fingers coming into contact with the animal. Remember, snakes do bite through bags. The advantages of hoop bags is that the hand holding the bag is at a distance because of the handle and the mouth of the bag is open so it can be swept up over a tailed snake giving greater safety.(see fig 7.2)  
The disadvantage of the traditional units described is that special bags are required and it is fiddly to change bags, especially when a series of animals is to be contained. Other hoop designs of hoop bag address this shortcoming:

- The hoop can be cut from the top 150mm of a polythene bucket of the type used to contain paint and other commercial liquids. A handle fashioned from solid metal strap is fitted and an elastic band of shock cord is made to fit the top. A bag of appropriate size is fed up through the hoop and the hem turned over the edge of the hoop, then tucked inside the shock cord band. Once a snake has been placed in it, the bag can be tied and removed from the frame then the next bag fitted.
- A further possibility is to fold the top of the bag over a hoop and hold it in place using spring back paper clips of the kind with folding wire handles that can be flipped out of the way.

These methods allow you to use ordinary collecting bags for hoop bagging so long as you standardize your bag and hoop sizes.

(Titmuss,A)



**Fig 7.2** Tiger snake being placed into hoop bag.  
(Photo. D.Kirshner, J.Mostyn, Sydney Wildlife World)

### **Snake hooks;**

Overseas snake hooks are seen as the universal tool for handling venomous snakes, however our elapids don't always sit in a hook quite as well as heavy bodied pit vipers, so hooks are often used in association with tailing. The purpose of the snake hook is either:

- To fit under the snake near the midpoint to lift and carry it, or
- To support the snake about one third of its length from the head to control its fore end, while tailing it with the other hand. This provides two points of support and keeps the snakes head away from the keeper.
- As a general purpose instrument to extract items from a cage, prod animals and so on.

The hook is formed from a metal rod, the thickness depending on the weight and diameter of the snakes for which it is intended and could be anything from coat hanger wire to 8mm rod. Most commonly used will be 4-5mm thick. Many designs used, from simple metal “L” to various U shapes at the end of a metal shaft securely fitted into a wooden dowel or the handle of a golf club. It is very important that the shaft cannot rotate in the handle. The radius of the hooks curve should reflect a width a little more than that of the midbody of the snake, often about 60-70 mm. It is helpful to have a point of the hook tapered to a rounded point, which is easier to fit under the beast than a blunt end. You should have a range of sizes to suit the animals you keep. Overall lengths should be from 400mm to a meter, again depending on the size of your charges. Snake hooks are not appropriate tools for pinning snakes.



**Fig 7.3** Pilston snake tongs and snake hooks and head pinner.  
(Photo. D.Kirshner, J.Mostyn, Sydney Wildlife World)

To place a snake in a cage using a hook and tailing, simply lift it through the open door onto the cage floor, release its tail and slide the door closed onto the hook, which you can slip out to allow the cage to be fully closed. Similar manipulation of the specimen can be used to place a snake into a hoop bag held by an assistant.  
(Titmuss,A)





Removal of tiger snake from enclosure with hook and tailing  
(Photo, D.Kirshner, J.Mostyn, Sydney Wildlife World)

### Tube Restraints:



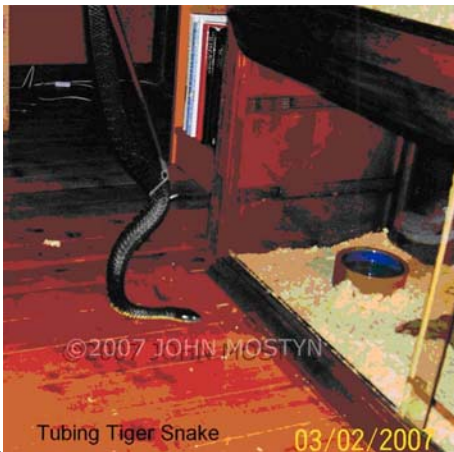
**Fig 7.4 A)** Plastic tubes used for restraint.  
(photo D.Kirshner, J.Mostyn, SWW)

These provide the safest method of hands on manipulation of a venomous snake for sexing, medical procedures and almost anything except for procedures to do with the head. Their use is by guiding a snake into a suitable sized tube, only slightly larger in diameter than the snake, so that it crawls into the tube till the head and forebody are covered. The operator can then pick up the snake, tube and all. It is important to hold the snake in the tube with one hand so that it cannot pull out. Another operator can then perform health checks, take samples, probe the snake, etc in safety. The tubes are available in various diameters.

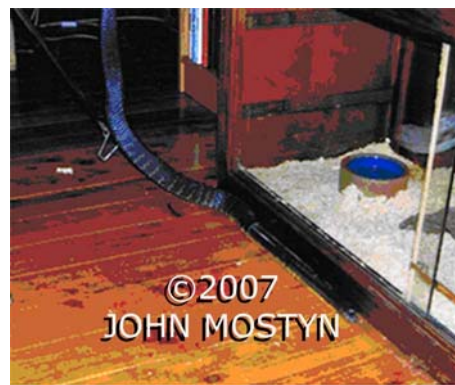
To get the snake into the tube, slowly move the mouth of the tube over the front of the snakes head. If it doesn't continue in, then nudge it on the tail with a hook. If that doesn't work put the snake in a holding bin and put the end of the tube over its muzzle. Because it is in unfamiliar territory it is likely to seek shelter in the tube, even though it is transparent.

(Titmuss,A)

Another way is to lay the tube against a wall on the floor, and run the snake along the wall into the tube. Once the snake in the tube sufficiently, you can grasp the snake while in the tube. This is the easiest and quickest way to tube the snake.



A



B

A) Guiding tiger snake into tube.

B) Tiger snake in tube ready to be grasped



C) Tiger snake tubed, and changing tube size down.

(photos by John Mostyn and Andrew Titmuss)

### **Holding Bins:**

Holding bins are tall, round plastic containers with clip on lids, a.k.a. garbage bins that may be used for short term holding of specimens while a cage is cleaned or for feeding. Some keepers routinely feed their snakes in holding bins rather than in their cages so that the specimens do not expect food when the cage is opened. Also, if the snakes are usually kept together they should be split up during feeding to avoid mishaps.



It is good practice to put some crumpled paper on the bottom of the bin to provide cover and a sense of security for the snake. Do not use towels in feeding bins.



A)



B)

A) Tiger snake in holding bin

B) Elapid holding bin used at Sydney Wildlife World.

(Photo D.Kirshner, J.Mostyn)

### **Trap Boxes:**

These very effective devices provide the means for safe and stress free control of snakes during routine maintenance and should be standard equipment for all venomous snake keepers. A trap box is a hide box fitted with a sliding panel that can cover the entrance to keep the animals inside. It can also have a removable Perspex or glass panel under the hinged top to allow viewing of animals inside with an intervening barrier. The sliding door must be remotely operated by a snake hook pushing a knob on the slide and should have a means of locking or tying the trap closed.

When you need to do something in the cage, look for the snake being in its sleeping quarters and, using a hook, slide the door closed then go about your business. If he's outside basking you could try chasing him in with a hook but failing that wait till the lights and heat turn off at night and lock him in when he retires. Don't forget to let him out again!

(Fowler, M: 1995)

To get a close look at the snake when it is locked in, just take the trap box out of the cage, open the hinged top and view him through the Perspex sub lid.

(Titmuss,A)

### **Divided Cages:**

Divided cages can be built with slide-in dividers to isolate animals in one part of the cage. The advantages are obvious- you isolate the snake in one half of the cage and clean that or place food in that and remove the slide when you have finished. The design challenges are that:

- The slide must be thin so that animals, including neonates, cannot escape. (The same problem has to be addressed with sliding glass fronts).
- Means have to be built in to prevent and facilitate removal of gravel, faeces and assorted rubbish falling into the slide track.

**Slide in acrylic service panels with small access doors:**

Clear acrylic (Perspex) slides, fitted with small sliding doors for feeding, hook access, etc; can be inserted in the front track of cages with sliding glass fronts in double tracks. This means that only a small opening need to be exposed when removing faeces and sloughs, feeding and minor procedures. It means improved safety when fast species like Brown snakes and Taipans are fed.

(Titmuss.A)

**Shields:**

A wide clear plastic rectangle with a moderately long handle fixed to it is very useful as a barrier between the snake and the keeper's hand while changing water dishes, etc. These are items which you can easily make yourself. For front opening cages a handle mounted perpendicular to the shield, like a long hoe, is appropriate while for top opening cages a handle attached in line with the shield, like a paddle is used.

(Fowler,M:1995)

**Tongs:**

Pilstrom and similar tongs are an aluminum rod or tube with a hinged hand piece at one end and hinged metal jaws at the other. They are mentioned in books and are used overseas for handling snakes but in Australia, are more often used to place food or other items into cages. Other gentler snake handling Methods are preferable.

It is possible to modify standard tongs, reshaping and widening the jaws and applying dual density plastic foam padding so that gentle but firm pressure can be applied over a wide area. These are safe to use to pick up and restrain snakes. A commercial version of this, called "Gentle Giant", has been made by Midwest in the USA.

Such modified tongs can be used to pick up snakes that are too jumpy to sit on a hook and place them in a cage or a hoop bag.

(Titmuss.A)



Tongs used at Sydney Wildlife World  
(photo D.Kirshner, J.Mostyn)

**Plastic Bags:**

Thin polythene allows some oxygen exchange so can be used for a brief holding of reptiles. The bag must not be allowed to be in direct sunlight, even for a short time. The snake is tipped from its shelter box into a clear plastic bag of suitable size. This, flattened against the snake it contains, provides some restraint and good vision, so a snake inside

can easily be grasped behind the head. The plastic may then be rolled back or cut away to work with the animal. The late Charles Tanner used this technique for handling the extensive range of snakes that he milked. Plastic bags have also been used so a snake can be photocopied when an accurate measurement of length is needed.

### **PLASTIC BAGS SHOULD NOT BE USED TO HOLD VENOMOUS SPECIES**

#### **Rigid splint restraints:**

A padded length of 50 mm wide timber with 'Velcro' fixed straps behind the angle of the jaws and at 150 mm intervals can be used to hold snakes during brief procedures. This is usually to facilitate such things as faecal collection for research purposes. Use of a tube and an assistant is probably a much better choice.

(Titmuss,A)

#### **Nooses:**

Nooses made from a leather strap fixed to a long handle are used overseas and may be illustrated in books you read. I doubt that they are used much overseas anymore and certainly they are not generally used for snakes in Australia. Their use involves risk of serious injury, particularly if the animal struggles violently.

#### **Anesthesia:**

For clinical examination and other procedures, elapid snakes can be anaesthetized using a volatile anesthetic such as Halothane or Isoflourane.

#### **(See appendix for MSDS on Isoflourane 8.6.1.1)**

Particularly for fast moving and excitable species it is best to bag the snake and put this into an induction chamber or to deliver the gas directly into a hide box.

Ketamine Hydrochloride is an effective and very safe anaesthetic for reptiles, but as it is injected, the animal has first to be restrained.

(Titmuss,A)

#### **(See appendix for MSDS on Ketamine 8.6.1.2)**

Currently tileamine/zolazepam is recommended (4-8 mg/kg IM). Higher doses have been reported in the literature, but higher doses cause considerable delay in recovery.

Ketamine is still recommended (50-80 mg/kg IM). That dose is higher than the dose required for mammals of comparative weights. The drug produces mild sedation or profound anaesthesia depending on the dose used. One of the first signs of a snake's impending immobilization after intramuscular injection of Ketamine is a characteristic elevation of the head in a peculiar stargazing manner, with the mouth held partially open.

All snake immobilization procedures should be carried out with the snake on a heating pad or in a warm environment- not on a cold stainless steel table. Aftercare must include monitoring the environmental temperature to maintain sufficient body heat to allow the animal to metabolize the drug. Snakes may be placed in an anaesthetic chamber (see fig 8) and a calibrated percentage of either isoflourane or halothane in oxygen flows into the chamber. The progression of anaesthesia is determined by inverting the jar. If the snake is unable to right itself, it is probably anaesthetized. Since a snake can hold its breath for 15-20 minutes, inhalant anaesthesia may be prolonged. For this reason apnea, a common concern of the mammalian restrainer is not a serious problem of restrained reptiles. In

fact, it is sometimes difficult to ascertain whether a snake is actually alive during anaesthetic procedures. However, it is easy to insert a tube past the glottis through the trachea, as described for administering anaesthetic, and respire a distressed animal either manually, using mouth tube respiration, or with inhalation equipment. Once a snake is anaesthetized, tape it to a board. Masking tape may be used on small snakes to minimize scale damage. Use only adhesive tape on large elapids.  
(Fowler,M:1995)

### **Things that go wrong:**

How do people get bitten? Snake bite is totally preventable in captive situations. It is always a consequence of operator error in some form. Following are some categories of error and some rules to follow with the aim of avoiding hazardous situations.

**Carelessness** is often linked with complacency. It is putting your hand where it shouldn't be- within the strike range of a snake, leaving doors open, not watching the animal and so on.

**Complacency** The epitome of complacency and over confidence is the keeper who trusts a 'dog-tame' snake. Let's face it; people can't really figure out other people all that well so what flight of fancy would lead them to imagine that they can really understand another species even better?

### **Misjudgment**

### **Distraction**

### **Inadequate equipment**

### **Taking on more than you should**

### **Alcohol and other drugs**

### **Common sense rules to survive by**

The saying 'Familiarity breeds contempt' is very true of captive snake keepers and their charges. It is very easy to be lulled into complacency and take short cuts which expose one to risk. You may get away with it several times, getting more daring all the time, till one day luck runs out.

- Never allow any part of you inside the strike range of a snake without an intervening barrier. To put an arbitrary figure on this, let's say it is two thirds of the length of the snake. If you are inside the snake's 'flight or fight' distance it will be agitated and may bite. Keep your fingers behind solid material when opening cages and use a hook to lift cover or open trap boxes.
- Follow established routines. In particular, be in the habit of closing doors as soon as possible.
- When you are working with your snakes always have someone who is capable of giving first aid, catching snakes and driving to hospital if you are bitten.
- Don't open a snake's cage, in fact don't even go into the snake room if you are fatigued, ill or affected by substances. If you have an alcohol or substance abuse problem don't keep snakes.
- Know your animal. Find out what you can expect before you get it and don't exceed your limits. Handle species that are appropriate to your level of experience and ability and limit yourself to those species allowed on your license. If you stay comfortably

within your limits, and gain experience before you move on to more challenging species you are not as likely to get into serious danger.

- Don't ever trivialize any venomous snake bite. It doesn't matter what size or species bit you, still treat the bite. Snake bite may have highly erratic outcomes. People may survive bites by the most potentially dangerous of species but on the other hand could die following the bite of juveniles or of small species that do not seem to warrant real consideration. You never know how much venom has been injected or whether you may have developed an allergy to the venom. Treat any bite, seek medical help and observe for signs of envenomation or allergic reaction.

(Titmuss,A)

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

Once reptile has been placed in hoop bag and the bag tied off, this is the perfect time to weigh your charge. The hoop bag can be hung from a hanging scale and weighed and the weight of the hoop bag is then subtracted. Alternatively, the reptile in the hoop bag can also be placed on normal scales and weighed, and then the weight of the hoop bag can be subtracted from the weight, giving you the weight of your charge.

Snake may also be placed in holding bin on scales, and the weight of the bin subtracted. At Sydney Wildlife World, all reptiles are weighed every 3 months, and if a snake is not eating, weights will be taken on the animal once a week. You also need to have an accurate weight on any animal that is to be medicated.

**7.6 Transport requirements.**





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

#### **Design and Construction**

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

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

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

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

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

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

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

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

If the primary enclosure is constructed of wood it must have a thickness of at least 0.6 cm (1/4 in). Wooden boxes must not be tamped. If fibreboard or corrugated cardboard is used as a primary enclosure it must be treated in a way that it has a moisture barrier, and the cardboard must be reinforced.

If polystyrene boxes are used inside cardboard boxes the walls of the polystyrene boxes must have a minimum thickness of 2 cm (3/4 in). If separate polystyrene panels are used they must be tightly fitted to each other within the primary enclosure with no gap to prevent escape and avoid injury. Spacer bars are not necessary on cardboard primary enclosures if these are so constructed that ventilation holes are not obstructed when the enclosure is pushed next to another vertical surface.

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

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

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

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

#### **Dimensions and Stocking Density**

Dimensions of inner enclosures and/or outer enclosures shown in these Regulations are illustrative and therefore must be related to the actual size of the specimens for which the container is constructed. The container must in general allow the animal to lie in a natural manner with enough space that stacking is avoided. The height of the container must permit air flow over the animals but prevent stacking. In general a clearance of 3 cm (1 1/4 in) is recommended. This needs to be increased accordingly for larger species.

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

#### **Ventilation and Temperature**

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



The ventilation openings must be small enough to prevent the escape of the animal. Meshed openings must be added to the outer container to prevent possible blockage of inner ventilation holes by the outer container.

Mesh covering of the ventilation holes must be attached to the inside surface of the outer container wall.

Since reptiles and amphibians have a lower tolerance to temperature fluctuations and can be harmed from extreme temperatures insulated or lined containers that are recommended for these species to provide better protection against temperature variations during shipment and transshipment. Care must always be taken that the specimens are not exposed to either extreme cold or heat. In hot conditions low temperatures can be maintained by the inclusion of ice in a polyethylene/waterproof plastic bag. In cold conditions, heat packs can be used, in hot conditions, cold packs can be used. Heat and cold packs are most useful in primary enclosures with good insulation. Dry ice is not allowed.

**Warning:** Some heat or cold packs can contain substances which, due to their properties, are classified as dangerous goods. Consequently, they are not allowed in packages containing live animals.

When using heat or cold packs, they must not be in direct contact with inner enclosures or bags containing animals, or with the animals themselves. Heat or cold packs must have insulation such as bubble wrap or foam rubber to avoid overheating or undercooling of the animals.

### Labelling and Marking

The container must be correctly labelled and marked with the consignee's name, address and telephone number. Labels must not block ventilation holes, especially on small containers.

The container must be marked "LIVE ANIMAL" and have "THIS WAY UP" labels affixed to all four sides. Reptiles and amphibians must be noted on the "LIVE ANIMAL" label.

### Documentation

Shipper's name, address and telephone number and a list with the scientific names and quantities of each species contained in the primary container must be attached to the outside of the primary container or printed on the outside of the outer container.

In addition, the shipper must check the appropriate box in the Shipper's Certification for Live Animals (see Chapter 7), certifying that the animals contained in his shipment are apparently healthy enough to travel by air, that they have been examined prior to shipment and are free of any apparent injury and readily recognizable disease, and that they are also free of external parasitic infestation, including mites, ticks and leeches, that can readily be seen under normal lighting conditions.

### Feeding and Watering Guide

The need to feed or water any of these species during the normal transport time must not arise. Under severe delay and under certain circumstances watering may be recommended if advised by a specialist.

### Special Care

Since reptiles and amphibians are highly dependent on the ambient temperature, they must be immediately removed from areas with very high and very low temperatures to a location where temperatures are not below 7°C (45°F) and not above 29°C (85°F). The preferred temperature range should be 15–25°C (59–77°F). The location should be free of drafts, out of direct sunlight, and should be sheltered as much as possible from physical vibration and noise.

### Specific Requirements

In addition to the above General Requirements, the Specific Requirements that are relevant to the individual species must be consulted and adhered to.

For proper handling and packaging of reptiles and amphibians, the following groups have been created based on the animal taxonomy and size:

- Lizards and tuataras (see Container Requirement 41)
- Crocodiles (see Container Requirement 42)
- Tortoises and turtles (see Container Requirement 43 and 47)
- Snakes (see Container Requirement 44)
- Amphibians (see Container Requirement 45 and 51).

### Measurements

All specimens must be measured using the text and illustrations contained in the appropriate Container Requirement.

### Transport Container

All specimens must be shipped in containers that comply with the text and illustrations contained in the appropriate Container Requirement.

Large reptiles must be crated individually in containers that prevent movement. Certain species require reinforced containers due to their weight and size.

The outer container for large species must be a strong heavy wooden or metal framed wooden crate with ventilation on the sides. The lining within the frame must be strong enough to withstand the animal's strength and can be plywood or solid wood. The ends of the container must be very smooth or padded to prevent injury to the animal's nose. This is especially important for crocodiles.

The direction of the head should be indicated on the outer enclosure for crocodiles and large lizards.

Forklift spacer must be provided for shipment with a total weight exceeding 60 kg (132 lb).

### Important Notes (also see Nomenclature)

Certain terms used in this General Container Requirement are defined as follows:

- primary enclosure also means outer container;
- inner enclosure is an inner container, compartment or bag, where the animal is confined.

Mixing of different species is not allowed in a single inner container, compartment or bag.



## CONTAINER REQUIREMENT 44

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

Applicable to Snakes

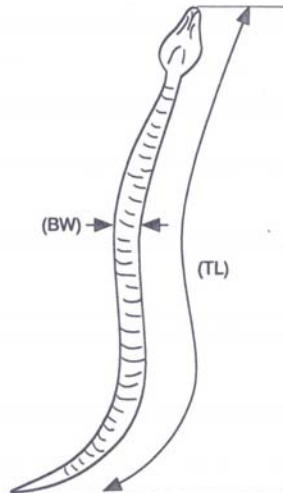
See *USG Exceptions in Chapter 2 and Exceptions CO-01 and UA-05 in Chapter 3.*

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

### Measurement

Snakes should be measured by total length (TL) and by body width (BW), at the widest point of the animal's body.

Care should be taken that these animals are never stretched during measurement. Measurements of width should be taken with the animal resting in a normal posture.



### Specific Requirements

All rigid containers must have some kind of packing material (i.e. crumpled paper). Packing material is also recommended for bags.

Burlap (hessian) sacks are not allowed for any snake species less than 120 cm (48 in).

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

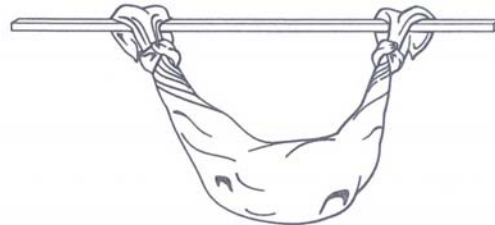
### Packing Density for Snakes in Flat Laying Bags

Total length (TL)	Body width (BW)	Maximum no. of animals per bag	Minimum bag size
≥ 120 cm (48 in)	> 4 cm (1.5 in)	1	Dependent on the size of the animal
≥ 90–120 cm ± 15 cm (36–48 in ± 6 in)	≤ 4 cm (1.5 in)	8	45 × 60 cm (18 × 24 in)
		4	30 × 45 cm (12 × 18 in)
≥ 60–90 cm ± 10 cm (24–36 in ± 4 in)	≤ 4 cm (1.5 in)	12	45 × 60 cm (18 × 24 in)
		8	30 × 45 cm (12 × 18 in)
≥ 30–60 cm ± 10 cm (12–24 in ± 4 in)	≤ 4 cm (1.5 in)	14	30 × 45 cm (12 × 18 in)
≤ 30 cm ± 7,5 cm (12 ± 3 in)	≤ 4 cm (1.5 in)	24	30 × 45 cm (12 × 18 in)

### Exception for Stout Bodied Python Regius (Ball Pythons)

All lengths up to 120 cm (48 in) (15 cm [6 in] variance)	> 4 cm (1,5 in)	8	45 × 60 cm (18 × 24 in)
All other lengths	< 4 cm (1,5 in)	Same as in snake table above	Same as in snake table above

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



Plastic containers are permissible for snakes less than 60 cm (24 in) in length. These containers must be rigid and able to support the entire weight of all other containers when stacked upright and if turned upside down, without failing structurally (without bending, cracking or collapsing). The size of these containers must enable the animals to have contact with their whole ventral surface to the floor of the container.

The following snake species should be packed singly because they are cannibalistic:

- Black-headed python, woma (*Aspiditis* spp.)
- Milk and king snakes (*Lampropeltis*)
- Mussurana (*Clelia clelia*)

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## **CONTAINER REQUIREMENT 44 (cont'd)**

The following snake species are very delicate and should be packed singly and need some with some moist substrate:

File snake (*Achrocordus* spp.)

### **Specific Requirements for Venomous Snakes**

In general, venomous snakes have the same requirements as other snakes, but they must be packed singly and if possible in rigid plastic containers which enable inspection and control of the animals without opening the container. If this is not possible, animals more than 30 cm (12 in) in length are to be double bagged with the specimen in a clear or transparent inner mesh bag (maximum mesh size: 2 mm [ $\frac{1}{8}$  in]) to enable control, inserted in an outer cloth bag which should not be transparent.

Labelling of each bag or inner container must list the specimen's scientific name, common name and venomous/poisonous or a pictorial warning label.

When venomous snakes are shipped in the same crate with other non-venomous species, they must be separately compartmentalized in a wood container.

All containers (inner and outer containers) with venomous species must be covered with a wire mesh over the entire opening of the container to prevent animal escape when the container is opened for inspection.

