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VOLUME 9 NUMBER 6

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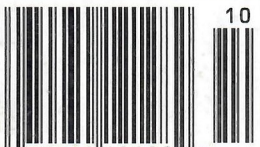


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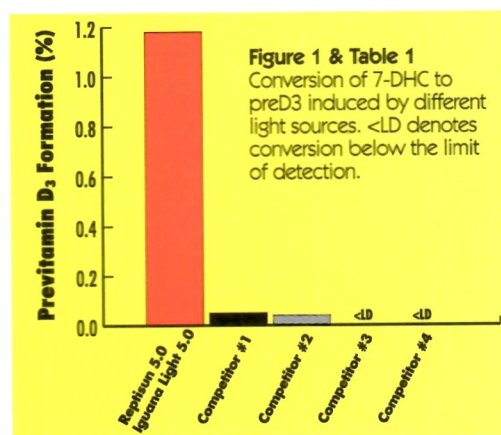
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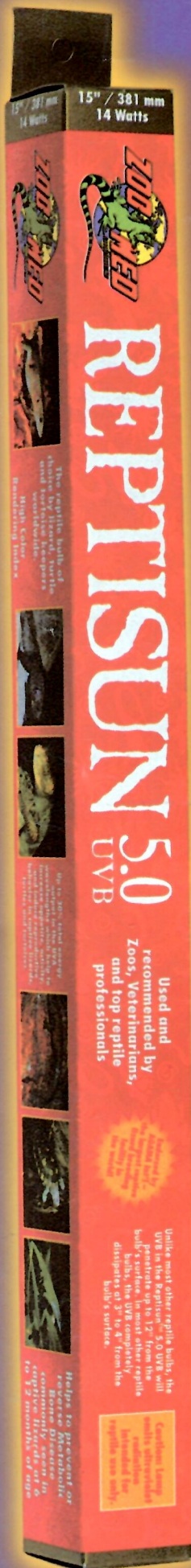
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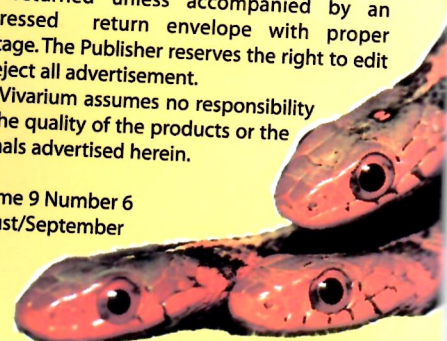
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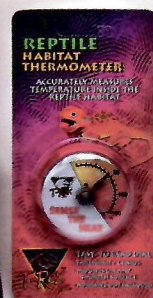
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Male Jackson's Chameleon

HAWAII'S WAR ON HERPS

Jackson's chameleons (*Chamaeleo jacksonii*) in Hawaii stand at risk. None are to be exported and efforts may be made to destroy any that can be captured

by *The Vivarium* staff

How would you describe a Jackson's chameleon (*Chamaeleo jacksonii*)? These lovely and graceful lizards have been described as hardy pets, providing superior chameleon-keeping experiences for both novice and advanced herpetoculturists.

Now Jackson's and most other reptiles and amphibians that have become established in the Hawaiian Islands over the past 100 years have a new tag - they've been listed by state officials in Hawaii as "potentially harmful pest animals," as reported by the Honolulu *Star-Bulletin* (July 15, 1998). Moreover, export of Jackson's and other herps to the mainland U.S. will now require a permit from Hawaii's Department of Land and Natural Resources; these permits will be "almost impossible to get," according to the article.

Jackson's as "Outlaws"

How did it come to this? Jackson's are non-native to Hawaii but have become well established and widespread on several of the main islands, especially on Oahu and Maui. They are the descendants of several dozen which were legally brought in under permit by a pet shop owner in 1972. The resulting wild populations are the source of most of the Jackson's now kept as pets on the U.S. mainland.

Paul Conry, a state wildlife biologist, gives a rationale for the new regulations in the Honolulu *Star-Bulletin*: "We're trying to take away the economic incentives in the pet trade." Conry goes on to state that individuals might release Jackson's to

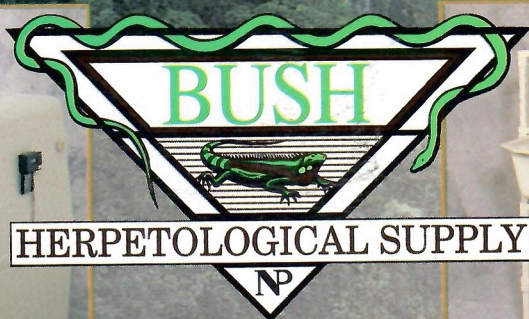


Female Jackson's Chameleon

create "wild populations... [that individuals] can ranch and sell for exports." Paul, there are hundreds of thousands of these lizards scattered throughout secondary vegetation on Oahu and tens of thousands living in disturbed habitat on Maui. Why would anyone in Hawaii want to go to all the trouble and expense of raising them when they can easily go out and collect as many as they like?

