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Panther chameleons

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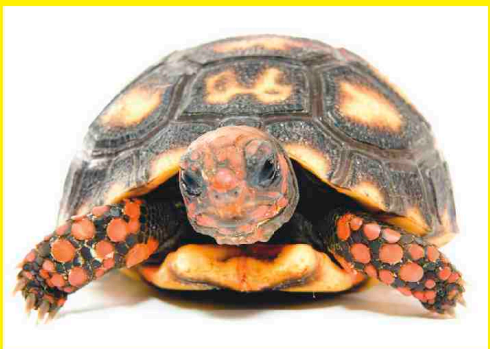
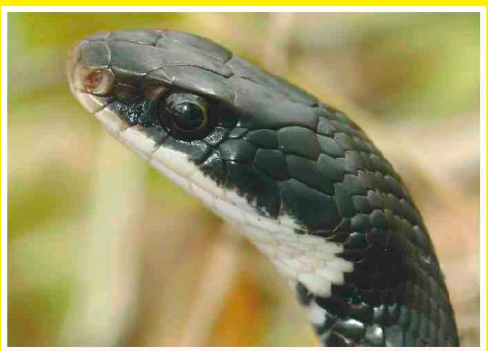


YOUNG REPTILES



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Welcome

Until I started work on this issue, I must confess that I'd never heard of Grace Olive Wiley, and yet I should have done. She was both a true pioneer in the world of reptile keeping, and a very remarkable woman. Fascinated by snakes from early childhood, she was clearly able to form a truly unique bond with them.

How else can you explain the fact that she free handled over 1000 of the most deadly venomous snakes in the world on a regular basis, without being bitten? Not only that, but she also assisted many of the three million visitors who were drawn to her Californian roadside zoo to do the same, without incident.

What was it that allowed her to convey to these snakes that they were in no danger with her, to the extent that they clearly trusted her? No-one knows. Yet as Julia Mueller-Paul reveals, there is much more to understanding reptile behaviour than we have ever suspected, and without any doubt, there is plenty more to learn too!

Who would have guessed that the incubation temperature of reptile eggs may determine not only the gender of the hatchlings in many cases, but can also impact directly on the behaviour of some species, for their entire lives?

Looking to the future, you may remember that last year, we profiled the remarkable Mr Grey, a highly distinctive bearded dragon bred at Monkfield Nutrition here in the UK. Now we can report that he has mated successfully with two females, and although the resulting offspring were not as colourful as he is, (as you can see in our News and views section), hopes are now very high that it will be possible to replicate his appearance in the next generation. Exciting times indeed, as the New Year dawns. I hope you have peaceful, prosperous and happy 2014.

David Alderton

David Alderton, Editor.
Email: prk.ed@kelsey.co.uk

✣ David has extensive practical experience with this group of creatures, extending back over 40 years. He has written and broadcast widely about their care and biology, and his website can be found at www.petinfoclub.com

Main cover photo: Bearded dragons. Photo by Praisaeng/www.shutterstock.com

Contents

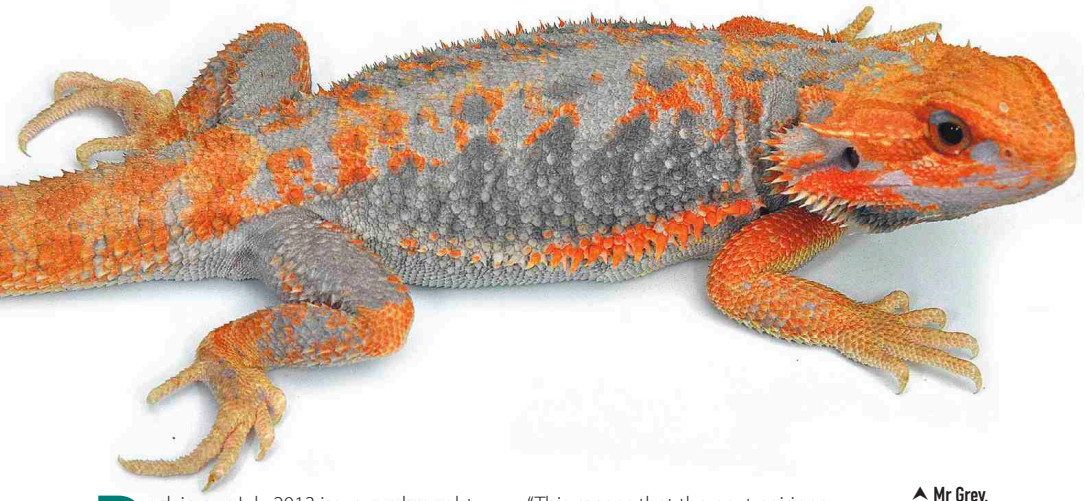
Features

Regulars

News & Views

Featuring news this month about the continuing debate as to whether early snakes and lizards gave birth to live young; an amazing commitment to amphibian conservation; the first case of tool use in reptiles, and starting here with an update on the most striking bearded dragon that has yet been bred.

Monkfield's Mr Grey – the story continues!



Back in our July 2013 issue, we brought you exclusive pictures of the bearded dragon bred at Monkfield Nutrition, in Wendy, Hertfordshire, who is known as Mr Grey. His spectacular appearance generated a lot of interest at the time.

Over the past six months, the team at Monkfield, one of the UK's leading breeders of this species, has been seeking to unravel his genetics, based on their records, and deciding how best to pair him up. Mr Grey, who displays the visual traits of hypomelanism and a black-eyed translucent, really is one of a kind, but this could change before long!

Mr Grey has now been paired with two females and although in neither case, the young actually resemble Mr Grey, they are clearly carrying some of his characteristics, which is very exciting for the future. All of his offspring display the visual traits of hypomelanism (a lack of dark pigment) as shown by their clear nails, and they are also heterozygous for the translucent trait too.

"This means that the next pairings, using these offspring, could give us some very interesting results!" says Peter Morris, Reptile Manager at Monkfield Nutrition.

Finding frills

Peter has also been busy putting together a breeding group of frill-necked lizards *(Chlamydosaurus kingii)*.

"We are only in the early stages of setting up this breeding group, as good quality captive bred stock is hard to find," he explains. "But this is a great-looking lizard, with a fantastic temperament, and strangely seems to have been rather overlooked in the past."

Also known simply as the frilled lizard or dragon, this species is a member of the agamid family and originates from northern Australia and southern New Guinea.

Arboreal by nature, frill-necked lizards spend most of their lives off the ground in trees in the wild, but they do descend occasionally to feed on ants and they also hunt small lizards. They are medium-sized, and can vary significantly in colour, from brownish to reddish shades, depending on their area of origin.

The species is named as a result of the large frill that extends around the neck, which is usually relatively inconspicuous, being kept folded against its body. When threatened however, the lizard rears up on its hind legs, opens its mouth, and unfurls the colourful, pleated skin flap encircling its head, as well as hissing loudly to disorientate and discourage a potential predator. This reaction is also evident during courtship and territorial conflicts.

Monkfield Nutrition has a very extensive captive-breeding programme for reptiles that also includes leopard geckos, crested geckos, veiled (Yemen) chameleons and colubrids, supplying to the trade. As the UK's first commercial live food breeder, the company also produces its own top-quality live and frozen food, as well as supplying reptile products from all the leading brands.

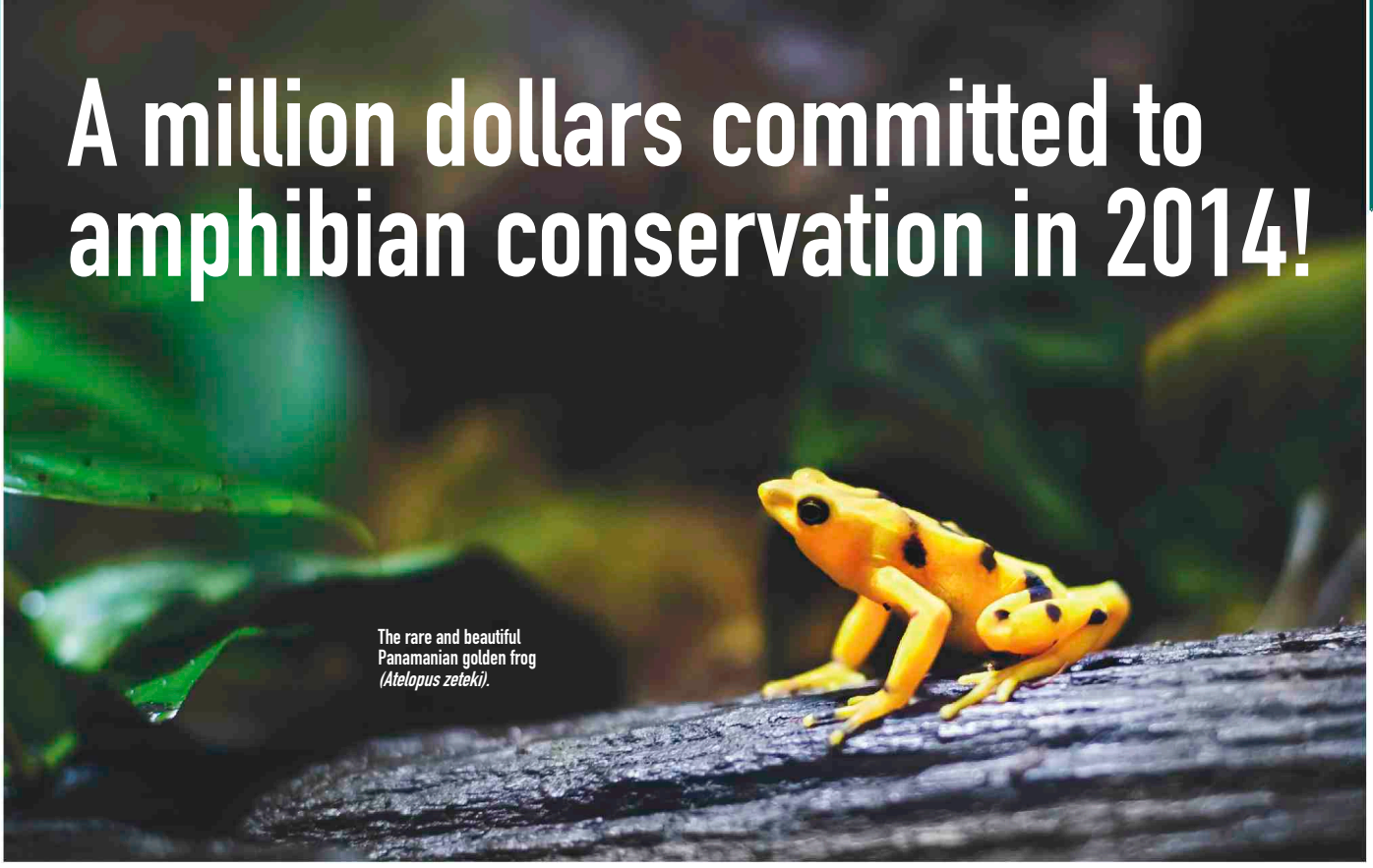
** Follow Monkfield Nutrition on Facebook or at http://www.monkfieldnutrition.co.uk.*

▲ Mr Grey.
Photo courtesy Adam Singleton/Monkfield Nutrition.

▼ One of the frilled dragons in Monkfield's growing collection.
Photo courtesy Adam Singleton/Monkfield Nutrition.

Grey's offspring, now six months of age, photographed recently at Monkfield Nutrition.
Photo courtesy Adam Singleton/ Monkfield Nutrition.

A million dollars committed to amphibian conservation in 2014!



The rare and beautiful Panamanian golden frog *(Atelopus zeteki)*.

Amphibians are at the forefront of what is being widely referred to as the sixth mass extinction event on earth. Around a half of over 7,000 amphibian species are in decline, a third are on the International Union for the Conservation of Nature (IUCN) Red List of Threatened species, and more than 120 species are thought to have been lost in recent years.

Disease and climate change have been implicated in the sudden and rapid disappearance of species from South, Central and North America, Europe and Australia – but the primary threat to the survival of many amphibian species is the rampant loss and degradation of habitats, such as rainforests.

In the tropics, where the entire range of a species may be as small as a single stream, amphibians often fall through the cracks in protected area coverage and a recent study revealed that 940 amphibian species worldwide occur in unprotected habitat.

The Amphibian Survival Alliance (ASA), Rainforest Trust, Global Wildlife Conservation and Andrew Sabin Family Foundation are taking a bold step in the fight to save amphibians by committing one million dollars to protect key habitats worldwide this year.

The fund, which has been named the Leapfrog Conservation Fund, will be dispersed through the ASA – the world's largest partnership for amphibian conservation – to strategically protect and manage key habitats for frogs, salamanders, caecilians and other species for the benefit of current and future generations.

"Habitat loss is the single biggest threat to the survival of amphibians worldwide" said Don Church, Executive Director of the ASA. "This million dollar commitment represents a landmark in the battle to stem the alarming loss of frogs, salamanders and caecilians. We hope that it will encourage others to step forward and make a commitment to protecting amphibians and their habitats."

➤ Habitat conservation is vital for amphibian survival. These are a pair of rare cave-dwelling blind salamanders *(Eurycea spelea)*.

Dr Paul Salaman, CEO of Rainforest Trust, adds: "Amphibians represent an opportunity to stem biodiversity loss through relatively modest investments. We can literally save entire species through strategic habitat protection. We are thrilled to be able to make this commitment to protecting the most threatened vertebrate group in priority sites worldwide."

The Leapfrog Conservation Fund will strategically and collaboratively target the most threatened habitats for protection. "Partnerships are the key to success," explains Robin Moore, Conservation Officer with the ASA, Rainforest Trust and Global Wildlife Conservation.

"We all have a stake in the future of our environment, and what is truly exciting about the Leapfrog Conservation Fund is that it represents an opportunity for unique collaborations to achieve a common goal – saving amphibians and the habitats upon which we all depend."

➤ Many amphibians occur in restricted areas. This is a strawberry poison dart frog, which occurs in many different forms through its Central American range.

Further information

To support amphibian conservation through the Leapfrog Conservation Fund, or apply for funding for a project, please visit our http://www.amphibians.org/leapfrog-conservation-fund/ or contact Robin Moore at rdmoore@amphibians.org

Crafty crocodilians

While they might not be the fastest hunters around, crocodiles have recently revealed just why they are regarded as being amongst the most deadly, enhancing their reputation in this respect. When it comes to luring birds within reach, they have recently revealed a new hunting method.

Lying still in the water and balancing sticks and twigs on their snouts or in their mouths, the crocodiles appear more cunning than a fox. At a time of nesting, birds such as egrets fly down to collect extra material to construct their nests, only to be snapped up unexpectedly in the crocodilian's jaws.

Perfect timing too

Two crocodilian species, namely the American alligator *(Alligator mississippiensis)* and mugger crocodile *(Crocodylus palustris)* in the USA and Asia respectively, have now been observed behaving in this way. The use of objects as hunting lures is very rare in nature, and this is the first report of tool use by any reptiles. However, what makes this discovery unique is that it is also the first known case on record of predators timing the use of lures to link in with a seasonal behaviour on the part of their prey - namely nest-building.

On several occasions, the crocodilians were observed to have balanced small sticks across their snouts whilst lying dormant for significant periods of time. Year-long observations at four sites in Louisiana, USA provided the basis for the study and each site was observed between 1-4 hours after sunrise, monthly in the period from August–February and weekly in March–July, covering the nest-building season of the birds, which extended from 24th March to 5th May.

➤ **One of the cunning mugger crocodiles with sticks and twigs over its snout, photographed at the Madras Crocodile Bank, Tamil Nadu, India.**

Further information

V. Dinets, J.C. Brueggen & J.D. Brueggen, Crocodilians use tools for hunting, Ethology Ecology & Evolution (2013). http://www.tandfonline.com/doi/full/10.1080/03949370.2013.858276

Ancestors of today's snakes and lizards had live offspring

➤ **A slow worm *(Anguis fragilis)* – one of today's lizards that produces live young.**

The ancestor of snakes and lizards probably gave birth to live young, rather than laying eggs, and over time, species have switched back and forth in their preferred mode of reproduction, according to the latest research in this area.

"This is a very unusual and controversial finding, and a major overturn of an accepted school of thought," says Alex Pyron, Robert F. Griggs Assistant Professor of Biology in the Columbian College of Arts and Sciences at the George Washington University. "Before, researchers long assumed that the ancestors of snakes and lizards laid eggs, and that if a species switched to live birth, it never reverted back. We found this wasn't the case."

The findings push researchers' understanding of the evolution of live birth a lot further back in time to 175 million years ago. This confirms that live birth has a much more ancient past as a reproductive strategy than has previously been believed. The evidence is supported by several recent plesiosaur and mosasaur fossil discoveries. There are also fossil records of a few lizards from the Cretaceous Period, which had embryos in their bodies, indicating that females clearly gave birth to live young.

Dr Pyron analysed an evolutionary tree containing all groups of squamates - the group that comprises lizards and snakes - which he and a team of researchers published in the journal *BMC Evolutionary Biology* earlier this year. The tree, which uses DNA sequencing technology to group thousands of lizards and snakes, includes all families and subfamilies, as

Dr Pyron at work in his laboratory at George Washington University.
Photo by William Atkins/GW University Photography.

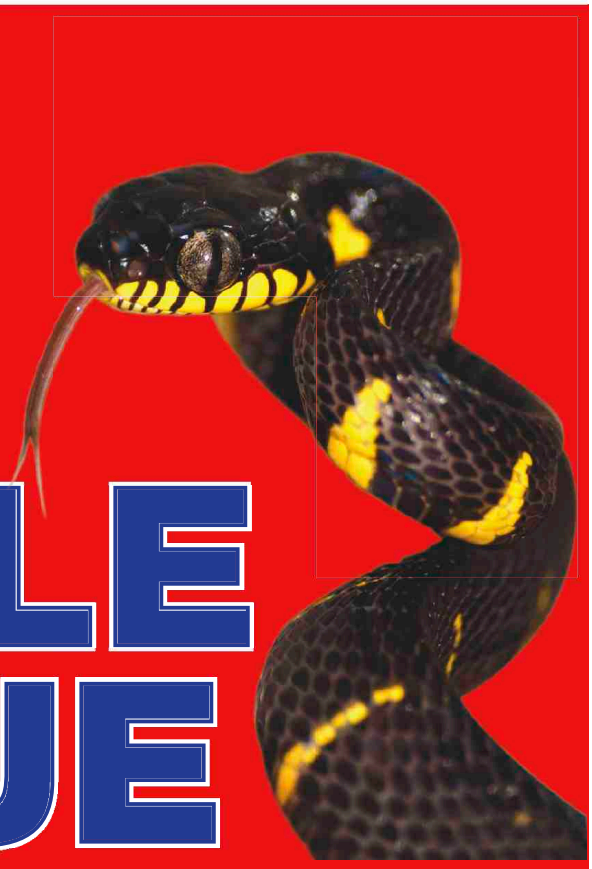
In total, about 115 groups of lizards and snakes, or about 2,000 species, reproduce through live birth. The other 8,000 species lay eggs - at least right now.

Dr. Pyron is now working to analyse all tetrapods -a group comprised of animals with four limbs, such as amphibians, turtles, crocodilians, as well as birds and mammals - to see if there are any new surprises about the evolution of their reproductive modes. He also wants to test the genetics at work behind the evolutionary switching of reproductive modes.

Further information

See: R. Alexander Pyron, Frank T. Burbrink. Early origin of viviparity and multiple reversions to oviparity in squamate reptiles. *Ecology Letters,* 2013; DOI: 10.1111/ele.12168

RSPCA



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www.rspcareptilerescue.com

A view of the vivariums at the unit. The occupants are each clearly labelled.

Join in and help rescued reptiles!

There is a great event happening in September to raise funds for rescued reptiles, and here Susie Kearley provides the background and explains how you can get involved.

RSPCA Reptile Rescue opened in 2007 after it became apparent that there was a need for a safe haven for unwanted and stray reptiles in the south of England. Since then, hundreds of reptiles have been rescued, rehabilitated, and rehomed throughout the country by this group.

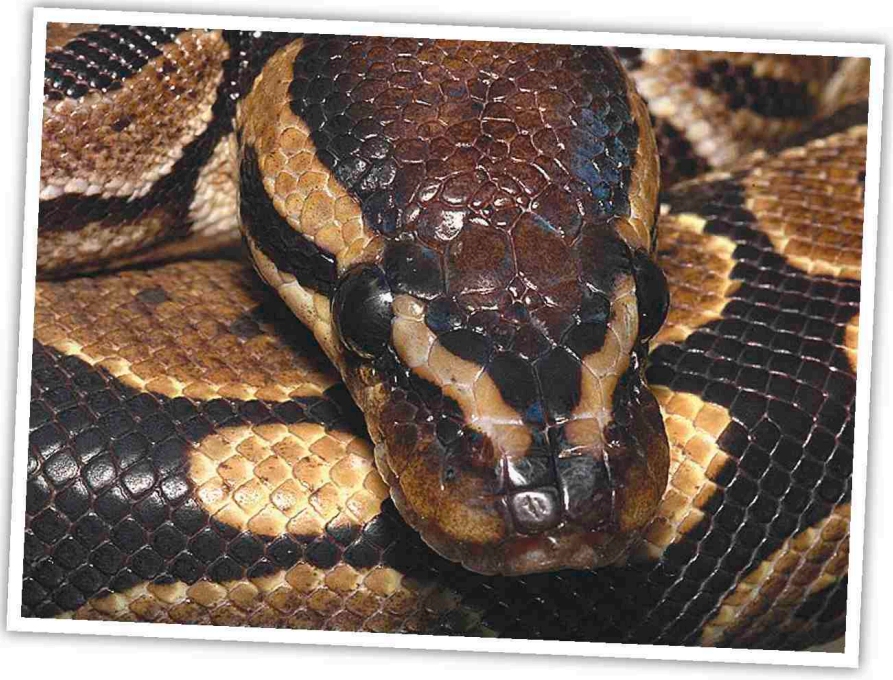
The facility itself, which is based on the outskirts of Brighton, takes in snakes, lizards, tortoises, invertebrates, and amphibians. In addition to rescue and rehoming, they also have a waiting list for those people seeking specific pets that are not currently available.

Education is the aim

As the popularity of exotic pets grows, so providing correct advice for those attracted to keeping reptiles and similar animals becomes increasingly important. RSPCA Reptile Rescue aims to do this by providing education to those people wishing to adopt reptiles, and helping to ensure that owners in general know what is involved, so they can cater for all their animal's needs properly.

Unfortunately, reptiles are going to new homes without the correct information being given about their care at the point of purchase. This results in many suffering through a lack of knowledge and neglect. RSPCA Reptile Rescue offers an advice service by telephone, to help reptile owners understand the welfare needs of their reptiles, invertebrates, and amphibians, so they can provide the correct care that these animals need.

This is the first RSPCA unit in the country dedicated to reptiles. A programme of expansion is underway, but it is very much dependent on public donations. The aim is to expand this unique facility for reptiles, in order to be able to accommodate the increasing number of such creatures in need of new homes.



➤ **There is an advice service for owners of reptiles such as ball (royal) pythons which is run by phone. This is especially useful for newcomers to the hobby, in search of trustworthy advice.**

Above and left: The rescue can cope with DWA species, like these two colourful vipers.

What is involved?

Susie Kearley spoke with Keith Wells, who has helped to pioneer the centre, in order to find out more about its work and what is planned for the future.

Q Tell me more about the centre and your plans going forward.

A We take in reptiles that the owners can no longer care for, including those that require a *Dangerous Wild Animals Act* (DWA) licence, and we currently have approximately 100 reptiles looking for good, loving homes. We are hoping to expand our reptile facility in the next year, but this all depends on the funds being available for the development.

We raise all our own funds and the branch is entirely self-funding. So to obtain the money that we need, we are organising a car banger rally and a walk up Mount Snowdon for this purpose.

The rally was my idea and it will take place in early September. I wanted to do something that was a bit novel and unusual, which would draw attention to the cause. Things like sponsored walks have been done to death and so we've been looking to do something different.