Venomous snakes as defined here include the true venomous snakes of the following Taxonomic groups:

- Elapidae — Cobras, mambas, coral snakes, kraits and relatives
- Viperidae — Adders, vipers
- Crotalidae — Rattlesnakes, copperheads, palm pit vipers
- Atractaspidae — Mole vipers, burrowing asps
- Hydrophiidae — Sea snakes

Rear fanged snakes must be packed like the true venomous snakes, they are:

- Boomslang (*Dispholidus*)
- African vine or twig snakes (*Thelotornis*)
- Rhabdophis*
- Mangrove and cat snakes (*Boiga*)

Some colubridae snakes with uncertain venoms or venom apparatus must be packed like the true venomous snakes, they are:

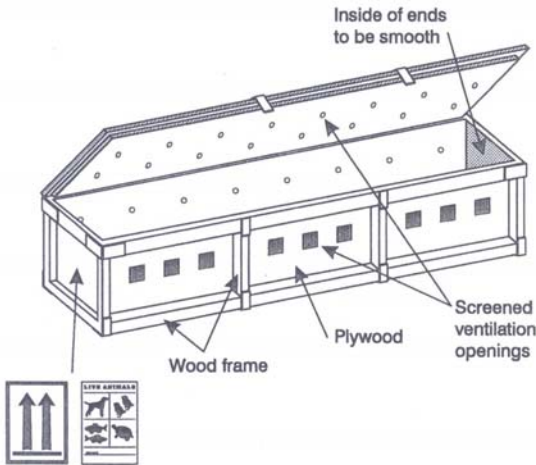
- Homolapsinae
- Xenodontidae

**South East Asian water snakes should be packed using the guidelines contained in Container Requirement 51.**

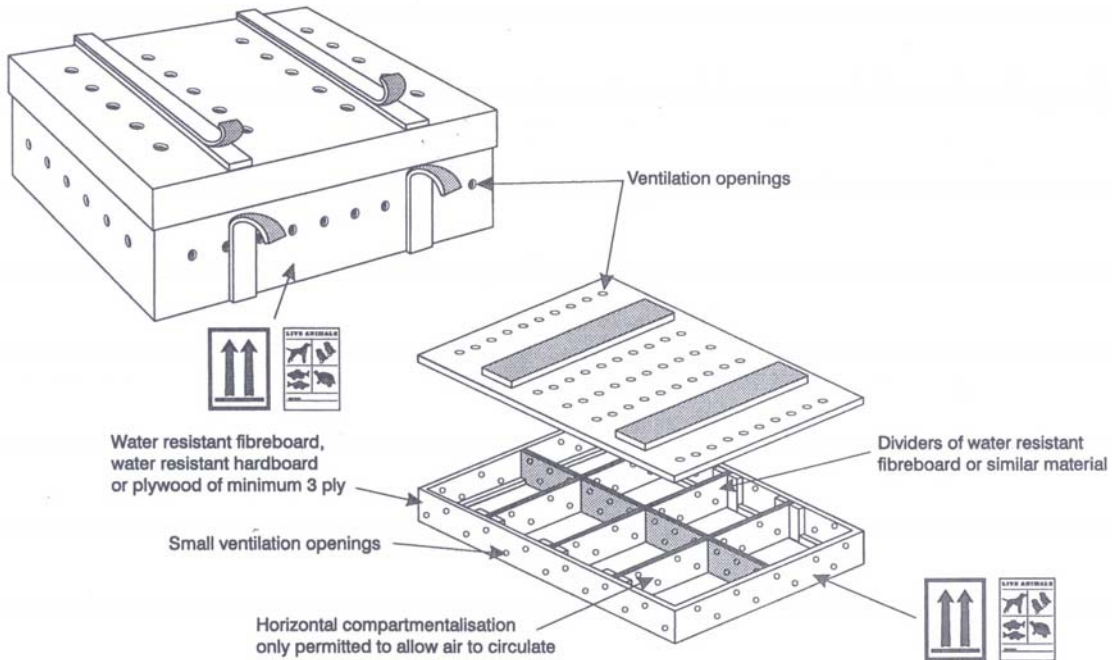
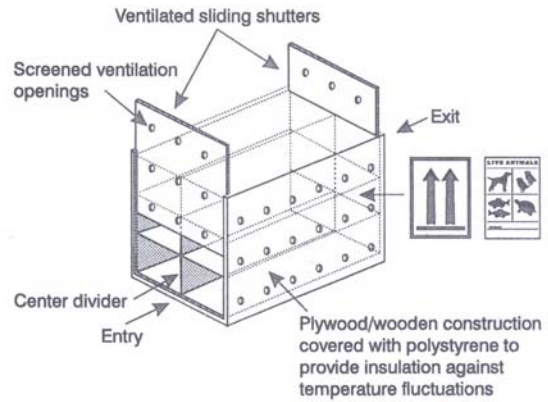
**CONTAINER REQUIREMENT 44 (cont'd)**

EXAMPLE:

**SINGLE CONTAINER**



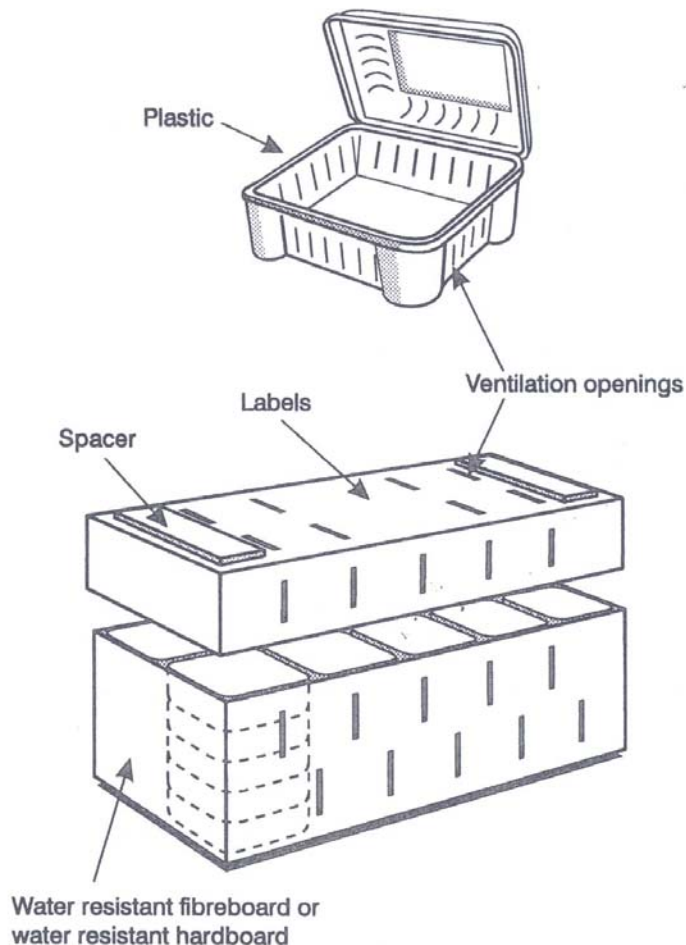
**MULTIPLE CONTAINER**  
(suitable for small or young animals not exceeding 50 cm [20 in] in total length)





## CONTAINER REQUIREMENT 44 (cont'd)

### MULTICOMPARTMENT CONTAINER



#### 7.6.1 Box Design

For general transport purposes, these species will be carried only in closed and adequately ventilated containers. The container must be well constructed and able to withstand other freight damaging it or causing the structure to buckle or collapse. It must be constructed of non-toxic materials. Chemically impregnated wood may be poisonous and must not be used. The container must be suitable to keep the species inside at all times and protect it from unauthorized access. The door or lid must be constructed so that accidental opening cannot occur, either from the inside or the outside.

The container must be rigid enough to prevent the animal escaping through gaps at the seams or joints. The container must not cause injury to the animal. All inside edges must be smooth or rounded. There must be no sharp projections, such as nails, upon which the

animal can injure itself. The container must be clean and leak proof. If it is to be reused, the container must be thoroughly cleaned and then disinfected or sterilized prior to reuse. The container must protect the handlers from being bitten by the animal. (p222)

### **7.6.2 Furnishings**

When shipping venomous snakes, there should NOT be any furnishings included in the shipping containers or cloth bags.

### **7.6.3 Water and Food**

The question of feeding during the 24 hours following the time of dispatch of the animal need not be of primary importance, providing that it is fed prior to dispatch in the following manner.

- Certain species of reptiles require starving before shipment;
- Watering is more important than feeding and if this cannot be performed during the flight, the animal must, at least, be watered before dispatch and upon arrival.

It has been suggested that for snakes that food be withheld from the animal up to at least 7 days before shipping, and that water be provided for the snake for at least 24 hours prior to shipping, and as soon as possible after arrival.

### **7.6.4 Animals per Box**

There are specific requirements for the shipping of venomous reptiles. These are;

- In general, venomous snakes have the same requirements as other snakes, but they must be packed singly and if possible in rigid plastic containers which enable inspection and control of the animals without opening the container. If this is not possible, animals more than 30cm (12 in) in length are to be double bagged with the specimen in a clear or transparent inner mesh bag (maximum mesh size: 2mm) to enable control, inserted in an outer cloth bag which should not be transparent. (I.A.T.A. Live Animals Regulations 2000)

### **7.6.5 Timing of Transportation**

The timing of transportation is important for reptiles. You do not want to ship a reptile by air in the middle of the day in summer, where temperatures on the ground are 40°C. It would be better to ship them in the late afternoon or early evening. The same in winter. It would be best to ship the animal in the middle of the day in winter as opposed to early morning or late evening.

### **7.6.6 Release from Box**

## 8 Health Requirements

### 8.5 Daily Health Checks

Initial Examination should include observations such as:

- **General;** overall body condition and color, any lumps and bumps, any strange odors!
- **Behavior;** active or lethargic. Alert or dull, responsive or not, general demeanor.
- **Locomotion;** normal movement, adopting any odd postures, tremors, loss of balance, co-ordination etc.

We can then start looking at the general body systems and note any of these conditions which may alert you to a problem that may be present. Some signs of problems or diseases will be obvious, however some reptiles show very little in the way of 'disease' and the signs may be very subtle.

### 8.6 Detailed Physical Examination

It is important to obtain a thorough clinical history. This should include feeding, weight, ecdysis, fecal and urate production.

The following needs to be assessed;

- 1) Obtain accurate length (rostrum-cloaca) and weight.
- 2) Inspect rostrum, nostrils (Discharge, occlusion, trauma)
- 3) Check eyes clear; inspect spectacles under magnification for abnormalities.
- 4) Ensure tongue flicking normally, tines not stuck together, snake moving normally, able to support head.
- 5) Examine oral cavity (mucous membranes normally clear, but no petechiation (tiny area of haemorrhage, spotted,) excess salivation, oedema (excessive accumulation of fluid in the body, usually in the tissues, body cavities), fluid from respiratory tract.
- 6) Body should be rounded (triangular if emaciated)
- 7) Skin elasticity? Check hydration and palpate for swellings.
- 8) Check scales for hemorrhage, blisters, loss of scales. (check ventral scales too)
- 9) Check cloaca for oedema, erythema (reddening of the skin caused by dilation of capillaries), discharge, swellings.
- 10) Make fecal smear if feces produced.
- 11) Smaller snakes may be Tran illuminated.

## **CLINICAL ASPECTS OF REPTILE MEDICINE**

### **Injection sites**

The renal portal venous circulation in reptiles means that injection into the hind limb musculature may be eliminated via the kidneys before reaching the rest of the body.

IM intramuscular injections; intercostals muscles of the snake's body

SC subcutaneous injections; in loose skin over the ribs

IV intravenous: The palatine vein, the ventral tail vein, or cardiocentesis.

- A) Ventral vein. This is the only method not requiring sedation, identify cloaca, insert needle distal to this, into tail at midline at 45° angle, advance to vertebrate, aspirate as slowly withdraw.
- B) Cardiocentesis requires sedation. Palpate/visualize beating heart, stabilize with finger and thumb. Use 23/25G needle on 3-6ml syringe. Slide needle under ventral scale and aspirate syringe. If only clear fluid is withdrawn, this is pericardial fluid.

### **Force Feeding**

Give oral fluids e.g. lactated Ringers, Hartmanns, daily equal to 4%-10% bodyweight.

Mix up feed at 5g protein and 500kj/kg bodyweight daily, e.g. Buildup (Carnation Foods), protinaid (VetDrug)

Manually restrain animal, open mouth and insert gag e.g. folded piece of radiograph with hole cut into centre. Hold anterior of snake vertically. Insert well lubricated end of French catheter into oesophagus to level of stomach. Syringe in fluid.

### **Fluid Therapy**

Most sick reptiles will present dehydrated, requiring fluid therapy or force feeding.

Consider this if;

The reptile has continued weight loss, dehydration (PCV < 0.25l/l) with an associated hypoglycaemia (blood glucose < 5.2mmol/l). Fluids given s/c, i/p, i/v. As reptiles lack a diaphragm, the administration of large volumes of fluid i/p may impair respiration.

### **Faecal Examination**

Reptiles often deposit urates/faeces when being examined. If not, a colonic wash may be performed as follows;

- 1) insert lubricated French catheter attached to syringe filled with sterile saline into the cloaca and colon ( it should slide in easily with the right size)
- 2) Flush in saline and aspirate several times.

The following examination techniques may then be used.

- 1) Direct wet mount – dilute small sample with saline and examine under high power (400x) to see spinning flagellates and static nematode ova
- 2) Mix faecal sample with eosin for background staining to show encysted entamoeba.
- 3) Gram stain. Care. Gram negative (VE-) bacteria are frequently recovered from clinically healthy captive reptiles. However, most infections are caused by gram negative (VE-) pathogens.

- 4) Examine sediment (following centrifugation) for protozoa and trematode ova.
- 5) Flotation technique for nematode ova.

Reptiles may pass prey parasites e.g. mouse nematodes which are non-pathogenic to the reptile.

### **Blood Sampling**

It is imperative that the maximum blood volume that may be safely withdrawn is accurately calculated as it is easy to overestimate in small animals. For reptiles the total blood volume varies with species but is approximately 5-8% bwt (70mg/kg). Of this, 10% may be the maximum withdrawn safely. Thus a 100g reptile can have 0.7ml safely taken.

*It is obviously important that the reptile patient is weighed accurately and the calculations made before the blood is withdrawn.*

Collect blood into lithium heparin tubes (EDTA tends to lyse cells).

### **Blood sampling sites.**

The palatine vein, ventral tail vein, or cardiocentesis.

- a) Ventral vein. The only method not requiring sedation, - identify cloaca, insert needle distal to this, into the tail at midline at 45° angle, advance to vertebrae, aspirate as slowly withdrawal.
- b) Cardiocentesis requires sedation. Palpate/visualize beating heart, stabilize with finger and thumb. Use 23/25G needle on 3-6ml syringe. Slide needle under ventral scale and aspirate syringe. If only clear fluid is withdrawn, this is pericardial fluid.

### **Haematology**

Measure number RBC, WBC, differential WBC count, PCV, and the haemoglobin concentration.

### **Biochemistry**

Use plasma (gain greater volume from blood sample and serum tends to clot). Take blood sample and centrifuge immediately, remove plasma.

Measure Na, Cl, Ca, P, GI, urea, uric acid, creatine, cholesterol, AST, ALT, ALP, total protein.

### **Blood smear**

The following may be carried out.

Differential WCC, morphology of cells, level of toxic changes, inclusion bodies, blood parasites, bacteria.

### **Radiography**

Positioning is important when radiographing reptiles. Animals can be taped down, radiographer through a box or bag if not sedated. Assess organ position, shape, size, density and homogeneity. Check state of reptile nutrition, skeletal density, gastrointestinal organs and content.

Radiograph regions of suspected lesion only. If radiographing whole snake, take sequential sections along length of snake using lead markers every 10-20 cm.



### **Barium meal.**

Studies can be performed as follows.

A 2kg snake requires 10ml barium sulphate suspension by oesophageal tube followed by 90ml air for double contrast study. 15 minutes later you should see oesophageal folds, gastric rugae, pyloric sphincter and duodenal villi. 5mg metoclopramide reduces the GIT food transit time from days to 12 hours.

### **Ultrasonography**

7.5 And 10 MHz transducers will stand off for suitable resolution in small reptiles. 5 and 3.5 MHz transducers for larger reptiles, linear array transducers are used to view the internal organs via the ventral body wall using an aqueous gel.

(Redrobe: S, 2006)

### **The Body System:**

**Skin:** any signs of wounds (cuts, burns, etc), presence of parasites (ticks/mites), retained skin, or about to shed, skin tenting revealing dehydration, skin discoloration or redness of scales (check belly especially), lumps, bumps and swellings etc.

**Locomotor system:** spinal column injury, part of tail missing.

**Special senses:**

- **Eyes:** injury to eye scale (brille) eye/ retained spectacle, redness, swelling. Check for symmetry, no bulging or eyes staying closed. Sunken eyes may include dehydration.
- **Nose:** abrasions, blocked nostrils, nasal discharge.
- **Tongue:** intact and functional, tines (forked tips) not stuck together
- **Cloaca:** any abnormal discharges, smells.

### **8.6.1 Chemical Restraint**

For clinical examination and other procedures, elapid snakes can be anaesthetized using a volatile anaesthetic such as Halothane. Particularly for fast moving and excitable species it is best to bag the snake and put this into an induction chamber or to deliver the gas directly into a hide box.

Ketamine Hydrochloride is an effective and very safe anaesthetic for reptiles, but as it is injected, the animal has first to be restrained.

(Titmuss, A).

Currently tileamine/zolazepam is recommended (4-8 mg/kg IM). Higher doses have been reported in the literature, but higher doses cause considerable delay in recovery.

Ketamine is still recommended (50-80 mg/kg IM). That dose is higher than the dose required for mammals of comparative weights. The drug produces mild sedation or profound anaesthesia depending on the dose used. One of the first signs of a snake's impending immobilization after intramuscular injection of ketamine is a characteristic elevation of the head in a peculiar stargazing manner, with the mouth held partially open.

**(See appendix 8.6.1.2 for ketamine msds)**

All snake immobilization procedures should be carried out with the snake on a heating pad or in a warm environment- not on a cold stainless steel table. Aftercare must include monitoring the environmental temperature to maintain sufficient body heat to allow the animal to metabolize the drug. Snakes may be placed in an anaesthetic chamber (see fig 8) and a calibrated percentage of either isoflourane in oxygen flows into the chamber.

The progression of anaesthesia is determined by inverting the jar. If the snake is unable to right itself, it is probably anaesthetized. Since a snake can hold its breath for 15-20 minutes, inhalant anaesthesia may be prolonged. For this reason apnea, a common concern of the mammalian restrainer, is not a serious problem of restrained reptiles. In fact, it is sometimes difficult to ascertain whether a snake is actually alive during anaesthetic procedures. However, it is easy to insert a tube past the glottis through the trachea, as described for administering anaesthetic, and respire a distressed animal either manually, using mouth tube respiration, or with inhalation equipment. Once a snake is anaesthetized, tape it to a board. Masking tape may be used on small snakes to minimize scale damage. Use only adhesive tape on large elapids.

(Fowler,M:1995)

(See appendix 8.6.1.1 for msds on Isoflourane)

### 8.6.2 Physical Examination

This type of examination should be carried out periodically (e.g. once a month). It actually involves picking the reptile up, and having a closer look and feeling and palpating for abnormalities.

Signs of ill health include;

- Teeth abnormalities.
- Discharge in eyes, nostrils, mouth and cloaca.
- Poor skin condition, look and feel for lumps, parasites, ulcers, blisters and foreign bodies, tenting of skin (dehydration)
- Any abnormal odors coming from the reptile.
- Any areas of heat, swelling and discharge, (sign of infection).
- Abnormal respiratory sounds.
- Loss of weight.

(Titmuss, A)

#### **The Body System:**

**Skin:** any signs of wounds (cuts, burns,etc), presence of parasites (ticks/mites), retained skin, or about to shed, skin tenting revealing dehydration, skin discoloration or redness of scales ( check belly especially), lumps, bumps and swellings etc.

**Locomotory system:** spinal column injury, part of tail missing.

#### **Special senses:**

- **Eyes:** injury to eye scale (brille) eye/ retained spectacle, redness, swelling. Check for symmetry, no bulging or eyes staying closed. Sunken eyes may include dehydration.
- **Nose:** abrasions, blocked nostrils, nasal discharge.
- **Tongue:** intact and functional, tynes (forked tips) not stuck together
- **Cloaca:** any abnormal discharges, smells.

## **8.7 Routine Treatments**

Fecal examination should be carried out every three to six months. You should have 3 negative returns before the snake is cleared.

I would suggest having your snake wormed every six months, as some prey items that have been purchased, may not have been frozen for the minimum of six weeks, which is required, to kill pathogens and protozoa.

## **8.8 Known Health Problems**

### **Disease**

A Disease is any abnormality in body condition. Diseases are either pathogenic or non-pathogenic. Pathogenic diseases are caused by viruses, bacteria, protozoa, fungi or parasites. Non-pathogenic diseases are caused by nutrition, environment or trauma/stress. Certain conditions may predispose an animal to a disease. These conditions include poor or incorrect diet, incorrect housing design, incorrect environmental parameters, unsanitary housing, and undue stress. If subjected to predisposing factors animals which would otherwise fight off a disease before they are affected or not contract the disease may become ill.

By law a veterinarian must perform a diagnosis and prescribe the appropriate medical treatment.

### **Types of Diseases**

#### **Pathogenic**

The treatment of pathogenic disease should include cleaning and disinfection of the enclosure more often and increasing the warmth of the enclosure.

### **Canker (mouth rot)**

#### **Symptoms**

Infected puss filled lesions and hemorrhages in mucous membranes.

#### **Treatment**

Clean mouth and rinse with saline, daily as well as treatment with Enrofloxacin at 5-10 mg/kg IM, PO q 24-48 h  
(Spielman,D 2006)

### **Respiratory Infections**

#### **Symptoms**

Gaping, sneezing, discharge from mouth, nose and eyes.

#### **Treatment**

Course of antibiotics

Enrofloxacin at 5-10 mg/kg IM, PO q  
(Spielman,D 2006)

### **Blister Disease (scale rot)**

#### **Symptoms**

Ulcerated skin between and beneath scales, blisters filled with clear or milky fluid.

#### **Treatment**

Antisepsis of infected skin, course of antibiotics. Enrofloxacin at 5-10 mg/kg IM, PO q  
(Spielman,D 2006)

## **External Parasites (Ectoparasites)**

External Parasites such as ticks and mites are generally seen by the naked eye. Recently fed ticks are engorged and protrude from under or around the scales. However, immature forms of ticks may hide under scales and avoid detection. On inspection of a reptile, pay special attention to flat or slightly raised, circular objects protruding from under a scale. (Klingenberg, R)

### **Top of Descent spray.**

Top of Descent spray is an aircraft insecticide, used for cabin spraying by Immigration, on arrival of International flights.

Top of descent effectively kills mosquitoes and other flying and crawling insects. This spray is effective on mites and ticks. It is safe enough to spray enclosures and directly onto snakes.

The active ingredient is 20g/kg d-Phenothrin 20:80

(see appendix 8.8.1)

### **Ticks**

#### **SYMPTOMS**

Visible ticks, general ill thrift, severe cases cause anaemia.

#### **TREATMENT**

They can also be physically removed with forceps; making sure the head of the tick is removed.

(Titmuss, A)



Examples of ticks. Ticks can be disease carriers and it is important to remove these from reptiles.

(Klingenberg,R:1993)

## **Mites**

Reptile mites (*Ophionyssus natricis*) are small, but can be observed moving on the host. (Reptile). In small numbers, mites may present a nuisance to the reptile, causing discomfort and agitation. In moderate to severe numbers, mites can cause

- 1) Anemia
- 2) Rough, eroded, damaged scales which predispose the skin to infection
- 3) Peri-orbital inflammation and swelling
- 4) Depression and anorexia
- 5) Sign related to blood- borne infections (including IBD)
- 6) Difficulties in shedding
- 7) Death

When in doubt, the reptile can be placed over a white piece of paper and rubbed, whereupon the mites that fall off will be seen moving on the paper. The appearance of white flecking or thick white “dust” particles on a snake is a reliable indicator of the presence of mites. The white flecks are actually mite faeces. Water containers can be examined for drowned mites, as mite-infested reptiles often spend an inordinate amount of time in their water containers in an attempt to rid themselves of these parasites. Patches of dry skin or crusty material around the eye or protruding eye rims should alert the keeper to look for mites.

(Klingenberg, R)

## **Symptoms**

Soaking in water for long periods of time, rubbing bodies, off food, anaemia, mites visible on skin or in water bowl.

## **Treatment**

Clean cage and dispose of bedding and furnishings. Spray enclosure and animal with Top of Descent spray, repeat after 7-10 days and use pest strips.

## **Internal Parasites (Endoparasites)**

There are two common forms of intestinal\* parasites in reptiles – worms and protozoan parasites and there are several different types of each. Both types of parasite can occur in reptiles in small numbers causing little or no damage to the host\* reptile. However in larger numbers they can cause irritation to the gut lining, diarrhea, and weight loss or failure to thrive. Many animals will carry small numbers of worms or protozoa without Any signs of ill health, but this will depend on the number of the parasites, the health status of the reptile and the age of the animal. Young animals can suffer from intestinal irritation more easily than more mature animals.

## **Signs of Intestinal Parasitism**

Worms and protozoa can damage cells lining the gut and can deprive the animal of nourishment from food. Damage to the gut reduces the absorption of nutrients from the gut and allows blood and fluids to be secreted into the gut reducing nourishment available to the reptile. Damage to the gut lining can also allow secondary bacterial infections to occur.

The most common signs of intestinal parasites include failure to grow well, or loss of weight, loss of appetite, sloppy droppings, sometimes with blood in it or occasionally constipation. Sometimes animals with intestinal parasites will eat abnormal things – they may ingest (swallow) small rocks, or other substrate material, or appear bloated in the abdomen. They can also get an irritation to the cloaca. Sometimes worms may migrate through the intestinal wall carrying bacteria with them. This can allow bacteria into the abdomen and cause an abscess or peritonitis and death.

### **Diagnosis**

Occasionally a worm may be passed or regurgitated by an animal but generally examination of faeces from the animal is required to identify a gastrointestinal parasite. Reptiles pass droppings composed of urine from the kidneys, urates (the gritty white material) also from the kidneys and faeces from the bowel. Many protozoan parasites are motile in the faeces- they swim around. After just a few minutes exposure to cooler dry air these protozoa form non-motile cysts\* which are much harder to see under the microscope. The cysts can be seen by using special stains, but usually we need to send the sample to a laboratory for these staining procedures so it is easier to identify them in a very fresh wet smear of faeces under the microscope. This sample can often be milked easily from the bowel of a snake. Some of the non-motile protozoa and worm eggs are passed in small numbers and we need to use a technique called faecal flotation to concentrate the eggs to see them under the microscope. Faecal flotations are performed using a larger amount of faeces, mixed with a saturated salts solution which will cause the eggs to float to the top of a container. The sample at the top is collected onto a microscope slide for examination.

