

ISSUE 06 | JULY 2024

bulletin

LSeT FOUNDATION

BROAD-SHELLED TURTLES

Breeding
brilliance in
captivity

TRANSFORMING REPTILE HUSBANDRY

Exploring India's
Modern Zoos and
Career Horizons
for Wildlife
Enthusiasts

Snakes in Captivity

Secrets to thriving
snake care

Komodo capers

adventures
with the
dragon kings



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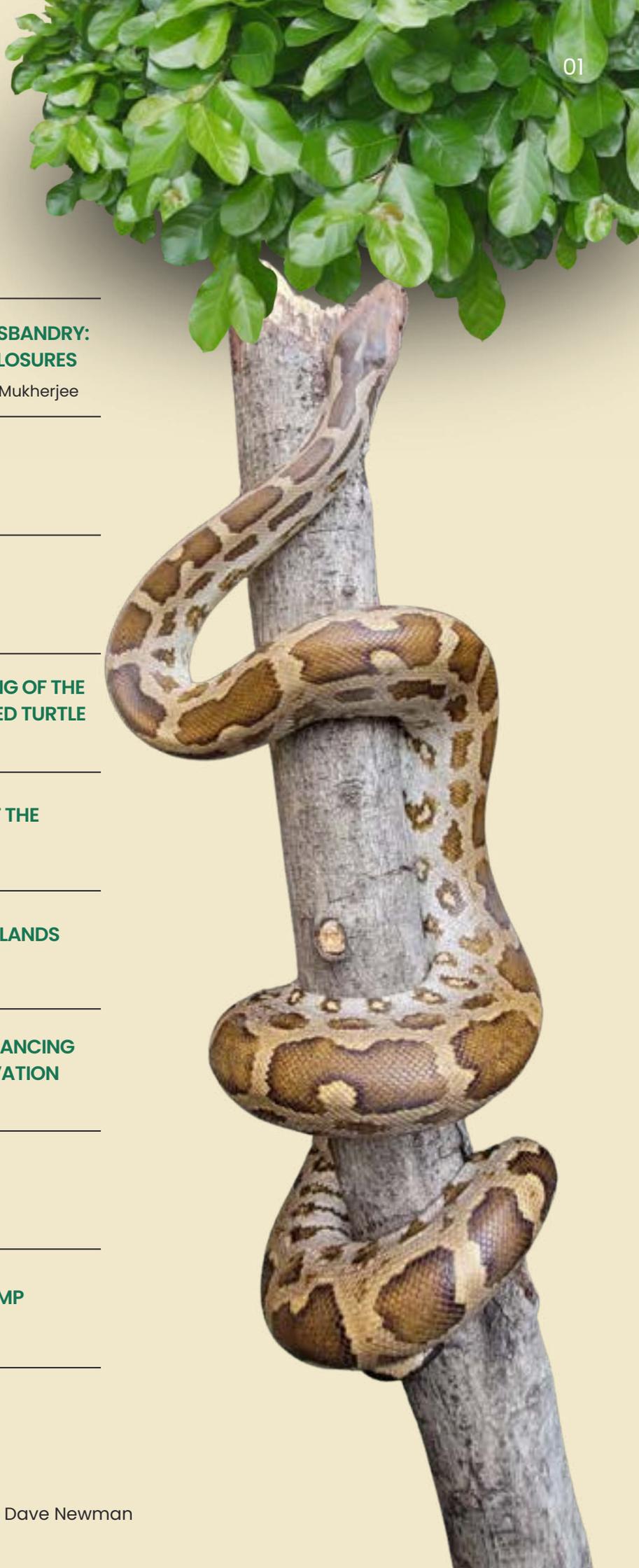
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Preface

Dear Readers

Welcome to the 3rd issue of BULLETIN, your trusted companion in the ever-evolving world of animal care and management. As we turn the page on another quarter, we reflect on the remarkable events and achievements that have shaped our community and look forward to the exciting new beginnings ahead.

Over the past few months, our field has seen a wealth of developments, from developments of Bio active Enclosures to inspiring stories of young wildlife conservationist. In this issue, we bring you in-depth coverage of the Reptilian world. Discover these amazing species that inhabit our world since the age of the dinosaur. Join us in celebrating the dedicated individuals whose work ensures that these species flourish, while they share their experiences towards taking better care and well-being of these magnificent species.

One of the highlights of this quarter has been the numerous events that have brought our community together. From school trips to local workshops, these gatherings have fostered collaboration and knowledge-sharing among experts and enthusiasts alike. We are thrilled to share highlights and insights from these events, showcasing the collective efforts that drive progress in animal care and management.

This issue also marks the commencement of a new batch of bootcamp students at our training center. These passionate individuals are embarking on an intensive journey to become the next generation of animal care professionals. We are proud to introduce them and share their aspirations with you. Their enthusiasm and dedication remind us of the importance of continuous learning and innovation in our field.

In addition to these stories, we offer practical advice and expert tips on a wide range of topics, from nutrition and behavioral training to advancements in animal husbandry and welfare. Our goal is to equip you with the knowledge and tools you need to provide the best care for the animals in your life.

We extend our heartfelt gratitude to our contributors, whose expertise and passion enrich every page of Bulletin. Their commitment to excellence ensures that we remain at the forefront of animal care and management.

As you read through this issue, we hope you find inspiration, valuable insights, and a renewed sense of purpose in your work with animals. Your feedback and engagement are essential to us, and we look forward to continuing this journey with you.

Thank you for being a part of our vibrant community.

Warm regards,
Taranjeet Singh
Editor-in-Chief,
BULLETIN

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G'day and welcome to the 3rd issue of the LSeT Foundation Bulletin for 2024. The year is flying by, and with each passing month, LSeT is growing from strength to strength. During this time, the Bulletin has blossomed into a very informative and respectable publication, sharing not only the goings on at our facility in Bangalore but also an array of interesting articles by authors from both India and abroad.

This latest issue focuses on reptiles, covering a variety of topics and species, including snakes, lizards, turtles, and more. For anyone with an interest in this fascinating group of animals, there is sure to be plenty of useful and interesting information within.

The stunning cover image of a beautiful Australian Green Tree Python is courtesy of very talented Australian photographer Dave Newman and was taken during his recent trip to Iron Range in Far North Queensland. We extend our thanks to Dave for allowing us to use his wonderful photos.

We would also like to thank our dedicated authors for their excellent contributions to this issue, without which we would not be able to bring you the Bulletin at all. In this issue, we have feature articles from Soham and Akanksha Mukherjee (IND), Dhruv Patel (IND), Harley and Ledger Chapman (AUS), Cooper Van Der Wal (AUS), Zac Bower (AUS), Sam Burbidge (AUS), and Symbio Wildlife Park (AUS)—a great selection, without a doubt!

To round off the issue, we report on a brilliant workshop with Vaclav Palvick, a memorable Summer Camp with Hope School, and welcome our new enthusiasts who have recently joined us here at LSeT.

We hope that you thoroughly enjoy our latest offering and look forward to continuing to bring you quality, up-to-date information through the pages of the LSeT Foundation Bulletin for many years to come.

Simon Degenhard
Editor
BULLETIN

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Fig 1 : A bioactive enclosure featuring live plants that enhance the habitat's aesthetics and functionality.

Transforming Reptile Husbandry: The Rise of Bioactive Enclosures

BY: SOHAM MUKHERJEE



AKANKSHA MUKHERJEE



Introduction

Reptile keeping has significantly evolved from the simplistic, barren enclosures of older times to modern setups that cater extensively to the physical and psychological needs of reptiles, providing mental stimulation and opportunities for natural behaviours. This transformation is being driven by a better understanding of reptile biology and behaviour, as well as a strong commitment to improving animal welfare. One of the most notable advancements in this field is the use of bioactive enclosures, which represents a significant step forward in habitat design.

Historically, reptile keeping involved simple, sterile enclosures with minimal furnishings that, while easy to maintain, did not meet the reptiles' complex needs. Research suggests that such environments can cause stress, boredom, and a variety of health problems in captive reptiles (Warwick et al., 2019). In stark contrast, modern practices emphasise environmental enrichment, which allows reptiles to engage in physical activity, mental stimulation, and the expression of natural behaviours. This not only improves the reptiles' welfare, but also makes them more engaging and interesting to observe, signalling a significant shift in reptile keeping practices.



Fig 2 : Rich organic substrates providing a natural base for plant growth and microfauna support..

