Our goals -
To promote “best care” rather than “basic care.”
To tackle the all-pervasive myths of reptile husbandry using research and science, not anecdote and assumption. To promote the use of new technologies where applicable, and the use of existing technologies where it has been proven to be beneficial to animals.

Of Twigs and Termite Mounds
An Advancing Herpetological Husbandry newsletter
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All members are invited to submit articles for publication in the newsletter. The aim is to have a quarterly publication driven by member submissions, with a broad range of topics.

Articles should be formatted as Arial font, size 11, and image captions should be Arial, italics and font size 8. Please attach the images as separate files with an appropriate filename (eg. Diagram1.jpg) so that we may insert them into the proof without formatting issues.

Content should be husbandry related or relevant in some way, such as natural observation of habitat, feeding, breeding and so on. All content is edited for grammar, spelling etc. and will be returned to you for your approval before publishing.

Please email your completed articles to ahhfunds@gmail.com along with any images.
The year in review...what happened in 2017?

Joint Advancing Herpetological Husbandry and the British Herpetological Society Husbandry Conference ‘From the Darkness, Into the Light’

The first joint Advancing Herpetological Husbandry and the British Herpetological Society event of 13-14th May 2017 was a resounding success, with approx. 100 delegates over the two day weekend enjoying a wide variety of workshops and talks. This couldn't have happened without the help of a great many people.

Huge thanks go to the Drayton Manor Zoo team, who escorted us around, arranged trolleys and access for equipment, and in general just took damn good care of us the entire event. Chris Mitchell, Tim Baker and Adam Faulkner in particular went out of their way to ensure we had everything we needed! Many thanks to John Cooper at the Drayton Manor Hotel who ensured we had food, drinks, conference rooms, equipment and everything else needed for a successful conference - I can't recommend this venue highly enough, they were absolutely fantastic and the quality of food and service was second to none!

To the experts giving the workshops, you were fantastic and I could see from the intent manner the audience was watching you all that you were all making a huge impression. Fran Baines, Roman Muryn, Francis Cosquieri, Tarron and Louise Boon of Bioactive Herps - you put the Advanced into Husbandry and gave it to everyone for free. Many thanks to Ross Deacon for stepping up and managing the night, you made things go so much smoother - and to your lovely long-suffering wife Jade for supporting you in your weird hobby and patiently sitting through our ramblings!

On to our speakers, all of whom presented us with top notch talks - in no particular order - Roman Muryn, Fran Baines, James Hicks, Fraser Gilchrist of the Save Our Sungazers Campaign, Chris Mitchell of Drayton Manor Zoo, Paul Eversfield of The British Herpetological Society - BHS, Will Thomas of Global Geckos Reptile Shop, Katy Upton of Paignton Zoo Environmental Park, and Jim Collins. The feedback we had from all of your talks was fantastic! Thank you all for speaking at our little (big) event.

To the amazing team that made this all happen. I won't lie, there were doubts, irritations, trials and tribulations along the way, but they all stuck it out and turned out an amazing conference for all to enjoy. In the process, we learned a lot to apply to future events (yes, there will be more!) so we can only get bigger and better from this. Darrell Raw, Roman Muryn, Francis Cosquieri, Ricky Johnson, Richard Barfield, Paul Eversfield, Chris Mitchell, John Cooper, Jenny Zhang, Mark Hollowell, and Clare Rodgers - Assisting with various logistical issues, James Hicks and Ross Deacon stepped up every time someone was needed and are deserving of recognition.

To our sponsors, Drayton Manor, Arcadia Reptile, OnlineReptileShop.co.uk, and www.eurorep.co.uk - thank you for your support, it is much appreciated, as were the goods and information stalls you brought to the event.

Last but not least, thank you to the BHS members, the AHH members, the academics and the hobbyists of no particular affiliation - and let's not forget the zoo staff - who attended a first ever conference and trusted us to make it worthwhile, it goes without saying that without you there would have been no conference!
Joint Advancing Herpetological Husbandry and Surrey Reptile and Amphibian Society (SRAS) meeting

On the 14th October this year we hosted a joint meeting with SRAS featuring two of AHH’s cornerstone speakers, Frances Baines and Roman Muryn, presenting their work to an excellent turnout at Merrist Wood Agricultural College. The talks were to the usual high standard we’ve come to expect from these two, and left many with a far better understanding of lighting and heating as well as the motivation to experiment with ideas put forward. Equipment was set up and demonstrated during the talks, making the whole event a much more interactive experience, similar to what we had done with our workshop day at the Husbandry event.

Thanks go to Faye Mercedes Da Costa and Edward Howard of SRAS for organising the meeting with their usual efficiency, and to Merrist Wood Agricultural College for hosting us in their excellent facilities. Delegates got to visit the animal facilities as well, and there was a great deal of armadillo cuddling going on!

I would heartily recommend people in the Surrey and surrounding areas join up with SRAS and attend their monthly meets, it’s a great chance to chat to like-minded keepers in a friendly environment, and they usually end up at a local pub for food and drinks afterwards. While you’re in the area, you’d be crazy to miss visiting Global Geckos Reptile Shop - after all, there are not too many places where you can get fondled by giant geckos!

The Great International Calendar Competition!

We ran a fundraising event in the group to raise money towards the costs of the 2018 conference. This consisted of a calendar competition from which 13 images were chosen to represent the calendar months and cover. The end result was spectacular! Thanks go to all the people who submitted their best shots, the winners, and of course Sam Perrett of Sparrow Media for providing design work for free and arranging production at cost.

We will be doing another calendar for 2019, so keep your eye out for that perfect photo!
Upcoming events…

2018 Joint Advancing Herpetological Husbandry, the British Herpetological Society and the International Herpetological Society Husbandry Conference - ‘Cooperation, the Future of Husbandry?’

21-22nd April 2018 at Drayton Manor Park

The second annual joint AHH and BHS husbandry event has gained a new partner, the IHS, along with a host of new sponsors who will be offering goods for sale at the event.

The Saturday will be a series of demonstrations as usual, once again Roman Muryn and Frances Baines will give us their insights into lighting and heating, and there are some exciting new developments there! More details of the speakers will be released closer to the day, with some very interesting stuff planned!

The speakers for Sunday are as follows:

Chris Mitchell - Zoo Manager, Drayton Manor Park
Dr. Andrew Gray - Curator of Herpetology at Manchester University
Tom Wells - Senior keeper at Colchester Zoo
Dr. Tariq Abou-Zahr - Veterinarian
Tell Hicks - World famous artist and author
Dave Perry - Peregrine Livefoods
Chris Davis - Keynote speaker - Successful Amphibian Husbandry

Booking is officially open for the April event. As before, Saturday is free and Sunday is £40 registration, however this time round you will need to book tickets for each day you plan on attending (Saturday is a free ticket). Book at http://thebhs.org

We will also be hosting a full dinner on the Saturday evening at Drayton Manor Hotel, cost for this is £22.50 pp and will need to be booked in addition to your tickets if you wish to attend. The menu can be found on the booking page for the meal.

A full programme for the Sunday is pinned to the top of the AHH Facebook group.
Member Articles

Chilabothrus striatus striatus - The Dominican mountain boa
By Matthew Kyriacou

An article briefly detailing the natural history of this species and my experiences with their captive husbandry in a private hobbyist setting.

Binomial nomenclature:
Chilabothrus striatus striatus

Vernacular names:
Dominican boa, Dominican mountain boa, Dominican red mountain boa, Hispaniolan boa.

Basic introduction: Formerly a member of the genus Epicrates (the Rainbow boas), these beautiful Caribbean snakes have become more sought after in the reptile keeping hobby in recent years, yet remain a more obscure Boid in a Boa constrictor and colour mutation dominated trade. They are particularly rare in the European and Asian trades where the number of animals to work with is rather low compared with the USA. While variable in colouration the vibrant red phase specimens have become somewhat sought after and are arguably the most well-known examples of Chilabothrus within the snake keeping hobby - hence the subspecies most commonly being referred to in the hobby as Dominican red mountain boas. They appeal to keepers due to this brilliant colouration, the interesting patterning that this subspecies exhibits and their limited resemblance to the more popular and well known Rainbow boas (Epicrates) and Carpet pythons (Morelia spilota).

Taxonomy and range: Part of the Boidae family, they are a member of the genus Chilabothrus. The genus exclusively occur in the West Indies. These are not the only 'boas' found in the Caribbean; Boa constrictor nebulosa and the genus Tropidophis also occur in the region. The members of this insular genus were formerly classed as Epicrates along with the mainland Rainbow boas, with many online sources and hobbyists still using this out of date taxonomy - just something to bear in mind when doing further research and interacting with other hobbyists.

Chilabothrus striatus is found on the island...
of Hispaniola; which is divided into Haiti on the east of the island and the Dominican Republic on the west. C. striatus exagistus is predominantly found on the east and central areas of the island, it is commonly known as the Haitian boa and in captivity is often confused with C. striatus striatus. The Dominican mountain boa (C. s striatus) occurs in the central and western regions of the island, being limited to the Dominican Republic unlike the Haitian boa that spans both nations. It is known that the ranges of C. s striatus and C. s exagistus overlap and they intergrade in these regions.

There is a third subspecies, C. striatus warreni, that is found on Île de la Tortue, a small island just north of the Haitian coast as seen in the map below. While this post is specifically aimed at the Dominican subspecies, C. striatus striatus, much of it can be applied to the Haitian boa also.

Image courtesy of Google Maps under fair use.

**Ecology:** The Dominican mountain boa reaches a slender 5-6 feet (150-180cm) in length on average, with the maximum size this species can attain being around 8 foot (245cm) for a particularly sizeable older female. This makes them the largest species of snake on the island and due to this size they are versatile and opportunistic hunters as adult boas. They're a secretive species, mostly emerging to hunt at night. These boas are at least semi-arboreal in nature, though many sources will state them to be largely arboreal particularly as younger animals. The species primarily feeds on both terrestrial and arboreal mammals but have been well documented in taking birds also, readily scaling trees and the roofs of caves in order to catch more difficult to access prey.

The neonates of this species are relatively small at around 8-12 inches long, but shoelace thin. While as adults they are opportunistic and readily consume many prey types, this is an ontogenetic dietary change, with neonates preying predominantly on the various small gecko and Anolis species also native to the island. Neonates will emerge at night just as the adults will, climbing through brush in search of resting Anolis.

As previously mentioned this species are versatile snakes, occupying many habitats across the island. C. s striatus specifically are most notably found in the wet lowland and mountain forests in the east of the Dominican Republic. I recommend readers search for pictures of these types of Dominican habitat online; this will help keepers further understand the species and recreate these habitats within their enclosures.
**Description:** I'd describe their body build as a middle ground between the extremely skinny Amazon tree boas (Corallus hortulanus) and the lean but more solidly built Brazilian rainbow boas (Epicrates cenchria). While not as extreme of a skinny 'tree snake' build as C. hortulanus, younger specimens in particular will be surprisingly long and thin compared to most Boids. As young and growing boas their long and sleek heads are rather unique, perhaps most closely being comparable to Epicrates. While they mature their heads broaden into a more triangular shape though still remain sleek - some larger adults can almost resemble the broad triangular Morelia head in structure.

Most who've heard of these boas only seem to acknowledge the extremely red phase specimens (animals that are sometimes enhanced in photographs), yet they're quite naturally variable. Many different shades of black, brown, grey, maroon, rust, silver, orange, yellow, pink and red can be exhibited. These boas also frequently and quite dramatically lighten up and darken down, revealing colour changes when viewing the same animal at different times. The same boa can be a dull mahogany one day and bright orange the next. It's very similar to the colour changes Candoia will demonstrate, a more familiar example would be comparing it to Crested geckos (Correlophus cilliatus) 'firing' up and down. This variety in a single snake is fascinating for a keeper to observe, especially so in a species that is naturally variable.

The patterning on this species is intricate, with each scale being individually highlighted in some cases. The dorsum features a broken strip of wavey saddling of varying boldness. The undersides are mostly blank and uniform in colour, ranging from creams in brown specimens to shades of pink or orange in redder individuals. Example below:
All three pictures above are of the same individual, an adult male grey/brown phase boa. Just to give an example of the dramatic colour change they regularly go through.

Scrolling through the article you’ll begin to recognise the same individual boas looking different in colour from picture to picture. For example to the right of this page you’ll see the same smaller red individual pictured in the basic introduction section looking much paler here, with silvery pink colour and faded patterning.

**Heating & Lighting:** I provided these boas with a wide thermal gradient, one side of the enclosure offering a maximum hotspot of up to 87-90 fahrenheit (30-32 celsius) that gradually cools in temperature at the opposite end of the enclosure down to the mid-low 70’s f (22-24c). A nighttime drop in the hotspot is preferable to help promote a more natural day and night cycle along with nocturnal behaviours. I tend to lower it by around 10f (so down to the upper mid 20s celsius on the hot side). With modern technology we can use even the most basic phone apps to keep track of weather in the Dominican Republic, this can be a useful tool in helping work temperatures out - though bear in mind the temps in these reports may differ from those present certain microhabitats the boas may occupy.

I feel it is important to provide a thermal gradient to allow these snakes to self regulate the temperatures that they are exposed to. This method is superior to the approach where keepers will heat an entire room to an ‘optimal ambient’ temperature. In the case of providing gradients the boa can decide for itself what optimal conditions are as it sees fit.
It also promotes the reptile to become a more active and fulfilling captive for the keeper instead of a more sedentary snake that rests with no choice in conditions.

I've used heat mats, heat bulbs and ceramic heat emitters (CHE) with this species to create these thermal gradients and hotspots. In most enclosures thermostats will be necessary in order to safely control these heating sources to prevent overheating. At the time I wrote this article the combinations I settled on were an overhead CHE or radiant heat panel (RHP) coupled with UV lighting. An overhead CHE or RHP will better raise ambient temperatures when compared to a heat mat that is more localised and less efficient at raising the air temperature. Overhead heating is more natural for snakes as heat in nature comes from the sun (above). In the case of this species of boa their arboreal nature will allow them to use this vertical temperature gradient when they climb.

As research, knowledge and available equipment progresses, more options are becoming available to us as hobbyists. For example, the emerging deep heat projectors that are set to outperform CHE's in both heating and useful IR output.

UV lighting is encouraged for beneficial UVB and a healthy day and night cycle - I have provided it with adult boas and have observed them utilizing it later on in the day from perches that have foliage cover. While UVB is the most beneficial way to create a day and night cycle, the use of LEDs is also a viable option. Experimenting with a combination of multiple of these heating and lighting options can allow us to best emulate the full lighting spectrum emitted by the sun.
Humidity: As they originate from the forests of the Dominican Republic, it is in the snake’s best interests if we try replicate this humid environment while being sure not to provide too much or too little humidity. To achieve this I will mist my Dominican boas at least twice a week and to a lesser frequency pour a small amount of water directly onto the substrate. This creates a relative humidity high in the 80-90% range initially, gradually drying out over a few days till it gets to around 55-65% when the misting and soaking is repeated. I make sure to use well ventilated enclosures to prevent the air quality within from becoming stagnant and unhygienic.