Prior to the arrival of Polynesians, Hawaii was a chain of islands devoid of many of the resources that would allow for the sustained survival of humans. It would have had little tourist appeal, and its unique, but overall rather impoverished fauna and flora could have remained as island relics, evolving into the future to achieve through adaptive radiation what insular isolation accomplishes.

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Photo by Bill Love

The green and black poison frog (*Dendrobates auratus*) was purposely introduced in Hawaii by state wildlife officials to fight mosquitos over 65 years ago. This beautiful creature has certainly added to the Hawaiian experience and its effect on insect fauna has not had a negative consequence. It would be understandable if Hawaii had just decided to consider several large anurans as injurious considering the ecological harm that can be caused by *Bufo marinus* after being introduced to Australia.



The green anole (*Anolis carolinensis*) is another species found mostly in lowland landscapes and, like day geckos, is a nice addition and relief to the fauna that would otherwise characterize lowland suburban areas of Hawaii.



Photo by Bill Love

Hawaiian state officials have declared that day geckos, *Phelsuma* spp., (two species occur in low density, entirely on human landscapes and feed virtually exclusively on a plethora of introduced insects and nectar from introduced backyard plants) are injurious to Hawaiian wildlife. This is a conclusion which lacks validity and supporting scientific data. Indeed, Hawaii's human residents have much to gain from the enjoyment of colorful lizards in their gardens, and the long term cultural, touristic and economic benefits are significant. If the same mentality was applied to introduced plants, the Hawaiian economy would crash — and deservedly so.

The local, touristic and economic appeal of Hawaii is, for the most part, the result of introduced species — the guava juice (from the West Indies, and Central and South America) served en route to the islands by the airlines; the flower lei of plumeria and orchids (from Mexico, Central and South America) placed around the necks of tourists as they disembark their planes; pineapples (Brazil); papayas (Colombia); mangos (India and Malaysia); other orchids (many countries); most of the palms and other lush green vegetation that imparts the feel of a tropical paradise. In fact, more than 4,500 species of non-native flowers, shrubs and trees have been planted in Hawaii and over 160 species of birds have been brought in and purposely released in the islands just since 1790.

The Legacy of Hawaiian Jackson's

The appeal of Jackson's chameleons is undeniable. To have chameleons within access of human observation

and part of human culture can only enrich our lives. Those intent on listing chameleons as "harmful pest animals" make unproven claims that the lizards pose a threat to native snails, fruit flies, and birds. The absurdity of claiming Jackson's chameleons having an impact on birds because they supposedly eat nestlings (which is entirely untrue)

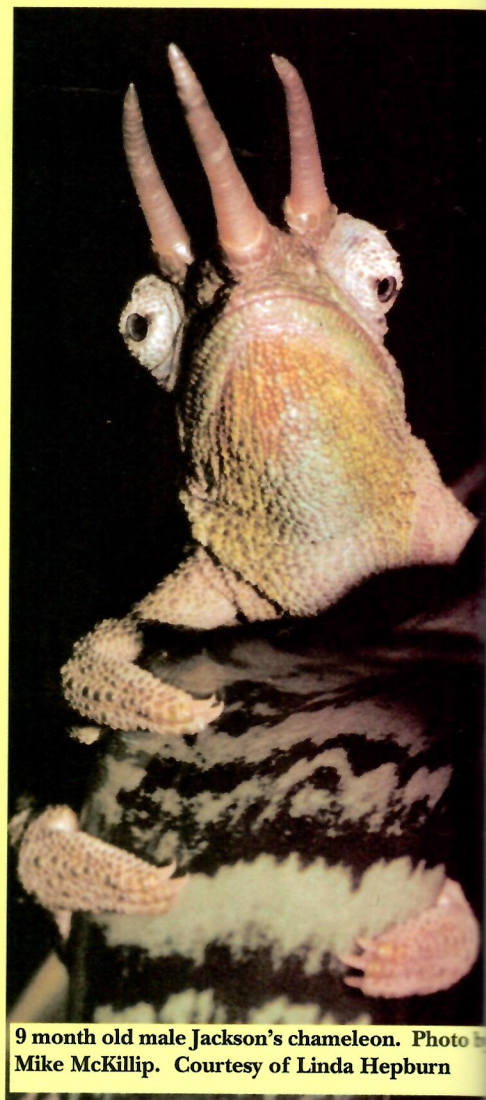
should be obvious to all. Most of the introduced lizards and small frogs live at low elevation in people's yards and feed on introduced insects including cockroaches, grasshoppers, and mosquitos — which is why the state officials purposely introduced herps to Hawaii between 1890–1950 in the first place.