The Concept of Bioactive Enclosures

Bioactive enclosures represent a significant advancement in reptile keeping. These enclosures are designed to mimic the natural habitat of the reptile, creating a self-sustaining ecosystem within the enclosure. Key components of a bioactive enclosure include:

1. Live plants: Plants provide cover, climbing opportunities, and help maintain humidity levels. They also contribute to the aesthetic appeal of the enclosure (Fig 1).

2. Organic Substrates: A mix of soil, leaf litter, and other organic materials provides a naturalistic base for the enclosure. This substrate supports the growth of plants and microfauna (Fig 2).

3. Microfauna: Small invertebrates such as springtails and isopods help break down waste and keep the substrate healthy.

4. Naturalistic Decor: Rocks, branches, and other natural elements create hiding spots and climbing opportunities, encouraging natural behaviours. (Fig 3)

Benefits of Bioactive Enclosures:

Enrichment and Behavioural Benefits

Bioactive enclosures provide a rich, stimulating environment that promotes natural behaviours. Reptiles in bioactive setups are more likely to engage in activities such as burrowing, climbing, and foraging. These behaviours are essential for their physical and mental health. For example,

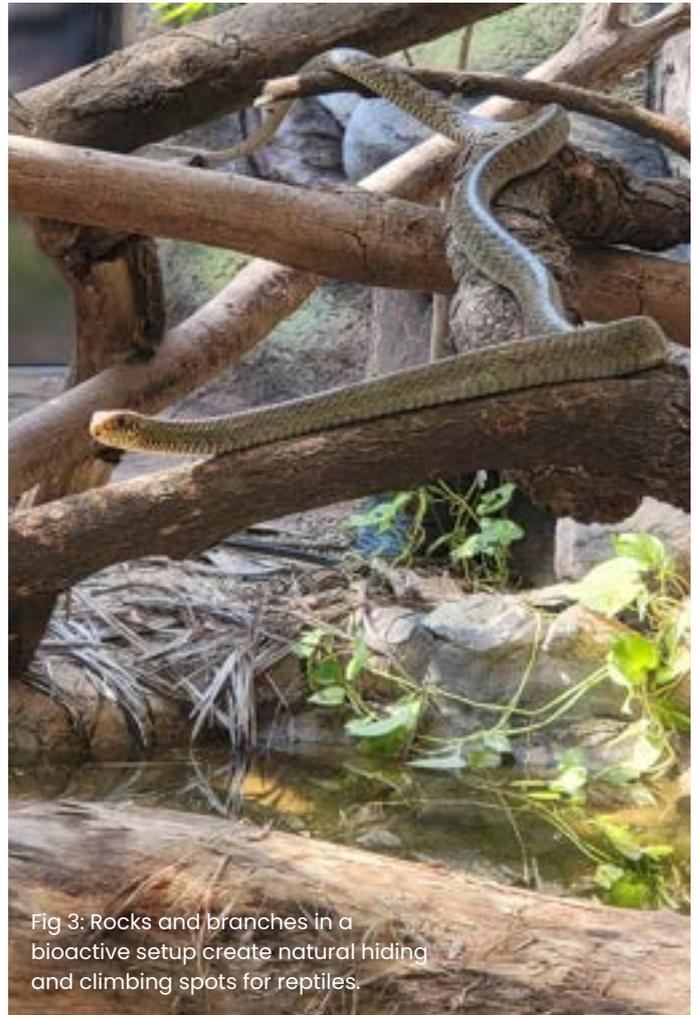


Fig 3: Rocks and branches in a bioactive setup create natural hiding and climbing spots for reptiles.

arboreal species benefit from climbing structures, while burrowing species thrive in substrates they can dig into (Hedley & O'Donnell, 2019).

Health Benefits

The dynamic environment of a bioactive enclosure can lead to improved health outcomes for reptiles. The presence of live plants and organic substrates helps maintain proper humidity and air quality, reducing the risk of respiratory illnesses. Beneficial microorganisms in the substrate can enhance gut health and reduce the incidence of parasitic infections. Studies have shown that reptiles in bioactive enclosures have better immune responses and overall health (Johnston et al., 2021).

Environmental Benefits

Bioactive enclosures are more sustainable and eco-friendly than traditional setups. The self-sustaining ecosystem reduces the need for frequent substrate changes and extensive cleaning, lowering waste and maintenance requirements. Additionally, the use of natural materials reduces the reliance on synthetic products, contributing to a smaller environmental footprint (Greenwood, 2021).

The Current State of Reptile Husbandry and The Way Forward

Reptile husbandry is often the most neglected area in both zoos and private collections. The primary reason is that reptiles can survive in small spaces with minimal provisions, leading to the misconception that these conditions are adequate for their well-being. However, this is far from the truth. Good welfare practices should be universally applied across all taxa, and reptiles are no exception. While modern zoos have made significant strides in creating large, complex habitats for mammals and birds, reptiles frequently remain in outdated and inadequate enclosures. This disparity is also evident among

1. Innovative Enclosure Design

Designing enclosures that incorporate the natural behaviours and biology of reptiles can help address visibility issues.

For instance, using transparent partitions, strategically placed lighting, and multiple viewing angles can offer visitors glimpses of natural behaviours and resting spaces. Enclosures can include elements like burrows with glass walls, elevated platforms, and water features that draw reptiles to visible areas (Fig 4).

2. Motivating Reptiles to Visible Spaces

Another approach is to control the microenvironments within the enclosure to



Fig 4: Innovative reptile enclosure design with improved visibility using transparent partitions and lighting.

private keepers. Many reptile enthusiasts and hobbyists continue to keep their pets in minimalistic environments that fail to meet their physical and psychological needs.

One major challenge faced by zoos is the "display" aspect of reptile husbandry. Naturalistic enclosures, while beneficial for the reptiles, often result in the animals hiding, making them difficult for visitors to see.

This can lead to visitor dissatisfaction and decreased interest in reptile exhibits. However, there are innovative ways to mitigate this challenge :

motivate reptiles to move to designated optimal spaces.

By providing choices of environmental spectra—such as varying temperature, humidity, and light intensity—reptiles can be encouraged to move from one environment to another within the enclosure.

This not only ensures that reptiles have the opportunity to express natural behaviours but also increases the likelihood of them being seen by visitors. For example, creating warmer basking spots near viewing areas can encourage reptiles to spend more time in visible locations (Fig 5).



Fig 5: Reptile basking under optimal conditions, demonstrating controlled microenvironment benefits.

3. Use of Technology

Advanced technology, such as automated climate control and smart sensors, can help manage these microenvironments more precisely. This ensures that reptiles have access to optimal conditions that encourage movement and activity, which can be monitored and adjusted based on their behaviour.

This situation is even more challenging for breeders who keep large numbers of reptiles and may lack the space or resources to provide optimal habitats for each animal. Nevertheless, for hobbyists and keepers who genuinely care about their reptiles' welfare, it is crucial to reconsider traditional keeping methods.

The modern reptile-keeping community is increasingly engaging in discussions about improving husbandry practices. There is a growing movement towards balancing good welfare with the available space and resources.

The acceptance and implementation of bioactive enclosures are gaining momentum as more keepers recognise the benefits of these setups. This approach not only enhances the reptiles' quality of life but also enriches the keeper's experience. The shift towards bioactive enclosures is an essential step forward in the evolution of reptile husbandry, reflecting a broader commitment to animal welfare.

Conclusion

The evolution and standardisation of bioactive enclosure protocols, including advancements such as automated climate control and smart sensors, are critical for the future of reptile keeping. Continued research is essential to understand the long-term benefits and potential challenges of these setups. Developing affordable and accessible bioactive kits will encourage the

broader adoption of these advanced husbandry practices. Collaboration between herpetologists, veterinarians, and the pet industry is necessary to develop guidelines and resources that ensure the safety and effectiveness of bioactive enclosures (Browning & Smith, 2019).

The use of bioactive enclosures represents a significant step forward in animal welfare, creating a more naturalistic and enriching environment for captive reptiles. This results in improved health and well-being. As reptile enthusiasts and professionals, it is our responsibility to support these advancements and advocate for their widespread adoption, fostering a healthier and more ethical approach to reptile care.

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Snakes in Captivity

AUTHOR AND PHOTOS BY : DHRUV PATEL

Evolution has favoured modification and disrupted the way reptiles live and evolve. India is an incredible destination for reptiles, home to countless venomous elapids, colubrids, multiple vipers, narrow-snouted pythons, aquatic keelbacks, four of the world's flying snakes, and vermicious caecilians.

