



Some thoughts on reptile caging

Naturalistic versus minimalistic enclosures for your reptiles

Former manager of the Australian Reptile Park and experienced keeper **Rob Porter** discusses the pros and cons of various enclosure styles. While giving us great advice on the construction of our 'home habitats,' he also describes the evolution of his own philosophy in this very important aspect of reptile keeping.

As a young enthusiastic reptile keeper just entering the hobby, my outlook on reptile caging was always to try and recreate a slice of natural environment in captivity. Whether this was done with the view of trying to make the subject more content by providing a microcosm of where it lives naturally, or to please my own aesthetic whim, is a matter for debate. I would often strive to establish little fragments of forest using live plants installed in pots or planted in the substrate of the enclosures. These, almost without fail, would quickly deteriorate and die an agonisingly slow death due to insufficient light, poor drainage, over or under watering, being abused by the reptilian inmates, or a combination of these events. Next, pieces of cut plant branches were tried, either pushed into the substrate and supported by rocks, or in small bottles of water to maintain their freshness. Again their life expectancy was fleeting, and as the collection grew, the whole process became very time consuming. The gap between replacing the foliage became longer and longer,

until eventually it had almost composted itself!

Gradually, the thought of maintaining any sort of natural plant life in enclosures dissipated completely. Never mind, I still had some semblance of the natural environment, with pieces of bark and rocks for hiding places. But these needed to be scrubbed or replaced regularly as their rough surfaces were difficult to clean, and having enough replacements to fulfil the purpose was not always practical. Consequently, many of these natural refuges were replaced with plastic pot saucers or containers with holes cut in the side. These are not as pleasing to the eye but they are easy to install, lightweight, readily available, cheap, good at retaining humidity and simple to clean.

The practicalities of maintaining a rapidly expanding collection with an ever decreasing amount of spare time eventually forces the gradual abandonment of almost all traces of natural landscape, in favour of a sterile, totally artificial captive environment designed to minimize the time spent on all aspects of maintenance. The



Main: Ridge-tailed Monitor (Varanus acanthurus) in its enclosure. Above: An example of a naturalistic but easily maintained enclosure, complete with substrate-coated hide boxes and pot saucers, and artificial plants, in this case housing Eastern Hooded Scaly-foot (Pygopus schraderi). All photographs supplied by Rob Porter.



The use of artificial grasses in a Common Scaly-foot (*Pygopus lepidopodus*) enclosure.

attractively made timber enclosure with front viewing glass is replaced by cheap but very practical plastic tubs, or at the extreme of minimalism, the now ubiquitous rack system. Here the enclosures comprise regimented rows of identical boxes, paper substrate and plastic hides and water bowls. The boxes are often held so neatly in the rack that no lid is required even for the most escape-prone specimen, thus reducing the time required for maintenance even further.

I think these systems have some tremendous advantages, and if it means the cages are maintained at a higher standard of hygiene because of this, it is better for all concerned. From the reptilian viewpoint it is debatable whether such a clinical environment would seem much different to one containing natural furnishings. Let's face it, both are highly artificial and contrived, provided that the features contained in the enclosure supply all the animal's basic needs, and allow it to perform normal functions and behaviours without hindrance. Some of these synthetic items may indeed be inadequate for some purposes. For example, a climbing structure for a snake should be at least slightly rough to supply the reptile with sufficient grip to scale the item, so a smooth piece of PVC pipe would make the job very difficult. Textured items such as rocks or rough-barked branches also play an important role in assisting with skin shedding at the appropriate time. Providing a thermal gradient in these racks is also straightforward and very efficient. Most systems have heating strips installed in the rack structure, often with thermostats or rheostats controlling the temperatures in each row of boxes.

Two important considerations which are often not addressed by racks are lighting and ventilation. The former parameter is difficult to design into

a rack-type set up because of the need for space both to install the lighting equipment, and also to allow the escape of heat produced by the fittings and or globes/tubs. The boxes utilised in these rack systems are usually made of transparent or translucent plastic so, as long as there is light in the surrounding room, either natural or artificial, the inhabitants will still receive a photoperiod separating day and night. However, for species requiring either a high intensity of light or specific wavelengths such as UV, such rack systems are not really suitable. Ventilation is something that is often overlooked in many cage designs; efficient ventilation can contribute greatly to the well being of the enclosure inhabitants, both directly through fresh air turnover and also by minimising the build up of potentially detrimental bacteria and fungal pathogens.