We're hoping to attract 20-30 cars to the rally, but who knows…? It's the first year and anything could happen! Readers who are interested in taking part should keep an eye on our website and our Facebook page, as there will be lots of updates and news nearer the time, but you can pencil the dates in your diary now!

Q Can you tell me more about your reptiles' environment?

A We use vivariums and thermostatically controlled T5 lighting. We currently have three reptile rooms and are creating another four. Hopefully, we'll raise enough to have a dry goods shop as well – subject to planning permission. We do sell reptile goods at the moment, but it would be nice to have a dedicated shop on the site where it can all be displayed properly. This helps the educational side of our work, as well as raising vital funds.

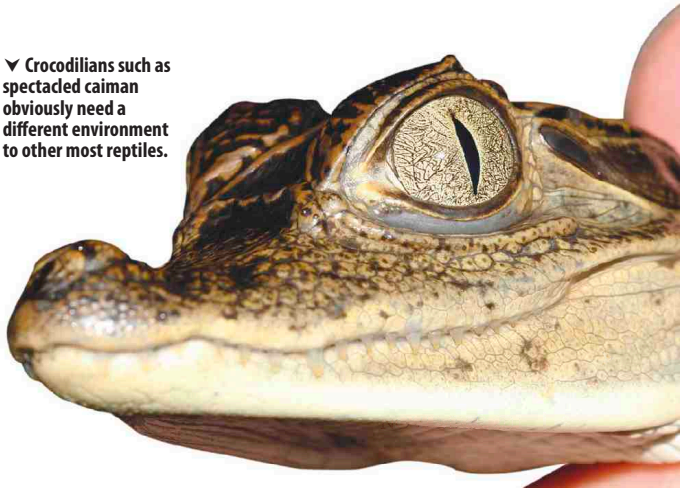
We have naturalistic set-ups for our long-term residents, but we keep the others in minimalist, sterile environments. We have animals in and out all the time, so we need to be able to clean the surroundings thoroughly and easily. If they're staying longer, we'll aim to give them a more natural environment.

Q What are the greatest challenges?

A We have a constant list of animals waiting to come into our care, but we are full to capacity and can only take in more animals if we manage to find adopters for our existing animals. The industry is getting huge and it's a big problem. Reptiles live a long time, and people just decide that they don't want them any more. That's how 80% of our animals come in. We also get animals that have been dumped in a box, a field, or wherever.

There was a black and white tegu left in a flat in London and its owners had just moved out and abandoned him. He's here with us now and he's a permanent resident. His name is Tarquin and we use him for education.

We've also taken in bearded dragons and boa constrictors that have been dumped in a box in the middle of winter. They have all been found good homes. ➤



Crocodilians such as spectacled caiman obviously need a different environment to other most reptiles.

Q What have been the highlights of running the centre?

A The highlights are making sure all the animals are healthy. Some that we receive are very thin and in a horrendous condition when they come in, but nursing them back to health and finding them good homes is very rewarding.

Q What is the most common mistake people make when they get reptiles?

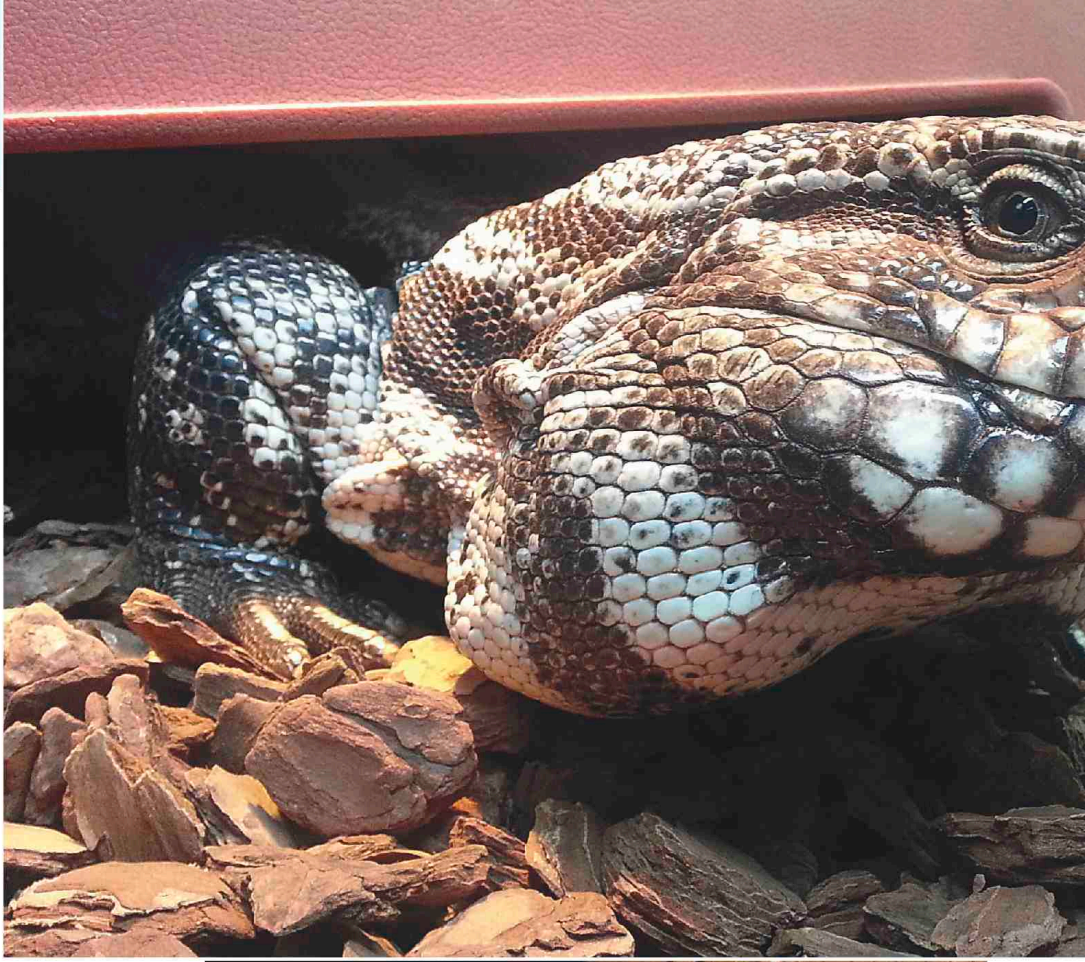
A They often don't seek out enough information before they buy a reptile. They just take the vendor's word as the truth, rather than doing their own research, to determine whether it will be compatible with their lifestyle. They don't bother to find out how long their pet will live, how big it will grow, or about the handling required. Lots of people become scared of their pets. They just don't have a clue.

Q Do you have any practical advice for people keeping reptiles that you'd like to share?

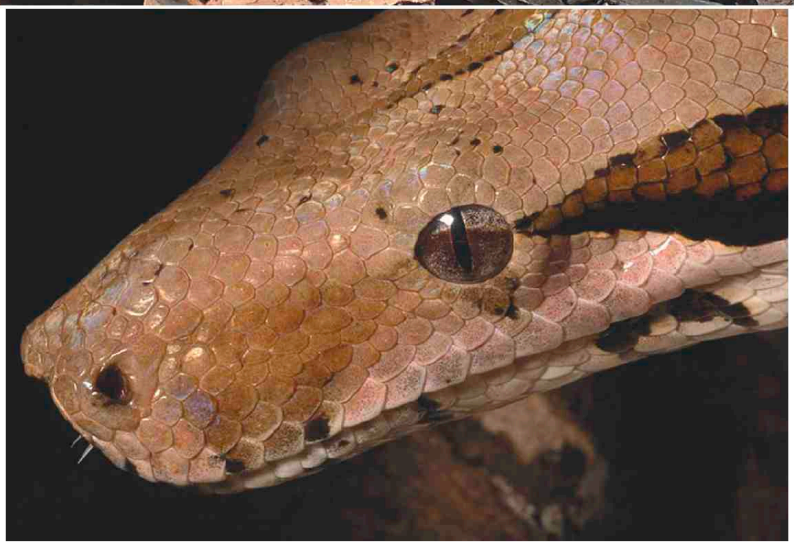
A Do your research before you buy a reptile… and stop breeding bearded dragons and corn snakes. I can see that the breeding is going to create a huge problem. It is already. We can't take any more in, but people think they can make money breeding the species, and so the cycle continues.

Q How can people help the rescue centre?

A If you have any unwanted vivariums or reptile equipment, just bring them in and we'll be delighted to take them from you. We can use them for our rescue animals or sell them to adopters looking for a suitable home for their reptile. We are also accepting funds and donations to help us with this important work. You can sponsor a vivarium and have your name on a badge attached to the outside.



➤ Tarquin was simply abandoned, but now lives permanently at the centre.



➤ It is very rewarding helping reptiles back to top condition. A boa is seen here.

> **All money raised by the branch goes directly into helping and housing the reptiles in our care.**

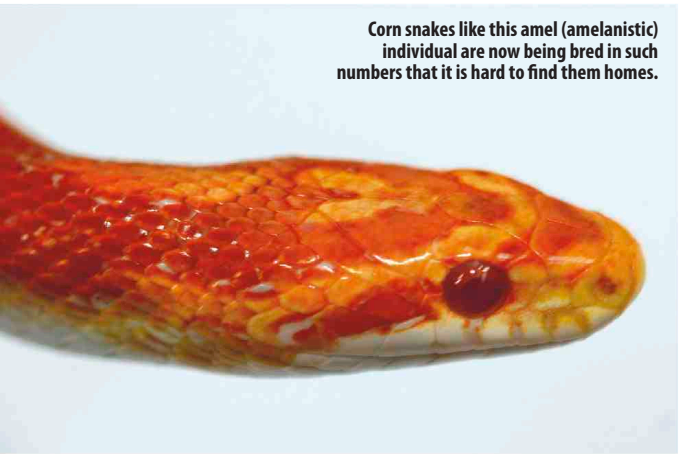
We'd also like to hear from anyone who has the time and inclination to volunteer to help here at the branch. For those who are interested, we are more than willing to show you around our units and run through the plans for the future. All money raised by the branch goes directly into helping and housing the reptiles in our care. We also offer reptile boarding for when people are away on holidays, which helps us to raise funds, as well as helping them out.

Adopting an animal

If you're interested in adopting an animal, do call us or pop in between 10:30am and 4pm, Monday to Saturday. You will need to complete an application form. If you do not have a vivarium already, then new and second-hand vivariums are available for purchase at the centre.

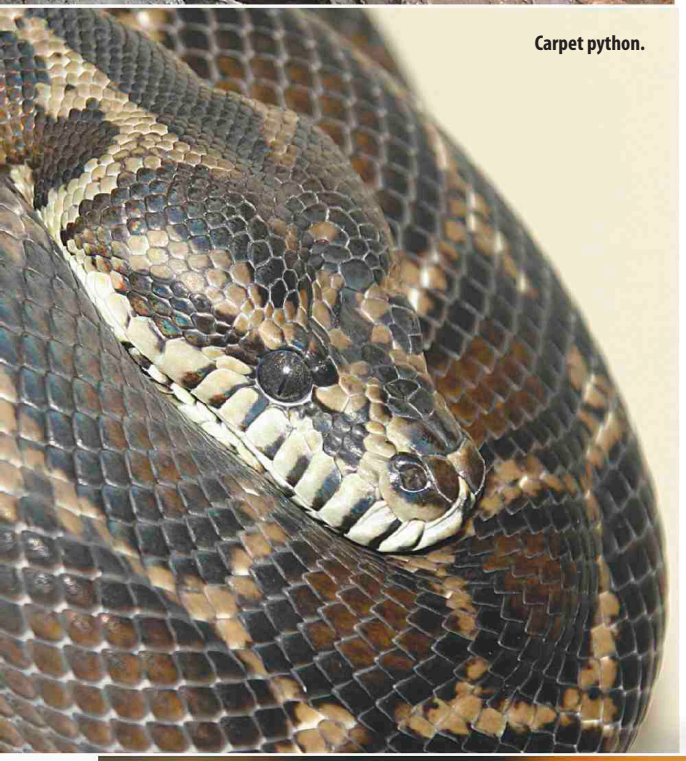
If you purchase a vivarium from the branch, we will make sure it is properly set up for you. If you have your own vivarium, we will ask to see pictures and we'll want to know the measurements as well as what heating, UV lighting and thermostat you are using.

All rehoming will be at the discretion of the rehoming officer, to ensure that you adopt a suitable reptile for your lifestyle and experience, and a home visit may need to be carried out at any stage of the adoption process. Also, any rehomed reptile would have to be returned to the branch, if you are longer able to keep it. ✣



Corn snakes like this amel (amelanistic) individual are now being bred in such numbers that it is hard to find them homes.

Carpet python.



The reptile car rally – snaking around Snowdonia

Do you fancy doing something interesting and different? Here are Keith's plans for the rally in September. Why not sign up to take part, and meet fellow reptile enthusiasts?

Mount Snowden is rich in colour in the early autumn, and the views are spectacular.

"We are planning a rally to raise riches for reptiles. The rally will take place from September 4th–8th 2014. We will meet at the RSPCA in Brighton on 4th September between 5pm and 7pm, and will kick the weekend off with a fabulous barbeque before retiring to our tents for the night.

"On 5th September, we will set off in our rally cars for Snowdonia and will meet again in Wales where we will camp for two nights. After the first night there, we will be rising early to climb Mount Snowden. We will do the scenic climb, which isn't the easiest but nor is it the most difficult route!

"It takes about three hours to climb up and a similar period to get back down, but you will be glad to hear there is a café at the top. After the climb, we will return back to the campsite for a much needed rest.

"Then on September 7th, it is off to beautiful North Devon where we will camp again, before returning to Brighton RSPCA on the next day for another barbeque, prize-giving and optional overnight camping.

This isn't a race but there will be prizes given for the most money raised and the best decorated car – you can be as inventive as you like and use any vehicle you want. It doesn't have to be sign written at all. Just let your imagination fly!

"The cost of this amazing weekend will be only £95 per person, and this includes all camping fees plus barbeques on the first and last evening. Each car will need to raise a minimum of £500 in sponsorship, all of which will go directly to assist the animals in our care. Motorcycles are also welcome – please ask us for prices.

"Why are we doing this? Well, obviously, it will be fun. But more importantly, we aim to improve the facilities at the RSPCA's Reptile Rescue unit including the hospital, and obtain new enclosures and equipment."

A bush viper.

Contact point

RSPCA Reptile Rescue, Braypool Lane, Patcham, Brighton BN1 8ZH.
(Note: Do not use postcode for sat nav purposes, but use the road name instead).
* Open: Monday to Saturday - 8am to 4pm.
* For details about the rally or general enquiries, please call Keith on 07815 525578.
Email: keith@rspcareptilerescue.co.uk
Web: www.rspcareptilerescue.co.uk

JOANNA'S CASEBOOK

Panther chameleons have become increasingly popular as pets over recent years, and they are now being bred more frequently, but their care can be more challenging than in the case of some other reptiles. Females are particularly vulnerable to reproductive diseases.

A common problem with panthers

In vivarium surroundings, female chameleons of this species may become reproductively active from as young as four months old, and lay much larger clutches than they would in the wild. This quickly depletes both their calcium and energy reserves, with Emerald sadly being a classic example of this problem.

Having been obtained at three months old, she had grown quickly and initially seemed bright and active. Her owners had set her up in her own vivarium and were careful to keep the temperature and humidity at an appropriate level. She had a UVB light for basking and ate a variety of insects, supplemented with vitamins and minerals.

By nine months old, however, her owners began to notice that Emerald's normally voracious appetite was declining, and she seemed to be spending more time on the floor of her enclosure. When she was brought in for a check-up, it became obvious that she was weak and unable to grip. She also appeared to have a relatively bloated appearance and round masses could be palpated within her coelomic cavity. Reproductive problems were suspected and so admitted for ıs ive treatment.

Chameleons are usually great patients to X-ray, because they will not move around

Emerald was intubated and a small Doppler probe was used to listen to her heart

Finding the cause

Initially, X-ray images were taken to establish if follicles or eggs were present, and to look for any other signs of disease. Chameleons are usually great patients to X-ray, because they will not move around, and true to form, Emerald sat perfectly still on a branch for this purpose, without requiring any sedation. Slightly more active chameleons may require a blindfold but then they too will generally stay immobile, especially if in a weakened condition.

Emerald's X-ray results showed that she did indeed have a good reason to be this state – not only could follicles be obviously seen, but her bone density appeared reduced as well. When a reptile is reproductively active, it is normal for its calcium and energy stores to be diverted into production of follicles and eggs.

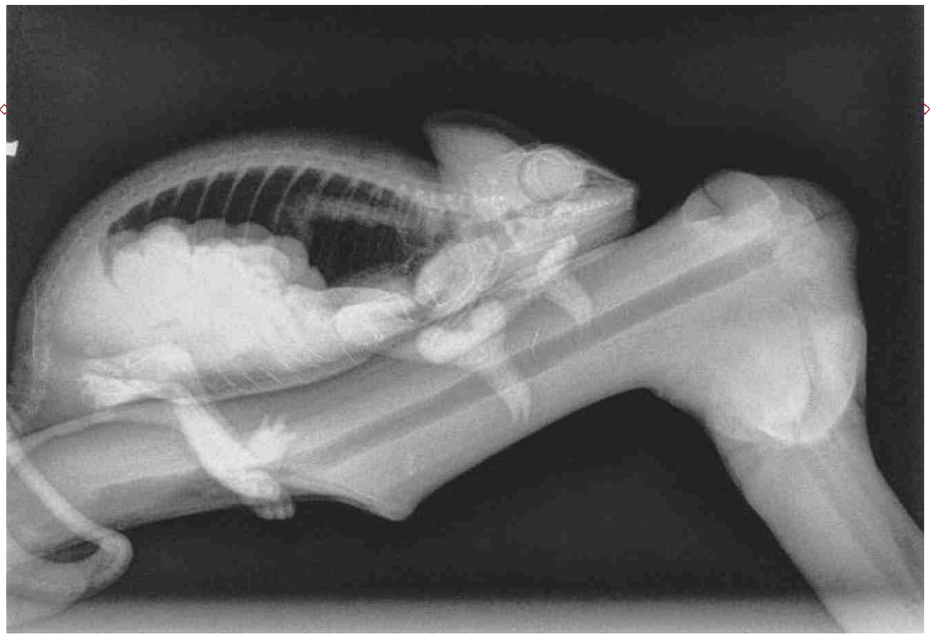
n reptiles with decent reserves of calcium, this does not necessarily cause problems. However, in young females with inadequate stores of this vital mineral, signs of metabolic bone disease (MBD) such as reduced

signs of reproductive problems.

Even so, the presence of follicles in X-ray images is not necessarily evidence that reproductive problems have arisen, unless follicles are present in particularly high numbers or there are other signs of disease. Issues only occur when the follicles fail to give rise to eggs – a condition known as follicular stasis.

There may be many different cues for normal follicular changes to take place in the wild, including shifts in temperature, light or food availability. Unfortunately, these can be difficult to replicate in vivarium surroundings and

All veterinary photographs courtesy of Joanna Hedley.



Emerald had multiple follicles seen on X-ray.

consequently, follicles can then accumulate within the reproductive system. This not only depletes a reptile of vital nutritional reserves but as they grow in numbers, so the follicles press on other internal organs, resulting in lethargy and anorexia.

Surgery is undertaken

Emerald's owners opted to have her spayed, as the best means of treating the problem. By removing the follicles and the ovaries too, so this would protect Emerald from further reproductive problems. Supportive care is important before surgery of this type, and so she was placed in a warm hospital vivarium and rehydrated with both oral and injectable fluids.

The following day, preparations were made for her operation. Spaying a chameleon is not technically a complicated procedure but it does involve working on very small structures and any blood loss can be significant. Specialised equipment such as magnification loupes for the surgeon help visualisation of the area, and tiny haemostatic clips are available to be used to seal blood vessels.

Anaesthesia was induced with an injection given into Emerald's tail vein, and then she was intubated with a small tube passed down her trachea. This maintained her airway, and provided a route to supply anaesthetic gas and oxygen to her lungs during the surgery. As reptiles will normally stop breathing during anaesthesia, so they need to be linked up to a small ventilator that ensures this is not a problem.

A tiny Doppler probe was then placed to allow us to listen to her heart throughout the procedure, and react quickly if any changes were heard. Once she was adequately anaesthetised, surgery could then begin. A small incision was made on Emerald's side between her ribs into her body cavity.

The follicles were easily visible but had to be handled carefully, so as to avoid any damage that could result in bleeding. Sterile cotton buds were used to lift these structures gently out of the body. Each ovary and all its associated follicles need to be completely removed when spaying a reptile. If even the smallest amount of ovarian tissue remains, this could start producing more follicles in future, and the whole operation may have to be repeated.

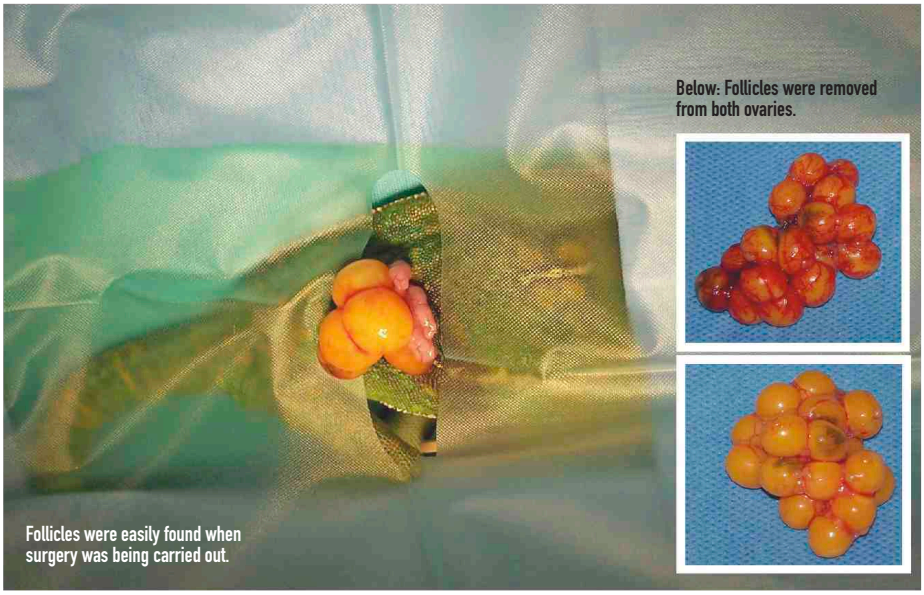
Recovery

In this case, Emerald's follicles were easily removed and no other problems were identified. Her body wall was therefore sutured closed and small absorbable sutures placed in the skin. In theory, these sutures will eventually degrade but as healing in reptiles is always very slow, they are usually removed about six weeks after surgery.

In terms of immediate post-operative care, it was important to keep Emerald warm, so as to allow her to metabolise the anaesthetic drugs. It was also vital to keep her hooked up to the ventilator so as to maintain her breathing until she was fully recovered. Pain relief and fluids were provided, and continued to be administered for several days after surgery, so as to help her through this period.

Sometimes, a feeding tube may need to be put in place if a reptile is not enthusiastic about eating after a period of illness. In this case though, Emerald was quickly back on her feet and keen to start hunting for food again. In view of her decreased bone density though, her level of calcium supplementation was increased and her UVB bulb was checked.

It turned out that this had been positioned above the vivarium mesh, which was therefore actually filtering out most of the UVB light. As a result, it was therefore not providing Emerald with much benefit. Repositioning the bulb and increasing the calcium level in her diet were sufficient to correct her metabolic bone disease (MBD), and she subsequently made a full recovery. ✣



Follicles were easily found when surgery was being carried out.

Below: Follicles were removed from both ovaries.

Another chameleon with even more severe problems than Emerald.

JO has had a varied clinical background since graduation. Her work has included developing a first opinion and referral service for exotic pets in clinical practice and involvement in a number of wildlife charities both in the UK and abroad. She completed a residency in Exotic Animal and Wildlife Medicine at the Royal (Dick) School of Veterinary Studies in 2011 and is currently working there as a Rabbit, Exotic Animal and Wildlife Clinician. Jo has recently obtained her RCVS Diploma in Zoological Medicine (Reptilian).