However, many misconceptions exist about reptile diversity. They exist on all continents except Antarctica.

Although it is a somewhat misleading perception, the general public has frequently believed that snakes are all "venomous creatures."

*There are over **3000** snake species in existence today, of which only approximately **700** are venomous.*

In order to maintain balance with other species, snakes have taken up a certain area of the ecological environment.

Often recognised for their predatory tendencies, snakes have evolved to adapt to the unpredictable environment and can now adjust to new kinds of food and shelter.

Since captive snakes no longer pose a threat to humans or cause conflicts between humans and wildlife, they have adapted over time and are now observed in captivity, changing according to the dynamics of their new environment.

The snakes in captivity now draw a parallel with the human empire, and thus it is essential to see the rhymes between the snake and the human world.

The handling of snakes kept in captivity needs to be carried out with care (fig 1). Before trying to handle the snake, it should first feel at ease. After the snake has consumed successive meals, you can begin handling it. Avoid handling a snake immediately after it has been fed, as this may cause it to regurgitate its food (a highly stressful event for snakes).

After feeding, allow at least 48 hours before handling. When handling hatchlings, exercise extreme caution because they are easily bruised if too much pressure is applied. It is important to wash your hands before and after handling.



Fig 1 : Handling of the Snake



Fig 2: The optimal fit out for a snake enclosure

Setting up a Snake Enclosure

Determining what the ideal enclosure temperature should be is crucial when creating a habitat for the snakes. Will the species be active at all? Does the snake desire to ascend? Prior to designing the enclosures, it is imperative to comprehend the fundamental factors that should satisfy the snakes' physical and psychological requirements.

Primarily prevalent in tropical or warmer areas, they are recognised for their cold-blooded physiology. Many species of snakes frequently bask in order to stay warm. On the other hand, snakes that are used to cooler environments require less artificial heat. Considering the size of the habitat is important, enclosures totalling a minimum of approximately 10–20 gallons in volume for juveniles and 20–40 gallons for adults are suitable for most snakes. However, the snake's individual size and rate of growth must be considered when designing the enclosure (fig 2).

For smaller species, the enclosure's width should be at least 40 cm, its height at least 35 cm, and its depth should not be less than 30 cm. For the species of average size, suitable dimensions for most adult snakes are 70 cm in width, 40 cm in depth, and 50 cm in height.

It should be designed in such a manner that it resembles the true wild environment, and the snakes should be able to move freely.

Snakes feel more secure when they are able to conceal themselves in tight-fitting spaces. To allow the snakes to enjoy burrowing and hiding, a thick layer of substrate can be included in the design. Adding up to two inches of soil, along with Aspen Snake Bedding, will create a suitable

substrate. It is essential to replace the substrate entirely every few weeks and to eliminate any noticeably soiled areas as soon as they are spotted. Before putting in fresh bedding, make sure the enclosure is thoroughly cleaned and disinfected.

The Ideal Temperature

Snakes have evolved to be ectotherms, or creatures that adjust their body temperature to match the environment. It is crucial to provide the right form of heating and the correct temperature for them. The enclosure's temperature should be set at approximately 21°C or 70°F at the cooler end and 35°C or 95°F at the warmer end. By positioning the heating mat or lamp at one end of the enclosure, the snakes are able to choose the most comfortable spot for themselves. The heat lamp inside the enclosure shouldn't ever be placed close to the water source (fig 3).



Fig 3: A snake basking under the heating lamp

Specific species requirements for humidity vary, but optimal ranges are between 40% and 50%. Typically, this benefits snakes throughout their skin-shedding process.

The humid area must have adequate ventilation, and the snakes should have a suitable hiding place. There are a variety of hiding boxes/shelters available for both the warm and the cooler ends of reptile enclosures. The water dish should be positioned at the cooler end of the enclosure, and it should only be partially filled to reduce the likelihood of spills (fig 4)

Enriching the Enclosure

Suitable enrichment within the enclosure promotes wellbeing and natural behaviour. One of the best ways to encourage snakes to engage in natural burrowing behaviours is to provide them with a suitable digging space within their enclosure.

It is possible for snakes to become indifferent in response to an unstimulating environment, and when this occurs, you may observe undesirable consequences such as altered behaviour or even disease.

To avoid this, you can create foraging areas, puzzle feeders, and even rearrange the entire enclosure's décor.

Offering both semi-arboreal and terrestrial animals plenty of climbing possibilities is a terrific strategy to support their development of muscle mass, resulting in healthier animals (fig 5.1, 5.2)

It is essential to clean and replenish the water dish at least once a day. It is also vital to regularly do visual inspections of your snakes. And to ensure that the right humidity and temperature are maintained and to eliminate any residue or stains within the enclosure.

Make sure you that remove shed skins. Be prepared to check the weight of the snake when necessary. Clean and disinfect the enclosure regularly, and ensure that the snakes are physically inspected once a week. Perform a thorough cleaning and replacement of all substrates once a month.



Fig 4: Placement of thermo-hygrometer

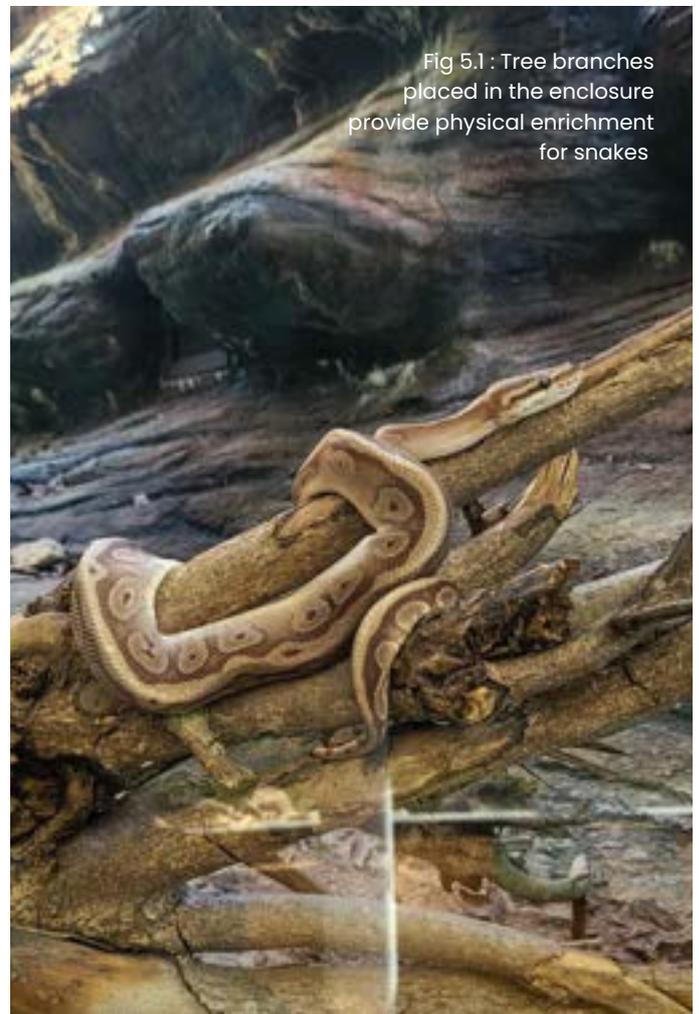


Fig 5.1 : Tree branches placed in the enclosure provide physical enrichment for snakes



Fig 5.2 : Tree branches placed in the enclosure provide physical enrichment for snakes

Keeping Snakes Healthy

Snakes retain their health when you provide them with a stress-free habitat, the right temperature, and regularity. A snake is considered healthy if it is active, attentive, has clean eyes (except when it sheds), eats frequently, maintains a healthy weight, has smooth, supple skin, sheds its skin in whole sections on a regular basis, and is free of ticks and mites.

Baby snakes should be fed every seven days. As a guide, you should feed mice or day-old chicks that are roughly equivalent in size to the snake's girth. Older snakes typically eat once a week or once every two weeks.

Avoid feeding during shedding. The majority of snakes that consume defrosted rodents can also be provided with day-old chicks.

Common symptoms of illness include hard breathing, bubbles coming from the mouth and nose, difficulty in shedding, frequent or infrequent shedding, vomiting or regurgitating, lethargy or reluctance to eat, abnormal faeces, bumps or spots on skin, red or pink skin colour . (which possibly indicates systemic infection), and swelling. Should your snake display any of these symptoms, it is advisable to immediately seek veterinary care.