The very real threat of the highly injurious very unreptile-like brown tree snake (*Boiga irregularis*) becoming established in Hawaii after destroying most of Guam's bird and other vertebrate fauna, has justifiably caused a panic. Seven of these snakes have arrived with cargo from Guam in Hawaii during the past 20 years but, fortunately, all have been apprehended and destroyed. Sensible programs such as better inspection procedures of freight leaving Guam and the use of sniffer dogs have been developed through the initiative and cooperation of a number of knowledgeable individu-

als and several federal and state government agencies. These have improved the odds but not eliminated this very real threat. [Brown tree snakes came to Guam as stowaways on military equipment transferred from New Guinea following World War II.]

The fear of brown tree snakes destroying Hawaii's fauna has created an atmo-

Continued on page 17



9 month old male Jackson's chameleon. Photo by Mike McKillip. Courtesy of Linda Hepburn

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Flame

A Variation on



A glimpse of a future breeding project: The "crimson" garter. Pictured here is a nine month old female (*Thamnophis s. sirtalis*)

In this boid-crazed age in the evolution of herpetoculture in America, garter snakes, *Thamnophis*, especially *T. sirtalis*, have pretty much laid solid claim to the title of "beginner" snake of wild origin, the corn snake having garnered the parallel status for captive-bred stock. Being still relatively abundant over much of the continental United States and Canada, garter snakes are often considered too common to bother breeding in captivity, or too drab to merit a second glance. But one need only to scan the pages of a field guide to notice that some subspecies are quite handsome in their own right, with their gaudy yellow, orange, blue or red stripes, spots or blotches. In

fact, these North American natricines stand out, aesthetically speaking, when compared to most other groups of similarly sized diurnal snakes throughout the globe. These looks have not escaped the attention of our European colleagues, amongst whom the popularity of garters has long been established. There are even specialized garter snake clubs in countries such as the Netherlands and Germany. And the immense variability of most species insures that some colorful variant populations crop up here and there across the continent, waiting to be discovered by some field-tripping herper.

This article focuses on one such vari-

ant, an erythristic population of the eastern garter snake hailing from southern Quebec in Canada, and perhaps the nicest morph of *T. sirtalis* east of San Francisco.

Description

This morph of *Thamnophis s. sirtalis* sports a bright orange to red hue on the lateral stripes (mainly scale rows two and three). However, on many specimens the erythristic pigmentation invades everything below the stripe, including the belly, and also the labial scales and the vertebral stripe at the nape of the neck. Extreme examples even show pigment suffusion over the entire head, and over the brown or

Garters an Old Theme

BY PHILIPPE BLAIS, M.D. ALL PHOTOS BY AUTHOR UNLESS OTHERWISE NOTED.

black/white checkerboard pattern between the stripes, giving that area of the body a purplish shade.

Such specimens originate mainly from the Montreal vicinity, but isolated pockets occur all over southern Quebec and adjacent upstate New York. Only a certain percentage of the specimens from each local population exhibit any amount of red pigment, most of those being only faintly colored.