The mystery of the Samar stick insect

The Samar stick insect *(Brasidas samarensis)* is certainly an enigmatic member of the phasmid group, based on its appearance. Females are large, powerful, spiky bugs, whereas males appear so much smaller and more delicate that they would seem to belong to a different species, writes James Brereton.

All photos of the Samar stick insects courtesy of the author.

As with many stick insects, this species can be maintained quite easily on bramble.

A breeding pair. The male is much smaller than the female.

The so-called 'bird poop mark' is not a consistent feature of these stick insects.

Its native environment

There has been very little recorded about the habits of the Samar stick insect in the wild. However, the species is known to occur on a cluster of islands in the Philippines including, as its name may suggest, Samar Island. The colours of these stick insects are naturally variable, ranging from deep green to brown, and thus indicate that it occurs in darker, dense rainforest habitat.

Young insects spend a lot of time in branches and trees, whereas adult females, with their heavier build, may show a preference for terrestrial life. Females are often observed 'planting' their eggs deep into soil: this has implications for the type of substrate required for this species in vivarium surroundings.

Some individuals display a very distinctive patch on the abdomen – I've nicknamed it 'the bird poop mark' for obvious reasons. This marking may help to break up the insect's outline, enabling it to merge more effectively into surrounding twigs. It should be noted that not every Samar stick insect develops the patch though. Further investigations into this mark may discern whether it is environmental or genetic in origin.

The lack of information on wild Samar stick insects highlights the importance of observing captive individuals. In species that are poorly documented, as in this case, behaviours that have never been seen before may be recorded by anyone – even if you are just starting out with stick insects! This is what can make them so fascinating to keep. Breeding lesser-known species like the Samar may also help to safeguard their futures, as explained later in this article.

Practical husbandry

This species makes an interesting vivarium display specimen. A considerable amount of space is required for adult females, which may grow up to 11cm (4.3in). Adult females have large appetites – if you plan to keep a colony, it may be necessary to replace the food plants up to twice a week.

Room temperature – basically somewhere 17-23°C (63-73°F) – is suitable for rearing this species, although it should be noted that temperatures on Samar island can exceed 31°C (88°F) during summer. Higher temperatures often equate to a quicker growth rate and faster metabolism in insects, so a hotter vivarium may help to speed the development of nymphs.

Humidity ratings from anywhere between 40-80% seem appropriate, but if the humidity is kept high, then the vivarium must have a good source of ventilation. Otherwise, moulds are likely to develop quickly in a tank with elevated humidity levels and little ventilation.

There are several choices of food-plant for the Samar stick insect, including bramble *(Rubus fruticosa)*, guava *(Psidium spp.)* and salmon berry *(Rubus spectabilis)*. In the UK, the most available of these plants is the ever present bramble. Cut thick, sturdy stems of bramble that can support the full weight of your stick insects.

Contrary to popular belief, stick insects actually prefer the old, dark green leaves! Don't bother with new shoots if there is older foliage available. Just trim off any brown edges here first. In order to keep the brambles fresh, place the cut ends into a narrow necked jug of water. Plug the rim with silver foil, to stop any risk of young here.

As with all important to spra daily: Samar stick insects will not drink from a water dish! Instead, they suck up water droplets from leaves, stems and vivarium décor. The best time to spray the tank is during the evening, because these sticks seem to be most active at night.

Breeding

In contrast to a number of other stick insects, *B samarensis* does not seem to be parthenogenetic (with females possessing the ability to produce fertile offspring without mating with a male). Both sexes are required in order to produce the next generation. However, if both sexes are housed together, mating tends to happen fairly quickly. These stick insects have proved to be very easy to breed, which is why their numbers are increasing rapidly in collections now.

After mating is complete, the male will hitch a lift on the female's back. This is believed to be a guarding behaviour; the ➤

male can stop any rivals from mating with the female if he covers the area. Males can stay in this position for days, or even weeks unless accidentally disturbed by routine cleaning or changing of the food plant.

A few weeks after mating is first observed, the eggs (also known as ova) will begin to be laid. As mentioned earlier, the female prefers to bury these in the substrate: she uses her tail as a shovel to dig perhaps 5cm (2in) into the soil, so the substrate needs to be slightly deeper.

Vermiculite or sterile compost can be used, as both of these will allow her to express this behaviour. A pot of soil on an otherwise paper-based substrate may also be suitable, provided that it is easily accessible to her.

Paper towelling is undoubtedly the best overall substrate for stick insects, in terms of their weekly maintenance. However, female Samar sticks will attempt to dig their tails into this solid substance, with varying success. If paper of this type is used, be sure to check for any eggs that may have been deposited here, before it is thrown away. Sometimes, eggs can even be found buried within the paper itself!

Ova can be incubated either within the enclosure or separately, in which case, keep the eggs on slightly damp tissue paper in a well-ventilated pot. A light spray each week should help to ensure the ova remain moist – but as always, watch out for any signs of mould.

In comparison with other stick insects, the ova of the Samar are fairly tolerant of damp conditions though, which is a further indicator that these stick insects originate from a rainforest habitat. At a room temperature of between 18-20°C (64-68°F), the ova should hatch in 3.5-4 months.

▲ **Stick insects have very effective mouthparts when it comes to eating vegetation. A giant prickly stick insect is shown here.**

▼ **The giant prickly is a popular and adaptable species that feeds readily on bramble, being a long-standing favourite in the hobby.**

An Indian stick insect (top) seen in the company of a young Samar stick insect.

The bramble challenge

Creating a self-sustaining stick insect cage is a hard task, but it is possible. Food plants such as bramble can be grown indoors in a relatively sunny spot – or with suitable artificial lighting.

Try growing the bramble inside an enclosure. It may take some time before the bramble has grown enough for stick insects, but this type of enclosure is certainly very interesting to observe. You may well be able to do this in a greenhouse during the summer, taking care to ensure that the surroundings here are well-ventilated and do not become too hot for the stick insects.

Be careful not to overstock this type of cage in the early stages – an adult female Samar, for example, may strip a small bramble plant within a week. Once grown, a bramble plant should hold up against a few smaller individuals – and it removes the need to top up brambles frequently!

How to find this species

When I purchased my first Samar stick insects, they were advertised under the name of 'mossy stick insect'. No scientific name was given, so it took quite some time to find any information about the particular species that I had obtained. After a couple of weeks of internet searches, I was finally able to identify the stick insects, which had already grown considerably larger than I'd expected them to by that stage!

Local pet shops are an excellent source of some of the more common species: the Indian stick insect *(Carausius morosus)*, a highly popular species seems to be available in almost every store that stocks invertebrates. Lots of shops also stock some of the quirkier species, including the scarlet-winged Peruvian stick insect *(Peruphasma schultei)*, and the charismatic large species known as Macleay's spectre, as well as the giant prickly stick insect *(Extatosoma tiaratum)*.

When searching for some of the more unusual stick species, online auction sites can be surprisingly productive. In addition to the common species, some such as the massive *Pharnacia jiangfengliensis*, which can grow to 20cm (8in), occasionally appear.

A regular emailing service known as Sticktalk™ is a great place to track down breeders and look for advice. Users of this email can swap ova and nymphs with other enthusiasts across the country. The definitive place to source stick insects in the UK, however, is most definitely the Phasmid Study Group, widely known simply as the PSG.

The Phasmid Study Group

This organisation was founded in 1980, with the word 'phasmid' reflecting the family name of stick insects and leaf insects. It literally means ghost, and

Leaf insects are classed as phasmids, alongside stick insects.

> There is still much more to learn, as there is with the other 3,039 known species of phasmid. Even if you have only limited space and a small budget, you can still get involved easily in breeding and studying stick insects

➤ The scarlet-winged stick insect occurs in a very restricted area in the wild, but it now widely-represented in collections.

➤ The Lord Howe Island stick insects was believed to be extinct by 1930, and then rediscovered in 2001. The species can reproduce by parthenogenesis if necessary, and this aided its survival. Melbourne zoo alone has now bred over 9000 of these insects.
Photo courtesy Peter Halasz (Pengo)

describes the way in which they merge into the background, suddenly reappearing on occasions.

Many species of stick insect have been discovered by the PSG. As a result, some of these sticks have been named after members, such as Brock's stick *(Alienobostra brockii)*. This is named after Paul D. Brock, who has published extensively on this group of insects, and has been a leading light in the PSG for many years.

With so many species to discuss, the group decided to give each species of stick insect a number, partly because they may not all be formerly classified by science. For example, our Samar stick is known as PSG #235. This makes it easier to quickly research or discuss a species.

The group holds two meetings per year at London's Natural History Museum – a pretty exciting venue for any get-together! At the end of each meeting, a stock exchange happens. Surplus insects, ranging from the common to the incredibly rare are swapped between members. This is a great way to obtain insects that are not available in pet shops.

Protecting species

Across the globe, rainforests and mangrove swamps are being destroyed in favour of palm oil plantations and agricultural areas. For many stick insect species, forested areas are prime habitat. Some species occupy only very small areas – the scarlet-winged or black beauty stick insect *(Peruphasma scultei)*, for example, has only been found in an area of 5 hectares (12 acres) in Peru.

If this habitat is destroyed, a stick insect is very likely to die out rapidly. Having a thriving captive population of the rarer species is clearly a useful backup plan, for conservation purposes. One species that has already been saved by captive breeding is the Lord Howe Island stick insect *(Dryococelus australis)*, which used to be found on the island of this name off the west coast of Australia.

While it seems unlikely that our UK populations of phasmids will be needed for reintroduction schemes though, great care should be taken to learn about these insects when managing species such as the Samar stick insect. This information can be very valuable, giving new insights into their care and behaviour. Keeping and breeding phasmids also helps to keep the UK population alive – after all, most of them are not bred commercially, and could easily die out.

Conclusion

In brief, the Samar stick is a rather quirky species, about which we know surprisingly little. There is still much more to learn, as there is with the other 3,039 known species of phasmid. Even if you have only limited space and a small budget, you can still get involved easily in breeding and studying stick insects, and making a genuine contribution to our knowledge about these fascinating insects and their habits. ✣

Want to know more?

You can find full details about the Phasmid Study Group here at http://phasmid-study-group.org/

Also, Paul Brock's website, containing a wealth of information is at http://phasmida.speciesfile.org/HomePage/Phasmida/HomePage.aspx

Snakes with character

Bright yellow, deep red, neon green or even a mix 'n' match of browns and greens are all very typical of naturally occurring snakes. Black colouration, however, is not something that most people tend to associate with these reptiles, but it predominates in the case of this American species. Christian Castille discusses one of his favourite snakes from this part of the world.

➤ Ready to bite – black racers have a reputation for speed and aggression.

So what's as aggressive as an African rock python, as black as an indigo snake and as quick as a taipan? It has to be the black racer of course! These snakes are fantastic. I have been interested in them since I was a kid when I first saw them in magazines and books. I can still remember that when I turned 6, we had a number of them come in from North America.

My first encounter

All of them were adults, incredibly fast and very snappy! As soon as the bag was opened they all started to whip out of the bag faster than anything I had ever seen in my life. I went to grab one by the tail as it was heading towards the top of the pen that they were released into, but I never even managed to get a firm grasp on its tail.

The slightest touch of my first finger was enough to make it instantly turn around on itself and fling its mouth at my neck and bite me. It then went back into its S-shaped position in a blink of an eye. Black racers have extremely small teeth so it didn't hurt at all; in fact, the only way that I knew it happened was because my neck was bleeding. Now many may think this is enough to put you off a snake of this type for good, but for me, it only enhanced my already growing love for these awesome colubrids!

Different forms

While this article can be used as a template for all of the North American racer species from the *Coluber* genus, its main focus is upon *Coluber constrictor.* There are 11 subspecies recognised in the case of this species, which are all extremely varied in colouration. Some are so rare they are on the verge of extinction, as in the case of *C.c.foxii,* which has been listed as endangered since 1971 in Canada.

Like many reptiles, the species was first ➤

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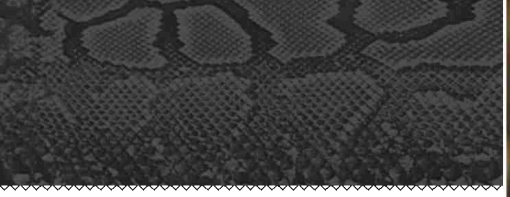

A northern black racer – recent research is suggesting there may actually be fewer valid subspecies than previous thought.

described by Carl Linnaeus, the famous taxonomist, back in 1758. Despite being reclassified many times over the years since then, it has now reverted back to its original name, like most of the species that he described. These snakes are found in over 30 states of USA, with their range extending north to Canada, and south to Mexico and other neighbouring areas of Central America.

Originally there were many more subspecies of *C.constrictor* recognised, but further studies saw some being given species status in their own right. Based on DNA research carried out in 2008, Burbrink found there may be even fewer subspecies than presently thought, and more individual species, although this research is still on-going.

Despite what their scientific name suggests, these snakes are not constrictors, but instead push their food down to the ground as they work their mouth over the prey. They swallow it alive, and can continue to breathe by using the vomeronasal organ in the roof of the mouth while they are feeding. This acts rather like a straw, allowing the snake to gain oxygen while its mouth is effectively airtight.

Black racers are very adaptable snakes. This one was found in a garden in Florida.

the
them
ed Hugo Flick.

natural history books, aside from the fact that he collected many of them for museum collections. It may be surprising that despite these snakes not being that well-known in the hobby, they have been studied in great detail.

In 1928, as an example, there was a study conducted on 552,491 black racers. Out of this total, some 377 were studied over a course of a year in captivity. The results of these investigations taught us many things, including how to care for these snakes more satisfactorily in vivarium surroundings so that they will thrive. Although this was not the actual purpose of the study, the findings from such a large-scale investigation have also helped people to breed, protect and conserve many hundreds of other species of snake successfully as a result.

Racers are well known to intergrade with each other at the borders of their individual ranges, which basically means that there can be naturally occurring hybrids of subspecies.

I have been lucky enough to catch many subspecies of these racers in the wild on two different occasions. While they are not rare, they certainly are not easy to catch. In fact, I spent nearly an hour just chasing one large male across a rocky-type desert landscape back in 2007.

➤ Black colouration helps snakes to blend in to the background in some areas, where there are trees for example.

A misleading suggestion

Sadly, and largely as the result of some very badly researched natural history programmes that have over-dramatised situations in order to engage the viewers' attention, these snakes have erroneously acquired a reputation for being venomous. This of course is not true at all, and they are essentially harmless if they bite, as mentioned previously. Aside from a few spots of blood, you certainly should not die if you do get bitten.

The cause for this mistaken belief is the presence of a Duvernoy's gland. It is important to remember that this is not the same as the venom gland. Duvernoy's gland is positioned posteriorly to the eye, encased in a thin cover of connective tissue, and consists mostly of serous cells that produce enzymes.

Reptile venom expert Dr Bryan Fry, who was responsible for discovering that Komodo dragons were venomous, has proposed that Duvernoy's gland is a primitive version of a venom gland and should be described as such. Much more research needs to be carried out to understand this structure. Some snakes, such as members of the hog-nosed *(Heterodon)* genus, possessing this type of gland are referred to as rear-fanged, posing a risk of envenomation through chewing, but there is no risk at all attaching to the black racer.

Adaptability

Something that may surprise you about these snakes is how they will adapt to

survive in different terrains, taking a remarkably varied range of prey. While they will typically feed on birds and rodents, they have also been known to hunt invertebrates, ranging from butterflies to earthworms, during periods when mammalian or avian sources of food are not available.

We often think of reptilians as heat lovers due to their ecothermic nature, requiring an external heat source to keep warm and maintain their level of activity, but the black racer can withstand temperatures as low as 10°C (50°F) because of its increased metabolic rate. However, the high metabolism of these snakes means they must feed much more regularly in order to retain their energy levels.

Their black colouration may also help, enabling them to absorb heat more rapidly from external sources. Even so, over-feeding them in vivarium surroundings generally results in an obese snake and a fatty liver that will

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death if unchecked.

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Not for everyone!

When it comes to the husbandry of black racers, they are different from many of the snakes that I write about – their appeal is likely to be more to a specialist rather than a general snake-keeper. It is true that these snakes are extremely cheap to buy, costing around £40 for a hatchling, and very easy to get feeding, and they will generally reproduce readily as well.

However, it needs to be said that they are extremely aggressive, and will constantly musk, so they have a very strong and unpleasant odour associated with them. They are also very nervous animals, which do not appreciate being located where there are people constantly coming and going in close proximity to them.

On this basis, they clearly do not make good display animals. They are very quick, making handling potentially difficult, stress easily and bite readily, ensuring that they will rarely tame down sufficiently to tolerate handling. So why am I writing an article about them when there are other, more placid species that I could profile?

▲ **Black racers are very alert snakes.**

Good experience

Well, quite frankly, I love these snakes and I think you could learn to love them as well. Corn snakes and ball (royal) pythons are great as pets that you can just sit down with and allow to slither through your fingers. However, I often find that as a reptile keeper evolves more skills, what they look for in a species changes to some extent. A "hands-off" snake does not mean that species of this type are not worth keeping; if it did, this would mean that we would not have any venomous snake keepers at all!

Black racers have very complex social structures and communicate with each other using head flicks and movements, while their speed and aggression make them a fantastic species on which to practice your hooking skills. Working in this way with non-venomous snakes will never get you up to the level that you must achieve before tackling front-fanged snakes with venom, but nevertheless, they will help you to improve your overall co-ordination.

Furthermore, they can teach you how to read a snake, and understand its movements. This in turn can ➤

▼ **This is the eastern yellow-bellied subspecies of the black racer, described as *Coluber constrictor flaviventris*.**

Black racers are very quick and agile snakes. A southern black racer *(C. c. priapus)* is seen here.

be invaluable when working with larger and more dangerous snakes such as cat snakes (*Boiga* species) and faster pythons species such as the Macklot's python *(Liasis mackloti)* and members of the *Morelia* complex.

Accommodation

For me, I find the best way to keep black racers is in vivariums, as they appreciate the space here compared with tubs. Nevertheless, I leave the coloured glass protection covers in place so they cannot see well outside the enclosure, and also recognise there is a barrier here. This is important, helping to prevent nose rub, which can lead on to the mouth infection known as stomatitis.

Black racers can grow to about 1.8m (6ft), but 1.4m (4.5ft) long is probably about average. I use 0.9x0.6x0.6m (3x2x2ft) vivariums as housing, because although they can grow to a good size, they are very thick-bodied snakes and in view of their nervous nature, smaller vivariums reduce stress by providing a better sense of security. I don't actually heat their quarters, but just keep them at room temperature, which I find works best.

If you do not have a heated reptile room though, you
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be constantly on the move, and getting very stressed. I believe this is possibly because they felt exposed, whereas normally, their own colouration which helps with camouflage.

➤ **Starting off with young, captive-bred black racers is to be recommended.**
Photo courtesy of the author.

By experimenting with a few different mediums for use as substrate, I eventually discovered that good old leaf litter works best for them. I now collect fallen leaves up in massive rubble sacks and store them in sheds throughout the year and use this as needed, starting with the older fallen leaves first. Alternatively of course, you can just purchase bags of leaf litter from garden centres or even via the internet.

I incorporate hides into the vivarium for these snakes as well, along with a few branches and a water bowl, and that is pretty much all that is required. Aside from feeding and spot checking for waste, the only time my black racers ever get handled is when their quarters are being cleaned out or cycling the males for breeding, plus when I am removing eggs of course.

Feeding needs

Feeding black racers is reasonably straightforward, and defrost mice are ideal for them. In the wild, lizards often feature prominently in their diet, and imported individuals may be difficult to feed at first because they are stressed. There can be another problem though – parasites.

If you have the choice between recent imports or long-term captive (LTC) stock,

Settling-in routine

Thanks to their relative lack of popularity, black racers are not produced very frequently in the trade, and so you may have to start off with imported stock. The routine that I would recommend to help your snakes settle in successfully is as follows:

1 If it is not looking in tip-top condition, then ensure the snake will be fully hydrated, by giving it a Powerade bath each day for the first two days. Then either arrange for a faecal or cloacal test to be carried out by your vet, to check for parasites.

2 Leave the snake completely alone afterwards, even to the state of only carry out water changes to prevent it running out or if the snake defaecates in the bowl. Remain alert though, so you can collect a faecal sample for parasitology if this was not possible beforehand.

3 After a stress-free period of six weeks, the snake should have settled in better by now. With species coming from Indonesia, it is usually recommended to get a blood test as well as a faecal test carried out, as they often suffer from subcutaneous parasites. Localising under the skin, these will not show up in a conventional faecal test, as they do not occur in the gut. However, these particular parasites are uncommon in the case of North American snakes.

There is a range of effective and safe treatments now available that can be used to treat faecal parasites in snakes, with drugs such as metronidazole, praziquantel and Ivermectin all being valuable in different situations. This is where the advice of a specialist reptile vet will prove essential.

But to come back to the loss of appetite in imported black racers and other species, it is often simply the parasitic load that stops them from feeding. If you do get blood tests carried out, then they will show the snake is likely to be suffering from non-regenerative anaemia (NRA) too. This is frequently the result of stress, and their feeding instinct is lost.

By keeping contact to a minimum during the initial settling-in period, this will significantly lower the stress on the snake, which will hopefully help to ensure that its appetite returns. In my experience, black racers are most likely to be afflicted by intestinal worms rather than other types of parasite, but they can suffer a heavy burden. I was advised to use Drontal® puppy wormer, administered orally at 0.02ml per 100g of body weight and repeated 10 days later. It worked very well in this case, but in no way am I stating this should be used generally – get advice regarding treatment from your vet.

my advice would be to go for the former, unless you are certain that the LTC snakes have been treated for parasites. Otherwise, all that will have happened is that their condition will have deteriorated further because they will not have eaten, That said, home-bred stock is best, as internal parasites should not be a problem in this case.

Internal parasites are very common in imported black racers, and they are the main reason as to why these snakes do not necessarily thrive in collections. All my original stock was treated and so it was possible to produce healthy captive-bred offspring that feed with no problems on defrost rodents.

Care and courtship

I feed my black racers on mice; adults may get the occasional rat weaner but they do have a habit of regurgitating anything too large. I give them two adult mice per adult every five days. Babies are started off on pinkies and then given larger sizes as they grow.

In terms of general husbandry, the best way to treat black racers is just like a corn snake. Captive bred specimens and those that have been correctly acclimatised will feed all year round, even throughout the breeding season.

In fact, I was routinely feeding my collection one day when I spotted a pair of racers were underneath the leaf litter, with just their heads visible. I offered each of them a mouse that they took readily, but then, as they moved forward and began wriggling to eat their food, I noticed they were mating too. This combination of behaviours is very rare in my experience.

When it comes to breeding, again there is nothing that I do to encourage these snakes. It is just a matter of literally adding t
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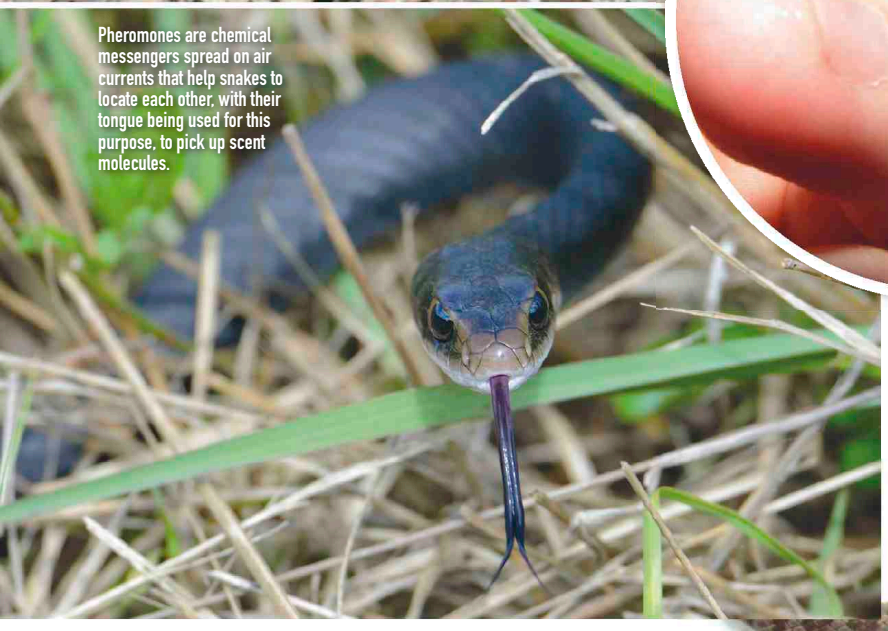
Young black racers can be fed on pinkies, although they may require lance fish at first.
Add Photo courtesy of the author.