Caution must be taken not to have these boas constantly at a very high humidity and with sodden substrate. Drier areas should always be present despite humidity needs. Failing in these two aspects can lead to a buildup of bacteria, scale rot, respiratory infections and other health complications. Keeping the humidity very low and the substrate dry for an extended period of time can also lead to issues such as retained sheds during the shedding cycle, respiratory infections and dehydration. Thankfully this is a fairly robust species and is relatively forgiving of errors here, but a good balance should be met to provide optimal conditions. To aid in providing humidity in your enclosure there are many simple options such as using a larger water bowl, using a substrate that supports moisture and using moist hides.

There is also more advanced equipment on the market such as misting systems, miniature waterfalls and foggers that can help boost humidity, though I don’t use any of these more intricate sets of equipment for my Dominican mountain boa enclosures myself.

Substrate: A substrate that supports humidity is necessary in my opinion given their habitat. Solely using newspaper or aspen is just not acceptable in my view as the species does benefit from misting (though they flee and tail whip in outrage from being sprayed directly). At the very least a moist area should be provided. Eco earth, cypress mulch, organic potting soil and orchid bark are all valid store bought substrates which support humidity. I generally find mixing any combination of these creates a more appealing substrate than using the products individually.

I used aspen with the neonates born from the largest female initially, they also had a large water source and a moist area of moss to give them a humid area. We would later switch them to eco earth and cypress mulch as aspen was rather incompatible with moisture in a hatchling...
Diet & Neonates: As youngsters this species naturally primarily feeds on small lizards, this can create some difficulty when raising the species in captivity as neonates. While they will readily take live or perhaps frozen-thawed anoles, they can be reluctant to take more traditional rodent prey at first. In the USA feeder lizards are slightly more readily available, so while it’s challenging for many keepers, this is more of a problem in the UK for example where options for snake food are more limited.

We had a litter of 7 healthy neonates from our largest female in 2015 and begun offering frozen-thawed newborn mice or ‘pinkies’ at first, with 1-2 takers in the litter. Then we tried live pinkies or frozen-thawed day old chicken thighs with a few more takers. Finally the hold outs were provided with live anoles till they had reliably taken several meals. From then on it was a process of either scenting pinky mice with anole or chicken; or the neonates (as they become bolder) simply just switched straight to unscented pinky mice themselves. This process of establishing neonates onto the more readily available prey types can be instant or take up to a year depending on individual neonates and other areas of husbandry.

A joyous moment: neonates were discovered in the dam’s enclosure, this was her first litter with the total count at 7 healthy neonates and 0 slugs or stillborns.

A young neonate, in this picture only 3 days old and freshly shed. At this age they are still plump from the yolk and don’t need to feed yet. The neonate was using this shelter (upturned for photograph) during the day. They can be very timid at this age, which is why I feel cover is important in establishing these boas as reliable and independent feeders.

With the adults being the size they are and the neonates being pencil thin, it’s
easy to forget to ‘baby proof’ the mother’s enclosure. Awaited neonates can easily escape through air vents, thermostat wire holes and the gap between sliding glass doors for example.

In my experience security is key with the neonates of this species. This can be achieved by giving them plenty of hides and foliage for cover so they feel concealed in their environment. They are active hunters, searching branches at night for sleeping anoles - therefore they need to feel secure enough to hunt in order to more reliably take prey on their own accord. At no point in raising a litter did we ever force or assist feed any neonates. They are more delicate than your average Boa constrictor and this would add stress to already insecure neonates.

Well established youngsters will take FT mice, rats, quail and chick parts. The adults will strike feed prey with much enthusiasm - the only time I’ve had refusals is from fasting adult males in breeding season. Only the neonates are of note in terms of feeding difficulty. I believe it is beneficial to offer these boas a variety of prey in their diet instead of solely relying upon mice or rats. There is a greater variety in frozen feeder items available in recent years, with various other mammals and even birds now readily obtainable and affordable.

The enclosure: It goes without saying that hides and cover must be provided and aren't optional, these are secretive boas when they want to be and a lack of cover can even cause problems when the boas are young. While it has become common for Boa constrictor keepers to skip hides and cover entirely, this to me is unacceptable, lazy and unfair on our captives.

I provide all of my Dominicans with water bowls large enough to soak in. I believe the option to soak should be available to these boas if they wish to do so - a larger water source also helps raise ambient humidity. Fresh water should be readily available and water bowls should be checked often as these boas frequently foul their water source leaving a very unhygienic situation. If you notice your Dominican mountain boa soaking don't be alarmed however, constant soaking is an indicator that either the ambient temperatures are too high on the cool end, the entire enclosure is too dry or the boa may have snake mites.
This species is at least semi-arboreal in nature and while a tall enclosure is optional, branches are less so. At all ages I've noticed both active climbing while hunting at night and perching during the day and night - these are very frequent occurrences with some individuals spending 50%+ of their time elevated. Enclosure size can be a broad and heated topic, but I'll try outline my opinion on some measurements.

I would not recommend keeping adult boas in permanent enclosures measuring less than 18 inches (45cm) in height, this is a minimum standard that allows for limited climbing opportunities. 2-3 foot (60-90cm) of height would be better but even more will be utilized if you provide it. While they reach average adult lengths of over 5 feet (>150cm), these are slender snakes that, coiled up in a hide, take up a fraction of the ground space a heavy bodied Boa constrictor of the same length would occupy. Ground space is therefore less essential as while far more active than say Viper boas (Candoia aspera) or Blood pythons (Python brongersmai), this species doesn't compare to many Colubrids in terms of activity levels.

I would begin classing these snakes as adults once they are at least 4 feet (120cm) in length. Enclosure depth under 2ft (60cm) and length under 3ft (90cm) for 4-5ft adults would not be acceptable for permanent housing to me personally. Definitely provide more as a minimum standard for larger specimens.

Larger enclosures will provide better gradients, more options for the boas and more opportunity for enrichment and exercise - despite a trend in the reptile keeping hobby to not deviate far from minimal standard recommendations I strongly recommend doing so. While beneficial to the snake, these are also beneficial for the keeper as giving these animals more, allows them to do more - thus making more interesting captives.
I will show examples of my enclosures to help demonstrate the points explained so far and perhaps to help inspire a few readers to create at least semi-naturalistic habitats for their captives.

To the upper right is a more extensive enclosure than typical for the size snakes in question, it housed an adult female (5.5ft/168cm) and at the time (breeding season) a slightly smaller adult male. It measured approximately 3ft deep by 3ft long by 6ft tall (90x90x180cm) internally. There were multiple hides, a water bowl large enough to soak in and (unfortunately garish) plastic foliage cover on the ground. Branches were used to allow the snakes to easily climb, perch and make use of the height provided.

The ledges increased the ground space usable to the snakes. They had substrate on them to help with cleaning as well as to keep their access to moisture more consistent throughout the expansive height. The ledges also had either cork pieces or foliage to allow the snakes some cover if they chose to rest at the temperature each level provides. By no means must people provide something like this for their captives, but it’s certainly more enjoyable for the keeper to have such an exhibit and the snakes certainly make use of all of this.

On the bottom left is a more typically sized enclosure, it measured 3ft in length by 2ft in depth by 2ft in height (90x60x60cm). It housed a 3.5ft (106cm) subadult male and was furnished with four separate ground hides, fake plant foliage for added cover and several branches to provide ample climbing and perching opportunities. This particular male spent roughly 40% of his time perched on branches as opposed to solely using ground hides. When hungry he could be seen actively searching his branches for prey. The male in question is visible in the top right of the picture constricting a quail from his perch, to give a sense of scale between the boa and his enclosure size.
**Temperament:** As neonates they are both timid and inquisitive, it's to be expected while they get used to being handled that they may musk upon being picked up. A note on the musk, it is excreted in relatively large volumes and in the consistency of syrup. It does not compare to the musk of say Thamnophis (Gartersnakes) for example, it is much more pungent. I find the adults far less willing to musk than younger boas, though when stressed they're capable of stinking out entire rooms. In general I've found this species to be rather reluctant to bite in a defensive manner unless you're really doing something wrong (though of course some individuals will be the exception to this).

They're a rather inquisitive species at night, eager to find out if your presence could mean food. During the day they will still feed, but can be more secretive, retreating upon noticing you if a shyer individual. Feeding responses are something to watch out for, use hooks with adults to snap them out of a prey response instead of immediately entering their enclosure with a warm mammalian hand.

Given their arboreal habits in nature they have rather long teeth to match this style of hunting. The species will give a painful bite in comparison with say Corn snakes (Pantherophis guttatus). It is also worth noting these are exceptionally strong snakes, even among constrictors and especially given how slender they are. If they tense coils around a handler in feeding response or stress they can prove difficult to remove and even damage fingers. The worst snake bite I've taken was from a 4.5ft adult (feeding response) and the same individual almost inadvertently broke my friend's thumb (coiling strength while climbing in hand). Due to this I'd not recommend this species to homed where snakes are expected to be handled by young children.

**Above:** The individual in question on a snake hook, a long golf club like tool with a blunt hook at the tip, it is used to safely handle snakes that handlers wish to avoid being bitten by.

**Above:** This individual had the strongest feeding response I've experienced from the species, gloves were normally worn to handle her as they're less tempting to bite than mammalian flesh.
Personal notes on the species as captives: I find these versatile and relatively active boas rewarding to keep for hobbyists who can appreciate a display animal that will also tolerate limited handling. Their arboreal tendencies make them much more interesting captives than more strictly terrestrial Boids in my opinion. Mine could be frequently observed climbing through branches at night or perching on display. Their feeding responses once mature and confident make them easy and entertaining snakes to feed. The colour changes the species exhibits can make photography difficult if you wish to capture a particularly flattering phase on an animal, but it makes them more interesting when one animal can look so different each time you check on them.

It must be noted they have several drawbacks that do make them less suitable for many enthusiasts and beginners in the snake keeping hobby. Neonates in particular can be timid and very readily expel large volumes of notably potent musk when handled. This coupled with the previously mentioned preference to lizards doesn't make the most ideal 'pet' baby boa for the casual keeper - although a good breeder should establish neonates on more readily available prey types before selling them to such homes.

One thing I don’t see mentioned by breeders of these boas, is the snakes produce much more frequent and messy waste than other Boids that have typically slow metabolisms. The urate especially is runny and smeared over enclosure furnishings, it sets like concrete and is frankly laborious to clean. It looks almost as if you’re keeping birds in there. I’ve heard several other keepers complain about this, some even selling them on altogether to focus on less messy genera.

In light of these quirks I tend to recommend the stunning Brazilian rainbow boa (Epicrates cenchria) to those wanting an easier to source, lower maintenance and more handleable pet. Brazilian rainbow boas are also much easier to come by in vibrant reds and oranges, while many Dominican mountain boas will be the duller phases, which may disappoint those enamoured with the viral images of large high red specimens.

Enough of their quirks though, they are interesting beautiful captives and after experiencing multiple other Boidae genera such as Epicrates, Acrantophis, Boa, Eryx, Lichurana and Candoia - Chilabothrus are certainly my favourite Boids with this species playing a large role in that.

All snakes used in this article belonged to myself, all pictures of the snakes were taken either by myself or the much more talented Melissa Baer. To conclude this piece here are a few more pictures of the Dominican mountain boa.
Temperature and Heat for Reptiles
By Roman Muryn

I have been meaning to put a few words together on temperature and light measurement. Before the measurement of heat is discussed it's probably good to understand the physics that generate it.

1. What is temperature: From a herpetologists perspective we talk about the temperature in the vivarium and we also talk about basking temperature as if they were linked, unwittingly we are confusing two different physical phenomena. If I cover temperature first then move onto measurement it might make this difficult to write note more palatable. Absolutely every physical body, piece of rock, water and even gas has a temperature. That temperature is referenced to a value defined in 1848 by William Thomson, who later was made Lord Kelvin, hence degrees K or the Kelvin temperature. He defined that the coldest it ever gets in the (whole) universe is -273°C (Absolute Zero) the temperature steps in his Kelvin scale were the same as the centigrade scale; so 273K is the temperature of ice forming (0°C) and room temperature is about 300K. Another clever chappie Nicolas Carnot developed the idea that all energy must decay to its lowest energy state ......this of course must be at zero Kelvin - Absolute Zero. So...... everything in our world is radiating heat. Yes even the ice, as its trying to cool to Absolute Zero. When we measure the temperature of something then, we either measure a body that has been warmed up above Absolute zero or we measure the radiation it gives off. Simples.

2. How does the world of the reptile get hot?: Always, but always, the world of the reptile gets hot because of the sun's radiation. The sun shines in the day,
whatever it shines on absorbs much of the heat radiated upon it then it reradiates the stored heat when the sun stops shining and when the surrounding air is cooler. After 24 hours the cycle is complete and temperature returns to the start. Diagram 1 shows the nature of the radiation from the sun reaching earth. All of the area in yellow under the curve is light energy which when it hits an object as light loses some energy that then converts to heat. Assume that for every square metre of earth we get about 1000 watts of radiated power reaching the dirt. Note that even the visible light carries energy but we don't feel it as heat.

3. **What is it about the sun's radiation that matters?**: Different parts of the sun's light affect objects differently. Those differences exist because light comes in different wavelengths. Our eyes are developed/optimised for the rainbow coloured wavelengths – the visible light but our bodies use the other wavelengths as well and it’s only in recent years that we have learned just how much.

4. **Grouping of wavelengths**: Diagram 1 above shows three distinct wavelength groups:

   **Ultraviolet light**

   **Visible light**

   **Infrared light**

   The wavelengths have such a wide dimensional range that each needs a different measuring approach – a bit like a loudspeaker system needs tweeters, midrange speakers and woofers to produce the whole spectrum of sound that we hear.

4.a. **Ultra-violet**: Ultra-Violet has three groups of wavelengths, however the wavelength UVc is blocked by the ozone layer and never gets to earth so is not considered here. UVa and UVb is very short wavelength light which we humans have evolved not to see but many other animals can. Because it is of a short wavelength it is relatively easy to produce an instrument to measure by looking at the source. We reptile keepers are most interested in the UVb light component because it contributes to the production of Vitamin D3. A meter is available to directly measure this and the preferred instrument is the Solar meter 6.5R.; the units we use are UVi. More here from Dr.Frances Baines; [UV Guide UK - Reptile Lamps - Visible Light Quality](http://example.com)

4.b. **Visible light**:

   This visible light is always considered as light but it does in fact carry energy which is eventually converted to heat.

   \[
   1000 \text{ Lumens} \times 1 \text{ metre} = 250 \text{ Lux}
   \]

   **Diagram 2** above (from Wikipedia) shows
the sensitivity of the human eye to the various wavelengths, there is clearly a peak in sensitivity and it means that a red light for example has to be lit with more power for it to be at the same brightness as green light. The standard that is used to measure the quantity of light produced by a lamp for human illumination is defined as Lumens. Lux is just the number of lumens reaching a sq metre target. All lamps produced must have a statement of their performance on the packaging. Lux meters are freely available and now apps are available to convert the light sensor in a phone into a light meter. I have tried a number of them on different phones and they all seem to give consistent answers. The visible light wavelength is such that it can be measured directly by pointing an instrument at the light source.