## **The Common types of Parasites**

### **NEMATODES**

#### **ROUNDWORMS**

Large white (spaghetti-like) worms. They do not attach to the lining of the bowel and small numbers in the gut do very little harm. They have an indirect life cycle so they are transmitted in food items such as frogs, lizards and rodents. In large numbers especially in young animals they can reduce significantly the nutrition and can sometimes cause bowel blockages. Freezing of food items reduces dramatically the potential for transmission. Larval stages of these worms can travel into the body and damage other organs such as liver and lungs.

They are diagnosed by finding eggs in a faecal flotation.

#### **Treatment**

Fenbendazole (panacur) at 25mg/kg or Ivermectin (ivomec) at 200ug/kg.

This may need to be repeated up to every 2 weeks for 2-3 treatments depending on the severity of infestation.

**(See appendix for MSDS on Ivermectin 8.8.1 and Panacur 8.8.1.5)**



Roundworm egg (Photo: Klingenberg, R: 1993)

### **CAPILLARIA (hepatic worms)**

These worms also have an indirect life cycle; they require an intermediate host which is threatened by the reptile.

They migrate into the liver and can cause damage there.

Diagnosis is by finding the operculated eggs (oval eggs with little knobs on either end) in faecal flotations.

### **Treatment**

With panacur or ivermectin but may need to be repeated several times to clear the infestation.



*Capillaria* eggs viewed under microscope at 100 xs

(Photo: Klingenberg, R: 1993)

### **HOOKWORMS**

They have a direct life cycle so they have the potential to develop large numbers in captive animals- they can re-infect themselves.

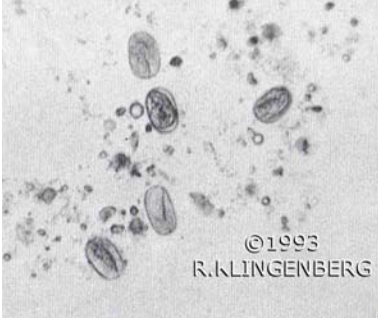
Are small worms that can cause severe damage. They are picked up by ingestion of eggs or by penetration of the skin by larvae which then migrate through the body to the gut.

They attach to the lining of the gut causing ulcers and bleeding leading to inflammation of the gut and anaemia and sometimes they can cause perforations of the gut and peritonitis\* with secondary bacterial infections.

Diagnosis is by finding the eggs or larvae on faecal flotation.

### **Treatment**

Treatment is with Ivomec or Panacur. Cleanliness is very important to control hookworms- removing faecal contamination quickly so animals do not become continually re-infected.



Hookworm eggs seen on fecal flotation at 100 xs  
(Photo: Klingenberg,R: 1993)

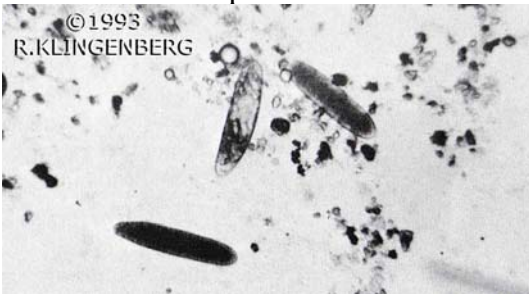
### **PINWORMS**

Have a direct life cycle. They live in the large bowel and can cause obstructions or impactions.

Diagnosis is by seeing large ovoid eggs in faecal flotations.

#### **Treatment**

They can be treated with Ivermectin or Panacur. Mice have their own types of pinworms and they can even be seen sometimes in reptile faeces that have eaten the mouse but do NOT infect the reptiles.



Pinworm eggs (ova) as seen on fecal flotation  
100x (Photo: Klingenberg, R: 1993)

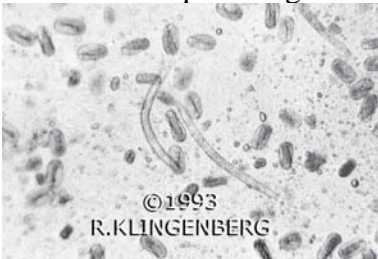
### **STRONGYLOIDES**

Their life cycle is direct and is similar to lungworms but they affect the gut causing diarrhea, while the larval migration has the potential to cause lung damage. Infection is by larval penetration or ingestion.

Diagnosis is by finding larvae in fresh preparations of faeces (not by flotation).

#### **Treatment**

Treatment requires higher doses of Panacur at 50mg/kg.



*Strongyloides* larvae among eggs characteristic of  
*Strongyloides*  
(Photo: Klingenberg, R: 1993)



## **LUNGWORMS**

### **Rhabdias sp**

The snake lungworm has a direct life cycle and is common parasite found in frogs, toads and snakes. The larvae that hatch from eggs can gain entry to the host by percutaneous penetration and by ingestion of faecally contaminated food and water, similar to hookworm. Lungworms generally have limited effects on the host. Like hookworm, their direct life cycle allows them to build up in large numbers.

**Diagnosis:** A verminous pneumonia, characterized by gaping mouth, wheezing, and exudates from the trachea. Can be seen in heavily infested or extremely stressed reptiles.

### **Treatment:**

Treatment used is Panacur at 50-100 mg/kg (higher dose than with other nematodes) or with Ivermectin at 0.2 mg/kg orally. Panacur is given weekly and Ivermectin every two weeks for 2-3 treatments.

Cleanliness is very important to control lungworms, removal of faecal matter quickly so reptile does not become reinfected.

(Klingenberg, R. 1993)

## **PROTOZOA**

### **AMOEBAE** (*Entamoeba invadens*)

Large slow motile protozoa which can cause severe damage to the gut leading to diarrhea, mucoid or bloody faeces, anorexia, wasting and death. Some animals can be asymptomatic carriers which pass amoebae in their droppings. The amoebae form cysts outside the body and these are ingested with food or water by susceptible animals.

Diagnosis is by finding the motile form in faecal wet prep.

### **Treatment**

Treatment is with Flagyl (metronidazole) at 20 -50mg/kg repeated weekly for at least three treatments.



Cysts of *Entamoeba* on a direct smear viewed under microscope at 100 xs

(Photo: Klingenberg, R: 1993)

### **COCCIDIA**

Small protozoa which are non-motile. They have a direct life cycle and can cause severe gut irritation, diarrhea and death.

**Diagnosis-** they can be treated with Baycox (toltrazuril) but this medication can have severe side effects in snakes. In snakes Trimethoprimsulpha drugs can be used but are not always effective.



Oocysts of coccidian viewed under the microscope at 400

xs

(Photo: Klingenberg, R: 1993)

### **CRYPTOSPORIDIA**

Is a small coccidian parasite occasionally seen in snakes. In snakes, the infestation is usually pathogenic- causing severe hypertrophic gastritis, and is mainly seen in elapids. This coccidian parasite can cause severe gut damage especially to the stomach. It is extremely resistant to treatment though some animals can carry the parasite without obvious signs- a carrier. The reptile parasite is not the same as the mammalian one but it is still contentious whether the mammalian one can cause disease in reptiles and vice versa. The main signs of infection include regurgitation and weight loss and sometimes swelling of the stomach (in snakes).

**Transmission:** ingestion of oocysts passed in faeces, immunodeficient individuals being particularly at risk.

**Clinical signs:** Regurgitation 2-3 days after eating, midbody (stomach swelling, weight loss in chronic cases). Almost always fatal.

**Diagnosis:** Examination for oocysts in smears of faeces, mucous from surface of regurgitated food, stomach washings and stain with modified Ziehl-Neilsen- oocysts stain acid fast in contrast to other material and organisms in the sample. Endoscopy, laparotomy and biopsy are unnecessary if oocysts are found in the above tests.

**Treatment:** At this stage no reliable treatment is known though Trimethoprim and sulphadiazine at 30mg/kg daily for 7 days has helped some animals. By stomach tube with food, smear drug on outside of prey before offering to snake. Supportive fluid vitamin therapy. Very poor prognosis. Some newer preparations used in humans with AIDS have potential but at present the cost is prohibitive.

**Control:** Isolate infected. Consider euthanasia. Test faeces of all in-contact animals. Treat all contacted enclosures and equipment with formaldehyde-cased disinfectant. Strict personal hygiene. New arrival checks for faecal Cryptosporidia before housing with others.

(Salkeld, J)



*Cryptosporidium* oocysts (dark dots) at 100 xs

This parasite is currently not treatable and can be devastating when present in collections (Photo-Klingenberg, R: 1993)

## **PENTASTOMIASIS**

Characteristics of phyla Arthropoda and Annelide. Pentastomes are almost exclusive parasites of reptiles. There are 9 genera in snakes, 3 in lizards, 4 in crocodiles and 2 in turtles. A variety of herbivorous vertebrates can be intermediate hosts such as rodents. Humans and primates are incidental hosts. The definitive host is snakes; where adult forms of the parasite are found in the respiratory tract (this stage is not transmissible to humans).

Pentastome eggs are then passed in respiratory secretions, saliva and faeces. These eggs are ingested by intermediate hosts (rodents) or incidental hosts (man, dogs).

- The primary larvae emerge and penetrate the gut, encyst in host tissues.
- The larvae becomes quiescent or in a nymph stage. This has been reported in man causing minimal- moderate inflammatory response.
- The third stage larvae in man can encyst, which calcifies and dies in incidental host.

Pentastomes are parasites of all reptile groups, relatively uncommon in captivity, as infestation acquired by ingestion of wild mammalian intermediate hosts. However some pentastomids have both direct and indirect life cycles. Therefore the infected snake can be infectious to enclosure mates.

Pentastomids inhabit lungs and air sacs, disease occur if in large numbers, i.e., inflammation and fibrous degeneration of pulmonary parenchyma result. Associated with serious human disease affecting liver and lungs.

**Clinical signs:** Dyspnoea, viscous oral mucous (may be blood tinged), lethargy, anorexia.

**Diagnosis:** Identifying eggs in oral mucous or lung washings (eggs have distended, thin walled capsule, and may contain larvae with hooklets).

**Treatment:** None reported, Ivermectin 0.2mg/kg SC have been effective in several cases in Melbourne Zoo. Vets need to educate owners: feed clean, lab reared rodents, at least 2 successive faecal specimens. Prompt removal of faeces and proper disposal.



Pentastomid egg viewed on fecal flotation 100x

(Photo: Klingenberg,R: 1993)

## **FLAGELLATES**

These are small motile protozoa dewdrop shaped with whip-like projections from the end which they use to move around. They can cause little problems in small numbers but large numbers can cause intestinal irritation, refusal to eat and diarrhea and cloacitis especially in young animals.

**Diagnosis** is by fresh faecal wet prep.

**Treatment** is Flagyl at 20mg/kg weekly for 3 weeks.

(Bellami, Terri; 2004)



Trichomonads viewed at 100x. These flagellate protozoans can be present in many reptiles. A drop of Lugol's iodine was added to the fecal matter before it was mixed.

(Photo: Klingenberg,R:1993)

## **CESTODES**

### **TAPEWORMS**

They have an indirect life cycle. Reptiles acquire tapeworms by ingesting an invertebrate or mammalian intermediate host. They can cause malnutrition by competing for nutrients with the host and can cause gut irritation and even obstruction if in large enough numbers.

Diagnosis is by seeing tapeworms or proglottids (egg sacks about the size of a rice grain) in faeces or by faecal flotation and identifying the eggs.

**Treatment:** Treatment is with Droncit (praziquantel) at 5mg/kg orally every 2 weeks for up to 2-3 treatments



Tapeworm egg as seen on fecal flotation at 400 xs  
(Photo,Klingenberg,R:1993)

## **TREMATODES**

### **FLUKES** (nose and mouth)

Flukes are very common in snakes that take to the water. They are acquired by the ingestion of an infected intermediate host, usually frogs, fish and snails.

Flukes found orally, within the respiratory system or on superficial tissue, rarely cause damage.

Renal flukes can cause a chronic interstitial nephritis or other kidney damage

### **Diagnosis**

Diagnosis is by observing adult flukes in the mouth, nose, cloaca and faeces. Ova can be found in faeces, but less common. Fluke eggs are large, yellow-brown eggs with a solid operculum at one end.

### **Treatment**

Treatment is with Droncit at 5-8 mg/kg. Adult flukes observed in the mouth can be rolled up with cotton buds and disposed of.

Transmission can be prevented by freezing food items such as frogs for at least 3 days prior to feeding.

(Klingenberg,R 1993)



Fluke egg as seen on fecal flotation at 100 xs.

(Photo: Klingenberg,R:1993)

## **Internal Parasites**

### **Determining their presence.**

Whenever possible, fecal samples should be obtained directly from the animal in question. If fresh stools cannot be obtained this way, an effort should be made to obtain as fresh a sample as possible. Sample containers should be as air- and water-tight as possible. **The lack of oxygen will inhibit the development of pre-parasitic stages.** Refrigeration will also prevent the rapid development of eggs into larvae at elevated temperatures. Dehydration of the sample is to be strictly avoided as the fragile parasitic stages (eggs, larvae, oocysts, etc) may be disrupted.

**Parasites such as protozoans, coccidial oocysts and certain worm larval forms will perish if exposed to drying or temperature extremes.**

### **A) DIRECT SMEARS**

A small amount of fecal material is applied to a microscope slide, mixed with a few drops of distilled water and a cover slip is applied. Stains like new methylene blue, and lugol's iodine may help to contrast difficult to visualize parasites, such as protozoans. This procedure may kill protozoans, but by staining the protozoan's and some parasite ova it will be easier to observe them.

Due to small sample size, smears are often unrewarding for diagnosing most parasites, but will be the method of choice for diagnosing protozoans.

### **B) GRAM STAINS**

The slide is set up the same as in a direct smear, but a gram stain is added to stain the bacteria, so you can tell whether or not the bacteria is gram positive (+VE), or gram negative (-VE)

A small amount of fecal matter is applied to a microscope slide, and then the slide is heated with hair dryer to set the fecal matter, then,

1) A couple of drops of gram stain violet are applied to the slide, left for 30 seconds, then softly rinsed under a tap.

2) A couple of drops of gram stain Iodine is applied to the slide, left for 30 seconds, then softly rinsed under a tap.

3) A couple of drops of Acetone are applied to the slide, left for ½ second, then softly rinsed under a tap.

4) A couple of drops of gram stain Safarin is applied to the slide, left for 30 seconds, then softly rinsed under a tap and allowed to dry.

The slide is then viewed under a microscope, and the bacteria will be stained.

Gram negative bacteria (-VE) will be stained PINK.

Gram positive bacteria (+VE) will be stained BLUE.

Once you have found whether the bacteria are either Gram positive or Gram negative, the appropriate antibiotic can be prescribed by the Vet.

(Phipps, Graeme, Richmond Tafe class notes)

### **C) FECAL FLOTATION**

The principle of differential flotation is based on the fact that the eggs of parasitic worms will float in certain solutions in which a mass of fecal debris will not. (See illustration on how to perform flotation). By allowing the eggs to float to the surface of the solution it concentrates them and allows identification. The addition of a few drops of Merthiolate (Frye) or Lugol's iodine to the flotation medium will allow for better observation of protozoan's and some ova. The lugol's iodine works best if mixed with the fecal matter before adding the flotation solution.

If fecal samples are found to be void of parasites, and yet a high index suspicion exists, then other methods can be used.

A) cloacal smears or flushes may produce richer materials for examination

B) Stomach flushes may also be examined

C) Sputum occasionally will reveal parasitic evidence, especially if respiratory symptoms are seen.

Cloacal flushes/smears and stomach flushes are usually performed and evaluated by a veterinarian or other trained person. (Klingenberg, R: 1993)

## **FECAL FLOTATION SOLUTIONS**

- 1. Sodium Nitrate.** This is the most common type used and can be purchased premade in litres at Veterinary Supply Stores. Fecasol® is a common name brand. (See appendix 8.8.2 for MSDS for Fecasol)
- 2. Zinc Sulfate.** This is probably the choice of flotation solutions, but it is harder to prepare. Zinc sulfate powder is added to water until a hydrometer reading of 1.20 is reached. To help identify protozoan's a few drops of lugol's iodine can be added to the fecal material and stirred in with it before the addition of the zinc sulfate. The lugol's iodine tends to stain the protozoans for easier identification.
- 3. Saturated Sugar Solution.** These solutions are easy to prepare by simply adding sugar to heated water until no more will dissolve. The liquid should be heated to near boiling, but need not actually boil. One recipe calls for 1lb. of granulated sugar is added to 12 fluid ounces of tap water and heated until the mixture is clear. This solution is not considered to be as good as the first two listed. Fungal/mould growth is a problem, but adding a few drops of phenol or house hold bleach helps control the fungal growth. Refrigeration of the solution between uses also slows fungal growth. The main advantage to this flotation solution is that it can be easily and inexpensively prepared at home. It is also sticky and attracts ants and insects.

## **EQUIPMENT REQUIRED**

Microscope, preferably with a movable stage (platform the slide with the sample sits on) allow for more precise movement of the slide while viewing. Most eyepieces in the microscope have a standard 10x magnification, but 10 xs and 40 xs are also needed. To obtain the final magnification, the eyepiece magnification is multiplied by the objective used. Thus, the 10x eyepiece looking through a 10x final objective results in a 100x magnification. Magnifications of 100 xs are a must, but 400 xs are desirable. Higher objectives (100 xs) are required to find the smallest of protozoan parasites.

Other equipment required consists of microscope slides and cover slips, fecal flotation solutions, and fecal flotation vials. Stains such as Mayers hematoxylin and Lugols iodine are desirable, but the merthiolate is an easily obtained, effective alternative.

(Klingenberg, R: 1993)

**(SEE APPENDIX 3 FOR FECAL FLOTATION TECHNIQUE)**

**(SEE APPENDIX 4 FOR IDENTIFICATION OF EGGS AND PARASITES)**

## **Necrotic enteritis.**

Necrotic enteritis associated with trichomonad organisms emerged as a major cause of mortality in the reptile collection at Taronga Zoo in 1979.

The disease was characterized by caseous pseudo membrane formation in the colon and rectum, often leading to frank necrosis of the gut wall with resultant peritonitis. Despite impressive pathology, clinical disease may not be noticed and the animal is just found dead. A wide variety of reptiles was affected.

Necrotic enteritis is a major cause of loss in many large reptile collections. *Entamoeba invadens* has been reported as the cause of this disease in a number of outbreaks.

*Pseudomonas aeruginosa* and *Trichomonas sp* have also been incriminated as causes of

this syndrome. During 1979 necrotic enteritis, consistently associated with great numbers of flagellate protozoans, emerged as the single major cause of loss in the reptile collection at Taronga Zoo, accounting for over 25% of deaths in non-neonate reptiles. (Reddacliff, G L, 1980)

### **SALMONELLA**

Salmonellosis is a zoonosis of worldwide economic importance in humans and animals. Infection of animals with various species of *salmonella* sometimes results in serious disease and always constitutes a vast reservoir for the disease in humans. The interplay of *salmonella* with its host takes a variety of forms including remarkable host specificity, unapparent infections, recovered carriers, enteritis, septicemia, abortion and combinations of disease syndromes. *Salmonella* are readily transferred from animal to animal, animal to humans, and human to human by direct or indirect pathways.

Salmonella is routinely isolated from apparently healthy reptiles; however it can also cause significant pathology in reptiles. Major concerns for vets working with reptiles is handling reptile associated salmonellosis (RAS).

A number of potential virulence factors have been identified to enable the organism to invade and infect a host, such as flagella, siderophores (iron scavenging chelators produced by bacteria when iron concentrations are low within a host), lipopolysaccharide (endotoxic properties- these stimulate inflammatory mediators and immunoregulatory cytokines, leading to vascular damage and thrombosis).

**Clinical signs:** these are variable, lethargy, anorexia, sudden death-bacteraemia, pneumonia, hepatitis, necrotizing enteritis. Reptiles that undergo bacteraemia may develop visceral lesions, hepatitis in snakes, nephritis, myocarditis.

Reptiles can suffer from diarrhea, dysentery, anorexia. Usually death is from septicemia, pneumonia, hypovolemic shock, intestinal granulomas (rare).

**Transmission:** usually faecal-oral route. Unhygienic handling of sick reptiles.

**Diagnosis:** Faecal culture from cloacal swab or faeces from culture and sensitivity.

**Treatment:** Appropriate antibiotics following culture and sensitivity> Supportive treatment eg. Fluids.

**Prevention:** Appropriate hygiene, Quarantine and faecal testing of all new arrivals to collection.

### **Keep the following points in mind when considering the problem.**

- A high proportion of reptiles are asymptomatic carriers of *Salmonella*. Salmonella is endemic in reptiles.
- Faecal carriage can be more than 90%.
- Attempted elimination of *Salmonella* in reptiles with antibiotics leads to increased resistance and rarely is permanently effective.
- Attempts to eliminate *Salmonella* in reptiles with antibiotics have been unsuccessful.
- A wide variety of serotypes from reptiles are rarely associated with other animals or sources.
- Reptiles can become infected through transovarial (through the egg) transmission.



- Reptiles are infected from before birth, obtaining infection as live newborn or shelled embryos passing through the cloaca of the mother; being captive bred, incubated and born is NO guarantee that any reptile is salmonella-free.

- They can become infected through contact with other reptiles.

(Stopford,F: 2004)

### **Who Should Avoid Contact With Reptiles**

The following categories of people should avoid all contact, direct or indirect, with any reptile as the risks of serious, symptomatic infection with *Salmonella* is greatly increased.

- Infants and children up to 5 years of age; some say up to age 8.
- Anyone with HIV/AIDS or other immunodeficiency disorders.
- Anyone who has had transplant surgery and is on anti-rejection therapy.
- Anyone who is on any drug which suppresses/alters immune function including: steroids, cancer chemotherapy, biological response modifiers and others.
- Anyone receiving radiation treatment.
- Women who are pregnant due to risk to the fetus.
- Elderly, frail or people with poor nutritional status.
- People subject to chronic infections.
- People receiving or who have recently received antibiotic treatment.

### **What to do to avoid becoming infected or becoming a carrier.**

- After handling any reptile be sure and wash hands with soap/hot water.
- Wash thoroughly for at least 30 seconds: an antibacterial soap is preferable.
- Keep reptiles out of kitchens and away from any surfaces where human food is stored, prepared or served.
- Do not permit unsupervised handling of reptiles by children under 12 years old.
- Do not handle any reptile or their caging materials with open cuts, lesions on ones hands unless such cuts are well covered with dressings; rubber gloves are recommended.
- When washing reptile enclosures/accessories avoid splashes to face.
- Disinfectant lotions pump sprays or similar products should be carried whenever reptiles are going to be handled in the field.

(Stopford. F. 2004)

## **Vitamin and Mineral Deficiencies in Reptiles**

### **Vitamin B1- Thiamin Deficiency**

Vitamin B1 is a water soluble vitamin. It is not appreciably stored in the body. All animals require Vitamin B1. It can be manufactured by many of the bacteria in the gut, especially in herbivores (and ingested when herbivores such as rats and mice are eaten). Excess Thiamin can be excreted by the kidneys.

Vitamin B1 functions in the cycle within the body to breakdown carbohydrate to form energy. If thiamin is not present energy is not released for normal functions and a build up of toxic metabolites (such as pyruvic and lactic acid) occurs. These metabolites cause polyneuritis or inflammation of nerve cells, causing ataxia\* and muscle twitching and even convulsions. Other signs of thiamin deficiency include slowing of the heart (bradycardia), enlargement of the heart, fluid buildup within the body tissues (oedema), anorexia and muscle weakness, fatigue and irritability and may also cause reproductive failure in adults and poor growth rates in juveniles. These signs are reversible if treated

early. The deficiency can occur in reptiles that have been off food for a long time. Hibernation reduces the body's requirement for vitamins so deficiency signs are not seen in hibernating reptiles but after they come out of hibernation, if they do not resume feeding vitamin B1 deficiency can occur.

### **Calcium/Vitamin D Deficiency**

This is the most common nutritional/ husbandry problem seen in reptiles. Calcium is required in all vertebrate animals (fish, amphibians, reptiles, birds and mammals) for bone formation and for nerve transmission. Young animals require more calcium than adults because of the rapid bone formation. Females producing young require more calcium for the formation of bones in the fetuses and because calcium is required for the oviduct contractions during birth of live young.

The calcium in the diet must be absorbed by the intestine. Vitamin D3 – cholecalciferol, is required for the absorption of calcium. Vitamin D3 is produced in reptile skin under the influence of UV radiation in sunlight. Vitamin D3 also is required for the calcium absorbed to be deposited in bone structure. Vitamin D also promotes the absorption of other minerals including iron, magnesium and zinc. Calcium is combined with phosphorus in the formation of bone in the ratio 1;2;1 so for strong bones phosphorus is also required but excess phosphorus in the diet can retard the absorption of calcium.

Clinically three situations occur to cause problems with bone formation:

- 1) There is not enough calcium in the diet especially in growing reptiles. Low calcium diets include young animals used as feed – pinkie mice, day old chicks and rat pups.
- 2) Vitamin D deficiency occurs due to lack of exposure to sunlight or ultraviolet (UV) radiation of the correct frequency. Rarely does this occur due to inadequate precursors of vitamin D. Ultraviolet rays can be blocked by glass, Perspex and water, though they do allow visible light through.

(Bellami,T: 2003)

**For Euthanasia, Lethobarb is the suggested drug. It is a euthanasia solution for small animals. (See appendix for MSDS on Lethobarb 8.8.1.4)**

## **8.9 Quarantine Requirements**

Complete medical records should be kept and be available for all animals during the quarantine period. Animals that die during the quarantine period should have a necropsy performed under the supervision of a veterinarian and representative tissues submitted for histopathological examination, with other laboratory analysis (i.e. cultures) applied as indicated. The results of all tests, both positive and negative, should be recorded. Thus a bank of baseline data will be developed.

Finally, the medical history and records of the human attendants, including the veterinarian, must be kept and the attendants must be regularly screened for infection

with transmissible diseases (e.g. tuberculosis, chicken pox, mumps, influenza, hepatitis A and B) and be up to date with rabies (lyssa virus) and tetanus toxoid.

(Woodford, M: 2000)

When you have acquired a new reptile it is suggested to Quarantine your reptile.