A Passion for Reptiles

BY HARLEY AND LEDGER CHAPMAN

Frill-necked Lizards





Cunningham's Skinks - Snowy Mountains race

Cunningham's Skink *Egernia cunninghami* - Snowy Mountains and Woodlands races

Land Mullet *Bellatorias major*

Shingleback Lizard *Tiliqua rugosa*

Centralian blue-tongued Skink *Tiliqua multifasciata*

Western Blue-tongued Skink *Tiliqua occipitalis*

Eastern Blue-tongued Skink *Tiliqua scincoides scincoides* - wild type, albino, hyper melanistic and anery

Pink-Tongued Skink *Cyclodomorphus Gerrardii*

Frill-necked Lizard *Chlamydosaurus kingii*

Bearded Dragon *Pogona*

Rusty Monitor *Varanus semiremex*

Lace Monitor *Varanus varius*

Spiny-tailed Monitor *Varanus acanthurus*

Black-headed Monitor *Varanus tristis* - Kimberley race

Spotted Tree Monitor *Varanus scalaris* and *V. s. pelliwensis*

We are Harley and Ledger Chapman, 18 and 15 years old respectively. We live in a small town called Childers in Queensland (QLD), Australia. As brothers growing up in country QLD, our parents encouraged us to develop a great appreciation of nature and all that our amazing natural environment has to offer. This affiliation with bush has no doubt fuelled our shared passion for animals, in particular our love of Australian reptiles.

We grew up surrounded by reptiles, as our mum and dad kept and bred a large variety, so you could say that a love of these incredible animals runs in our veins. It didn't take us long before we both wanted to acquire some for ourselves.

Harley has a keen interest in skinks, having approximately 50 in his collection, but also loves dragons and monitors, keeping numerous species of these as well. Harley's collection includes species such as:



Baby Shingleback Lizards



We use outdoor pits such as this one to house skinks and monitors



Spiny-tailed Monitor

Both the skinks and monitors are mostly kept in outdoor enclosures and pits, so they have access to natural sunlight, providing them with adequate UV exposure and the ability to partake in natural basking behaviour. Housing them outside also ensures that they go through their natural seasonal cycles which aids in achieving successful breeding.

The outdoor enclosures and pits are also much easier to maintain, as they are mostly self-regulating, with only occasional cleaning required. Whilst the adults are kept outside, our young skinks and monitors are kept inside in appropriate enclosures equipped with heating and UVB lights to give them the best possible start in life.

The skinks are fed a mixture of premium lean beef mince, raw eggs, crushed dry puppy kibble and vegetables. This is fed to the babies/juveniles every second day and twice a week to the adults. The adults also always have dry puppy kibble available - we use high-quality kibble to assist in providing the skinks with a balanced diet. With the Land Mulletts being fungus eaters, they also get diced mushrooms once a week.

The monitors receive a mix of turkey mince, quail, rats and chicken hearts. It is very beneficial for them to be offered whole food items as a regular component of their diet.

They all always have access to fresh water.



Centralian blue-tongued Skink



Eastern Blue-tongued Skink



Food for the skinks



Eastern Blue-tongued Skink - hyper malenistic mutation

Ledger's focus is on snakes and turtles, with his collection including 46 snakes along with several turtles, including the following species:

Australian Scrub Python *Simalia kinghorni*

Olive Python *Liasis olivaceus*

Jungle Carpet Python *Morelia spilota cheynei*

Coastal Carpet Python *Morelia spilota mcdowelli*

Darwin Carpet Python *Morelia spilota variegata*

Woma Python *Aspidites ramsayi*

Black-headed Python *Aspidites melanocephalus*

Stimson's Python *Antaresia stimsoni*

Diamond Python *Morelia spilota*

Water Python *Liasis fuscus*

Oenpelli Python *Simalia oenpelliensis*

Macleay River Turtle *Emydura macquarii*

The adult pythons are kept in cabinets equipped with the appropriate heating and basking spots. All hatchlings are kept in tubs on racks.

The tubs for the hatchlings are maintained at a consistent temperature for the first 12 months, this allows for them to be fed throughout their first year, giving them the best start, as it does get quite cold in our location during winter.



Australian Scrub Python



Olive Python



Oenpelli Python



Pure coastal Carpet Python - ghost mutation

Pythons are relatively easy to keep and maintain. Hatchlings and females that are close to breeding are fed once a week. Males and other larger non-breeding females are fed once every 2 or 3 weeks, though this schedule does depend on the condition of the individual snakes and the size of the food items.

All snake cabinets are cleaned weekly.

As there are so many animals to feed that require different-sized food items, we breed our own rats and mice, which not only proves more convenient but is also much more economical.

The turtles are kept in outside ponds with a consistent supply of duckweed and guppies, with turtle pellets also being supplied.

Harley graduated year 12 in 2023, after which he started volunteering at our local reptile park Snakes Down Under and has now commenced a 2-year traineeship with them.

On completion of Certificate III in wildlife and exhibited animal care he will become a qualified zookeeper.

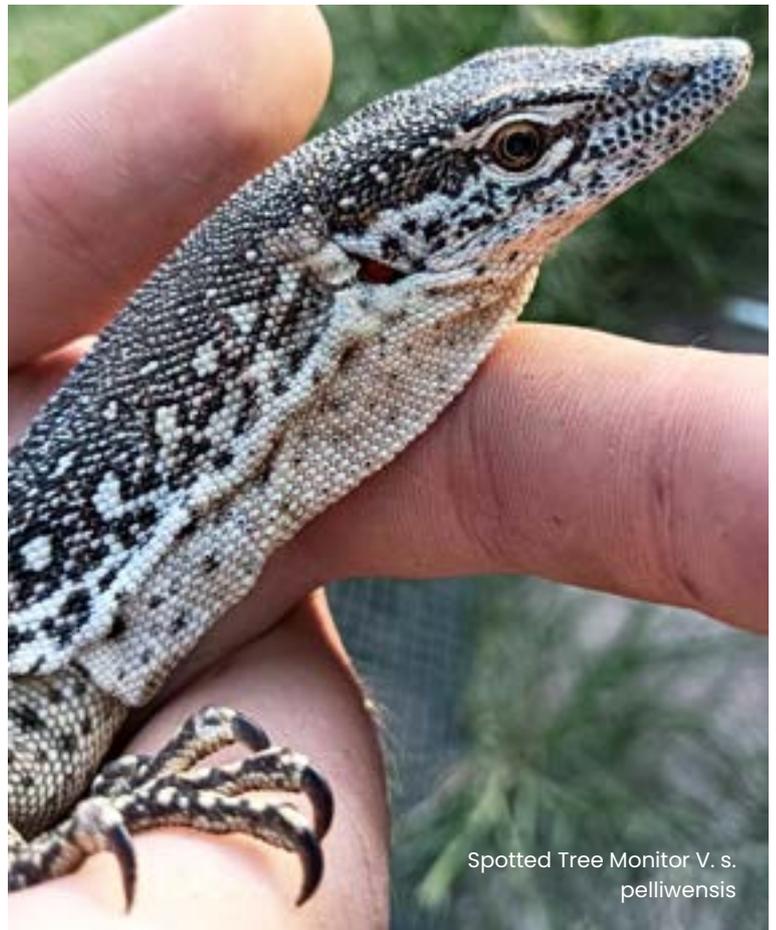
Ledger is currently in year 10 and volunteers at Snakes Down Under every Thursday as part of his school curriculum along with one day every weekend as well.

They both love their work at Snakes Down Under and thoroughly enjoy working alongside great people who possess vast knowledge of and experience with reptiles, whom they are very grateful to be learning from.

Harley is looking forward to completing Certificate III in Wildlife and Exhibited Animal Care and becoming a qualified zookeeper and hopes to continue working at Snakes Down Under.

He is always striving to increase his knowledge of different animal species. He also has plans to travel around Australia in his spare time to observe and study reptiles in the wild.

Ledger's future goals include travelling around Australia to observe different species of reptiles to record their habits and localities.



Spotted Tree Monitor *V. s. pelliwensis*

He plans to become a licensed snake catcher to allow him to assist locals in his community and other towns.

He would also like to have the opportunity to do mobile reptile demonstrations as a future business. In the meantime, he intends to continue volunteering and working at Snakes Down Under.