4.c. Infrared light: The infrared light that comprises the longer light wavelengths is also sometimes called Near InfraRed (NIR). NIR starts with just-visible dark red at about 650nm and extends to 1400nm. Because of this long wavelength, NIR is very challenging to measure directly. Expensive equipment is required and is beyond the financial capabilities of most keepers. NIR is just as valuable a light source as UV and visible light and must be provisioned in a vivarium. Many consider NIR as heat but really it is light and is the transition between light and the much longer wavelength low grade heat. This wavelength is analogous to the point where sound is still sound but can also be felt as vibration.

5. What do we provide for our animals?

5.a. Background heat: This is heat that is felt throughout a vivarium and may be required to maintain metabolism. This is a low grade heat operating at very long wavelengths (10 microns or 10000nm). Nominally room temperature. It is always as a result of secondary re-radiation such as a hot rock or some other “radiator”. This can also be emulated in a vivarium with a low power heat mat or a ceramic heat emitter.

5.b. Basking light and heat In the first instance we must recognise that animals don’t just bask to gain heat. Here are some reasons for basking, all of which may need some or all of the three kinds of wavelength which we discussed above.

1. Sheer pleasure.
2. Circadian cycle excitation through the parietal eye.
3. D3 capture through UV.
4. Increase metabolism through warmth.
5. Use UV and IR for managing Fungal and Bacterial infections.
6. Raise temperature to manage viral infections.
7. Use NIR for wound healing.
8. Use NIR for deeper heat penetration and heat sinking.
9. Use NIR for internal egg and neonate incubation (Esp viviparous animals).
10. Digesting food.
11. Drying and heating to aid in shedding.
12. Parasite management.

You can see from the above list that it is not only the heat element that is important; it is the quality of total light that we must get right. We can measure UV and visible light easily; these words are about getting the NIR right.

6. Heat Lamps: Before we talk of measuring heat in a vivarium we should understand how it is made. Right at the start of this note it was stated that all energy comes from the sun. When any object is irradiated with sunlight some of the light energy is captured by the object being irradiated. The amount of energy that is captured depends on the objects' material absorption properties and its colour - we all know that black absorbs light and reflects very little. The absorbed light energy is converted to heat and is stored by the object; whilst the sun's energy is high the object will continue to absorb and grow hotter but as soon as the sun stops the object will start radiating out the absorbed heat but, at a much longer wavelength than the original source of energy. This is what happens with tarmac roads in warmer climes and why reptile hunting is good after sunset. The animals that operate at night seek out that asphalt heat source in order to metabolise for the nights hunt. This re-radiating of heat produces background heat, some nooks stay warmer but the open flat surfaces soon cool down and by morning the cycle starts again. We as hobbyists have no easy tool to measure NIR, what we have to do is to look at the lamp paper work in the first instance and select the basking lamp based on its technical specifications. NIR is generated by most incandescent lamps with colour temperatures around the 3000K region and tungsten halogen lamps are really good examples. They provide light through heating a tungsten filament to a white hot temperature and releasing photons in the process but most of the electrical power is used to make NIR. From the herpetological perspective the less efficient a lamp is the better a basking lamp for basking. Diagram 4 below shows the irradiation curves for tungsten lamps and a professional medical heat lamp. Such a lamp will produce about 4 lumens per watt used, they do produce a lovely dull red light useful in basking. Domestic tungsten lamps usually provide over 6 lumens per watt.

Diagram 4

Some manufacturers tweak the design of the tungsten filament such that more NIR is produced than light, one example on the market produces no light visible to the human eye, however many reptiles will see the lamp because their colour
receptors cover the NIR spectrum as is shown in Diagram 5 below. It follows that if you control the lamp using a pulse controller; we humans may not see the lamp pulsing but your reptile may. This will be uncomfortable for it. A dimmer should be used.

Diagram 5

The guidance here is that the type of light you choose is through selecting the technology. Tungsten lamps can be dimmed to reduce their power and this can be an effective way of tuning the lamp to the basking spot, provided that after power reduction the radiating performance of the lamp is not unduly affected. For my Bearded Dragon I am using a tungsten lamp and running the temperature of my slate at 45°C. That's the temperature the slate is re-radiating at. The Beardie spends several minutes during the day sitting on it under the lamp often after eating food. He does not stay long. The vivarium background heat is about 30°C. In the wild the rock would easily be 60°C at mid-day.

7. Measuring temperature:
7.a. Bi-metal thermometers

These instruments are as simple as it gets. A strip of metal comprised of two metals of different temperature expansion coefficients are bonded together. As temperature changes one half expands more than the other and deflects a pointer. These can be reliable if not extremely accurate. They should be placed in a ventilated shade spot and will give an indication of the back-ground temperature. Use them as a canary.

7.b. Thermometers with thermistor sensor lead:

The comments here also apply to temperature controllers that have a remote sensor. The measurement sensor is usually a thermistor - an electronic component whose resistance varies with temperature. When a constant current is passed through it, the voltage across it will vary. That varying voltage can then be used to provide temperature indication or temperature control. If it is small and black and just laid onto a rock there is danger that it may absorb heat differently to the substrate and provide a false reading. It should be fixed with good contact with the object being measured. Notice the two different readings of the same spot using two different instruments (7b and 7c) The black shiny remote sensor is not
absorbing as much of the heat as the matt slate. If it were fixed directly on the slate it would probably give a better more accurate reading, gaining heat through conduction. Generally if the sensor is placed in good contact with the slate both readings tie up.

7.c. **Infrared thermometers with laser pointer:**

Earlier it was stated that every object radiates heat and these instruments actually measure that radiated heat. They are similar to light sensors in operation but instead of using semiconductor light sensing diodes they use a thermopile heat sensor as the target. The thermopile has a limited sensing range from 6000 nm to 14000 nm (150°C to -60°C) so it is beyond the range of the light produced by NIR. We use it to measure the secondary radiated heat from the basking spot. The radiated infrared light on the spot target is focused onto the thermopile via a special lens - just like children do with the sun and a magnifying glass. The thermopile generates a small electrical current which is amplified and used to indicate the temperature. I advise some caution in the use of these instruments; just as with visible light, different surfaces have different emissivity and so it is with infrared light. Different surfaces may give different readings. The most reliable emissive surfaces are matt black or dark grey substances such as slate or stone and least reliable are shiny metals.

8. **Summary:** To summarise when we choose basking arrangements, we start with choosing the lamp that provides the right wavelengths. Then we set up the lamp such that the basking target gets to about 40°C or 45°C when measured with a thermometer. If you are controlling (dimming) the lamp ensure that the sensor is affixed to the target basking spot without being directly illuminated. Your animals will seek to get warm in the basking spot and will move off when warmed up. If they only bask for very short periods then the setting may be too high. If they stay for ages then the setting may be too low and they are not getting warm enough. All three wavelength groups are important in the vivarium as they are in the wild.

We have talked about colour temperature; that can be directly linked to wavelength through the following equation, where \( \lambda \) is the wavelength in microns.

So the conversion from Colour temperature to wavelength can easily be done.

The temperature in Kelvin = \( \frac{2900}{\lambda} \)
**Tungsten Halogen Lighting**
by Roman Muryn

This note is intended to offer an outline on tungsten halogen lighting with a brief explanation of why it is recommended as a heat source, and why more powerful halogen heaters need special controllers.

A tungsten halogen lamp or heater is just an incandescent lamp; a clever one, but it is just a lamp. Incandescent lamps work by passing an electric current (amps) through a wire filament (a resistor) that gets white hot. How many amps flow through the filament depends on the voltage; Ohm's law says volts=amps x resistance, so, amps=volts/resistance and the lower the resistance the higher the amps and the brighter the light.

The design of a lamp tries to get a thin wire as hot as possible - to emit a bright white light without melting it. Tungsten is a brilliant material for this but at high temperatures it begins to oxidise and leave deposits on the glass, so to overcome this, inert halogen gas is used inside the glass enclosure.

Higher temperatures are also achieved by using quartz instead of glass. So a quartz halogen lamp is still a tungsten lamp.

Tungsten has a positive temperature coefficient so as it warms up, its resistance increases. When first switched on the filament is cold so the resistance is low, thus the initial current (called the inrush current) may be several times greater than the working current. This reduced resistance (almost a short circuit) may only last a thousandth of a second but if this current flow is great enough, it can do damage to some electrical parts. What we can do is allow a safety factor of 3; for the assessment of current flow, this is a common design practice.

The power of equipment is defined in watts (w) as the voltage multiplied by the current.

\[
\text{Power} = \text{volts} \times \text{amps}.
\]

So a 2kw (2000w) heater will draw 2000/240 amps which is about 8 amps. Given the above observation, the inrush current rating could be 24 amps. This could damage contactors and switches designed for the standard UK 13 amp rating. The inrush current causes sparking and pitting of the contact with a premature degradation of the contact surface – it reduces the number of design contact cycles.

We can now think about halogen lighting; the standard lamps we use in reptile keeping fall in the 250 watt range or less and so the inrush current is unlikely to exceed 3 – 4 amps, posing no problems with switching, but as we increase the power we have to take the inrush current into consideration if using standard switches, including timers and thermostats.

If our maximum working current in the UK is 13 amps and we wanted to cope with the inrush current our equipment should not take more than 4 amps in a steady state, that's about 1 kW.

Of course each of the lamps will have a different filament characteristic. Some may burn whiter and some redder, which will be determined by the tungsten alloy make up, its diameter and its length. If the item is intended to be a heater and not a lamp its light output profile will be different but
the essential description above is the same.

The diagram below shows a typical light spectrum from the sun. I have added the output from a tungsten halogen lamp. You will see that much of the lamp’s output is infrared - the hot end of the spectrum. The filament design will determine just how the curve looks but the one shown is typical. The curve shows that there is a good light content and a great IR-A content also. IR-A is also known as short wavelength infrared or near infrared. It is the IR-A that make us feel warm when we sunbathe, as it has the ability to penetrate deep into our skin and positively helps many of our physical functions. IR-A also works in conjunction with UVB allowing more effective generation of vitamin D3. The diagram below shows the level of penetration that can be achieved on human skin.

The optimal wavelength for IR-A penetration is about 800 nm, which ties in with the output of many of the tungsten halogen lamps currently on sale. There are lamps that are designed specifically to produce IR-A at the wavelengths of interest to us and having seen them, nay felt them, they are really good. A tingly feeling in our skin I would say – nice.

A simple way for us hobbyists to assess a lamp as to its usefulness (as a heater) is to check its efficiency as a light source. What we want from our tungsten source is poor lighting efficiency, which means that more of the power used is radiated as IR-A. All lamps now must state how many lumens they produce. I look for less than 10 lumens per watt (lm/W). Heater lamps specially designed for IR-A output run at 4 lm/W. Here’s what you do: divide the lumens (as stated) by the lamp power in watts, and you get the efficiency. So a 7W LED giving 650 lm gives 92 lm/W, and is a very efficient light source but a really poor heater! A regular 46W halogen reflector light bulb from Tesco gives 300 lumen, giving 6.5 lm/W.

The diagram above shows most penetrative wavelengths into animal skin are centred around 800 nm or 0.8 microns. That is also the wavelength that has the greatest benefits to the animal's well being.
Our animals bask to gain energy which is mostly through the absorption of the red end of the visible spectrum through to the invisible near infrared spectrum. We know that the halogen lamp produces some light but mostly heat; its output curve is shown on the diagram above. Our animals absorb most energy right on the cusp of the curve; yellow going through red into IR (sorry about the repeat but it’s important).

An efficient lamp will run hotter and its peak will be skewed more to the left and produce more visible bluer light. A less efficient lamp will have a curve skewed to the right and produce less light and more heat. Where heat lamps are produced for medical applications the designer will produce an element that produces the reddish light centred around the 800 nm wavelength.

If you use a controller to reduce the heat too much (by providing less power) then you are actually moving the centre of the radiation curve to the right and away from the lamp design intention.

It is for the reasons above, that it is, my view that a basking lamp should provide some of the visible spectrum as well as the non visible infrared. The tungsten based lamps seem to offer the best and most cost effective option.

Unfortunately for us these lovely lamps are being phased out for obvious reasons – get some in now.

Associated Definitions:
Bask = To lie in or be exposed to pleasant warmth, esp that of the sun
Conformer = use environmental heat (ectotherm) & have variable temperature (heterotherm)
Ectotherm = An organism that regulates its body temperature largely by exchanging heat with its surroundings; (cold blooded)
Endotherms = rely largely, even predominantly, on heat from internal metabolic processes (warm blooded).
Heliothermic = Gaining heat from the sun
Heterothermic = animals that exhibit characteristics of both poikilothermy and homeothermy
Homeothermy = is thermoregulation that maintains a stable internal body temperature regardless of external influence.
Mesotherms = uses an intermediate strategy between an Ectotherm and an Endotherm...
Poikilotherm = an animal whose internal temperature varies considerably.
Regulator = produce heat (endotherm) & have constant body temperature (homeotherm)
Thermoconformer = Any organism whose body temperature changes according to the external temperature, rather than carrying out thermoregulation.
Thigmotherm = An animal that draws heat into its body from contact with a warm object in its environment.
Britain’s oddball, the humble Slow-Worm (*Anguis fragilis*)

By Matt Legg

The Slow-Worm comes from a range of habitats including Grassland, Heathland, Gardens and Woodland. While having a vast range covering much of Europe from the South of Scandinavia to the North of Portugal and going as far East as the South West of Asia and parts of Russia this small snake like creature is often associated with Great Britain. Many older keepers living in the UK will have fond memories of capturing and keeping these animals as children and it’s a shame that they aren’t as popular as they once were especially considering their unusual appearance, small size, ease of care and endearing personalities and I hope with this short article any new potential owners will be equipped with the knowledge to suitably care for these animals.

**What is a Slow-Worm**

A Slow-Worm is a species of legless lizard. These are lizards which through years of evolution have lost their limbs and now reside in a serpentine like body. This however doesn’t make them a snake and with close inspection a legless lizard can be distinguished from a snake due to features such as functional eyelids. Reaching typical lengths of 40-50cm this proportionally long legless body, a large proportion of which is just the animals tail, allows the animal to easily dig under objects and enter small and tight burrows aiding it in its semi fossorial lifestyle. This means it only shows limited adaptations to underground life and typically doesn’t dig at great depths but close to the surface usually just under logs, stones and other objects resting on the ground. Its scales are smooth and do not overlap preventing soil becoming caught between them and the skin is shed in regular intervals in whole pieces just like a snake. Equipped with strong jaws full of tiny sharp teeth they easily grip their typically slimy, mucus covered prey such as slugs and worms. Another trait that could be seen as unusual is the fact that the Slow-Worm is Ooviviparous. What this means is rather than laying eggs in the conventional manner taught to us at school they actually give birth to live young. A thin membrane like egg shell is formed around the young who develop using nutrients from an egg yolk like in a typical egg. They then hatch inside the mother who gives birth to the live young. This method keeps the young safe and allows the mother to regulate the incubation temperature to a degree by basking. This is actually a very common occurrence in the world of reptiles. In the UK we only have one native egg laying snake and lizard out of our three native snakes and three native lizards.