Quarantine for reptiles should last for **90 Days**. Quarantine facilities should be adequate for the thermal requirements of the species under quarantine and allow for thermo-regulatory behavior.

1. Faecal examination, direct and flotation, for protozoan (especially *Cryptosporidia sp* and *Amoeba sp.*) and metazoan parasites. Three or more consecutive tests should be negative.

2. Culture faeces for *Salmonella sp.*

**Note:** Since > 80% of reptiles can test positive for *Salmonella sp.* evidence of infection may not preclude release.

3. Carry out Blood count and PCV (packed cell volume)

4. Examine blood smears for haemoparasites.

5. Swab/nasal wash and examine for *Mycoplasma sp.* And *Mycobacteria. Sp.*

6. Serology for antibodies of *Mycoplasma sp.* and ophidian paramyxovirus for reptiles.

7. Check for tick infestation.

(Woodford, M: 2000)

- **Never Introduce new snakes to the rest of your collection:**

- Keep snakes in Quarantine in a separate room to other reptiles or snakes.

Place them in Quarantine for at least 90 days and monitor their health for any signs of disease.

Snakes with diseases such as IBD can take a long time to show any signs, so even if a new snake looks healthy, it may be carrying a disease.

- Whilst in Quarantine, reptile should be checked weekly for diseases, pathogens and protozoa, and once you have 2-3 consecutive negatives on the tests, the vet should clear the reptile for release from Quarantine.

(Dept of Environment and Conservation)

- **Quarantine your collection after an unexplained death:**

You don't want to expose any more animals to disease and death if an animal in your collection has already died from unknown causes. You should wait at least 6 months before introducing any new animals to the collection. Neither should you pass on or sell an animal from your collection to anyone else for at least 6 months after an unexplained death.

- Clean and handle the animals in quarantine last, each day, using the routine described in **5.1**.

- Use paper substrate for quarantined animals as this makes it easier to spot evidence of disease, parasites, abnormal faeces and the like.

- In large or commercial collections, particularly where snakes are kept in separate locations within the one site, a simple disinfecting footbath can be installed at the entry to the quarantine area.

- Put a mat in a plastic tray or container large enough to step into and keep the mat soaked in disinfectant. Footbaths, however, become easily contaminated with dirt and organic matter, making them ineffective. They may also not work well because the contact time with the disinfectant is too short to kill pathogens.
- Use separate equipment for each animal in quarantine.
- Thoroughly wash your hands with hot, soapy water after handling any animals in quarantine.
- During the quarantine period the snake should be examined by a vet for presence of parasites or diseases.
- Assume all new snakes are infested with snake mites and treat them immediately with a proprietary treatment or as advised by your vet, taking care not to spread the infestation to other snakes.
- Closely monitor any snake in quarantine for signs of disease or other problems and keep a written record. Follow the advice of your vet regarding treatments or tests for your snake while it is quarantined.

(Dept of Environment and Conservation)

## 9 Behaviour

Tiger snakes need to devote at least part of their time to thermoregulatory behavior, and the behavior that is required may vary considerably depending on three factors; the surrounding environmental conditions; the reflectance of the snake; and the temperature that is preferred by the snake.

All of these may change for several reasons. The main variation in the ambient thermal environment comes from seasonal changes. Particularly in southern Australia, there may be a huge difference in air temperatures over the course of the year. A tiger snake wants to keep its body temperature close to 30°C may have to bask for long periods in spring and autumn to get warm enough but must remain undercover and find the coolest possible habitats in midsummer to avoid becoming too warm. One way to keep within the same range of ambient temperatures year round, despite seasonal changes is to modify the time of day for activity. Island Tiger snakes are active in the middle of the day in cool weather but become crepuscular or nocturnal in very warm weather.

(Shine,R: 1991)

### 9.5 Activity

When ectotherms engage in strenuous activity, the oxygen in their muscles is rapidly depleted, and their circulatory system cannot supply any more for a long while. However, they don't simply stop. Instead, they use a different system to keep their muscles working, one that uses a different biochemical pathway. This *anaerobic metabolism* relies on chemical energy stored in the muscle cells, and breaks this down to lactic acid. Eventually, however, the lactic acid accumulates in the muscles and activity must be stopped. The ectotherm is then exhausted (often only after a few minutes), and will not be capable of vigorous activity again until it has a chance to process all the lactic acid and get its system back to equilibrium. This may take hours. Ectotherms are active only for relatively short periods, because otherwise they would build up lactic acid stores in their muscles. Their ecology and behavior are modified to avoid the need for prolonged periods of active exertion. For example, they often bask close to places of shelter. If surprised by a predator, they can simply slither for cover, rather than trying to outrun the predator in a long chase. The low metabolic requirements of ectothermy mean that a snake can go without food for weeks or months, and so can afford not to be out foraging every day.

A snake can change its body temperature in several different ways. The world a snake inhabits is a very complex one in terms of temperature. For example, it may be several degrees cooler under a log (especially if it is moist) than in a spot on open ground a few centimeters away. Places warmed by the sun can be much hotter than nearby places in the shade. Thus a snake can usually adjust its body temperature by selecting a slightly warmer or cooler place in its environment, often by moving only a few centimeters. The snake may not need to emerge from cover to do this; for example, a short move might place it in a position so that its back is touching the underside of a thin rock heated by the sun's rays. It could, of course, heat up even faster if it emerged from cover and basked in directly in the sunshine. Many factors will determine how quickly the snake heats up as it basks. The intensity of solar radiation, the amount of wind, the air temperature, the

ground temperature and the amount of the snake's surface area exposed to the sun, will all be important.

Tiger snakes tend to be 'shuttling' thermo regulators; they shuttle backwards and forwards between the sun and shade, heating up and cooling down many times during the day.

Preferred operating temperatures differ quite a lot. Certain species have special adaptations that allow them to heat up more rapidly. For example, dark colors absorb radiant heat more rapidly than light colors, and dark coloration has evolved in the black tiger snake, living in cold areas. The challenges involved in maintaining a relatively high and stable body temperature will obviously depend a great deal on the climate occupied by the tiger snake.

Tiger snakes need to devote at least part of their time to thermoregulatory behavior, and the behavior that is required may vary considerably depending on three factors; the surrounding environmental conditions; the reflectance of the snake; and the temperature that is preferred by the snake.

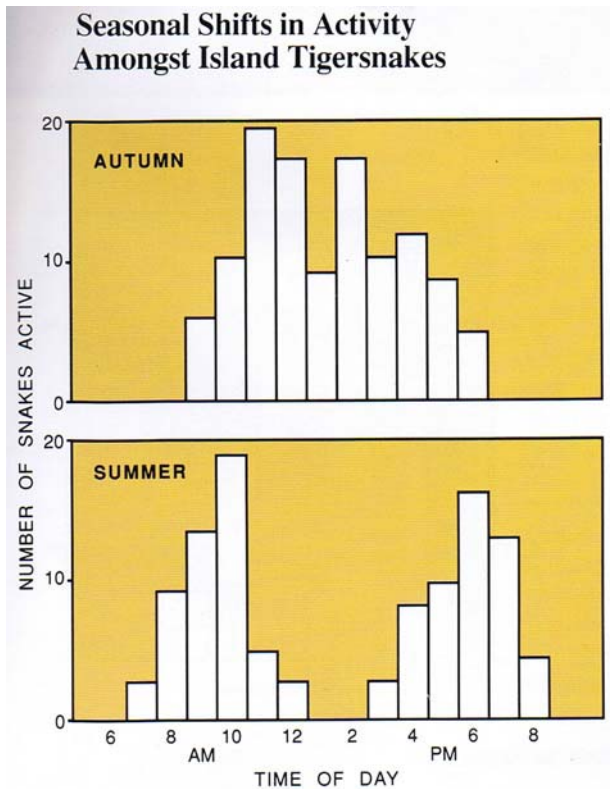
All of these may change for several reasons. The main variation in the ambient thermal environment comes from seasonal changes. Particularly in southern Australia, there may be a huge difference in air temperatures over the course of the year. A tiger snake wants to keep its body temperature close to 30°C may have to bask for long periods in spring and autumn to get warm enough but must remain undercover and find the coolest possible habitats in midsummer to avoid becoming too warm. One way to keep within the same range of ambient temperatures year round, despite seasonal changes is to modify the time of day for activity. Island Tiger snakes are active in the middle of the day in cool weather but become crepuscular or nocturnal in very warm weather.

(Shine,R: 1991)

Also the water in the creeks is icy cold despite the high air temperatures. This means the snakes can hunt tadpoles effectively only for a short time each day.

Every time they enter the water they rapidly lose their body heat. So basking in the sun to restore their temperature to a level necessary for hunting activity is crucial for them. Their black color allows this in the shortest time.

(Mertschin,P).



(Graph by Shine, R: 1991, ©, Reproduced with Permission)

Terry Schwaner found that tiger snakes on southern islands changed their daily activity patterns according to the season. The snakes are active during the middle of the day in autumn but not in the hotter weather of summer.

(Shine, R: 1991).

## 9.6 Social Behavior

It is common to find males and females together during the intervening winter.

(Shine,R: 1991)

## 9.7 Reproductive Behavior



(Shine,R: 1991, ©, Reproduced with Permission)

The smallest movements that have been recorded have been in pregnant tiger snakes. One animal stayed within a circular area with a radius of less than 3 metres for about two weeks. She did not feed during this time, but simply stayed under the same rock at night, emerging to bask every morning. After she gave birth, however, she immediately moved away and started hunting for food. Two other tiger snakes monitored at the same time, both males, had larger home ranges. Both snakes covered areas about 0.75 hectares in extent.

Mating was observed in autumn (April and May), although only on a limited scale. This activity peaked for a period of about 3 weeks in September. At this time, on days with a mean temperature of 16°C or higher, the males appeared to be in a highly agitated state. Some mating activity was observed as early as the middle of August, tapering off to almost nothing by the middle of October.

The location of females by males appears to be random, e.g. a male is continually on the move until it comes into contact with a female, when it immediately attempts copulation; or, if the female moves past it, the male becomes alert and pursues the female the same way as it hunts prey.

Prior to copulation the male moves along the female's body touching it with its snout. This movement may commence at any point along the intended mate's body, although no attempt at copulation takes place until the male's snout is positioned somewhere near the female's head. Then, at intervals of from 60 seconds to five minutes, the male's body commences spasmodic twitching; at the climax the tail is curved under the female and drawn forward in an attempt to align the sexual organs. The spasmodic movement by the male over the female appears to stimulate her in two ways;



- 1) To elevate the tail, sometimes almost to vertical; and
- 2) To dilate the cloaca aperture. This reaction was not observed in females that had previously been inseminated. Although attempts by males at copulation often appeared to be made in exposed parts of the enclosure, effective union was only observed to take place in partially protected areas i.e., beneath the overhanging slab of rock, and amongst the malee roots. The only way to determine whether copulation was occurring was to disturb the mating pair.  
(Bush,B; 1983)

## **9.8 Bathing**

Tiger Snakes are generally found near water, and are proficient swimmers, who actively forage in water for frogs and tadpoles, so it is not necessary to bathe them.

## **9.9 Behavioral Problems**

Tiger snakes settle into captivity very well, but have a habit of associating fingers with food, and can sometimes become snappy.

## **9.10 Signs of Stress**

One sign of stress in a tiger snake is to hiss very loudly. It sometimes sounds like a steam train. They puff themselves up and let out several loud hisses. They can also do this when disturbed.

## **9.11 Behavioral Enrichment**

### **Physical Characteristics of the Captive Environment.**

#### **Space:**

Enclosure size, the animals must not be restricted in movement, either basic locomotion or rapid movement. A too small enclosure affects the condition of reptiles. Different taxa and species will have different minimum space requirements.

- Refugia are important. Some species only do well when they can be in contact with substrate on at least two or more sides.
- Spatial familiarity, the least recognized aspect of space. An enclosure very quickly becomes familiar to the occupants. Moving placement of furniture, waterbowls, etc, causes more investigatory behavior (like tongue flicking).

#### **Temperature:**

- A fundamental feature of the captive environments for reptiles can be manipulated to improve welfare and increased activity.
- Variations and gradients of temperature in an enclosure are important to provide choice; impossible to provide if the space is too small.
- The use of stationary substrate heat source has been criticized as it does not promote normal movement because the continuous bottom heat will keep a location warm constantly, whereas in the wild the sun heat would move after a while.
- Multiple substrate heating sources on timers that are switched on and off on a regular basis provide more variation.

- Seasonal variation of temperature for hibernation can lead to an increase in breeding success
- Exhibits can be designed to use the seasonal changes in the angle of the sun.

### **Light:**

Another key variable that can interact with temperature in inducing selected behaviors. In outdoor enclosures captives experience light regimes relatively similar to the wild. For indoor enclosures captives are exposed to a light regime that may include some ambient light, often with selected wavelengths attenuated, as well as artificial light of selected wavelengths. Attempts for enrichment should focus on:-

- Daily and season variation.
- By having a photo sensor placed outside and connected to the lights of the enclosure, you can replicate the length of the light of day, to almost exactly the same time frame (for indoor enclosures) giving the reptile an exact duplicate of the day lengths, which is great for breeding, as day length is a trigger factor for breeding.
- Long range UV light.
- Taxon specific light quality and photoperiod needs.

### **Water:**

- A diversity of water sources.
- Water quality, water may need to be frequently changed because of aquatic feeding (any uneaten food will rot), aquatic defecation or urination and shedding of skin.
- The manner in which water is presented can be as important as the quality. Some species will lap water droplets from vegetation and will never take water from a large source so water must be misted or sprayed on surfaces or vegetation.
- Some species have life stages that live mostly or completely in water.
- Some species can detect prey only in water.
- Olfaction: the use of chemical clues has the potential to alter behavior in aquatic captives from foraging activities to social interactions through the use of selectively inoculated water sources.

### **Auditory:**

Aqueous environments carry sound more effectively than terrestrial environments. Opportunities may exist to manipulate the social environment of animals that hear underwater.

### **Prey organisms for captive herptofauna:**

- There is a lack of variety of live prey commercially available in captivity is an issue.
- Often fed on a regular rather than an opportunistic schedule. Scheduling of feeding can be modified to increase variability.
- Olfactory tracking of prey. Novel enrichment methods simulate addresses the prey stimulating stimuli, require knowledge of the sensory abilities of the species and can be as providing the prey itself.
- Use of alternative diets.
- Prey recognition - particularly important for reptiles being repatriated.

Determining the most desirable form of enrichment requires experimental examination of the frequency and sequence of presentation. Be aware of the hazards, living prey can pose risk to captive reptiles. They can be injured, maimed, or even killed by the prey species/organism. There are laws that govern what can be fed as live prey and it may be considered unacceptable to visitors.

### **Predator Experience for Captive Herptofauna.**

Captive environments lack predators. However total isolation of predator associated stimuli can be a cause of lethargy and also cause stress.

There are numerous ways to provide stimuli that stimulate the presence of a predator;

- Adding faeces or shed skin of a predator or rubbing the extract of predator's scent on parts of the enclosure.
- Placing the predator in adjacent enclosure to allow for visual and /or olfactory contact.
- Predator recognition and development an appropriate response is also particularly important for reptiles being released back into the wild.

### **Enrichment device list for reptiles.**

#### **Food;**

- Warm, fresh killed, or warmed pre-frozen rodents can be moved about to simulate live prey. Warming may aid in the digestion of prey.

#### **Sensory-olfactory food.**

- Scent trails. A scent trail created by rubbing a dead mouse or sausage along the ground, before hiding it under a log, or up a tree on a branch, so the reptile will follow the trail to the food.

#### **Physical;**

- Temperature gradient, temporal variation in temperature. Providing a temperature gradient provides choice. Additional spotlights on timers create different basking sites at different times of the day. Lights can be moved manually several times a day, the addition of a sun circle (from hydroponics shops) which slowly revolves in a circle, a drop of temperature at night.
- Substrate. Provide each reptile with a substrate as close as possible to its natural substrate. Substrates used include organic potting mix, crushed leaves, pine shavings, shredded paper, peat moss, trimmed grass, dried bamboo leaves. Substrate can be raked out to provide a different arrangement.
- Misting with water. Misting with water can increase humidity and provide water to drink. This can be achieved by an overhead misting system to recreate rain.
- Large water bowls. Large water bowl big enough for full submersion.
- UVB light. UVB lights on timers to simulate the moving sun. Exposure must be related to intensity animal would receive in natural habitat.
- Enclosure furnishings. Branches for snakes to climb on can be suspended from the ceiling so there is some movement. Thick rope can be used to link branches. Rocks can create vantage points for basking or to aid removal of skin. Clumps of grass with soil attached.
- Changing furniture. Furniture can be rearranged occasionally to stimulate the reptile. Change position of rocks, climbing branches (to change pathways), pieces

of bark, hollow logs, etc. Add fresh branches, or transfer from another enclosure to stimulate olfactory responses.

- Retreats. Tubes, cork bark, hollow logs, half logs, pvc piping, hide boxes, crevices under rocks and logs, hanging retreats or hide boxes.

#### **Social;**

- Separation and reintroductions. The separation for a short period of animals normally kept together and then reintroducing them can provide stimulus and can encourage breeding behavior. Social factors can play a big part in successful breeding. Special enclosures with removable solid partitions can be used. The partition is removed when the breeding season approaches to pair the animals.

#### **Sensory Olfactory;**

- Putting in sloughs from conspecifics, and other reptiles into the enclosure can cause an increase in activity, Skins can be sterilized by autoclave.
- Mammal hair in water. Fur from cats, micro waved to sterilize then put into water. Water then scattered into reptile exhibit. Other scents used- rabbit, ferret, and hoof stock. Response of cruising, alert posture, tracking scent, tongue flicking will be observed.

(Hawkins,M: Willemsen, M: 2004)

### **9.12 Introductions and Removals**

Introducing tiger snakes to each other is best done by placing the female into the males enclosure. This way the male is in his own territory. If you introduce the male into the females enclosure, he will be too busy following the new scents and smells, than paying the female any attention. By introducing her to his enclosure, he will want to know who is in his territory. The same with removals, remove the female first, then the male.

### **9.13 Intraspecific Compatibility**

Tiger snakes are not social creatures, although groups of gravid females have been recorded basking together.

(Mertschin,P)

Tiger snakes are also known to be cannibalistic; therefore it would be wise to have a male and female of around the same size housed together. It has been suggested that when neonates are born, to separate them as quickly as possible to avoid cannibalism.

### **9.14 Interspecific Compatibility**

As tiger snakes are known to be cannibalistic, I would not house them with any other species.

### **9.15 Suitability to Captivity**

Tiger snakes are ideal for keeping outdoors as they are very hardy, easy to get feeding, and become relatively docile quite rapidly under captive conditions. These attributes, along with their large size, long life spans and readiness to breed, make them suited to long term captivity in outdoor enclosures.

(Fearn,S)

This depends on the climate, and the license held.

## 10 Breeding



(Shine, R: 1991, ©, Reproduced with Permission)

Live bearing (viviparity) has evolved by means of gradual evolutionary increases in the period of time for which developing eggs are retained inside the mother's uterus.

Where natural selection continues to favor such increases over thousands of years, the end result has been a condition in which the female snake retains her embryos until development is complete. Instead of laying eggs, she gives birth to fully formed offspring.

Live bearing has evolved from egg-laying about a hundred times within snakes and lizards worldwide and many of these newly evolved live bearers have given rise to major evolutionary radiations of live bearing species.

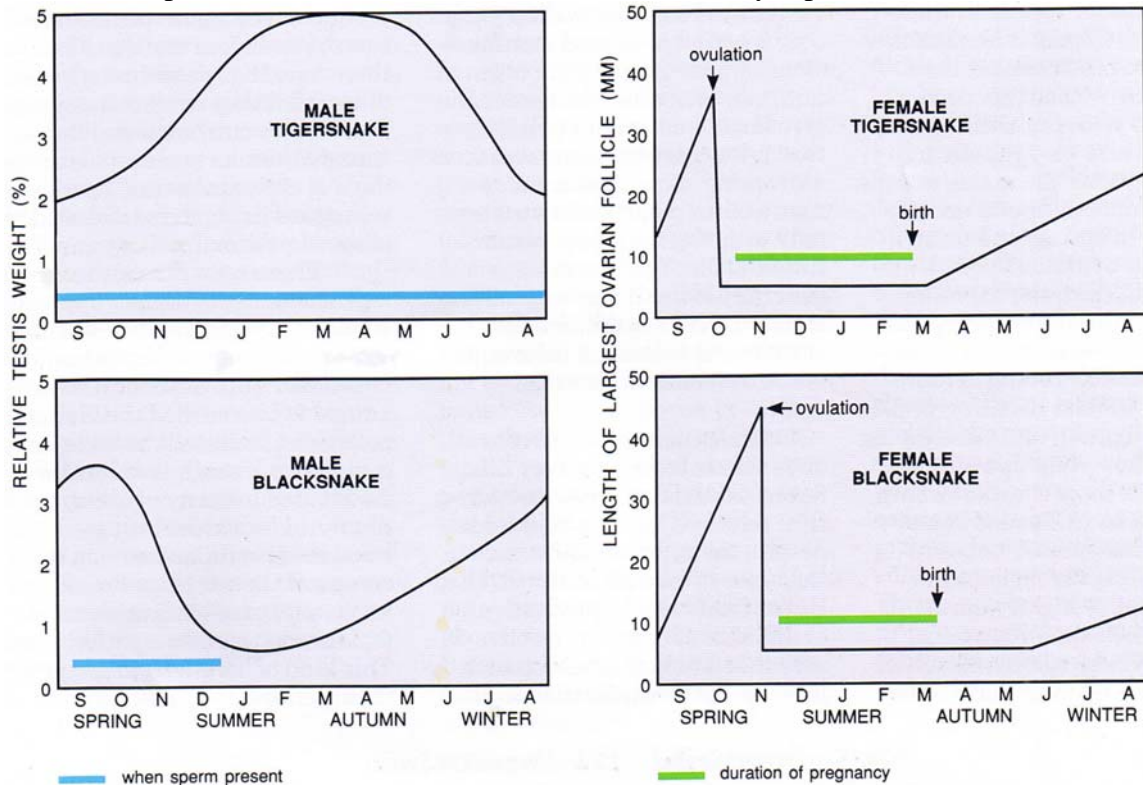
None the less, there are consistent patterns in the types of habitats they occupy. Live bearing species generally inhabit cooler climates than do closely related species of egg layers. Indeed, in very cold areas, the only species to be found are live bearers.

This suggests that cold climates have somehow stimulated the evolution of live bearing. It seems that the key factor is incubation temperature. In cold climates, eggs laid in the soil will develop very slowly (because of the low soil temperatures) and thus may not be able to hatch before the first lethal frosts of autumn.

In contrast, eggs retained inside the females uterus, will be kept much warmer, because the female will maintain higher body temperatures by basking in the sun. This acceleration of embryonic development may mean that the babies will be born much earlier, giving them time to feed and seek shelter before the advent of lower temperatures in autumn.

Climatic factors play a large role in determining the times of year that reproduction occurs in snakes. All of the behavioral and metabolic processes that lead up to actual production of the offspring (such as manufacturing eggs and sperm, courtship and mating) require snakes to be relatively warm.

Presumably for this reason, reproductive cycles in temperate-zone Australian snakes are, as far as we know, always centered around summer. Typically, females ovulate late in spring or early summer (October, December), gestation occupies approximately 14 weeks, with parturition in late summer or autumn (February-April).



(Table by R.Shine, 1991,©, Reproduced with Permission)

Tiger snakes and Blacksnakes live side by side on the New England tablelands of New South Wales. Both species are viviparous, and their female cycles are very similar. However, the male cycles are very different. Male blacksnakes produce sperm, fight other males, and mate with females, for only a brief period in springtime. Male tiger snakes continue these activities over most of the year.

(Shine,R: 1991)

*Notechis scutatus* showed relatively little seasonal variation in testes size.

Spermiogenesis occurred in midsummer (December), and the testes contained abundant spermatozoa from then until late Autumn (April). They did not contain spermatozoa in spring. Tiger snakes mate in both autumn and spring.

It has been shown that the oviducts of spring collected female tiger snakes often contained very abundant spermatozoa, which indicates recent mating, hence the females ability to store spermatozoa until ovulation in October/November.

(Shine,R: 1977)



Spring ovulation is presumably adaptive in ensuring that females will be gravid during a season when high and constant temperatures are easiest to attain. This speeds embryonic development, and may reduce the incidence of developmental abnormalities. It has been suggested that this adaption may ensure that the young are born at the season of greatest food abundance.

(Shine,R:1991)

#### *Notechis scutatus humphreysi.*

Mating activity reaches a peak in late Summer/Autumn in Tasmania with male snakes traveling large distances in search of reproductive females.

After mating, living sperm is retained by the female through winter torpor with ovulation and fertilization taking place the following spring. Embryonic development takes place through the course of the summer with females giving birth from late February to April. The whole cycle from mating to birth therefore takes a full 12 months. Heavily gravid females move around little and do not have many opportunities to forage and catch prey. Litter size varies with female body size. Small, recently mature females around 1 meter in length can give birth to as few as 10 neonates whereas very large females between 1.3 and 1.5 meters can give birth to as many as 64. This situation appears to reflect the simple fact that a large body cavity can hold more baby snakes than a small one.

(Fearn,S)

#### *Notechis scutatus serventyi*

Tiger snakes on the Bass Strait Islands tend to give birth to fewer, larger young. With juvenile mortality rates as high as 98% on islands such as Mt Chappell Island, it makes sense for females to invest in a smaller number of very large young to give them a head start. Juvenile Chappell Island snakes have to grow very rapidly on a diet of lizards to get to a size where they can swallow a hatchling mutton-bird chick, often heavier than themselves.

(Fearn,S)

### **10.5 Mating System**

Tiger Snakes are able to separate the time of mating from the time of fertilization of the eggs (which occurs at ovulation, when the ova are released from the ovaries into the uterus). This separation in time is possible because, sperm can survive for long periods in the female's reproductive tract. Indeed, females have special pockets in their oviducts, in which the sperm from a previous mating may be stored and maintained.