Both Harley and Ledger love working with reptiles of all types and take every opportunity to encourage others to take an interest in and learn more about this amazing group of animals.



Western Blue-tongued Skinks

The Australian Broad-shelled Turtle, *Chelodina expansa*, is the largest freshwater turtle species found in Australia. Recognised by its distinctively broad carapace and exhibiting the longest neck-to-body ratio of any turtle, it is a truly impressive reptile.

Naturally occurring throughout the Murray-Darling basin of eastern Australia. These turtles can tolerate a variety of climatic conditions, making them a hardy species well suited to keeping in outdoor settings. Featherdale Sydney Wildlife Park has housed a trio of these turtles for many years but had not experienced successful captive breeding until the autumn of 2024. After a long incubation, 22 turtles hatched with a 100% success rate, marking an exciting achievement for the reptile department.

Captive Care and Breeding of the Australian Broad-shelled Turtle

BY COOPER VAN DER WAL
REPTILE KEEPER | FEATHERDALE SYDNEY WILDLIFE PARK



Broad-shelled Turtle



Broad-shelled Turtle enclosure at Featherdale Sydney Wildlife Park

Captive Housing

Mature Broad-shelled Turtles are best suited to outdoor ponds due to their large size and the benefits that natural conditions can provide. Most Australian freshwater turtles are highly aquatic, typically only leaving the water for short periods to bask in the sunshine or to nest. Thus, most of the space should consist of water.

Featherdale houses their turtles in purpose-made pond exhibits with land areas filled with sandy substrate and plants. High water quality is essential, with regular water changes and cleaning occurring on a weekly basis. Alternatively, an extensive filtration system can mitigate maintenance frequency.

Rocks, logs, and plants are added to the exhibit to replicate wild habitat, which often sees turtles using these ornaments for cover. Outdoor conditions allow turtles access to natural sunlight, providing essential vitamin D3 production for general health and egg production.

Furthermore, seasonal temperature changes are important in triggering natural breeding cycles. Housing should provide ample space for all individuals to exhibit natural behaviours without competing.



Broad-shelled Turtle enclosure at Featherdale Sydney Wildlife Park



Cooper holding an adult Broad-shelled Turtle

Diet and Nutrition

Australian Broad-shelled Turtles are carnivorous, hunting primarily by using ambush techniques. They will sit still and wait with their necks retracted for fish or other freshwater prey to swim past, then swiftly strike and retract again. In captivity, however, they become easily accustomed to thawed frozen food items such as chopped fish and prawns. They also seem to enjoy vitamin- and calcium-coated invertebrates tossed onto the water's surface, with the turtles sneaking up from below to pick them off.

A varied diet is important for health and wellbeing. Food cycling occurs seasonally, with feeding increased during the spring and summer months to match metabolic needs and promote breeding. No feeding occurs throughout the coolest parts of the year.

Breeding

Broad-shelled Turtles, like other freshwater turtle species, can take years to become sexually mature. Being a cold-blooded temperate species, their reproductive cycle is linked with seasonal temperature changes. Breeding begins as temperatures start to cool. Unlike other species, Broad-shelled Turtles typically nest during the autumn and winter months.

Females will exit the water during daylight hours, often after rain, and deposit their eggs in a shallow burrow, roughly 10 cm deep, using their hind legs to dig it out and then again to fill it back in. Featherdale has experienced females depositing eggs in water in previous years that did not survive or were not fertile. This lack of natural nesting behaviour could be a result of insufficient substrate levels in the exhibit.



Broad-shelled Turtles - adult and hatchling



Cooper holding adult and hatchling Broad-shelled Turtles

Prior to the previous nesting season, keepers added extra sandy substrate to the land areas of the exhibit to ensure these areas were above water level. This change is believed to be a contributing factor to the successful nesting that took place in July 2023, when a female deposited 22 fertile eggs.

The eggs were removed from the nest site and placed in two tubs with vermiculite dampened with water at a 1:1 ratio and lids containing a few small holes for air exchange. These tubs were placed in an incubator initially set at 24 degrees Celsius.

Broad-shelled Turtle eggs can withstand the cold conditions of the unusual winter nesting time by entering a diapause state. The duration of colder conditions can significantly impact incubation time, with wild clutches potentially taking up to a year to hatch. In captivity, however, this duration can be decreased due to temperature-controlled conditions.

After a few months at 24 degrees, the temperature was increased to 28 degrees Celsius to simulate the onset of the warmer seasons. Egg-incubation continued until early March 2024, when the first hatchlings began to emerge. Over the course of two weeks, all 22 turtles hatched out fully formed and healthy.

Hatchling care

Once hatched, baby turtles are kept inside the incubator to absorb their yolk reserves, which are visible on the plastron. After this occurs, they are moved to a small tank, tub, or pond with shallow, heated, and filtered water. This allows them to gain strength while swimming without having to struggle to reach the surface for air.

The tub is set up with real or fake aquatic plants and a basking dock so that the animals can seek refuge and bask. Heat and UVB lamps are provided to simulate the benefits of sunlight.

Feeding is like for adults; however, foods must be cut down to a smaller size that hatchlings can easily consume, and food items such as bloodworms are added initially to induce feeding.

As turtles grow and gain strength, water volume and depth can be increased accordingly.

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Size comparison between adult and hatchling Broad-shelled Turtles

Anti-Venom Program at the Australian Reptile Park

BY ZAC BOWER

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The Australian Reptile Park opened in 1949 and has been involved with the Australian Antivenom Program since 1951. Originally founded by the late Eric Worrel, the reptile park started collecting snakes in response to the arising need to develop an antivenin. Over the past 65 years, ARP staff have collected venom from indigenous, terrestrial snakes for use in the production of antivenom and in doing so, saved a reported 300 lives per year. Through my association with ARP, I have had the great fortune to be selected to be a part of this program and have had the opportunity to be mentored by some incredible venom keepers including John Weigel, Craig Adams and Bill Collet and now perform the role of Venom Supervisor at the park, which has been a lifelong dream.



Eric Worrel milking
a snake in 1951

Over the past few years, we have investigated venom extraction techniques utilised in other venom facilities around the world to refine our processes with the view to maximise the amount of venom recovered as well as minimise the risk to keepers and snakes. We had noticed a significant amount of venom was being lost using the traditional vial method which involved a snake biting onto a vial with a membrane stretched across the top, this was especially noticeable whilst milking our Eastern Brown Snakes as the venom yield was so small.



Milking a Coastal Taipan using a vial

We investigated multiple techniques including milking multiple snakes per vial, a technique used by world-renowned venom labs including Kentucky Reptile Zoo, Reptile Discovery Centre and Medtoxins Venom Laboratories but decided not to use this technique due to the high chance of disease transfer from snake to snake. We also investigated using capillary tubes as used by the University of Northern Colorado, but they seemed to suit vipers with large, hinged fangs as opposed to our elapids with fixed fangs and a more solid jaw structure that would hinder the ability to use the long tubes. They also presented the same problem as the multiple snakes per vial technique regarding the transfer of disease. We eventually found a technique that appeared to suit our needs and fit almost all the criteria that we were looking for.



Milking a Coastal Taipan using a vial

We then moved on to one vial per snake to raise the hygiene standards and nullify any chance of disease transfer during the milking process. This technique has been successful for 60 or more years, as evidenced by the approximately 15,000 lives that have been saved during that period.

However, this single vial technique had its drawbacks. To effectively clean the up to 150 vials that are used weekly is very time-consuming, as is re-covering each vial individually. This means one staff member is tied up prepping vials for a full day each week.