![Slow worm range from herptolife.ro.com](image)
Sexual dimorphism occurs in this species which means the males and females are visually different just like humans. The head on the male is longer and broader than a female and he is typically pattern less with a silver, grey, brown, copperish or even a reddish colour body. The female on the other hand has a smaller and narrower head with a copper, brown or reddish back with a brown or black side often with lighter freckling on the flanks and black stripes both on the back and flanks. The belly is typically black with some lighter markings in both genders. While not common some individual animals have blue freckling in the back, a trait more commonly found in males than females though have been recorded in both genders. Albinos and melanistic animals can also be found though these are quite rare especially the albinos. Neonates/young juveniles are typically silver, bronze, copper or gold on the back with some iridescence with brown or black flanks and bellies.

![A juvenile animal waiting for food](image)

**Keeping Slow-Worms**

Keeping Slow-Worms is a controversial topic, though less so these days than just a few years ago. This is because the only way to keep them until very recently was to keep wild caught animals. Being a very hardy animal, it is very rare to hear of animals dying from stress even when being kept inside as long as the basic conditions are met. I even kept one secretly in a drawer in an empty haribo tub with some dried leaf litter and a water dish as it recovered from a very bad cat attack for a few weeks before being released and even fed several times when I had him. Obviously, this is far from the best way to keep them long term but it does show how hardy these animals are.

While my animals are wild caught, along with most other Slow-Worm keepers, we do not advocate others to do so. We know the sites we collected from well and knew taking a female or a male here or there wouldn’t significantly impact the local population, as well as taking from doomed sites. By doing so this has reduced/almost nullified our impact and increase our genetic material to work with. The hope is soon CB stock will become more common than they currently are and so we can meet the demand without it causing people to irresponsibly collect wild animals left, right and centre.

There are two main ways to keep Slow-Worms in the UK. Either in outdoor enclosure or an indoor one. Both come with their pros and cons and will be discussed later on.

**The law what you need to know**

It’s a commonly known fact that Slow-Worms are protected under UK law. However, there are many myths and misunderstandings to what this entails and so this is what you need to know! Black & white with no debate.

The main piece of law that protects the Slow-Worms is the Wildlife & Countryside act 1981 and Slow-Worms are covered by Schedule 5 section 9 (part of S.9(1) & all of S.9(5)) which deems it illegal to intentionally kill or injure a Slow-Worm as well as selling, offering for sale, possessing or transporting for the purpose of sale as well as advertising for buying or selling. This includes live animals, dead animals or derivatives. However, it is legal to take wild animals
and to sell captive bred animals, as the Wildlife & Countryside act 1981 covers only wild individuals. However, I’d recommend documentation of the mating be kept where possible so it is available if required to cover the breeder.

Slow-Worms (Anguis fragilis), Viviparous lizards (Zootoca vivipara) and Smooth newts (Lissotriton vulgaris) and so the hottest part of the enclosure reaches up to 35°C which the Viviparous lizards make use of.

I personally feel it’s best to have different levels with different temperatures at the basking spot to allow the animals to efficiently control their body temperature. The use of branches, dried heather stacked on each other or a branch with many smaller branches emerging from a mini log pile make an effective basking platform. These different levels vary in distance from the basking bulb and so have different temperatures.

My setup makes use of a 100 watt Arcadia Solar flood and similar daylight bulbs should be used. I avoid the use of heat mats as it makes it harder for the substrate to maintain humidity. Of course, a thermostat should be used to maintain the temperature with the sensor put at the highest basking point. However, in the average room it’s harder to reach the lows of 16°C which while not essential I do find desirable. If a cool room that can reach those temperatures isn’t available I’d recommend using an air conditioner and having a room for species that appreciate cooler conditions.

UVB strip lights should be used in conjunction to plenty of cover to allow the animal to regulate its exposure. While mine are kept under a T5 14% (which due to my cover and enclosure height isn’t an issue) for the Viviparous lizards if you are only keeping slow worms then no more than a 6% T5 is needed. This should be on top or attached to the ceiling of the enclosure and not side on which can damage the eyes and cause Photo-Kerato-Conjunctivitis.

I have my heating set from 7:30am-8pm and my UV lighting from 8am-9:30pm which gives 14 hours of daylight, from
when the heat bulb comes on until the UV goes off, and 10 hours of darkness.

**Indoor Humidity**

Air humidity can vary quite significantly without any issues becoming present as long as adequate ventilation is provided. The background humidity is typically between 60-70% with spikes whenever I spray. Spraying is done about twice a week to increase humidity, water plants and to allow the animals to drink from the water droplets. The substrate is maintained at a damp but not wet consistency when is squeezed it keeps its shape but little to no water leaks out. As well as spraying, a water bowl is provided which cleaned every few days and the old water is simply tipped into the substrate. A humid hide filled with moss can certainly be used although I have found no significant improvement with using them as long as your soil is damp enough.

**Indoor Substrate**

Slow-Worms require a deep substrate, at least 4 inches, to allow them to dig. This must have a soil base as they do very poorly when kept on just bark or any dry substrate like aspen. A sandy soil with leaf litter and bark mixed together is a good combination, allowing for drainage but also for moisture retention and tunnelling. There is no set ratio though I go for about 40% soil, 40% play sand, 10% bark and 10% leaf litter. As well as this, leaf litter and moss should be put on the surface at least in parts as this provides enrichment and cover further allowing for Cryptic basking having only certain body parts exposed for basking. A bioactive substrate is also very beneficial for this species preventing stress from having the enclosure stripped and cleaned on a regular basis. Springtails, Woodlice and earthworms make good clean up crew members just to list a few.

A drainage layer can be used though I personally have never had any need for one.

**Indoor Enclosure**

The indoor enclosure should be at the very least 60X30X30cm although bigger is far better allowing for social housing and lets you see more behaviours. This should also be made of glass due to its poor insulation properties and so prevents overheating. Plenty of rocks, logs and plant cover should be provided as I find the more densely packed an enclosure is, the more interactive and visible the animals become. To increase usable surface area the substrate can slope from front to back creating a hill effect with various rocks and logs built into the landscape. Climbing branches should be relatively thin and rough to allow the animals to properly grip them. As well as this, having them intertwined with other branches will also increase the surface area useable for the Slow-Worms. Rotting logs back for good hides as well as slabs of bark and hollow logs. Reptile caves and
half coconuts will also be effective hides and I have even used the exo terra cricket feeding rock as a hide before to great effect.

Indoor enclosure provides easier access and viewing of your animal. They also allow a basic relationship to be formed where the animal recognises the keeper’s presence with food and so allows for some interaction including tong/hand feeding and even touching on the keeper’s part, at least in my experience. However these enclosures cost a significant amount to make and maintain and use electricity. They also require more maintenance than outdoor enclosures.

Outdoor Enclosure

The outdoor enclosure should at the very least, in my opinion, be 90X90X90cm as this is the smallest I feel that is viable to appropriately meet the animals needs with regards to basking zones, hibernation refuges etc. Again, a rock or log pile can be used for the basking zone and a UV transmitting plastic should be used at least on the walls facing where the sunlight enters the enclosure. These can be open topped if the walls are tall enough though I also like to put an overhang over to be safer. The walls should also go deep underground by about 2-3ft at least to try and prevent escapes. Slow-Worms can also be housed in glass houses with outside access or UV transmitting panels as long as measures are taken to prevent overheating (such as deep underground hides about 1-2 feet down) as this is a very real threat for Slow-Worms. Hibernation sites should be areas where flooding isn’t likely and allow the animal to go deep underground. Leaf litter can also be put on top of the hibernation area in winter to further insulate it and, depending on the leaf litter depth, may provide warmth as it breaks down.

Outdoor enclosures can be cheaper to make, although they can also be very expensive depending on what is done, and cheaper/free to maintain. They can look very effective in the garden and be self sufficient in regards to feeding, temps and watering so are a good option for those with a busy lifestyle. However when outside Slow-Worms are very secretive and so you won’t often see them without going hunting for them. However, they are a good add-on to an enclosure with small European lizards or amphibians.

Diet/feeding

Slow-Worms must be fed slugs, earth worms and small snails, foods which are harder to come across for most people. Lob worms can be ordered from online stores, typically fishing stores, and kept in the fridge or put into an outside wormery located in a cool area. I recommend breeding most prey items as it makes it easier to have a stable supply of food. Wax worms, Mealworms and Morio worms can be added to the diet but should not be a staple and Dendrobaena worms should be avoided due to the fact most Slow-Worms won’t eat them due to the foul-smelling fluid produced when stressed.

Feeding should be down twice a week and I like to both scatter feed as well as hand/tong feed often involving a chase to keep the animals active. For young
animals then prey items may need to be chopped up and served on a plate.

**Breeding**

Mating occurs in the Spring after a hibernation period from mid Oct-March although in captivity I found a general cool down in temps and decrease daylight is more than enough. The male bites the females head restraining her as they mate. Naturally mating occurs in between mid-May & late-June and the females give birth from mid-August to mid-September. Officially 8 is the normal number though I had a female have 33 young with no slugs or still born a number of years ago. These small 70-100mm long young should be fed on ant larvae and finely chopped earthworms and hatchling slugs.

While it takes six-eight years for Slow-Worms to mature males can mate from three-four years and females from four to five years old. Also, Slow-Worms can have a potential life span of 54+ years, the record was a male kept at Copenhagen Zoo from 1892 until 1946 and his age at capture was also unknown. This long-life span is something to keep in consideration.

**A note on handling**

It is so common to see Slow-Worms handled like snakes even by very well-respected people and come close to dropping their tails or even actually doing so. Now while doing so won’t affect the animal long term, the process is called Autotomy which is when an animal voluntary sheds part of its body to allow it to escape from a predator, it certainly should be avoided when possible.

In my experience flighty animals should be allowed to run through your hands, often while defecating, for a few minutes which tires them out. After that your fingers should be spread apart and in most cases the animal will calmly rest or crawl through them using its tail and body to grip. I have found one of the worst things to do is try and restrain them before they are tired out, something a lot of people used to small flighty snakes seem to do. Once tired then restrains can be performed by experienced individuals. By using the tired open finger method, I have never had an animal drop its tail. While in the past, as a child learning, I have had a few animals drop their tails before working this method out.

While it takes six-eight years for Slow-Worms to mature males can mate from three-four years and females from four to five years old. Also, Slow-Worms can have a potential life span of 54+ years, the record was a male kept at Copenhagen Zoo from 1892 until 1946 and his age at capture was also unknown. This long-life span is something to keep in consideration.

**Conclusion**

A very fun and handsome species to keep which has been at the heart of many UK Zoologists, Herpetologists and reptile keepers alike which hopefully will become more commonly kept in the coming years. It is a truly endearing part of the British countryside.

*All images are mine unless stated otherwise.*
**Field Guide to East African Reptiles**

The second edition of this legendary book has just been released and is available through Amazon.co.uk (click on the link above to order your copy).

"East Africa is home to a remarkable assemblage of reptiles, from crocodiles and chameleons to turtles and tortoises, lizards, worm-lizards, and a stunning array of snakes. The region is a true herpetological hot-spot.

This fully revised edition of the classic field guide to the region's reptiles explores the full diversity of these animals. With updated text, detailed maps and more than 600 new photographs, this book includes every one of the 500 or so species in the region. All are described and mapped, with virtually every species accompanied by at least one colour photograph.

Comprehensive and definitive, Field Guide to East African Reptiles is an essential tool for all naturalists, conservationists, educators, field workers, medical personnel and students in the region."
Of Bog Roll and Dull Brown Snakes
By Francis Cosquieri

1. The Reasoning Behind the Madness

There is a word at the heart of “advancing herpetological husbandry” that is the core of our beliefs. It is a big and scary-sounding word that is misunderstood by many – some erroneously read it as “anthropomorphism” and others actually do use it as the misguided basis for anthropomorphism. It is a word that has fuelled countless debates and is the greatest sticking point in the divide between sterile keepers and naturalistic keepers.

That word is ENRICHMENT.

The context and connotations of this word are actually very simple: nothing more or less than “to enhance the quality of captive animal care by identifying and providing the environmental stimuli necessary for optimal psychological and physiological well-being.”

The role of enrichment in animal welfare and husbandry has long been studied in birds and mammals and has been an important part of the maintenance of this kind of animal for a long time. However it is only in the last few decades that reptiles and amphibians have been deemed worthy of enrichment studies and our understanding of the role it plays in the wellbeing of these creatures is still incomplete but gradually increasing.

The fortunate thing about reptiles is that, unlike most mammals or birds, they tend to be precocial creatures and thus simple manipulations of their environment under experimental conditions can tell us a great deal about their preferences and how the environment around them affects them.

Of course one question often asked is “why is this relevant?” And that is an understandable question; our animals are not “in the wild” so they do not really “need” to exhibit “wild-like” behaviours. They do not need to develop innovative hunting skills or learn different prey-handling techniques for different prey animals the way wild reptiles do; not when they get fed like clockwork and don’t have
to worry about things like predation, inclement weather, parasites, competition or all the other things that can happen living the wild life. “My snake is not wild, and the terrarium is not its natural habitat - therefore it does not need to exhibit wild behaviours or benefit from enrichment” is a common response.

However, there is now a wealth of literature across a wide variety of taxa that leave little doubt at all that enrichment DOES have a very positive effect on captive reptiles, and experiments on everything from pythons and boas to corn snakes and leopard geckos to iguanas and even tadpoles have taught us that richer, complex environments result in animals that are better able to cope with stressful or changing situations; that exhibit improved learning and cognition, physical activity; as well as a reduction in abnormal behaviours.

In other words, the environment we provide to our pets is fundamentally affecting their stress levels, growth rate, habituation and cognition!

There is an age-old adage bandied about – “there is more than one way to do things.” And this is undoubtedly true… however it is also a rather dangerous statement to make, because it contains the inherent implication that “all ways are equal” – and we categorically know that this is NOT true.

Of course, no matter which way you look at it the reptile-keeping hobby at its core involves confining your chosen species of pet in a box. The dimensions of that box and the conditions within may vary, but the box itself is the one given in reptile keeping (unless you are one of those very fortunate people that has a garden and uses outdoor enclosures – by and large the great majority of keepers don’t fall into this category though).