Sperm storage in the female's oviduct is an important feature of reproduction in many snakes, and allows mating to occur several months before ovulation and fertilization.

(Shine,R:1991)

### **10.6 Ease of Breeding**

Tiger snakes breed readily in captivity, although it must be remembered that the possibility of 15-30 neonates (sometimes more), homes should be sourced before mating is encouraged. When wishing to breed, simply separate the sexes throughout the year, provide plenty of food, until June, when they are cooled down for about three months. During this cooling down period, still allow 3-4 hours of heat during the day, via a



reflector globe. During early September, introduce the adults to each other over two week periods. Once a mating has been observed, separate them, and consider the female gravid. (Tristram,H)

In terms of compatibility, in large areas similarly sized tigers can coexist, but it is preferable to keep them singularly, due to their cannibalistic tendencies and rather violent courtship behaviors.

(Tristram,H)

## **10.7 Reproductive Condition**

### **10.7.1 Females**



(Photo by R.Shine 1991. ©, Reproduced with Permission)

The dissection of a mainland Tiger snake *Notechis scutatus* shows just how tightly packed a pregnant snake can be. The developing offspring look like beads along the oviduct. (Shine, R: 1991)

Courtship and copulation begin in autumn, soon after the females give birth, and continue right through winter (in warm weather) and spring.

(Shine,R: 1991) (Shine,R: 1977)

Female tiger snakes need to have a large fat storage on their body coming into breeding season, as they generally will not eat while gravid. They may take food for two to three weeks after mating, but then the egg follicles become enlarged, and the female will stop eating. The gestation period for tiger snakes is about 14 weeks; therefore the female will need to have a sustainable supply of body fat to live off, and to supply the developing ova for the gestation period. It is crucial that in the period leading up to breeding season, that the female be supplied with prey *ad libitum*, and the prey items should include Vitamin C tablets, as well as being dusted with reptile calcium powder.

Tasmanian tiger snakes.

In Tasmania's cool climate with activity and feeding limited to around 5 months of the year, coupled with the burden of gestating large litters of juveniles which place a great strain on their fat reserves, females reproduce at best, every second year. This means that in any given year only a percentage of females in any given population are reproductive.

(Fearn,S)

. When wishing to breed, simply separate the sexes throughout the year, provide plenty of food, until June,

(Tristram,H)

### **10.7.2 Males**

Tiger snakes testes remain fairly big throughout the year, enlarging slightly during summer when sperm are being produced. These sperm are stored in the male's efferent ducts of the testes (epididymes) throughout the rest of the year, and mating occurs over a period of several months.

(Shine,R: 1991)

. When wishing to breed, simply separate the sexes throughout the year, provide plenty of food, until June,

(Tristram,H)

Male tiger snakes grow considerably larger than females as a result of male combat for access to reproductive females, therefore, the male's reproductive condition, is not as crucial as the females.

## **10.8 Techniques Used to Control Breeding**

Techniques used to control breeding can be as simple as removing either the male or female tiger snake from the enclosure during breeding season.

Another technique can be the cycling of lights and temperatures. If you do not want to breed, remove the male or female tiger snake from the enclosure during breeding season.

Another technique can be the cycling of lights and temperatures. If you do not want your tiger snakes to breed, you could keep the lights and temperatures as though it was the middle of summer, knowing that tiger snakes breed in Autumn and in spring, not giving their body clocks the lowering of temperatures, and the shortening of the days, or the increase in temperatures and the lengthening of the daylight. The lowering of temperatures and shortening of the days, and the increase in temperatures and longer daylight hours, is a trigger for tiger snakes, letting them know breeding season is approaching.

Another way to control breeding is by vasectomy of the male. He can still go through the motions of breeding, but without the fertilization of the female. I would not consider using this technique, as the separation of the sexes would be the best way to control breeding. If you vasectomize the male, then one season you may want to breed with him, but you can't. Most vasectomies are reversible these days, but this is placing a lot of stress on the reptile subjecting him to needless operations.

When wishing to breed, simply separate the sexes throughout the year, provide plenty of food, until June, when they are cooled down for about three months. During this cooling down period, still allow 3-4 hours of heat during the day, via a reflector globe. During early September, introduce the adults to each other over two week periods, (Tristram,H) and when not wanting to breed, keep them separated all year round.

It is preferable to keep them singularly, due to their cannibalistic tendencies and rather violent courtship behaviors.

(Tristram,H)

### **10.9 Occurrence of Hybrids**

There is no known occurrence of tiger snake hybrids within captivity, or even in the wild.

### **10.10 Timing of Breeding**

Tiger snakes breed readily in captivity, although it must be remembered that the possibility of 15-30 neonates (sometimes more), homes should be sourced before mating is encouraged. When wishing to breed, simply separate the sexes throughout the year, provide plenty of food, until June, when they are cooled down for about three months. During this cooling down period, still allow 3-4 hours of heat during the day, via a reflector globe. During early September, introduce the adults to each other over two week periods. Once a mating has been observed, separate them, and consider the female gravid. (Tristram,H)

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

It has been reported (Shine, R: 1978) that tiger snakes are sexually mature at 24 months of age.

### **10.12 Ability to Breed Every Year**

All tiger snakes in captivity have the ability to reproduce every year. Fearn (1993) reports biannual reproduction in Tiger snakes from the Tasmanian region

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

There are no records or scientific papers that I could find on the ability of tiger snakes to breed more than once a year, but due to the tiger snakes being viviparous, and the gestation time of these reptiles, double clutching them would place significant strain upon the snake, to a point of death before, during or after the second clutch.

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

Once it has been determined that the female is gravid, it has been suggested that you remove the female from the enclosure (if the male is still in the enclosure) and place her into an off exhibit enclosure. Inside this enclosure you should provide a nest box. As tiger snakes are viviparous (live young) it is not necessary to provide any substrate or materials such as you would with oviparous (egg laying) elapids. The nest box should have at the bare minimum paper as substrate, sphagnum moss, or organic potting mixed with sand has also been suggested, and or leaf litter substrate, which will allow the tiger snake to hide.

### **10.15 Breeding Diet**

For the period of time leading up to mating season, both male and female tiger snakes should have a varied diet. Defrosted rats, mice, quail and chickens and ducklings can be used, varying this weekly. You should also include with these feeds vitamin C tablets. These can be placed into the mouth of the feed items. As well as vitamin C, you can also

dust the food items with reptile calcium powder. This should be done every time you feed the reptiles, not just necessarily during mating season.

### **10.16 Incubation Period**

As tiger snakes are viviparous, they are born live and precocial, and there is no need for incubation.

### **10.17 Clutch Size**

Shine (1991) in a summary of his work states that the number of offspring correlates with female body size.

Larger females produced larger clutch sizes.

(Shine,R:1977)

Between March 1983 (age 47 months) and June 1987, a female tiger snake *Notechis scutatus occidentalis* produced five litters (one per year) numbering in total 136 offspring plus 2 infertile oocytes in the final clutch. The combined mass of offspring was 950.6g. At death (August 1992 and 160 months old) this snake had a snout–vent length of 1040mm and weighed 584g.

Nineteen months earlier this snake was the same length but weighed 715g. The successful breeding of this snake each consecutive year is of particular interest.

The clutch size of the first litter was 20, 2<sup>nd</sup> was 32, 3<sup>rd</sup> was 31, 4<sup>th</sup> was 35, however the 5<sup>th</sup> litter regressed in both number (20) and size.

The size at birth of Western Australian *N scutatus occidentalis* are larger than some populations in Eastern Australia.

(Bush,B: 1994)

Infertile eggs in *Notechis scutatus* is common and the infertility rate in *Notechis* significantly higher than in other viviparous species. There is little evidence of reabsorption of these infertile oocytes, because they did not decrease significantly in live weight from the time of ovulation to parturition. These cases of infertility may have been due to mechanical difficulties preventing spermatozoa reaching the eggs, to insufficient spermatozoa in the oviducts, or to some inadequacy of the oocytes. The high rate of infertility comprises an enormous cost to reproducing *N. scutatus* females, and is a very puzzling phenomenon.

(Shine,R:1977)

### **10.18 Age at Weaning**

Once born, tiger snakes are precocial and are on their own. They have enough stores from the developing ova to last them a couple of days, and once they shed their first slough, they need to eat.

### **10.19 Age of Removal from Parents**

Due to the cannibalistic nature of tiger snakes, it has been suggested that neonates be removed immediately from their mother and placed into individual containers, pet packs, or enclosures and kept separately. They have been known to eat each other when they are all housed together. (Burns. Neville. Pers comm.)

### **10.20 Growth and Development**

#### *Notechis scutatus*

Larger species have larger young, but the ratio of offspring size to adult size is lower in the larger species. Growth is rapid, body length more than doubles in the first year of life. Females first mate at 24 months. Males generally reach maturity at slightly younger ages than females.

In *Notechis scutatus*, both sexes mature at 24 months of age. (Shine,R:1978)

#### *Notechis ater serventyi*

Shine (1978) plotted monthly body lengths and estimated age classes and growth rates of mainland tiger snakes *Notechis scutatus* from NSW. Both sexes matured in about 24 months at body (snout to vent) lengths of 650mm

(Shine, R: 1978):

Total length would be about 760mm. Growth in length after 14 months was approximately 550mm SVL (640mm total length) and the relative rate of increase (adult length/length at birth) was 2.9.

Similar values for the captive brood from MT Chappell Island were 1140mmSVL (1366mm total length) and 4.7 respectively.

Thus the Chappell Island brood, when fed *ad libitum*, grew at almost twice the rate of mainland tiger snakes under natural conditions. Furthermore, one pair of the Chappell island tiger snakes (male and female) exhibited courtship and mating behavior during the 11<sup>th</sup> month of the study at body sizes of 1116mm SVL (1337mm total length) and 1077mm SVL (1290mm total length), respectively.

Apparently (under laboratory conditions) maturity is reached in Chappell Island tiger snakes at total lengths almost twice that of mainland tiger snakes.

#### *Notechis ater niger*

An extensive mark/release/capture programme for black tiger snakes on West Franklin Island was begun in 1982. The overall average monthly increases in body lengths (SVL) are only 5.5mm for male's and 3.3mm for females. The smallest body size for a snake observed in courtship and mating on the Franklin Islands was a female 1002mm SVL. Given that this size represents adulthood, the mark recapture data suggests that sexual maturity in females could be achieved in about 20 years (about 12 years in males) on the Franklin Islands.

Several intrinsic factors obviously affect growth in the natural environment. Primarily among these is 1) the availability of food, 2) the effects of temperature, and 3) interspecific and intraspecific competition and/or predation.

Prey types vary remarkably among tiger snake populations, particularly on Islands. Diets are composed almost entirely on frogs in most mainland areas, whilst island populations (except for Kangaroo I. and Tasmania) are devoid of frogs.

Tiger snakes on many islands eat small mammals, birds, and or lizards. Little is known of the effects of differing quantity and quality of prey among natural populations of tiger snakes. However, a high correlation between maximal body size and mean weight of available prey exists for several offshore island populations of tiger snakes in South Australia.

Seasonal variations in temperature apparently affect the feeding habits of tiger snakes on the Franklin Islands. Adults (>1000mm SVL) do not feed during winter months apparently because they are unable to digest large prey and do not eat small prey. Under laboratory conditions, these snakes regurgitated large prey at body temperatures lower than those measured when prey was ingested.

Survival of Island tiger snakes during winter may depend heavily on their ability to store body fat. On the Franklin islands (and on Chappell Island) adult tiger snakes feed primarily on mutton birds, a highly seasonal prey. Adult female tiger snakes are gravid during this season, and it has been indicated that gravid female tiger snakes do not feed. (Schwaner, T.D; Barnett, B; 1985)

*Notechis ater humphreysi / serventyi*

Growth is very rapid in juvenile snakes and Tasmanian specimens in the wild mature at around a meter in length at two years of age. Apart from research on Mt Chappell Island, rates of growth in wild tiger snakes after sexual maturity is attained is largely unknown for specimens from the Tasmanian region, however, this situation will change in the future as data from a current mark/recapture study in northern Tasmania is analyzed. Simon Fearn has raised large numbers of these snakes from birth and growth rates can be very impressive. If you can't get these snakes to 1.8m and between 2-4kg (depending on which population you are dealing with) in 3 years, then you are simply not trying (Fearn, S)

## **Artificial Rearing**

### **10.21 Diet and Feeding Routine**

As with all neonate snakes, they will only feed after their first slough. Due to the size of tiger snake neonates at birth, it may be necessary to feed them their first dozen feeds on mouse tails until they have gotten a little bigger. Once they have completed their 3-4<sup>th</sup> slough, you can start to feed them on day old pink mice.

I personally offer my neonate tiger snakes the above food every 4<sup>th</sup> day, which they will generally take. I would suggest dusting the food with Reptical and Reptivite powder at least once a week. Neonate tiger snakes can be very hard to get feeding, especially their first feeds.

You may have to try things as scenting the mouse tail with a skink, or a frog. This involves rubbing the food item on a frog or skink, then offering the snake the food item. You can also assist feed them by placing the food item in the neonates mouth, and allowing them to eat it. Care should be taken when doing this, as the snake is highly venomous, and you need to physically opening the snakes mouth to place the food item in. You may also have to force feed the snake; this is done in the same way, but pushed further down the snakes throat. You should lubricate the item before force feeding, with egg being the preference. Force feeding the snake places significant stress on the animal, and should be avoided. A pinkie pump is another option. This is like a large syringe. Pinkies are placed in the pump, then the tube placed down the snake's throat, and the plunger depressed, and the pinkies are turned into a soup and forced into the snake's stomach.

### **10.22 Specific Requirements**

Tiger snakes require specific temperature requirements. I personally use Chinese containers and or pet packs as enclosures for the first 2-3 months, then they go into bigger pet packs.

I place 1/3 of the Chinese container onto a heat mat, which has a surface temperature of 36.5°C. This allows them a thermal gradient. I use a small water bowl inside the container, as well as paper towel as substrate. When they are blue (preslough) I mist them daily, as well as putting the water bowl over the heat mat to humidify the container, which will help them when they slough. I also use calcium powder and herptivite vitamin powder sprinkled on their prey. They are also under a black light globe to give them UVA and UVB. Their lighting cycle is timed and it is exactly the same as outside. When the sun comes up, the lights come on, sun goes down, and lights go off.



A) Authors neonate in pet pack on heat mat.  
(Photo by John Mostyn)

### **10.23 Data Recording**

Routine data collection is a must for captive reptiles.

- Monitor the health of your snake by keeping a written health record of each snake in a notebook or diary kept specifically for the purpose.

Record significant details and dates such as:

- Date of birth, arrival and where snake came from, including feed, shedding, weight, vaccinations, worming records from previous owner.
- Date and weight each time snake is weighed; including the snout/vent length
- Date and time and what snake ate, or didn't eat.
- Date eyes went milky, indicating that it will shed soon.
- Date of sloughing.
- Date and nature of any treatments, e.g., treatment for snake mites or signs of sickness.
- Any visits to a veterinarian and resultant treatments.
- Any details what so ever, no matter how insignificant the details may seem.

When neonates are born, you should immediately weigh and measure them, recording the information on their individual record or observation sheet. Then they should be weighed every month for the first year, then every 2-3 months after that.

### **10.24 Identification Methods**

Identification methods can range from

For health, monitoring and breeding it is important to individually identify each snake. We can give each snake a number, code or name and identify them by

- Cage cards, with photograph, description, microchip number, and a warning that this species is highly venomous.
- Photo or description – illustrating distinguishing features, such as, individual markings, color patterns, old wounds or scars.
- Microchip – inserted sub-cutaneously, need scanner to read microchip number, access to database for registration numbers.



- Scale clipping.
- Scale counts, see section 3.1 and 3.1.1.
- Individual containers with their feed card, observation sheet and photograph or description of markings which differ from other neonates.

### **10.25 Hygiene**

Hygiene of your enclosure is very important. Change the substrate as soon as it is dirty. F10 enclosure, allowing to stand for minimum of two minutes before washing out. F10 all furniture as well as water bowls. Personal Hygiene is also important in terms of catching zoonosis. Always wash hands before and after handling snakes.

### **10.26 Behavioural Considerations**

Tiger snakes have attitude. They are the 4<sup>th</sup> most venomous snake in the world, and their venom can do serious damage to you, if not death, and they have an attitude like they know they are deadly. They can settle into captivity really well, to a point where I have seen captive tigers that can be freehanded, but I would not recommend doing this. They seem to associate food with fingers, and can become quite snappy, especially when in a feeding frenzy. (Tristham, H). Use of feeding tongs is recommended as well as a separate container to feed them in, unless on exhibit, where at Sydney Wildlife World, we use grab sticks to feed the tiger snakes.

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N.S.W Reptile Keepers License Species List (2002)  
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## **Glossary**

**Holotype** – A single specimen designated as the name –bearing type of a species or Subspecies when it was established, or the single specimen on which Such a taxon was based when no type was specified.

**Melanism** – Melanism is an increased amount of black or nearly black pigmentation of An individual or kind of organism. More technically it refers to a phenotype In which pigmentation of an organism is entirely, or nearly entirely, Expressed.

# Appendix

## Appendix 1

### 1 Introduction

Pooled samples of freeze dried venoms of *Notechis scutatus* are less toxic than *N.a.ater*, *N.s.occidentalis* and *N.a.niger*. Its venom is 4.3 times more toxic than the Indian Cobra *Naja naja*. The venom contains neurotoxins, coagulants and myotoxins.

The venom of *Notechis ater* is the most toxic of all the tiger snakes.

The venom of the Reevesby Island tiger snake (*N. a. niger*) is more toxic than *N. scutatus* venom. The freeze dried venoms of all *N. ater niger* populations is white in color, except for the Kangaroo Island population, which is a cream color, similar to that of *N. scutatus*.

The venom of the Reevesby Island tiger snake is about 5 times more toxic than that of the Indian cobra *Naja naja*.

The venom from King Island tiger snakes (*N. a. humphreysi*) is slightly more toxic than most mainland *N. scutatus*, but samples tested from Tasmanian and New Year Island tiger snakes is less toxic. This venom is neurotoxic and has a coagulation action.

The venom of the Chappell Island tiger snake (*N.a.serventyi*) is the least toxic of all the tiger snakes. Its neurotoxicity is different to other tiger snakes and its toxicity is about 1.8 times more toxic than the Indian Cobra *Naja naja*. The venom is neurotoxic but lacks the same lethal neurotoxin as other *Notechis* snakes. It also has a coagulant.

The venom of the Western Tiger snake (*N.s.occidentalis*) is about 4 times more toxic than the Indian Cobra *Naja naja* and is the second most toxic of all the tiger snake venoms.

The venom is probably similar in action to *N.scutatus* but definitely has neurotoxins and coagulants.

(Mirtschin,P; Davis,R)

## 8.8.2Fecasol

### MATERIAL SAFETY DATA SHEET

**FECASOL: A FECAL FLOTATION SOLUTION (30521-01848 OR 01849)**

**EVSCO PHARMACEUTICALS (800) 267-5707**

**DIVISION OF VÉTOQUINOL USA, INC.**

**101 LINCOLN AVE.**

**BUENA, N.J. 08310-0687**

**Date Prepared: 17 January 2003**

#### **Section I - Hazardous Ingredients/ Identity Information**

Hazardous Components	OSHA PEL	ACGIH TLV
<b>Sodium Nitrate (CAS 07631-99-4)</b>		
There is 1.58kg of sodium nitrate in each gallon of purified water.		

#### **Section II- Physical/Chemical Characteristics**

<b>Boiling Point</b>	N/A	<b>Specific Gravity H<sub>2</sub>O = 1</b>	1.2 @ 25 C
<b>Vapor Pressure</b>	N/A	<b>Melting Point</b>	N/A
<b>Vapor Density (air=1)</b>	N/A	<b>Evaporation Rate</b>	N/A
<b>Solubility in Water</b>	Soluble		
<b>Appearance and Odor:</b> Clear, colorless liquid			

#### **Section III- Fire and Explosion Hazard Data**

Flash Point	Flammable Limits	LEL	UEL
<b>Extinguishing Media:</b> Use extinguishing media appropriate for surrounding fire conditions.			
<b>Special Fire Fighting Procedures:</b> Wear self-contained breathing apparatus.			
<b>Unusual Fire &amp; Explosion Hazards:</b> ***** Sodium nitrate powder is a strong oxidizer, however remaining in solution, it is considered non-regulated for DOT purposes. *****			

#### **Section IV - Reactivity Data**

<b>Stability</b>	<b>Unstable</b>	<b>Conditions to Avoid:</b> High temperatures	
	<b>Stable</b>	<b>X</b>	
<b>Incompatibility (materials to avoid):</b> Cyanides, strong reducing agents and acids			
<b>Hazardous Decomposition or Byproducts</b>			

<b>Hazardous Polymerization</b>	<b>May Occur</b>	<b>Conditions to Avoid</b>	
	<b>Will Not Occur</b>		<b>X</b>

## **TERIAL SAFETY DATA SHEET**

**Product: FECASOL FECAL FLOTATION SOLUTION (03521-01848 OR 01849)**

**Date Prepared: 17 January 2003**

### **Section V - Health Hazard Data**

<b>Routes of Entry:</b>	<b>Inhalation</b>	<b>Skin X</b>	<b>Oral X</b>
<b>Health Hazards (Acute &amp; Chronic)</b> May cause eye irritation. Ingestion may cause irritation to mouth and stomach. Ingestion of large amounts may cause dizziness, abdominal cramps, vomiting and headaches.			
<b>Carcinogenicity:</b> Some experimental data on animals indicate that sodium nitrate may be carcinogenic.	<b>NTP?</b>	<b>ARC</b>	<b>OSHA</b>
<b>Signs and Symptoms of Exposure:</b> As above.			
<b>Medical Conditions Generally Aggravated by Exposure:</b>			
<b>Emergency &amp; First Aid Procedures: EYES:</b> Flush with plenty of water and contact a physician. In case of ingestion immediately induce vomiting if conscious and consult a physician.			

### **Section VI - Precautions for Safe Handling & Use**

<b>Steps to Be Taken In Case of Spill or Release:</b> Wear complete protective equipment including NIOSH approved respiratory protection. Absorb on sand or vermiculite and place in a closed container for disposal.
<b>Waste Disposal Method:</b> Dispose IAW federal, state and local regulations.
<b>Precautions To Be Taken in Handling &amp; Storage:</b> Keep container tightly closed and away from incompatible materials.
<b>Other Precautions:</b> Read and follow label instructions and instructions accompanying fecal analysis device before use.

### **Section VII - Control Measures:**

<b>Respiratory Protection (Specify Type)</b> Not required for normal use.		
<b>Ventilation</b>	<b>Local Exhaust</b> adequate	<b>Special</b> adequate
	<b>Mechanical(General)</b> adequate	<b>Other</b> N/A
<b>Protective Gloves</b> Preferred		<b>Eye Protection</b> Not required for normal use.
<b>Other Protective Clothing or Equipment</b> Not required for normal use.		
<b>Work/Hygienic Practices</b> Not required for normal use.		

The information contained in this Material Safety Data Sheet (MSDS) has been compiled from information believed to be accurate and from our own experiences. While we believe that the data presented is factual, Vétoquinol USA, Inc. and its divisions make no warranty or representation, nor assume any responsibility in conjunction with the use of this information.

(AccessButler 2007)

PAGE 2

### **8.6.1.1 Isoflurane**

#### **MATERIAL SAFETY DATA SHEET**

IDENTITY: ISOFLURANE (1-CHLORO-2,2,2-TRIFLUOROETHYL  
DIFLUOROMETHYL ETHER)

SECTION I: MANUFACTURER

HALOCARBON LABORATORIES Emergency Number: (803) 278-3504  
(Div. of Halocarbon Products Corp.)  
P.O. Box 661 Customer Service & Sales: (201) 262-8899  
River Edge, N.J. 07661  
Prepared by: Dr. Neville P. Pavri

SECTION II: CHEMICAL IDENTITY

CAS OSHA ACGIH Other  
Components No. PEL TLV Internal Guide  
1-Chloro-2,2,2-Trifluoroethyl 50 ppm  
Difluoromethyl Ether 26675-46-7 None None (8 hour TWA)

OSHA HAZARD RATING:

This product contains the following toxic chemical(s) subject to Section  
313 Title III reporting requirements (40 CFR Part 372).

None

SECTION III - PHYSICAL/CHEMICAL CHARACTERISTICS

Boiling Point : 48.5 C Vapor Pressure: 330mmHg @ 20 C  
Melting Point : Not known Vapor Density(Air=1): >1  
Specific Gravity(H2O=1): 1.50 Solubility in Water : Negligible  
Appearance and Odor: Clear, colorless liquid with slight pungent odor

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

Flash Point/Method: None Autoignition Temp: Not determined  
Flammability Limits in Air - LEL: N/A UEL: N/A  
Extinguishing Media: Non-flammable. Use methods appropriate for  
surroundings.  
Special Fire Fighting Procedures: Wear self-contained breathing

apparatus if there is danger of leakage.

Unusual Fire and Explosion Hazards: Emits toxic and corrosive fumes under fire  
conditions.