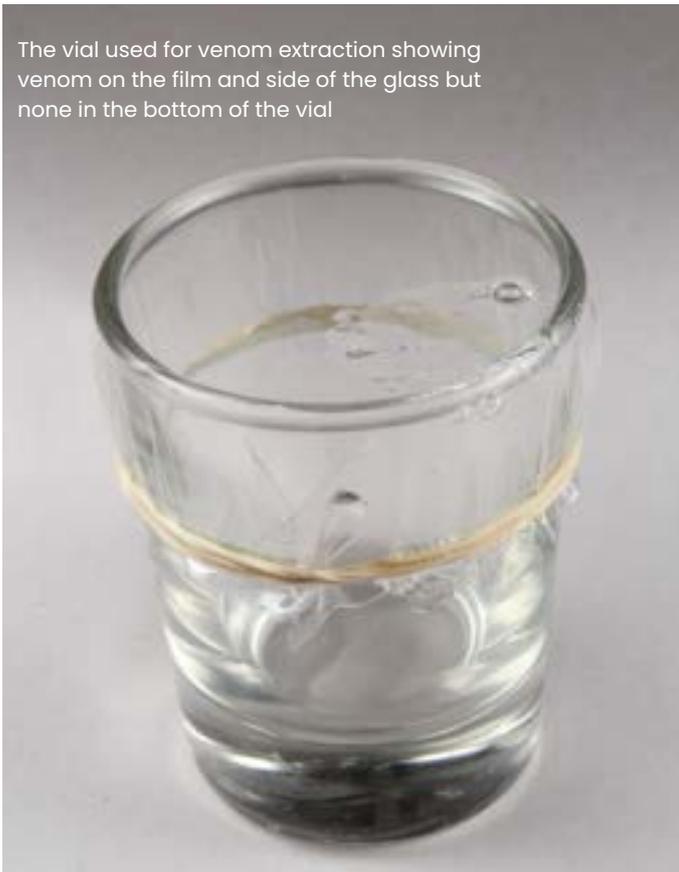
Additionally, each time a snake's venom is extracted a small amount is left on the membrane, vial and inside the transfer syringe when it's transferred from the vial to a vacuum-sealable bottle. The amount that is wasted from individual snakes is tiny but when you consider that we extract venom from over 250 snakes every fortnight it starts to add up.

If we then multiply that over the last 65 years, it equates to a significantly large amount of venom, that until recently, we have been unable to retrieve.

Traditionally, venom extractions used a glass beaker with a cut-up dishwashing glove stretched over the beaker to roughly the tension of skin, that they would have anywhere up to 50 snakes bite into, which we now understand was an unhygienic process. It'd be like sharing your toothbrush with everyone else in the room. Any snakes that may have had infections or viruses could spread this through a whole collection extremely fast with devastating consequences, as some international venom facilities have experienced.

This isn't an issue when working with the larger (venom) yielding species like Coastal Taipans as the % of venom lost is so minuscule that it doesn't warrant any change to the well-tried and tested technique. On average with Coastal Taipans the % lost would be under 1% of the total amount of venom extracted. Being such a small amount, it seemed unwise to try any other techniques that could present a slightly higher risk to the keeper. The loss becomes more significant when Eastern Brown Snakes are milked with this technique and can total anywhere between 10-20% of the milked venom left as residue on the equipment, depending on the individual snake.

The vial used for venom extraction showing venom on the film and side of the glass but none in the bottom of the vial



In the accompanying photo of the vial, you can see that there is venom on the film and the side of the glass but not a single drop in the bottom of the vial. In this instance, we would have an incredibly hard time retrieving most of this venom. On average Eastern Brown Snakes give 0.1 grams of venom compared to Coastal Taipans from which I have extracted up to 3.1 grams. With the percentage lost from Eastern Browns being so large, it gave us the perfect reason to attempt to trial different techniques to enable us to operate with maximum efficiency. We decided to try the pipetting method used by the Australian company Venom Supplies which specialises in supplying venom for pharmaceutical companies and has fine-tuned this technique over many years.



Pipetting an Eastern Brown Snake



Pipetting an Eastern Brown Snake

The pipetting technique was something very different to the traditional method. It involves placing a small pipette over the fang of the snake and applying light pressure to push the fang sheath up and stimulate a bite response on that side. It would allow us to extract venom from one side of the snake at a time and ensure we were collecting as much as possible. It could then be placed immediately into the sealable vial cutting out almost all chance for venom loss. We also were about to improve this yet again by using polycarbonate pipettes, which repel the venom proteins allowing all the venom to be collected. Initial trials saw good results and an increase of 57% in venom collected.

We were happy but believed that our technique could be improved if we were able to see it done effectively. We contacted Nathan Dunstan at Venom Supplies who allowed me to spend a week there to observe him and his team whilst they worked. He explained and demonstrated the finer details of the technique, and I was able to bring those back to ARP and pass the information on to my staff. Initial trials showed immediate positive results of roughly double the amount of venom collected. With these rapid improvements management gave me permission to continue trialling this technique and over the coming

months as my proficiency grew and I fine-tuned the technique our results got even better to a point where the venom extracted from the 23 Eastern Browns that had previously been milked using the vial, showed an increase of roughly 250%.

As you can see in the accompanying graph the improvement was incredible and far exceeded anything we expected.

As with all venom extraction techniques Pipetting snakes isn't without its risks but our main concern with this method was how close your hand is to the fangs.

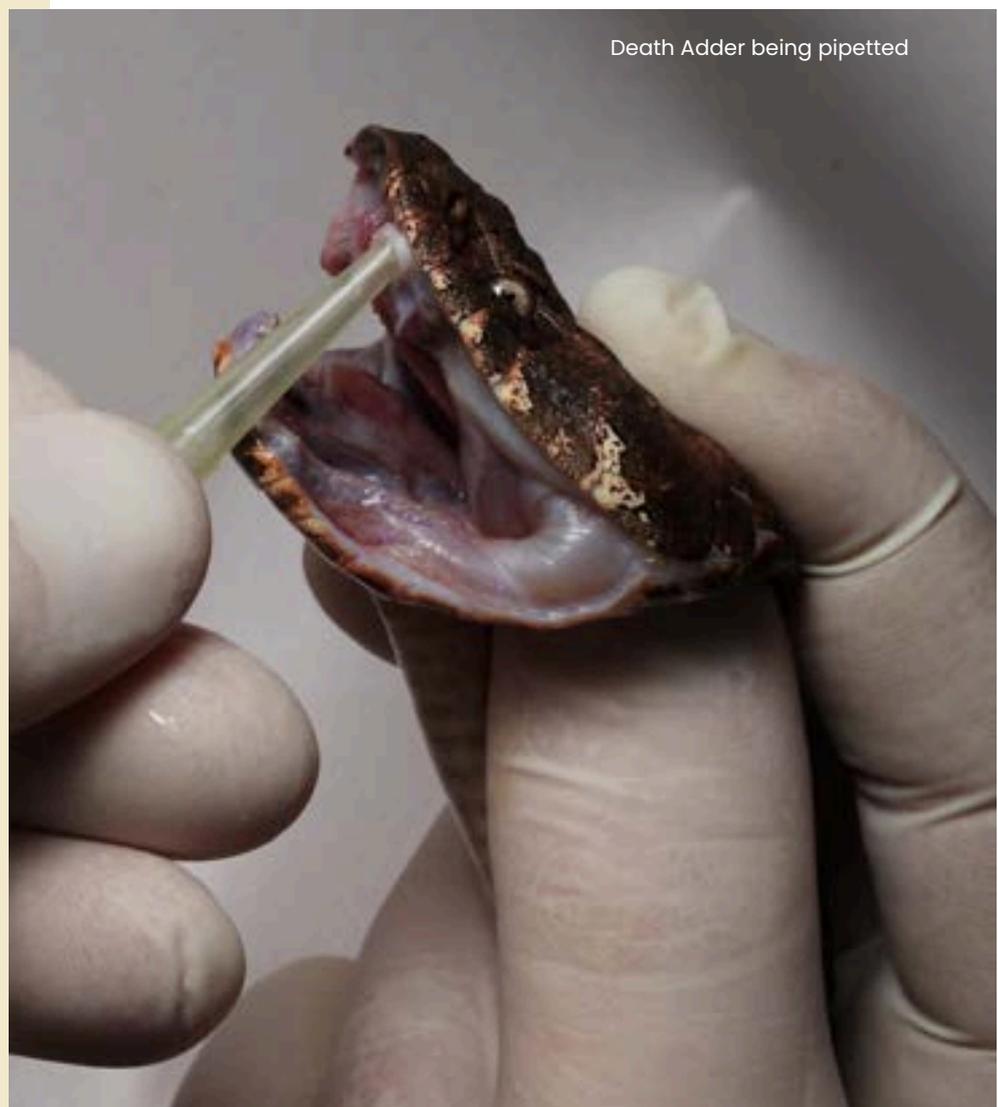
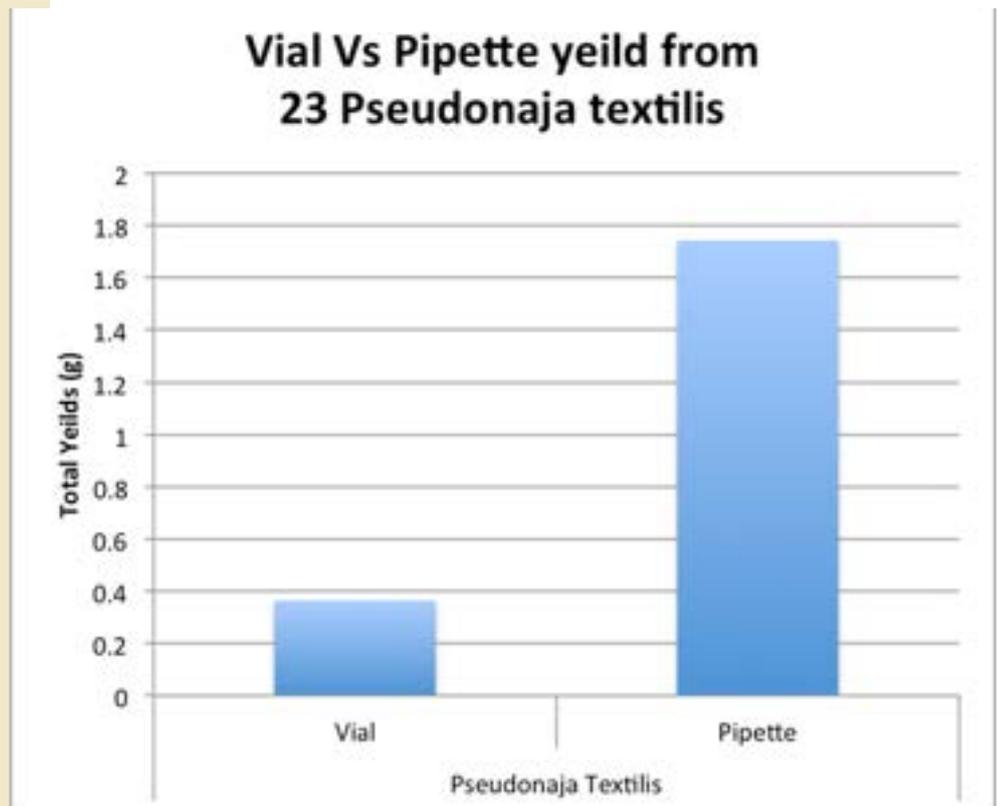
With the pipette being around 40mm the fingers holding it would be even closer.