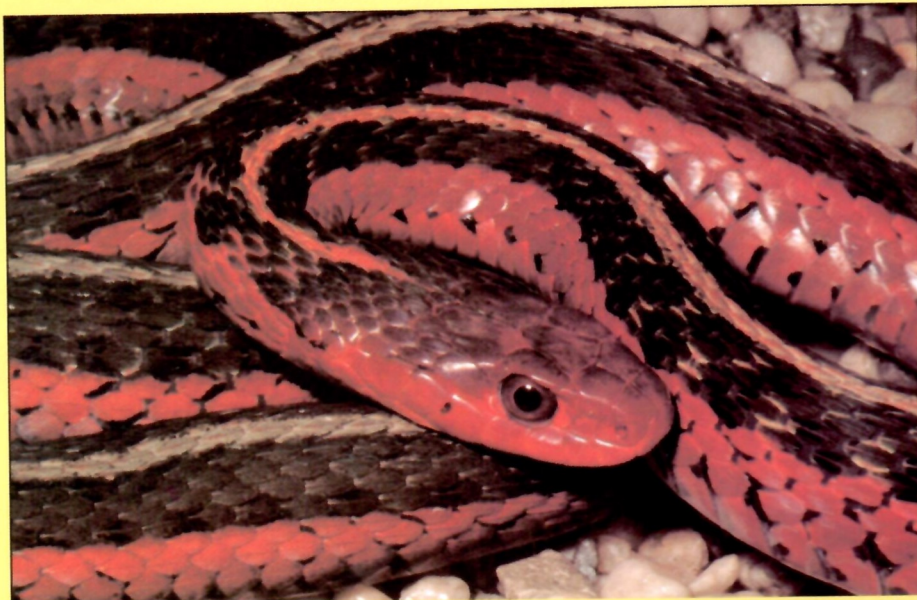
The intensity of the erythristic pigment undergoes a significant ontogenic increase over at least the first two years of life, newborns being only shadows of their future selves. The least pigmented specimens often do not start showing any hint of orange before their fourth or fifth sheds. Following the same principle, many individuals that start out orangish, eventually turn apple-red in their second year as pigment density in the skin increases.

Moreover, Montreal-area specimens often harbor a recessive gene for axanthism (absence of yellow pigment), as proven by the regular occurrence of such specimens in their litters. These animals are a bright peach or salmon color instead of the usual red.

In Captivity

Housing - Standard ten to 20 gallon (38-76 l) terraria seem well suited for these active snakes, if only for the fact that garters prefer a spotlight to bask under. Animals kept in the relative darkness of plastic shoebox stacking systems usually fare well, but this kind of housing tends to render a finicky eater even more fussy or nervous.

Flame garters definitely thrive best in



An unusual red-headed female captured near the city of Roujn in northwestern Quebec. *Thamnophis s. sirtalis*



Young male with the usual blurry black stripe. *Thamnophis s. sirtalis*

a set-up that allows thermoregulation. Temperature within enclosures should range from the low 70s° F (21–23°C) to no more than 85° F (29°C), with a gradient. Night temperature in such a set-up is easily lowered by shutting off the basking light. Although arguably preferable, UV lighting seems optional for these serpents, as are ground heating devices.

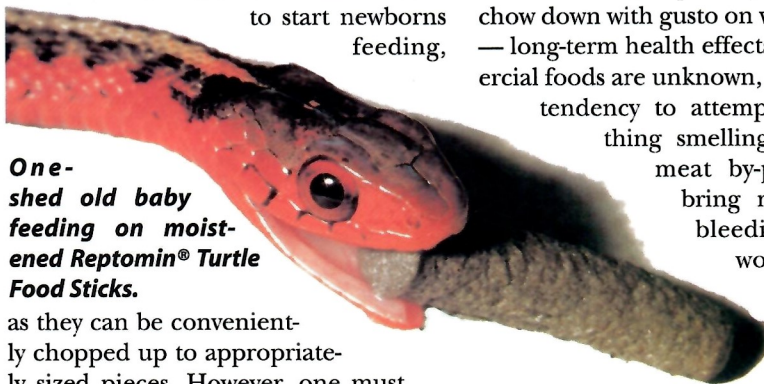
Substrate - These greedy eaters need an easily cleaned bedding, for they are proportionately prolific defecators. A rodent diet greatly improves the watery stool problem, and *de facto*, the cage cleaning problem.

Personally, I prefer triple thickness newspaper, even if it's probably the least aesthetic choice. Apart from easy replacement, the main advantage of a whole newspaper substrate is that stool consistency is readily observable, enabling the keeper to spot pathological feces right away, something of a challenge when using a particulate substrate such as wood shavings or aspen.

Feeding - Most specimens eagerly consume the usual *Thamnophis* fare of earthworms, fish and anurans. In captivity, a few wild-caught individuals stubbornly refuse any coaxing toward a rodent diet, but most eventually will accept it over time. A reliable way of achieving this is to offer the snake a fresh, humanely killed, nestling rodent which has been cut in half, presented bloody end first. It's gruesome, but works amazingly well. Unaccustomed snakes seem to find fur

other instrument and presenting that end to the snake. Captive-born snakes, however, invariably transfer readily to rodents, with minimal worm or fish scenting.

Worms are most useful to start newborns feeding,



One-shed old baby feeding on moistened Reptomin® Turtle Food Sticks.

as they can be conveniently chopped up to appropriately sized pieces. However, one must be alert to any decrease in appetite with such a diet, since worms purchased at bait shops are sometimes held in substrate that can render the worms toxic to neonates, a situation that can swiftly bring on sudden death. Also, I know of at least one instance where a young juvenile died suddenly overnight from swallowing an apparently too big, first-time pinkie, so caution is warranted when choosing meal size (Rodrigue, pers. comm.).