I must stress that the main subjects of this article are lizards and frogs, as naturalistic enclosures hold particular problems for housing snakes. It certainly can be done, but the furnishings need to be much more resilient and cope with heavy bodied reptiles climbing all over them. Also, considering the amount of faecal matter produced by snakes, and health issues associated with close contact with substrates such as ventral blistering, special attention needs to be paid to maintenance and cleaning and also the type of substrate used.

So, by a process of "herpetocultural evolution", my reptile housing policy had changed from high-maintenance but attractive naturalistic enclosures, to low-maintenance, practical but aesthetically boring tubs, however, at least I had the time to service them at the level that the inhabitants deserved. Recently however, I seem to have been spending less and less time on my collection, and I thought it was because I had less available time,

and the minimalist enclosures had fewer demands. But it became apparent that there was an additional reason - these setups had certainly decreased the amount of maintenance required, but their sterile, soul-less appearance was simply not conducive to being able to appreciate the animals, their behaviours and the captive environment in which they are maintained. Even when the animals within were active they often couldn't be observed easily as there is no direct viewing through the translucent plastic walls of their boxes. Consequently, I was less able to appreciate the reptiles for what they are; amazing living organisms that over millions of years had become perfectly adapted to their own habitat.

To be able to observe a captive animal behaving as it would in nature is one of the greatest privileges of being able to keep reptiles in captivity, particularly in an enclosure that replicates its natural setting. I realised that the minimalist approach was not working for me, and the more low maintenance and sterile the setup, the less enjoyment I received from my charges, contradicting the main reason for entering the hobby in the first place. So the wheel had turned full circle, and I found myself re-examining the potential for establishing more naturalistic enclosures, but this time with a user-friendly maintenance program. Gone are the plastic tubs - they have been replaced with attractive enclosures set up in a fashion to mimic the reptile's natural environment and habitat, but which require a manageable amount of upkeep.

First, let's look at the enclosures themselves. The herp hobby has gone forward in leaps and bounds in the last 10-15 years and the range of specialized vivaria available on the market is extensive. Some of these are ideal for the naturalistic approach, especially the all-glass enclosures manufactured by companies such as ExoTerra, Reptile One and Zoo



1. Example of simple plastic tub set up, in this case used successfully to house and breed Storr's Monitors (*Varanus storr*) for several years. 2. A no-frills cage set-up used successfully to house Box-patterned Geckos (*Lucasium steindachneri*). 3. Enclosure frame constructed from "Qubeloc" aluminium square tube. 4. A close-up of a custom made background made from polystyrene foam with a sand and PVA glue coating, and coloured with acrylic paint to provide a resilient finish.



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Med. Many of these are supplied complete with relatively natural backdrops, an essential part of creating an aesthetically pleasing artificial environment. The importance of good ventilation has also been addressed in these commercially available cages in recent years with systems promoting good air flow with vents at different heights standard in most brands. The overall size and design must be dictated by the captive requirements of the animals they house, but other features such as access to the enclosure and its inhabitants may be a matter of personal preference. Personally, I am a great fan of the hinged opening door as opposed to the sliding-glass opening. I have always found the latter somewhat problematic with debris becoming caught in the track hindering movement, and also the limitations of access when only one half of the door can be open at a time.

