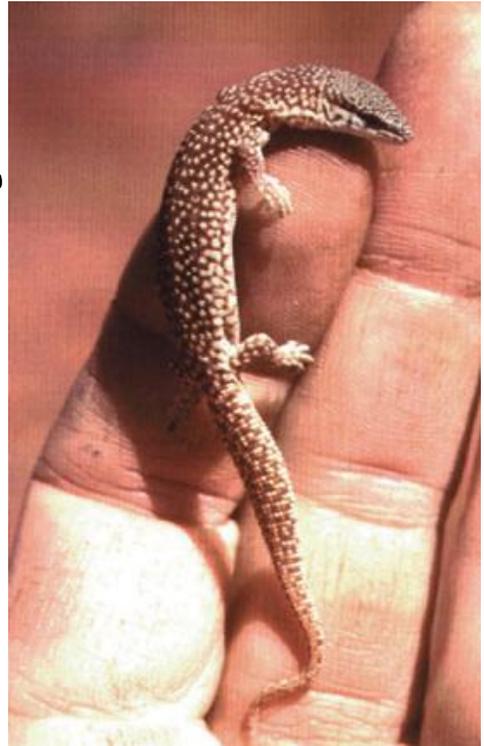


Husbandry Manual for

Short Tailed Monitor

Varanus brevicauda

(Reptilia: Varanidae)



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1 Introduction

The Hazards to remember working with a short tailed monitor is the bending and reaching into the cage, which if done on a regular basis will cause back injuries. So when cleaning enclosures it is important to use correct posture and appropriate cleaning tools if available.

Also being bitten by a *Varanus brevicauda* doesn't pose an immediate threat, although if the bite site is not cleaned, infection may occur.

2 Taxonomy

2.1 Nomenclature

Class - Vertebrate

Order - Reptilia

Family - Varanidae

Genus - Varanus

Species - brevicauda

2.2 Subspecies

In my research I have found that no sub species have been recorded so far.

2.3 Recent Synonyms

In my research I have found that no recent synonyms have been recorded so far.

2.4 Other Common Names

Short Tailed Monitor

Short Tailed Pygmy Monitor

Pygmy monitor

(Vincent, Wilson, 1999)

(Wilson, Swan, 2003)

3 Natural History

Varanids are the largest group of Squamata on the planet, which include the largest lizard the Komodo dragon (*Varanus komodoensis*). Australia is home to both the largest order Varanid after the Komodo dragon, which is the Perentie (*Varanus giganteus*) as well as the worlds smallest Varanid, the short tailed pygmy monitor (*Varanus brevicauda*).

Varanus brevicauda or the short tailed pygmy monitor is the smallest varanid species in the world growing to a maximum length of 23cm. It is entirely a terrestrial animal. It is a reddish brown colour with dark circular like flecks on the body. It is found on sandy dunes that are predominantly spinifex, as they burrow under them for shelter in the arid regions of central and Western Australia. However they have also been viewed in the wild climbing through the spinifex grass, to hunt.

As the *V.brevicauda* is the smallest species of Varanid in the world and is very secretive more research is needed to ensure their numbers in the wild are maintained, even though their conservation status is secure.



(Vincent, Wilson, 1999)
(C. James)

3.1 Morphometrics

3.1.1 Mass And Basic Body Measurements

The head and body length of *V.brevicauda* is 11 – 12cm and its total length is 20 – 23cm. A specimen that is fully grown (23cm) will weigh approximately 6 grams. When they hatch they measure approximately 8-10cm in length from snout to tip of tail, and weight anywhere between 1.3-3 grams

(Vincent, Wilson, 1999)

3.1.2 Sexual Dimorphism

Sexing technique for this species is not yet known. Although because of its similarities to the Spiny Tailed Monitors it is believed that their hemipenal organs may be visible on X-ray. By studying the behaviour of the animal a sex can be determined. The males will fight each other, and the females will obviously become gravid and lay eggs. With *Varanus acanthurus* sexing can also be done by head size, although due to the size difference this cannot be done with *V. brevicauda*. Popping of the hemipenes is not very accurate due to the small size of the species.

(Vincent, Wilson, 1999)
(Reptiles Australia)

3.1.3 Distinguishing Features

The *V.brevicauda* is the smallest species of Varanidae known in the world. All *V.brevicauda*, *V.storri* & *V.primordius* are closely related and are similar in the fact that they all are coloured yellow to reddish brown with dark circular looking flecks. However it is distinguished between *V.storri* & *V.primordius* by its size, as it is a few centimeters smaller. Also it has a ridged tail that is equal to or shorter than its snout to vent length which is more “spine- nosed” than that of *V.primordius*. A feature that distinguishes *V.brevicauda* from *V.storri* is the *V.storri* has a dark streak between the eye and ear and a much longer tail compared to *V.brevicauda*. The short tailed monitor is also known for its prehensile tail.



(Vincent, Wilson, 1999)
(Wilson, Swan, 2003)

3.2 Distribution and Habitat



V.brevicauda is found exclusively in the arid regions of Australia which include central and coastal Western Australia, southern Northern Territory, Western Queensland and north-western South Australia. It lives on sandy dunes which are predominantly spinifex grass and stone. This is because this species is a burrower, and will burrow underneath the spinifex grass for shelter. However they will also take shelter under rocks, and are very opportunistic, and will frequently be found under scrap sheet metal if presented with it.

(Vincent, Wilson, 1999)

3.3 Conservation Status

upon first glance there doesn't appear to be many of them in the wild, however, through studies that have been conducted on this species, there are up to 40 animals per hectare

were their habitat is at its best. They are not found on the IUCN red list criteria, which indicates its state of well being of numbers in the wild.