SECTION V - REACTIVITY DATA

Unstable [ ] Conditions to Avoid: N/A  
Stable [X]

Incompatibility (Materials to Avoid): Reactive metals such as sodium, potassium, or finely divided zinc, aluminum or magnesium, especially at high temperature.  
Hazardous Decomposition or By-products: Halogen acids and carbonyl halides formed by thermal or oxidative decomposition.  
Hazardous Polymerization [ ] May Occur [X] Will Not Occur  
Conditions To Avoid: N/A

=====SECTION VI - HEALTH HAZARD DATA

RTECS Number KN6799000

Rat: oral LD50 4770 mg/kg (KSRNAM 21,3031,87)

Rat: inhalation LC50 15,300 ppm/3 hours

Rat: intraperitoneal LD50 4280 mg/kg

Mouse: oral LD50 5080 mg/kg

Mouse: inhalation LC50 16,800 ppm/3 hours

Mouse: intraperitoneal LD50 3030 mg/kg

Reproductive effects (RTECS)

Inhalation of isoflurane at a concentration of 0.5-3.0% can induce general anesthesia in 7 to 10 minutes, with analgesia, muscle relaxation, and loss of consciousness. Isoflurane is mildly pungent and may cause coughing, laryngospasm and breath holding in an unconscious individual; secretions may be slightly stimulated and pharyngeal and laryngeal reflexes may be obtunded. Isoflurane is a severe respiratory depressant, causing a decreased tidal volume that may produce hypercapnia. Blood pressure is depressed with an initial decrease in systemic vascular resistance, heart rate and cardiac output, although rate and output may increase due to compensatory mechanisms. Arrhythmias can occur, and the myocardium may be slightly sensitized to epinephrine. Renal blood flow, glomerular filtration and urine flow are decreased without residual renal depression or renal injury following isoflurane anesthesia. Isoflurane does not appear to produce liver injury when given for prolonged periods. Inhalation of higher concentrations may lead to death by medullary paralysis. Those recovering from exposure may exhibit shivering, nausea, vomiting, ileus, or excitation,

and there may be a transient white blood count increase. A slight decrease in intellectual function may persist for 2-3 days, with small mood changes or symptoms possible for 6 days. Induction of general anesthesia may cause malignant hyperthermia from hypermetabolism of skeletal muscles in susceptible individuals.

Target organs are respiratory, cardiovascular and central nervous system.

Primary routes of entry: [X] Inhalation [X] Skin [ ] Eyes [ ] Oral

Acute Effects of Overexposure: Anesthesia, respiratory depression, coughing

Chronic Effects of Overexposure: No present evidence demonstrates that isoflurane is a mutagen, teratogen or carcinogen.

In a study by Corbett, male Swiss ICR mice (but not females) exposed to isoflurane were found to have a higher incidence of liver tumors than control mice. The study was found to be flawed. When the flaws were corrected the results were negative.

May cause sterility or other reproductive effects.

Carcinogenicity listing: [NO] NTP [NO ] IARC [NO ] OSHA

[NO] Other:

IARC Cancer Review: Group-3, Human Inadequate Evidence, Animal Inadequate Evidence.

Exposure Limits/Toxicity: See also Section II

NIOSH: 2ppm/1 hr. ceiling limit is the recommended exposure limit to waste anesthetic gas

Internal: 50 ppm TWA (same TWA recommended by the ACGIH for Halothane, a similar inhalation anesthetic)

First Aid

Inhalation: Remove to fresh air. If necessary give artificial respiration and seek medical help.

Skin: Wash immediately with soap and water.

Eye: Flush eyes out for at least 15 minutes with water. Seek medical help.

Oral: Induce vomiting if conscious. Seek medical help.

Medical Conditions Generally Aggravated by Exposure: Myocardial sensitization to epinephrine.

Other Health Hazards: None known

=====  
=====

## SECTION VII - PROTECTION INFORMATION

Respiratory: Self-contained breathing apparatus for emergency use

Ventilation: Adequate general and local ventilation

Eye and Face: Safety glasses or goggles and/or face shield

Gloves: Impervious gloves

Other equipment: Provide safety shower and eye wash facilities

=====  
=====

## SECTION VIII - SPILL, LEAK AND DISPOSAL PROCEDURES



Spill, Leak, or Release: Allow small spills to dissipate with good ventilation. For large spills wear self-contained breathing apparatus and absorb on vermiculite and place in closed container.

Waste Disposal: This material may be incinerated by licensed waste disposal company. Observe all federal, state & local regulations.

=====

=====SECTION IX - OTHER INFORMATION

1. Hazardous Materials/Dangerous Goods Shipping Regulations

Anesthetics are classified as Dangerous Goods/Hazardous Materials when shipped by air. U.S. and international shipping regulations require that any person(s) shipping Dangerous Goods be properly trained and certified. Shipping Dangerous Goods without meeting these requirements is a violation of U.S. law and the shipper could be subject to fines and/or imprisonment. Anesthetics cannot be shipped by U.S. Mail. U.S.

(49 CFR): N/A (Regulated by Air Only)

IATA: Proper Shipping Name: Aviation Regulated Liquid, N.O.S.

(1-Chloro-2,2,2-Trifluoroethyl Difluoromethyl Ether)

Hazard Class: 9; ID No.: UN 3334

Packaging Group: NA

IMDG: N/A (Regulated by Air Only)

2. Other Information: HMIS Labeling: H1; F 0; R0, PB

=====

===== REVISED: JULY 7, 2003

(AccessButler 2007)

**8.8.1 Ivomec**

----- MATERIAL SAFETY DATA SHEET -----  
ECOMECTIN CATTLE POUR-ON  
IVERMECTIN 5 MG/ML

-----  
-----  
MANUFACTURED FOR ACCESS ANIMAL HEALTH, INC  
-----  
-----

SECTION I - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION  
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IDENTITY:

ANADA 200-348

TRUE NAME: IVERMECTIN

TRADE NAME: ECOMECTIN CATTLE POUR-ON

PRODUCT NUMBER(S): 30234, 30225, 30205, 30231

ANADA SPONSOR: ECO LLC LAS VEGAS, NV 89131

MARKETED BY: ACCESS ANIMAL HEALTH ARGYLE, NY 12809

1-866-483-7632

EMERGENCY TELEPHONE NUMBER FOR SPILLS AND ACCIDENTAL

RELEASE: CHEMTREC 1-800-424-9300

DATE PREPARED: 16 SEPTEMBER 2002

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SECTION II - COMPOSITION, INFORMATION ON INGREDIENTS  
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COMPOSITION:

Hazardous Components

(Specific Chemical Identity;

Common Name(s)), CAS Number OSHA PEL ACGIH TLV %

-----  
Ivermectin Mixture 70288-88-7 Not Est. Not Est. 0.5 w/v  
(Comp. B1a and B1b)

Other Limits Recommended: ECL: 0.08 mg/M3

Isopropyl Alcohol 67-63-0 400 ppm 400 ppm 80.0 v/v

Other Limits Recommended: Not Established

Inert Ingredients 16.0 w/v

Other Limits Recommended: Not Established

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### SECTION III - HAZARDS IDENTIFICATION

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APPEARANCE AND ODOR: Clean, clear, blue liquid.

OSHA/DOT HAZARD CLASSIFICATION(S):

PRODUCT 30234: Drugs or medicines, NOI, Consumer  
Commodity, Class 70 NMFC 6000RVNX

PRODUCTS 30225, 30205 & 30231: Isopropanol Solution, Class 3,  
UN1219, PG II, Drugs or medicines, NOI, Class 70 RVNX

POTENTIAL HEALTH HAZARDS: Pure Ivermectin in Rats

INHALATION:

INHALATION LD50: >5.11 mg/L

INGESTION:

ORAL LD50: 50 mg/kg

SKIN:

DERMAL LD50: >660 mg/kg

Page 1 of 5

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### SECTION IV – FIRST AID MEASURES

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SIGNS AND SYMPTOMS OF EXPOSURE:

Symptoms may include decreased activity, slow rate of breathing, dilation of pupils, muscle tremors, and incoordination.

MEDICAL CONDITIONS GENERALLY AGGRAVATED BY EXPOSURE:

None Known

EMERGENCY AND FIRST AID PROCEDURES:

EYE: Immediately flush with water for at least 5 minutes. Get medical attention if irritation persists.

SKIN: Flush with water and wash contact area with soap and water after handling. Remove contaminated clothing and wash before reuse.

INHALATION: Remove to fresh air. Get medical attention if symptoms persist.

INGESTION: Get immediate medical attention if significant quantity is ingested. Do NOT induce vomiting.

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### SECTION V – FIRE FIGHTING MEASURES

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FLASH POINT (deg C/deg F) (Method Used): 14 deg C/58 deg F

Penske closed cup  
FLAMMABLE LIMITS:

LEL: 2.5 (IPA)

UEL: Not Available

EXTINGUISHING MEDIA:

Carbon dioxide, dry chemical, alcohol resistant foam. Use water spray to cool fire-exposed containers.

SPECIAL FIRE FIGHTING PROCEDURES:

Do not use solid stream of water to avoid spreading fire. Firefighters should wear self-contained breathing apparatus.

UNUSUAL FIRE AND EXPLOSION HAZARDS:

Isopropyl Alcohol is a moderate explosion hazard when exposed to heat, flames, or oxidizers. Vapors are heavier than air and may travel considerable distances to an ignition source.

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## SECTION VI – ACCIDENTAL RELEASE MEASURES

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STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED:

Eliminate all ignition sources. Absorb small spills in suitable absorbent material and place in sealed container for disposal. Dike large spills and transfer to an appropriate container for disposal.

CALL CHEMTREC 1-800-424-9300. Avoid contact of spilled materials with soil and surface waterways.

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## SECTION VII – HANDLING AND STORAGE

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PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING:

Store in closed containers in a cool dry, well-ventilated area away from oxidizers, heat, sparks, and open flame. Follow local regulation for the storage of flammable liquids. Protect from light. Avoid contact with eyes and skin, do not breathe vapors or mist. Do not ingest. Wash thoroughly after handling. Do not smoke or eat while handling the product.

OTHER PRECAUTIONS:

Keep container closed when not in use. Release any built-up pressure by loosening closure slowly. Do not transfer contents to unlabelled containers. Use only with adequate ventilation. Keep out of reach of children.

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SECTION VIII - EXPOSURE CONTROLS, PERSONAL PROTECTION

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RESPIRATORY PROTECTION:

If vapors or mist are above the ECL, an approved respirator for vapors/mist is recommended.

VENTILATION:

LOCAL EXHAUST: Well ventilated area

MECHANICAL (General): Recommended

SPECIAL:

OTHER:

PROTECTIVE GLOVES: Rubber gloves and boots should be worn during application.

EYE PROTECTION: Goggles should be worn.

OTHER PROTECTIVE CLOTHING OR EQUIPMENT: Protective aprons and/or coveralls are

recommended. Wash protective clothing after use.

WORK/HYGIENIC PRACTICES: Avoid contact with eyes and skin. Do not breathe vapors or mist. Do

not ingest. Do not eat or smoke when handling material. Wash thoroughly with soap and water after handling.

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SECTION IX - PHYSICAL AND CHEMICAL PROPERTIES

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FLASH POINT (deg C/deg F) (Method Used): 14 deg C/58 deg F

Penskey closed cup

FLAMMABLE LIMITS:

LEL: 2.5 (IPA)

UEL: Not Available

APPEARANCE: Clean, clear, blue liquid

BOILING POINT (deg C/deg F): 82.5 deg C/180 deg F

SPECIFIC GRAVITY (H<sub>2</sub>O = 1): 0.784 (IPA)

pH: Not Available

ODOR: Characteristic smell of alcohol

VAPOR PRESSURE (mm Hg.): 33 mmHg @ 20 deg C/88 deg F (IPA)

FREEZING/MELTING POINT (specify) (deg C/deg F): Not Available

PHYSICAL STATE: Liquid

VAPOR DENSITY (AIR = 1): 20 IPA

EVAPORATION RATE (Butyl Acetate = 1): Not Available

SOLUBILITY IN WATER: Not Available

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## SECTION X - STABILITY AND REACTIVITY DATA

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STABILITY: Stable

CONDITIONS TO AVOID: None under normal conditions and use.

INCOMPATIBILITY (Materials to Avoid): Isopropyl alcohol is incompatible with acetaldehyde, chlorine,

ethylene oxide, hypochlorous acid, isocyanates, phosgene, oleum, perchloric acid, and strong oxidizing agents.

HAZARDOUS DECOMPOSITION OR BYPRODUCTS: None Known

HAZARDOUS POLYMERIZATION: Will Not Occur

Page 3 of 5

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## SECTION XI - TOXICOLOGICAL INFORMATION

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ACUTE DATA:

PURE IVERMECTIN IN RATS:

ORAL LD50: 60 mg/kg

DERMAL LD50: >550 mg/kg

INHALATION LD50: >5.11 mg/L

TARGET ORGANS: None Known

CARCINOGENICITY:

NTP? Not Listed

IARC MONOGRAPHS? Not Listed

OSHA REGULATED? Not Listed

SPECIAL STUDIES (epidemiology, carcinogenicity, other studies relevant to subject materials):

[Dr. William C. Campbell Ivermectin and Abacaetin (New York: Springer-Verlag. 1989) 100]

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## SECTION XII - ECOLOGICAL INFORMATION

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ECOTOXICITY (fish and invertebrates, plant life, birds, other):

IVERMECTIN: Very toxic to certain aquatic species.

LC50 - Daphnia magna, 48 hours = 0.025 ppb; NOEL (No Observable Effect Level) Daphnia magna = 0.01 ppb;

LC50 - Rainbow trout, 96 hours = 3.0 ppb;

LC50 - Bluegill sunfish, 96 hours = 4.8 ppb.

ENVIRONMENTAL FATE (persistence, degradation, hydrolytic/photolytic stability, etc.): Ivermectin

photodegrades rapidly in the environment and is metabolized in the soil. Water solubility is limited and

it binds to soil very tightly. It does not bioconcentrate in fish and is not taken up from soil to plants. Both

aquatic and terrestrial studies confirm rapid degradation of Ivermectin in the environment and lack of accumulation and persistence.

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### SECTION XIII - DISPOSAL CONSIDERATIONS

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Responsibility for proper waste disposal is with the owner of the waste.

EPA/RCRA WASTE NUMBERS UNDER RCRA 40CFR 261: D001,

Flammable Liquids

WASTE DISPOSAL METHOD: Residual surface areas, spill residues, and absorbing materials will be

incinerated at temperatures greater than 600 deg C.

SPECIAL INSTRUCTION OR SPECIFIC LIMITATIONS: Avoid contact of spilled materials and runoff

with soil and surface waterways.

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### SECTION XIV- REGULATORY INFORMATION

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OSHA: N/A

DOT/IATA/IMDG:

DOT: 49CFR

IATA: Dangerous Goods Regs.

IMDG: International Marine Dangerous Goods Regs.

EPA/RCRA: 29 CFR

Page 4 of 5

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### SECTION XV - OTHER

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RIGHT TO KNOW HAZARD INFORMATION: (4=Severe Hazard; 3=Serious Hazard;  
2=Moderate Hazard; 1=Slight Hazard; 0=Minimal Hazard)

HEALTH: 1

FIRE: 3

REACTIVITY: 0

OTHER (Specify): 0

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KEY/LEGENDS USED:

"N/A" = Not Applicable

"CFR" = Code of Federal Regulations

"DOT" = Department of Transportation

"IATA" = International Air Transport Association

"IMDG / IMO" = International Marine Dangerous Goods /  
International Maritime Organization

PREPARATION DATE: 01 September 2002

REVISION INFORMATION: Initial Version

OTHER:

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(AccessButler 2007)



## 8.6.1.2Ketamine

10 July 2003 Page 1 of 3

Replaces MSDS Dated 27 August 1998

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### Material Safety Data Sheet:

*Parnell Ketamine Injection*

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#### STATEMENT OF HAZARDOUS NATURE:

Hazardous substance according to criteria of Worksafe Australia.

#### MANUFACTURER COMPANY DETAILS: LICENSEE (NEW ZEALAND) DETAILS:

Parnell Laboratories (Aust) Pty Ltd Parnell Laboratories New Zealand Limited

#### Address Address

Unit 6, Century Estate Unit 2, 13-19 Highbrook Drive

476 Gardeners Road East Tamaki

Alexandria, NSW 2015 New Zealand

Australia

#### Telephone Number Telephone Number

61 (0)2-9667 4411 64 (0)9 273 7270 (Business Hours)

0800 446282 (Toll free from NZ to Australia) (BH)

#### Emergency Telephone Number Emergency Telephone Number

61 (0)2-9667 4411 (Business Hours) 64 (0)9 273 7270 (Business Hours)

0800 446282 (Toll free from NZ to Australia) (BH)

#### Facsimile Number Facsimile Number

61 (0)2-9667 4139 64 (0)9 273 7260

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#### IDENTIFICATION

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#### Product Name

*Parnell Ketamine Injection*

#### Other Names

Ketamine

#### U.N. Number

No UN number allocated

#### Dangerous Goods Class and Subsidiary Risk

No class and subsidiary risk allocated

#### Hazchem Code

No Hazchem code allocated

#### Poisons Schedule

Schedule 4 (Australia)

Prescription Animal Remedy (P.A.R) Class II (New Zealand)

#### Packaging

Labelled 20mL or 50mL amber glass vial sealed with rubber stopper and aluminium closure

#### Use

FOR ANIMAL TREATMENT ONLY.

For veterinary use for induction of anaesthesia; for use singly or in combination with muscle relaxants or

tranquillisers.

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**PHYSICAL DESCRIPTION AND PROPERTIES:**

**Appearance and Odour Solubility in Water**

Clear, colourless solution Aqueous solution

10 July 2003 Page 2 of 3

Replaces MSDS Dated 27 August 1998

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**Material Safety Data Sheet:**

***Parnell Ketamine Injection***

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**Boiling Point Melting Point**

Not determined Not determined

10 July 2003 Page 3 of 3

Replaces MSDS Dated 27 August 1998

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**Material Safety Data Sheet:**

***Parnell Ketamine Injection***

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**Vapour Pressure Specific Gravity**

Not determined Not determined

**Flash Point Flammability Limits**

Not determined Not determined

**pH Other Properties**

3.5 - 5.5

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**INGREDIENTS:**

**Chemical Entity CAS Number Proportion**

Ketamine Hydrochloride 1867-66-9 10%

Preservative <1%

Water 7732-18-5 to 100%

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**HEALTH HAZARD INFORMATION**

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**HEALTH EFFECTS:**

***Acute Exposure:***

LD<sub>50</sub> mice, ip 224 ± 4mg/kg

Rats, ip 229 ± 5mg/kg

Ketamine may cause confusion hallucinations and irrational behaviour, increased muscle tone, tachycardia and

hypertension (although hypotension, cardiac arrhythmias and bradycardia have also been reported), and respiratory depression. Nausea and vomiting have also been reported. High doses produce dissociative anaesthesia (anaesthetic doses: intravenously: 2mg/kg ketamine, equivalent to 1.4mL/70kg *Parnell Ketamine Injection*; intramuscularly: 10mg/kg, equivalent to 7mL 70kg *Parnell Ketamine Injection*.) Significant effects as a result of accidental exposure to *Parnell Ketamine Injection* are unlikely. Ketamine may be subject to substance abuse.

**Swallowed**

Ketamine may be absorbed from the gastrointestinal tract.

**Eye**

Ketamine may be absorbed from the conjunctival mucosa, and may cause eye irritation.

**Skin**

Significant absorption of ketamine through intact skin is unlikely.

**Inhaled**

Significant accidental absorption of ketamine via inhalation is unlikely.

**Chronic Exposure:**

Hallucinations may recur and there is the possibility of psychoses resulting from repeated substance abuse involving ketamine.

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**FIRST AID:**

**Swallowed**

Seek medical attention if required

**Eye**

10 July 2003 Page 4 of 3

Replaces MSDS Dated 27 August 1998

---

**Material Safety Data Sheet:**

***Parnell Ketamine Injection***

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If in eyes, hold eyes open, flood with water for at least 15 minutes. Seek medical assistance if required.

**Skin**

If skin contact occurs remove contaminated clothing and wash skin thoroughly with soap and water.

**Inhaled**

No specific requirements. Seek medical attention if required.

**First Aid Facilities**

No specific first aid facilities required.

**ADVICE TO DOCTOR**

Treat symptomatically as required. Provide respiratory support if necessary. Diazepam or other benzodiazepines may reduce hallucinogenic and other effects.

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**PRECAUTIONS FOR USE**

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**Exposure Standards**

No exposure standard allocated

**Engineering Controls**

Not applicable

**Personal Protection**

Wear gloves when handling product.

Avoid spraying or splashing of the preparation.

Avoid eating, drinking or smoking in area of product or during handling of product.

Avoid contamination of work area.

**Flammability**

Not flammable under conditions of use.

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**SAFE HANDLING INFORMATION**

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**Storage and Transport**

Store in secure area. Prevent unauthorised access.

Store below 30°C (Room Temperature). Protect from light.

**Spills and Disposal**

Clean up spilled material with absorbent ensuring no contact with skin during operation. Flush contaminated

area with water and detergent.

Dispose of waste in accordance with local, state or federal laws.

**Fire/Explosion Hazards**

This material is not considered a fire hazard. Use standard fire fighting techniques to extinguish fires involving

this material. Use water spray, dry chemical, carbon dioxide or foam.

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**OTHER INFORMATION**

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**Contact Point**

Production Manager Technical Services Manager

Parnell Laboratories (Aust) Pty Ltd Parnell Laboratories (Aust) Pty Ltd

Telephone: 61 (0)2 9667 4411 Telephone: 61 (0)2 9667 4411

(AccessButler 2007)

### 8.8.1.4 Lethobarb

## VIRBAC (AUSTRALIA) PTY. LTD.

Document No:

Lethabarb

Revision A

# MATERIAL SAFETY DATA SHEET

Product Name:

Lethabarb Euthanasia Injection

Page: 1 of 5

Date of Issue

24 November,

2004

## Section 1 - Identification of Chemical Product and Company

**Company:** Virbac (Australia) Pty. Ltd ABN 77 003 268 871

**Address** 15 Pritchard Place, Peakhurst, NSW 2210, Australia

Locked Bag 1000, Peakhurst Delivery Centre, Peakhurst, NSW 2210, Australia

**Telephone:** (02) 9533 2000 or 1800 242 100

**Fax:** (02) 9533 1522

**Emergency phone** As above during business hours; answering machine after hours

**Substance:** Active ingredient is a barbiturate derivative.

**Trade Name:** Lethabarb Euthanasia Injection

**Product Use:** Injectable rapid euthanasia agent for dogs and cats.

**Creation Date:** June, 2002

**Revision Date:** November, 2004

## Section 2 - Hazards Identification

### STATEMENT OF HAZARDOUS NATURE

This product is classified as: Hazardous according to the criteria of NOHSC Australia.

Dangerous according to the Australian Dangerous Goods (ADG) Code.

**Risk Phrases:** R25, R36/37/38. Toxic if swallowed. Irritating to eyes, respiratory system and skin.

**Safety Phrases:** S20, S23, S38, S24/25. When using, do not eat or drink. Do not breathe mists. In case of insufficient ventilation, wear suitable respiratory equipment. Avoid contact with skin and eyes.

**SUSDP Classification:** S4

**ADG Classification:** Class 6.1 (TOXIC LIQUID, INORGANIC, N.O.S.)

**UN Number:** 3287

### Emergency Overview

**Physical Description & colour:** Clear green solution in amber glass bottle.

**Odour:** No data.

**Major Health Hazards:** In all cases of excessive dose intake, the symptoms would be as follows: Nystagmus (rapid eye movements), miosis (contraction of pupils), slurred speech and ataxia (uncoordination in movements). With overdose, coma, respiratory and cardiovascular depression with hypotension (lowering of blood pressure) and shock leading to death. Also after rapid intravenous administration, apnoea (stop in respiration) may occur.

### Potential Health Effects

**Extremely dangerous, especially if injected intravenously as it will cause death very rapidly.**

**We suggest that this product only be used when the user is in the presence of another responsible adult.**

Due to the high concentration of the active ingredient in this product, the principal danger is due to acute toxicity.

Chronic toxicity would appear if extremely low doses of the product were administered over a prolonged period (dependence). This is very unlikely to occur with this product.

#### **Inhalation**

**Short term exposure:** This product is an inhalation irritant. Symptoms may include headache, irritation of nose and throat and increased secretion of mucous in the nose and throat. Other symptoms may also become evident, but they should disappear after exposure has ceased. The product may be absorbed if it is actually instilled into the nose.

#### **Skin Contact:**

**Short term exposure:** This product is a skin irritant. Symptoms may include itchiness and reddening of contacted skin. Other symptoms may also become evident, but all should disappear once exposure has ceased. Not normally absorbed through the skin, unless applied on extensive skin lesions (broken skin).

#### **Eye Contact:**

**Short term exposure:** Irritating to eyes. Some absorption may occur through the eye mucosa. In addition, this product is an eye irritant. Symptoms may include stinging and reddening of eyes and watering which may become

### **VIRBAC (AUSTRALIA) PTY. LTD.**

**Document No:**

**Lethabarb**

**Revision A**

## **MATERIAL SAFETY DATA SHEET**

**Product Name:**

Lethabarb Euthanasia Injection

**Page: 2 of 5**

**Date of Issue**

**24 November,  
2004**

copious. Other symptoms may also become evident. If exposure is brief, symptoms should disappear once exposure has ceased. However, lengthy exposure or delayed treatment may cause permanent damage.

#### **Ingestion:**

**Short term exposure:** Toxic if swallowed. Can cause death, as pentobarbitone sodium is well absorbed by the oral route. First symptoms of intoxication (narcosis) may occur as early as 15 minutes after intake (with as low a dose as 100 to 200 mg for an adult person, i.e. less than 1 mL of LETHABARB). The acute oral LD<sub>50</sub> of the active ingredient in the rat is 118 mg/kg.

#### **Carcinogen Status:**

**NOHSC:** No significant ingredient is classified as carcinogenic by NOHSC.

**NTP:** No significant ingredient is classified as carcinogenic by NTP.

**IARC:** No significant ingredient is classified as carcinogenic by IARC.

## Section 3 – Composition/Information on Ingredients

### Ingredients CAS No Conc,% TWA (mg/m3) STEL (mg/m3)

Pentobarbital sodium 57-33-0 29.7 not set not set

Other non hazardous ingredients secret <10 not set not set

Water 7732-18-5 to 100 not set not set

This is a commercial product whose exact ratio of components may vary slightly. Minor quantities of other non

hazardous ingredients are also possible.

The TWA exposure value is the average airborne concentration of a particular substance when calculated over a normal 8 hour working day for a 5

day working week. The STEL (Short Term Exposure Limit) is an exposure value that should not be exceeded for more than 15 minutes and should

not be repeated for more than 4 times per day. There should be at least 60 minutes between successive exposures at the STEL. The term "peak" is

used when the TWA limit, because of the rapid action of the substance, should never be exceeded, even briefly.