To counter this, we had to modify the 3 fingered viper grip to prevent any movement of the head whilst extracting venom. At first, this was a very scary thought and there were a few close calls when the snakes attempted to free themselves from my grip as I started placing the pipette onto the fang.

I was able to minimise the chance of this happening by placing the first third of the snake under my arm and having the second person support the rest of the snake.

Therefore, not allowing it to use its body as leverage to pull its head away from my grip.

This graph shows 6 months of data for Eastern Brown Snakes - 3 months of milking compared to 3 months of pipetting - averaged out





Death Adder being pipetted

As my confidence and expertise grew, we decided to attempt the pipetting technique on another species, the Death Adder. We were seeing the same problem with extraction as had been identified with Eastern Browns i.e., venom lost on the plastic film and the jar throughout the procedure. The Death Adder presented another problem, with their large fang length, flexible jaw structure and the affectionately called “you bastard bite” that they give, adding to concerns for handler safety. Death Adders are incredibly quick and very determined to bite once restrained. They can also flick their bodies and reef their head out of your grip. This had to be investigated to ensure this technique would be safe enough to use with this species.

After some experimentation, the pipetting technique was modified to ensure the apparatus was always between the jaw and my hand, essentially acting as a physical barrier. Another adaption in the process was to use one of the restraining fingers to move the bottom jaw slightly to reveal the fang.

This may look rough, but Death Adders have a very flexible jaw structure and very little pressure is applied. We once again saw a large increase in venom yields of up to 24%.

While noting that the increase isn't as impressive as that noted for Eastern Browns it must be acknowledged that every drop of venom counts, as it can take up to 40 snakes to make one vial of antivenom.

The significant increases seen in both Eastern Browns (250%) and Death Adders (24%) have led to these 2 species being milked exclusively using the pipetting method. This technique has revolutionised the way the Australian Reptile Park extracts venom from our smaller yielding snakes.

It has allowed us to collect the precious venom that was, in the past, lost during the process. As the years go on each keeper is sure to bring their unique style and flare to the section but as the results of the pipetting technique have shown to be so significantly more effective, we are sure that this technique will continue to be used into the future.



Padar Island

Exploring the Komodo Islands

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Located in the middle of the Indonesian archipelago, near the Island of Flores, Komodo National Park is home to one of the most iconic species of reptiles, the Komodo Dragon *Varanus komodoensis*. Komodo National Park consists of three main islands known as Komodo, Padar and Rinca, along with numerous smaller islands. The islands are a part of the active volcanic “Shatter Belt” and are known for their rugged hillsides, dry savannas, white sandy beaches and beautiful coral reefs.

Komodo National Park houses a vast array of marine and terrestrial wildlife with the Komodo Dragon being the most well-known.

The Komodo Dragon is the world’s largest extant species of lizard and is a member of the family Varanidae. There are approximately 3,000 individuals left in the wild, all of which are located exclusively within the Lesser Sunda Islands. This species can weigh over 100kg and is an apex predator, feeding on a variety of prey items including large deer and buffalo. They are also known to feed on carrion and can smell flesh from over 4km away.



Komodo Dragon

Komodo Dragons are a cannibalistic species, feeding on younger dragons. To reduce the risk of being predated on, younger dragons are almost exclusively arboreal, whilst mature adults are terrestrial due to their large size. These incredible creatures can be spotted fairly easily when hiking on both Rinca and Komodo Islands.

Komodo Dragons aren't the only unique and marvellous species of reptile found in Komodo National Park. The park is home to a variety of species of snakes, including the stunning Lesser Sunda White-lipped Pit Viper *Trimeresurus insularis* and the Javan Spitting Cobra *Naja sputatrix*. In addition to the 12 terrestrial snake species calling Komodo National Park home, there are a variety of skinks, geckoes, legless lizards, marine turtles and marine snakes found within the park.

Whilst many of these species can be spotted throughout the day, heading on an evening fauna spotting tour is bound to increase the chances of seeing these unique species.

Komodo National Park is also teeming with other wildlife both in and out of the water, aside from its unique reptiles. On the islands species such as Timor Deer *Rusa timorensis*, Water Buffalo *Bubablis arnee*, Crab-eating Macaques *Macaca fascicularis* and Asian Palm Civets *Paradoxurus hermaphroditus* can be spotted. Looking toward the skies, fruit bats and a variety of bird species can be seen overhead, including the endangered Yellow-crested Cockatoo *Cacatua sulphurea*.

Below the water's surface lies an incredible variety of fish, coral, sea turtles, cetaceans and rays, labelling Komodo National Park as one of the top dive sites in the world.



Travelling to Komodo National Park is an incredible experience and one to be cherished and remembered for a lifetime. To get there, adventurers will need to fly into Flores, one of the many Lesser Sunda islands.

Once in Flores, access to the national park is exclusively via boat and there are several ways travellers can arrange their visit.

One option is to book one of the many day tours that leave from Flores taking groups of travellers for a whirlwind trip of the park.

This option allows travellers who are short on time the opportunity to get a taste of what the Komodo National Park has to offer.



Green Lesser Sunda White-lipped Pit Viper

Travellers wanting to get a much better experience of the national park are better off booking a multi-day tour through a reputable company such as Picnic to Komodo which uses Komodo National Park guides to facilitate your tour of the incredible landscapes and reefs that the Park has to offer. Tours like these will include a personal national park guide, food and accommodation on board a boat, as accommodation options on the islands are little to none.

Overall, Komodo National Park provides the trip of a lifetime for adventure lovers and wildlife enthusiasts alike. The park offers incredible views, reefs and wildlife that make for a truly unforgettable experience.



Blue Lesser Sunda White-lipped Pit Viper



Hawksbill Sea Turtle



Green and Golden Bell Frog

Symbio Wildlife Park Advancing Herpetological Conservation Efforts

Since the opening of our state-of-the-art reptile facility in 2014, Symbio Wildlife Park's herpetological division has continually expanded its conservation efforts. Our reptile house features 24 diverse exhibits, showcasing a variety of mixed displays that have been met with great success. Beyond the public exhibits, we house several species of elapids, lizards, skinks, and amphibians off display.

