

Husbandry Guidelines for **PERENTIE**



Varanus giganteus, Gray 1945
Reptilia: Varanidae

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Course Name and Number: Captive animals RUV

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DISCLAIMER

OCCUPATIONAL HEALTH AND SAFETY RISKS

The occupational Health and safety Act (OH&S), 2000 is in place to help provide a safe and healthy working environment that protects people at work from injury, illness and death in the workplace. This Act is enforced by Work safe Australia. All employers and employees should be familiar with OH&S legislation and be aware of their individual responsibilities. For further information on the OH&S Act refer to www.legislation.gov.au

The Perentie is classed as dangerous and can cause serious harm or death. Two trained keepers must be present at all times when entering this exhibit. (Pers. Comm. Mostyn, J, SWW 2009)

First Aid equipment necessary

(Contents of First Aid Kits/ trauma, Occupational Health and Safety Regulation 1989)

- Adhesive plastic dressing strips, sterile, packets of 50
- Adhesive dressing tape, 2.5 cm x 5 cm
- Bags, plastic, for amputated parts:
 - Small
 - Medium
 - Large
- Dressing, non-adherent, sterile 7.5cm x 7.5cm
- Eye pads, sterile
- Gauze bandages
 - 5cm
 - 10cm
- Gloves, disposable, single
- Rescue blanket, silver space
- Safety pins, packets
- Scissors, blunt/short nosed, minimum length 12.5 cm
- Splinter forceps, stainless steel
- Sterile eyewash solution, 10 ml single use ampoules or sachets
- Swabs, pre-packed, antiseptic, packs of 10
- Triangular bandages, minimum 90 cm
- Wound dressings, sterile, non-medicated, large
- First-aid pamphlets (as issued by the St. John Ambulance or the Australian Red Cross Society, or any other first aid pamphlet approved by the Authority)

(UWS 2007)

First Aid in case of bite or injury

- 1. Have the injured person lie down.** If possible, position the person's head slightly lower than the trunk or elevate the legs. This position reduces the risk of fainting by increasing blood flow to the brain. If possible, elevate the site of bleeding.
- 2. While wearing gloves, remove any obvious dirt or debris from the wound.** Don't remove any large or more deeply embedded objects. Don't probe the wound or attempt to clean it at this point. Your principal concern is to stop the bleeding.
- 3. Apply pressure directly on the wound.** Use a sterile bandage.
- 4. Maintain pressure until the bleeding stops.** Hold continuous pressure for at least 20 minutes without looking to see if the bleeding has stopped. You can maintain pressure by binding the wound tightly with a bandage and adhesive tape.
- 5. Don't remove the gauze or bandage.** If the bleeding continues and seeps through the gauze or other material you are holding on the wound, don't remove it. Instead, add more absorbent material on top of it.
- 6. Squeeze a main artery if necessary.** If the bleeding doesn't stop with direct pressure, apply pressure to the artery delivering blood to the area of the wound. Pressure points of the arm are on the inside of the arm just above the elbow and just below the armpit. Pressure points of the leg are just behind the knee and in the groin. Squeeze the main artery in these areas against the bone. Keep your fingers flat. With your other hand, continue to exert pressure on the wound itself.
- 7. Immobilize the injured body part once the bleeding has stopped.** Leave the bandages in place and get the injured person to the emergency room as soon as possible.

(MFMER 2008)

In the interest of OH&S it is the employer's responsibility to provide the employees with all necessary personal protective equipment (PPE) such as safety glasses, facemask, latex gloves and work gloves, apron, overalls, gum boots and hats. It is the employee's responsibility to use PPE as directed. Employers must also provide such information, instruction, training and supervision as may be necessary to ensure the employees' health and safety at work.

The employer should also develop Standard operating procedures (SOPs) for all workplace tasks. SOPs should reflect the safest way to complete any one task.

OH&S hazards can be divided into six categories. These categories are: Biological, Chemical, Ergonomic, Physical, Psychological and Radiation.

Biological: The main biological risk is zoonotic disease. Keepers may come in contact with these diseases from dirty bedding, waste products, food and water, bites or scratches, or directly from the animal. In the interest of avoiding disease a high standard

of personal hygiene should be maintained including the regular wash of hands and the use of appropriate PPE such as gloves when removing animal waste, or handling of food and water.

The following is a list of organisms that can possibly be carried by the parentie and may produce zoonotic disease.

Bacteria:

Aeromonas spp.

Campylobacter spp.

Edwardsiella spp.

Escherichia spp.

Mycobacterium spp.

Pasteurella spp.

Proteus spp.

Salmonella spp.

Staphylococcus spp.

Streptococcus spp.

Fungi:

Aspergillus spp.

Trichophyton spp.

Protozoa:

Cryptosporium spp.

Coccidian spp.

(Titmus. A, 2007)

Although many of the above are regarded as being potentially zoonotic only a few commonly cause clinical disease.

Chemical: various chemicals used when working with reptiles are hazardous. Material safety data sheets (MSDS) should be supplied for all chemicals and read before chemicals are used.

Ergonomic: the workplace and equipment used should be ergonomically designed, reducing incidences of RSI and other workplace injuries. Areas of consideration include; work bench and shelving height, cage design and location. Staff should also be adequately informed and trained in good workplace practices, for example good posture, appropriate exercises and adequate breaks.

Physical: some of the physical hazards encountered include fire, wet floors and manual handling. Staff should be trained and encouraged to follow correct lifting techniques. Staff should experience annual drills in evacuation procedures and fire safety. Charts should be displayed outlining the use of fire safety equipment, including extinguishers. Emergency phone numbers should be displayed by the telephone. There should be a first

aid officer appointed and encouragement of first aid training for all staff. In the case of individuals it is always a good idea to have some basic first aid training. Signage showing correct lifting techniques should be displayed in areas where lifting occurs. Proper equipment should be provided for the safe disposal of spills. Physical hazards also include injuries inflicted by the animals i.e. Scratch and bite wounds. A first aid kit should be supplied.

Psychological: Psychological problems which may occur include reptile, rodent or insect phobias, dealing with injured animals, euthanasia of food items and lizard deaths, euthanasia and post mortems. Staff should be provided with appropriate education. Team leaders need to encourage good communication, delegate duties accordingly, and where necessary provide qualified counseling.

Radiation: Sources of radiation hazards are Ultra Violet (UV) radiation from the sun or UV tubes. It is best to avoid UV tubes and to turn tubes off when dealing with animals. When outside wear appropriate PPE including UV protective glasses, sunscreen, hat, long sleeve clothing and avoid outdoors at high UV times. (Titmuss. A, 2007)

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1 Introduction

The Perentie is classed as dangerous and can cause serious harm or death. Two trained keepers must be present at all times when entering this exhibit. (Pers. Comm. Mostyn. J, SWW 2009)

National Parks and Wildlife Services (NPWS) list the Perentie as a Class 2 species (Species code number Z2267), indicating that the species is either rare, difficult to keep and/or potentially dangerous venomous species may be kept only under a Class 2 licence. All applicants for a Class 2 licence must be over the age of 18 years with at least 2 years experience keeping reptiles. (NPWS 2002)

WRITE THE INTRODUCTION LAST.

(general features of the species or group, history in captivity, potential contribution of the species to education, conservation and research)

Ahead of Introduction, place any OHS Warnings! Eg Toxicity. Include first aid recommendations if relevant.

May include in the introduction the following. Most of this information will be drawn from the most recent copy of Australasian Species Management Program (ASMP) Regional Census and Plan. Indicate which edition (year) is used.

1.1 ASMP Category

Is the species part of the Australasian Species Management Program?

1.2 IUCN Category

1.3 EA Category

State protection

Threatened Status

EA/State requirements / permits for movement or transfer

1.4 NZ and PNG Categories and Legislation

1.5 Wild Population Management

Relevant only if the species is threatened and being managed

1.6 Species Coordinator

1.7 Studbook Holder

2 Taxonomy

Varanid-like reptiles first appear in the fossil record during the Cretaceous period, about 100 million years ago. These fossil varanoids are called platynotans and are found throughout Europe, Asia and North America. The genus *Varanus* first appeared in the fossil deposits of the Miocene 15 to 20 million years ago, in Eastern Europe, Africa and Australia. It is likely that the genus originated in Asia and radiated outwards into Africa and Australia. The first thorough attempt to classify the living species, all of which are currently placed in the genus *Varanus*, was that of Robert Mertens. It has since been modified extensively. (King, D, Green, B 1999)

Perenties are from the family Varanidae which consists of about 30 lizards found throughout Africa, Asia, Indo-Paupuan Archipelago and Australia. All are egg laying, diurnal and raptorial. This family contains the world largest lizard, (the Indonesian Komodo Dragon *Varanus komodoensis*) and Australia's largest lizard, (the perentie *Varanus giganteus*)

Genus: *Varanus*, Merrem, 1820. All Australian members of the Family Varanidae belong to the genus *Varanus*. (Cogger, H, 2000)

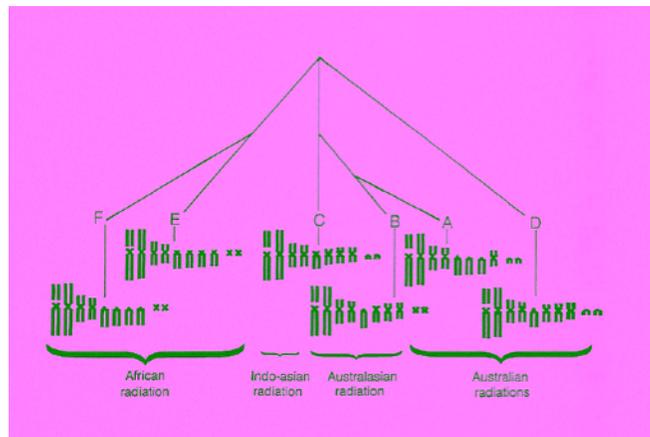


FIG 1 Chromosomal shape and relationships of varanids (King, D, Green, 1999)

2.1 Nomenclature

Scientific name: *Varanus giganteus*

Common name: Perentie

Classification

Kindom:Animalia

Phylum:Chordata

Sub Phylum:Vertebrata

Class: Reptilia

Order: Squamata

Sub Order: Scleroglossa

Family: Varanidae

Genus: Varanus

Species: giganteus

(Wikipedia 2009)

2.2 Subspecies

N/A

2.3 Recent Synonyms

Hydrosaurus giganteus -GRAY 1845: 13

Varanus giganteus -BOULENGER 1885: 320

Varanus (Varanus) giganteus - MERTENS 1942

Varanus giganteus - COGGER 1983

Varanus giganteus - DE LISLE 1996: 125

Varanus giganteus - COGGER 2000: 362

(Venter, C 2009)

2.4 Other Common Names

Goanna

Monitor

Gigantic lace lizard

Prenty

Printie

Bathawayi (aboriginal, costal and central WA)

Atypunpe (aboriginal, south eastern NT and central northern SA)

3. Natural History

The Perentie is the largest monitor lizard native to Australia, fourth largest lizard on earth after the Komodo dragon, crocodile monitor and the water monitor. Found west of the Great Dividing Range in the arid areas of Australia, they are not commonly sighted due to their shyness and remoteness of much of their range from human habitation.