The main disadvantages of these commercial enclosures are their cost, with prices ranging from \$150-\$300 for a medium sized all-glass tank off the shelf, and their limited size range, especially at the larger end of the scale. Another option is to have an enclosure custom-built to your own specifications. This does have some major advantages, not the least of which is being able





The first completed aluminium square tube enclosure with custom rock backgrounds, artificial plants and even artificial mossy rocks, housing Rough-throated Leaf-tailed Geckos (*Saltuarius salebrosus*).

to design an enclosure to specifically meet the demands of a particular type of reptile, while at the same time incorporating all the features you like or require, both for the inhabitant's benefit and also for personal taste and aesthetics. If you have a basic knowledge of general construction, there is a huge range of materials and products suitable for reptile enclosures, including timber, plastic, glass, aluminium, steel, etc., and significant cost-saving can be achieved as long as you have the time. If you are planning to have a custom enclosure made by a tradesman it will probably work out at least as expensive as an off-the-shelf product, and often it may be significantly more.

One product that I have found excellent to use for reptile and amphibian enclosures is square aluminium tube held together by rigid plastic fittings. There are several brands available such as 'Qubeloc' and 'Speedframe,' and suppliers will

usually cut pieces to length according to your requirements. Once all the pieces and the necessary fittings have been acquired it is just a matter of knocking the frame together with a rubber mallet and it is ready to go and has the added advantages of being strong, lightweight and resilient. Once the framework has been assembled it is then a matter of filling in the sides, top and bottom with whatever material you prefer; glass, Perspex, plastic, plywood, mesh, etc., chosen to meet your own and your reptile's specific needs. A future article will look at the construction steps required to build and decorate one of these custom-made enclosures.

Once the cage has been completed, it is then time to decide on how to furnish and decorate it. This is where a decision needs to be made with regard to the level of naturalism required in the finished product, e.g. live or artificial plants, natural substrates, furnishings, etc. As mentioned earlier,

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the use of live plants in reptile cages is somewhat problematic, although the science behind it has come a long way in recent years. For those interested in this aspect of husbandry I highly recommend a series of articles that have been published over the last few years in the American magazine *Reptiles*, by Rex Lee Searcey. These articles discuss in great detail all the important aspects of successfully maintaining and growing live plants in reptile enclosures. Subjects such as drainage, substrates, lighting, etc. are all covered in depth, providing excellent guidelines in a simple and straightforward manner. While the successful use of live plants is achievable, it is still a relatively high maintenance technique which many keepers may aspire to but simply don't have the time to establish and ultimately maintain, especially for large collections. Consequently, my personal choice was to use a combination of natural and artificial furnishings, plus good quality artificial plants.

In days gone by, the term "artificial plants" conjured up images of gaudy, glossy lime-green plastic imitations that only really looked at home on Nana's mantelpiece! Today the quality of some artificial plants is so good even those interested in the real thing have a hard time distinguishing them at a glance. This quality does come at a price however, with top of the range products selling for \$100 or more for even a medium-sized specimen. It really comes down to a personal choice as to how authentic you want your enclosure to look, and some of the lower priced products can still look very natural particularly in enclosures with less intense lighting. Check out some of the suppliers online, most have good internet catalogues with a wide range of plant types suitable for most species and enclosures. There are even realistic Australian native plants available for those who want to be truly authentic.



An example of an off-the-shelf commercially available glass terrarium, incorporating a foam background, and decorated with artificial plants and natural branches.

The next decision to tackle is the background. There is no point going to great lengths to establish a natural captive setting if the most noticeable feature is the floral wallpaper visible through the back glass, or the white melamine of the back wall of the enclosure. Many commercially available enclosures are now supplied with ready-made and coloured natural backgrounds. Although the quality of these does vary, most will fulfil the general purpose of providing a background to blend in with the natural furnishings. If you are more particular about the authenticity of the surroundings, or you have built your own custom made enclosure, then another option is to make your own background. Again, technology and the arrival of new products on the market means this is achievable by keepers with no more skills than the average home handyman, and there are varying degrees of sophistication in the style and techniques used. "You Tube" has a multitude of budding enclosure landscapers, all using different methods to create their masterpieces... and some of these are truly awful! However, it is a good place to pick up a few skills and ideas when you are starting out.