(Vincent, Wilson, 1999)

3.4 Diet in the Wild

A short Tailed Monitors wild diet consists of smaller species of lizards, such as skink, and even their eggs. They will also eat a variety of insects, including crickets and cockroaches. Being a monitor it is very opportunistic and will eat anything that comes its way, including carrion.

(Vincent, Wilson, 1999)

3.5 Longevity

3.5.1 In the Wild

No data on the longevity of *V. brevicauda* in the wild is available as no long term field research has been conducted.

(King, Green, 1999)

3.5.2 In Captivity

Unable to find any published data on the longevity of *V. brevicauda* although *Varanus gouldii* has been found to live for an average life span of 7 years in captivity.

(King, Green, 1999)

3.5.3 Techniques Used to Determine Age in Adults

There is no general way to determine the age of *V. brevicauda*'s, it is just taken from their health and appearance. For example an old short tailed monitor may have a lot of dry skin around the eyes from multiple bad sloughs, it may be a lot slower than others or it may frequently develop abscesses. An exact age is never able to be determined in the short tailed monitor. Also older animals will have a larger snout to vent length and tail length. And upon dissection the older males will have larger gonads than young males.

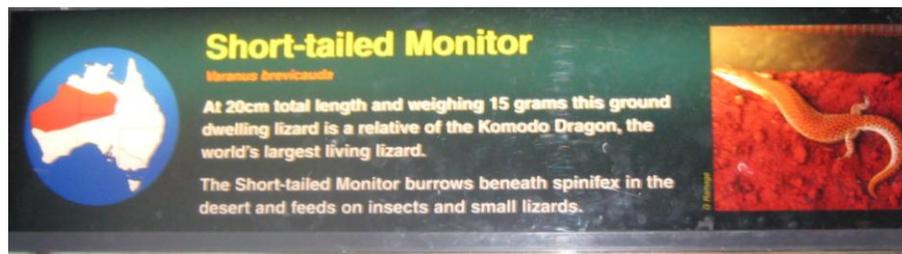
(Taronga)

(C. James)

4 Housing Requirements

4.1 Exhibit/Enclosure Design

As *V. brevicauda* is entirely a terrestrial species that lives in the arid regions of central and Western Australia, so the enclosure should have more floor area than height. It is important to have the enclosure deep enough for burrowing purposes and to be able to withstand a heavy amount of substrate. The enclosure should not be too large for the specimen, keeping in mind that it is the smallest Varanid in the world, so the number of animals being housed needs to be taken into account. Also when designing an enclosure, make sure it is escape proof and has plenty of airflow.



It should also have areas where the specimen can feel like it cannot be seen which is away from the heated end of the enclosure. That look natural and simulate its natural environment. Like spinifex grass is good as it occurs naturally in its habitat, and it gives the animal a place to hide.

It will also need the appropriate full spectrum Ultra violet lighting, along with heating either from a heat mat under the substrate at one end of the enclosure, or a spot globe. Make sure which ever heating option is chosen that only one end of the enclosure is heating leaving a cool end for the animal to escape to. This is known as a thermal gradient. If a good thermal gradient is not adhered to it can cause the animal to overheat and may ultimately cause death.

When designing areas to put enclosure furniture, be aware that *V. brevicauda* is a burrowing species, so all heavy rocks and others alike should be in a position so that if/and when the animal burrows underneath it, it will not fall on top of it, crushing the tiny Varanid.

I don't recommend an outdoor exhibit as the monitoring of the temperatures and other environmental factors become very difficult. And the environmental requirements that are needed to keep this species at its optimum are not normally found throughout Australia, except the central parts of Australia. Even if the specimen is kept within its natural distribution, as they are quite small and would make a poor exhibit. So I will not give any recommendations on an outdoor exhibit as I do not recommend it.

(Vincent, Wilson, 1999)

(King, Green, 1999)

4.2 Holding Area Design

An area that is to hold a short tailed monitor should be escape proof, this includes having a lock or latch on the enclosure lid. But still allow easy and ergonomically safe cleaning. Also to have surfaces that are easily cleaned and disinfected. It should still have enough space to create a thermal gradient. So heating should still be supplied to the holding enclosure.

The special requirements for the holding area is described in the next section (3.3 Spatial Requirements)

(Taronga)
(EAPA Vers. 5)

4.3 Spatial Requirements

The special requirements of all reptiles, not just *Varanus brevicauda*, include things such as; the area needs to be large enough so an adequate temperature gradient can be reached, sufficient space must be provided both in length and height to ensure that the specimens behavioral needs are met. 20% of the minimum floor space area must be added for each additional specimen housed.

The following formulae are only guides as the needs of different species differ, hence changing their special requirements. Though for our *Varanus brevicauda* these special requirements are more than sufficient.

The minimum floor area for two specimens is 2 ½ lengths X 2 ½ lengths of one specimen. However if it is only going be a temporary display enclosure the requirements differ, 1 ½ lengths X 1 ½ lengths of one specimen. And seeing as the short tailed monitor is a terrestrial lizard, its minimum height of the enclosure is 40cm. This information is gathered from the EAPA Guidelines, that can be found in the appendix of this document.



(EAPA Vers. 5)

4.4 Position of Enclosures

If this species is to be housed in an indoor glass enclosure, it is important to position it out of direct sunlight, and in an area where it can get fresh flowing air without a draft.

If this species is to be housed outside more precautions of positioning is required. A mesh top should be provided to prevent birds attacking the specimen. And it should have a solid bottom to prevent the specimens from burrowing out. If the species *V. brevicauda* is not found where the outdoor enclosure is proposed to being built, I do not recommend an outdoor enclosure as extra heating will be required to meet this species temperature and humidity requirements. Because I do not recommend outdoor exhibits for this species I wont go into detail about it.