The Perentie has a long neck and a snout adorned with distinctive large black reticulations, its head has a distinctive angular brow. The body is robust with a long, tapering tail. It is yellow or cream with brown rosettes edged in dark brown on the back. The limbs are darker brown, spotted with cream or yellow. The head and neck are pale creamy-white with pattern of black lines and flecks. In juveniles the pattern is more brilliant, gradually becoming more obscure with increasing size. (Cogger, H, 2000)

The varanus genus has adapted the unique ability to stand on their back legs and tail to gain a better view of the surrounding terrain. This behaviour, known as "tripoding", and is quite commonly seen in the Perentie. (King, D, Green, B, 1999)

Although it can be swift in retreat, a mature Perentie will often stand its ground when approached. It raises its body on stiffened limbs, arches its body and tail, extends the throat and gives a loud, drawn out hiss in warning. At close quarters it will lash its tail and if further provoked, will readily bite. (Parish, S 2008)

Their status in Indigenous Aboriginal culture is evident in the totemic relationship, and part of the dreaming, as well as a food source. They were favoured food items among desert Aboriginal tribes, and the fat was used for medicinal and ceremonial purposes. Many are depicted in Aboriginal art and their accompanying stories such as the piece 'Goanna Calling for Rain' and 'How the Perentie and goanna got their Colours.'

V. giganteus actively seeks partners and mates in spring. Ritual combat is known to occur in males. Females lay six to eleven eggs in a deep burrow during the summer months. Eggs overwinter with hatchlings emerging in spring some eight months after laying. Hatchlings are brightly coloured and almost 40cm TL on emergence. (Vincent, Matt 1971). Females can be double clutched in captivity. At Sydney Wildlife World in 2006 the first double clutch by a Perentie in captivity was observed. 11 eggs were produced in the first and 7 eggs in the second. (Pers.comm. Mostyn, J 2009)

2.1 Morphometrics

Head scales including the supraoculars are small, smooth and irregular.

Nostril is lateral and about twice as far from the eye as from the tip of the snout.

240-290 scales around the body.

Tail is strongly laterally compressed, except at the base, with a distinct median dorsal double keel along its hind half. The tail is about 1.3 times longer than the head and body.

Caudal scales are not keeled, and because the lower scales are larger than the upper scales, the caudal scales are not arranged in regular rings. (Cogger. H, 2000)

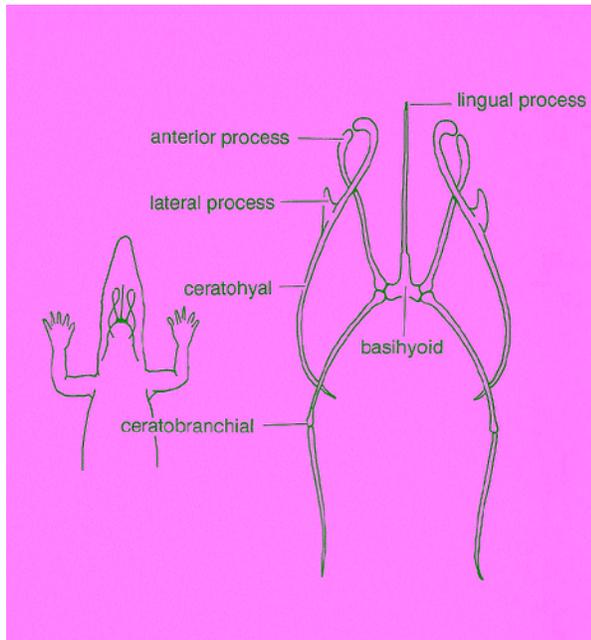


FIG2 Hyoid apparatus (King,D, Green, 1999)

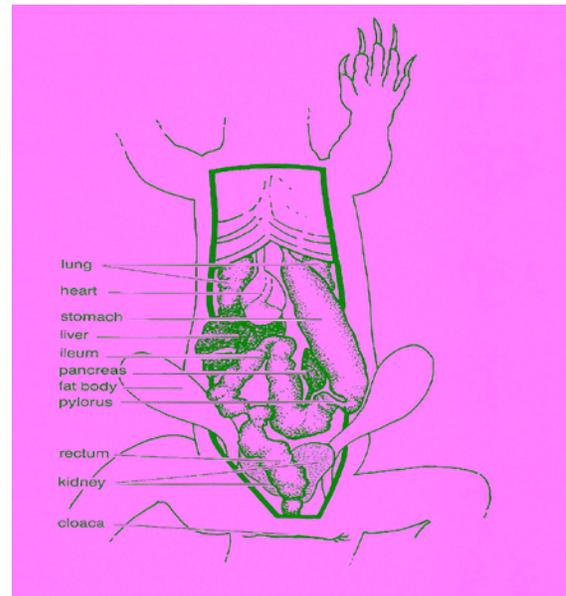


FIG3 Internal organs the genus Varanus (King,D, Green, 1999)

2.1.1 Mass And Basic Body Measurements

SV length 75 to 90cm (males)

SV length 55 to 70cm (females)

TL 150 to 250cm although the average TL is around 1.75-2 metres.

Weight up to 15 kg, maximum weight can be over 20 kg.

(Vincent, Matt, 1971)

2.1.2 Sexual Dimorphism

Male varanids generally grow faster and reach larger size than females. Two lateral bulges at the base of the tail indicate the presence of the male copulatory organs, the hemipenes. (Harold. F 1996)

Males are distinguished by their generally larger size as an adaptation for male combat for access to reproductive females. When two or more males converge on a female, combat may result especially when the males are large and evenly matched in length and weight. Larger stronger males would therefore be most advantageous in obtaining more mating by defeating rivals in prolonged wrestling matches. (Mostyn. J, 2007)

2.1.3 Distinguishing Features

The perentie has a long neck and a snout adorned with distinctive large black reticulations, its head has a distinctive angular brow. The body is robust with long, tapering tail. It is yellow or cream with brown rosettes edged in dark brown on the back. The limbs are darker brown, spotted with cream or yellow. The head and neck are pale creamy-white with pattern of black lines and flecks. In juveniles the pattern is more brilliant, gradually becoming more obscure with increasing size. (Cogger, H, 2000)

Key

TO THE AUSTRALIAN SPECIES OF VARANUS

- 1 Tail strongly laterally compressed except at the base; a distinct median double keel dorsally along the posterior half of the tail (a) 2
Tail only moderately laterally compressed or not at all; no obvious median double keel dorsally along the tail (b) ... 10
- 2 Caudal scales not arranged in regular rings, as ventral caudal scales are larger than the dorsal caudals (c) 3
Caudal scales arranged in regular rings (d), occasionally incomplete on the sides of the tail. 6
- 3 Nostrils directed laterally (e); caudal keel moderate, low 4
Nostrils directed upwards (f); a very high strong caudal keel. *mertensi*
- 4 All supraoculars small, irregularly distributed (g) 5
A series of a few distinctly broader or enlarged scales among the supraoculars (h) *indicus*
- 5 A row of enlarged scales forming a ridge on the inner edge of the basal part of the fourth toe (i) *varius*
No ridge of enlarged scales on the fourth toe (j) *giganteus*

(Cogger, H 2000)

FIG 4 Key pictures

2.1 Distribution and Habitat

Native west of the Great Dividing Range to semidry and desert regions of central and northern Australia. Prefers rocky outcrops and escarpments, but also occurs in open woodland, scrubland or hammock grassland, sand ridges and plains.
(Vincent, Matt, 1971)

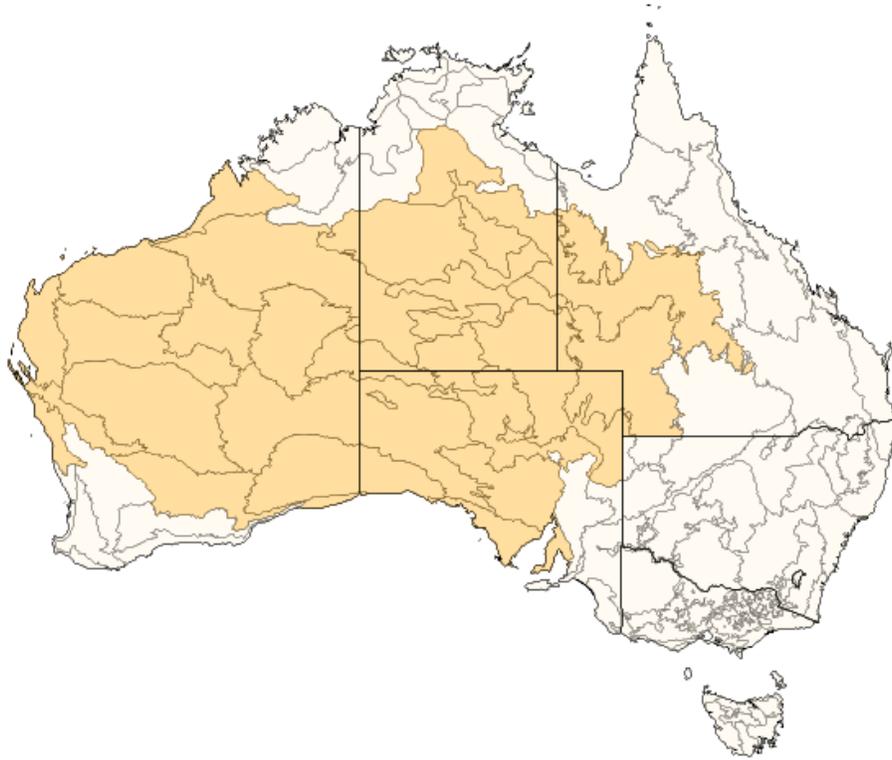


FIG 5 Distribution map
(www.environment.gov.au 2009)

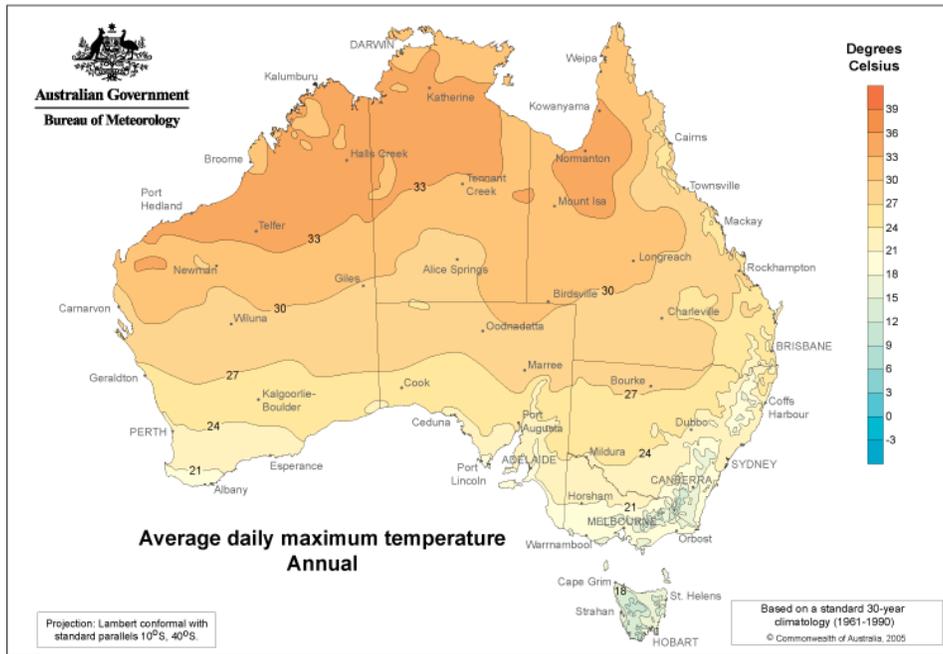


FIG 6
(Commonwealth of Australia 2009, Bureau of Meteorology)