“The box” is perhaps one of the biggest draws of reptiles for the modern household – unlike a cat or a dog that would need the run of a whole house and possibly even outdoor time as well, a reptile is small enough to spend its whole life within a box and can thus be easily kept in smaller homes such as flats.

It is how we go about providing that more complex environment within the confines of the humble box that will determine how our pet will be able to act and whether it will be able to demonstrate a wider range of natural behaviours or not.

There are of course many different types of enrichment. Giving an animal a thermal
gradient so it can choose the temperature it wishes to bask at is a good example. Varying its diet is another. Changing the cage furnishings around a bit after cleaning is yet another. Studies have shown that the types of enrichment that affect reptiles most dramatically are thermal enrichment, light enrichment, feeding enrichment, object enrichment, olfactory enrichment and visual enrichment.

The above are just fancy ways of saying “provide a thermal gradient” in the case of heat enrichment or “put in the shed skin of another snake or provide a new object such as a used teabag or leaves rubbed over a mouse” for object or olfactory enrichment. Each of these can be a profound opportunity to interact with its environment in a new way to an animal that is spending its life in a box.

What seems to be the case though is heat, light and feeding enrichment are the types of enrichment that elicit the largest responses from reptiles, and this is of course somewhat predictable in animals that rely on the environment around them to warm themselves, tend to spend a certain amount of time basking in the sun, and need to capture food in order to survive.

Prey enrichment is a large topic in and of itself and will perhaps be addressed in a future article. What we will concern ourselves with in this article is light enrichment and heat enrichment and their interplay.

So having ascertained that, yes, enrichment is beneficial, it pays to look a little closer. There are as explained above many types of enrichment; many stimuli a reptile will respond to. However one of the problems of a limited captive environment is what happens when the animal’s need or desire for two different stimuli clash? For example, say you have an arboreal lizard or snake and provide a tall enclosure for it to climb about in, but you place the heat source near the bottom corner. The animal is then forced to choose between its desire to climb and its need to seek out warmth.

Situations like this are all too common in a captive environment. Another example would be placing a single hide at the cool end of a thermal gradient and providing no cover at the basking zone. For a vigorous, acclimated species this may prove to be no problem – the animal will simply bask when it wants to then hide when it wants to. But to a more timid, delicate species this could cause an inordinate amount of stress; you are forcing the animal to choose between seeking shelter and thermoregulating. One drive will prevail over the other.

Or yet another example – you provide a nice hot zone on one side of the enclosure, with bright lights and UV; just what any reptile needs. However you do not provide any cover and the animal is forced to expose itself to UV in order to also expose itself to heat. As stated above, we know that at least some reptiles thermoregulate and photoregulate independently of one another. You are therefore once more forcing an animal to conform to both stimuli to gain the desired one.

In other words… the big problem in many captive environments is CHOICE.

There are so many factors at play; humidity, light, heat, hides; it is understanding and providing for the
interplay of all these factors and how we allow an animal to choose its own place within them that can truly make good husbandry great.

And so, what I will present here is one simple method of providing the maximum amount of choice, and a great way to help allow a reptile to display natural behaviours in relation to light and heat – as well as increasing the surface area they are able to utilise in the confines of often quite small enclosures.

After all, as much as we would all love to give our snakes and lizards as much room as possible, there is usually only a finite amount of space we can provide them – usually a few square feet. Any way we have of increasing the amount of room the animal can utilise in that space is a very useful tool!

2. The Benefits of a Fake Background

Fake backgrounds can be a fantastic way to enrich a snake or lizard’s enclosure. Of course, in the wild these animals often can be found climbing on rock walls, cliff faces, clinging to tree bark and so on, so it follows that providing more utilisable surface area in the enclosure can only be a good thing. Not to mention, they can look great! Creating a good aesthetic that the keeper can enjoy may not be at the top of the list of priorities but it certainly does improve one’s enjoyment of keeping a reptile. However if carefully thought out, their utility can go far beyond simple aesthetics and providing more climbing space for a snake or lizard.

Now, when I speak of “fake rock walls” here, I mean more than just a flat cork bark tile or pieces of slate siliconed to the back wall. These might serve well for lizards, but would not really be useful for most snakes, which need larger, jutting areas to perch or coil up on and use for climbing.

My inspiration originally came from a man named Frank Retes, who will no doubt be familiar to many readers. He hit upon a great idea for providing overhead heating for small Australian monitors and “invented” what has become celebrated as the “Retes Stack” – a stack of wooden or stone pieces each raised up from the one below by a smaller chunk of wood or stone in each corner, with the overhead heat source positioned above it. In this way, the monitors were able to squeeze themselves into the gaps at whichever level (and distance from the heater) they liked, thus regulating their own basking temperature much as they would if they were in the cracks of a cliff face in the wild.

My reasoning was to take this idea one step further – to build on this idea so that
not only would it provide the animal with hiding spaces at different heights (allowing the animal to regulate the distance from the overhead heat) but also allow it to photoregulate and dramatically increase the amount of space it has to climb over.

Here is one of my first efforts, perhaps most painstakingly adapted from the idea of the Rete’s Stack:

Since we know reptiles are capable of regulating UV exposure and heat independently, this provides the animal greater choice in how and where it basks. Does it want maximum UV exposure? Then it can move right to the top of the wall next to the light. Does it want heat but not light? It can use one of the shadier areas or crevices within the warm zone, allowing it to warm up without being exposed to the UV. Does it want UV but not heat? It can bask at the cool end of the thermal gradient but still retain access to the light. In other words, we are providing the animal CHOICE – which is really what enrichment boils down to.

I have never been a “by the numbers care sheet” keeper. Many care sheets will provide a specific temperature the animal prefers. Beauty Snakes at 28c, for example. Bearded Dragons at 35c. This is not how reptiles thermoregulate. Generally, reptiles will move into a warm area to bask, then move around, perhaps retiring to a cooler area to forage, then returning to bask and “top up” its heat. As such, absolute numbers become meaningless as long as a good range of temperatures is provided across the enclosure, making sure there is a warm side the animal can use to bask and warm itself, and a cool side where it can cool off (excessive heat can of course be deadly to reptiles if they cannot escape it). In this way one can offer higher temperatures at the basking zone and cooler temperatures at the cold side, so that our Beauty Snake is able to move from an area of 22c to an area of 35c at will, with plenty of gradient in between for it to find its preferred temperature.

As can be seen from the previous image, the addition of a bespoke fake background can enhance this. You can see areas of extreme illumination, areas of deep shade, and areas at different heights tha the snake can choose to sun itself on.

Since we are designing and making it ourselves, we can factor in the rest of the terrarium décor, the position of the heat source and light source, and build in perches (basking spots) and crevices (hides) at different heights. We can also create areas of bright light and deep
shade, making the “light and shade” method of providing UV simple. The upshot is the animal gets to choose distance from heat source, distance from light source freely, as well as having the option to thermoregulate while exposed to UV or without being exposed to it, and likewise can regulate its UV exposure separately to its heat exposure.
Aside from this, the other big benefit of creating fake back walls is that we can provide transit routes above the ground and thus make a whole third dimension of usable space for the animal to traverse. After all, all that space was just there not being used, right?

Now, some of you may be reading this thinking “this only applies to arboreal animals, to animals that climb will make use of such a thing” – and you are dead wrong. The average terrarium is not likely to be more than a couple of feet high; this is nothing to a terrestrial reptile. Many “terrestrial” reptiles will climb onto tree stumps or logs or stones or into low vegetation to bask or forage. Some may even be found climbing even higher than this occasionally – there are numerous photographs of Bull Snakes and King Snakes and Corn Snakes climbing trees or cliffs or even bridges online. A couple of feet of height inside a terrarium is nothing to such an animal; they can and will explore every corner and absolutely would make use of the extra crawl space a few more ledges or a fake rock wall will provide.

So, around 2010-2011, I began experimenting with small snakes in enclosures that incorporated these fake rock backgrounds. The species I first tried this technique out on were Four Lined Snakes (Elaphe quatuorlineata), Twin-Spotted Rat Snakes (Elaphe bimaculata) and Schokari Sand Snakes (Psammophis schokari). What I found was that this is exactly what happened; the snakes would ascend or descend the background as they wished, climbing right near the light and heats source in the morning, then descending later on, and returning to bask a intervals throughout the day.

Encouraged by seeing this very natural behaviour resulting in active snakes that were often in view basking, I continued to hone my techniques with everything from Carpet Pythons to Garter Snakes, Water Snakes, Whip Snakes, Rat Snakes and King Snakes, with the same great results every time.

3. Creating a Rock Wall

There are of course lots of ways to go about creating fake backgrounds. Some people use real stone, either building up actual rock walls inside the enclosure or using silicone to stick flat pieces of rock to the back. Others make great use of expanding spray insulation foam covered with coco coir. These are all great methods, but the technique I prefer for small snakes and lizards is the one I describe here. It is quick, easy and relatively tough (although will not withstand the claws of lizards larger than about 8-10”).

The Sculpt: Obviously the first thing you need to do is make the rock wall itself! To do this I use Kingspan or Celotex, since they are heat resistant materials that won’t catch fire. I have used extruded polystyrene and this can also be good in cooler enclosures, but that material can
easily burn resulting in tragedy so I tend to avoid it now.

A disclaimer here and now: this is a very messy process, likely to incur the wrath of any spouse, partner or flat mate!

It is best to wear a mask to avoid inhaling any particles in the air, and to keep plenty of plastic bags and the hoover ready as the floor will quickly become covered with off-cuts.

The basic idea is to carve the desired shape out of the Kingspan. I find it easiest to use a bread knife and simply scrape shapes out of the rough chunks. You can build this up in layers to provide basking spots and caves for the animal to hide in. It is very important not to make these crevices too small to be accessible. It is heart-breaking to have to rip out a finished work to rescue an animal that has got stuck behind it! It is very important at the construction stage to ensure there are no little cracks or seams the animal can squeeze into. I therefore make sure I use the same adhesive to make a bead around every seal and join.

When carving, be mindful to try and make the crevices and strata all go in roughly the same direction. This looks realistic.

Here are a couple of examples of what basic sculpts could look like:

I use simple Wickes Instant-Grab, solvent free adhesive. It works on wood and glass and will bond the chunks of Kingspan well. It is worth letting it dry overnight, preferably with some heavy objects on top of the build to make sure it stays in place.
Once you are satisfied with your build, the time has come to seal it.

Sealing: The rock wall will be subjected to all kinds of stresses during its life time. A snake or lizard will not be tender with its affections as it moves all over it. You will need to occasionally brush it down to clean it. To preserve your handiwork and give it a measure of strength, you will need to seal it. Again, there are several ways of doing this. One method I used to use was to apply thin layers of grout, letting each layer dry for 24 hours before applying the next. Given 10-12 thin coats of grout are required this is a very painstaking and time consuming process. The benefit is that you can add paints into the final few layers to tint it and skip the painting stage. However I soon found that unless it is sealed with varnish of some kind (which results in a very shiny and unrealistic finish) the grout will eventually start to peel off in flakes and look terrible.

Instead, I came up with a much quicker and stronger method. What I do is apply a layer of watered down outdoor PVA (about 50:50 water to PVA is required – the consistency of milk). Waterproof PVA is very important as you will probably want to spray the animal now and again. On top of this wet mix, apply toilet tissue or kitchen towel (the unmarked kind – you do not want little kitties or puppies appearing on your “realistic” fake rock!) and then daub on more of the PVA: water mix so that it soaks into the tissue. You can also “fix” any holes or build up your shapes using balled-up tissue dipped in PVA and pushed into the crevices.

When it dries, it will be rock solid and the tissue will have shrunk around your fake rock, creating a really pleasing, wrinkled texture that will look great once painted.

Give the build a good 48-72 hours to dry thoroughly. When it does, most of the tissue and glue should look vaguely transparent and be hard to the touch. For more humid environments it is worth sealing the whole thing again with varnish.

Here are two sealed fake backgrounds prior to painting:
Spraying: This is where you can let your imagination run wild. I won’t mince my words – a lot of fake rock walls I see are far better and more realistically built than mine could ever be, but are often ruined by a cartoonish paint job. For aesthetic reasons alone it is worth taking a bit of time over the painting stage and using a good few different colours to layer up the rock “texture” – very few types of rock are just one flat, uniform colour.

Personally, I am all for the “quick but realistic” look of spray-paints, but I have seen brushed on paints look great too. However I am a huge fan of the sprays. The brand I use is Montana Gold, a type of spray paint specifically designed for outdoor use and graffiti that is waterproof and weatherproof. They come in a huge variety of colours and there is even an app that will make use of your camera when you point it at something to suggest some colours that will match whatever you are pointing it at.

The spraying process requires an outdoor space or at least a large, very well ventilated workroom, as it produces a lot of smell in aerosol form.

I work from a dark undercoat up. Montana Gold paints give extremely strong coverage so you will not lose colour intensity doing this – indeed you have to be careful not to completely cover the previous layers!

My favourite undercoat colour is Anthracite – a really dark grey. But you can use dark brown or even wine red for reddish, Australian-style rock. The first layer is the most important. The undercoat has to be dark and it MUST cover every last inch of the fake rock wall. No nook or cranny can be left unpainted, as the white layer underneath with stick out and ruin the effect.

After the undercoat is done it is really up to you to decide what colours to use, although I strongly recommend not just using the basic “browns” or “greys” but also oranges, greens, creams and yellows when layering up. Using the Montana Gold app on a rock formation can reveal interesting shade and highlight colours. Some examples of combinations I use are detailed with the photos.

Above the undercoat, the next coat should be an overspray of a slightly lighter base colour, which will set the tone for whatever your finished colour is to be. The key here is to not just spray the whole thing again, as you will end up with the just the new colour. One must be judicious and spray from a good distance (a couple of feet is usually about right), using light, cautious sprays and letting the mist of paint settle on the surface.

In this case I wanted some slightly reddish brown rocks reminiscent of outcrops in the Sinai so I went for a deep, dark red (Wine Red), followed by a more subdued brown (Cacao)... but a dark brown or grey is just as good!
After the base colours is when things get interesting. This is when your greens and oranges can come out. Spray an orange colour from below (even on a grey stone) and a mossy green colour from above. Never sprays these colours head on; the objective is for a directional, light coat that caches only at one angle. Take your time and spray from a good distance away. These colours will provide a subtle richness and depth that will make the finished product look much more “real.”

The final layer will be a lighter version of the base colour (usually this will be brown or grey) sprayed perpendicular to the fake rock, but again lightly and from a good distance. In between all these steps, you will probably find you need to return to previous colours to “touch them up” until you end up with a desired result. The painting process is actually very quick and with four or five spray cans I can usually finish spraying a moderately sized wall in under twenty minutes.

Drybrushing: Once you have finished spray painting the rock, the time has come to finish it off and make the details really “pop out.” This is where sealing the sculpt with tissue really pays off, as the wrinkles and textures it makes will have formed into all kinds of interesting creases that will make the rock look really textured.