(Pers Comm)

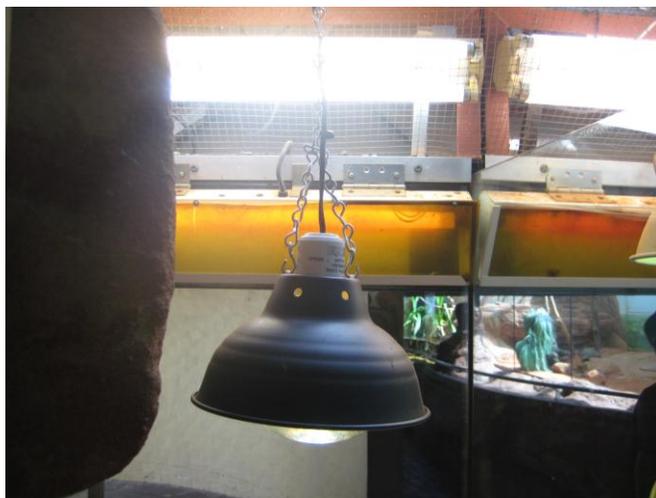
4.5 Weather Protection

If you house this species indoors like it should be if you wish to observe this species properly, weather protection is not an issue. However if you believe you meet the appropriate husbandry requirements, including, enclosure security, temperature, and adequate observations can be made, and you decide to house it outside, ensure that it has shelter from the elements including rain (flooding the enclosure) and the sun(refer to section 3.7 – Substrate to see ways this species escapes the weather in the wild).

(Class)

4.6 Temperature Requirements

As all Varanids are ectotherms, they need supplemented heat to reach their optimum body temperature. They do this by basking either under a spotlight or by heat rock/mat that should be supplied. For the short tailed monitor a heat lamp should be used over a heat mat/rock, as the *V. brevicauda* will bask at the mouth of its burrow where the surface of the sand is still warm. If a heat mat is used the Specimen will burrow to the bottom of the substrate and heat itself under the sand, which is not good for viewing behavior. Being a desert dwelling animal it maintains its body temperature between 30-40 degrees celcius. The short tailed monitor's optimum temperature is maintained within a few degrees of 36 degrees celcius. A temperature of



around 60 degrees should be maintained only for brief periods under the basking site. This temperature should only be supplied at one end of the enclosure with the other end cooler, keeping a good thermal gradient. At night time or during the cooler months, temperatures can be dropped to below 10 degrees celcius.

(King, Green, 1999)

4.7 Substrate

The most suitable substrate for *V. brevicauda* is sand as this is what it is found to live on/in, in the wild. This is of course red desert sand. Keep in mind that any sand will do the same job as long as it has been sterilized, otherwise the enclosure just wont look as natural to us (the viewers). Ensure that a large enough amount of the substrate is supplied to allow the animal to burrow, as it is a terrestrial reptile, not needing branches to climb. The substrate should be moistened regularly with a spray bottle, to make burrowing easy to accomplish. Burrowing is essential for this Varanid to survive, as it burrows to escape predators, weather & just to sleep.

(CH&B, Greg Fyfe)

4.8 Nestboxes and/or Bedding Material

No nest boxes or bedding material is needed for this species. A comfortable place for the female to lay her eggs is all that is needed. This can be achieved with a small container with moistened sand or vermiculite (both of which can be bought from a local nursery) for her to bury her eggs in, with a small hide over the container to give the laying female some privacy.

(Class)

4.9 Enclosure Furnishings

The most suitable enclosure furnishings for *V.brevicauda* should be predominantly spinifex tusks, placed around the enclosure, so that the base of the tusk is just buried. This will allow the small monitor to burrow underneath the spinifex tussock as well as climb through them as they have been observed doing in the wild. Also a small water dish should be supplied for the monitor to drink as it pleases.

Please remember that all enclosure furnishings should be sterilized before being placed into the enclosure. This is done to prevent any parasites coming into contact with your specimen.

(Sydney museum)

5 General Husbandry

5.1 Hygiene and Cleaning

Keeping *Varanus brevicauda* is not that hard but time consuming, from a cleaning perspective. This is because *V. brevicauda* is a burrowing species and because of this reason, it makes it time consuming to clean. To properly clean out the enclosure, complete removal of the sand substrate isn't necessary, you can simply take the enclosure furniture out, as well as the monitor(s) being housed, and use a normal kitchen strainer to sort through collecting the waste that has been buried in the sand, leaving the cleaned sand behind. And cleaning of the other furniture if necessary and putting back it back in along with the specimen.

However, complete substrate change over should happen between 3 – 6 months. This is to ensure that the sand being strained out isn't carrying disease or faecal waste. Always remember to mist down an area to allow the *V. brevicauda* to burrow.

Spinifex tusks of grass do not need to be changed, this is because once they dry out they are still perfect furniture for this small monitor. Obviously if they become covered in faecal wastes they need to be either cleaned or replaced.

The cleaning products that most people use, not only with *V. brevicauda* but with most reptile species is 'F10' or 'Divermite'. Both of these cleaning chemicals are perfectly safe to use if the dilution methods are followed, they can be found on the bottle.

(Class)
(Pers. Com.)

5.2 Record Keeping

When keeping records on the short tailed monitor, several events need to be recorded when known. These include dates of acquisition and disposal, the date of egg laying and/or birth, breeding, sloughing, clinical data, e.g. what form of treatment and faecal sample results, dimensions and weight of body. All these should be kept on record either on a cage card near the enclosure or on a software program that relates to the specific animal. If the specimen is micro-chipped it is possible to update information on the data base once it is known.

(Class)
(Pers. Com.)

5.3 Methods of Identification

Some methods of identification for not just Varanids but all reptiles is micro-chipping. Micro chipping all reptiles is done into the left inguinal. Being a microchip it is possible for it to move around under the epidermal layer. Also as this species is very small, due to the size of the micro-chip it may cause abscess's.