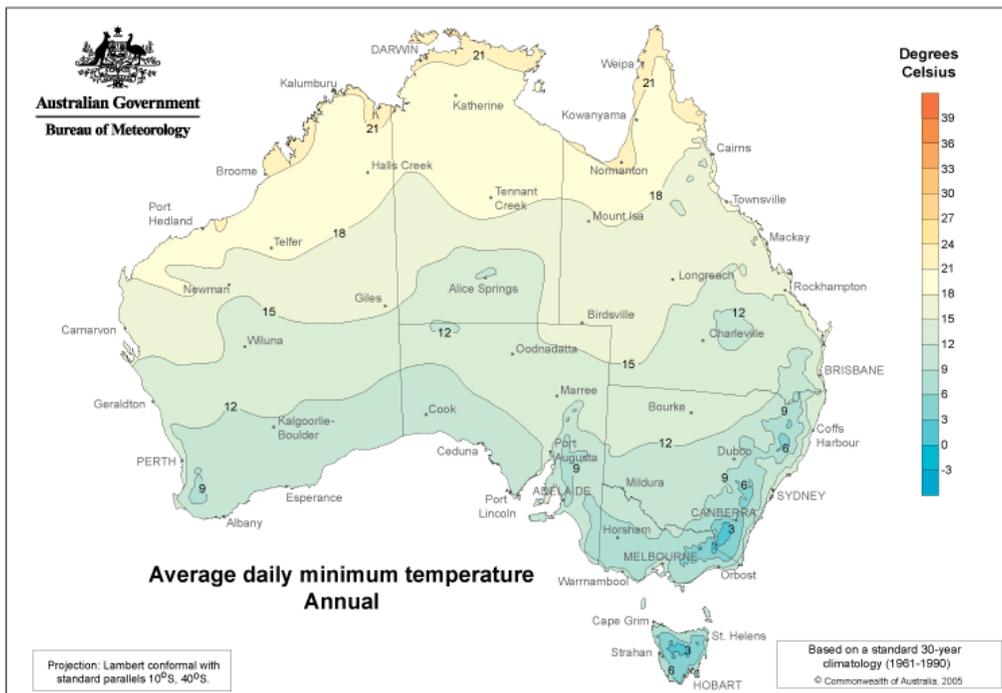


FIG 7
(Commonwealth of Australia 2009, Bureau of Meteorology)

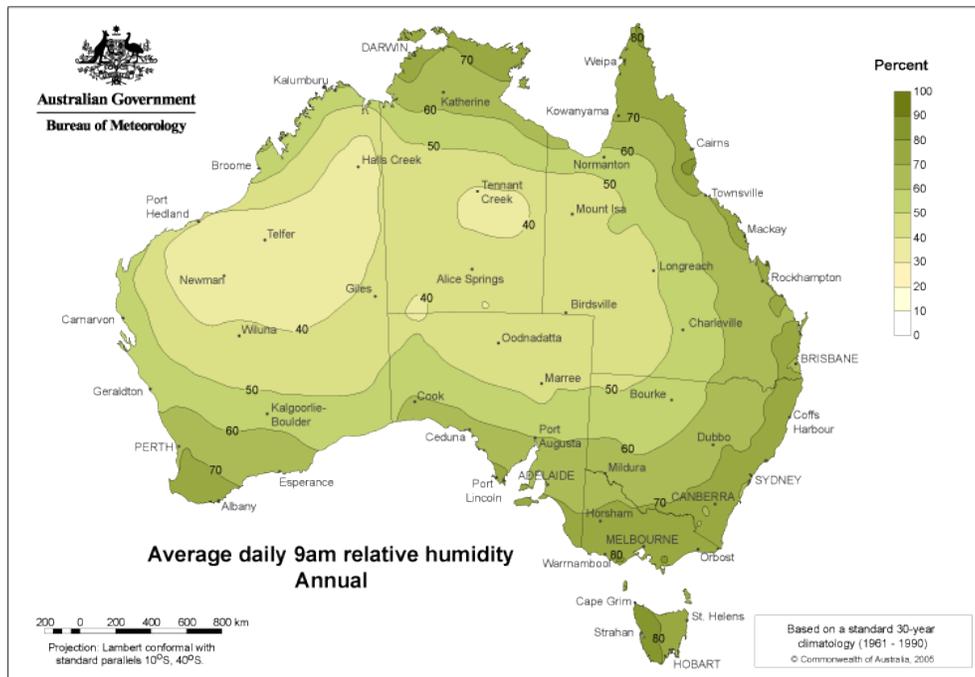


FIG 8
(Commonwealth of Australia 2009, Bureau of Meteorology)

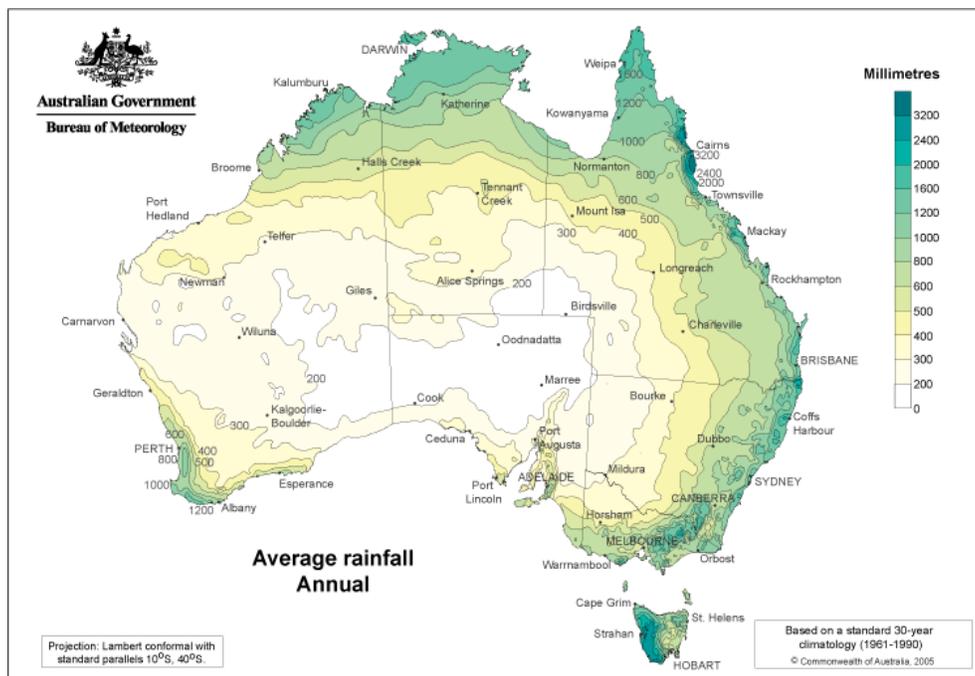


FIG 9
(Commonwealth of Australia 2009, Bureau of Meteorology)

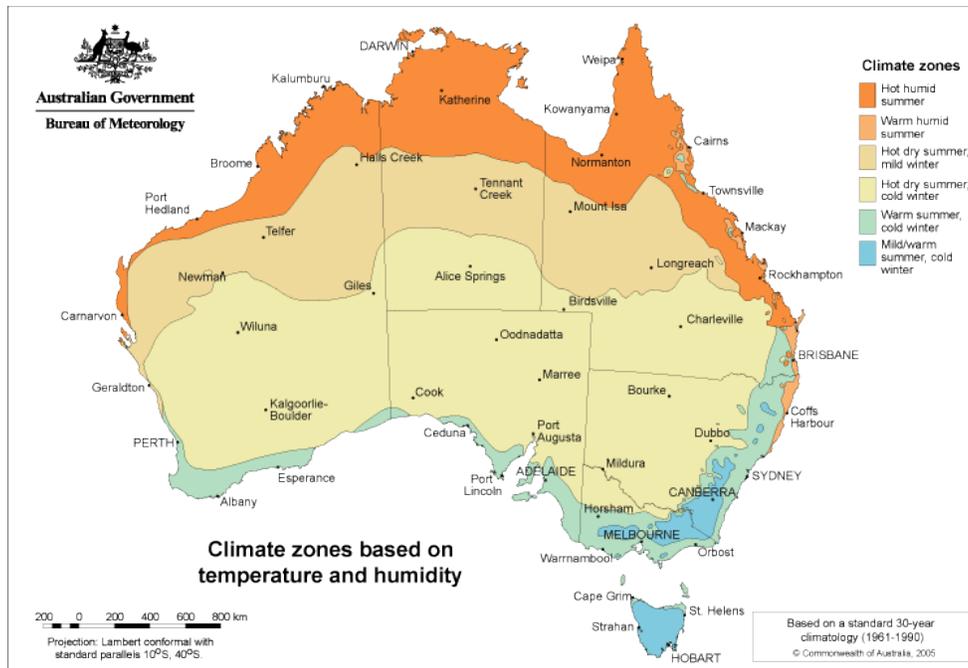


FIG 10
(Commonwealth of Australia 2009, Bureau of Meteorology)

These maps show the average annual and average monthly maximum and minimum temperatures, relative humidity levels, rainfall and climatic zones over the period 1961 to 1990.

2.2 Conservation Status

Secure, sparsely distributed, but not regarded as threatened at present.

All Australian monitors are protected by state, national and international law. The collection of wildlife for research, zoological exhibition and the pet trade is closely controlled. Commercial use for skins or meat is prohibited.

(King. D, Green. B 1999)

Not a species listed to the IUCN Red List

2.3 Longevity

2.3.1 In the Wild

Few data are available on the longevity of perentie lizards, as no long term field studies have been carried out to determine the population dynamics and survival rates of any species. (King. D, Green. B 1999)

2.3.2 In Captivity

Few data are available as they have not been kept in captivity for long enough periods of time. At least nine species of varanids are known to have lived for more than five years in captivity. Records show that the longest period that a perentie has been maintained in captivity is thought to be 19 years old and has been kept in captivity over a 5 year period. (Harold. F 1996)

Number of years other species have been kept in captivity;

V.salvador-	10 years 8 months
V.komodoensis-	16 years 7 months
V.niloticus-	15 years
V.exanthematicus-	17 years +

2.3.3 Techniques Used to Determine Age in Adults

There is no accurate method available for determining age, like other reptiles they grow at a rate that varies with the amount of food available or provided, the temperature at which they are kept and their size (larger animals will grow more slowly than smaller animals) so size cannot be used to determine age. The only way to estimate age in adults is to capture, mark and release a number of individuals, recapture and determine growth rates. This only gives an estimated guess and takes sometimes months to recapture a tagged individual. (pers. Comm... Mostyn. J 2009)

Housing Requirements

2.4 Exhibit/Enclosure Design

Enclosures can be designed for either out doors or indoors. Outdoor enclosures are encouraged for species from climatic regions similar to that of the exhibit location, thus providing a natural regime of climatic and seasonal conditions. (DPI) I have found that species of lizard's particularly eastern bearded dragons display more natural behaviors when exhibited outside rather than inside, natural behavior should always be encouraged when available.