Green and Golden Bell Frog Conservation

In 2015, discussions with the Roads and Maritime Services highlighted a significant threat to a key population of the Green and Golden Bell Frog *Litoria aurea* in Arncliffe due to the West Connex road development project.

This project posed both direct and indirect risks to the existing purpose-built breeding ponds. In response, Symbio Wildlife Park partnered with Roads and Maritime to establish a holding and

breeding facility aimed at repopulating the affected habitat post-construction.

Our team swiftly constructed a dedicated facility and prepared to receive 18 Green and Golden Bell Frogs, anticipating a productive breeding season. Since then, Symbio Wildlife Park has successfully bred and released over 20,000 tadpoles into purpose-built wetlands at Arncliffe, significantly bolstering the wild population.



Symbio Wildlife Park's breeding facility for the critically endangered Bellinger River Snapping Turtle

Bellinger River Snapping Turtle Conservation

The conservation landscape in New South Wales faced another challenge in 2015 with the rapid decline of the Bellinger River Snapping Turtle *Myuchelys georgesi* due to an unknown virus. With the turtle population dwindling to critically low numbers, immediate action was necessary. The first insurance population was successfully housed at Taronga Zoo, and we are proud to announce that Symbio Wildlife Park now hosts the second insurance population.

This critical initiative is a collaborative effort with leading conservation teams, and we are optimistic about the future of this endangered species.

Our work at Symbio Wildlife Park is driven by a commitment to preserving biodiversity and ensuring the survival of these remarkable reptiles.

Since 2015, Symbio Wildlife Park has successfully bred and released over 20,000 Green and Golden Bell Frog tadpoles





Green and Golden Bell Frog
holding and breeding facility

Looking Ahead

Symbio Wildlife Park continues to play a pivotal role in herpetological conservation. Our efforts are not only about safeguarding species but also about fostering collaboration with conservationists, researchers, and the broader community. Together, we aim to create a sustainable future for all our reptile residents and the ecosystems they inhabit.



Bellinger River
Snapping Turtle

Dartfrogs Demystified

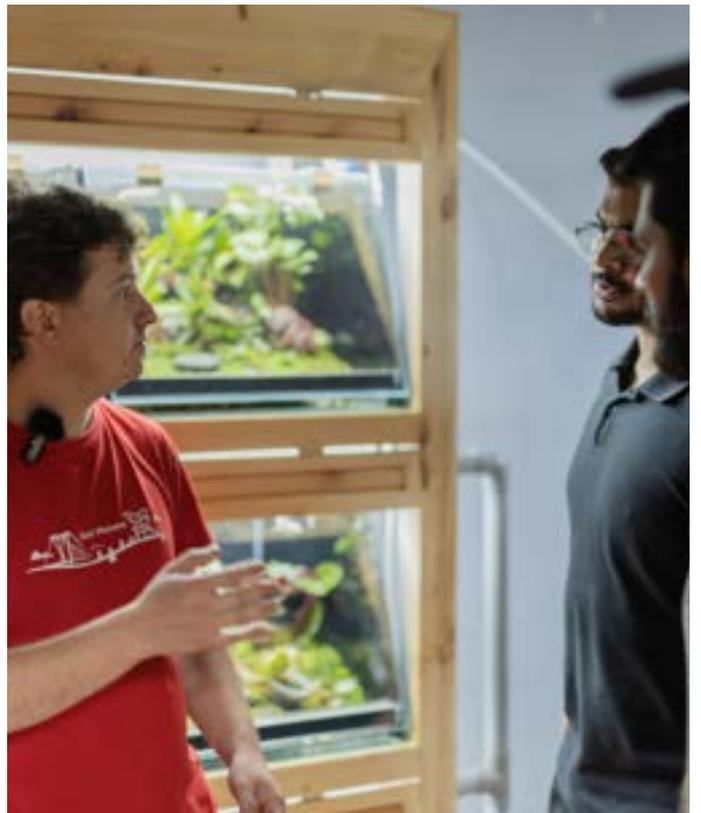
Workshop By Mr. Vaclav Palvick (Herpetologist)

On the **16th of May, 2024**, enthusiasts of the natural world gathered at the LSeT Foundation in Bangalore for an exclusive live workshop titled "Dartfrogs Demystified." This immersive session, hosted by the LSeT Foundation, was led by the renowned herpetologist Mr. Vaclav Palvick. Mr. Palvick captivated the audience with his deep knowledge and passion for dart frogs. The workshop seamlessly combined theoretical knowledge with practical insights, unraveling the secrets of these mesmerizing amphibians.



Participants delved into the intricate details of dart frog biology, behavior, and habitat. Mr. Palvick shared his extensive experience in field research, emphasizing the ecological significance of these vibrant creatures. The attendees learned about the diverse species of dart frogs, their striking coloration, and their care in captivity.

The event provided a unique opportunity for both seasoned herpetologists and curious newcomers to deepen their understanding of dart frogs. Mr. Palvick's engaging presentation and interactive approach left participants with a newfound appreciation for these remarkable animals and the importance of preserving their natural habitats.





This workshop was a resounding success, leaving a lasting impression on all who attended. The workshop not only enriched the knowledge of its participants but also fostered a greater respect for the wonders of the natural world.



A Memorable Summer Camp with Hope School

This summer, LSeT was thrilled to host a group of enthusiastic students from Hope School for a special summer camp dedicated to animal care and education.

The camp was a delightful blend of fun and learning, designed to instill a sense of wonder and responsibility in young minds.

From the moment the students stepped into our facility, their excitement was evident. The camp kicked off with a warm welcome and an overview of the day's activities.

The highlight of their visit was undoubtedly the interactive sessions with our resident birds and animals.



In the bird interaction segment, students were introduced to a variety of species, including cockatoos. Guided by our expert handlers, the children learned about the birds' natural habitats, behaviors, and dietary needs. They even had the opportunity to feed and hold some of the birds, an experience that left them wide-eyed with amazement.

The animal interaction sessions were equally engaging. Students met friendly lizards, snakes and various insects. They learned about the daily care routines, grooming practices, and nutritional needs of these animals. The positive feedback from the students and their teachers was heartwarming, affirming the success of the camp.

Hosting the students was a true pleasure, and we are proud to have contributed to their learning journey. We look forward to welcoming more young explorers and continuing our mission to educate and inspire future generations about the importance of animal care and management.



Welcoming June batch



Rajat Bawankar

Rajat Bawankar, a zoology graduate from Nagpur, has volunteered at several esteemed organizations, gaining hands-on experience and making a significant impact. With a blend of academic knowledge, practical experience, and a deep love for animals, Rajat is poised to make a meaningful difference in animal care and management.



Kartar kaur

Kartar Kaur, a dynamic BBA graduate from NMIMS School of Branding and Advertising in Mumbai, is passionate about animal care. Her dedication has led her to volunteer at various organizations, and as an avid horse rider, she finds joy and fulfillment in the company of these magnificent creatures, deepening her commitment to their well-being.



Santhose kumar S

Santhose, a dedicated professional from Pollachi, Tamil Nadu, whose diverse expertise spans IT and sales. Beyond his professional achievements, Santhose is an ardent animal lover with a deep-seated passion for the well-being of all creatures. Santhose's unique blend of technical skills, sales experience, and genuine love for animals positions him as a multifaceted individual ready to make a positive impact.



Sandesh Kakade

Sandesh, a passionate B.Sc. Computer Science graduate from Savitribai Phule University, combines technical expertise with a dedication to animal care. His fascination with exotic birds, from majestic macaws to delicate parakeets, fuels his deep interest in their diverse species.



Ayush Prathmesh Ahire

Ayush, from Nashik, recently completed his +12 and is now exploring his passion for hand-feeding and training exotic birds and animals. His fascination with these creatures drives his hands-on approach and ability to connect with them, setting him apart as a budding expert in this field.



Praveen H.S

Praveen H.S, a Bangalore native, completed his pre-university education at Bangalore University. His interests encompass cricket, volleyball, and traveling.



Matthew.K.Korath

Matthew.K.Korath is a Bannerughatta zoo marketing manager and his interest includes Photography, Cooking, Aqua Scaping ,and bike riding.



Vinayak Kadam

Vinayak is a dedicated zoologist from Satara. With a Bachelor of Science degree in Zoology, Vinayak has cultivated a deep interest in the animal kingdom, focusing especially on the fascinating world of reptiles.

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