For hobbyists this is often to expensive so, having the animals details written down somewhere near its enclosure would be handy for identifying the particular animal.



(Lauren Turner)
(Pers. Com.)

5.4 Routine Data Collection

Data that needs to be collected regularly includes the weight and length of the specimens. As well as the intake of food, quantity and what was eaten (mealworms, crickets). Faecal samples every 3 months should be taken to ensure good health. Regular checks on temperature of the enclosure should also be done and noted on cage card. Also any discharges or sloughs, especially when the specimen is having trouble sloughing should be written on the cage card and in the daily diary as well as any breeding behavior.

(Class)
(Pers. Com.)

6 Feeding Requirements

6.1 Captive Diet

All monitors are strictly carnivorous, so this means that no fruit or vegetables should be offered as food. The Short Tailed Monitor is a diurnal species, this means that they will forage for food during the day; hence they should only be feed at that time.

Within a captive environment, simulating weather changes throughout the year is very important if breeding and natural behavior is to be seen. This means that their diet along with the temperature should be changed to simulate the seasons. In spring and summer the food supply should be plentiful, and gradually decrease during the simulated cooler months.

Before breeding females begin to breed after brumation through the colder months, they must eat large amounts of food, to raise their nutrient levels or their eggs will be malnourished and may not survive the incubation period. So this as well must be simulated in by feeding large amounts of food to the female before pairing with a male.



Due to the size of the *V. brevicauda*, its food size is limited especially in captivity. In the wild they feed on native skinks and reptile eggs, which of course in Australia we are unable to provide that food source to them due to legislative acts which protect native wildlife (National Parks & Wildlife Services). However, most captive institutions feed large sized crickets and woodies (cockroaches) as this is similar to what they would feed on in the wild and according to the individual animal's size. All of these live insects can be purchased from most local pet shops, but if a large order is needed it is best to get it from the company 'Pisces' or 'Bio supplies'.

Food type	Quantity
Crickets	4-6 crickets every 3 days or
Wood roaches	4-6 wood roaches every 3 days or
Other insects(spiders, beetles, etc)	Depending on size of the insect/spider, roughly the same size of the lizards head preferably.

These food types should be provided in accordance with the size of the animal. For hatchlings small crickets should be used. As a general rule the food should be increased to a size that is a little more than the lizards head. So as the lizard grows so too should the food size.

(Class)
(Peter Harlow)
(CH&B, Greg Fyfe)
(Pers. Com)

6.2 Supplements

There are different formulae of dragon pellets that are made specially for Agamids, however no such formula exists for Varanids. So what is done, is the insects that are fed to the *V. brevicauda* are dusted with either or both a calcium and minerals supplement about once a month (unless a neonate, in which case it should be done each feed) several different brands are out, I personally use rep-cal and herp-tivite (these can be purchased from any local pet shop). To use these products, thoroughly mix a ratio of rep-cal and herptivite in a plastic bag, then place the insects in the bag and shake until they are completely covered. Also what can be done instead or as well as dusting the insects, is what is called gut loading. This is when the insects are fed a specialised diet that will be passed onto the specimen once eaten, eg, Flukers cricket feed.



(Flukers)
(Repcal)
(Pers. Com.)
(Peter Harlow)

6.3 Presentation of Food

In a captive environment, presenting food on a food dish or in a food bowl to a short tailed monitor is not necessary unless the specimen is having a hard time finding and catching the insects on a regular basis. Generally the supplement dusted crickets or woodies are thrown into the enclosure and the *V. brevicauda* will chase them down and eat them, this is behavioral enrichment feeding, as it is what they would do in the wild. However, care is needed when scatter feeding is done, because if the lizard doesn't eat all the crickets they may start to eat the lizard while it is sleeping. So tong feeding can be done aswell with only an occasional scatter feed if you feel that your enclosure would provide an adequate breeding ground for "runaway" crickets.

(Taronga)
(Pers. Com.)

7 Handling and Transport

7.1 Timing of Capture and Handling

As reptiles are ectothermic the timing is very important because different temperatures will mean different behaviour and activity rates. So with this in mind the capture of you captive animal should be done earl in the morning preferably before the heat lamps come on. If capturing a wild specimen the season and the daily temperature should be taken into account to ensure that the *V. brevicauda* will be active on the day for capture.

(Jacki Salkeld)
(Pers. Com)

7.2 Catching Bags

Pillow slips turned inside out are a suitable transport bag. Although the corners of the pillow slip should be sewn at a 45 degree angle, and turned inside out to ensure the animal cannot tangle itself in any loose threads. The bags that the pisces live insect order comes in would also be suitable, or any small bag that is made of a breathable material.

(Jacki Salkeld)
(Class)

7.3 Capture and Restraint Techniques

There are no right or wrong techniques for the capture and restraint of a lizard this small, the main thing to remember is that you are restraining not crushing the animal. Although I have found that a thumb on the back of the head or neck and your index finger underneath the animal on its upper chest area, and supporting the legs and body with the rest of you fingers underneath works fine. Just be sure that your index finger is on the chest not blocking the airway on the neck.

(Pers. Com)
(Taronga Zoo)



7.4 Weighing and Examination

Using the holding technique mentioned above makes examination of the monitor very simple with a slight shift of your fingers and carefully maneuvering the animal any site can be examined. To weigh the animal use the restraint method just mentioned and place in a pre-weighed bag, then weigh the animal and the bag together. You may want to place the bag and animal into a pre weight small box if the specimen is moving a lot and making the weight reading difficult to measure.

(Class)

7.5 Release

When releasing the animal from a transport bag into an enclosure or anywhere, it is important to never just tip the bag up from a height. When releasing short tailed monitors from their transport containers, it is important to make sure you have read the transport container labels to ensure that you have the right animal. Once you are certain you have the right container, place it on the ground just incase the animal has gotten out of the transport bag and falls to the ground. Then open the container and remove the packing material. Once this is done remove the transport bag from the container and put it on the ground. Holding the bag slightly of the ground, remove the elastic band and look inside. Once you have spotted the animal and it is okay put the bag on the ground and using the capture technique mentioned in 7.3 remove the animal from the transport bag and put into the ready made enclosure.