Outdoor enclosures:

Adequate drainage must be provided for outdoor enclosures. Agricultural pipe and / or materials such as crushed sandstone can provide very good drainage. Outdoor enclosures must not be dug below ground level unless there is provision of adequate drainage. The walls of outdoor enclosures must be constructed of smooth, non-climbable barriers and should continue into the ground not less than 50 cm to prevent reptiles from escaping by climbing or burrowing out. The walls of the enclosure should be of sufficient height to prevent escape. A 45 return, angled inwards on the top of the wall, will also help prevent climbing reptiles from escaping.

Outdoor enclosures must:

- provide access to direct sunlight throughout the day;
- provide adequate hiding facilities for all reptiles housed within;
- provide adequate shade at all times of the day;
- be well drained to prevent the accumulation of water and facilitate dehydration of the substrate;
- Provide areas which are permanently covered and dry. (DPI 2009)

Security should always be considered when designing an enclosure, both for public and animal safety. Enclosures should always be designed to facilitate ease of maintenance and keeper safety/access.

Indoor Enclosures:

Indoor enclosures provide a greater degree of environmental control than outdoor enclosures, thereby allowing less hardy animals to be kept, although this is true I have found that breeding perenties in captive can be very difficult when kept indoors. Sydney Wildlife World is the only institute to have bred perenties indoors in captivity.

When keeping perenties indoor cage walls, floor and fittings must be made of impervious materials that can be efficiently disinfected and cleaned.

Indoor enclosures must be escape-proof and:

- have all ventilation holes securely screened;
- have all doors and lids fitted with latches, hooks or clasps to securely fasten the door or lid;

- be designed to facilitate ease of maintenance and keeper safety;
- Have smooth walls to reduce the likelihood of injury.

2.2 Holding Area Design

Holding areas can be used for quarantine and isolation, cleaning and maintaining exhibits, they are temporary arrangements. The enclosure must be large enough to at least allow the lizards to lay fully stretched out and to turn around. As with other housing create a thermal gradient in holding cages using heat lamps. If the lizards are being held under EAPA standards, holding cages are temporary and do not have to meet EAPA exhibit standards if the lizards are to be held for less than 3 months. (DPI 2009, A.Titmuss 2004)



FIG 11 holding cage at Sydney wildlife World (R.Ryman 2009)

2.3 Spatial Requirements

The following formula refers to the minimum floor area applicable for enclosures containing two specimens; additional space is required for more than two animals. 'L' refers to the extended length (snout to tail tip) of the longest specimens housed in the enclosure. 'SNL' refers to the extended head- body length (snout to vent) of the longest species.

Minimum floor area for 2 adult specimens = $2.5L \times 2.0L$; for each additional specimen add 20% to the area. (DPI 2009)

2.4 Position of Enclosures

Outdoor enclosures are usually only suitable for species from a similar climatic region to that of the enclosure location, as they provide a natural regime of climatic and seasonal conditions.

(DPI 2009)

Ideally position any enclosures facing a north easterly direction to take advantage of maximum sun exposure. Outdoor enclosures should be positioned so that reptiles have access to direct sunlight for at least eight hours a day in spring and summer. Enclosures need to be erected in an open area; preferably with a north easterly aspect that allows basking opportunities from approximately 8-30 am till 7-00pm during the summer months, in line with the reptiles natural activity patterns and photoperiod. This is particularly important for proper digestion of food, and embryonic development in gravid females.

(Mostyn. J 2004)

2.5 Weather Protection

Outdoor enclosures must be provided with adequate shade at all times of the day and provided with areas that are permanently covered and dry. (DPI 2009) This can be achieved by using hides, vegetation and partial enclosure cover. (Titmus A. 2004)

2.6 Temperature Requirements

Reptiles are ectothermic and maintain their preferred body temperature through behavioural means, such as the selection of micro-environments so that heat gain or loss occurs as required. Reptile activity, physiological functions and feeding occur within a narrow range of the species' preferred body temperature. Consequently, it is critical that optimal body temperatures be accommodated by the creation of a thermal gradient across the floor of the enclosure for terrestrial reptiles, or the depth of the enclosure for arboreal species. (DPI 2009)

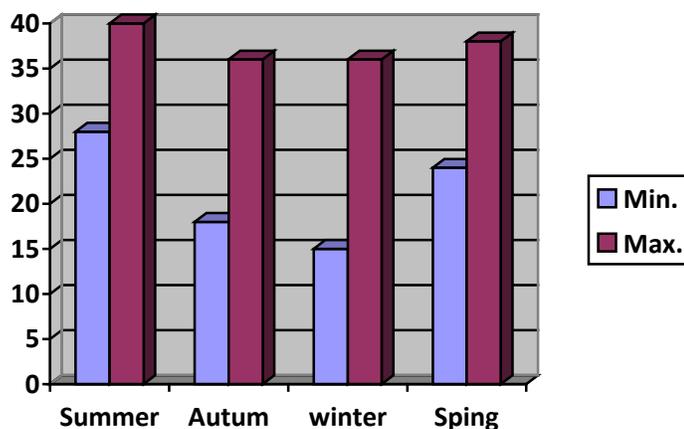
A basking spot must be provided; this allows the body to gain heat using radiant energy. It generally occurs in the morning, after lizards have emerged from their overnight shelter, but may also occur at intervals throughout the day. Red or infrared bulbs can be

used at night where nocturnal temperatures drop below those likely to be experienced in the wild (12°C-18°C). Heating equipment should always be set to a thermostat to prevent over heating. (Harold. F 1996)

The temperature of an active free ranging *Varanus giganteus* recorded using radio-telemetry, recorded over several days showed that its temperature range was 26.8-39.4°C and the mean being 35.8°C. (D. King, B. Green 1999)

Warning: care must be taken that the lizard cannot come into direct contact with any heat lamps or lights; this can result in serious harm or death to an animal as lizards do not seem to have pain receptors in their skin. (Harold. F 1996)

The temperatures of the Perentie enclosure on display at Sydney Wildlife World



Their preferred body temperature is 35-36°C (Jason Hankie SWW keeper 2009)

A thermal gradient must be provided; this can be achieved by putting the heat source to one end of the enclosure in indoor enclosures. Outdoor enclosures must be sunny but a shaded area must also be provided.

Methods of heating include the use of hot rocks, heat mats, heat strips and basking lights. At night, blue or red globes may be used for heating. Over heating the enclosure may become an issue. Enclosures can be cooled down with extra ventilation, an exhaust fan or an air conditioned room. (A.Titmus 2004)

2.7 Substrate

A variety of substrates may be used, including gravel, sand, peat, exfoliated bark and leaf litter. Soil is not recommended. Ideally a good substrate will reduce humidity. (DPI 2009) Choose a substrate that is easily kept dry, reduces odour and clumps faeces so that it can be easily removed. I have found sand substrate to be most effective and easily spot cleaned.

Substrate should be as close as possible to what it would be in a natural environment, as per EPA standards

2.8 Nestboxes and/or Bedding Material

In the wild Perentie's like to sleep up high above the ground on branches, trees, caves and rocks, this can be replicated by providing a cave like hide up high. This has been achieved at Sydney Wildlife World using a mock rock hide cave. Tall trees and braches can also provide this.

2.9 Enclosure Furnishings

Include furnishings that encourage natural behavior. Enclosure furnishings should include a large enough body of water so that the monitor can fully immerse itself without spilling. A basking site, such as a rock slab or log, should be provided under the heat source. Multiple basking sites must be provided in group situations. At least one visual barrier must be provided, such as logs, dry vegetation or hide box/ cave. (DPI 2009) Exhibited animals must be displayed in their natural environment, as per EAPA standards.

Enclosure furnishing may include:

- Trees
- Logs
- Caves
- Rocks
- Ponds
- Vegetation

5 General Husbandry

5.1 Hygiene and Cleaning

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

New animals:

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 animal into a cage, ensure that the cage and all its associated equipment is clean and has been disinfected.

Urine, wastes and uneaten food must be removed daily, and the substrate regularly replaced or is able to be easily cleaned.

Daily cleaning:

- Fecal material should be removed by spot cleaning
- Uneaten food should be removed
- Water bowls should be cleaned and disinfected after every use.
- Basking sites should be cleaned using disinfectant
- Rocks and logs/ branches/ trees can be hosed to remove faeces and urine. It is a good idea to leave a small amount of faeces each time the enclosure is cleaned, as the pheromones released mark the cage with the animals own scent.

Weekly cleaning:

- Full enclosure clean
- When a full enclosure clean is conducted the animal should be removed and placed in a holding cage.
- Hard surfaces of the enclosures must be cleaned with the same disinfectant fortnightly to prevent the accumulation of fecal matter and urine.
- When substrate is changed the caging should be cleaned with a veterinary grade disinfectant such as F10.
- All materials should come in contact with disinfectant for at least 15 minutes.
- After disinfection, the materials should be thoroughly rinsed with tap water to remove any residue chemicals that could potentially be dangerous to reptiles.
- Leave enclosures to air dry before putting new substrate in.

Monthly cleaning:

- Throw away items such as branches or other material that cannot be cleaned.
- Any large ponds may be fully drained, scrubbed and disinfected.

Yearly cleaning:

- Substrate in large sandy enclosures may only be fully changed once a year but removed of soiled sand is necessary daily.

Disinfectants to use:

- Freshly prepared solution of 0.15% dilution of sodium hypo chloride (house hold bleach), follow manufactures instructions.
- F10 is an effective against bacteria, fungi, viruses and spores. It is safe for reptile and people. It is non toxic, non corrosive and biodegradable.

Personal Hygiene:

Always wash your hands with hot soapy water before and after touching or cleaning up after any animal, after cleaning enclosures and accessories and after coming in contact with any area of the housing where reptiles are kept.

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 area thoroughly with warm water and an antibacterial soap, dry well and apply an antibacterial skin treatment.

Six stage handwashing technique



Reproduced with kind permission of the Nursing Standard

(www.eastdevon.gov.uk/google/handwashing-3.jpg)

2.10 Record Keeping

An important aspect of captive husbandry is to record and communicate information. Records should be kept in a book, such as a diary or account book. Records should be maintained for each animal providing at least the following information:

- Animal identification.
- Species, sex, mating behavior, acquisition and disposal of animals.
- Feeding date as well as quantities and type of food both offered and eaten.
- The dates of acquisition and disposal, with details of circumstances and addresses.
- The date or estimated date of birth.
- Breeding and details of any offspring.
- The date of occurrence of skin shedding and any problems encountered.
- Clinical data, including results of any physical examinations by a qualified veterinarian and details of, and date when, any form of treatment was given.
- Opportunistic measurements of body weight and snout vent length (SVL).
- The date of death and results of necropsy (where performed).