Pheromones are chemical messengers spread on air currents that help snakes to locate each other, with their tongue being used for this purpose, to pick up scent molecules.

▲ Even at a young age, hatchling will display their innate aggressive tendencies.
Photo courtesy of the author.

subspecies can lack the egg tooth. As a result, they may require some assistance, which will mean that you have to help out by lancing the egg open (see my article in the March 2012 issue on how to do this safely).

Young black racers are a blotched grey and brown colour with some red shades on them. Over the course of the next 16 months or so, they will go through an ontogenetic change in colour and finally turn black. This process is rather similar to the way in which hatchling yellow and red green tree pythons ultimately turn green.

The likely reason for this in the case of the racers is because their main predators are hawks, and hatching out in this colour form makes it easier for the young to avoid predation. Hatchlings are just as aggressive as the adults, and they can also prove to be rather fussy about food at this stage. I find that chopped up
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In conclusion

So to summarise, these snakes will never be top of the snake keeping popularity chart, but they have a following, and deserve a larger one. They are beautiful jet black snakes that have a attitude to match. Their care requirements are generally very straightforward, to the point that they are well-worth keeping and breeding, and for me, a snake that tries to bite you every time that you change its water is a "must-have" species. The black racer does deserve the reputation that it has acquired, but that does not mean it deserves to be avoided! ✣

corn snakes, black racers will breed all year round.

However, I have found that males will not breed with the same female continuously. It appears that you need to introduce a new male to encourage the female to produce additional pheromones, which serve to attract the male for mating purposes. Similar responses have been recognised in other reptiles and even birds. This is believed to be a way of diversifying the gene pools of species in order to reduce inbreeding.

Breeding

Having a minimum of two males is vital if you wish to breed black racers consistently in my experience, and of course, at least one female. In the wild, anywhere from 5-20 eggs forms a typical clutch, but I've found 15 to be the average clutch size.

The eggs take between 37-55 days to hatch and the young hatchlings generally use their egg tooth to break through the shell. However, I have noticed that intergrades of the different

A young black racer bred by Christian. Note the relatively large eye.
Photo courtesy of the author.

Bearded dragon with a loose sand substrate in a vivarium. Note the reddish upper and lower lips, revealing that its mouth has been in contact with the substrate and indicating that it may have ingested some sand recently.

Dragons and sand

How safe is this substrate?

It's a big talking point in the reptile world – the choice of substrates for bearded dragons. Here are two opinions, starting with those of experienced keeper Richard White and followed by the views of Dave Perry, whose company distributes a wide range of bedding materials from different manufacturers.

Arguments within the lizard keeping community rage about the best choice of substrate for bearded dragons. Advocates claim sand is more naturalistic, while critics argue the risk of impaction and that their natural habitat is not the beach.

While it's true to say that bearded dragons will come across loose materials on the ground in their natural environment, it's a very common misconception that their habitat consists of deep and plentiful loose sand. Rather, they predominately live on clay soil or solid, dry rock, with only a light, superficial covering of dirt or sand in areas. Bearded dragons clearly do not therefore require a loose substrate in vivarium surroundings.

Other risks

Sand may receive the most amount of criticism, but it isn't the only substrate that can endanger the health of a bearded dragon. Wood chips have shown up in their faeces, and unlike sand, there is no chance for the body to digest these particles.

Evidence of them passing through a dragon's digestive system is indicative that this type of bedding should not be used, lest the animal ingests a larger piece and is unable to pass it. Walnut shells are also used as a substrate, and like wood chips, these also cannot be broken down, making impaction a risk once more, with this type of floor covering.

There are two main types of sand marketed for use with bearded dragons: children's play sand, and calcium sand. Of the two, play sand is the safer option as it is more easily digested and does not clump when it gets wet. Unfortunately, it is calci-sand that is sold in reptile shops. Particles do clump together when wet in this case, and thus make it a possibility that a bearded dragon kept on this substrate will suffer impaction as a result.

It's a known and observable fact that bearded dragons lick their surroundings. Like snakes, this is done to familiarise themselves with their environment – which, in a vivarium with loose substrate, further increases the likelihood of ingesting the sand. They also do it to increase their levels of nutrients from the rocks, and this is where calcium sand is a particular problem.

When owners dust a dragon's food, they can observe how much of the supplement the lizard is receiving, and how often, but this control is impossible if the dragon is consuming more by licking the sand. Given that captive bearded dragons have far less nutritional variety in their diet than wild ones, thanks to a massive reduction in the types of bugs and vegetation accessible to them, they run the risk of having a bigger shortfall in their dietary requirements. They will often try to counter this then by eating the sand.

Safety warnings

Calcium sand states on the bag that it is 100% digestible and safe. The problem is there is no requirement to clarify under what conditions this is actually the case, nor to highlight the possible complications or risks attaching to its use.

It's like saying that chocolate biscuits are digestible and safe for us to consume – well, they are, but we wouldn't do very well if we ate them exclusively! Presumably since there is no legal requirement to do so, the manufacturers don't mention that calcium carbonate has a Mallinckrodt Chemicals Material Safety Data Sheet for safe handling.

To give a brief explanation, a Material Safety Data Sheet (MSDS) becomes a requirement when a product has been demonstrated to cause injury or illness to people, so individuals are then aware of the consequences of improper handling of the


Aspen bedding


Bark chips


Coarse beech chips


Calci-sand


A bearded dragon seen in the wild.

product. Calcium carbonate has the following MSDS:

- **Inhalation:** excessive concentrations of a nuisance dust may cause conditions such as coughing, sneezing, and nasal irritation.
- **Ingestion:** non-toxic.
- **Skin contact:** not expected to be a health hazard from skin exposure.
- **Eye contact:** no information found, but presumed to cause mechanical irritation.
- **Chronic exposure:** excessive oral doses of calcium carbonate may produce alkalosis and hypercalcaemia.

Hypercalcaemia is a condition where there are elevated calcium levels in the blood, which can cause muscle weaknesses and nerve damage. Alkalosis is similar but often has nastier results – renal failure and metastatic calcification, which results when calcium is deposited outside the skeleton, in the major blood vessels for example.

Calcium carbonate is also available medicinally, to increase calcium levels when dietary intake is too low, or for use as an antacid. However, the National Library of Medicine states that it should not be taken for more than two weeks without a doctor's advice.

Long-term exposure

In other words, the product we place our small reptiles on for their entire lives has health warnings and poses risks to humans. The question has to be what is the real threat to bearded dragons kept on calcium sand?

The biggest danger may not be the risk of impaction, but the ability of calcium to neutralise stomach acids – which is what antacids for human consumption do. Once in a while, this is not a problem, but for a lizard that lives permanently on this type of substrate, will eat food off it and randomly licks the sand as it walks around, the effect could be very different.

Over a period of weeks, months and years, a bearded dragon is almost constantly ingesting an antacid, which means increased neutralisation of the acid in its stomach. This in turn will reduce the lizard's ability to break down its food, leading to impaction and a very compromised digestive system.

It is this risk of calci-sand that typically remains unknown. Worse owners are encourage the use of calci-sand because it is regarded as non-toxic. The risk posed by the sand is not just from consuming so much that it clumps in the gut and forms a blockage. There is a potentially more insidious threat here.

Ultimately, the antacid effect potentially harms the animal over a period of time and stops the digestive system functioning correctly, causing suffering and potentially death. If you are determined to using sand as substrate, baked play sand is the safest choice, but a solid substrate removes the risk entirely.

Another view

Dave Perry agrees that the best choice of substrate to use for a reptile is one of the most hotly discussed topics amongst keepers. Apart from suitability in terms of texture, humidity retention, insulation and so on, there is also the dreaded subject of impaction. He writes as follows:

Impaction is where a substrate is ingested and subsequently gets lodged in the animal's gut, causing a blockage. It can be caused by the animal eating a piece of substrate that is simply too large to pass through the gut normally, or by ingesting lots of small particles, in the guise of sand for example, which then stick together to create an obstruction.

In reality, there are no 100% "safe" substrates and they all have different characteristics. Things like wood and bark chips are less likely to be ingested as they have no mineral content, but if accidentally eaten, then their correspondingly large particle sizes may cause a blockage.


Hemp bedding

Changing behaviour

Mineral substrates are sometimes eaten selectively by lizards. This can be as a way of assisting digestion, or as an attempt to obtain essential nutrients such as calcium. Persistent, deliberate ingestion of a mineral-based substrate is likely to indicate an issue with the husbandry of the animal. Perhaps the diet is low in calcium, the ultraviolet (UV) levels are wrong or the environmental temperatures are incorrect? Keen observation and good management will protect lizards from potential harm.

While a solid substrate may reduce the risk of impaction, it also removes the ability of the animal to dig, which bearded dragons and many other species do, so it is clearly impacting adversely on their natural behaviour. It also reduces the buffering effect on temperature changes that a loose substrate has, which help to dampen large fluctuations inside a vivarium and lowers the availability of microclimates.

Weighing up the options

That is not to say that solid substrates, be they linoleum or newspaper, are bad, or that more traditional substrates are all ideal, but simply that they have different characteristics which are managed in different ways inside the vivarium.

In the end, a keeper must evaluate the plusses and minuses of the options available and make an informed decision, based in part on the natural behaviour of the species that they are keeping.

There is plenty of information on the internet but I think the best way to get informed advice is to go into your local specialist reptile store and speak to the staff there about their experiences, working with a wide variety of species, and ask for their recommendations.

A conversation with an experienced shop owner will be worth hours of internet trawling. If you value this source of information though, be prepared to support the shop – otherwise, you may soon find that it is no longer in business in today's highly competitive market. ✣

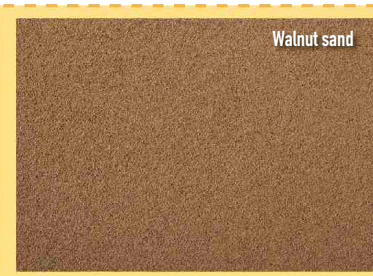
Your opinion

So what do you think? What are your experiences? Let us know! Email prk.ed@kelsey.co.uk and share your views.


Corn cob


Desert sand


Fine vermiculite


Walnut sand

The snake whisperer

The life of one of the most remarkable people ever involved with reptiles and their care is profiled here by Christian Castille.

Photos of Grace: courtesy of Wesley Dickinson, Daniel Mannix, George Rabb and Ray Pawley.

➤ **Grace holding a rattlesnake.**

Ask anyone about famous names in the hobby, and the chances are that the names of Mark O'Shea, Austin Stevens, Steve Irwin and Steve Backshaw are likely to be those that come to mind, when people recall well-known snake wranglers and herpetologists.

Few people will come up with any names from a previous era, and this just shows how easy it is to forget about some of the real pioneers of reptile keeping; the unsung heroes that may not have got the credit they deserved, even when they were alive. Unfortunately, with the digital age upon us, their stories are disappearing fast as the old books that tell their stories are no longer reprinted.

This is the story of one such person, by the name of Grace Olive Wiley, whose approach was far ahead of her time. She not only studied reptiles, but she also dared to understand them from an emotional point of view as well. This in the long run proved to be invaluable for our hobby by offering better ways of keeping reptiles in captivity, and providing key insights into how to breed them successfully that are still applicable today.

Born in 1883 in the US state of Kansas, she grew up on her parents' farm, and this is what inspired her passion for nature. She was soon catching insects and reptiles, and keeping them as pets. She eventually ended up studying entomology at Kansas University, where she ultimately got her first job.

In June 1922, she became the first-ever person to breed rattlesnakes in captivity. During the following year, she went on to become a librarian at the Minneapolis public library, where she also acted as a curator of reptiles, using her own private collection of venomous snakes for display purposes.

Heading to Illinois

On the 29th January 1927, she wrote a letter to John McCutcheon, who at the time was president of the Brookfield zoo, applying for the job of reptile curator. She was unsuccessful, which was of no great surprise because there had only been a handful of female curators at zoos right across America.

Six years later, she wrote again, this time to Edward Bean, the zoo's director, applying for the role. This time though, she offered many of her own hand-made reptile enclosures, not to mention her entire personal collection, which consisted of 115 species, comprising 330 specimens in total. On this occasion, her application was successful, but she only remained in the role for two years. Her reputation for free handling venomous species was highly controversial, and attracted unwelcome criticism for the zoo.

Puff adder – one of the venomous species free handled by Grace.

As a way of defending herself, she wrote an article in the *Natural History* magazine soon afterwards, on how it was possible to tame cobras and rattlesnakes. While this generated a hate campaign towards her, it also elevated her profile and raised the awareness of reptiles in the public's mind, in a way that zoos had never been capable of doing previously.

Her boss fired her for two reasons at the time. Firstly, and rather ironically, because she placed her own safety below the welfare of the snakes, but also because the liability insurance that the zoo had to pay to cover her free handling activities was actually more than her own salary! Grace complained about this to *Time* magazine, stating how she felt the reason that so many criticised her was because they were scared of the snakes and failed to comprehend them properly.

Growing media interest

During her time working with venomous reptiles, she had managed to free handle and calm snakes including 4.87m (16ft) king cobras, Egyptian cobras, 13 species of rattlesnakes, puff adders, Australian black snakes, tiger snakes, taipans, green mambas, sea snakes, coral snakes, fer-de-lances, moccasins, copperheads, rhino vipers and gaboon vipers! This is a truly remarkable list.

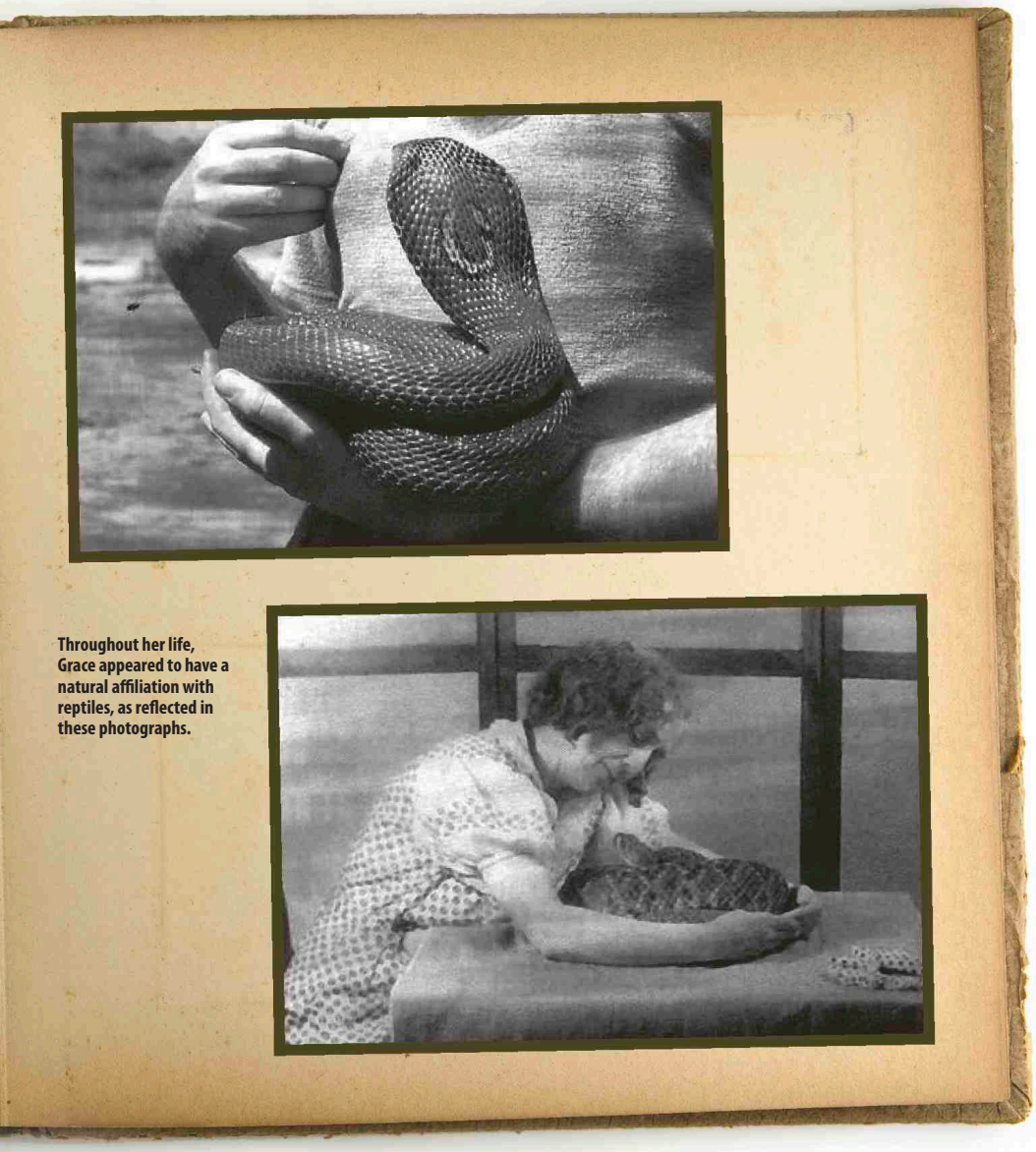
She was also the first person ever to keep aquatic snakes successfully in captivity and even managed to breed them, along with more than 70 other species of reptile. She figured out the relationship between humidity and temperature for incubation. She also developed many of the husbandry methods that we use today, including sloughing

The media attention that she generated through her love for reptiles, and her articles about them and their care was sufficient of an advertisement to enable her to open up her own small roadside zoo in Cypress, California. She allowed members of the public to handle venomous snakes for a small fee. Shocking as this appears to us today, it has to be said that there were no incidents and no one was ever bitten.

Winning people over

One of her biggest achievements was to win the hearts of hundreds of thousands of people who originally hated reptiles. Her roadside zoo drew over three million visitors, many of whom came to see her. Unlike other zoos of that era, she was actually changing the way that people saw these animals. She treated her reptiles with respect and love and it appeared to work, as she only ever received one bite up until the time of her death, and even that was seemingly accidental. She was bitten when she was trying to break up a fight between two male rattlesnakes that were battling with each other over a female.

Grace was regularly hired by Hollywood film producers, both as a snake trainer and as a consultant on films where snakes were required. She did this for a number of years and her snakes can be seen in over 90 films including *Moon over Burma, The Jungle Book* and *Tarzan*. Her zoo was only small, and she charged just 25 cents for people to see the venomous and non-venomous reptiles in her collection. These included corn snakes, leopard geckos, blue tongue skinks, ball (royal) pythons, king snakes, boa constrictors and even reticulated pythons.



Throughout her life, Grace appeared to have a natural affiliation with reptiles, as reflected in these photographs.

A blue tongue skink – one of the species in Grace's collection.

She was breeding reptiles that today are mainstream in the hobby, yet some 80 years ago were almost unknown to people. One of her most significant observations was that by powdering up calcium from rocks that she bought, she was able to stop her lizards from developing rubbery, deformed bones. This marked the first step in unravelling what we now know today as metabolic bone disease (MBD).

Nevertheless, Grace was not a great believer in looking at preserved jars of snakes and other reptiles in museum collections. She did not feel that this gave much of an understanding about them or their needs. Not that she only kept reptiles. She had birds of prey too, and bred various bats and other exotic

An Indian cobra.

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name of *Rheumatobates hungerfordi*.

A fateful encounter

On July 20th 1948, she invited journalist Daniel Pratt Mannix IV to photograph her reptiles. He, like her, was something of a maverick. As well as being a well-known writer and fellow keeper of reptiles, he was also a sideshow performer, stage magician, animal trainer and filmmaker. His most famous book, entitled *The Fox and the Hound* was later to be turned into a film by Walt Disney Productions.

On this occasion though, things did not go to plan. While being photographed with an Indian cobra, the flash from Daniel's camera disturbed the snake, causing it to lunge towards him. Grace tried to restrain it, and ended up being bitten on her finger.

While waiting for the ambulance to take her to hospital, she grabbed her only vial of antivenom that had been created at the Haffkine Institute in India. Tragically though, during the ambulance ride to hospital, the vial ended up being cracked in her pocket without her knowledge.

There was nothing that could be done. Just an hour and a half after arriving at hospital she died, in a tremendous amount of pain. Yet even here on her deathbed, she asked her family and friends to take care of her reptile collection, and not to blame the cobra for what had happened to her.

Sadly, as much as they tried to continue her work, looking after the snakes and also educating the public,

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Throughout her life, Grace was very keen to pass on her love for reptiles.

The Indian cobra that had fatally bitten Grace eventually went to a friend of hers, and was then used in snake talks in Arizona, at yet another roadside zoo. It remained aggressive for the rest of its life and even managed to kill another person as well. It had a very distinctive marking in the shape of a G on its back. The belief grew that this was Grace's initial, and fate had decreed that it would be this snake that killed her.

Her legacy

Looking back at Grace's life today raises two conflicting schools of thought. Firstly, and perhaps most obviously, it is foolish to even attempt to free handle any venomous snake. I would certainly not do this myself, nor recommend that anyone should do so, however much experience you have. Even working with venomous snakes using hooks can turn out to be fatal if you lack the necessary experience or lose concentration.

However, it has to be said that Grace worked with over 1000 venomous snakes, including some of the most deadly on the planet, at a time when medical facilities for treatment of snake bites were rudimentary at best, and with equipment that we would never dream of using today. She only ever received two bites and both were accidental rather than resulting from her handling technique.

I don't condone what she did, but I greatly admire her supreme dedication and commitment to doing what she loved. She spent her whole life studying and watching these snakes so carefully that she knew how to manipulate them into a state of calm that allowed her not only to handle them safely, but a wide range of members of the public too.

Her pioneering interest in breeding reptiles is something to admire as well. In fact, it was her efforts, gained through breeding many non-venomous reptiles over a century ago, that have ultimately resulted in reptile-keeping becoming the fastest growing sector of the pet trade today, as people have utilised and developed the knowledge that she first acquired.

Her passion for these animals was outstanding. Whether you believe that she was expert in what she did with venomous snakes, or simply foolish, you cannot deny that it is thanks in part to her that we now all enjoy the company of a group of animals that she was so passionate about. ✣

QUESTIONS & ANSWERS

DO YOU NEED A HELPING HAND OR ADVICE?

Email your queries to prk.ed@kelsey.co.uk or write to the address on page 66. A selection of submitted questions will appear here every month, and a prize of Vetark products will be awarded to the writer of the Star Question. Regrettably, replies can only be given through this column, and if you are worried about the health of your animal, seek veterinary advice without delay.

Bearded dragons will climb and bask under a light in a vivarium.

Safe lighting for a bearded dragon

Q&A

I have a D3+T5 system for my bearded dragon and I wondered if fitting the lamp and reflector 20cm (8in) from the dragon's back is at all dangerous? Also, are there any other things that I should be concerned about?

Vivarium lighting today is now refined down to a definite science, rather than having to be based on hunches or guesswork. In recent years, we have been able to start to learn from nature and to utilise this knowledge, by applying it to the development of lighting technology to suit vivarium surroundings.

Reptiles, especially those from the desert regions such as bearded dragons, are able to deal with very high levels of UVB radiation in a very effective way. However, we should never seek to provide more energy from a light to the animal than the level that it would experience every day in the wild.

It is vital that vivarium lighting systems are suitably powerful, but the light must be provided in a measured and usable way. By following some simple basic rules, the good news is that it will be very hard to overprovide for your bearded dragon.

Firstly, quality lamps such as those we produce at Arcadia reptile are very stable indeed now. This will mean that these systems emit the same amount of energy every day for a very long period of time, without any increase or decrease in output.

A lifespan of 12 months is usual for such lamps when using a typical photoperiod of 10-12 hours running hours per day. This means that once your lighting system is set up, you will not have to worry that the power gradients are changing and falling in output to a dangerously low level. Your bearded dragon is therefore protected for the entire year.