(Class)

(Jacki Salkeld)

(Pers. Com)

7.6 Transport Requirements

7.6.1 Box Design

Any transport box according to IATA should be rigid and able to withstand a few kilos of weight. It should also be packed tightly within the box with newspaper r another suitable material. Also ventilation holes should be provided. If only transporting a single animal, a small commercial bird nesting box can be used as the rigid container. Also appropriate labels indicating which way to have the container standing, what is inside, and live animal, should be clearly marked on the outside of the container.

The Varanid is not just thrown in a container with some packing, It needs to be placed in a bag that is sized at 45x60cm, that has the corners sewn at a 45°angle to prevent the animal pushing its way through the threading. If a bag is not available, it is important to

at the very least put the lizard in a smaller container with a soft substrate such as toilet paper or a tea towel that has no loose threads.

(IATA, LAR)

7.6.2 Furnishings

There is no need for furnishings when transporting a *V. brevicauda* as long as the bag is turned inside out, and it has something underneath it (container packing, or rubber mat). If something like a log is put in with it, it may very well fall over during the transport and harm the animal.

(Class)
(Pers. Com.)

7.6.3 Water and Food

Water and food is not necessary to be offered during transport. Even if it were to be offered the animal would most likely decline anyway as it would be too stressed. Although every half an hour during the transport, it should be checked to see if dehydration is occurring.

(IATA, LAR)

7.6.4 Animals per Box

Even though according to the IATA, LAR 2000, suggests that 15 animals can be kept in a single bag, this is not recommended as fighting and injuries will become more evident. I suggest transporting only one animal per bag, Although multiple bags may be placed within the same rigid container. Highlighted below are the relevant sizes for the *Varanus brevicauda*.

Snout to vent length	Body width	Max. animals per bag	Min. bag size
>20cm	>5cm	1	Depending
> 15cm <20cm	>2.5cm <5cm	15	45x60cm
>10cm <15cm	<2.5cm	10	30x45cm
>10cm <15cm	<2.5cm	30	45x60cm
>10cm <15cm	<2.5cm	20	30x45cm
<10cm	2.5cm	30	30x45cm

(IATA, LAR)
(Jacki Salkeld)

7.6.5 Timing of Transportation

The timing of transport should definitely be taken into account, just like the capture of the animal. When transporting any reptile let alone a small reptile the size of a *V. brevicauda*, they should be kept out of the temperature extremes. So in the middle of a hot Summer's day should be avoided unless air conditioning the entire trip can be provided. Preferably the transport should be done early in the morning to avoid the extreme heat.

(Pers. Com)

(Class)

7.6.6 Release from Box

When releasing the lizard from the transport box, don't just tip it out. Carefully pick it up out of the bag/box and put your hand on the ground and let it go, And it should scurry away. However if it doesn't simply slide your hand out from underneath the lizard while it is on the ground.

8 Health Requirements

8.1 Daily Health Checks

During daily checks of a morning, it is always important to observe your animals health for anything that is out of the ordinary. Some abnormal behaviour that may be viewed from an unwell *V.brevicauda* includes (doing a distant examination):

- resting in the water bowl before lights come on,
- lack of movement, especially at feeding times,
- trying to climb up branches to excessive heights.

Other obvious signs of ill health, such as:

- Limbs missing,
- Any discharge from face area or cloaca,
- Any blood around enclosure,
- Abnormal faeces,
- Regurgitated crickets/insects.

(Class)

8.2 Detailed Physical Examination

8.2.1 Chemical Restraint

Alfaxan is generally used at Taronga Zoo as a pre-med or used for induction. Ketamine used to be used, but due to the small size of a *V.brevicauda* and its strength it no longer is. Gasing a reptile can be difficult as they are able to go a long time without breathing if they want, which makes for a lengthy process. So usually it is done sub cutaneously.

(Kimberely Taronga Zoo Vetrinarian)

8.2.2 Physical Examination

In a detailed physical exam there are several things that need to be checked. These include:

- Eyes – don't have any discharge
- Ears - don't have any discharge
- oral cavity - don't have any discharge
- teeth – not rotting or discoloured

- external parasites
- scale condition/slough condition around limbs and digits
- weight of the animal
- tail (fat storages) – if it is thick it is healthy
- respiration rate – seeing if it is “puffing”

This is done without the animal being sedated so it is faster and easier than a detailed physical examination. Being a monitor it doesn't drop its tail as a defense so restraint of the animal doesn't have to be as delicate as you would for a skink or gecko. Still keeping in mind it is quite small.

(Taronga)
(Class)

8.3 Routine Treatments

A routine treatment is preventative worming. This can be done using flagyl, or panacur. And the strengths of these will be dependant on the weight of the individual, always follow the directions from the vet or the bottle. Other than this quarantining animals (refer to “quarantine requirements”).

Another routine treatment is weighing the animal to check its weight, as this can be a symptom of many diseases.

Also collection of faeces is done every three months and sent to the vet to make sure the animal is all healthy, and if not we can hopefully catch any health problems before it gets bad.

(Lauren Turner)
(Kimberely Taronga Zoo Vetrinarian)

8.4 Known Health Problems

All reptiles are susceptible to a variety of different diseases. In this section I will give the main diseases along with their signs.