My choice was to use polystyrene foam sheets of varying thicknesses, glued to a plywood backboard as the basis for my new backgrounds and although my first attempts were less than convincing, with a little more practice and experimentation with different tools and implements, the quality is improving. The main equipment required is a sharp or serrated kitchen knife, or preferably a heat knife, which will certainly make cuts easier and a lot less messy. Once your background has been roughly carved to your liking the edges can be made more natural and 'weathered' by the use of a heat gun or hairdryer to soften and round the

cut edges. It is also possible to install a heat cord into the surface of the foam to provide an inbuilt heat pad. The cord can be pushed through from the back of the enclosure and a groove of appropriate size and length can be melted into the surface of

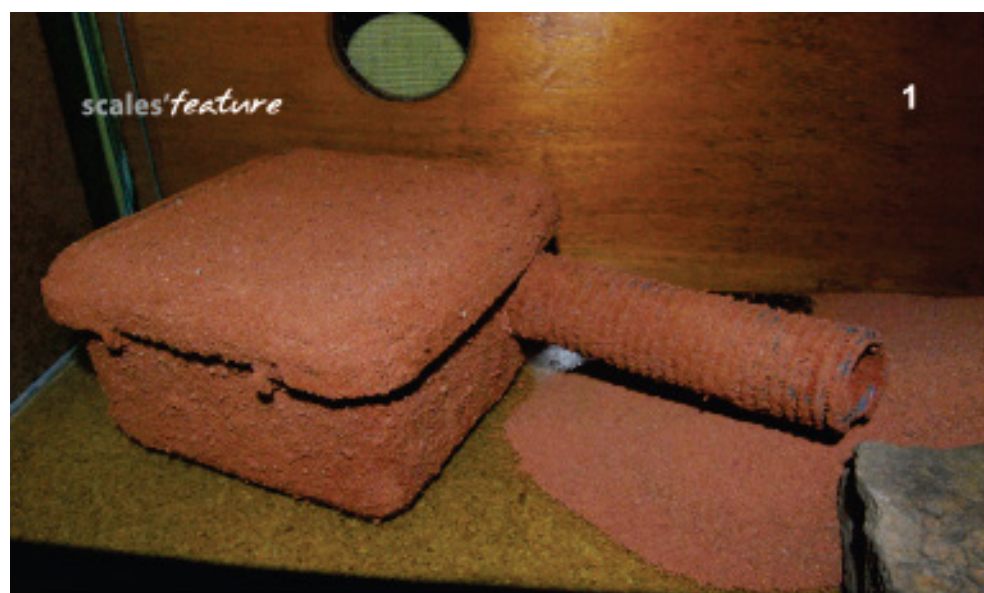
The sand serves two roles, firstly to add a natural colour and finish to the rockwork, and secondly it provides a rough surface permitting grip for climbing reptiles.

the foam into which the cable can be pressed. One word of caution with this technique, because of the insulative properties of the foam, heat build up around the cable can be excessive and needs to be monitored and preferably controlled by a rheostat or dimmer to make sure it doesn't overheat and melt the foam. Most of the commercially available foams contain a fire-retardant, so will not support combustion, however they will melt and give off toxic fumes if they overheat.

The advantages of using foam are that it is very light, relatively cheap and with a little trial and error, quite easy to work. The main disadvantage is that it is not very strong and resilient, so it must be covered with some type of coating to protect

it from the enclosure inhabitants, and also from vigorous cleaning that may be required from time to time. There are several options, but remember many products will act as a solvent to polystyrene, so try and stick to a water-based product if possible, and if not, try the material on a sample of foam first to make sure the results of your hard work don't dissolve before your eyes!

After a little research and inquiry I decided upon a PVA glue and sand mix mainly because the materials are cheap and easy to obtain, and the glue is water-based and non-toxic. The glue is diluted to around one part glue to one part water and applied by a hand-sprayer or brush over the surface. The process is basically a series of layers of diluted glue sprayed onto the carved foam, over which handfuls of sand are scattered, followed by more glue, more sand, etc. It is possible to apply about three thin coats of PVA interspersed with two applications of sand before the foam is left overnight to dry thoroughly, always finishing with a coat of glue to seal the work. Placing the work in front of a fan will greatly speed up the drying process. Keep applying these layers until the foam is completely covered in sand, and then apply a final coat or two of glue to give the surface a strong, resilient finish. The sand serves two roles, firstly to add a natural colour and finish to the rockwork, and secondly it provides a rough surface permitting grip for climbing reptiles. The final two coats of glue will take a little of the roughness off the surface, but this will make cleaning slightly easier. Any type of sand can be used, preferably it should match the rock colours of the species' natural habitat. If this isn't possible, the finished surface can be further enhanced with diluted acrylic paint in appropriate colours, again applied by a hand-spray bottle. More glue can be sprayed over the final paint finish for additional