We can use the output of a lamp and a reflector to match the usual or average exposure levels of a particular species in the wild, forming part of the so-called 'light and shade' method. So for a bearded dragon, you could quite safely provide an UV (ultraviolet) index of around 7-8 at the very centre of the highest basking platform in the vivarium. This is of course the centre of your hot zone, where the distance between the lamp and the dragon's back is shortest.

Some keepers provide indexes of between 9-11 though, which I feel could be too high over a long period of time and in a confined space. Being able to self-regulate between heat and light, cool and shade is vital to the health and wellbeing of all reptiles.

Possible dangers

Exposure to a UV index that is significantly higher in a vivarium than can be found in nature is not to be recommended in my view. The reptile would not have had an opportunity to develop a use for this index of exposure, or a level of in-built protection against it. This could therefore prove to be dangerous over a period of time.

You should also to be aware of the risks from non-terrestrial wavelengths of light. While UVA and UVB wavelengths are beneficial, UVC is deadly! It is not found in sunlight as the earth's atmosphere filters it out, but these damaging wavelengths can be projected from an artificial light source.

I can only speak for Arcadia Reptile, but all of our lamps incorporate 100% UVC protection. This particular wavelength will cause skin and eye burns and can lead to skin cancers and has other adverse effects. It is commonly used in hospitals and in pond filtration systems to destroy bacteria or algae, being described as germicidal or sterilising light. Neither your reptile nor you should be directly exposed to this type of UV light.

As in the case of other lizards, suitable lighting naturally enhances the colouration of a bearded dragon.

The vivarium environment

The 'light and shade method' simply describes the practice of providing heat and light over a measured and defined section of an enclosure. This then allows the bearded dragon to use its ability to see UV light (which we are unable to do), and adjust its position accordingly within its enclosure, according to its requirements.

Lighting and heating should tie in together. So place the heat source and light at one end therefore, which will then allow a fall-off to cooler, shadier conditions at the other end.

Hides can also be used and will serve to mimic wild patterns of behaviour, which typically involve basking and then hiding away during the heat of the day. Reptiles are commonly found in burrows and under rocks at this stage of the day. This protects them from over-exposure and predation, and in most cases it allows them to find some level of humidity as well.

With older, less powerful lighting technology, the general advice was against the use of hides as the UV systems were underpowered. This meant that we had to encourage an animal to spend longer periods under weaker forms of light, in order to meet its UV needs. With T5 now being so powerful though, this means that we can now mirror the conditions that a reptile would experience in the wild.

Positioning the lamp

A well-recognised risk associated with a lighting system where the lamps are poorly fitted is of course eye inflammation and/or infection. All lamps MUST always be fitted to the roof of an enclosure and never hung half way down the back wall.

Light from any source (and not just UV lamps) hitting the eye of an animal from the side can cause inflammation. If left untreated, this can in turn lead on to infection. So all lamps should be fitted well above the top of the vivarium occupants, with suitable reflectors being used.

I would advise fitting lamps in the corner between the roof and the front plate above the door. This ensures that the light is above the lizard and is also out of an onlooker's direct eye line. Lamps do look ugly, particularly when they loom above attractive naturalistic décor.

You can then use your chosen decoration to generate a useable 'solar gradient' within the enclosure. So with the aid of a suitable reflector, a High Output T5 D3+ 12% lamp will be producing suitable levels of exposure at around 30-38cm (12-15in), as measured from the lamp to the lizard's back at the highest point. I would advise that 20cm (8in) is too close.

Your basking platform could be almost pyramidal in design or a graduated slope with the thin edge entering the cool zone and the highest point under the hot zone, creating an upper index basking zone. This will then allow the lizard to adjust its position in accordance with its needs.

Don't forget that hydration and measured supplementation, especially with calcium, are all vital in terms of the vitamin D3 cycle as well. This is in addition to the correct lighting. The way that we keep reptiles has changed, and brought measurable benefits. It will undoubtedly continue to so in the future, as our systems become increasingly sophisticated.

John Courteney-Smith, Arcadia Reptile.

Wild bearded dragon sunning itself in Australia.

AMPHIBIAN FOCUS

Alpine newt (*Ichthyosaura alpestris*)

Few caudates ('tailed amphibians') are more striking than male Alpine newts in their spawning colouration, as shown here. Rich, dark shades of blue are conspicuous at this stage, offset against their bright orange underparts. They average about 9cm (3.5in) overall, whereas their mottled brown mates are larger, growing up to 12cm (4.7in) long.

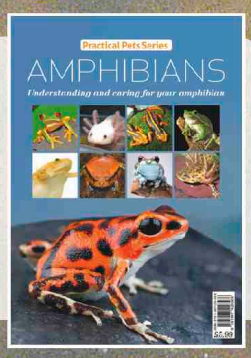
As their name suggests, Alpine newts originate largely from upland areas in central and southern parts of Europe, with an isolated population occurring in the northern Iberian peninsula. There are currently 10 different subspecies recognised through their wide range, which extends from France to Denmark and Italy, and eastwards to Ukraine.

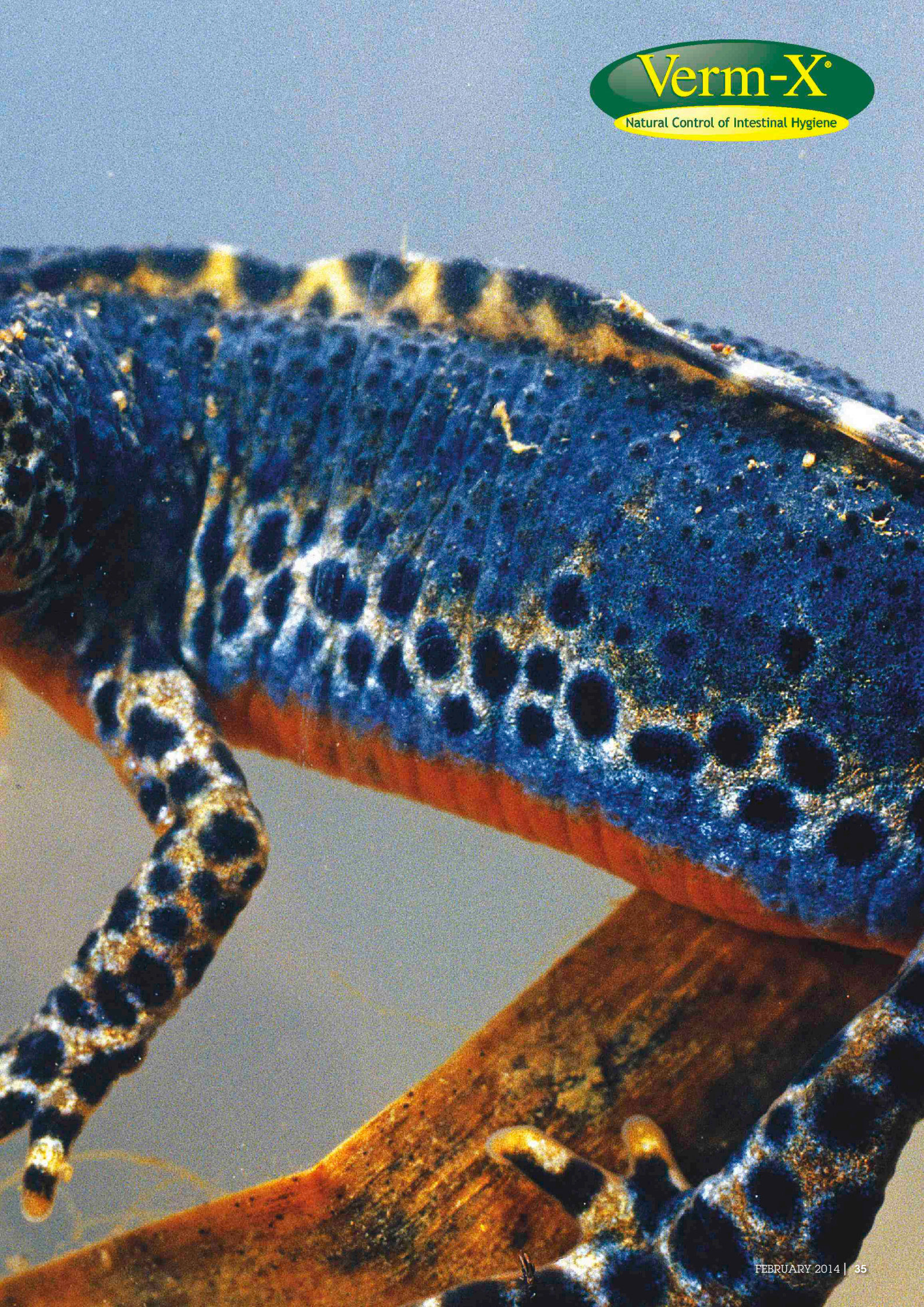
Alpine newts favour forested areas, spawning in ponds in spring and then often spending more time on land through the rest of the year, when males lose this bright colouration, becoming brownish. In a few localities, populations have become neotenous, with tadpoles themselves being able to breed successfully.

These newts remain generally common across their wide range, although they are scarce in waters where there are predatory fish. They are long-lived, with a life expectancy of seven years in the wild, and can live for 20 years or so in aqua-terrariums, where they can usually be bred without too much difficulty.

Further information

Want to know more about this group of creatures and their care? Then order a copy of our special guide to amphibians today. See page 3 for further details.





Skin care issues in reptiles

Paul Donovan looks at the issues surrounding skin growth in reptiles, and how this impacts on their care needs.

➤ **The tail of a rattlesnake in close-up, with a new segment being added here after each shed.** Photo by the author.

If I was to ask you to name one common feature that reptiles share with humans, you may have something of a perplexed expression on your face, thinking of an answer. But one thing that we do have in common is that we both periodically shed and replace the outer layer of our skin. Yet of course, this is where all similarities end, for while we humans are shedding our skin continuously as microscopic flakes, reptiles shed theirs as a single piece or in pieces.

The process of skin shedding in snakes is called 'sloughing' or 'ecdysis', and the discarded piece of skin is called the exuvia. What you see discarded is just the outer layer of skin as the underlying dermis consists of connective tissue, blood vessels, nerves and pigment cells is not lost in the sloughing process.

Sloughing has a number of benefits to the reptile. Firstly, old skin is replaced for new, so wear and tear on the vulnerable outer part of the body is minimised. This process can also help to control external parasites such as mites and ticks, as these are likely to be shed with the old skin.

➤ **Only once these young corn snakes have shed for the first time will they then feed.**

A new born snake will usually undergo its first slough within about 7-14 days following birth, although with some individuals, it can occur within a couple of days. This marks a critical period in the snake's life, because until the yolk sac has been fully absorbed and the first slough has taken place, then the young snake will not feed.

The frequency of sloughing is closely aligned with an individual's growth rate. So, whereas an adult snake may slough two or three times a year once it has reached maturity, a juvenile or sub-adult will slough more frequently; in some cases, as often as perhaps once every six weeks or so.

A common misconception

Although it is true to say that sloughing is aligned to growth rate, it is erroneous to think that when the snake sheds, it actually comes out as a larger individual, as happens with invertebrates. These groups have two totally different types of growth pattern. With invertebrates, there are a set number of sheds from the stage that the nymph hatches through until it reaches adulthood. Once in the adult phase, growth ceases, and hence so does shedding.

As a snake will grow continuously though until the day it dies, albeit at a slower unnoticeable rate once it reaches sexual maturity, the shedding process will

Snakes are more vibrantly coloured after a shed. Photo by the author.

The cloudy appearance of this false water cobra's eye indicates that it is about to shed. Photo by the author.

continue throughout its life. Shedding may also be a prelude to mating or giving birth.

Rattling along

Following on from this, many people believe that the rattle of a rattlesnake can be used to determine its age. This is not so. Each time the snake sheds, it produces a new segment to the rattle. This means that this is an indication of the number of times that the individual has shed, rather than its age – and even this may not be accurate!

There does, however, come a point where the rattle becomes so heavy that segments of it will naturally break off, and even as the individual moves along the ground, the rattle can snag on things and discard segments. This means therefore, that it can only be used as a guide rather than an absolutely reliable indicator of the number of sheds that the individual snake has undergone.

Recognising when a shed is due

The first sign that may alert you to an impending shed is evidence of cloudiness in your snake's eyes. But if you have been a little bit more observant, then you may also have noticed the skin takes on a much duller tone too. The snake is then likely to hide away, and appears more nervous at this stage, as well as losing its appetite.

The cloudiness in the eyes temporarily blinds the reptile, which is why it is more inclined to lash out. Throughout the shedding period, you should refrain from handling the snake, not only to reduce the chances of being bitten, but also to prevent damage to the skin that could lead to difficulties with the shedding process.

The dull opaqueness is caused because of the epidermal secretions that form between the old layer of skin and the new base layer. This not only helps to separate the two layers, but also acts as a lubricant in due course when the time comes for the skin to be discarded. This opaqueness will remain until a few days – typically 3-4 – prior to the slough, when the snake will then adopt a 'normal' appearance again.

▲ The spectacles were clearly shed cleanly in this case.
Photo by the author.

Checking the outcome

The snake usually begins the slough by rubbing its nose against a stone or branch. This serves to split the skin and literally allows the reptile to proceed to crawl out of it, turning the skin inside out in the process; it is a bit like removing a sock! Everything is shed, even the scale covering each of the eyes, which is called the brille or spectacle.

It is important that once a shed has taken place, the old skin is examined to ensure this eye scale has been shed, because if not, it will impede the snake's vision. There is the risk of new scale becoming dry and causing eye problems that may predispose to a bacterial infection.

Retained spectacles can be removed quite easily, but this should only be attempted if you know what you are doing, because otherwise, you could easily damage the eyes. Seek the advice of a vet who is experienced with exotics therefore, should you need assistance.

Although the old skin still shows signs of the snake's patterning, where present, it will be void of any skin pigmentation. As the scales are extensions of the epidermis, they are not shed separately, but as part of the outer layer of skin during each slough cycle. The snake as it emerges from its old skin will be much more brightly coloured.This is partly due to the oil secreted between the old and new skin, but it will become duller in colour again over the following day or two, having completed its shed.

▼ A snake will seek out a rough surface to begin the shedding process, starting at its head.
Photo by the author.

Snake tracking

The presence of a sloughed skin often reveals not only to a snake hunter that there is a snake in the area, but also in which direction it is travelling. The direction can be determined by looking at the tail end. As the skin is shed inside out, the tail will be the last part out. Hence, it will be pointing in the direction that the snake is moving.

Although I have talked about shedding occurring in one piece, it would be wrong to think that this also applies to the 'giant' snakes. During the thirty years that I have been working with snakes, I have never ➤

seen an intact skin from a large boa or python. Instead, the skin tends to come off in small pieces or flakes that adhere to the surface as the snake moves over it. The effect is like paper stuck down with glue. The same also applies in the case of large lizards such as iguanas and monitors. It is of course only snakes that have spectacles though – a lizard's eyes do not form part of a complete covering of skin over the surface of its body.

➤ Large lizards such as this red iguana will not shed their skin in one piece.

Humidity

The correct humidity level is important for the well-being of all reptiles, and not just snakes. Obviously this will vary from individual to individual, but it is usually somewhere in the region of 50-70%. Incomplete sheds can usually be attributed to incorrect humidity – almost always as a result of the snake's quarters being too dry.

It really is vital to ensure that you keep snakes at the correct humidity for their health. If you are in doubt, you will have a good indication of the snake's distribution, and then it will simply be a question of carrying out an internet search to find out what the humidity is likely to be in its natural habitat.

Trouble-shooting

That being said, sometimes an individual may have difficulty in shedding and requires assistance. This situation is most likely to arise when you have recently acquired a snake, and it may have been housed previously under less than ideal conditions. Hopefully, in the future, it will be able to shed without difficulty.

A green mamba that was kept too dry, and this served to make shedding difficult on this occasion. Note the small flecks of old skin. Photo by the author.

The solution on this occasion may be as simple as spraying the reptile with lukewarm water; soaking it in a suitable container of lukewarm water; placing the snake in a wet pillow case or duvet cover for several hours or, for larger individuals, wrapping a wet towel around the snake and let it crawl through this damp environment.

If you are assisting a shed, always work from head to tail in this case. It is possible to buy commercial shedding aids, but as by volume, these are mostly water anyway, I think that you are better off using what comes out of your tap!

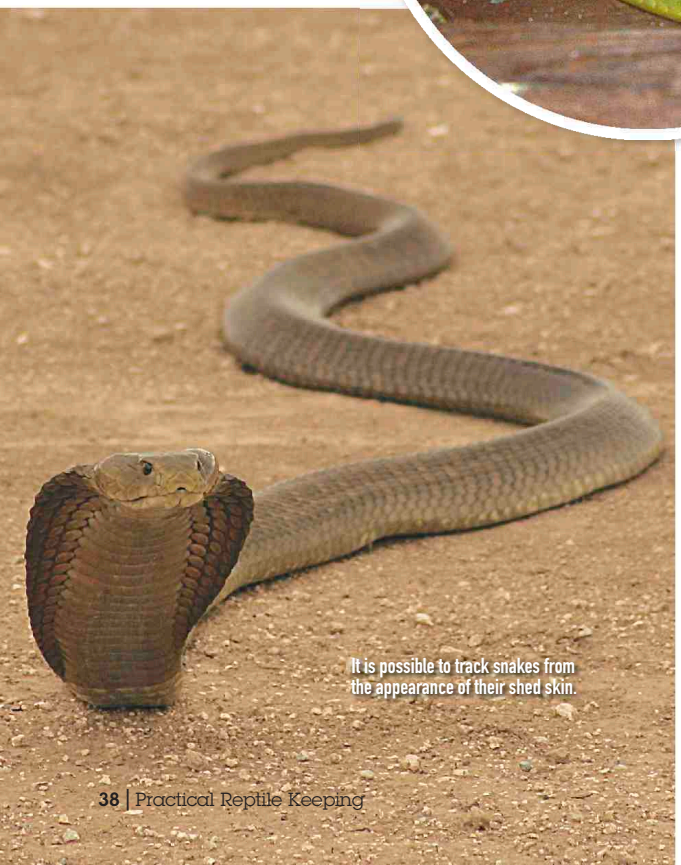
A further problem related to incorrect humidity and shedding is an individual's loss of appetite and eventual malnourishment. Hypoproteinaemic (protein-deficient) individuals lack the ability to manufacture all the necessary enzymes required to bring about the complete breakdown of the epidermal layers between the old skin and the new skin.

Additionally, too dry an environment for a snake requiring a high humidity level will actually retard shedding. This is because there is insufficient fluid available to form the lubricating fluid which brings about eventual separation of the old and new skin layers.

Dysecdysis

Pronounced *dis-ek-dih-sis,* this is the term given to an incomplete shed where parts of, or all of, the skin remain attached to the individual's body. It is not a primary problem in its own right, but a symptom of another problem; usually low humidity, dehydration, inadequate temperature, malnutrition, mites, bacterial infections of the skin, dermatitis/old injuries or stress caused through over-handling.

Be aware that during the shedding cycle, you may hear the snake making wheezing noises reminiscent of it having a cold. It is important to monitor this, as it can often be caused by pieces of skin flapping around the nostrils. If the wheezing disappears after the shed, then it was simply loose skin. Should this sound persist though, then seek veterinary advice as the individual may have developed a respiratory infection.



It is possible to track snakes from the appearance of their shed skin.

In the case of smaller lizards, old fragments of skin are most likely to be left attached around the digits, and this can cause serious problems, restricting the blood supply here and leading to loss of toes unless rapid action is taken. Spraying the affected area is a good way to soften the skin.

The situation with chelonians

It is important that where dysecdysis occurs, measures be taken to rectify the underlying cause.

Some species of tortoise and other terrestrial chelonians may take advantage of more humid microclimates in the wild, burrowing under plants and digging into the earth around their roots where moisture may be retained long after it has dried up on the surface of the ground.

These species may benefit from the occasional wallow, soak or spray when they appear to be having problems shedding. Do not allow them to remain constantly submerged though, as this can itself trigger an infection. Some individuals may retain skin around the neck region, and it is again a good idea to soak the tortoise, as this skin can potentially harden in place and lead to the underlying skin cracking.

I used to look after two giant Aldabra tortoises that, during the summer months, would experience neck problems because of their dried skin, so we used to rub linseed oil on to this part of the body in order to soften the skin, before picking it off. In the wild, this would be a task undertaken by small birds.

It is well known that snakes and lizards shed their skin, but the process also takes place in aquatic chelonians. The skin hangs from the body like wispy pieces of tissue paper before it comes off. It is not just the skin around the head and legs which is shed, but also the skin covering the scutes; basically the shell itself. Sliders need to be able to bask for this purpose. Never be tempted to pull off the raised scutes. These will come off naturally in due course.

A cautionary note

During the shedding phase and for a day or two afterwards, you should refrain from using any proprietary mite medications in the snake's quarters as the skin has been shown to be more permeable than usual during this period. Being much more sensitive to the chemicals in this medication could then prove to be detrimental to their health.

It is also important that once the old skin has been shed, it is inspected to ensure that not only have the eye caps been shed, but also the tip of the tail has come off too. If a piece is left on the tail, then it can act like a constrictive bandage, resulting in tissue death or necrosis of that portion of the tail. This will ultimately shrivel up and fall off.

If the skin is not fully shed, soaking this area in water and then gently peeling it off should rectify the problem. Of course, before you pick up the old skin, you need to ensure that the snake has not defaecated in it, which often happens during the shed.

In any event, do not forget to wash your hands thoroughly, not just when handling a snake or lizard directly, but after dealing with the skin in any way. This will ensure that you will not be at any potential risk of suffering from a *Salmonella* infection if the skin has been contaminated. ✣

Lasting impacts on life

Early experiences of young reptiles

Science is revealing some truly amazing findings about young reptiles, and how the period in the egg can impact on the rest of their lives. Dr Julia Mueller-Paul explains more.

➤ Although crocodilians today are closely associated with water, there used to be terrestrial forms that existed in the past. Laying their eggs on land enabled these and other reptiles to spread much more widely as a group.

Reptiles are such a large and immensely varied group of animals that the process of their development also varies in many ways. Yet some aspects of their early development are common across the group. In an evolutionary sense, reptiles represent the first group of vertebrates that were able to lay eggs independently of an aquatic environment, whereas previous classes such as fish and amphibians are closely tied to water, especially for reproductive purposes.

Freed from water

Reptile eggs are different in the way they are structured. They contain a membrane called amnios that allows the developing foetus to survive outside the water. This was a major biological advance, and allowed reptiles to be able to spread much further across the globe as they were not required to return to water for reproduction.

Another feature that distinguishes reptiles from their predecessors is the lack of a larval stage in their life cycle. Reptile hatchlings emerge as miniature versions of their future form with no need to undergo the substantial changes that occur during the development of amphibians.

Many amphibians have to learn first about life in the water and then about life on land, and even those that remain in the water often exhibit entirely different behaviours as larvae than they do as mature animals. Reptiles have the advantage of being able to acquire valuable learning and experiences from the moment of hatching.

State of development

It is also noteworthy that reptiles hatch as fully developed, functional small individuals from eggs which are proportionally much small than those produced by many birds. Yet young birds are often very poorly developed when they emerge from the egg and they do not generally hatch in such a correspondingly advanced state as reptiles.

The reason for this might lie in the lower energy needs of ectothermal (cold-blooded) animals such as reptiles. Despite this however, hatchlings of, for example, the herbivorous marine iguana *(Amblyrhynchus cristatus)* from the Galápagos islands require proportionally more food than adults to support their more rapid growth. In many respects, external temperature has a great influence on their development and patterns of behaviour, influencing their pattern of feeding as an example.

The impact of temperature

Incubation temperature can have an enormous effect on the development of young reptiles. In some species, it can ➤

determine the sex of the developing young. This process is called environmental or temperature-dependent sex determination (TSD) as the sex of the young is influenced by external environmental factors rather than by genes, underpinning genotypic sex determination which occurs for example in humans.