Disease	Signs & prevention
Mouth rot	Cheesy discharge, swelling around the mouth and infections. It is usually a secondary infection from another physical injury or poor enclosure conditions. Make sure you are feeding the appropriate diet, and continuously check the animal to see if there are any injuries.
Tuberculosis	Abscess are generally visible on the skin, but sometimes they occur on and in the

	internal organs, making them invisible to the keeper.
Salmonellosis	There are minimal affects hat salmonella has on the host (your short tailed monitor), but the effect that it can have on you if transmitted, can be great, so it is important to have faecal samples, and cloacal swabs to test before entry into your main collection. Practice good hygiene when handling different animals (wash hands between the handling of each animal.

(BSAVA of reptile veterinary nursing)

8.5 Quarantine Requirements

The quarantine requirements for a short tailed monitor vary depending upon where the animal is coming from. If it is coming from another zoo e.g. Melbourne Zoo the quarantine is a minimum of 30 days, but three pathogen and parasite free faecal samples in a row need to be taken before entry into your main collection and other thorough physical exams. A short tailed monitor would only be imported from overseas for bloodline management in a breeding plan, but as they are native and wouldn't need to be brought in from over seas. However if they were the quarantine time would could be anything up to a year, this is to prevent any diseases from outside the country being spread to Australia. Also all enclosure tools need to be enclosure specific and gloves should be worn each time the animal is handled or the cage is cleaned.

(Kimberely Taronga Zoo Vetrinarian)

9 Behaviour

9.1 Activity

The activity levels of the Short Tailed monitor varies sexually according to capture results from the museum. The museum collection included higher ratios of males than females, which were collected during the daytime. This could be due to the males traveling in search of females, or simply patrolling their territories. What ever it is, it is important to note that they don't venture too far from their burrow as they are very secretive and retreat to their burrow when startled or are extremely quick at scurrying into a spinifex tussock.



Spinifex Tussock

(Museum)

9.2 Social Behaviour

There isn't any research that has been done on the social structures of the short tailed monitors in the wild. So through my personal observations I have determined that within the specimens at my workplace there is a slight social structure, in that the male and female get more food over the other male. This may be due to the fact that the male has established his territories. I have not sighted any male on male combat outside of the breeding season. The specimens that get more food seem to use the same spinifex tusks to seek shelter in, while the other male is left alone in another tusk. Therefore according to my own personal experiences I believe that there are subtle social behaviour and structures that are in place within my trio.

In other monitor species the males will stand on its hind legs and hiss loudly and even charge to protect his territory from other males or other threats. This is a behaviour to establish a social hierarchy and territory.

(Pers. Com)

9.3 Reproductive Behaviour

There are a few simple practices that can be done by a keeper to help stimulate reproductive behaviour between males and females. These include:

- male on male combat, or even just the males being in site of each other for brief periods
- increasing temperatures will increase the activity levels and also the courtship and mating processes
- increased food availability
- increased photo periods

All of these are done to simulate the seasonal changes that are brought on in the wild. Some behaviours that may be viewed during these changes are:

- males fighting
- males pursuing females with tail wags
- males rubbing against females during courtship
- males may become over aggressive towards the female if left in with her for too long

(Class)

(King, Green, 1999)

9.4 Bathing

Being a desert species bathing rarely occurs, although in captivity it is not abnormal to see your short tailed monitor occasionally sitting in the water bowl in the hotter months. However if it is doing this regularly, perhaps the temperature of the enclosure need to be checked.

(Taronga)

9.5 Behavioural Problems

All captive animals will experience behavioural problems. It is our job to identify them and manage them accordingly. Below is a table with some problems that a short tailed monitor may have in captivity with a recommended solution to each of them.

Behavioural problem	Solution
Lack of interest in feeding	<ul style="list-style-type: none">- Temperatures may not be at optimum (refer to temperature requirements)- Another animal in the cage may be holding dominance over it.- May have internal or external parasites- May be a sign of stress, so stress factors

	Need to be addressed.
Males may become aggressive in breeding season (Territorial problems)	- Separate problem males - Move to a larger enclosure with more hides so the less dominant males have places to retreat to.
Males may over breed, popping hemipenes	- Reduce the amount of females available to the male during the warmer months. - Separate them once mating has occurred.
Females may not lay eggs	- Supply suitable egg laying sites, e.g. Chinese container full of moist sand
Obesity (majority in males)	- Reduce the amount of food given - Feed live faster moving food so it can experience “the hunt” and earn its food

(Class)
(Pers. Com)
(BSAVA of reptile veterinary nursing)

9.6 Signs of Stress

Some signs of stress in a *V.brevicauda* include:

- Lack of appetite
- Abnormal activity rates (lethargic)
- Improper shed
- Abnormal locomotion
- Not basking

All signs of stress need to be addressed and a management plan needs to be put in place. For example If a wild bird is pecking at the glass of the enclosure, simply move the enclosure, or put a door into the reptile house (if housed in a Zoo or Wildlife Park) preventing the access of birds.

(BSAVA of reptile veterinary nursing)

9.7 Behavioural Enrichment

Many people think that there is little to no forms of enrichment for reptiles. This is not the case at all. There are so many different kinds of enrichment that can be done for reptiles that give so much pleasure for them. These include:

- Provide Zeolite (a non-digestable substrate) for burrowing, as burrowing is a natural behaviour

- Plant spinifex tusks in the enclosure and around the designated burrowing site, to give the animals the feeling of protection they need.
- Providing not just a burrowing site but also several hides around the enclosure.
- Add to the enclosure sloughs of other reptiles. When this and scent marking is done a whole new animal will come out, showing how enriching simple things can be to your animal.
- Scatter feeding should be done to encourage natural feeding behaviours.
- Browse can also be cut and placed into the enclosure as it brings in a variety of different scents.
- A good form of enrichment can be set up by using pieces of slate under the basking site, providing a range of temperatures, as per the illustration

(Taronga)
(Class)

9.8 Introductions and Removals

When introducing a new animal into the collection, it is very important that the animal is put aside from your regular collection, for observations, to ensure that it isn't bringing any diseases or parasites into your collection. Once this is done, and it is cleared and healthy, you should check to see what sex it is, as I mentioned earlier it is near impossible to sex them. But if it's put in and it starts fighting with another, or is fighting during the breeding season it is going to be a male. This is important as when males fight they can cause injuries to each other, which isn't what you want for a new animal into your collection.