1. Plastic container with a corrugated tube access tunnel coated with red desert sand, for use as hide boxes and/or egg laying sites. 2. A range of good quality realistic artificial plants is now available, as well as mossy rocks and rolls of carpet moss, all useful for decorating reptile and frog enclosures. 3. Sand-coated plastic containers used in an enclosure which houses Night Skinks (*Egernia striolata*).

protection. This is probably the most time-consuming part of the whole construction process but it can also be the most fun, experimenting with different colours and textures. It doesn't matter if you get it wrong, because you can just paint over the top until you achieve a finish you like.

Substrate is the next area to tackle. If the enclosure is attempting to replicate the animal's natural habitat as closely as possible, it makes sense to try and use a floor covering in line with this approach. However, for some natural substrates are simply impractical for use in caging and others may even cause health concerns for the inhabitants. Coarse sandy substrates can lead to digestive tract problems such as impaction if ingested in quantity, while other very fine materials can become very dusty when dry. Fine sands such as washed beach sand, plasterers sand, or red desert sand are ideal and readily available, while coco-peat made from ground coconut fibres is also excellent due to its organic nature and good water holding capacity. Even if some of these coverings are not in key with the theme of the enclosure concerned, it is relatively easy to blend them in, using a layer of leaf litter, she-oak needles, dried grasses, etc.

Most reptiles require some type of refuge in their enclosure, in which to rest or hide. While natural items such as rocks, bark and logs can be used for this purpose it is often useful to have

more specific areas to fulfil particular roles and this can be achieved by using plastic containers of appropriate size camouflaged to blend into the cage environment with access holes cut into the lid or side. These are particularly useful for creating a humid microclimate somewhere in the cage, which is especially important during sloughing time, and also to act as an egg-laying site. Using a container with an easily removable lid also enables the keeper to check on the inhabitants or to look for eggs without having to disturb or damage large areas of the enclosure while searching. There are a couple of tricks that can be employed to conceal these non-natural hides. A thin, flat rock can be placed or glued on top of the lid, or the container itself can be smeared with glue and a natural substrate applied to it in layers until it is fully covered. For burrowing species, this can be taken one step further, with the container buried into the substrate with only the lid accessible and a small flexible tube fitted to the access hole in the side of the container. This can be partially buried, with only the open end visible. The tube can also be coated with glue and materials to blend it in. Remember to use a diameter of tube allowing easy movement through by the inhabitants, preferably wide enough to allow two animals to pass each other if more than one are housed together. A corrugated plastic product will also provide grip for reptiles using the tube,

allowing ease of access.

At this stage the main structure of the enclosure is complete and now comes the exciting task of decorating and furnishing the enclosure by adding the artificial plants, logs, branches, rocks, etc. This process will be greatly dictated by the reptiles to be housed and their habits and natural habitat, but also by the practicalities of maintaining and servicing the enclosure. Overfurnishing it may make the cage an attractive feature, but if the access is greatly restricted, it may make the task of regular cleaning impossible without removing some of the furnishings and disturbing the whole setup, and it will make general observations of the inhabitants very difficult. Once this has been completed and the lighting and heating components have been added, you are finally ready to introduce the reptiles. This is what makes the whole process worthwhile and allows you to appreciate the magical benefits of maintaining these fascinating creatures in an "organic" environment and observing them behave, thrive and breed in a relatively natural way without you having the chore of excessive maintenance and cleaning. Hopefully, this and future articles in the series will inspire keepers to experiment a little more with their captive environments to enhance both their own enjoyment, and their herps' appreciation of their artificial habitat.