- Movements between or within institutions.

(Titmuss, A 2006)

All relevant records must accompany an animal when it is transferred to another person.

(DPI 2009)

For all reptile species for which a licence is required under the Wildlife Regulations 2002, a licensee is required to keep the following information:

- dates of acquisition and disposal, with details of circumstances and addresses;
- date or estimated date of egg laying and/or birth;
- breeding and details of any offspring;
- date of death.

In addition, it is recommended that the following information should be kept to monitor the health of reptiles:

- the date of occurrence of skin shedding and any problems encountered;
- clinical data, including results of physical examination by a qualified veterinarian and details of, and date when, any form of treatment was given;
- opportunistic measurements of body weight and lengths;
- Results of post mortem (where performed).

Methods of Identification

Cages should be labeled with a written cage card or use of a computerized bar code system identifying each animal. Depending on the number of individuals kept, depends on the intensity of individual identification. When few animals are kept it is easy to distinguish between specimens by size or markings, or a general familiarity with the animal. The greater the number of species kept, the more unreliable this method becomes.

The identification of animals is important for the following reasons:

- Social breeding management
- Health monitoring
- Specialised diet
- Medication
- Peace of mind

Methods of other identification include:

- Photography
- Physical characteristics, patterns and colour
- Tattooing
- Toe or tail clipping or tagging
- The most reliable and permanent method is the implantation of a microchip.

These chips must be implanted by a veterinarian. (King, Green 1999)

2.11 Routine Data Collection

Routine data collection includes:

Weights and measurements

Breeding

Egg laying, clutch size

Feeding Requirements

All varanid lizards are carnivorous except *V. olivaceus* and extreme generalists both within and between species. The range of the diet generally reflects prey abundance and diversity. Diet is thus highly variable, reflecting what is available in the habitat and varies with seasonal prey availability. (De Lisle H 1996)

All reptiles must be offered a variety of wholesome foods in sufficient quantities to ensure normal growth and good health unless otherwise dictated by veterinary advice or approved scientific research. The feeding regime must take care to avoid obesity, as disease problems are associated with this condition. Varanid species must be offered a natural whole animal diet. Reptiles should not be fed live food for their own protection. Live food items such as rats and mice can cause injury to animals if not eaten straight away; this can include bites, scratches, injury to eyes and even death in small specimens.

Food should only be offered when the appropriate temperature required to metabolise the food is available before, during and at least 48–120 hours after feeding.

Handling should be restricted for up to 24 hours after feeding.

Clean drinking water must be provided at all times, and must be replaced, and the container cleaned, not less than three times weekly.

Water may be provided in impervious non-spillable containers or in the form of a natural pool. Containers should be heavy enough that the largest inhabitant is unable to tip the container.

(DPI 2009)

6.1 Diet in the Wild

Wild monitors feed on a large variety of food types. Generally opportunistic, they make the most of what ever food is available and in many cases will consume any prey items they can overpower. Large monitors commonly consume carrion when available, while juveniles rely heavily on smaller prey items such as invertebrates and small reptiles. (M. Vincent, S. Wilson 1999)

The diet of wild lizards is studied either by identifying traces of prey left in faeces or by examining stomach contents. By either or both of these methods, the stomach contents of all known Australian varanids species have been examined. A high percentage of stomachs of many varanids contain no food, which indicates that prey capture is infrequent. (D. King, B. Green 1999)

Adult wild monitors may consume:

- Rodents
- Rabbits
- Birds
- Eggs
- Fish
- Carrion
- Reptiles, (even smaller animals of the same species)
- And even large marsupials like wallabies

6.2 Captive Diet

Care must be taken not to over feed, as this species is prone to obesity. (M. Vincent, S. Wilson 1999). Finding the right balance between food type and quantity is a vital ingredient when feeding. As a general rule invertebrate prey items may be offered between three to five times a week and whole mammal or bird prey should be offered about once a week during the summer months.

Monitors of all species may compete for food. In *Varanus giganteus* this is likely to result in serious injury from fighting over prey items. Separation, several feeding sites and target feeding needs to be used when a number of animals are kept within the same enclosure.

Adult captive diet may include:

- Rabbits
- Mice
- Rats
- Birds- Poultry, quail
- Guinea pigs

Juvenile captive diet may include:

- Crickets
- Cockroaches
- Grass hoppers
- Moths
- Occasional fish
- Mealworms
- Young rodents



FIG 13 Pinkie mice fed to juveniles (Rebecca Ryman 2009)

Sydney wildlife World (SWW) adult diet includes:

- Rats
- Mice
- Quail
- Day old chickens
- And calcium and vitamin powder supplemented monthly

Smaller prey items are used at SWW so that prey can be eaten whole and not needed to be ripped apart. This is to stop the male eating the female’s food when he is finished. It is also to minimise clean up and make the sight less gory to the public. At SWW the male and female are also separated to each corner when fed. (J.Mostyn pers. Comm. 2009)

Sydney Wild World yearly diet changes:

Summer, autumn and spring months	Winter Months
Fed once weekly 2-3 medium rats, quail or mice.	Feeding is reduced. Fed once fortnightly 1-2 rats, quail or mice.

Pre-paring food items:

- Prey can be either fresh killed or frozen.
- Frozen items need to be removed from the freezer prior to feeding and fully thawed.
- Feeder animals can be thawed naturally by leaving out of freezer until thawed or put in warm water. Do not put in the sun, or leave out for a long period of time. It is best to take prey out of the freezer and put in the fridge the day before needed, and then out of the fridge half an hour before use.
- Prey items must be dry prior to feeding.
- Food items need to be around 26-28 degrees c before feeding.



FIG 14, 15 Adult mice(left) day old chicken (right) (Rebecca Ryman 2009)



FIG 16 Food items fed at SWW mice, rats, day old chicken and pinkie mice (Rebecca Ryman 2009)



FIG 17 Large, Medium and small quail (Rebecca Ryman 2009)

6.3 Supplements

One of the difficulties with the feeding of varanids is that the diet provided may not necessarily fulfill the nutritional requirements of the animal, no matter how much variety is offered. Usually rodents, whole fish and birds are well balanced and highly nutritious foods that do not require supplementation. (M.Vincent, S.Wilson 1999)

Vitamins, minerals and calcium phosphate are essential for the normal functioning of metabolism, bone development and production of eggs in females. Food items may be dusted monthly with calcium and vitamin powder. Care must be taken to avoid over vitamin/ mineral overdosing and ensure correct dietary calcium: phosphorus ratios. (DPI 2009) Commercially prepared supplements such as, Repti-cal and multi-vitamins designed for reptiles, such as repti-vite can be sprinkled over food items. Following the product directions will ensure adequate nutrition without overdose. (refer to FIG 19, 20) Vitamin C is also important when keeping monitors in captivity. (especially with indoor exhibits) vitamin C can be injected into the tail of the monitor or injected into food items before being fed out. SWW injects vitamin C into rats on occasion before feeding. (pers.comm John Mostyn SWW Reptile keeper)

6.4 Presentation of Food

Food items may be either be placed directly into the enclosure, or offered to individuals on the end of grabs. The food can be jiggled in front of the lizard using the long handled grabs. (refer to FIG 13). Food presented should be completely thawed, and temperature of around 26-28 degrees c



FIG 18 Grabs, (Rebecca Ryman 2009)



(Feeding perentie at SWW 2010)

Behavioral enrichment feeding:

There are many enrichment strategies being used in captive monitors, basically anything that enriches the lives of the monitor and encourages natural feeding behavior or replicates feeding in the wild without harm to keepers or the animal itself or other animals within the enclosure can be used.

- Food items may be buried in the substrate (sand is preferred) meaning the monitor would have to smell out the food and dig to find its prey. This makes for great enrichment and also for public viewing. (J. Mostyn SWW pers. Comm. 2009)
- Scatters are also a great enrichment activity, numerous small prey items can be hidden around the enclosure, and this increases physical activity.
- Placing prey up the top of trees or in hard to get rock crevasses can also be good behavioral enrichment.
- At The Australian Reptile Park food items are place in boxes which are glued up so the animal has to scratch and dig to open the box. (Pers..comm. Cory Reptile park)

Please note: live food should not be used as enrichment as the prey items can injure monitors if not eaten straight away.

2.12 Diet in the Wild

The diet of lizards is studied either by identifying traces of prey left in faeces or by examining stomach contents. By either or both of these methods, the stomach contents of all known Australian varanids species have been examined. A high percentage of

stomachs of many varanids contain no food, which indicates they prey capture is infrequent. (D. King, B, Green 1999)

2.13 Captive Diet

The captive diet includes; rabbits, mice, rats, quail, guinea pigs.

Care must be taken not to over feed, as this species is prone to obesity. (Vincent, Matt, 1971)

(List diets used successfully in captivity, including any information on diet changes at different times of the year. Itemise the range of diets offered by different institutions and give reasons why the diet varies.)

Handling and Transport

When a reptile or amphibian must be moved, transporting should be done in such a way that stress and the possibility of physical injury are minimised.

Care must be taken to avoid exposure of reptiles to extreme temperatures during transport.

Transport containers must not be placed in direct sunlight, water or draughts. (DPI 2009)

7.1 Timing of Capture and Handling

An aggressive monitor is difficult to catch, particularly when their body temperature rises during the hot part of the day. Therefore it is more appropriate to catch an animal in the coolest part of the day (the early morning). Large monitors are extremely powerful and should not be handled by inexperienced keepers. If a handler is bitten by a small monitor during handling the monitor will often be reluctant to release its grip. The use of a small quantity of any kind of alcohol in its mouth will normally prompt a release. The use of long welders gloves and full length clothing may help to avoid injury to exposed skin. (M. Vincent, S. Wilson 1999)

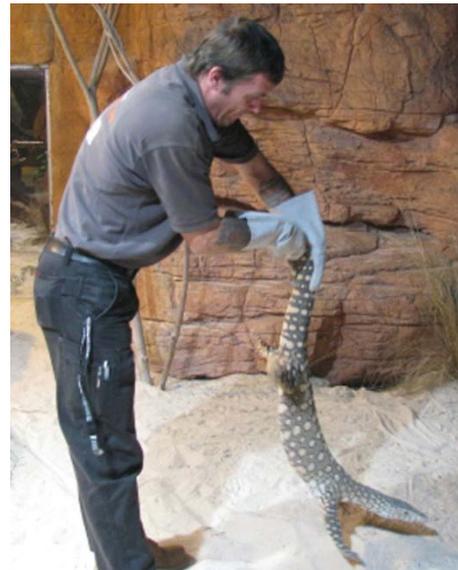
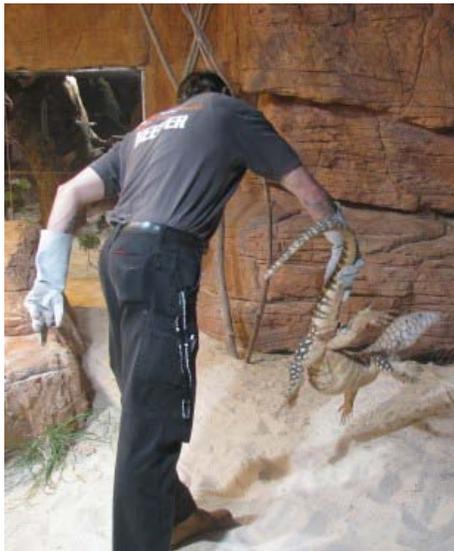


FIG 19,20 (J. Mostyn SWW restraining perentie 2007)



FIG 21 correct holding technique of monitors (Mostyn. J SWW 2009)

7.2 Catching Bags

Catching bags are not used when catching this species. They have very powerful claws which can easily destroy calico bags. Individuals are caught up with physical restraint. Refer to 7.3 (pers. Com Hanky. J SWW reptile keeper 2009) When physically caught and restrained the animal can then be put in a bag that is zip tied and double bagged.