Other than the males fighting there is only one other issue, and that is overcrowding of an enclosure. Refer to the section earlier in the paper titled "Spatial Requirements".

(BSAVA of reptile veterinary nursing)
(Class)
(EAPA Vers. 5)

9.9 Intraspecific Compatibility

V.brevicauda is definitely an intraspecific compatible animal. The only time that housing them together could be a problem would be during breeding seasons, as males may fight each other to mate with the females.

(Vincent, Wilson, 1999)

9.10 Interspecific Compatibility

They are also interspecific animals, but obviously due to their small size, they can only be housed with other small reptiles. At Alice Springs Desert Park, the Short Tailed Monitors were housed with sand swimmers and thorny devils (*Horridus moloch*).

(Vincent, Wilson, 1999)

9.11 Suitability to Captivity

I believe that the *V.brevicauda* is suitable to captivity if its basic requirements are met, these include heating, UV requirements, feeding calcium: phosphorus ratios, and the basics such as water and ventilation. If these are not at optimum it will make keeping this species very difficult. Their numbers in the captive private industry are steadily increasing with is a sign of smart keeping. Hopefully more study can be done to make them a more hardy and easier species to house in the captive environment.

(Taronga)

(Jacki Salkeld)

10 Breeding

10.1 Mating System

The male will seek out a female every spring for mating. He will observe the females behaviour and if she is willing, the male will approach her and rub along side her, maneuvering the base of his tail around hers. This is the reason why, males should always be introduced to females in the captive situation. Rival males will fight for the right to mate with the females as they are territorial. They are generally a solitary animal although several animals may be sharing the same sand dune as a home, they only make deliberate contact with each other during the breeding season.

(ADW)
(Pers. Com.)

10.2 Ease of Breeding

This species is easy to breed if the appropriate requirements are met such as;

- * Increased temperatures, more food available,
- * A variety in the diet, not just crickets, include cockroaches moths, etc. and
- * Also supplement the diet by dusting the insects with calcium.

Then yes they are capable of breeding. All of the requirements listed above are done to simulate the warming up and entrance into spring.

(Pers. Com.)
(ADW)

10.3 Reproductive Condition

10.3.1 Females

The females need to be fed on a high calcium diet to ensure that the eggs she produces are of the best quality. If the high calcium isn't there the calcium needed to make the egg shell the calcium will be extracted from her bones, making her extremely weak. Females also will require a large amount of food after eggs have been laid as they lose a lot of condition at the time of laying. This means the female should have about 7 crickets or other food source as mentioned earlier, every day or every second day. When calcium dusting the insects enough just to lightly cover the insect is sufficient.

(Jacki Salkeld)
(Pers. Com.)

10.3.2 Males

Males need to increase their diet around the reproductive season by a few extra crickets per feed, as males will stand on their hind legs and wrestle each other for the right to fight the females. This is where the extra weight is needed.

Also during the middle of the breeding season, some males become too focused on reproducing and not enough time searching for food, that is why it's important to keep the health of your male closely observed.

(Pers. Com.)

10.4 Techniques Used to Control Breeding

In captivity it is extremely easy to control the breeding, all that is needed is to both separate the breeding pair and cool them down over the winter for the following breeding season. Or turn the heat down to around 24 degrees Celsius this way it is warm enough for them to be active but not warm enough for them to display mating behaviours.

(Pers. Com.)

10.5 Occurrence of Hybrids

This is not to be possible as Short Tailed Monitors have no close relatives that are at the size to be able to mate. And there are no identified sub species.

(Pers. Com.)

10.6 Timing of Breeding

The males gonads will increase in size in late Winter so the sperm is ready for fertilization when mating happens, which is around early Spring. The female will then lay the eggs typically around November or December. The eggs will incubate for a few months and hatching will occur in January or February.

(ADW)

(CH&B, Greg Fyfe)

10.7 Age at First Breeding and Last Breeding

Within the year of a male short tailed monitors life he will be able to breed. It generally takes males just 10 months to become sexually mature. Where as females take almost 2 years to become sexually reproductive. This means that every second year there are a lot more neonates around.

(ADW)
(CH&B, Greg Fyfe)

10.8 Ability to Breed Every Year

They are capable of reproducing every year if the males are cooled down over the winter months, to make their sperm viable. Also if the requirements listed in 8.13 are met. Within 10 months of hatching, males are able to reproduce and females 2 years.

(Peter Harlow)
(CH&B, Greg Fyfe)
(C. James)

10.9 Ability to Breed More than Once Per Year

In captivity they have been known to double even triple clutch. But only if the females condition is brought back to a healthy level after each clutch. This is not known if it happens in the wild, although there is no reason it couldn't happen if the conditions were right and the food plentiful.

(C. James)
(ADW)
(Peter Harlow)

10.10 Nesting, Hollow or Other Requirements

They females will find a suitable spot to lay their eggs and will burrow down roughly 15cm, this is where the temperature remains relatively constant throughout incubation. So the only requirement would be heating for the enclosure with a good thermal gradient ranging from 27-35 Degrees Celsius and appropriate depth sand substrate.

(CH&B, Greg Fyfe)
(Pers. Com.)

10.11 Breeding Diet

The diet doesn't have to change it just needs to increase the amount it eats. So say for instance the specimen was eating 4 crickets per sitting, increasing the temperature needs to be increased and offer 6-7 crickets per feeding (for females only). Males can and should be offered more food, but I recommend the same amount just more frequent. As the males may become unhealthily large. The females will lose their large appearance once she has laid her eggs. A variety of insects may help keep the specimen interested in eating consistently, a few weeks prior to the female laying every feed should be calcium dusted.