What you do is take a large, wide flat brush (such as a wall brush) and dab it in a lighter colour acrylic paint (I almost always use “Sand” colour acrylic paint from WHSmith, regardless of whether I am painting a grey or brown fake rock).

Once you have loaded up the brush, wipe it dry again on cardboard or tissue. When it looks like there is no wet paint left on the brush, swiftly draw it back and forth all
over the raised areas of the rock wall. What will happen is that the last remnants of paint will catch on all the raised surfaces, highlighting the details for you. This instantly brings the whole thing to life, giving it a much more 3D appearance and bringing out the texture.

This is the part I love best, as you will see your hard work leap out. At the end you will have a rock face that looks brown or grey or whatever colour you have chosen to paint it, but upon closer inspection you will see other subtle hues so it does not look flat, uniform and cartoonish. You end up with a beautiful, aesthetically pleasing rock face that will provide you pet with far more opportunities than just a couple of branches to climb.

It is worth mentioning here that these spray paints have a very strong smell; not only will I repeat that it is best to do the spraying outside, the terrarium must now be left for a week or so for the smell to disappear before animals can be put inside.

Here are just a few examples of fake backgrounds I have built for various snakes and lizards over the years. It can really enhance any enclosure and provide great enrichment for your pet as well!
Platyceps rogersi (Roger’s Whip Snake)

Elaphe dione (Dione’s Rat Snake - Xi’an locality)

Hemorrhois hippocrepis (Horseshoe Whip Snake)

Elaphe climacophora (Japanese Rat Snake)

Psammophis schokari (Schokari sand racer)

Hemorrhois hippocrepis (Horseshoe Whip Snake)
Elaphe climacophora (Japanese Rat Snake)

Elaphe dione (Dione’s Rat Snake)

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On Skinks: More than first thought – A summary of captive species variation

By Ricky Johnson

When first hearing the word skink it’s likely that a keeper may first, or only, have the charismatic large blue tongued lizard come to mind – and even then no specific species of bluey of which there are currently 7 recognised species and many subspecies across Australasia with varying husbandry needs! But is this as far as it goes? Surely Agamidae or Lacertidae are much wider ranging with many more species, but not so! Both of those families currently contain anywhere between 300 and 400 species. The skink family Scincidae currently contains over 1300 species, so why aren’t they given more ranging attention?

The UK, Europe and US can be majorly summarised with 2 species of blue tongue plus subspecies (Tiliqua gigas, T. scincoides), Fire Skinks (Lepidothryis fernandi), Schneider’s skinks (Eumeces schneideri), Sand skinks (Scincus scincus), red eyed crocodile skinks (Tribolonotus gracilis) and Golden/Sun skinks (Eutropis multifasciata). A tiny sample of a massively ranging family of lizards.

Skinks can be found on every continent but Antarctica, and most major biomes including hot desert and savannah to coastal beach and rock pools to subtropical and tropical forest, as well as much in-between – even including tiny rocky outcrop islands! There are skinks that majorly burrow, skinks that fill the canopies, there are skinks without legs which can be found among leaf litter, skinks that swim through sand, and even species on cool stream and riversides. So there are species to fit almost every example of captive enclosure, not to mention the hardiness of many species.

Their adaptations are immensely ranging including some with semi and fully prehensile tails, maternal care in both viviparous and ooviparous species, pheromone use in individual recognition, immensely social colony species as well as strictly solitary species and physiological adaptations to very specific environments such as dirt-digging or trunk holding long claws, reduced physiology to meet particulate or leaf litter environments and an immense range of colouration.

If there are so many species, but little exposure, does this mean they can’t be obtained? Well while this is indeed true for most species for a multitude of reasons which could change with time, there are in fact a huge number of accessible species if one is looking in the right places and

Top: Northern Blue Tongued Skink (Tiliqua scincoides intermedia). Credit: Melissa Baer

Bottom: Merauke Blue Tongued Skink (Tiliqua gigas euanescens) of mine, both a show of usual perception of what a skink bluntly is, both are commonly bred captives..

There are many enthusiasts of skinks, though the standard retail skink market in

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asking the right questions. For example my own collection contains well over a dozen skink species, only 3 of which are listed above! So, what are a few interesting species are available & to what husbandry are they suited? Here are some examples that may spur further research yourself.

The warmer and drier

*Chalcides* species were once very commonly kept, with Ocellated skinks (*Chalcides ocellatus*) once being bred in large numbers in the UK hobby. They’re now not so numerous but are absolutely source-able with breeders potted about and semi-periodic imports of African animals. They’re certainly some of the drier skinks preferring a warmer hot spot, however they are not desert species – being found most common in dry scrubland, coastlines, forest edges and often in gardens across the Mediterranean. They are a small to medium sized skink (~20cm adult) with varying shades of beige, and as the name suggests, lots of ocellation depending on locality.

Gran Canarian Skink (*Chalcides sexlineatus*) is a gorgeous small skink endemic to Gran Canaria but extremely common across the island using many of the coastline, grassland, shrubland, rocky and temperate forest habitats. They have similar bodies to *C. ocellatus* however with a flank patterned stripe and some have vivid blue tails and back legs making then a jewel species for keepers (it’s noted that bluer tails tend to be found further south in Gran Canaria). Within the hobby they are, again, less kept but absolutely bred by multiple keepers in Europe. They are very active, enjoying a hot basking spot (35-38°C) and moderate to strong UV (UVI 3-5), colourful specimens cannot be missed when their sky-blue tails shimmer between rocks!

Wedge-snouted Skinks (*Chalcides sepsoides*) are small, slender skinks with
tiny legs (the rear of which adapted to pushing through sand much like swimming) and, as the name suggests, a wedge shaped head. These are the most arid of these noted Chalcides species, being found often in low shrubland and sand dunes, clearly adapted to using sand and similarly particulate substrates in burrowing. These were recently exported from Egypt to the UK and US so are easily source-able at the moment, a good chance to experience a small, hardy and active skink.

Zebra or Two-coloured Skinks (Trachylepis dichroma) are very uncommonly kept medium sized skinks native to Tanzania and Kenya, most often found in dry Acacia woodland and grasslands. They are not too hard to source despite being rarely kept, being relatively commonly bred within keeper circles with noted lines in the US, Europe and Japan – they do show up at shows such as Terraristika Hamm. They are hardy and active but their most notable characteristics are their social behaviour and their incredible sexual dimorphism. They can be kept in colonies with a male to multiple females, and communicate a lot, as I've seen, by using slow arcing head movements wherein I believe I've seen a female convey her mood to the male using this to avoid conflict! Their sexual dimorphism is phenomenal with females bright sandy colours covered in lines of ocellation causing the 'Zebra' vernacular, but males being half vivid red, and half grey causing the 'Two-coloured' vernacular.

Top: Adult Wedge-snouted Skink (C. sepsoides) of mine, showing the namesake wedged head.
Bottom: Very young Wedge-snouted Skink (C. sepsoides) of mine, note the reduced limbs, but significantly larger hind limbs.

Adult Zebra/Two-coloured Skinks (T. dichroma) of mine, showing the namesake zebra female, and double coloured vivid male.
The cooler and wetter

Olive Tree Skinks (Dasia olivacea) are small arboreal skinks with, as the name suggests, an olive green underside from snout to tail tip and bronze back with striped ocellation. They are very common across Southeast Asia, particularly noted along coastlines and preferring palms – commonly laying eggs in palm epiphytes. They do well in single male and multiple female groups or in pairs, thriving in moderate heat (28-33°C) and high humidity (60-90%). An extremely active and personable skink I’m very fond of, while they do not often turn up commercially, they are easily sourced from multiple US and European breeders, as well as periodically in the UK. I cannot overstate how entertaining this species is!

The number and variation of tree skink species cannot be overstated! Thus another hits this list, one that people are likely to know more so than Dasia olivacea, and that is the Emerald Tree Skinks (Lamprolepis smaragdina). These are a small arboreal skink which are entirely deep green, and very common across Indonesia with multiple subspecies. They can be kept extremely well in groups, thriving in similar conditions noted for Dasia olivacea above. Best kept in large vivaria with as much usable surface as possible including vertical and horizontal branches and lots of foliage – expect very active and personable skinks! These are periodically exported from Indonesia and often were from the Solomon Islands specifically, and are bred by a few people both in the US and Europe, a species to put your money where your mouth is to buy good quality animals.

Something incredibly different, and something I’d note as a definite hands-off and admire at a distance species is the Sulawesi Spiny Water Skink (Tropidophorus baconi), this unique species is a small to medium skink with a black/grey back, and cream/white underside. The body scales from head to
tail are extremely keeled and overlapping giving a unique look and feel to the skink. They are periodically imported with Indonesian stock. Some important notes regarding the care of this skink is firstly a low temperature, I do not keep this animal any higher than 30°C, with the enclosure gradient ideally being 16-26°C, to aid this and aspects of their natural history I also provide it with a large deep dedicated water area (at least 5-6” deep) – they are extremely proficient swimmers, and undoubtedly seek the water when startled, darting into it and swimming to whatever deep crevice they can find, thus a paludarium is ideal. Their large highly set eyes also support their semi-aquatic lifestyle as well as their natural environment in Southern Sulawesi.

The potential of skinks has been barely utilised, a vast majority of skink species have never touched captivity, many more only by a few or singular keepers. While putting aside protected species, and regional laws – a lot of reasoning for this low variation is the perception of what skinks are (the common few) to many keepers which is not their fault! And demand for species to cause their initial move into captivity. The variation in every which way is important to note – if you have interest in something unusual, research their natural history and wild ecology as in depth as possible so as to best understand their adaptations and thus what environment would suit them best in captivity. To close, if the word “skink” has caused some semantic satiation - me too.
Basics of Taxonomy as it Applies to the Hobbyist

by James Hicks

Binomial names, often incorrectly referred to as “Latin names”, are a precise and accurate way to name organisms. While Latin does indeed have a presence in binomial nomenclature, so too does Greek and various other languages and names, often Latinised it is true, but this is more of a convention than a requirement. Reptile taxonomy is a very volatile field which is constantly changing, learning and adapting to new discoveries and it is up to us to try to keep up with these changes, at least as far as our favourite species are concerned. These names are always written italicised although managing that in Facebook is tricky!

In the hobby, we are primarily concerned with genus, species and occasionally subspecies (as a taxonomist this list grows considerably). Species are, generally, the base unit of taxonomy and are often described and re-assessed. A species (note the plural and singular are ‘species’ NOT ‘one specie’) is defined as a “group of closely related organisms that are very similar to each other and are usually capable of interbreeding and producing fertile offspring” although several subtly different definitions of what a species actually is exist in Biology. It is obviously important to be able to identify animals at the species level from one another in the hobby but becomes more important when sellers may not be entirely accurate with their descriptions of similar-looking species, especially when they are often simply passing on inaccurate identifications from their sources. The species epithet is the second part of a scientific name and is always written in lowercase e.g., Stellagama *stelgio* brachydactyla.

Subspecies are usually geographically distinct populations where there are sufficient differences to the type population to warrant distinction, usually based on genetic or superficial taxonomic differences. Subspecies can interbreed with the nominate species (original species from which the subspecies derived) and produce fertile offspring. Without geographic data on the origin of the source population, subspecies are often difficult to assign without obvious morphological differences. In terms of the hobby they are most useful to refer to in species with very obviously distinct subspecies as in Stellagama stelio, for example, although they are often used enthusiastically by certain groups to promote the maintenance of certain lineages and sometimes to simply make collections appear more diverse. Many historical subspecies likely represent full cryptic species awaiting (re)description. The subspecies is the third part of a scientific name and (if it is included at all) is always written in lowercase e.g., Stellagama stelio *brachydactyla*.

Genus (plural: genera) is used to describe a group of species that are often structurally similar and must be phylogenetically (evolutionary development and history of a species) related, all originating from a single common ancestor (a monophyletic group). Many genera were historically much larger than they are currently but were further divided into smaller genera that more accurately reflect the true diversity of organisms, a recent ‘high-profile example’ being the 2012 revision of the New Caledonian gecko genus Rhacodactylus (Bauer et al., 2012), that saw the crested
gecko being returned to its original genus Correlophus. In reality the genus of an animal has little direct bearing on herpetoculture aside from the obvious need to identify our animals as accurately as possible. The genus is the first part of a scientific name and is always capitalised e.g., *Stellagama* stellio brachydactyla, and is abbreviated to the first letter on subsequent mentions in the main text of a piece of writing e.g., *S.* stellio brachydactyla.

Higher taxonomic ranks like families (a group of related genera) are always written with a capital letter when written in full e.g., Colubridae, and lowercase when colloquialised e.g., colubrid, and not italicised.

Taxonomy has a bad reputation, with classifications changing often and new species being discovered almost constantly. While some bad examples exist, including serial taxonomic ‘vandals’ driven entirely by vanity and largely ignored by other workers, every field suffers from the occasional study with poorly supported conclusions or contention. Taxonomy is an entirely legitimate and fascinating branch of Biology, without which we would not be able to recognise or classify the diversity around us and it is up to us to endeavour to keep up with its rapid rates of discovery.

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On the dangers of assuming activity patterns are rigidly tied to their biological assignation

By Darrell Raw

Biologically speaking, we can categorise most animals into activity pattern groups, predominantly “Nocturnal”, “Diurnal” and “Crepuscular”. These classifications refer to peak activity levels, when they are most active foraging, mating, moving about. Unfortunately, these terms are often taken to mean the animal is only ever active in their assigned category time period, and this is simply not true. Yes there are animals where this does fit, I find most of these are diurnal as they have no biological imperative to seek out UVB outside of their normal activity periods. Chameleons are one such species - however many crepuscular and nocturnal animals don't fit these categories so neatly.

In the discussion to come, I will be focusing on a very common pet lizard, the leopard gecko (Eublepharis macularius) - one of the most frequently misunderstood pets in the hobby today. However, the considerations discussed in this article apply to all of our captive animals and can be applied universally for a complete husbandry experience.

To start, I'd like to discuss a word. Cathemeral. "Applied to an activity pattern in which an animal is neither pre-scriptively nocturnal, nor diurnal, nor crepuscular, but irregularly active at any time of night or day, according to prevailing circumstances.". A Dictionary of Zoology, 1999.

This word is important to us. You're all familiar with the terms crepuscular, diurnal, nocturnal - and how these terms define husbandry practices and have done for as long as we have been keeping animals. In many cases, poor understanding of the animal in question's natural history leads to incorrect assignation to one of the above 3 terms - case in point, many people still believe leopard geckos to be nocturnal, and as such reject the use of UVB for this species - we now know they are actually most active at dawn and dusk, making them crepuscular in behaviour. I'm going to suggest that the term crepuscular is also misleading when applied to this (and other) species in husbandry terms, and that they are in fact Cathemeral.

This can easily be seen in a well appointed vivarium, complete with UVB - where you will often see leopard geckos hunting with the lights on. This is also backed up by reports (anecdotal to be sure) of military personnel in Afghanistan
finding them out and about during the day. It would seem, then, that this species merely avoids the heat of the midday sun but is otherwise prone to activity patterns throughout the day and night.