## Section 4 - First Aid Measures

### General Information:

You should call The Poisons Information Centre if you feel that you may have been poisoned, burned or irritated by

this product. The number is 13 1126 from anywhere in Australia and is available at all times.

Have this MSDS with

you when you call.

This product contains a barbiturate (sodium pentobarbitone) in a very high concentration form. It is intended to kill

animals and should not be used for any other purposes, such as anaesthesia, for example.

Gastric lavage, oral

administration of activated charcoal, intensive symptomatic and supportive therapy are part of the treatment. The

solution being extremely alkaline, necrosis or gangrene can follow subcutaneous injection.

**Inhalation:** If inhalation occurs, contact a Poisons Information Centre, or call a doctor at once.

Remove source of

contamination or move victim to fresh air. If breathing is difficult, oxygen may be beneficial if administered by trained

personnel, preferably on a doctor's advice. DO NOT allow victim to move about unnecessarily.

Symptoms of

pulmonary oedema can be delayed up to 48 hours after exposure.

**Skin Contact:** Quickly and gently, blot or brush away excess chemical. Wash gently and thoroughly with water (use

non-abrasive soap if necessary) for 20 minutes or until chemical is removed. Under running water, remove

contaminated clothing, shoes and leather goods (e.g. watchbands and belts). If irritation persists, repeat flushing and

obtain medical advice. Completely decontaminate clothing, shoes and leather goods before reuse or discard.

**Eye Contact:** If poisoning occurs, contact a Poisons Information Centre. Urgent hospital treatment is likely to be

needed. Quickly and gently blot or brush away chemical. Immediately flush the contaminated eye(s) with lukewarm,

gently flowing water for 20 minutes or until the chemical is removed, while holding the eyelid(s) open. Take care not to

rinse contaminated water into the unaffected eye or onto the face.

**Ingestion:** If swallowed, rinse mouth thoroughly with water and contact a Poisons Information Centre, or call a

doctor at once. Give activated charcoal if instructed.

## Section 5 – Fire Fighting Measures

**Fire and Explosion Hazards:** There is no risk of an explosion from this product under normal circumstances if it is involved in a fire.

Fire decomposition products from this product may be toxic if inhaled. Take appropriate protective measures.

This product is likely to decompose only after heating to dryness, followed by further strong heating.

**Extinguishing Media:** Not Combustible. Use extinguishing media suited to burning materials. water fog. Water fog

or fine spray is the preferred medium for large fires.

## **VIRBAC (AUSTRALIA) PTY. LTD.**

**Document No:**

**Lethabarb**

**Revision A**

# **MATERIAL SAFETY DATA SHEET**

**Product Name:**

Lethabarb Euthanasia Injection

**Page: 3 of 5**

**Date of Issue**

**24 November,  
2004**

**Fire Fighting:** When fighting fires involving significant quantities of this product, no special equipment is believed to be necessary.

**Flash point:** Does not burn.

**Upper Flammability Limit:** Does not burn.

**Lower Flammability Limit:** Does not burn.

**Autoignition temperature:** Not applicable - does not burn.

**Flammability Class:** Does not burn.

## **Section 6 – Accidental Release Measures**

**Accidental release:** In the event of a major spill, prevent spillage from entering drains or water courses. Evacuate the spill area and deny entry to unnecessary and unprotected personnel. Immediately call the Fire Brigade. Wear full

protective chemically resistant clothing including face mask, face shield, gauntlets and self contained breathing

apparatus. See above under Personal Protection regarding Australian Standards relating to personal protective

equipment. Suitable materials for protective clothing include rubber, PVC. Stop leak if safe to do so, and contain spill.

Absorb onto sand, vermiculite or other suitable absorbent material. If spill is too large or if absorbent material is not

available, try to create a dike to stop material spreading or going into drains or waterways. Avoid using sawdust or

other combustible material. Because of the toxicity of this product, special personal care should be taken in any

cleanup operation. Sweep up and shovel or collect recoverable product into labelled containers for recycling or

salvage, and dispose of promptly. After spills, wash area preventing runoff from entering drains. If a significant

quantity of material enters drains, advise emergency services. Full details regarding disposal of used containers,

spillage and unused material may be found on the label. If there is any conflict between this MSDS and the label,



instructions on the label prevail. Ensure legality of disposal by consulting regulations prior to disposal. Thoroughly launder protective clothing before storage or re-use. Advise laundry of nature of contamination when sending contaminated clothing to laundry.

## **Section 7 – Handling and Storage**

**Handling:** Keep exposure to this product to a minimum, and minimise the quantities kept in work areas. Check

Section 8 of this MSDS for details of personal protective measures, and make sure that those measures are followed.

The measures detailed below under "Storage" should be followed during handling in order to minimise risks to persons using the product in the workplace. Also, avoid contact or contamination of product with incompatible materials listed in Section 10.

**Storage:** This product is a Scheduled Poison. Observe all relevant regulations regarding sale, transport and storage of this class of poison. Store in a cool, well ventilated area. Check containers periodically for leaks. Containers should be kept closed in order to minimise contamination. Make sure that the product does not come into contact with substances listed under "Materials to avoid" in Section 10. If you keep more than 1000kg or 1000L of Toxic Substances of Packaging Group III, you will require a license to do so. If you have any doubts, we suggest you contact your licensing authority in order to clarify your obligations. Check packaging - there may be further storage instructions on the label.

## **Section 8 Exposure Controls and Personal Protection**

The following Australian Standards will provide general advice regarding safety clothing and equipment:

Respiratory equipment: **AS/NZS 1715**, Protective Gloves: **AS 2161**, Industrial Clothing: **AS2919**, Industrial Eye

Protection: **AS1336** and **AS/NZS 1337**, Occupational Protective Footwear: **AS/NZS2210**.

### **Exposure Limits TWA (mg/m<sup>3</sup>) STEL (mg/m<sup>3</sup>)**

Exposure limits have not been established by NOHSC for any of the significant ingredients in this product.

**Ventilation:** No special ventilation requirements are normally necessary for this product. However make sure that the work environment remains clean and that dusts are minimised.

**Eye Protection:** Protective glasses or goggles must be worn when this product is being used. Failure to protect your eyes may lead to severe harm to eyes or to general health. Emergency eye wash facilities must also be available in an area close to where the product is being used.

**Skin Protection:** Prevent skin contact by wearing impervious gloves, clothes and, preferably, apron. Make sure that all skin areas are covered. See below for suitable material types.

**Protective Material Types:** We suggest that protective clothing be made from the following materials: rubber, PVC.

**Respirator:** If there is a significant chance that vapours or mists are likely to build up in the area where this product

is being used, we recommend that you use a respirator. It should be fitted with a suitable cartridge.

## **VIRBAC (AUSTRALIA) PTY. LTD.**

**Document No:**

**Lethabarb**

**Revision A**

# **MATERIAL SAFETY DATA SHEET**

**Product Name:**

Lethabarb Euthanasia Injection

**Page: 4 of 5**

**Date of Issue**

**24 November,  
2004**

Eyebaths or eyewash stations and safety deluge showers should be provided near to where this product is being used.

## **Section 9 - Physical and Chemical Properties:**

**Physical Description & colour:** Clear green solution in amber glass bottle.

**Odour:** No data.

**Boiling Point:** Approximately 100°C at 100kPa.

**Freezing/Melting Point:** Approximately 0°C.

**Volatiles:** Water component.

**Vapour Pressure:** 2.37 kPa at 20°C (water vapour pressure).

**Vapour Density:**

**Specific Gravity:** 1.08

**Water Solubility:** Completely soluble in water.

**pH:** 11.0 approx

**Volatility:** No data.

**Odour Threshold:** No data.

**Evaporation Rate:** No data.

**Coeff Oil/water distribution:** No data

**Autoignition temp:** Not applicable - does not burn.

## **Section 10 – Stability and Reactivity**

**Reactivity:** This product is unlikely to react or decompose under normal storage conditions.

However, if you have

any doubts, contact the supplier for advice on shelf life properties.

**Conditions to Avoid:** None known.

**Incompatibilities:** strong acids, strong bases.

**Fire Decomposition:** Carbon dioxide, and if combustion is incomplete, carbon monoxide and smoke. Nitrogen and

its compounds, and under some circumstances, oxides of nitrogen. Occasionally hydrogen cyanide gas. Water.

sodium compounds. Carbon monoxide poisoning produces headache, weakness, nausea, dizziness, confusion,

dimness of vision, disturbance of judgment, and unconsciousness followed by coma and death. Hydrogen cyanide

poisoning signs and symptoms are weakness, dizziness, headache, nausea, vomiting, coma, convulsions, and death.

Death results from respiratory arrest. Hydrogen cyanide gas acts very rapidly; symptoms and death can both occur quickly.

**Polymerisation:** This product is unlikely to undergo polymerisation processes.

## Section 11 – Toxicological Information

**Target Organs:** There is no data to hand indicating any particular target organs.

### Classification of Hazardous Ingredients

Ingredient Risk Phrases

**Pentobarbital Sodium:** R25, R36/37/38

**Pentobarbital Sodium:** LD<sub>50</sub> Oral, Rat 118mg/kg

## Section 12 – Ecological Information

Insufficient data to be sure of status.

## Section 13 – Disposal Considerations

**Disposal:** Instructions concerning the disposal of this product and its containers are given on the product label.

These should be carefully followed.

## Section 14 – Transport Information

**ADG Code:** 3287, TOXIC LIQUID, INORGANIC, N.O.S.

**Hazchem Code:** 2X

**Special Provisions:** SP109, SP185, SP274

**Packaging Group:** III

**VIRBAC (AUSTRALIA) PTY. LTD.**

**Document No:**

**Lethabarb**

**Revision A**

# MATERIAL SAFETY DATA SHEET

**Product Name:**

Lethabarb Euthanasia Injection

**Page: 5 of 5**

**Date of Issue**

**24 November,  
2004**

**Packaging Method:** 3.8.6

This product is classed as UN3287, Dangerous Goods Class 6.1 Toxic Substances. Proper Shipping name is TOXIC

LIQUID, INORGANIC, N.O.S.. Class 6 Toxic Substances shall not be loaded in the same vehicle or packed in the

same freight container with Classes 1 (Explosives), 3 (Flammable Liquids where the Flammable Liquid is

nitromethane), 5.1 (Oxidising Agents where the Toxic Substances are Fire Risk Substances), 5.2 (Organic Peroxides

where the Toxic Substances are Fire Risk Substances), 8 (Corrosive Substances where the Toxic Substances are

cyanides and the Corrosives are acids), Foodstuffs and foodstuff empties. They may however be loaded in the same

vehicle or packed in the same freight container with Classes, 2.1 (Flammable Gases), 2.2 (Non-Flammable, Non-

Toxic Gases), 2.3 (Toxic Gases), 3 (Flammable liquids, except where the flammable liquid is nitromethane), 4.1

(Flammable Solids), 4.2 (Spontaneously Combustible Substances), 4.3 (Dangerous When Wet Substances), 5.1

(Oxidising Agents except where the Toxic Substances are Fire Risk Substances), 5.2 (Organic Peroxides except

where the Toxic Substances are Fire Risk Substances), 7 (Radioactive Substances), 8 (Corrosive Substances except

where the Toxic Substances are cyanides and the Corrosives are acids), 9 (Miscellaneous Dangerous Goods)

## **Section 15 – Regulatory Information**

**AICS:** All of the significant ingredients in this formulation are to be found in the public AICS Database.

The following ingredient: Pentobarbital sodium is listed in the SUSDP.

## **Section 16 – Other Information**

**This MSDS contains only safety-related information. For other data see product literature.**

**Contact point: Technical Manager, QA Manager or R&D Director**

**Telephone (02) 9533 2000 or 1800 242 100**

**Fax (02) 9533 1522**

### **Acronyms:**

**ADG Code** Australian Code for the Transport of Dangerous Goods by Road and Rail

**AICS** Australian Inventory of Chemical Substances

**CAS number** Chemical Abstracts Service Registry Number

**Hazchem Number** Emergency action code of numbers and letters that provide information to emergency services especially firefighters

**IARC** International Agency for Research on Cancer

**NOHSC** National Occupational Health and Safety Commission

**NOS** Not otherwise specified

**NTP** National Toxicology Program (USA)

**R-Phrase** Risk Phrase

**SUSDP** Standard for the Uniform Scheduling of Drugs & Poisons

**UN Number** United Nations Number

THIS MSDS SUMMARISES OUR BEST KNOWLEDGE OF THE HEALTH AND SAFETY HAZARD INFORMATION OF THE PRODUCT AND

HOW TO SAFELY HANDLE AND USE THE PRODUCT IN THE WORKPLACE. EACH USER MUST REVIEW THIS MSDS IN THE CONTEXT OF

HOW THE PRODUCT WILL BE HANDLED AND USED IN THE WORKPLACE.

IF CLARIFICATION OR FURTHER INFORMATION IS NEEDED TO ENSURE THAT AN APPROPRIATE RISK ASSESSMENT CAN BE MADE,

THE USER SHOULD CONTACT THIS COMPANY SO WE CAN ATTEMPT TO OBTAIN ADDITIONAL INFORMATION FROM OUR SUPPLIERS

OUR RESPONSIBILITY FOR PRODUCTS SOLD IS SUBJECT TO OUR STANDARD TERMS AND CONDITIONS, A COPY OF WHICH IS SENT

TO OUR CUSTOMERS AND IS ALSO AVAILABLE ON REQUEST.

**Please read all labels carefully before using product.**

This MSDS is prepared in accord with the NOHSC document "National Code of Practice for the

Preparation of Material Safety Data Sheets" 2nd Edition [NOHSC:2011(2003)]

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<http://www.kilford.com.au/> Phone (02)9251 4532

(Virbac 2007)

### 8.8.1.5 Panacur

Panacur 100 – Issue 2

Page 1 of 4

# MATERIAL SAFETY DATA SHEET

## PANACUR 100

Issue Date: March 24<sup>th</sup>, 2001

Review Date: March 24<sup>th</sup>, 2003

Company Address: Intervet Ltd

P O Box 4079

Auckland

New Zealand

Phone: (09) 309-0600

Fax: (09) 309-9101

Emergency Tel. No.: John Southworth

R & D Manager

Intervet Ltd

021-932-876

Poisons Information Centre: 0800-764-766

### 1. IDENTIFICATION

1.10 Product Name: Panacur 100

1.11 Correct Shipping Name: Panacur 100 ( 1L, 5L, 10L and 20L )

1.12 ARB Number: 7154

1.13 UN Number: Not applicable

1.14 Hazchem Code: Not applicable

1.15 Dangerous Goods Class: Not classified

Sub-risk:

1.16 Poison Schedule: NA

1.17 Manufacturers Product

Code: 000006 (1L), 000007 (5L)

1.18 Use: Oral anthelmintic for sheep, goats, cattle and horses.

Panacur 100 – Issue 2

Page 2 of 4

### 1.2 Ingredients

1.20 Chemical Entity CAS Number. Proportion

\*Fenbendazole 43210-67-9 100g/L

Water carrier 7732-18-5 >600g/L

\*(5 – (phenylthio) – 1H – Benzimidazol – 2 – YL) Carbamic Acid Methyl Ester

\* Active Constituent

+ Confidential Manufacturing Information

1.21 Chemical Characterisation: Suspension.

### 1.3 Physical Description / Properties

1.30 Form: A white liquid

1.31 Colour: White

1.32 Odour: Slightly chalky odour

1.33 Change in Physical State: Stable under normal conditions

1.34 SG: Not available

1.35 Vapour Pressure: Not available

1.36 Viscosity: Not available

1.37 Solubility in Water: Dispersion

1.38 pH Value: Not available

1.39 Flash Point: Not available

1.40 Boiling Point: Not available

1.41 Explosive Limits: Not applicable

## **2. HEALTH HAZARD INFORMATION**

2.1 Health Effects:

2.10 Information on Toxicity: a) Eyes – Avoid contact with the eyes

b) Skin – Not considered hazardous

c) Ingestion – Only hazardous if swallowed in large amounts

d) Inhalation – Not considered hazardous

2.2 First Aid

2.20 First Aid: a) Eyes – Wash with copious amounts of clean water for 15 minutes.

b) Skin – Wash with soap and water

c) Ingestion – Contact doctor or Poisons Information Centre

d) Inhalation – Remove from the source of the fumes

Reassure the casualty and encourage them to rest.

Panacur 100 – Issue 2

Page 3 of 4

2.21 Advice to Doctor: Note ingredients and their possible irritant effects

## **3. PRECAUTIONS FOR USE**

3.1 Exposure Standards / Engineering Control

3.10 Regulations: This product is not subject to Australian Code for the Transport of Dangerous Goods by Road and Rail.

3.11 Technical Protective Measures: No special measures are required. Store away from

food, drink and animal feedstuffs. Store below 30°C. Do not

freeze. Shake before use. Wash hands thoroughly after

handling. Do not eat, drink or smoke until after washing.

3.2 Personal Protective Measures

3.21 Personal Protective

Equipment: None required

3.22 Industrial Hygiene: Avoid contact with the skin and eyes. Follow the data sheet instructions.

3.3 Flammability

3.31 Protection Against Fire: No special precautions required. The product is not flammable.

## **4. MEASURES IN CASE OF ACCIDENTS AND FIRES**

4.1 Storage and Transport Store below 30°C. Do not freeze.

4.11 Classification under the

Transportation of

Dangerous Goods Code: Not classified as a dangerous good

Shipping Name: Panacur 100

Packing Group: None allocated

UN Number: None allocated

DG Class: None allocated

Sub-risk: None allocated

Hazchem: None allocated

#### 4.12 International Transport

Codes: Not applicable

#### 4.2 Spills and Disposals

4.21 Place unused material in a sealed container and dispose of in an authorised landfill.

4.22 After Spillage/Leakage: Eliminate sources of ignition.

Absorb spills into an inert material (sand, soil, hydrated lime or vermiculite) or another absorbent material (i.e. paper towel). Wash the residue from the area with large quantities of water.

4.23 Disposal of Spillage: Place recovered material in a sealed container and dispose of in an authorised landfill

Panacur 100 – Issue 2

Page 4 of 4

#### 4.3 Fire / Exposure Hazards

4.35 Thermal Decomposition: No hazards known

4.36 Hazardous Decomposition

Products: No hazards known

4.37 Hazardous Reactions: None known

4.38 Extinguishing Media: Water, foam or dry chemical

### 5. OTHER INFORMATION

5.10 Information on Ecological Effects:

Flora: No effects anticipated

Fauna ( rat ): Oral LD<sub>50</sub> = >1000mg/kg

Fish: No effects anticipated

Birds: No effects anticipated

Soil: No effects anticipated

Water: Do not allow product to enter waste water, rivers or creeks.

### 6. CONTACT POINT (For Non-Emergency Calls)

6.10 Product Safety Coordinator: John Southworth

R & D Manager

Intervet Limited

09-309-0600

#### DISCLAIMER

*The Material Safety Data Sheet has been developed according to OSH guidelines.*

*The data, information and recommendations herein ("information") are represented in good faith and believed to be*

*correct as of the date hereof.*

*The purpose of this Material Safety Data Sheet is to describe product in terms of their safety requirements. Intervet Ltd makes no representation of merchantability, fitness for a particular purpose or application, or of any other*

*nature with respect to the information or the product to which the information refers ("the product").*

*The information is supplied upon the condition that the persons receiving same will make their own determination as*

*to its suitability for their purposes prior to use of the product.*

*The physical data shown herein are typical values based on material tested. These values should not be construed*

*as a guaranteed analysis of any specific lot or as guaranteed specification for the product or specific lots thereof.*

*Due care should be taken to make sure that the use or disposal of this product is in compliance with relevant Local*

*Government regulations.*

(AccessButler 2007)

## **Repti-cal**

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Not classified as Hazardous according to criteria of Worksafe Australia

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Issue date: February 2005 MSDS 129

### IDENTIFICATION

**Product Name: Aristopet Repti-Cal**

**Synonyms: NIL**

**Manufacturer's Product Code(s): RE04,RE05,RE055**

**Use:** Natural Phosphorus-Free Calcium & Vitamin D3 Supplement

**UN Number:** None allocated

**Proper Shipping Name:** NONE ALLOCATED

**Dangerous Goods Class:** None allocated

**Subsidiary risk:** None allocated

**Packing Group:** None allocated

**Hazchem Code:** None allocated

**Poison Schedule:** None allocated

### PHYSICAL PROPERTIES

**Appearance:** Fine white powder

**Melting Point:** N/A

**Vapour Pressure:** N/A

**Specific Gravity:** N/A

**Flash Point:** N/A

**Flammability Limits:** Not flammable

**Solubility in Water:** Insoluble

### INGREDIENTS

**SUBSTANCE NAME Proportion CAS Number**

CALCIUM CARBONATE Greater than 60% 471-34-1

NON-HAZARDOUS SUBSTANCES 1 to 10% Mixture

### HEALTH HAZARD INFORMATION

#### ACUTE HEALTH EFFECTS

NOT CLASSIFIED AS HAZARDOUS ACCORDING TO THE CRITERIA OF WORKSAFE AUSTRALIA

**HAZARD CATEGORY: None allocated**

#### ACUTE HEALTH EFFECTS

##### Swallowed:

Large doses may cause irritation to mouth and throat.

##### Eye:

May cause irritation to the eyes, with effects including: tearing, pain, stinging and blurred vision.

##### Skin:

Not expected to cause any health effects.

##### Inhaled:

This product may cause irritation to the nose, throat and respiratory system with effects including: Cough, discomfort, difficulty breathing and shortness of breath.



Not classified as Hazardous according to criteria of Worksafe Australia

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Issue date: February 2005 MSDS 129

MSDS 129 Page 2 of 3

Document Issue: 01 Aristopet Pty Ltd Printed 14/02/2005

**Chronic:**

None allocated

**FIRST AID**

**Swallowed:**

If swallowed, DO NOT induce vomiting. Give 3 to 4 glasses of water to drink. If irritation persists transport to hospital or doctor.

**Eye:**

If dust enters the eyes, flush with plenty of water for at least 15 minutes, ensuring eye lids are held open. If irritation persists, immediately transport to hospital or doctor.

**Skin:**

None required.

**Inhaled:**

Move victim to fresh air.

**First Aid Facilities:**

Eye wash fountain, safety shower and normal wash room facilities.

**Advice to Doctor:**

Treat symptomatically.

In case of poisoning, contact Poisons Information Centre

In Australia call Tel: 131126

In New Zealand Tel:0800 764 766

## PRECAUTIONS FOR USE

**Exposure Standards**

No exposure standards are available for this product, however, the following exposure standards have been assigned by the

National Occupational Health & Safety Commission (NOHSC) to the following components of the product:

***CALCIUM CARBONATE***

(Worksafe Australia)

**[TWA]**10 mg/m<sup>3</sup>

\*\*\*\*\*

***WATER AND OTHER NON-HAZARDOUS SUBSTANCES***

No Exposure details available

**Engineering Controls**

Good industrial hygiene practice requires that employee exposure be maintained below the recommended exposure standards. This

is preferably achieved through the provision of adequate ventilation where necessary. Where dust cannot be controlled in this way,

personal respiratory protection should be employed.

**Personal Protection Equipment**

GLOVES: None required during normal use..

EYES: Chemical goggles or faceshield may be desirable when handling large quantities.to protect eyes.

RESPIRATORY PROTECTION: Avoid breathing of dusts. The use of a respirator is not normally required, however, if high dust

levels are present, then the use of a suitable dust mask or half-face respirator with a P1 filter is recommended. All respirators must

comply with AS/NZS 1715 and AS/NZS 1716.

## SAFE HANDLING INFORMATION

Avoid generating dusts. Store in a cool place and out of direct sunlight. Store away from sources of heat or ignition. Store away from oxidizing agents. Keep containers closed, when not using the product. Store in original packages as approved by manufacturer.

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Not classified as Hazardous according to criteria of Worksafe Australia

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Issue date: February 2005 MSDS 129

MSDS 129 Page 3 of 3

Document Issue: 01 Aristopet Pty Ltd Printed 14/02/2005

### **Transport**

**UN Number:** None allocated

**Proper Shipping Name:** NONE ALLOCATED

**Dangerous Goods Class:** None allocated

**Subsidiary risk:** None allocated

**Packing Group:** None allocated

**Hazchem Code:** None allocated

Not classified as a Dangerous Good according to the Australian Code for the Transport of Dangerous Goods by Road and Rail (ADG

Code) 6th Edition. Not classified as a Dangerous Good according to the UN, DOT(US), ICAO(IATA) or IMO(IMDG).

### **Spills**

This product is a powder, under appropriate conditions dusts may be generated. Wear suitable protective equipment in these

circumstances. Ventilate area. If possible wet area down to prevent high dust levels. If spill occurs, use dustless methods, such as a

HEPA vacuum and filter. Otherwise, use a non-sparking shovel and place into a suitably labeled container for later disposal. Do not

dry sweep. Remainder of material can be picked up and re-cycled or disposed.

### **Disposal**

Refer to appropriate authority in your State. Dispose of material through a licensed waste contractor. Normally suitable for disposal

by approved waste disposal agent.

### **Fire**

#### **Fire/Explosion Hazard**

If safe to do so, move undamaged containers from fire area.

Hazardous Decomposition Products: Decomposes on heating emitting soot, smoke and decomposition products.

Fire Fighting Procedures: Fire fighters to wear Self-contained breathing apparatus (SCBA) in confined spaces, in oxygen deficient

atmospheres or if exposed to products of decomposition. Full protective clothing is also recommended.

Extinguishing Media: Use extinguishing media suitable for surrounding fire situation.

### **Flammability**

This material is not a combustible or flammable solid.

## OTHER INFORMATION

There is no toxicological information available for this product.

### **Ecotoxicity**

None allocated

### **Poison Schedule**

None allocated

### **RISK PHRASES**

None allocated

## SAFETY PHRASES

S26 In case of contact with eyes, rinse immediately with plenty of water and contact a doctor or Poisons Information Centre.

S39 Wear eye/face protection.