7.3 Capture and Restraint Techniques

All monitors should be restrained around the neck, close behind the head, with the front legs restrained against the tail, and the tail restrained. Depending on the size of the animal this may require one or two people. It is easier to achieve restraint when the animal is pressed firmly to the ground or tree while being manipulated into this position.

Chemical restraint: should be performed by a qualified vet. As monitor lizards can cause serious harm, animals should be anaesthetised in able to perform a detailed examination on the animal. Detailed examinations should be performed seasonally or on a yearly basis. Inhalation anaesthesia is recommended for small and medium-sized specimens. For large animals medicinal muscle relaxation followed by endotracheal intubation and inhalation anaesthesia using an anaesthesia machine is suggested.

I/ m: Injection sites in monitor lizards are located in the fore- and hind-leg muscles, tail muscles.

S/c: in loose skin above ribs

I/v: ventral tail vein



FIG 22 (J.Mostyn and keeper restraining parentie using heshen bag 2007)

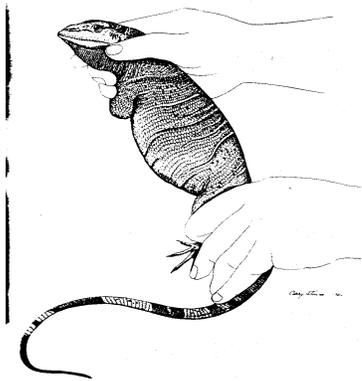


FIG 23 Restraining small monitor (TAFE reptile and amphibian subject book, 2008)

Restraint using a cloth
Bag to cover eyes
SWW 2010



7.4 Weighing and Examination

When weighting adult monitors:

It is most important that the animal is well restrained, this involves the use of tape or cable ties over the mouth, the monitor can then be restrained in a strong material bag and weighed using a large and hanging scale.

- At least two people should be present
- First capture and restrain animal using techniques in 7.3
- Then mouth can be taped closed, ensuring that nostrils are not covered.
- A physical examination of the head, legs, cloaca, and body can then be performed.
- Monitor can then be placed in bag which is then zip tied
- The bag is then attached to hanging scales.
- Weight can be recorded
- Animal can then be restrained and the bag carefully removed, tape removed from mouth
- When releasing everyone should be out of the enclosure except the handler
- The animal can then be released using a forward pushing movement in to an open area.
- Handler should exit immediately after release.

This method is used at Sydney Wildlife World. (pers. Comm... Hanky. J, Mostyn. J SWW 2009)

- Juvenile monitors can also be placed in holding bins and then weighed on scales.

Please note: any materials used to restrain the animal need also to be weighed and subtracted from total weight.



FIG 24 Holding bin at SWW (Rebecca Ryman 2009)

7.5 Release

When releasing monitors it should be done in the early morning, this allows a complete day to read adjust itself to the enclosure and feel secure. Monitors should not be released during the night as they do not settle in. Monitors should be restrained correctly (shown in FIG 21) everyone but the handler must be out of the enclosure, and must take all equipment out with them. Face the monitor to a clear area because it will most likely try to quickly get away after release and if face towards a wall or solid object it could run into it and injury itself. Face the monitor with its head away from your body, and with a forward pushing movement release the monitor. Remove yourself from enclosure as soon as possible.

7.6 Transport Requirements

Labeling and marking:

- The container must be correctly labeled and marked with the consignees name, address, and telephone number.
- Labels must not block ventilation holes
- The container must be marked 'LIVE ANIMAL' and have 'THIS WAY UP' labels affixed to all four sides. Reptile common name and scientific name must be noted on the 'LIVE ANIMAL' label.

A person who consigns a live reptile must:

- Attach appropriate labels to the container which clearly identifies the type of reptile being consigned and if the reptile is dangerous or venomous. The container should also be marked 'fragile', 'this way up.'
- Attach to the outside of the container an envelope containing a consignment note showing the consignor's name and address, the consignee's name and address, wildlife licence details (if required for the species being consigned), the date of dispatch, the number of reptiles dispatched, and the common name and scientific names of the species of reptile.
- Write the name and address of the consignee and consignor on a label fixed to the container.
- do not place specimens of different species, or specimens of greatly differing size of the same species within the same bag for transportation;

(DPI 2009)

IATA Size requirements

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.

- Enclose the reptile within a strong, dry, durable, porous linen bag which is secured with tape or ties. The bag is then enclosed by a sufficiently ventilated, escape-proof, rigid container. A cardboard box is not a suitable container. Any empty space should be padded with shredded paper to prevent excessive movement within the container.
- Styrofoam is preferable as it has insulating properties. Keep in dark area with minimal noise ensuring container is away from thermal extremes and direct sunlight. Never keep in these conditions longer than is needed.

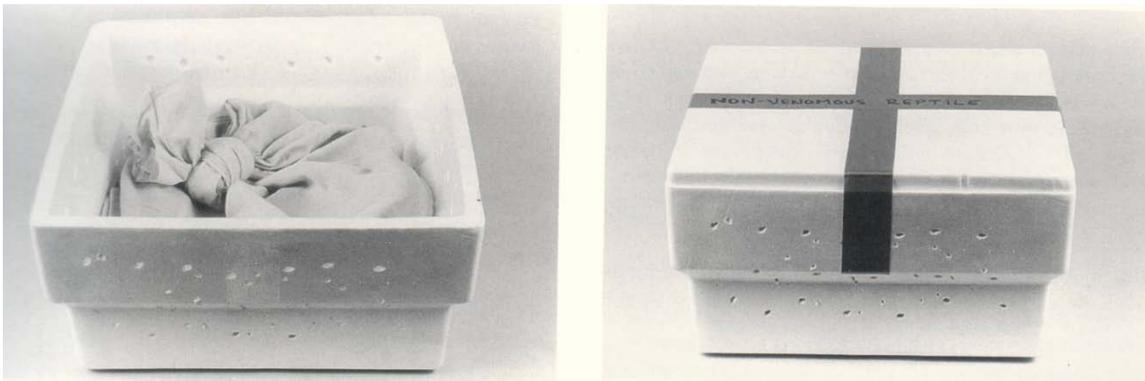


FIG 25 Styrofoam inner transport box. (TAFE reptile and amphibian subject book, 2008)



FIG 26,27,28 Crocodile transport tube used at SWW (Rebecca Ryman 2009)

Crocodile transport tubes can also be used to transport large monitors. The Tube shown in FIG 26,27 and 28 is a tube that was used to transport a fresh water crocodile. It has been specially modified with a hinge door and rope attached to it. This allows easy release of an animal.

7.6.2 Furnishings

When transporting monitor lizards, there should NOT be any furnishings included in the container or cloth bags.

IATA Box Requirements

7.6.3 Water and Food

Reptiles must not be transported unless they have been maintained for a sufficient time prior to departure at a temperature that will ensure complete digestion of any ingested food. Reptiles must not be fed during transport. Water need not be supplied during normal transport time. Under severe delay and under certain circumstances watering may be recommended if advised by a specialist. (DPI 2009) Reptiles must have access to water prior to transport and upon arrival to prevent dehydration. Lizards must be provided with water for at least 24 hrs prior to transportation. (Mostyn. J 2004)

7.6.4 Animals per Box

It is recommended that varanids are individually placed in calico bags and transport boxes.

7.6.5 Timing of Transportation

The timing of transportation is important for reptiles. You do not want to transport a reptile in the middle of the day in summer, where temperatures are 40 degrees c. it would be better to transport them in the early morning or late afternoon. In winter, it would be best to transport the animal in the middle of the day opposed to early morning or late afternoon. (Mostyn. J 2004)

7.6.6 Release from Box

When releasing monitors it should be done in the early morning, this allows a complete day to read adjust itself to the enclosure and feel secure. Monitors should not be released during the night as they do not settle in.

Release from box can be done by facing the box to a clear area and releasing door made easy if it can be hinged with a rope attached so you can be well clear of the door. The monitor will more than likely run out away and not try to turn towards you. When released handler should exit enclosure immediately. If you need to physically need to remove the animal from box first refer to 7.5.

Health Requirements

8.1 Daily Health Checks

Distant physical examinations can be performed on unrestrained individuals and may involve the estimation of length and nutritional status of the animal, as well as noting any changes in smells, behavioral changes, and over all body condition. Distant physical examinations should be done on a daily basis to ensure anything unusual can be picked up quickly.

Animals should be observed daily for any signs of injury or illness. The most appropriate time to do this is generally each morning when the enclosure is being cleaned.

Observations should include:

- The amount or consistency of feces
- Locomotion
- Behavior
- Smell
- Sounds

Signs of illness may include:

- Lack of alertness: eyes closed much of the time, or cloudy, or swollen
- Not feeding. Remember it is normal for monitors to feed little or not at all during the winter.
- Difficulty in breathing as evidence by gaping or collection of mucus around nostrils or mouth.
- Cuts, scratches, or sores should be treated at once as they can develop into abscesses
- Lumps or swelling under the skin
- Swollen toes or feet
- Bloody feces; diarrhea

8.2 Detailed Physical Examination

Restrained animals can be given a more detailed thorough examination as they can be turned over for close examination of the underside and cloaca. A Detailed physical examination should be done monthly or seasonally. Full vet checks should be conducted at least yearly with the animal under anesthetic so a more detailed examination can be done, findings recorded on individual animal records.

M. Vincent, S. Wilson (1999)

Detailed physical examination may include:

- **Cloaca:** should be clean, check for faeces around the cloaca
- **Eyes:** Should be clear, bright and alert, no discharge or secretions should be present
- **Nostrils:** should be clean. If discharge is present swab for pathogens The nostrils and ears are a favored resting place for ticks, which tended to clog up both openings.
- **Body condition:** Monitors and other lizards tend to show body condition in the tail, the tail should be well rounded at the base and pelvic bones should not be visible in a healthy animal.
- **Weight:** is recorded and compared to the previous weights recorded. Trends in body Weight can give a good general indication of the animal's state of health; provided age, sex and geographical location are taken into account.
- **Mouth:** should be clean and free of any lumps or swelling. The tissues in the mouth should be uniformly pink. Red spots or yellow cheesy matter are signs of mouth rot.
- **Fecal sample:** perform a qualitative faecal float to test for parasites, done yearly or seasonally.
- **Blood sampling:** Blood should be tested on a yearly basis by a qualified vet. Maximum blood sampling volume should be no more than 10% of the animals total body weight. Blood should be taken from the ventral tail vein.