What I suggest is this: We stop looking only at peak activity patterns and assigning animals to nocturnal, diurnal or crepuscular - and consider their natural history to determine if, in husbandry terms, they are in fact cathemeral. Many

Leopard gecko (Eublepharis macularius) exploring with the lights on

Crepuscular is the most fitting term in a biological sense, however in a husbandry sense we cannot ignore the fact that they can and will roam about and feed at all hours. To be sure, the bulk of their activity will be early mornings and late evenings, when temperatures cool and feeding begins - but exposure to light and UVB also needs to be incorporated when considering husbandry. Many people have accepted this, and now incorporate these features in their vivariums.

of our common species are. Take corn and rat snakes for example, most pythons - several boas - many colubrids and so on. Many species are active both day and night, as conditions dictate. I'd go so far as to say we should consider everything cathemeral and plan our husbandry on this basis, as this way we have covered all bases. The replication of their natural environment should contain all the elements they would encounter in nature, this includes substrates, plants (real or fake), features (logs, rocks etc.) water (standing or misted), ventilation, heating and full spectrum light/UVB.
**Pseudoxenodon macrops** - Visiting North-East India and Improving Captive Care as a Consequence

By John Benjamin Owens, *Captive and Field Herpetology*

*Pseudoxenodon macrops*, often called the Chinese false cobra or large-eyed bamboo snake is a small colubrid in the sub-family Pseudoxenodontinae. It’s a species which exhibits a high level of variance when it comes to patterning. Females are usually shades of bright orange, red and yellow. Males in contrast will often exhibit yellow or red patterning upon a primarily black body. They are opisthoglyphous snakes with a diet made up of primarily amphibians. An important point when considering keeping them in captivity.

They are often short-lived in captivity and labelled as a species unsuitable for a captive environment. However, due to the small numbers of them that are imported into the European trade and the high proportion of them that end up in the hands of people who know nothing of their natural history this is inevitably going to lead to a large proportion of them failing to thrive.

This is a species that I have kept for approximately three years. Initially I acquired one male which came to me in a malnourished and dehydrated state. This individual did quite well for about 12 months, it never fed brilliantly but would eat a live *Xenopus* frog or *Hyla* sp. every couple of weeks. An important point which I will come to later is feeding frequency. Eventually the low feeding frequency and what I believe initial dehydration led to this individual eventually perishing. After that I had another pair which arrived in a very malnourished and dehydrated state, this was after being purchased as ‘keelbacks’ from a local reptile store. Being kept like *Thamnophis* for a number of weeks, attempting and failing to feed them rodents quickly led them into a state which sadly meant that they did not last long, approximately 4-6 weeks once in my care.

The current pair that I am keeping came to me in September 2017, after already being kept in captivity for 8 months. Whenever this species comes into conversation, particularly its husbandry you’ll always hear that you should keep them cool. This is the case for many of the ‘difficult’ asian herpetofauna. However, travel to a number of differing asian habitats, be it coastal, lowland, high altitude, thick forest and you’ll often find that you can find somewhere, a niche that provides herpetofauna somewhere to gain access to a higher than expected amount of light, heat and humidity. I collected this particular pair of *P.macrops*, to my surprise both appeared to be in very healthy condition. Upon speaking to the keeper who had been caring for them for the last 8 months as expected they told me keep them with temperatures of 24-27c and give them a daily spray. Having not long visited the habitat of this species a few months prior I already knew...
I was going to do things differently this time. Often, in my opinion and experience keeping some of these species which are best kept cool yet have ambient temperatures of 27°C+ in their native range is only prolonging dehydrating, hence why they appear to last longer in captivity when being kept like this. What is currently working for me with a number of species is warmer temperatures and an increase in humidity along with sufficient access to drinking water, whether it’s a spray, droplets on the head or a water bowl.

So onto the wild habitat of *P. macrops*. Just keep in mind that we are apparently supposed to keep this species at no more than 27°C, 70-80% humidity with an amphibian diet. So if it’s that simple why aren’t they thriving in captivity yet? Well, this is where a thirteen mile hike in the Himalayan foothills up to the border of Bhutan became very useful. At an altitude of 1000-1500m, yes, the foothills are cold, bloody freezing during the night. I recorded night-time temperatures of approximately 1-2°C. However, when you step out of the shade and into the sun at that altitude you quickly start to burn up in the sun’s radiation. Air temperatures in the daytime sit anywhere between 25-32°C but the surface temperature of rocks quickly gets up to 40-45°C after a short exposure to the sun’s radiation in the morning. The habitat in which this species lives is made up of large boulders which cover dried up riverbeds running down the mountain. Vegetation is sparse until you reach the edge of the river bed and often overhead the canopy if thick. This shade is cool and in general the air temperatures are much cooler than what you would experience in much of the lower elevation habitats, usually between 14-21°C (it’s likely the idea that these snakes need cooler temperatures comes from this). Humidity ranges from 30-40% in the open, warmer areas to 70-80% under the cooler canopy. The ground is damp regardless of where you look, the canopy and large boulders allow the ground to retain moisture from a large number of cold (and I mean cold!) mountain streams. This provides an abundance of humid (up to 100% humidity, cool microclimates).

After spending a few days in this habitat, taking habitat and environmental notes there’s one key thing that I believe is the initial factor needed to keep this species successfully. It’s also one of the most important aspects of any animal’s enclosure. Space! This is a small species of active, diurnal snake. It could probably stretch itself out comfortably and obtain the physical exercise needed in a small enclosure. But, one thing is missing if you don’t have space. The opportunity to provide variety, whether it’s light, heat, humidity gradients or enrichment. This small species likely spends a large
percentage of it’s time under boulders, logs and other objects within a microclimate of high humidity and dampness, especially during the night.

However, it is also likely to come out to bask on those high surface temperatures and under the exposure of the sun at 1500m. That’s a hell of a lot of heat and light exposure.

Jumping to the diet of this species, amphibians. Many of the species you encounter in the Himalayan foothills and around Bhutan are un-described and small in size. My female *P.macrops* will feed on approximately four to six frogs per-week, usually about the same thickness as the widest girth on her body. The streams that you find in their habitat are often teeming with amphibians in the early evenings all the way through to the early hours of the morning. So, if *P.macrops* feeds at a frequency of amphibians anything near to what the captive animals are capable of they are likely going to need to digest rapidly. What better way than to soak up some of the sun’s radiation, seeing as there’s so much of it available.

![Amolops sp. are very abundant around mountain streams in the habitat of Pseudoxenodon macrops.](image)

So, what have I done to improve my enclosures and attempt to keep this species successfully? Firstly a large enclosure, I have my pair in an enclosure which measures a little over 4ft long. A deep substrate is important, key in my opinion. I lay about 5 inches of playground bark, leaf litter and coco fibre down. Sometimes the animals will burrow down into this substrate and I won’t see them for two or three weeks. Another important point is to not go digging around for them, keep stress low and just let them be, when you do see them they are a pleasure to watch foraging and digging around their enclosure. I have based the enclosure around a dry river bed and included some large boulder piles which allow them to get down underneath them at various levels. Again, variety, all of the cracks in-between the pebbles will have differing temperatures and humidities. Then I have included a 25w halogen bulb for basking, it’s left to run on full power for about 7-8hrs a day. Yes that’s correct! I have a bulb on full power with no stat, why is this ok? Because the animals have plenty of space to escape this heat if required. It sits directly above one pile of boulders.
and the surface temperature reaches around 40-45°C. They will often sit around this very briefly, less than an hour during mornings which they have fed the day/ evening before. I spray the enclosure down once or twice a week, I wait until there is no condensation at the cooler end of the enclosure. As long as there are humid retreats and damp areas for the snakes to retreat to I don’t worry about spraying too often. I do however, fill a spray bottle with very cold water (<4°C) every 1-2 days and drip this down the pebbles, this often entices them to drink from the running water. Finally, I do not provide any night time heating, their enclosure is in my garage on a concrete floor so it get very cold in the evening (I live in north Wales so we don’t really know what warmth without electricity is!). The entire enclosure decreases to a temperature of below 10°C and sometimes below 5°C, often the snakes will be curled up underneath the substrates or boulders during this time.

To tie this article off, I think it’s important to note that much of what can be done to improve the husbandry of this species is exactly what can be done to improve the husbandry of a huge number of other species i.e. understand the natural history of the species, provide space, variety and gradients in every aspect of the enclosure. Many other species from the same habitat as *Pseudoxenodon* are kept successfully and have been for many years such as *Oreocryptophis porphyraceus*, what’s the difference? In my opinion, a lack of understanding of the natural history and niche use of *P.macrops* and many other species.

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*My current female has the typical patterning and colour of a female P.macrops.*
The realities of keeping Venomous Animals
By Ross Deacon

The keeping of venomous animals was once greatly regarded as the pinnacle of reptile keeping for many involved in the herpetology hobby, however, with this view many items and views have become skewed about what actually are the realities of keeping DWA (dangerous wild animals) in your home, this has led to many venomous snake keepers becoming disconnected with the main hobby and almost feeling like they are on a pedestal! So I am writing a series of articles to try and reconnect for many the differences in keeping venomous animals to non-venomous.

Firstly I would like to point out that I am relatively new into the world of keeping venomous snakes and would also like to admit that many other keepers with a lot more time under their belts are more likely to give a more accurate account of living with some of the most deadly animals in the world! However, as I like to talk about my experiences I thought this maybe fascinating and insightful to some members of the reptile and non-reptile hobby.

I am going to write this in a way I feel comfortable to explain what I believe to be some of the differences and fears and hopefully personal account of living with venomous snakes. In this first article I am going to go into some of the main differences between venomous and non-venomous keeping then into the consequences then a little into how I believe is the most important part of keeping venomous snakes in the UK, the relationship with your local authority.

So where to start? The differences between venomous and nonvenomous snakes? Well there is none! A snake is a snake no matter whether it can kill you or not, yes there is differences in handling technique and restraints but a snake is a snake! The care is the same and they work with in the same attributes as non venomous snakes do! I personally always have believed in a safety first approach and will use my trusty yellow hook to handle majority of my animals with or without the venom aspect! (I cannot tell you the amount of times I have been laughed at for using a hook with a corn snake, but I don’t want to be bitten!) I do not enjoy being bitten by whatever animal especially a snake, it’s stressful for me and the snake! I use handling techniques that have been taught to me by many handlers from around the world and different backgrounds, I have adapted those techniques to find my own safe handling style and I am a massive advocate of when people learn to use snake hooks and handle they use those techniques and adapt them to what works for the individual. I have been very lucky with the sheer amount of people I have met and handled with and I will thank every one of them for helping me find my own style of handling. So I have maybe
gone off on a tangent here but I would like to reiterate that the snakes are the same just the handling is what is different!

These differences in handling techniques really can save your life! Bites can be survived with the appropriate care but survival of a bite can be down to what the individual can do at home! It is important to have a well-defined and written down and trained bite protocol in case of a bite. This bite protocol can vary for different species that you keep and a bite protocol for viperidae and elapidae is different in its first aid. So if you are going to get into venomous snakes PLEASE PLEASE have current and correct bite protocols. The correct bite care can save your life and a big shout out to Joe Pitman of the Florida Snake Bite Institute for all his work in making bite protocols available to private keepers around the world to help ensure the best possible outcome for snake bite victims.

Another killer that could sneak up on you is an allergy to venom, this is actually more common with in keepers than we realise! The venom particles in the air work against your immune system to create a hyper sensitivity to venom over the years and this silent killer can be your worst enemy in a bite situation. The owning of a few epipens is an essential items with in the bite first aid kit as is salbutamol to keep your airways open for the ambulance to be able to get to you still alive!

The third and most important part of keeping venomous reptiles in the UK is the relationship with your local authority, this open chain of confidence and communication from both parties will make obtaining a licence easier as well as the updating and renewal an easier process. A good relationship between you and your local authority can be the difference between you obtaining a licence and not! Most authorities will look for the keeper to demonstrate knowledge and understanding and willingness to bend to conform to them, as well as being able to push back in a mutual way and explain your position to work with them to get a favourable outcome. Remember this is a two way street!

I hope this gave a little insight into the keeping of venomous animals and the realities of keeping DWA and what I believe are the most important parts of keeping a venomous animal.

Rinkhals (Hemachatus haemachatus) using an underground burrow

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Definitions Project:
In 2017, we decided to start a little project with definitions of some of the more confusing jargon thrown about in husbandry. These are all definitions from that project.

Definitions Project: PAR - Photosynthetically Active Radiation (Not to be confused with PAR on spot/flood lights)
By Darrell Raw

Photosynthetically Active Radiation is important to the herpetoculturalist who wishes to include live plants in enclosures. It is defined as the amount of light available to a plant for photosynthesis, in the wavelength range of 400-700 nanometers (visible light). Plants tend to use light in the blue (between 400-500 nm) or red spectra (650-750 nm). Blue light is needed to have healthy leaves and stems, and red light encourages fruiting and flowers, both used in conjunction will give the best results. To this end, recommended plant lights are either a combination of blue/red emitting lights, or full spectrum which cover the visible light spectrum with peaks in red and blue. Most plants reflect green light, which is why we see them as green, so cannot use much of this for photosynthesis.

PAR will vary with distance from the lamp, and any obstructions (glass, mesh, leaf shadow) will reduce it. In addition, not all light sources have equal penetration - LEDs in particular suffer from short penetration and may not have sufficient PAR at the lower portions of a tall enclosure. Another issue with LEDs is their extremely narrow wavelength. Single diode LEDs simply have no range, and are virtually useless for plant growth, unless you have a number of these at different wavelengths combined into a single lamp. This can become unwieldy due to the sheer number of diodes required to replicate the useful red and blue wavelengths. Alternatively, you can use RGB LED chips, which have - as the name suggests - three diodes in red, blue and green wavelengths, which are then combined to give a preferred colour temperature of light.

Lights in the 6000-7000 Kelvin colour temperature range often produce the best PAR combinations (this holds true for most light sources, as this is the “daylight” colour temperature range).

Definitions Project: PAR - Parabolic Aluminized Reflector
By Darrell Raw

You will often see mention of spot and flood lights sporting the designation PAR and a number, for example PAR38. This is often confused with Photosynthetically Active radiation, but in fact refers merely to the reflector type built into the bulb. The number indicates the diameter of the lamp. These lamps come in spot and flood varieties, spot will focus the light into a tight beam and thus are generally not recommended for herpetocultural use, as they can create dangerous localised hot-spots. Flood lamps diffuse the light so it covers a greater area and thus are extremely useful for building basking spots that cover the animal's entire body. These lights also tend to have quite decent PAR (Photosynthetically Active Radiation) so it is not all that unusual to see the two PAR’s used in the same sentence, with completely different meanings!
Definitions Project - Activity Patterns
By Darrell Raw

This section covers the biological activity classifications of animals. There are four main types of activity,-
- Nocturnal (night) - active primarily at night for feeding/breeding.
- Diurnal (day) - active primarily during daylight hours for feeding/breeding.
- Crepuscular (dawn and dusk) - active in the twilight hours of when the sun is rising or setting.
- Cathemeral - active at all times of the day/night as needs dictate.