## CONTACT POINT

### Contact Point

Mr Len Walker  
Tel: 07 3630 2166

### Disclaimer

The information herein is to the best of our knowledge, correct and complete. It describes the safety requirements for this product and should not be construed as guaranteeing specific properties. Since methods and conditions are beyond our control we do not accept liability for any damages resulting from the use of, or reliance on, this information in inappropriate contexts. (Aristopet 2006)

## 8.8 Top of descent

### CALLINGTON HAVEN TOP OF DESCENT INSECTICIDE

**Hazard Alert Code:**  
**MODERATE**

Chemwatch Material Safety Data Sheet    Revision No: 2    Chemwatch 16747  
Issue Date: 4-Jun-2003    CD 2006/4

### Section 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME: CALLINGTON HAVEN TOP OF DESCENT  
INSECTICIDE

#### SYNONYMS

"d-phenothrin aircraft cabin insecticide spray"

#### PROPER SHIPPING NAME

#### AEROSOLS

#### PRODUCT USE

Aircraft aerosol insecticide for cabin spraying before landing.

#### SUPPLIER

Company: Callington Haven Pty Ltd

Address:

PO Box 144

Rydalmere

NSW, 2116

AUS

Company: Callington Haven Pty Ltd

Address:

30 South Street

Rydalmere

NSW, 2116

AUS

Telephone: +61 2 9898 2788

Emergency Tel: 1800 039 008 (24  
hours)

Emergency Tel: +61 3 9573 3112

Fax: +61 2 9684 4215

## HAZARD RATINGS

CALLINGTON HAVEN TOP OF DESCENT  
INSECTICIDE

Hazard Alert Code:  
MODERATE

Chemwatch Material Safety Data Sheet  
Issue Date: 4-Jun-2003

Revision No: 2

Chemwatch 16747  
CD 2006/4

	Min	Max
Flammability:	0	
Toxicity:	0	
Body Contact:	2	Min/Nil=0
Reactivity:	0	Low=1
		Moderate=2
Chronic:	0	High=3
		Extreme=4

Section 2 - HAZARDS IDENTIFICATION

STATEMENT OF HAZARDOUS NATURE

DANGEROUS GOODS. NON-HAZARDOUS SUBSTANCE. According to the Criteria of NOHSC, and the ADG Code.

POISONS SCHEDULE

None

RISK	SAFETY
Risk of explosion if heated under confinement.	Do not breathe gas/fumes/vapour/spray.
May produce discomfort of the respiratory system*.	Avoid contact with skin.
Possible respiratory and skin sensitiser*.	This material and its container must be disposed of as hazardous waste.

\* (limited evidence).

Section 3 - COMPOSITION / INFORMATION ON INGREDIENTS

NAME	CAS RN	%
d-phenothrin	51186-88-0	<10
propellant, as HFC		>60
NOTE: Manufacturer has supplied full ingredient information to allow CHEMWATCH assessment.		

Section 4 - FIRST AID MEASURES

SWALLOWED

CALLINGTON HAVEN TOP OF DESCENT  
INSECTICIDE

Hazard Alert Code:  
MODERATE

Chemwatch Material Safety Data Sheet  
Issue Date: 4-Jun-2003

Revision No: 2

Chemwatch 16747  
CD 2006/4

For advice, contact a Poisons Information Centre or a doctor.

- If swallowed do NOT induce vomiting.
- If vomiting occurs, lean patient forward or place on left side (head-down position, if possible) to maintain open airway and prevent aspiration.
- Observe the patient carefully.
- Never give liquid to a person showing signs of being sleepy or with reduced awareness; i.e. becoming unconscious
- Give water to rinse out mouth, then provide liquid slowly and as much as casualty can comfortably drink.
- Seek medical advice.

#### EYE

If this product comes in contact with the eyes:

- Wash out immediately with fresh running water.
- Ensure complete irrigation of the eye by keeping eyelids apart and away from eye and moving the eyelids by occasionally lifting the upper and lower lids.
- If pain persists or recurs seek medical attention.
- Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

#### SKIN

If solids or aerosol mists are deposited upon the skin:

- Flush skin and hair with running water (and soap if available).
- Remove any adhering solids with industrial skin cleansing cream.
- DO NOT use solvents.
- Seek medical attention in the event of irritation.

#### INHALED

- If fumes or combustion products are inhaled remove from contaminated area.
- Lay patient down. Keep warm and rested.
- Prostheses such as false teeth, which may block airway, should be removed, where possible, prior to initiating first aid procedures.
- Apply artificial respiration if not breathing, preferably with a demand valve resuscitator, bag-valve mask device, or pocket mask as trained. Perform CPR if necessary.

CALLINGTON HAVEN TOP OF DESCENT  
INSECTICIDE

Hazard Alert Code:  
MODERATE

Chemwatch Material Safety Data Sheet  
Issue Date: 4-Jun-2003

Revision No: 2

Chemwatch 16747  
CD 2006/4

- Transport to hospital, or doctor.

NOTES TO PHYSICIAN

Treat symptomatically.

Section 5 - FIRE FIGHTING MEASURES

EXTINGUISHING MEDIA

- Water spray or fog.
- Foam.
- Dry chemical powder.
- BCF (where regulations permit).
- Carbon dioxide.

FIRE FIGHTING

- Alert Fire Brigade and tell them location and nature of hazard.
- May be violently or explosively reactive.
- Wear breathing apparatus plus protective gloves.
- Prevent, by any means available, spillage from entering drains or water courses.
- Use fire fighting procedures suitable for surrounding area.
- DO NOT approach containers suspected to be hot.
- Cool fire exposed containers with water spray from a protected location.
- If safe to do so, remove containers from path of fire.
- Equipment should be thoroughly decontaminated after use.

FIRE/EXPLOSION HAZARD

- Non combustible.
- Not considered to be a significant fire risk.
- Heating may cause expansion or decomposition leading to violent rupture of containers.
- Aerosol cans may explode on exposure to naked flames.
- Rupturing containers may rocket and scatter burning materials.
- Hazards may not be restricted to pressure effects.
- May emit acrid, poisonous or corrosive fumes.
- Decomposes on heating and may emit toxic fumes of carbon monoxide (CO).

Other combustion products include:

CALLINGTON HAVEN TOP OF DESCENT  
INSECTICIDE

Hazard Alert Code:  
MODERATE

Chemwatch Material Safety Data Sheet  
Issue Date: 4-Jun-2003

Revision No: 2

Chemwatch 16747  
CD 2006/4

carbon dioxide (CO<sub>2</sub>).  
phosgene.  
chlorides and fluorides.

HAZCHEM

2Y

Personal Protective Equipment

Breathing apparatus.

Gas tight chemical resistant suit.

Limit exposure duration to 1 BA set 30 mins.

**Section 6 - ACCIDENTAL RELEASE MEASURES**

EMERGENCY PROCEDURES

MINOR SPILLS

- Clean up all spills immediately.
- Avoid breathing vapours and contact with skin and eyes.
- Wear protective clothing, impervious gloves and safety glasses.
- Shut off all possible sources of ignition and increase ventilation.
- Wipe up.
- If safe, damaged cans should be placed in a container outdoors, away from all ignition sources, until pressure has dissipated.
- Undamaged cans should be gathered and stowed safely.

MAJOR SPILLS

- Clear area of personnel and move upwind.
- Alert Fire Brigade and tell them location and nature of hazard.
- May be violently or explosively reactive.
- Wear breathing apparatus plus protective gloves.
- Prevent, by any means available, spillage from entering drains or water courses
- No smoking, naked lights or ignition sources.
- Increase ventilation.
- Stop leak if safe to do so.
- Water spray or fog may be used to disperse / absorb vapour.
- Absorb or cover spill with sand, earth, inert materials or vermiculite.
- If safe, damaged cans should be placed in a container outdoors, away from ignition sources, until pressure has dissipated.
- Undamaged cans should be gathered and stowed safely.
- Collect residues and seal in labelled drums for disposal.

CALLINGTON HAVEN TOP OF DESCENT  
INSECTICIDE

Hazard Alert Code:  
MODERATE

Chemwatch Material Safety Data Sheet  
Issue Date: 4-Jun-2003

Revision No: 2

Chemwatch 16747  
CD 2006/4

SAFE STORAGE WITH OTHER CLASSIFIED CHEMICALS

+ + + + + +

*X: Must not be stored together*

*O: May be stored together with specific preventions*

*+: May be stored together*

Personal Protective Equipment advice is contained in Section 8 of the MSDS.

Section 7 - HANDLING AND STORAGE

PROCEDURE FOR HANDLING

- Avoid all personal contact, including inhalation.
- Wear protective clothing when risk of exposure occurs.
- Use in a well-ventilated area.
- Prevent concentration in hollows and sumps.
- DO NOT enter confined spaces until atmosphere has been checked.
- Avoid smoking, naked lights or ignition sources.
- Avoid contact with incompatible materials.
- When handling, DO NOT eat, drink or smoke.
- DO NOT incinerate or puncture aerosol cans.
- DO NOT spray directly on humans, exposed food or food utensils.
- Avoid physical damage to containers.
- Always wash hands with soap and water after handling.
- Work clothes should be laundered separately.
- Use good occupational work practice.
- Observe manufacturer's storing and handling recommendations.
- Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions are maintained.

SUITABLE CONTAINER

- Aerosol dispenser.
- Check that containers are clearly labelled.

STORAGE INCOMPATIBILITY

Avoid reaction with alkali metals, magnesium and magnesium alloys, zinc, aluminium alloys ( 2% magnesium).



CALLINGTON HAVEN TOP OF DESCENT  
INSECTICIDE

Hazard Alert Code:  
MODERATE

Chemwatch Material Safety Data Sheet  
Issue Date: 4-Jun-2003

Revision No: 2

Chemwatch 16747  
CD 2006/4

Avoid contact with plastics such as methacrylate polymers, polyethylene and polystyrene.

#### STORAGE REQUIREMENTS

- Store in original containers.
- Store in an upright position.
- DO NOT store in pits, depressions, basements or areas where vapours may be trapped.
- No smoking, naked lights, heat or ignition sources.
- Keep containers securely sealed.
- Contents under pressure.
- Store in a cool, dry, well ventilated area; away from incompatible materials.
- Avoid storage at temperatures higher than 40 deg C.
- Protect containers against physical damage.
- Check regularly for leaks.
- Observe manufacturer's storing and handling recommendations.

#### Section 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION

##### EXPOSURE CONTROLS

The following materials had no OELs on our records

- d-phenothrin: CAS:51186-88-0

##### MATERIAL DATA

Not available. Refer to individual constituents.

##### INGREDIENT DATA

##### D-PHENOTHRIN:

No exposure limits set by NOHSC or ACGIH.

##### PERSONAL PROTECTION

##### EYE

No special equipment for minor exposure i.e. when handling small quantities.

- OTHERWISE:
- Safety glasses with side shields.
- Contact lenses may pose a special hazard; soft contact lenses may absorb and concentrate irritants. A written policy document, describing the wearing of lens or restrictions on use, should be created for each workplace or task. This should include a review of lens absorption and adsorption for the class of chemicals in use and an account of injury

CALLINGTON HAVEN TOP OF DESCENT  
INSECTICIDE

Hazard Alert Code:  
MODERATE

Chemwatch Material Safety Data Sheet  
Issue Date: 4-Jun-2003

Revision No: 2

Chemwatch 16747  
CD 2006/4

experience. Medical and first-aid personnel should be trained in their removal and suitable equipment should be readily available. In the event of chemical exposure, begin eye irrigation immediately and remove contact lens as soon as practicable. Lens should be removed at the first signs of eye redness or irritation - lens should be removed in a clean environment only after workers have washed hands thoroughly. [CDC NIOSH Current Intelligence Bulletin 59]

HANDS/FEET

No special equipment needed when handling small quantities.

OTHERWISE: Wear general protective gloves, eg. light weight rubber gloves.

Or as required: Wear chemical protective gloves, eg. PVC. Wear safety footwear.

OTHER

No special equipment needed when handling small quantities.

OTHERWISE:

- Overalls.
- Barrier cream.
- Eyewash unit.

DO NOT spray on hot surfaces.

ENGINEERING CONTROLS

General exhaust is adequate under normal operating conditions. If risk of overexposure exists, wear SAA approved respirator. Correct fit is essential to obtain adequate protection. Provide adequate ventilation in warehouse or closed storage areas.

Section 9 - PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE

Liquid in aerosol pack. Contains non-combustible propellant.

PHYSICAL PROPERTIES

Liquid.

Gas.

Does not mix with water.

Molecular Weight: Not applicable.

Boiling Range (°C): Not available.

Melting Range (°C): Not available.

Specific Gravity (water=1): Not available

Solubility in water (g/L): Immiscible

pH (as supplied): Not applicable

pH (1% solution): Not applicable.

Vapour Pressure (kPa): Not available.

Volatile Component (% vol): Not available

Evaporation Rate: Not available

CALLINGTON HAVEN TOP OF DESCENT  
INSECTICIDE

Hazard Alert Code:  
MODERATE

Chemwatch Material Safety Data Sheet  
Issue Date: 4-Jun-2003

Revision No: 2

Chemwatch 16747  
CD 2006/4

Relative Vapour Density (air=1): >1	Flash Point (°C): Not applicable
Lower Explosive Limit (%): Not applicable	Upper Explosive Limit (%): Not applicable
Autoignition Temp (°C): Not applicable	Decomposition Temp (°C): Not available
State: Liquid	Viscosity: Not available

**Section 10 - CHEMICAL STABILITY AND REACTIVITY INFORMATION**  
CONDITIONS CONTRIBUTING TO INSTABILITY

- Elevated temperatures.
- Presence of open flame.
- Product is considered stable.
- Hazardous polymerisation will not occur.

**Section 11 - TOXICOLOGICAL INFORMATION**

POTENTIAL HEALTH EFFECTS

ACUTE HEALTH EFFECTS

SWALLOWED

Overexposure is unlikely in this form.

Considered an unlikely route of entry in commercial/industrial environments.

The mist is discomforting to the gastro-intestinal tract.

EYE

The mist is discomforting to the eyes and is capable of causing a mild, temporary redness of the conjunctiva (similar to wind-burn), temporary impairment of vision and/ or other transient eye damage/ ulceration.

Not considered an irritant through normal use.

SKIN

The material may be slightly discomforting to the skin.  
if exposure is prolonged.

INHALED

The vapour/mist is discomforting to the upper respiratory tract and lungs.

Acute effects from inhalation of high vapour concentrations may be chest and nasal irritation with coughing, sneezing, headache and even nausea.

WARNING: Intentional misuse by concentrating/inhaling contents may be lethal.

Not considered an irritant through normal use.

CHRONIC HEALTH EFFECTS

Principal routes of exposure are usually by skin contact and inhalation of vapour/spray mist.

CALLINGTON HAVEN TOP OF DESCENT  
INSECTICIDE

Hazard Alert Code:  
MODERATE

Chemwatch Material Safety Data Sheet  
Issue Date: 4-Jun-2003

Revision No: 2

Chemwatch 16747  
CD 2006/4

As with any chemical product, contact with unprotected bare skin; inhalation of vapour, mist or dust in work place atmosphere; or ingestion in any form, should be avoided by observing good occupational work practice.

WARNING: Aerosol containers may present pressure related hazards.

### Section 12 - ECOLOGICAL INFORMATION

Marine Pollutant: Not Determined

Refer to data for ingredients, which follows:

D-PHENOTHRIN:

Synthetic pyrethroids are examples of optimised insecticidal activity, selectivity and tailored environmental persistence. Through modifications of both acid and alcohol portions of the ester, compounds of desired residual activity have been synthesised whilst maintaining a biodegradable ester linkage. These compounds are generally very toxic to crustaceans and fish in laboratory bioassays. Under field conditions, however, the residues are tightly bound in sediment, and ingested residues are readily metabolised. Their toxicity in natural systems are generally less than laboratory test data might indicate. They are generally non-persistent in the environment.

Pyrethrins are generally unstable in the presence of light, are hydrolysed rapidly under alkaline conditions and oxidise rapidly in air. Vapour phase pyrethrins may combine chemically with ozone to produce hydroxy radicals.

Because agricultural dose rates are low and biological degradation is generally rapid, residues are unlikely to attain significant levels. Permethrin disappears from ponds and streams within 6-24 hours, pond sediments within 7 days and foliage and forest soil within 58 days. Pyrethroids are highly toxic to fish; the bioaccumulation factor of cypermethrin in fish is approximately 1000 when measured experimentally, although the potential for significant toxicity is not reached in fields. Under aerobic conditions in soil, permethrin degrades in a relatively short time (half-life 28 days).

Drinking Water Standards:  
pesticide 0.1 ug/l (UK max.).

### Section 13 - DISPOSAL CONSIDERATIONS

- Recycle where possible

Otherwise ensure that:

- licenced contractors dispose of the product and its container.
- disposal occurs at a licenced facility.

CALLINGTON HAVEN TOP OF DESCENT  
INSECTICIDE

Hazard Alert Code:  
MODERATE

Chemwatch Material Safety Data Sheet  
Issue Date: 4-Jun-2003

Revision No: 2

Chemwatch 16747  
CD 2006/4

Section 14 - TRANSPORTATION INFORMATION

Labels Required: NON-FLAMMABLE COMPRESSED GAS  
HAZCHEM: 2Y

UNDG:

Dangerous Goods Class:	2.2	Subrisk:	NONE, NONE
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UN Number: 1950      Packing Group: NONE

Shipping Name: AEROSOLS

Air Transport IATA:

ICAO/IATA Class:	2.2	ICAO/IATA Subrisk:	None
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UN/ID Number: 1950      Packing Group: None

ERG Code: 2L

Shipping Name: Aerosols, non-flammable

Maritime Transport IMDG:

IMDG Class:	2	IMDG Subrisk:	SP63
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UN Number: 1950      Packing Group: None

EMS Number: F-D,S-U      Marine Pollutant: Not Determined

Shipping Name: AEROSOLS

Section 15 - REGULATORY INFORMATION

POISONS SCHEDULE

None

REGULATIONS

d- phenothrin (CAS No:51186- 88- 0):

No regulations applicable

No data available for d- phenothrin as CAS: 51186- 88- 0.

Section 16 - OTHER INFORMATION

REPRODUCTIVE HEALTH GUIDELINES

These exposure guidelines have been derived from a screening level of risk assessment and should not be construed as unequivocally safe limits. ORGS represent an 8-hour time-weighted average unless specified otherwise. CR = Cancer Risk/10000; UF = Uncertainty factor: TLV believed to be adequate to protect reproductive health: LOD: Limit of detection Toxic endpoints have also

CALLINGTON HAVEN TOP OF DESCENT  
INSECTICIDE

Hazard Alert Code:  
MODERATE

Chemwatch Material Safety Data Sheet    Revision No: 2    Chemwatch 16747  
Issue Date: 4-Jun-2003    CD 2006/4



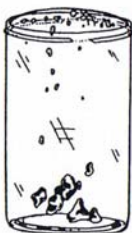


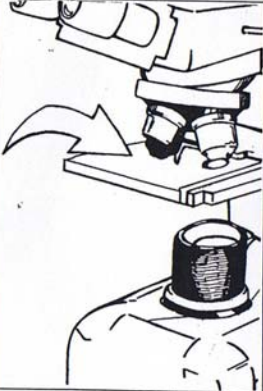
been identified as: D = Developmental; R = Reproductive; TC = Transplacental carcinogen Jankovic J., Drake F.: A Screening Method for Occupational Reproductive American Industrial Hygiene Association Journal 57: 641-649 (1996).

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### APPENDIX 3

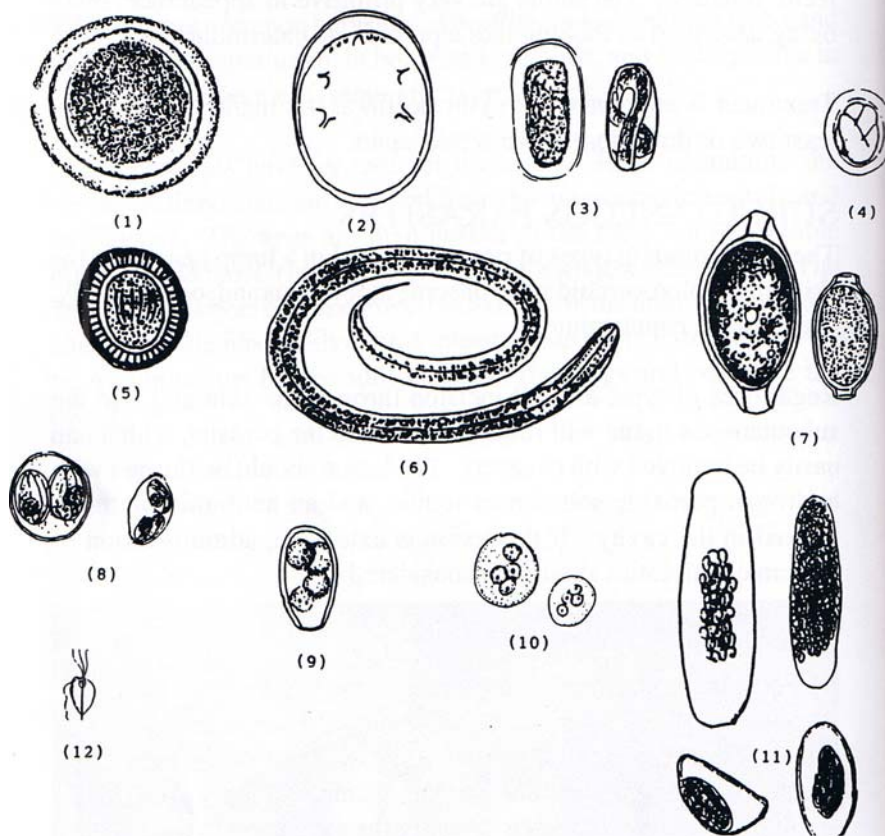
## FLOTATION TECHNIQUE FOR CONCENTRATING EGGS AND OTHER PARASITIC STAGES

<p><b>Flotation technique for concentrating eggs and other parasitic stages</b></p> <p>Fecal flotation is based on the principle of differences in specific gravity. When feces are mixed in liquids of high specific gravity and allowed to stand, the worm eggs, oocysts, and protozoal cysts float to the top while the heavy fecal debris sinks to the bottom. The top film of concentrated material can then be removed and examined.</p>	
	
<p>1) A lump of feces the size of a raisin is placed in a pill vial</p>	<p>2) The vial is filled 2/3 full with the flotation solution and stirred vigorously to break up the fecal material</p>
	
<p>3) More flotation solution is added until it "brims" over the top of the vial</p>	<p>4) A glass coverslip is placed on top of the brimming fluid and is allowed to sit 10 minutes</p>
	
<p>5) The coverslip is removed and is turned moisture side down on a waiting microscope slide</p>	<p>6) The slide is placed on the microscope stage and is carefully examined</p>



## APPENDIX 4

### DIAGNOSTICALLY IMPORTANT PARASITES, THEIR INFECTIVE STAGES, AND RELATIVE SIZES



- |  |   |
|--|---|
| 1) Ascarid (roundworm) ova   | 7) <i>Capillaria</i> sp. ova                |
| 2) Pentastomid ova   | 8) <i>Isospora</i> cyst (coccidia)          |
| 3) <i>Kalicephalus</i> (hookworm) ova                              | 9) <i>Eimeria</i> cyst (coccidia)           |
| 4) <i>Rhabdias</i> , <i>Entomela</i> , or <i>Strongyloides</i> ova | 10) <i>Entamoeba invadens</i> cyst (ameoba) |
| 5) <i>Taenia</i> sp. (tapeworm) ova                                | 11) Oxyurid sp. (pinworms) ova              |
| 6) <i>Strongyloides</i> larva                                      | 12) Trichomonad (protozoan)                 |

## SUPPLY COMPANIES

Virkon®S : Broad spectrum disinfectant.  
Intensive Farming Supplies Australia;  
4/9 Cardiff Court, Cavan SA 5094  
PO Box 2467,



Dry Creek SA 5094.  
Ph: (08) 8349 8077

F10      Chemical Essentials Pty Ltd  
13 Abelia street,  
Doncaster East,  
Victoria, 3111  
03 9841 9901 Fax 03 9841 9909  
[chemicalessentials@bigpond.com](mailto:chemicalessentials@bigpond.com)

Bleach      Trojan Bleach  
2 – 6 Perry Street,  
Campsie,  
NSW 2194  
02 9789 3366 Fax 02 97873232

Frozen Rats and Mice  
Rays Frozen Rodents for Reptiles  
38 Hatfield street,  
Mascot  
NSW 2020  
Mob # 0438 008 472  
[Roco7985@bigpond.net.au](mailto:Roco7985@bigpond.net.au)

Frozen Rats and Mice, Rabbits Quail, Chickens  
Critter-Snax  
PO Box 274  
Ourimbah  
NSW 2258  
Ph/Fax 0243628558  
Mob 0425200309

Hoop Bags, Hooks and Head Pinners  
Jeff Banks  
Ph 02 96257561

## Personal Communications;

Cogger, Harold: 2006. Personal communication 5/6/06 Email

Dear John,

My apologies for the delay in getting back to you.

The current taxonomic situation with the tiger snakes is a bit of a dog's breakfast. There is little agreement about the number of species and subspecies, despite the enormous variation in size, body form, colour pattern and toxins/toxicity. Until a solid phylogeny/taxonomy based of molecular data is complete (I'm pretty sure that Steve Donnellan and Mark Hutchinson at the South Australian Museum are working on it) my preferred position is that of Laurie Smith and Ron Johnstone in their 2002 revision of Storr, Smith & Jonstone's "Snakes of Western Australia". They treat all tiger snakes as a single species (*Notechis scutatus*) with a series of regional and island subspecies. What they actually say is "probably a single species with two or three moderately well differentiated subspecies".

Certainly I'm not convinced that anyone can confidently separate the taxa in *Notechis* without ultimately depending on geographic information. In your husbandry manual I think my approach would be to recognise a single species and list the names applied in the literature to various geographically delineated populations, cite their published diagnoses and point out that the taxonomic status of each (whether as subspecies or distinct species) awaits further work.

Regards,

Hal