8.2.1 Chemical restraint

Chemical restraint should be performed by a qualified vet. As monitor lizards can cause serious harm, animals should be anesthetised in able to perform a detailed examination on the animal. Detailed examinations should be performed seasonally or on a yearly basis. Inhalation anaesthesia is recommended for small and medium-sized specimens. For large animals medicinal muscle relaxation followed by endotracheal intubation and inhalation anaesthesia using an anaesthesia machine is suggested.

I/ m: Injection sites in monitor lizards are located in the fore- and hind-leg muscles, tail muscles.

S/c: in loose skin above ribs

I/v: ventral tail vein

8.3 Routine treatments

Small cuts and abrasions are common in monitors, for wounds and abrasions a topical administration of disinfectants for example povidone-iodine, chlorohexadine can be administered to prevent infection.

Because of the complexities involved in identification of endoparasites and the necessity to accurately weigh specimens to be treated, the eradication of internal parasites is best left to a qualified reptile vet.

Here are a few recommendations and dosages:

- Cestodes- tapeworm

Bunamidine- may be given orally at a dose rate of 50mg/kg and repeated in 14 days

Praziquartel- may be administered orally or intramuscularly at a dosage rate of 5-8mg/kg and repeated in 14 days

- Nematodes- roundworm

Levamisole- injectable intraperitoneal treatment administered at a dose rate of 10mg/kg and repeated after 14 days

Mebendazole- administered orally at a dose rate of 20-25mg/kg repeated after 14 days

(R. Bartlett, P Bartlet 1999)

8.4 Known Health Problems

Most problems may be avoided by paying close attention to appropriate husbandry, feeding and hygiene. In most cases reptile keepers following this rule will avoid major problems. 8.4.1 shows a list of the most common health problems encountered by monitor lizards. Skin and foot infections are possibly the most commonly seen disorders in long term captive monitors. (Harold. F 1996)

8.4.1 Ecto-parasites

Cause: Mites, less than pin head size white dots usually found around the eyes.

Signs: signs of irritation such as rubbing, white dots over body

Diagnosis: Physical examination and skin scraping

Treatment: The use of commercial reptile mite insecticides, manufactures direction should be followed.

Prevention: Always quarantine new animals and maintain good hygiene practices

Cause: Ticks

Signs: Skin irritation, continual rubbing, lethargic behaviour

Diagnosis: Physical examination

Treatment: Ticks should be removed individually when seen by spotting alcohol directly onto the tick, wait a couple of minutes for the tick to withdraw its mouth parts, it can then be gently removed with tweezers.

Prevention: Ticks are hard to prevent as they can come in on substrate or branches there is no real prevention.

8.4.2 Endo-parasites

Cause: round worm, tape worm, nematods and protozoans.

Signs: Weight loss, lethargic behavior, loss or gain in appetite

Diagnosis: fecal floatation

Treatment: Levamisole- injectable intraperitoneal treatment administered at a dose rate of 10mg/kg and repeated after 14 days or Mebendazole- administered orally at a dose rate of 20-25mg/kg repeated after 14 days

Prevention: routine worming treatment

8.4.3 Respiratory disorders

Cause: may be the result of low temperatures, damp conditions and depressed immunity due to endo-parasite burden or stress

Signs: sneezing, lethargic behavior, rapid, erratic or labored breathing, lack of appetite, gasping and the presence of mucus in the nostrils and mouth.

Diagnosis: physical examination

Treatment: immediately elevation of temperature and removal of stress factors or parasite burden. Antibiotic treatment may be necessary.

Prevention: Ensure temperature and humidity are checked daily, note that the preferred temperature of *Varanus giganteus* is 35- 36°C. If animal is prone to endo-parasites a worming program may need to be put in place.

8.4.4 Diet related problems

Metabolic bone disease

Cause: usually the direct result of poor feeding most likely to occur in juveniles and reproducing females.

Signs: inactivity, jerky movements, swollen limbs, deformities such as poor shape, shortened jaws, 'rubber' jaw, odd shaped limbs, inability to lay eggs in females.

Diagnosis: physical examination

Treatment: If disorder occurs feeding, temperatures and supply of UV radiation should be reviewed. Increased exposure to UV radiation usually has immediate positive effect although treatment is a very long slow process.

Obesity

Cause: overfeeding, poor diet, inactivity, low temperatures.

Signs: rapid increase in weight

Diagnosis: Physical examination

Treatment: animal should be placed on strict diet with increased exercise and higher temperatures.

Prevention: balanced diet, correct enclosure temperature, adequate exercise such as climbing.

Impaction

Usually only occurs in juveniles

Cause: Impaction can be caused by various sources. The most common of which is housing them on loose substrates. Other causes of impaction include feeding food that is either too large or inappropriate feeding at temperatures too low for digestion. Mealworms, rodent hair, and fine sand particles have been known to cause problems in juvenile monitors.

high risk substrates include:

- Play sand
- Pine
- Aspen

- Cypress
- Woodchips
- Dirt
- Bark.

Signs:

Mild signs include:

- constipation and bloating of the abdominal region

Moderate to severe signs:

- lack of appetite
- regurgitation
- difficulty breathing
- paralysis
- Slight leg tremors

Diagnosis: ex-rays

Treatment: If you are able to catch impaction early on, you can set up the reptile in a different enclosure, or reformat the current one. Include an under tank heater to help achieve appropriate temperatures. Administer a few drops of mineral oil, olive oil, or vegetable oil, daily. Give the reptile warm soaks at least once a day, as well. Make sure to not let the water get hotter than the reptiles normal basking temperatures.

You want to try to get as much fluids in the reptile as you can without too much force. Try giving the reptile diluted Gatorade or pedialyte by using a dropper.

Prevention: Feed size appropriate foods. Make sure the temperatures in the enclosure are not too low or too high. Using a digital thermometer with a probe, you can accurately determine the temperatures in the enclosure.

8.4.5 Other health problems

Toe and tail constriction

Cause: some monitors may have difficulty sloughing from their tail tips or toes if kept in inappropriate temperatures or humidity.

Signs: loss of extremities from loss of blood flow to affected areas, discolouration of affected area.

Diagnosis: Physical examination

Treatment: repeatedly soaking the animal in warm water and removing the skin.

Prevention: allow animal access to suitably high basking temperatures, elevate humidity or keep one section of the substrate permanently moist, and provide a water body large enough for the animal to be able to completely submerge itself.

Overgrown claws

Cause: claws not being worn down. Some large species may have trouble wearing down their claws in captivity.

Signs: long claws may ultimately result in foot deformities.

Diagnosis: physical examination

Treatment: Claws can be trimmed with dog nail-clippers but be careful not to cut the quick. In large specimens this may need to be done under anesthetic.

Prevention: Provides enclosure furnishing that will naturally wear down claws such as tree branches to climb.

Abrasions and cuts

Cause: Most cuts and abrasions result from the presence of sharp or abrasive objects in an enclosure, unsuitable substrate or wounds as a result of fighting. The most common type of abrasion is snout rubbing around the face in attempt to escape. This can become serious as the animal will continue to damage its face unless modifications are made to the existing enclosure, or the animals are moved to a new area.

Signs: redness or swelling, uneasy locomotion, bleeding

Diagnosis: physical examination

Treatment: In all cases causative agents should be removed. A treatment will depend on the severity of the wound. Minor cuts and abrasions generally heal without intervention, and if muscle tissue is not severely damaged wounds may be best left alone. If you feel the need to apply treatment to any cuts or abrasions a simple disinfectant can be used and the area should be covered to protect it from dirt until healed.

Prevention: ensure there are not sharp objects in enclosure; keep a eye on aggression within an enclosure especially in breeding season and watch for early signs of snout rub. M. Vincent, S. Wilson (1999)

Ulcers

Cause: Tail whipping and hitting glass, furniture, rocks etc

Signs: infection, redness, swelling

Diagnosis: Physical examination

Treatment: Once infection has set in parts of the tail may die and need to be amutated to stop the spread of infection. Antibiotics such as..... needs to be given to clear up any infection. Antiseptic cream can be then be applied to the tail and then the wound should be covered with a bandage. The bandage should never be wraped too tight as this can lead to poor circulation, bandages should also always finish at the top of the tail to stop substrate from getting in when tail drags on the ground.

Prevention: Always comply with EAPA standards. Enclosures should not be cluttered and keepers should stay together while in the exhibit as not to unknowingly corner and to reduce stress.

Juvenile monitors are prone to cataracts. The cause is unknown, perhaps dietary. Blindness may or may not result. There is no treatment. Puffy eyes are usually a sign of systemic disorder rather than a problem with the eyes themselves. (Harold. F 1996)

8.5 Quarantine Requirements

It is always good practice to quarantine new animals, it is advised that all transport materials should be considered potentially infested with parasites and treated accordingly. This includes disinfecting or incinerating them. Quarantine facilities must be provided for the isolation of specimens for a minimum of 30 days but this period may vary depending on the source of the specimen and any potential associated disease risks. (Recommended 60 days by M. Balsai 1997) A newly-acquired animal must be kept in isolation for as long as may be necessary to provide for its examination, acclimatisation and, if necessary, restoration to good health before being placed in the company of other animals.

Things that may affect quarantine duration include:

- Diseases incubation periods
- Where the animal is being obtained from
- Any finding from vet checks
- Treatment time if something is found

New animal quarters should be cleaned last and no handling of other reptiles should take place after the handling of quarantine animals if possible. Each quarantine area should have its own set of husbandry tools which should not come in contact with main collection (M. Balsai 1997). The quarantine area must have the ability to cater for individual isolation and be spatially separated from other reptiles and must be accessible for disinfection (NSW DPI 2004)

Tests that should be performed in quarantine:

- Fecal floatation
- Fecal smear
- Physical examination
- Blood sampling
- Blood smear

NOT COMPLETED STILL DOING THURSDAY CLASS FOR THIS TOPIC

3 Behaviour

3.1 Activity

3.2 Social Behaviour

3.3 Reproductive Behaviour

3.4 Bathing

3.5 Behavioural Problems

3.6 Signs of Stress

3.7 Behavioural Enrichment

3.8 Introductions and Removals

3.9 Intraspecific Compatibility

3.10 Interspecific Compatibility

3.11 Suitability to Captivity

4 Breeding

The success rate of breeding varanids in captivity has increased dramatically due to far greater understanding of the lizards and their needs. Breeding is the ultimate goal in successful keeping. (Vincent. M, Wilson. S 1999)

3.12 Mating System

Courtship in most lizards is often stereotyped with display patterns distinctive at least to the genus. Varanids lack any distinctive visual display. Being solitary animals for most of the year, monitor courtship seems primarily aimed at conveying information that the approach of the male to the female is nonaggressive.