(Pers. Com.)

10.12 Incubation Period

The incubation period ranges depending on the temperature the eggs are incubated at, but generally it ranges between 70-100 days. The eggs should be removed from the enclosure as soon as possible and placed into an incubator, to maximize the chances of the eggs hatching. In the wild the female will search for an appropriate spot to bury her eggs, where as in a captive situation those optimum spots for her to lay are greatly reduced, which is why they should be placed in an incubator, on either vermiculite or perlite as a substrate (these can be purchased from any local nursery or hardware stores).

(ADW)
(Peter Harlow)

10.13 Clutch Size

The clutch size varies on the size of the lizard, it can be anywhere between 1 – 5 eggs per clutch. The specimens found in the Pilbara region tend to get a bit bigger than others and hence produce more eggs.

(ADW)
(Peter Harlow)
(C. James)

10.14 Age at Weaning

Being a reptile they don't go through a weaning process as they are precocial animals.

(Pers. Com.)

10.15 Age of Removal from Parents

The parents remove themselves from their young's lives as soon as the eggs are laid, if they come across them again they may very well eat them if they are small enough.

(Pers. Com.)

10.16 Growth and Development

All reptiles are precocial which means they have to hunt for their own food. If the food supply is low, they won't grow so much, whereas if the food supply is high they will grow at a faster rate. With a steady food supply they can reach adult size and reach sexual maturity within one year. Then after the first year of living the growth rates will slow down dramatically, but they will continue to grow for their entire lives. If they are growing at a slow rate and are still quite small compared to their parents and other adults, it would be best not to mate them, wait until they reach a decent size just to be sure they are fully developed.



(ADW)
(C.James)

11 Artificial Rearing

11.1 Incubator Type

There are two types of incubators that could be used to artificially incubate *V. brevicauda* eggs. One of them is heated using heat cord as the heating property, around the inside of the incubator, with a thermostat in the middle set to the desired temperature. Also a fan will need to be supplied to regulate the temperature, this fan can be in the shape of a computer fan. Another type of incubator is essentially the same thing except that the heating medium isn't heat cord, it is in the shape of heat lights, placed both at the bottom and the top of the incubator.

(Bellsouth)

11.2 Incubation Temperature and Humidity

The incubation temperature required to hatch *V. brevicauda* eggs is 30 degrees celcius. This temperature should be maintained to within a degree higher or lower throughout the entire incubation period. Any variation greater than one degree can cause either death of the eggs or deformities of the neonates.

The short tailed monitor is a desert dwelling species as discussed in previous chapters. And in the deserts of Australia the humidity is extremely low, so this should be mimicked in the incubator. The eggs of a short tailed monitor are specially developed to incubate and hatch at this low humidity so if the eggs are incubated at a high humidity they will more than likely not survive. So try to keep the humidity at least below 35%.

(Taronga)

11.3 Desired % Egg Mass Loss

I was unable to find any information, published or unpublished

11.4 Hatching Temperature and Humidity

The hatching temperature and humidity is the same as the incubation temperatures and humidity's. Within 2-5 days prior to the eggs hatching the eggs will sweat, which will increase the humidity within the incubation container. I advise that when this happens to wipe the lid of the incubation container of the excess moisture, this will decrease the humidity slightly, but it can make a difference.

(Pars. Com.)

11.5 Normal Pip to Hatch Interval

I was unable to find any information, published or unpublished

11.6 Diet and Feeding Routine

The diet for a hatchling short tailed monitor is small crickets, calcium dusted to begin with. And once it starts to gain size the size of the crickets can be increased. They should be offered food 2 – 3 days after hatching and every second day after the first feed. 3 – 4 crickets should be fed per animal per feed.

11.7 Specific Requirements

There are no specific requirements for a young *V.brevicauda*. They have the same requirements as their adult parents. I would suggest keeping them off sand for the first two weeks of hatching, because they may not be perfect hunters like their parents, and may ingest a lot of sand within their first few attempted feeds, which can lead to gut impactions and potential death.

11.8 Data Recording

Record the weight of the neonate when it first hatched, and every week I would record weight after that. Also record what it has eaten and how much, also the supplements that were given.

(Jacki Salkeld)
(Class)

11.9 Identification Methods

To distinguish young from each other a photo on the cage cards can be used, also microchips or even something as simple as a liquid paper marking on the back of one of them can be done.

11.10 Hygiene

When handling young monitors care should be taken, gloves do not need to be worn, however hands should be washed before handling to minimize the risk of transferring pathogens. Also removing any faeces and providing clean water should be done daily.

(Taronga)
(Pers. Com)

11.11 Behavioural Considerations

When the young reach sexual maturity they will become territorial and males will need to be separated from each other. However when they are young males may be housed together. Females can be kept with either males or females without problems. Keeping in mind that there shouldn't be too great of a size difference as they feed on smaller lizards in the wild, and may eat a smaller *V.brevicauda* if given the chance.

11.12 Weaning

Reptiles are not dependant on their parents at all, so there is no weaning stage for a juvenile short tail monitor

12 Acknowledgements

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Taronga – Taronga Zoo Reptile division staff

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15 Glossary

Term	Meaning
Varanid	Latin name for monitor or goanna
Terrestrial	land dwelling animal
Squamata	Latin name for order of lizards
Thermal Gradient	Having one area warmer than another, keeping a range of Temperatures throughout
Pers. com	Personal comment from my own experiences
Pers. Obs.	Personal observation

16 Appendix

- EAPA version 5 for reptiles
- Flukers
- Reocal calcium and vitamins
- Coggers identification key
- F10 fact sheet
- Divermite MSDS