It is important to consider that these definitions relate to PRIMARY activity periods, and in no way suggest that these animals cannot be active within other periods to a lesser degree. With this in mind, it is vital that we approach husbandry with the view to providing the option to display all activity patterns, and we do this by providing defined night/day periods, with full spectrum light including UVA/UVB. It is important to provide the opportunity to escape to somewhere dark during the daylight hours should the animal wish, and to provide areas of shade/partly shaded light as well as a direct basking area. In effect, we are treating all animals as cathemeral. Even nocturnal animals require a full daylight period, as many will bask (sometimes cryptically) and use light levels to regulate their circadian rhythms. "Circadian rhythms are physical, mental and behavioral changes that follow a roughly 24-hour cycle, responding primarily to light and darkness in an organism's environment. They are found in most living things, including animals, plants and many tiny microbes. The study of circadian rhythms is called chronobiology."

Definitions Project: Cryptic Basking
By Paul Tapley

Cryptic, or hidden basking is used by many animals as a means of exposing themselves to sunlight, whilst remaining sheltered from threats such as predation.

Often favoured by juvenile animals or those more reliant on camouflage than speed, cryptic baskers will often avoid exposed perches in favour of open vegetation, or employ tactics such as leaving part of the body outside of a shelter - a common example is that of Leopard geckos exposing a tail or limb while lying in a favoured hide or burrow.

Such species are often characterised by highly efficient adaptations for making the most of limited exposure to solar radiation, coupled with a high surface area to volume ratio. Many, such as Mediterranean tortoises, outgrow the need for this behaviour as predation risks diminish.

As these animals are often uncomfortable sitting under a source of uvb without a little cover, it can lead keepers to associate the provision of such lighting with a negative reaction. When more suitable basking facilities are offered, a more natural response can usually be observed.

Definitions Project: Habitat Type
By Darrell Raw

(Science: ecology) a land or aquatic unit, consisting of an aggregation of habitats having equivalent structure, function, and responses to disturbance.
Habitat is a complex topic, often misconstrued and generalised in the herpetoculture hobby. By this, I mean we can look at an animal, and see it is from a region that is arid, with low rainfall, temperatures drop to near 0c at night and exceed +45c during the day - and make several false assumptions from that. For example, we could say that the animal is capable of tolerating extremes of temperature, while overlooking that the particular animal lies buried in a burrow or deep sand during these extreme periods, where temperatures remain far milder. We could say that the lack of water means it must get its daily requirement from the food it eats, but this ignores the inevitable result of hot days and freezing nights...massive amounts of dew as sun-warmed air encounters cold objects, causing condensation. Many arid species rely on this for their hydration (this is what happens to spinifex grass in arid Australian areas where Pogona species are often found).

This is just one example of how we can misconstrue an animal’s requirements by not looking at the fine detail. Of course there are many more factors to consider in this vein, for example basking montane species are naturally exposed to higher UV indexes and lower temps than their lowland cousins, but we often link UVB exposure to high temperatures and ignore the effects of altitude. Likewise non-basking high-altitude animals may have evolved a coping mechanism to deal with higher UVB indexes, such as mosaic basking, crepuscular activity etc.

Habitat is therefore only of use as a base starting point - remember, habitat refers to specific conditions (aggregation of habitats having equivalent structure, function, and responses to disturbance) - and a single habitat can be represented on each continent, as it is a collection of variables. Our animals don't occur on each continent, so using an arid habitat for one continent may not necessarily be good for an animal from another. It is more valuable to understand the microhabitat and microclimate the species utilises.

Definitions Project: Microclimates
By Darrell Raw

Microclimates are very important to the herpetological keeper. In the past, temperature and humidity requirements for our animals was based on meteorological data for the area they inhabit. This data is averaged, and measured several feet above the ground. Our animals don't live there, they live in amongst rocks and vegetation - places where temperatures and humidity will be wildly different from the average air conditions. For example, let's look at the following scenario:

Pseudoxenodon macrops (Chinese false cobra or large eyed bamboo snake) is an Asian “rear fanged” colubrid very similar to the American garter snakes (Thamnophis sp.). It is a montane species, known to have low tolerance to heat. Humidity requirements are also high, but it is intolerant of damp, stale air. Yet temperatures in some of their range can exceed 38°C on occasion - so how do they manage? By living alongside water courses, typically amongst rocks and stones. Water evaporation from the damp stones significantly cools the gaps between the rocks, as well as providing high humidity without being continuously wet. Snakes living in these gaps are therefore inhabiting a microclimate that would seldom exceed 22-25°C and be close to 100% humidity. However, the
animal has the opportunity to regulate its temperature/humidity by moving deeper into the rocks, or further out depending on its needs.

How do we duplicate this in captivity? We provide gradients. One of the strongest arguments for space is the ability to provide heat/humidity/light gradients, which allow the animal to choose its comfort level. A properly set up enclosure should see the animal moving between the various microclimates during the day/night, not sitting squashed in one corner of the enclosure. We achieve this by providing heat to one side, usually with the lighting as heat and light are naturally associated by the animals. Breaking up the terrain with rocks/logs, providing leaf litter, hides spread along the gradient and sufficient cover to allow the animal to move between these securely. The addition of live plants can significantly improve humidity gradients, and these gradients can also be adjusted by moving the water source closer or further from the heat source. Deep substrates with buried hides can also provide gradients. Proper ventilation is essential, as even in a large enclosure, lack of moving air will cause the temperature to equalise over time, thus negating your carefully set up gradients.

Definitions Project: Microhabitat
By James Hicks

“noun
Ecology
A habitat which is of small or limited extent and which differs in character from some surrounding more extensive habitat” Oxford Dictionary

We have covered habitat types and some of the microclimates found within each habitat but what about the specific structural niches our animals occupy? These are the microhabitats that are so important to replicate when maintaining reptiles and amphibians in captivity. As a hypothetical example: a distribution map may show a species in question as occurring in a tropical forest. The animal in question will almost never realistically utilise every part of that forest and will persist in the part of the forest it is best adapted to. This may be a certain section of the tree trunk, the canopy, fallen logs or leaf litter on the forest floor or any number of other, sometimes subtle, features each with their own distinct challenges and opportunities. The animal will display certain traits that maximise its performance in that given microhabitat, with the most obvious ones to us usually being tied to movement for example; keeled ventral scales in snakes to climb wide, vertical tree trunks and gliding as a means of moving from tree to tree without descending to the ground to cross. In fact, gliding is so successful that it has evolved numerous times in very different groups of animals with species of lizard, snake, amphibian, fish and mammal showing gliding capabilities (termed ‘volant’ locomotion), and has evolved in at least seven lizard genera with many more showing primitive stages of this behaviour. This link between the morphology of the animal and it’s microhabitat is not always this obvious, but is always very strong. Certain aspects of morphology (the animal’s physical characteristics) such as the relative length of the thigh are very closely tied to what sort of structures the animal moves over in the wild. If a species lives on wide tree trunks it will often have comparatively longer legs when compared to a closely related species that lives on thinner trunks. In some species this can even be influenced by the conditions as the lizard grows i.e., babies from a single
clutch raised on wide branches may end up as adults with longer legs than siblings raised on narrow branches (an example of phenotypic plasticity- that is, an aspect of the animal's appearance that can change and is not entirely controlled by genes).

The most well-studied example of the link between microhabitats and animals are the anole lizards (genus *Anolis*) of the Caribbean. On the islands of the Greater Antilles separate species of anole have evolved to occupy similar microhabitats on each island, resulting in groups of species with a similar shaped lizard in each given microhabitat (an ‘ecomorph’) e.g., the twig anoles always have elongated bodies with short limbs- adaptations to maximise stability on very thin perches like twigs. (See and learn more about the *Anolis* ecomorph diagram here on anoleannals.com: http://www.anoleannals.org/wp-content/uploads/2011/03/ecomorph_figure.jpg). Since the initial work on anoles, similar patterns in the physical characteristics and how they relate to their respective microhabitats have been noticed in many other groups of lizards.

In captivity it is important to match up the species we are keeping with its microhabitat type, in terms of substrate and even less obvious aspects like the thickness and roughness of the branches offered. For example; if your species has long, gangly legs it is unlikely to be well adapted to moving over very thin branches and may not be able to move around the vivarium easily. Another example is species that live on sand- if a more compacted, hard substrate is offered, their often delicate toes and claws may break or wear down, not being adapted to cope with the increased resistance. Obviously the post from this "definitions project": microclimates, ties in very closely with microhabitats with both needing to be considered in tandem for the most accurate replication of your animal's wild niche in captivity.

**Definitions Project: Thermoconforming and thermoregulating**

By James Hicks

Most people when they think of a reptile will have the image of 'cold-blooded' animals that sit out in the sun to raise their internal body temperature before they can move. This is partly true- many species will bask to regulate their body temperature within a preferred range of temperatures that allow their body to function at its maximum efficiency. This temperature range varies between species and can change over time e.g., when gravid. The time spent regulating body temperature within this range however, needs to be balanced against the potential increased risk of being captured by predators while lying out in the open (although see the note on 'cryptic basking' coming soon) and time that could be spent feeding, mating or defending a territory i.e., risk versus reward. A 'perfect' thermoregulating reptile would keep its body temperature at its exact optimum temperature i.e., when it can sprint and digest the fastest, all of the time. Such a reptile obviously doesn’t exist although some species e.g., the desert iguana (*Dipsosaurus dorsalis*) will go to the extremes of only being active for short periods of the day when temperatures are warm enough to allow them to reach their narrow and high optimum temperature range without having to lie out in the open for excessive periods of time. In captivity these thermal conditions need to be replicated with a focussed basking zone kept far above ambient temperatures to
allow them to reach these thermal optima and cooler areas to retreat to outside these times.
At the opposite end of this continuum would be a species that doesn’t regulate its body temperature at all, allowing itself to track the ambient temperatures. This strategy is termed thermoconforming and is also a surprisingly common strategy found in reptiles but is less commonly considered by herpetoculturists. It is usually observed in scenarios where it would be either difficult to regulate body temperatures to a relatively higher optimum level, accurately, due to very uniform and stable temperatures e.g., in deep rainforests, or where temperatures are generally warm enough to allow good performance levels without the increased risks of regulating to a more specific temperature. In these cases the physiology of the reptiles have evolved to function equally well over much wider temperature ranges than thermoregulating species and often at lower temperatures. Many tropical arboreal agamid species and Anolis lizards are thought to be primarily thermoconformers amongst others. For these species a diffuse area of warmer air can be offered, the most natural way being to create a thermal gradient from warm air at the top of the vivarium, to cooler air at substrate level to mimic the thermal conditions found in closed canopy forests, but covering a much smaller range of temperatures overall than a conventional vivarium with a focussed basking zone. Should these animals then need to slightly alter their body temperatures they can (some species may want to subtly increase their body temperature as a response to illnesses and also when gravid) and this approach also makes maintaining a humidity gradient easier. The two thermal strategies detailed above are merely the two end points on a whole spectrum and are not always mutually exclusive either - some species may switch between thermoregulating and conforming depending on the environment and climate and some may be very relaxed examples of either, making distinguishing which strategy is predominant difficult.

Definitions Project: Bioactive
By Darrell Raw

The term bioactivity refers to the presence of a self-maintaining mini-ecosystem of organisms which work together to keep the soil fresh and alive. One of the most bioactive environments I have is an accidental one, formed in a tub of giant African land snails. Any enclosure with natural soils and sufficient humidity will, over time, develop some degree of bioactivity - and the benefits of this are legion. Typically, we set up our environments using two main bioactive components - woodlice and springtails, and these are easily purchased in starter packs - but there are a host of other organisms that will do just as well or will complement the standard invertebrates. Earthworms of various species can be used to aerate the soil and prevent it becoming a compacted dead mass. Addition of leaf mould (the partly decayed layer underneath fresh fallen leaves) or decaying wood introduces other components too, such as microorganisms and fungi, all of which help to break down waste. This processing of waste prevents bacterial build up, leaves the soil fresh smelling and fertile, and has the added advantage of providing enrichment for the animals. There is a common misconception that bioactive enclosures must contain plants to be truly bioactive. This is not the case, however live plants are certainly an advantage both in terms
of environmental enrichment and aesthetics. They will also help to break down wastes.

The typical bioactive setup is temperate forest or rainforest, however it need not be restricted to these environments, many people are maintaining successful arid bioactive setups simply by using more tolerant invertebrates.

The BHS is one of the world’s oldest and largest UK Herpetological Societies. Founded in 1947 by Britain’s leading herpetologists, the Society still enjoys its national learned status and celebrated its 70th Anniversary in 2017. Find out more about the society here. The interests of our members are catered for by our range of specialist committees: Research, Education, Captive Breeding and Conservation.

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The BHS is partnered with AHH with the goal of improving husbandry standards in the trade and community.
Biodiversity tours in the Atlantic Forest

Launching later this year will be the amazing opportunity to experience a week of exploration in the Atlantic Forest, which has an extremely high rate of endemism (around 40% of flora and fauna). The trip will involve consecutive night time excursions into different areas of the Forest to experience the amazing biodiversity that can be found in parts of the remaining 6% of the Atlantic Forest. Each night time excursion will be navigated by experienced locals who grew up in the forest, along with a qualified Zoologist to help with spotting and identification so candidates get the most out of the experience.

The day times will be spent either relaxing, visiting the beach or spending more time looking for as many animals as possible, depending on what the group wants. Accommodation and food will be provided in a house within a 17ha section of lush forest in the city of Itacaré, as well as transport to and from Ilhéus airport and to all exploration destinations. We are currently ironing out some of the details but the trips will look to be open to around 5-8 candidates who must be fit and able. The duration of the trips is still TBC and may change depending on season and costs are still being calculated but should be around $1700-$2000 USD.

The trips will be based around herping but expect to see large amounts of invertebrates, birds and the occasional mammal. Unfortunately seeing specific taxa can be tricky so we cannot guarantee that we will find any species specifically. Funds from the tours will go towards running the Nucleo Serra Grande, which has been working hard for 16 years with no external funding or support to conserve Lachesis muta rhombeata, the Atlantic Bushmaster. Not only this but funding will also eventually help to purchase more areas of the Atlantic Forest and in turn prevent further deforestation whilst providing essential islands of habitat which will help promote gene flow between fragmented habitats and preserve genetic integrity of otherwise isolated populations.

Follow the centre’s blog for more info as it becomes available!

Lachesis muta rhombeata, assessed as Vulnerable on the IUCN Red List, this is the species that the NSG is fighting to save from further decline

Tropidurus torquatus, one of the more abundant lizard species of Bahia and a species that will be commonly seen throughout the day.

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