3.13 Ease of Breeding

Monitors raised in captivity since they were hatchlings appear to breed more readily than wild caught adults but captive breeding in varanids is an art that is still in its infancy. Records have shown that females can be left with the male for only a week before she begins to show signs of stress from not being able to escape the male's constant persute, but in saying that, a pair of perenties are kept together on exhibit year round at SWW with no problems. SWW is also the only institution to breed perenties in an indoor enclosure. (Harold. F 1996)

3.14 Reproductive Condition

3.14.1 Females

3.14.2 Males

3.15 Techniques Used to Control Breeding

3.16 Occurrence of Hybrids

3.17 Timing of Breeding

The time of egg laying varies considerably, being tuned to environmental conditions but usually lay in late spring or early summer. Ovulation in the female seems to be triggered by a combination of photoperiod, temperature, and humidity cues which vary not only between species but also among differed geographical population of the same species. Since females are receptive for only a few weeks timing is crucial. (Harold. F 1996)

3.18 Age at First Breeding and Last Breeding

3.19 Ability to Breed Every Year

3.20 Ability to Breed More than Once Per Year

Female monitors of several species if not all species are able to lay multiple clutches in a season. At SWW in 2008 2 clutches were laid in one breeding season, the first clutch was 11 and the second 7.

3.21 Nesting, Hollow or Other Requirements

Very little information on natural nesting among varanids is available. In the wild Perenties are reported to excavate nests in the ground, especially in the sandy banks of creek beds. Termite nests make perfect incubators, when available, because they protect the eggs from predators and provide nearly perfect conditions of temperature and moisture for developing young.

3.22 Breeding Diet

Most females will cease eating 2-4 weeks before egg- laying.

3.23 Incubation Period

Eggs are incubated over winter and hatch in early spring ,around 8 months after they are laid.

3.24 Clutch Size

Clutch size is generally related to body size, larger specimens will have larger clutches. sizeUsually between 1 and 35 eggs

3.25 Age at Weaning

3.26 Age of Removal from Parents

3.27 Growth and Development

4 Artificial Rearing

4.1 Incubator Type

There are many methods of incubating reptile eggs in various substrates. The majority of successful hatchings have occurred using vermiculite or perlite or sand and peat or a mixture of both can be used successfully as a substrate.

Recommended method:

1. Mark the top of the eggs at their highest point
2. Remove the eggs from the egg laying site immediately- be careful not to turn them.
3. Weigh and measure them, and place them in a clear container, half buried in a mixture of vermiculite and water or perlite and water which should be 1:1 by weight.
4. Place the container in incubator at temperatures between 27 and 31 degrees celcius.
5. Throughout the incubation period the container should be checked periodically for water loss.

4.2 Incubation Temperature and Humidity

Temperature gradient of 20-35 degrees celcius

4.3 Desired % Egg Mass Loss

In gravid *V. rosenbergi* eggs mass equals 40% of female's body weight

4.4 Hatching Temperature and Humidity

4.5 Normal Pip to Hatch Interval

Hatchling varanids will slit their egg and protrude their snout, and often sit with their heads out of the egg for several hours, sometimes for up to two days, before fully emerging. Some eggs may need to be slit manually with a razor blade if they fail to hatch within several days of the others in the clutch. If the yolk sac is still present upon emergence, the young should be transferred to another container in the incubator until the sac is absorbed. Hatchlings left in the incubator must have access to fresh air; this may be achieved by making a small hole in the incubation container. (Vincent. M, Wilson. S 1999)

4.6 Diet and Feeding Routine

Juvenile monitors are highly insectivorous and need to be fed daily. A mistake that is often made is attempting to feed too large an animal.

Juvenile captive diet may include:

- Crickets
- Cockroaches
- Grass hoppers
- Moths
- Occasional fish
- Mealworms
- Young rodents

Food items can be dusted with calcium powder and vitamin powder every few days.

4.7 Specific Requirements

Because monitors will fight for food and basking areas they should be kept single or in small groups of the same size. Fighting in juveniles can lead to injuries such as bite, scratches and loss of limbs. If perenties are kept in groups multiple basking areas must be provided and each should be feed separate to ensure all are getting enough food and warmth.

4.8 Data Recording

Data which should be recorded:

- Dates eggs are laid
- Number of eggs laid
- Number of clutches laid
- Egg weights and measurements
- Hatch dates
- Deaths
- Feeding records

4.9 Identification Methods

Hatchlings can be identified using:

- Micro chips
- Photos
- Coloured markings used on tail
- Tags

4.10 Hygiene

Hygiene is very important when it comes to reproduction. Gloves should always be used when handling eggs and hatclings.

4.11 Behavioural Considerations

Hatchlings should be kept single or in small groups that are around the same size. Monitors will compete for food and basking lights and smaller animals will miss out.

4.12 Weaning

N/A

5 Acknowledgements

6 References

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Personal communication

Hanky. J Sydney Wild Life World Reptile keeper

Mostyn. J Sydney Wild Life World head Reptile keeper

Images

FIG 11- websites, viewed 10/6/09, veemd.files.wordpress.com/.../handwashing-31.jpg

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7 Glossary

(of terms used that may not be easily understood without explanation/definition)

8 Appendix

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

8.1 Safety Data Sheet - Bleach

Classified as hazardous according to the criteria of Worksafe Australia

8.1.1 Section 01 Identification

MSDS:	Rev 2 Date: 06 August 2003
Domestic Trade Name:	Bleach
Other Names:	Hypochlorite Solution, Bleach Solution, Hypo.
Manufacturers Product Code:	None Allocated
UN Number:	1791
Dangerous Goods Class:	8
HAZCHEM Code:	2X
Poison Schedule Number:	None Allocated
Use:	Bleaching Agent, Disinfectant

8.1.2 Section 2 Physical Description / Properties

Appearance:	Clear, green-yellow liquid having a chlorine odour. Bleach is strongly corrosive and a moderate oxidising agent.
Boiling Point or Melting Point:	110°C (15% available Chlorine)
Vapour Pressure:	Not Available
Specific Gravity:	1.1
Flash Point:	Not Available
Flammability Limits:	Not Available
Solubility in Water:	Aqueous Solution

8.1.3 Section 3 Other Properties

pH of Concentrate:	12 (approximately)
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8.1.4 Section 4 Ingredients

Chemical Name:	CAS Number:	Proportion:
Sodium Hypochlorite [NaOCl]	7681-52-9	10% weight / volume

Sodium Hydroxide [NaOH]	1310-73-2	0.8%
Water	-	Remainder

8.1.5 Section 5 Health Effects

Acute:	Corrosive and irritating if swallowed or ingested. Dangerous when in contact with the eyes.
Swallowed:	Severe internal irritation due to corrosive effect.
Eye:	Severe irritation and burns.
Skin:	Irritation and burns.
Inhaled:	Irritation of respiratory tract, resulting in coughing and breathing difficulty caused by chlorine fumes.
Chronic:	If condition persists, seek further attention.

8.1.6 Section 6 First Aid

Swallowed:	Wash out mouth with water and give water to drink. Do not induce vomiting.
Eye:	Irrigate immediately with water for 15 minutes and seek medical attention.
Skin:	Wash with large amounts of water. Remove affected clothing and wash underlying skin.
Inhaled:	Remove from exposure. Keep warm and at rest.

8.1.6.1 Section 6B First Aid Facilities:

Advice to Doctor:	Treat symptomatically.
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8.1.7 Section 7 Precautions for Use

Exposure Standard:	There are no exposure limits available.
Engineering Controls:	Use in open or well ventilated areas.
Personal Protection:	Wear PVC gloves and chemical goggles. An acid resistant respirator to AS 1716 is recommended if spray mists are produced during use. It is recommended that a shirt with long sleeves and long trousers be worn. Always wash skin and clothing after using this product.
Flammability:	Non-flamable.

8.1.8 Section 8 Safe Handling Information

Storage and Transport:	This product is classified as non dangerous according to the ACTDG. Store in plastic containers in a clean, dry, cool, well ventilated place away from foodstuffs, other oxidising agents and acids. Store and transport in an upright container. Containers must be carefully vented to release
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Spills and Disposal:	any pressure build-up. Minimise leak and or contain spills. Collect as much of the spillage as possible. Keep pH of the remaining spilled solution above 7.0 and dilute it with large amounts of water. Avoid contact with acids. Add soda ash to the cleanup liquid to minimise release of chlorine gas during cleanup.
Fire / Explosion Hazard	This product is not flammable under the conditions of use and does not support combustion. The product is stable and will not polymerise. It is incompatible with strong acids, metals, metal salts, peroxides and other oxidising agents and with reducing agents. It decomposes on exposure to heat or light. Upon heating or upon contact with acids, this product may emit toxic fumes, including chlorine gas which has a TLV of 1 ppm; 3 mg/m ³ – peak exposure. Source: NOHSC (under review). If the product is involved in a fire, fire fighters should wear self-contained breathing apparatus as well as PVC gloves and chemical goggles. Fire fighters should fight any fires with dry chemical, carbon dioxide, vaporising liquid or foam extinguishers or water delivered in a fine spray or fog if available.

8.1.9 Section 9 Other Information

Sodium hydroxide solution Acids, Temperature, Metals and Aging is chemically sensitive to:

8.1.10 Section 10 Contact Point

Customer Service: 1300 307 755

Emergency Advice: 1300 307 755

8.1.11 Important Notes

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 should read this MSDS and consider the information in the context of how the product will be handled and used in the workplace including in conjunction with other products.

The user should contact the Solo Pak Customer Service Department if clarification or further information is needed to make an appropriate risk assessment of the use of this material.

REPTI-CAL



Product Information

Natural Phosphorus Free, Calcium & Vitamin D3 Supplement
FOR ALL REPTILES & AMPHIBIANS

Calcium deficiency is a major dietary problem with captive reptiles and amphibians. Maintaining a correct calcium:phosphorous (Ca:P) ratio in the diet of 1:1 to 1.5:1 is equally important nutritionally as adequate calcium intake. Commonly used food sources such as Crickets, Meal Worms and Mice contain high levels of Phosphorous and low levels of calcium.

Repti-Cal assists in balancing the Ca:P ratio by providing a natural phosphorous free calcium source together with vitamin D3 to assist in absorption from the intestinal tract. Repti-Cal is manufactured from natural oyster shell ground to a ultrafine powder with added vitamin D3.

Active Constituents:
350mg/g Calcium (as Calcium Carbonate)
70iu/g Cholecalciferol (Vitamin D3)

Directions For Use:
Mix with vegetables, fruits and pastes at approximately 1/2 Tablespoon (9g - 0.02Lbs)

per 500g (1.1Lbs) of food. Before feeding insects: Place Repti-Cal in a plastic bag, add insects and shake slowly until insects are completely coated.

Storage:

Store below 30°C (Room Temperature) in a cool dry place.

FIG 20 Repti-cal (Pets Mighty Mart 2009)

Repti-Vite

Product Information

Concentrated Multi-Vitamin, Mineral, Amino Acid Supplement
FOR ALL REPTILES & AMPHIBIANS

Directions for Use:

Mix with vegetables, fruits and pastes at approximately 1 level teaspoon of Repti-Vite (4g - 0.01Lbs) per 500g (1.1Lbs) of food.

Before feeding insects:

Place Repti-Vite in a plastic bag, add insects and shake slowly until insects are completely coated.

Storage:

Store below 30°C (Room Temperature) in a cool place, protect from light. Keep container tightly closed.

Disposal:
Clean empty container can be recycle

FIG 19 Repti-vite (Pets mighty mart 2009)