A clutch of leopard gecko eggs incubated at around 32°C (90°F) produces mostly male offspring while one incubated at 26°C (79°F) results in mostly female hatchlings. Interestingly, even the breeding results of reptiles displaying genotypic sex determination, such as the Australian bearded dragon *(Pogona vitticeps)*, can be influenced by temperature. High temperatures have been shown to reverse genetically predetermined males into females in this case.

The sex of the developing reptile is not the only factor that might be affected by incubation temperature though. Temperature commonly impacts on the growth rate and developmental speed of the foetus and continues to influence the development of the individual even after hatching.

Other factors that are affected are hatchling size, morphology, and colouration. Sometimes, even reproductive behaviours and hormonal states of adult leopard geckos are influenced by the temperature they experienced when they were still in the egg.

Life-long impacts on behaviour

Research on pine snake *(Pituophis melanoleucus)* hatchlings shows that those from low-temperature nests are slower to find shelter from the sun and from predators. Another study showed that negative effects were also recorded after particularly warm incubation. Pine snake hatchlings incubated at 27-28°C (81-82°F) were both more secure and more responsive than those incubated at 22-23°C (72-73°F) or 32-33°C (90-91°F).

They emerged from their hiding places sooner when all was quiet but returned to their hideouts more quickly on perceiving danger. This means that they can spend more time outside foraging, while still being less vulnerable to predators than the warmer or cooler incubation groups.

Another aspect that distinguishes the average reptile's development from that of any bird or mammal is the comparative lack of parental care. Even solitary birds or mammals are raised by one or both parents. Their parents prepare them for adulthood and teach them about most aspects of life that are important once they have to look after themselves.

Fast learning

This is not the case for the vast majority of reptiles. After hatching from the egg, they are entirely reliant on themselves. Any knowledge about what to eat, where to rest, how to recognise dangers, and how to fight is discovered anew by each individual based on instinctual predispositions and early experiences.

Whether inherited instinct or experiences are a stronger guide depends on the behaviour in question. In one study, pine snake hatchlings were raised in an environment smelling of king snakes, which are their natural predator. Despite a harmless encounter with the smell of the predatory snake, they still chose the scent of their own species when given the choice of moving in one of two directions. So in this case, instinct proved to be stronger than experience.

It is likely that the unsupported development of reptile hatchlings has had consequences for the development of their cognitive abilities and

▲ The gender of young leopard geckos is directly influenced by the incubation temperature of the eggs.

➤ Behaviour such as swimming is not taught, in the case of reptiles. They just have to take the plunge, even if, as in the case of this water monitor seen here in the sea, they normally live on land.

▼ Temperature may also impact on the gender of young bearded dragons, although it is usually less significant.

Sometimes, even reproductive behaviours and hormonal states of adult leopard geckos are influenced by the temperature they experienced when they were still in the egg.

intelligence. For example, it is likely that a good long-term memory is very important. Remembering rare incidents that have resulted in solutions to problems or escape from predators can save lives when such methods have not been learnt from a caring parent.

An individual approach to life

The little research that is at present available about the way that reptiles process information suggests that they might be very flexible in their problem-solving methods. Furthermore, reptiles appear to show more individuality in their preferred way to solve problems than many mammals.

Sub-adult red-footed tortoises, for example, were tested in a radial maze which consists of a central platform from which eight arms are radiating off like the spokes of a wheel. At the end of each arm, a treat is hidden. The animals are given eight attempts to enter the arms, so that they miss out if they visit the same arms repeatedly.

The tortoises have different approaches that they could take to solve the maze. They could go from one arm into the next and the next and so on. They could also follow the smell of the hidden food or orientate using the cues around the room in which the maze stands. This task is very commonly used when testing rats and other rodents.

Under the same circumstances, the vast majority of rats opt for the same method to solve the maze. This is not the case with the tortoises. The method chosen by each tortoise seems to be determined to a large extent by personal preference.

Interestingly, their preference is not necessarily always for the easiest option but seems to be for the first method that was successful for that particular individual. One possible explanation for this is the lack of parental teaching, and the fact that the tortoises always had to rely on their own discoveries rather than being taught specific strategies on how to deal with certain situations.

Living alone

The unprotected nature of young reptiles also means that they are solely responsible for their safety and survival. As hatchlings tend to be very small and delicate, they often have to behave in ways that differ from those of their adult counterparts. Hatchling pine snakes, for example, are more likely to slip away rather than attack a predator.

Similarly, hatchling red-footed tortoises spend most their time hiding under leaf litter. Only once they reach a certain size and their shell is relatively strong will they emerge and spend the rest of their lives in comparative safety without needing to hide.

Human interference in the landscape

Sadly though, not receiving guidance upon emerging from the egg can have devastating effects as is repeatedly shown by sea turtle hatchlings that for various, mostly man-made, reasons head inland rather than out to the sea. One such reason appears to be artificial light sources from cities or streets that are attractive enough to the hatchlings to overcome all the other indicators that would have pointed them in the correct direction. This can result in the death of virtually an entire clutch, as they are drawn inland, away from the sea.

The race for life – young turtles head to the sea.

Under natural circumstances, hatchling sea turtles are, however, very good at reaching the surf. This feat is not as simply achieved as might be supposed. First, the youngsters have to emerge from their nest at the correct time, which is at night. If they emerge during the day they are faced with several perils.

Sunny beaches can reach deadly temperatures that do not allow safe passage for a very small, delicate turtle

It is rare to spot young red-footed tortoises in the wild. They hide away, being vulnerable to predators, but adults are much more conspicuous.

> The female does not continually watch over the nest, but as the time for hatching approaches, she makes regular nightly visits back here.

and there will be a multitude of sea birds keen to make a snack out of any such creature trying to clamber across the beach. These perils are so great that turtle hatchlings that have accidentally emerged during daytime have been seen to burry themselves back into their nest and wait for night to fall, before attempting their journey to the sea.

Usually, however, the heat of the day is an indicator that stops any attempts to escape from the nest. Even once the turtles have emerged at the correct time, their task is not an easy one. They have to consider several indicators that point them into the right direction, including light sources such as the moon reflecting off the sea and the smoothness of the horizon.

Parental concern

Not all reptiles have to fend for themselves upon hatching though. Several crocodile and alligator species are known to attend carefully to their nests and newly hatched young. Male and female Nile crocodiles *(Crocodylus niloticus)* have been observed to enter into a pair bond and to protect their offspring together. During incubation, the female stays with the nest, while the male defends the surrounding area.

When they are ready to hatch, young alligators begin to call from within and their mother opens the nest – something that they would be unable to do under their own strength at this stage. The mother then transports the young in her mouth to a suitable nursery site by the water, where she continues to look after them and defends them for several weeks.

Female Orinoco crocodiles prove to be devoted parents.

Turtles like these olive ridleys *(Lepidochelys olivacea)*, hatching on a beach at Managua, Nicaragua, will usually emerge under cover of darkness.

Similarly, Orinoco crocodiles *(Crocodylus intermedius)* provide extensive parental care. The female does not continually watch over the nest, but as the time for hatching approaches, she makes regular nightly visits back here. Once the young have hatched, she picks them up in her jaws and carries them in small groups to the water's edge.

For some time thereafter, the mother remains with her young, allowing them to bask in the sun while sitting on her head and back. After several weeks, the young start to prepare themselves for a separation by individually exploring their environment at night while returning to the mother during the day. Male Orinoco crocodiles were not observed to take part in these parental care activities.

Devoted lizards

While this degree of parental care displayed by crocodiles and alligators is rare amongst reptiles, other forms of parental care can occasionally be found. A type of parental care in lizards has been observed in the black rock skink *(Egernia saxatilis)*. These skinks live in pairs that defend territories.

Adults allow their juvenile offspring to remain with them for some time, and they thus reap the benefits of living within the relatively safe bounds of a protected territory. Studies show that the juveniles are attacked less often when an adult is nearby, defending that area of the territory, and adults only allow their own young to remain within their territory.

When two family groups are forced to live within close proximity of each other, the offspring of the dominant adult pair has better access to feeding sources and locations that benefit thermoregulation. Thus the adult's behaviour clearly benefits the young and can be considered parental care.

In conclusion

Reptile development inside the egg and outside is an immensely varied area with many different physiological and behavioural variations that are all exactly fitted to the needs of the specific species. For the reptile breeder or enthusiast, it is particularly important to remember the tremendous influence that such external factors have on the development of the youngsters, even before hatching.

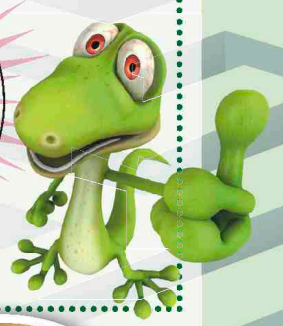
Providing the right conditions, and especially the ideal temperature, may not only influence the sex and physical appearance of the animal, but also its developmental speed, growth rate, and reproductive behaviour as an adult. ✣

Puzzle Corner

Find the solutions to these puzzles by following the clues, to discover which reptiles, amphibians or invertebrates are hidden within them. The answers can be found on p66.

THE ONE & ONLY

From each ring pick out and rearrange those letters printed ONCE and once only to spell out two names for a species of tree frog.



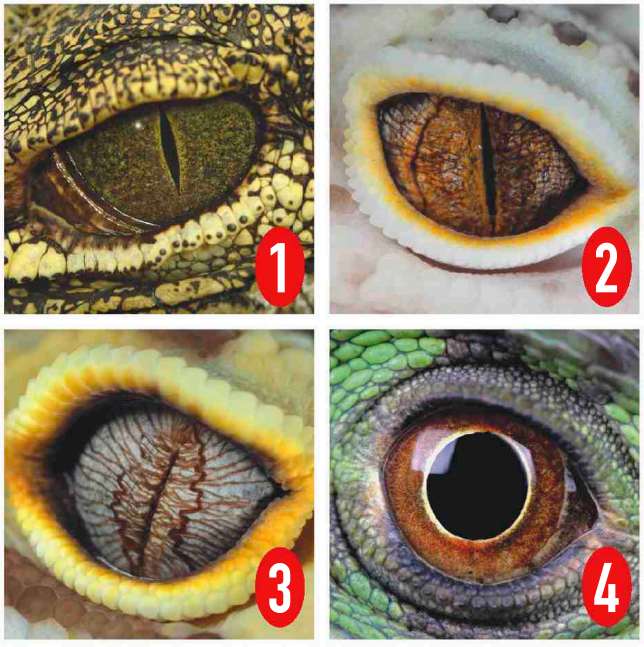
THE LINKS

There's something in each of the five listed words that links them - can you find it?

BODICES
MOCKINGLY
NARRATIVE
SCORNFUL
STREET

Snakes up-close

Can you recognise these reptiles?



TWO OF A KIND

Select seven letters - one from each star in clockwise sequence - to spell out the name of a tortoise species, and then find another one from the letters that remain. They will not both necessarily start in the same place and we don't tell you where to begin either of them!

THE TARANTULA THAT ALWAYS GOT A SEAT ON THE TRAIN

Having worked for many years as the curator of a zoological collection in Scotland, Bill Lowe had to learn how to overcome one of his own phobias and, in so doing, soon discovered that having a tarantula crawling all over him was something that he really did not mind at all.

I have to admit that I am no James Bond. However, like myself, the very first actor to play the part of the iconic British spy, Sean Connery, was born in Edinburgh. In 1962 when the first Bond movie had its cinema release, I would have been only just out of my teens.

As a young barman, before I got a job working in a nearby zoological establishment, I recall pulling a pint for Sean Connery and his brother, Neil in the Fountain Bar in Fountainbridge. It was some years before fame beckoned for the young would-be actor, who was then working as a polisher of coffins.

Little did I realise that not long afterwards, I would be queuing up at the Odeon Cinema to see him immortalised in his most famous part of all time – that of the first James Bond to appear on the silver screen.

Lasting impact

He first played the part of James Bond in the film, *Dr No*. I well recall seeing that film and, for me, the lasting memory was not of Ursula Andress stepping out of the waves on to the beach in Jamaica, but the scene where a tarantula walks over Bond's hairy chest as he lies in his bed in a hotel room.

From that moment on, I was fascinated by tarantulas, although at the time, like so many people I had an irrational fear of them. The fact of the matter was that you simply did not see them back then – they were never kept as pets, let alone bred as they are today.

The scene was initially shot by placing a protective glass screen between actor and arachnid, but the film's director was not happy with the results and a stuntman was brought in to double for our hero. Stuntman Bob Simmons was later quoted as describing the scene as the most frightening stunt he has ever performed.

I also recall being mightily impressed by the apparent stoicism of the actor. It appeared that Sean Connery was

➤ **Tarantulas such as the red-kneed have featured in a variety of scary film roles.**

▲ A crate of bananas caused Bill's arachnophobia.

conquering any fear that he might have had for the sake of the dramatic effect of that particular scene – or so I imagined. At the time, what I certainly could not imagine was myself in a similar role.

Later films to feature tarantulas included *Kiss of the Tarantula* – a 1976 horror movie, which features the teenage daughter of a mortuary operator unleashing tarantulas against her enemies and, more recently, *Arachnophobia* in which killer tarantulas terrorised a town in California.

Arachnophobia reached the cinema screens in 1990. By that time, I had handled more tarantulas than James Bond had enjoyed vodka martinis, and by then the experience had long since ceased to leave me either "shaken" or "stirred".

In my role as the curator of a small zoological collection in Dunfermline, I soon learnt that in was in the Reptile House that most people visiting the park would be heard to voice their own irrational fears.

It was invariably in front of the vivarium containing a Mexican red-kneed tarantula *(Brachypelma smithi)* – otherwise known simply as the red-kneed tarantula - that visitors would pause in fearful fascination of the creature that was being displayed before them.

Small and mysterious – and very painful!

I have to admit that before I was able to persuade members of the public visiting the establishment where I worked that tarantulas are not necessarily the evil demons that they are often portrayed as being in films, it was necessary for me to overcome my own initial fear of spiders.

It was not so much that I feared handling a big, hairy tarantula. No, my own reluctance to develop any kind of relationship with arachnids was due to an early experience in the park, being bitten by something very much smaller than a typical tarantula. Indeed, what sparked off my own fears was an unidentified species no larger than the size of my small fingernail.

In the park, we housed all manner of creatures great and small, including a troupe of macaques and, like all monkeys, they were passionate about their bananas. As it was necessary to purchase large quantities of fruit at any one time, it was sensible to buy in bulk.

On one occasion, whilst opening a crate of bananas that had arrived straight from the docks, I was bitten by small spider. At the time, I did not really think too much about what had happened, but within a few minutes, the pain had spread up my arm and I felt that I was experiencing some difficulty in breathing.

I was taken to the Royal Infirmary in Edinburgh for treatment, but the problem was that I had only paid scant attention to observing the creature that had bitten me. I was therefore unable to identity it, making the necessary treatment all the more difficult. I remained in pain for several days and the result was that I became very wary of all spiders.

The arrival of Rosie

However, I subsequently made the active decision that I should overcome my own fears and that the best way forward was for me to obtain a tarantula for the park. Hence "Rosie" – a Mexican red-kneed tarantula entered my life and she was soon creating quite a stir both within the Reptile House and elsewhere!

Much to most people's surprise, in actual fact this species is normally not aggressive, and individuals can make wonderful pets. Naturally, they should always be handled with a certain amount of care and when doing so, you should remain perfectly calm at all times.

Careful handling required

A tarantula should always be picked up by cupping it gently, with its legs folded under its body. Take care to ensure that there is no way that the spider will slip from your grasp though, as a tarantula's abdomen is very fragile, and a fall to the floor can easily be fatal. This is why it is better to move them any distance in a container with a secure lid.

You can simply place your outstretched hand straight out in front of the animal and gently prod its abdomen. In this way, it will usually be persuaded to walk on to your hand. As it begins to crawl over the one hand, place your other hand in front and allow it to transfer from one hand to the other in a continuous, flowing action. Be sure not to make any jerky movements.

Occasionally, it is true that, if agitated for any reason, an individual may rear up in a threatening gesture. It may even flick urticating hairs at its would-be aggressor and care should always be taken not to get these hairs into your eyes, as they will be extremely itchy and painful. ➤

▼ Moving your finger can encourage your tarantula to move forward. Always keep it well-away from your eyes.

Rearing up serves as a warning sign.

These barbed bristles cover the dorsal and posterior surfaces of a tarantula's abdomen and can be directed towards a potential attacker. If they become embedded into the skin, they can cause considerable irritation, leading to a good deal of discomfort.

It may therefore be worth wearing a pair of thin gloves as protection when you have to handle your spider. However, in most cases, after a short threatening display, most individuals will usually simply turn around and walk away.

Off to Birmingham

In my experience, the red-kneed tarantula is one of the most docile species to be found in the hands of enthusiasts and, in the case of Rosie, she proved to be quite a gentle individual who soon garnered quite a following!

My partner runs a small publishing business, specialising in the publication of monthly trade magazines for the woodworking sector. Every two years, a major exhibition is held at Birmingham's National Exhibition Centre (NEC) and on one occasion, I was persuaded to go along and help out on the stand.

That year, the theme for the stand was to be a tropical rainforest and the whole area was decked out in palm trees, tree ferns and other lush foliage, occupied by a troupe of cuddly toy monkeys suspended from the overhead branches, in order to give the impression of a jungle scene.

A lively addition

What was lacking though was something "alive and kicking" living in the jungle. For my sins, I proposed that I took Rosie along with me, as she would certainly prove to be a topic of conversation and, hopefully, might help to attract additional visitors to the stand.

She was to be housed in a glass fronted display case styled to resemble a miniature tropical rainforest. By this time, she was completely used to being handled by me on a daily basis and there was no way that she was going to be content to stay in her display cabinet all day long.

These barbed bristles cover the dorsal and posterior surfaces of a tarantula's abdomen and can be directed towards a potential attacker.

Rosie developed a habit of tapping on the glass to attract my attention, so as to let me know when she wanted to come out. She would be quite happy to run up and down the length of my arm – much to the fascination of visitors to the stand.

The authorities at the NEC insisted that she was not left in the hall overnight and, for her own comfort and safety, I had no intentions of leaving her on her own anyway. For this reason, her display cabinet would be vacated every evening when the magazine staff and I left for the evening to return to our hotel in Birmingham.

Panic!

On the second evening of the show, I inadvertently left the door of her display cabinet ajar. Little did I realise when I did so that this would cause quite a stir! The next morning, my partner left the hotel before breakfast in order to arrive at the NEC well before the doors were opened to the public. Extra copies of the magazines were being delivered to the stand and it was necessary for someone to be there to sign for them.

On arrival at the show hall, my partner was confronted by a couple of very agitated security guards in the company of the show organizer. Apparently one of the officials had gone into the gent's toilet and noticed a "large" spider running across the floor in front of him whilst he sat with his trousers at his ankles. By the time that he had hoisted his pants, it had disappeared.

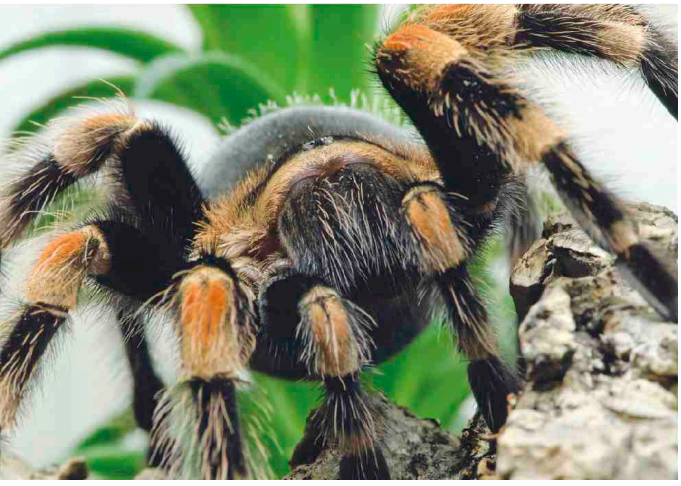
Rosie's fame had spread and it was already well known that a tarantula was being displayed in the show hall. When one of his colleagues arrived at the magazine's stand, it was duly noted that the door to the glass display cabinet was ajar.

It had been immediately assumed that a tarantula was on the loose at the NEC and to an overactive imagination, this had all the makings of a new horror movie. Only when I arrived on the scene with Rosie were the officials prepared to allow any of the other stand holders into the hall!

Wary travellers

One definite advantage of travelling by public transport with a tarantula is that other passengers tend to give you a wide berth. This became apparent each evening as the magazine staff returned to the hotel in Birmingham. For most people, travelling at peak times, it was always difficult to get a seat on the train and especially if a small group of you were trying to sit together.

I soon learnt that if I alone secured a seat on the train for myself and placed Rosie in her clear plastic travelling box on my lap, the seats immediately opposite me were very quickly vacated, allowing my partner and all the magazine staff to be able to sit together for the duration of ➤



Rosie fitted in well with the theme of the stand.

the journey. It had to be said that the tarantula always got a seat on the train!

Rosie became a seasoned traveller, often accompanying me to the various talks that I gave at local schools and other institutions and, on such occasions, she was always perfectly behaving, provided that she was not undergoing one of her periodic moults.

Moulting

One of the most common reasons for a pet tarantula to demonstrate a degree of unusual behaviour is because of a moult. As it outgrows its existing skin covering, a tarantula will undergo an extensive moult, shedding its entire skin and even the linings of its mouth, respiratory organs, stomach and sexual organs.

What many new enthusiasts to tarantula keeping do not realise is that for several weeks beforehand, your pet tarantula will be in the process of developing a completely new skin beneath the old one. It is during this period that the animal can become quite lethargic and may even stop eating altogether.

Such natural lethargy is alternated with bouts of furious spinning activity immediately prior to the moult. When an individual actually begins the moult, it will often lay on its back with its legs in the air and, to all intents and purposes, appears to be dead.

I well recall the countless occasions upon which I was called upon to explain this to visitors to the Reptile House who would seek me out as I set about my daily chores.

"Was I aware that I had a very large, dead spider on display?" was the question that was posed to me more times than I care to remember. In the end, I found that it was simpler to mount a laminated placard detailing this quirk of natural behaviour alongside the vivarium in which the red-kneed tarantula lived.

➤ **The hairs on the abdomen can become worn prior to a moult.**

Tarantulas may use their legs for communication.

If your tarantula is found on its back when moulting, do not worry unduly. Most tarantulas flip on to their backs at this stage. Although this is a very stressful time for any tarantula, once your pet has moulted its exoskeleton, it will usually roll back over into an upright position and its new body covering will harden up.

During the moult, it is especially important not to disturb your tarantula. Once the shedding process has been completed, the new skin may appear to be very pale in colour. Initially this covering is very soft as well, so it is important that the humidity levels in the vivarium are adequately maintained.

If your pet has recently shed, you should always be particularly vigilant about removing uneaten prey items, as newly moulted tarantulas are vulnerable to infections until their exoskeleton hardens. In this state, the spider could also be easily attacked by crickets roaming around in the quarters.

How long should this process take and how long will it be before your pet is eating well and behaving in a normal manner once more? The answer is that this can vary enormously. Much depends on the size of the individual, with smaller spiders recovering much more quickly than larger ones.

The amount of time that it takes for your pet to recover fully may vary from

> One of the most common reasons for a pet tarantula to demonstrate a degree of unusual behaviour is because of a moult.

▲ Depth of substrate is very important.

▼ A piece of wood is useful to screen the entrance to the female's burrow.

days to several weeks and it is very difficult to offer any hard and fast ruling. Within seven to 10 days on average, it may be ready for its next meal.

Recognition

In appearance, the Mexican red-kneed tarantula is quite striking, sporting a black and tan carapace. The legs and abdomen are dark coloured and the vermillion coloured patches on the joints of each of the legs are immediately apparent. The male is the smaller, stockier of the sexes, although he is likely to have longer legs than the female; her leg span can measure anything up to 15cm (6in).

Individuals are likely to enjoy a lengthy lifespan and, as is the case with the majority of species that have a long lifespan, a slow growth rate is a characteristic feature. It is not unusual for specimens kept in collections to be anything up to 25 years old, and sometimes older still. Females have a much longer lifespan than their mates.

Their environment

As the name would suggest, this species originates from Mexico, notably along the Pacific coast, being commonly found on the Sierra Madre and Sierra Madre del Sur mountain ranges, where it lives in the deciduous tropical forests which occupy the hilly terrain.

It is naturally a burrowing species and tends to occupy very deep cavities. Every effort should therefore be made to simulate such living arrangements for individuals being housed in vivarium surroundings.

You should provide a deep, 15-20cm (6-8in) layer of substrate, comprised of a mixture of damp sand and peat moss. Construct a cave-like opening at one end of your vivarium, creating the start of a burrow.

An ideal means of providing the entrance to your spider's lair is to use a small section of tree bark. You should find that your pet tarantula will continue with the task of excavation, burrowing as deeply as the level of the substrate will permit.

You should maintain a humidity level of approximately 55 per cent within the vivarium and the temperature of the enclosure should be kept at around 27°C ➤

(80°F). A heat lamp fitted with a 60 watt bulb situated over an area immediately outside the entrance to the burrow will provide the necessary warmth.

Production of spiderlings

You should be able to observe your pet basking at the entrance of its burrow – just as it would do in the wild. If breeding success is achieved, it may even be possible to witness egg sacs being dragged into this area to warm the developing embryos within. This species generally breeds quite successfully, and captive-bred spiderlings are widely available as pets.

If successful breeding is to be achieved though, it is important to ensure that the conditions in your vivarium are right. Females tend to benefit from being maintained at a slightly lower temperature prior to mating. Once a mature male is seen to have produced a sperm web, he should be introduced to the female, whereupon, in all probability, he will approach the female's "cave" cautiously, all the while

▲ A young Mexican red-kneed tarantula spiderling.

the male will lunge forwards in an attempt to utilise his hooks to hold the female's chelicerae and propel her into an almost upright position to allow himself access to the female's epigyne for mating. He will then insert either the left or right pedipalp (or both alternately) into the female's epigyne and inject his sperm.

If mating is successful, the female will produce a typically large egg sac containing 250-300 young. If you are in any doubt that a successful mating has occurred, there is nothing to prevent a mature male being re-introduced to a female to enhance the possibilities of success. Typically, the male will die shortly after a successful mating. A pair will often mate, but the female may never lay eggs. Sometimes she does so, but then folds up her egg sac and consumes it, or simply abandons it after a few days.

Feeding tarantulas

The Mexican red-kneed tarantula is amongst the hardiest of tarantulas and is an excellent choice if you are thinking of starting out with one of these spiders. It is quite easy to provide a suitable diet for this species as well. When it comes to its dietary requirements, this tarantula feeds voraciously on large insects.

For the most part, it will thrive on readily available crickets and small locusts. Dust these if possible with a vitamin and mineral powder before offering them to your spider. Other items that may feature on the menu include moths, if you have any waxmoth larvae that pupate. Larger red-kneed tarantulas may even be offered the occasional pinkie mouse - perhaps once every month or so.

You should take care to clean up and dispose of any uneaten food items within 24 hours. Try to match the amount that you offer with what your spider normally eats, so as to avoid wastage too. Good cleanliness is important to avoid the development of moulds, fungi and other potentially harmful organisms.

Indicators of concern

Among the most evident signs that all is not well with your pet will be a loss of appetite, general lethargy, weight loss, and inexplicable pacing in the enclosure. Ill health is generally caused by some form of environmental stress, such as a drop in the temperature, a fall-off in humidity or the existence of parasites.

Alternatively, your pet may simply not be happy with its shelter, especially if this cannot be excavated down to a sufficient depth, because there is not enough substrate for this purpose. Some rearrangement of its quarters may therefore be required.

Rosie herself lived to be a ripe old age and finally died shortly before I retired from the park. She may never have had the opportunity to star in the cast of a Hollywood movie, but except when she was casting, she remained perfectly happy in her own skin. She certainly helped to ensure that if I were ever to appear in an acting role with a tarantula, I would have no need of a stunt double! ✣

▼ Tarantulas tend to eat what they can catch, including cockroaches as in this case.

Health issues are often linked with environmental problems, such as low humidity, which can be fatal.

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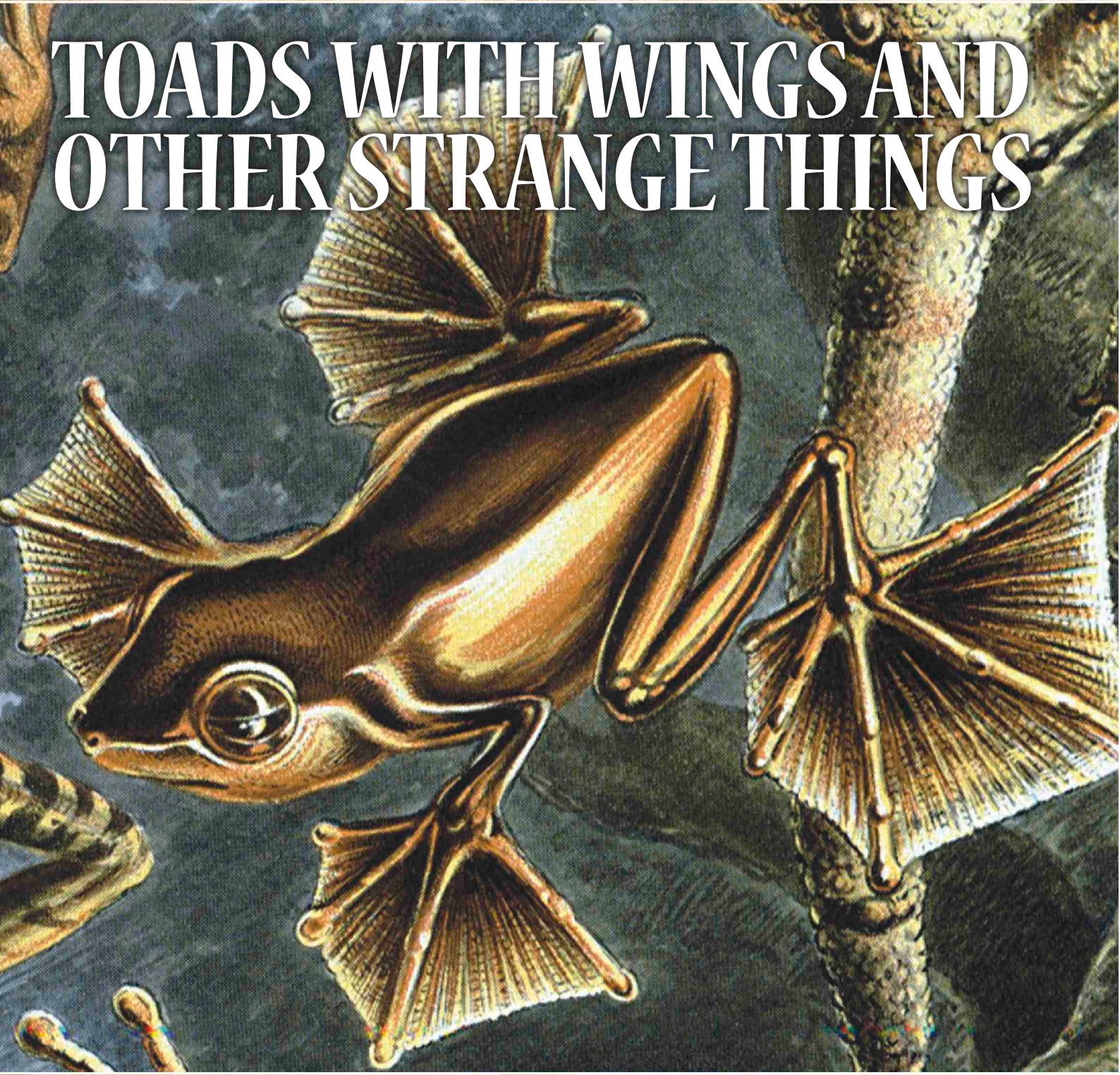
TOADS WITH WINGS AND OTHER STRANGE THINGS

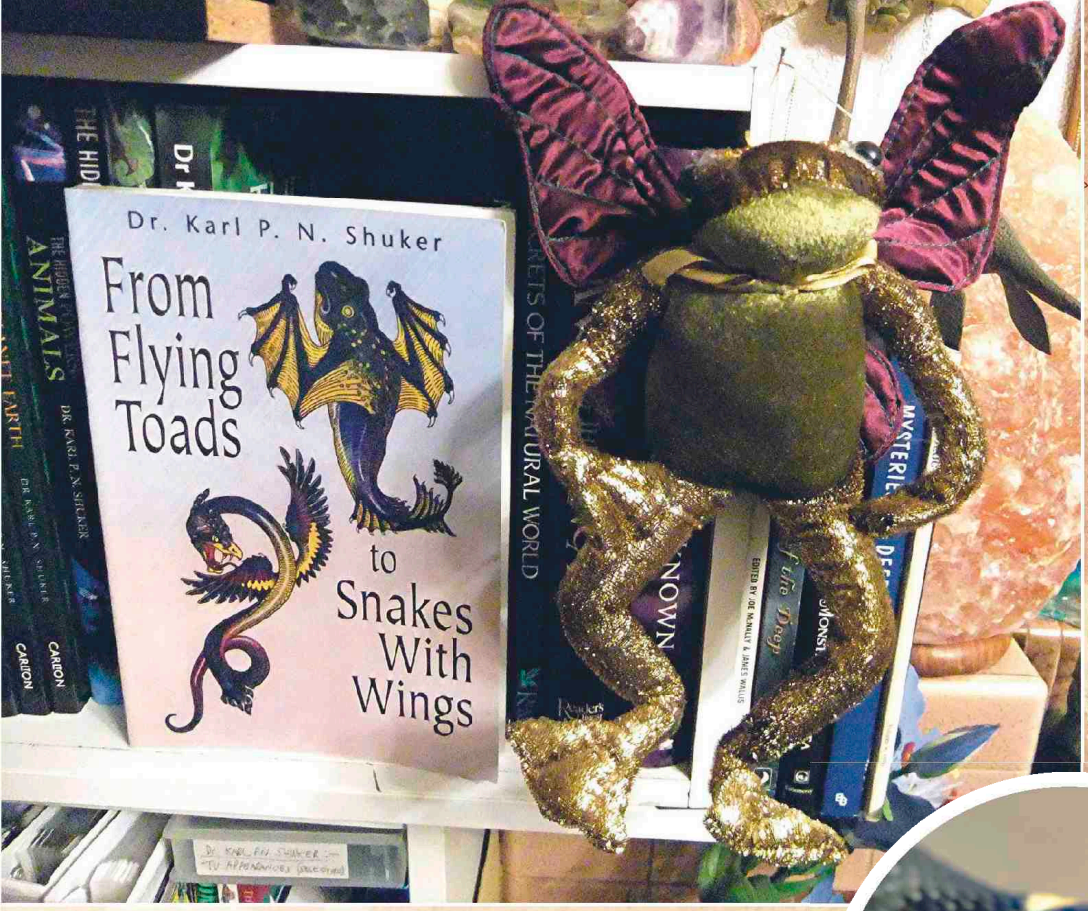


There are accounts of bizarre, winged toads from various localities around the world. Dr Karl Shuker investigates, to see if there could be any truth in any of them.

▲ Frogs with the ability to glide are quite widely-distributed in southern Asia.

As far as I was aware at the time when I wrote my book entitled *From Flying Toads To Snakes With Wings* (1997), the only creature on record that could in any way be likened to a flying toad was the example that I referred to in the title. It was an obscure creature, with a vaguely bufonine (toad-like) appearance and airborne ability that featured briefly in Welsh folklore. It was known as the water-leaper or *llamhigyn y dwr,* to give it its local name.

Very recently, however, I have encountered some more precise but no less mystifying accounts of alleged winged toads from elsewhere around the world. Consequently, it is clearly time to revisit the fascinating subject of unidentified aerial anurans.



Karl's book alongside a flying toad toy.

A WINGED TOAD FROM ENGLAND?

In the November 2012 issue of the periodical *Flying Snake*, British cryptozoologist Richard Muirhead reproduced the following letter, written by Thomas Flatman of Mendham, Suffolk, to his brother on 25 September 1662. Richard had unearthed it while perusing the Early Modern Letters Online database at Oxford University's Bodleian Library:

"I have iust [just] leysure enough to answere that part of yours wch [which] concernes the newes of the Serpent-amongst us, I have not seene it myselfe but can name you 20 yt [yet] have all agreeing punctually in the relacon [relation] & descripcon of ye same; tis above a yard and an halfe long an head like a toade but very large a yellowish ring about ye neck 2 wings as broad as a mans hand like a Batts 4 yellowe short leggs like a ducke as bigg as a lusty mans Thigh the Belly yellowe speckled with blacke spotts, head and back all covered with thick scales wch shine in the sunne reflect all manner of coullers hee was seen eating a water henn is most often seene before sunn rise in the morning and about noone when the Sunne shines bright and hott. Heere is one affirmes that hee surprised the Serpent one morning and being in a place where hee could not retreate hee ris: & sprung att ye man but mis't him..."

Despite the fact that this creature was referred to by Flatman as a serpent, and that its yellow torque is reminiscent of that of the common grass snake *(Natrix natrix)*, its wings and especially its four short legs evidently rule out any ophidian (snake-related) identity for this mystery beast. Yet who has ever heard of a toad with wings, or even one with scales for that matter?

A genuine puzzle

Bizarrely, the known animals that Flatman's bat-winged description most closely recalls are the famous so-called flying dragons or gliding lizards (*Draco* species). They in fact possess a pair of extendable wing-like gliding membranes, but these species are endemic to Asia.

Could a living specimen have been brought back to England at some time by someone who had visited that continent, or might it have been part of a travelling sideshow and then later escaped? All extremely speculative, but unless Flatman's letter was a hoax, this identity does at least offer a vaguely plausible solution to what is otherwise a seemingly irresolvable riddle.

A COLONY OF WINGED TOADS IN FRANCE?

I am greatly indebted to cryptozoological correspondent Raphaël Marlière for bringing the following case to my attention in this context. In an article from 1990 in the periodical *Communications,* French cryptozoologist Jean-Jacques Barloy presented an equally curious report of supposed winged toads. It consisted of a letter written to him on 26 August 1985 by correspondent Marcel Buisson of Alençon.

In this letter, Buisson claimed that his father had told him that during the years 1916-1921, the park of a castle near Fresnay-sur-Sarthe in northwestern France had harboured about 30 flying toads. These creatures were allegedly identical in general appearance to common toads except for one remarkable extra feature – a pair of small membranous wings similar to those of bats.

They would fly away if anyone approached to within about 1m (3.3ft) of them, but as their flight was heavy, it never exceeded 10m (33ft) before they came back down to the ground. They tended to be seen under poplar trees, along the main driveway of the park. One specimen had supposedly been killed by Buisson's father, but was not preserved because he had no interest in it.

Not surprisingly, Barloy was thoroughly perplexed by this report. Indeed, apart from speculating as to whether they represe some freak, tera variety, or, e exotically colony *Rhac* glid wa of re b ex H pa am achi airbo via win

The yellow areas as described are rather reminiscent of a grass snake.

A portrayal of the lizards popularly known as flying dragons. Could there be a link through them to accounts of winged toads in England? It seems unlikely.
Source: PD.

membranes as do gliding lizards, but instead by extensile membranes between their toes.

What happened to them?

As for any freak toads that had somehow developed wings: these would surely be much too precious to be allowed simply to live unfettered in the park and thereby take their chances against the ever-present threat of possible predation from foxes, cats, and other carnivorous animals?

What a tragedy that the killed specimen was not preserved – and what happened to these astonishing creatures after 1921? Once again, we have a reputed record of winged toads that defies any satisfactory resolution.

WINGED TOADS – OR FLYING FROGS - IN INDONESIA?

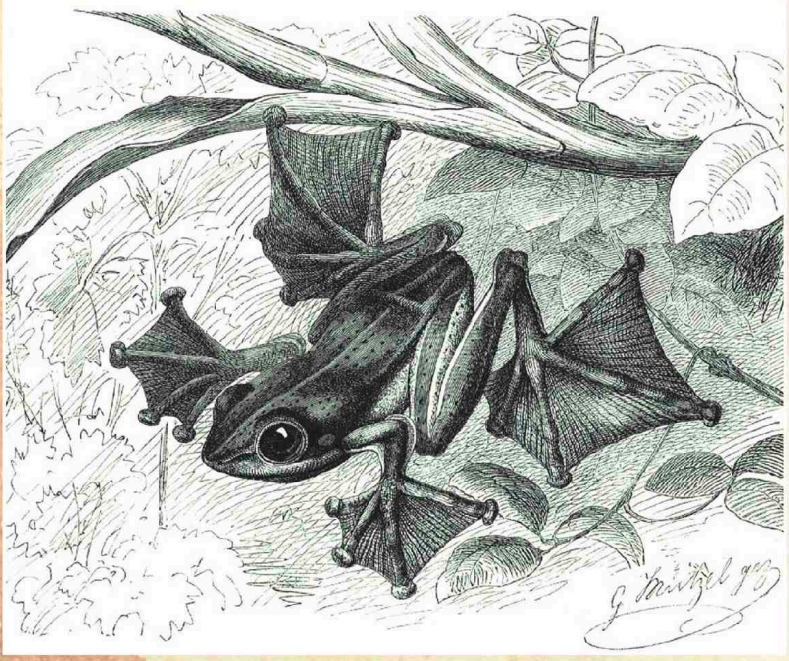
Indonesia has a long folkloric tradition with regard to winged anurans. According to legend, a flying frog is a very special frog that after going through the normal metamorphosis from a water-dwelling tadpole to an adult frog can live either in the water or on land, and then progresses through an additional metamorphic stage.

During this period, it grows wings and thus becomes a frog that can live in the water, on land, or in the air. Consequently, this extraordinary creature symbolises change and transformation on a spiritual level, and is also a bringer of good fortune, because it can mediate between the elements of water, earth, and air.

The Indonesian island of Bali in particular is famous for its beautiful, multi-coloured wooden carvings of flying frogs (although some more closely resemble toads than frogs), which are frequently suspended over the cribs of babies to protect them. They are also hung over the doorways of the homes of menopausal women, who, by progressing from their years as care-givers to the more liberating years as wise women, are thereby transforming from the physical to the spiritual.

➤ The concept of flying toads or frogs features prominently in Indonesian folklore, as shown by the colourful carving here and the one shown on the opposite page. Photos courtesy Dr Karl Shuker.

A harlequin flying frog *(Rhacophorus pardalis)*, with the membranes between its toes clearly evident..



➤ Frogs can move through the air, and not just by jumping. Members of the Asian genus *Rhacophorus* can glide well, from tree to tree if necessary. Source PD.

Origins of this belief

But from where has the notion of flying, winged frogs in Indonesia originated? Again, the most obvious sources of inspiration, and much more likely too in this instance than in the case of the French flying toads, are the *Rhacophorus* gliding frogs.

Sometimes referred to as flying frogs themselves, in reality they are only capable of passive gliding rather than actively powered flight, and, as already noted, they are not equipped with wing-like gliding membranes. Instead, they glide by spreading out their legs and extending their greatly enlarged interdigital membranes when they leap from trees in their native rainforest domain.

Nevertheless, at least a dozen species of gliding frog occur in Indonesia, including the Sulawesi *(R. edentulous)*, Sumatran *(R. poecilonotus)*, Javan *(R. margaritifer)*, and Boulenger's *(R.*

modestus). Consequently, the sight of such remarkable amphibians gliding through the air may well have been sufficient to inspire fables and superstitions featuring greatly elaborated, exaggerated versions of such amphibians sporting genuine wings. A much less likely but not impossible alternative possibility is that there is – or once was – an undiscovered creature in Indonesia that at least superficially resembled a frog (or toad) with wings or wing-like gliding membranes.

THE WELSH WATER-LEAPER

I end this survey of toads with wings, and other strange things, by returning to the entity that first aroused my interest in them – the water-leaper or *llamhigyn y dwr* of Wales. Modern books on Welsh folklore claim that this formidable beast resembled a huge toad in body shape, but that instead of hind limbs, it possessed a pair of wings and also sported a tail.

It supposedly inhabited lonely Welsh rivers, where it devoured any unsuspecting sheep or other livestock that approached to take a drink. It was also said to emit a loud unearthly shriek that would so frighten travellers attempting to cross any such river that they would lose their footing, fall into the water, and be promptly gobbled up by its deadly inhabitant.

Could such a creature have remained undetected?

Apart from a bold attempt by one cryptozoological enthusiast to identify the Welsh water-leaper as an undiscovered species of freshwater stingray, this aquatic wonder has generally been accepted as wholly mythical. As for the freshwater stingray notion: quite apart from its implausibility on fundamental zoogeographical grounds, there is also the sociological improbability factor to consider.

Bearing in mind that the fauna of Great Britain is unquestionably among the most intensely studied anywhere in the world, if anything as exotic as a freshwater stingray had ever existed in Wales, it would not only have been extensively documented, with its name and form incorporated into numerous place-names and other local terminology, but it would also have been extremely familiar to the angling fraternity. In reality, and conversely, the water-leaper is confined entirely to traditional Welsh legend – and possibly not even to that.

➤ An artwork portraying the Welsh water-leaper. Courtesy Andy Paviorek – Strange Lands.

The River Gaslyn flows through Beddgellert but there have been no sightings of mysterious amphibians reported there.

An explanation – of sorts!

This is because convincing evidence exists to suggest that this distinctive monster is actually of very modern, and far more dubious, origin! During 2009, in an online blog, Welsh cryptozoological researcher Oll Lewis presented two startling revelations.

One was that the famous history of the brave, martyred dog Gellert - who supposedly rescued the baby son of Prince Llewellyn the Great of Wales from a wolf, only for the prince to slay the poor hound in the mistaken belief that it had attacked his son – was a complete fabrication. It was a memorable yarn deftly spun by the owners of the inn in the North Wales town of Beddgellert to entice tourists to visit it.

Oll's second revelation was that the only known eyewitness account of the water-leaper ever recorded in print had originated from a man named William Jones – who just so happened to be a descendant of the same family that had invented the Gellert story. Moreover, the local eyewitness in question, named Han Owen, was a very skillful, much-in-demand yarn-spinner at regular story-telling evenings held at the Beddgellert inn by the family who owned it.

And it was at one of these evenings where Jones first heard Owen recalling his supposed encounter with the water-leaper. Owen claimed that one day while fishing he had actually hooked a water-leaper, but it had erupted out of the water, breaking free of the hook and soaring away, before crashing against a cliff.

Mystery solved?

As Oll judiciously pointed out: "Given the dubious pedigree of the tale, the smart money is on the water leaper having been one of Han's tall tales, but you can make up your own mind about that."

I already have done, especially as every source of information concerning it that I have consulted can be traced back to one and the same book. This is John Rhys's two-volume tome *Celtic Folk-Lore, Welsh and Manx* (1901). His source was none other than William Jones and, via him, the clearly unreliable eyewitness Han Owen.

Nevertheless, I'd very much like to know whether anyone is aware of any publication documenting the water-leaper whose publication *precedes* that of Rhys's book and whose source is not Han Owen's eyewitness account derived from William Jones.

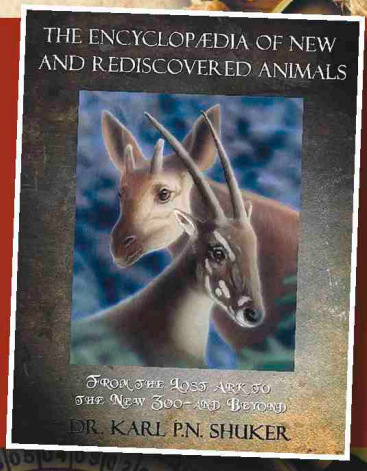
If such sources do exist, then we may owe the water-leaper an apology. Otherwise, however, the existence of this flying quasi-toad even as a creature of legend, let alone one of reality, seems as likely as the occurrence of flying pigs!

** Dr Karl Shuker BSc PhD FRES FZS is a zoologist, author and broadcaster who is pre-eminent in the field of cryptozoology – the study of animals whose existence is not proven.*

➤ Gellert's grave – unfortunately, this whole story is now known to be completely untrue.

Further information

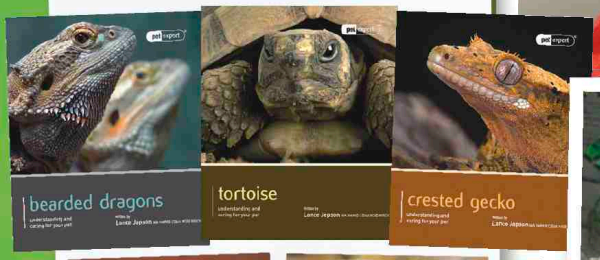
Karl's latest book - *The Encyclopaedia of New and Rediscovered Animals* (Coachwhip Publications: Landisville, 2012) extends to 370 pages long and is packed throughout with rare colour and b/w photographs. It costs £24.95, is available in hardback from Amazon and can also be ordered through all good bookshops.



YOU & YOUR Reptiles

If you have a favourite photograph of one of your reptiles, amphibians or invertebrates which you'd like to see included in the magazine, then email us a **high resolution** digital image to **prk.ed@kelsey.co.uk.** Please include details about the subject, confirm anyone in the picture is happy for it to be published and that you took it.

Also, tell us where you live, because the best photograph, as judged by the *Practical Reptile Keeping* team, will win a prize. This month's winner will receive a set of the Pet Expert series of reptile care books, with the titles being *corn snakes, tortoise, leopard geckos, crested gecko, bearded dragons* and *ball pythons*, courtesy of Peregrine Livefoods. Each book has a rrp of £9.99.Written by exotics veterinary specialist and keen reptile enthusiast Lance Jepson, MA VetMB CBiol MSB MRCVS, each title provides clear advice on how to look after these species correctly, even if you have had little or no experience with them before, and make a valuable library.

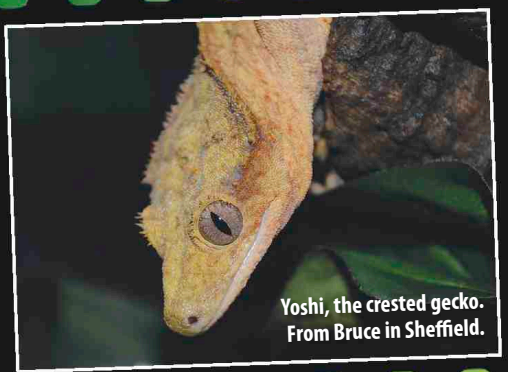


Rocky Bal the boa meets a Christmas guest! From Jeremy in Hull.

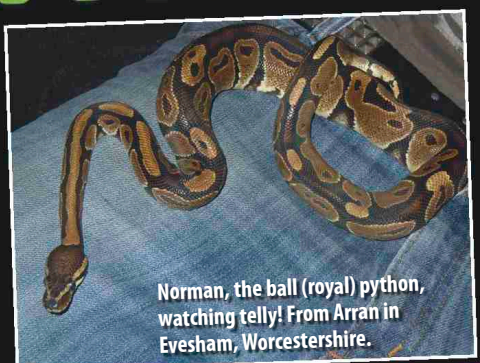
STAR PICTURE

Left: Vinnie and Blazer. From Malcolm, in East Preston, West Sussex.

Super-fast strike! Milo the bearded dragon. From Jackie in Crouch End.

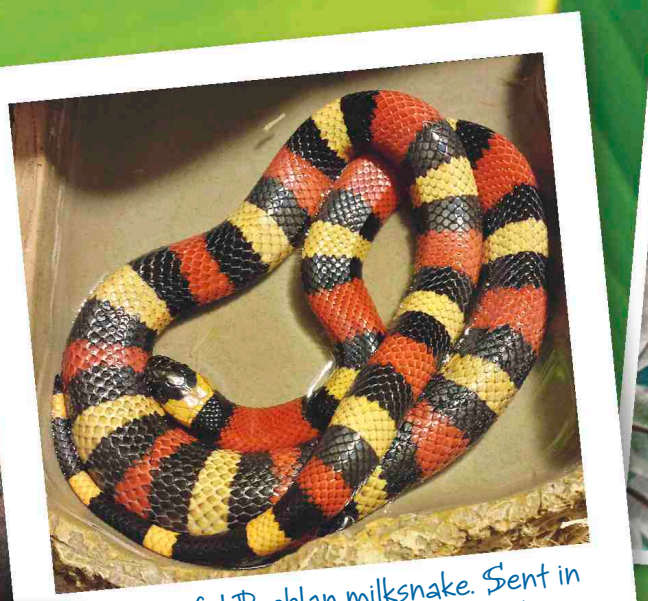


Yoshi, the crested gecko. From Bruce in Sheffield.



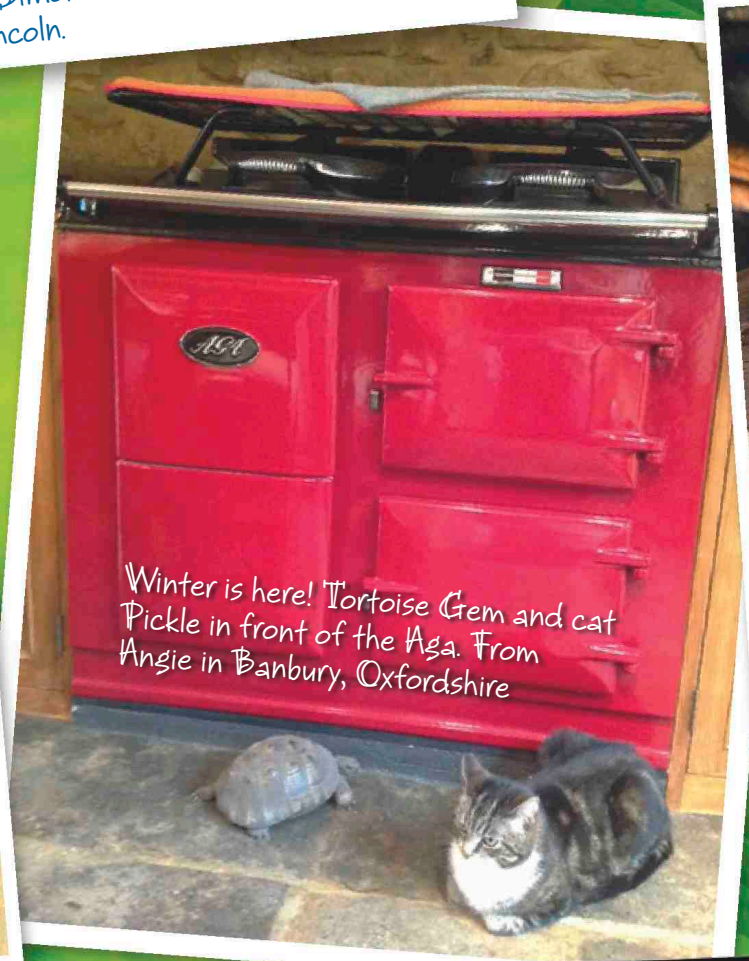
Norman, the ball (royal) python, watching telly! From Arran in Evesham, Worcestershire.

Kane, the carpet chameleon on his first day at his new home. From Keifer, in Street, Somerset.

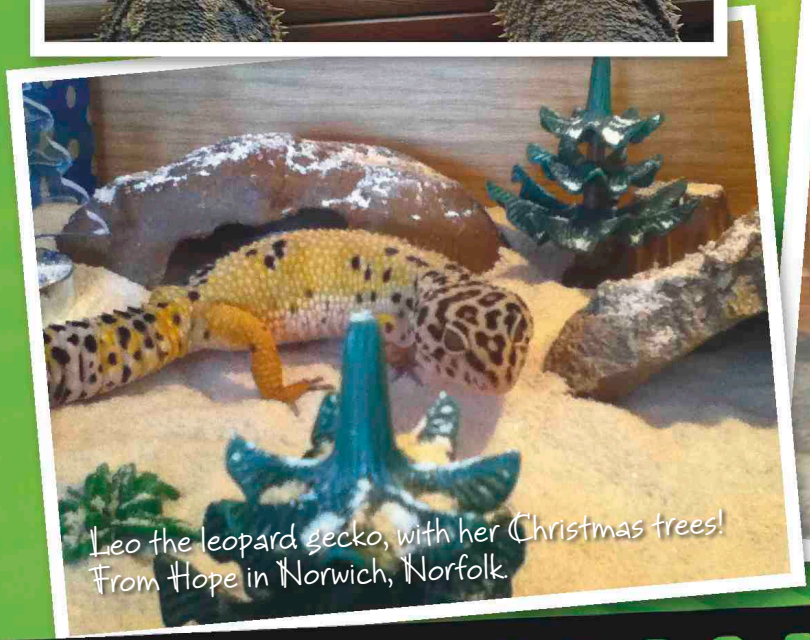


A beautiful Pueblan milksnake. Sent in by Simon from Bracebridge Heath, Lincoln.

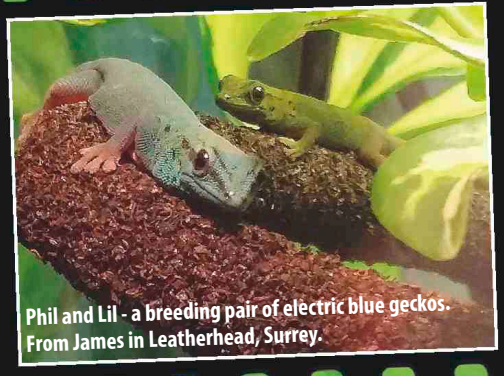
Bearded dragons Penny (left) and Lenny (right) waiting for the return of Nicks daughters from school. They live in Bournemouth.



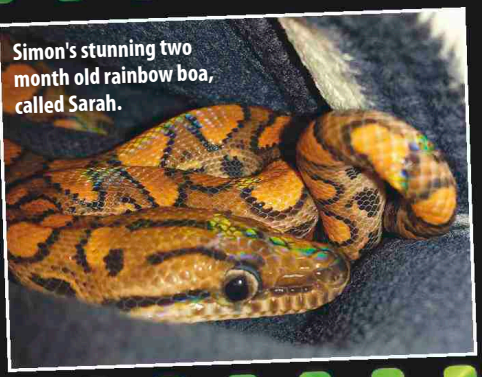
Winter is here! Tortoise Gem and cat Pickle in front of the Aga. From Angie in Banbury, Oxfordshire



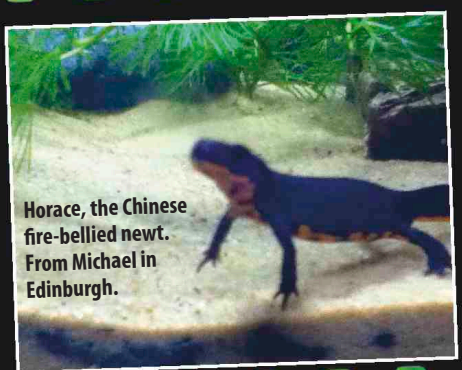
Leo the leopard gecko, with her Christmas trees! From Hope in Norwich, Norfolk.



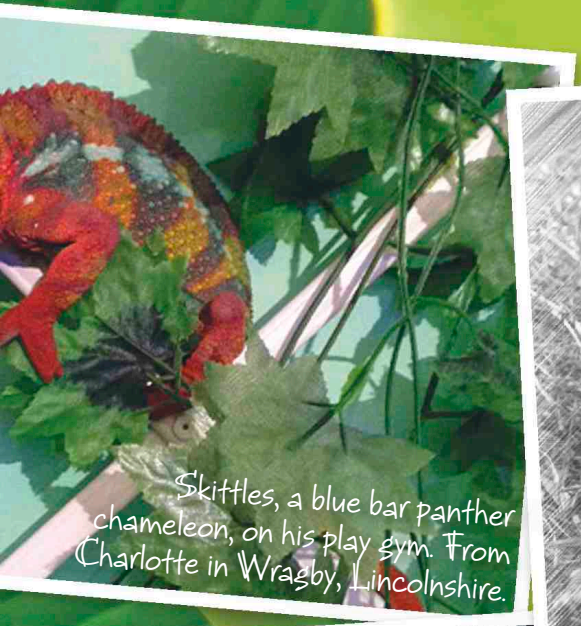
Phil and Lil - a breeding pair of electric blue geckos. From James in Leatherhead, Surrey.



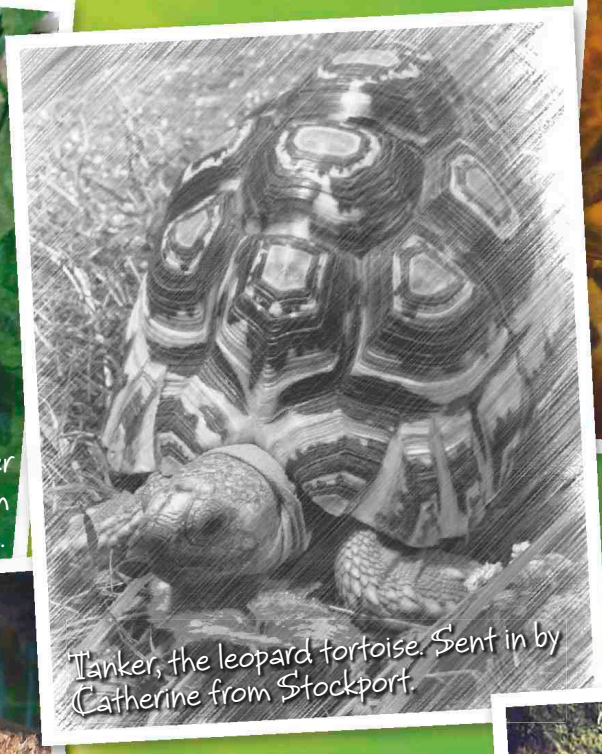
Simon's stunning two month old rainbow boa, called Sarah.



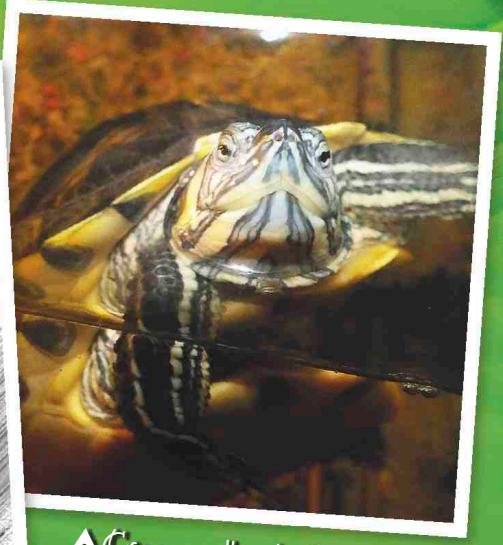
Horace, the Chinese fire-bellied newt. From Michael in Edinburgh.



Skittles, a blue bar panther chameleon, on his play gym. From Charlotte in Wragby, Lincolnshire.

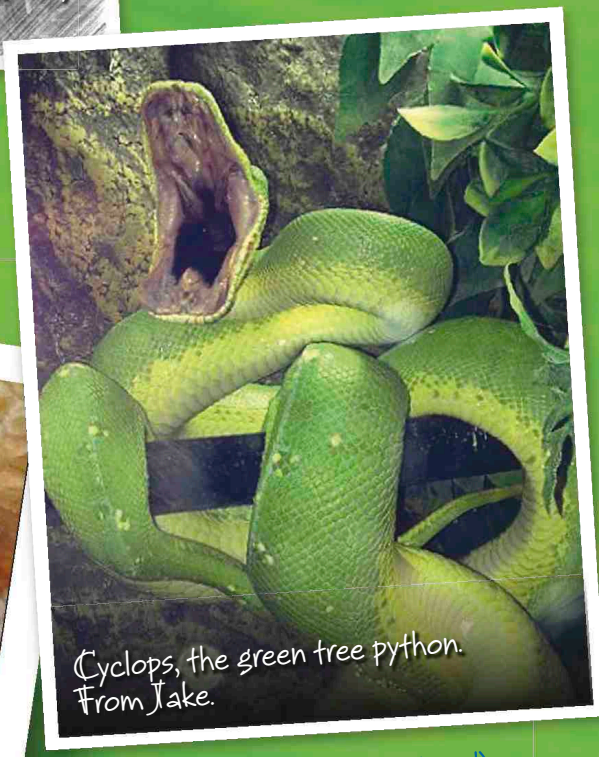


Tanker, the leopard tortoise. Sent in by Catherine from Stockport.

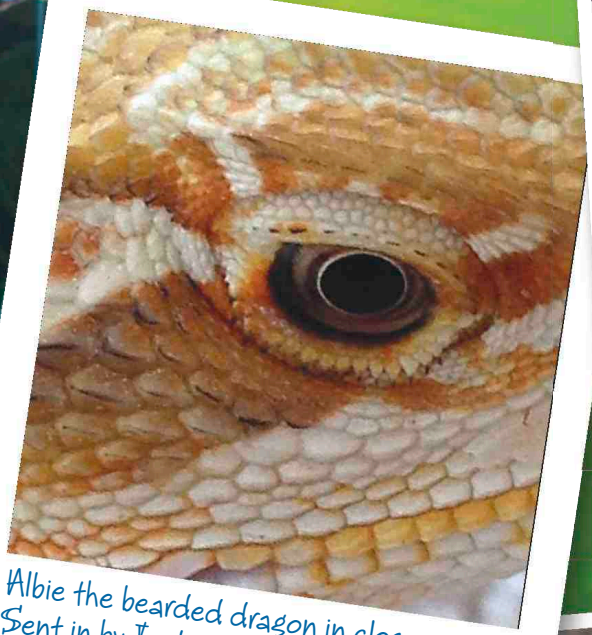


▲ Croc, a yellow-bellied slider who is 18 months old. From Carl.

◀ Skylar's mountain horn dragon. Sent in by Donna.



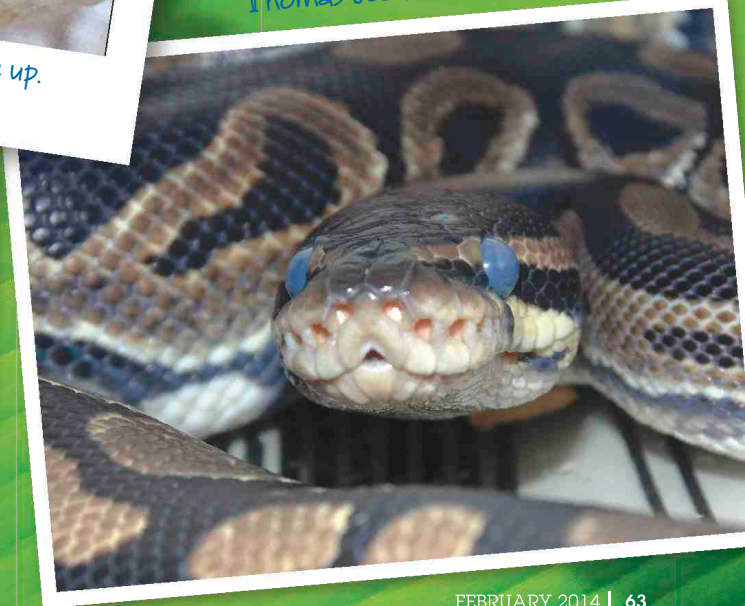
Cyclops, the green tree python. From Jake.



Albie the bearded dragon in close up. Sent in by Jackie.

▼ Daniel and Claire's ball (royal) python, about to shed. He is named Thomas because he moves like a train!

Sid, a rescue Argus monitor, watching the world go by. Sent in by Matt from Rushden in Northamptonshire.



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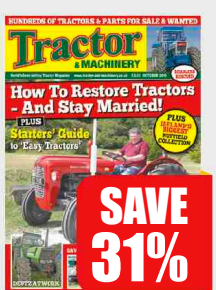

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UNDERRATED SKINKS

Christian Castille profiles one of his favourite groups of lizards, and explains just why they deserve to be more popular, rather than largely overlooked as tends to be the case today, compared with other groups of lizard.

ON SALE ✦ ON SALE
Tuesday, February 4th
ON SALE ✦ ON SALE

In the March Practical Reptile Keeping issue

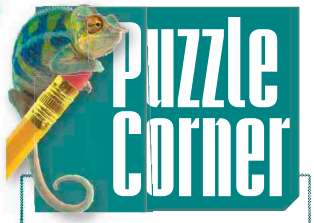
REEVE'S TURTLE

This attractive species is becoming more widely available. Find out about these personable turtles and why they can be recommended if you are seeking a turtle as a pet.

Photo courtesy Adam Singleton/Monkfield Nutrition.

ALL ABOARD!

An exclusive interview with Dr Mike Leahy about his television work, his travels and his latest Zoo Bus project, introducing the fascinating world of reptiles, amphibians and invertebrates to a new generation at close quarters.



Puzzle Corner

THE ONE AND ONLY
SOLUTION: WHITE'S AND DUMPY

THE LINKS
SOLUTION: ALL THE WORDS HIDE SNAKES BODICES, MOCKINGLY, NARRATIVE, SCORNFUL AND STREET.

CAN YOU RECOGNISE THESE REPTILES?
CLOCKWISE, FROM TOP LEFT: CROCODILE; LEOPARD GECKO; GREEN IGUANA AND LEOPARD GECKO

SNAKES UP-CLOSE
SOLUTION: 1. TRANS-PECOS RAT SNAKE
2. CORN SNAKE
3. YELLOW ANACONDA

TWO OF A KIND
SOLUTION: LEOPARD AND REDFOOT

PLUS ALL OF OUR REGULAR FEATURES

including veterinary care with Joanna's Casebook, Out of Africa, Herpetological Mysteries, You & Your Reptiles, plus Tales from the Reptile House.

**These are just some of the features planned for the next issue but circumstances outside our control may force last-minute changes. If this happens, we will substitute items of equal or greater interest.*

***Practical Reptile Keeping* and the Pet Advertising Advisory Group recommend that if you decide to buy a reptile or amphibian, you should:-**

- **RESEARCH BEFORE YOU BUY.** Be sure you fully understand and appreciate the needs of the reptile or amphibian you are interested in, and that you can provide a suitable environment.
- **SEEK ADVICE FROM BOOKS,** the internet and your local veterinary practice who may also be able to recommend a suitable expert for additional advice.
- **ENSURE YOU KNOW** what facilities are necessary to provide a suitable environment for the animal – e.g., vivarium, temperature, humidity, light quality etc..
- **ENSURE YOU BUY** from someone who specialises in the animal you are interested in.
- **VISIT THE ANIMAL** you are intending to buy.
- **CHECK THAT THE ANIMAL'S** accommodation is clean, it is supplied with the appropriate food and water, and that special equipment for maintaining the animal's environment (e.g., heat lamps or UV lights, etc) is working properly.
- **ENSURE THAT ALL RELEVANT PAPERWORK IS AVAILABLE FOR INSPECTION WHEN YOU VISIT.** This could include any necessary permits such as CITES registration documents, Dangerous Wild Animals Licence or other documentation.
- **IF ANY PAPERWORK IS UNAVAILABLE** and has to be sent on, obtain a written commitment as to when it will be delivered.
- **ENSURE THAT THE ANIMAL YOU ARE BUYING** is healthy and free from signs of injury or disease.
- **REMEMBER THAT SOME REPTILES CAN GROW VERY LARGE** and some species can live for 50 years or more. Veterinary care can be very expensive.

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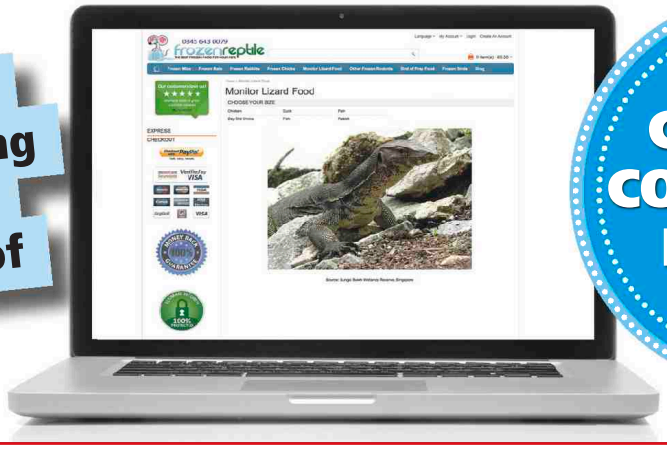

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