If using fish as a main foodstuff, one must avoid feeding mostly *thawed* fish, unless a thiamin (vitamin B₁) supplement is added, as fast growing juveniles will start showing signs of thiamin deficiency (restlessness, stargazing, head-tilt, corkscrewing, and blindness) rather suddenly, after as little as two or three months of such an exclusive diet.

Boiling fish prior to feeding snakes, as often recommended in literature concerning this problem, is too messy and time consuming in my experience, but is in vogue in Europe.

Besides, thiamin is available at any drugstore, making supplementation much more convenient. Such supplementation can be done by dipping the food morsel in a powder of crushed pills.

Garters are well known for their propensity to adapt to rather unorthodox food items in captivity, and flame garters are no exception. Many of my captive-reared juvies have fed on Reptomin® turtle foodsticks and most of the adults, especially females, will chow down with gusto on wet dog kibble — long-term health effects of such commercial foods are unknown, however. This tendency to attempt to eat anything smelling remotely of meat by-products can bring many a small bleeding puncture wound to a keeper's hand, for captives

held in small groups tend to go "gaga" at feeding time. Therefore, to avoid intraspecific injuries, individuals should be fed separately, and their chins wiped clean of any "gravy" before reintroduction to communal quarters. Also, gravid females approaching parturition should be isolated, since cannibalism by cagemates on newborns still in their birth membranes is commonplace. [To add insult to injury, such meals are frequently up-chucked a day or two later, a sign of their apparent indigestibility.]

Fully grown adults can be fed every five to seven days, but babies and juveniles should be fed at least every two to three days, preferably daily.

Sociability - Ideally, each snake should be kept singly, especially for contagious disease control. However, keeping garters in small communal groups adds an interesting dimension to snake watching. Indeed, these snakes seem to exhibit a hint of social interaction not usually observed with other colubrids. They show a distinct propensity to *pile up* on each other, even when there is no obvious reason (such as thermoregulation) for them to congregate all in the same corner of the cage.

An even more compelling "social" behavior is what I refer to as the *hello twitch*: often times an individual snake will exhibit a light but obvious twitching movement of the neck in rapid staccato fashion upon coming into contact with another cagemate. This is much more pronounced when encountering a just-introduced animal, and seems unrelat-



Most specimens adapt readily to eating thawed rodents

quite unpalatable, so "jumpers" and older mice are inappropriate for first-time tryouts. If there is no other choice but mature rodents to offer at the time, another practical trick is to "scalp" a dead mouse by pinching off the skin on the head with a clamp or

ed to the respective sex of the animals that meet. This behavior rarely elicits a response from the "twitchee" and lasts only a second or two. I have yet to come upon anything relative to this type of behavior in the scientific literature.

Another amusing behavior is when animals are fed in groups. When a cage-mate approaches too close to an animal that is feeding, the latter animal will often flee to a remote corner of the

Males - For spring breeding, males use sperm which had been stocked in their vas deferens from the previous summer's gonadal production, a strategy that effectively allows them to copulate immediately after brumation. The males replenish their sperm stocks during the next three to four months, for use the following spring (refer to an excellent article on snake reproductive physiology by Crews in *Scientific American*

traditional sites. At one such gravid female "summer spa" I've been visiting for the last five years, I've recaptured at least three previously observed females in different years. They seem to leave these rookeries just prior to parturition, since no young have ever been found there.

The area of the "summer spa" is approximately the size of an average living room, and by gross estimate at least fifty females visit in any given year. Very few males or juveniles are found in the area.

The animals' daily routine consists of emerging in the morning from a small, very inconspicuous hole under a road-side man-made cement structure only to come back to enter it in late afternoon. Much basking takes place near the entrance around these hours, but snakes are rarely observed in the area at mid-day. This documented behavior has also been observed in other snakes, notably timber rattlers (*Crotalus horridus*), and would be interesting to



Pair of axanthic flames courting (*T. s. sirtalis*) photo by Don Pogue ©1998

cage, prey in mouth, in order to swallow in peace. I sometimes think my garters behave more like lizards than snakes.

Naturalized vivaria - Since garters in captivity often climb cage furnishings to bask or simply rest, these diurnal snakes offer their keeper the opportunity to set them up in a naturalized vivarium with rocks, branches and live plants. Unlike milk snakes and kingsnakes that might invariably hide all day in such terraria, garters can be viewed moving about or draped on the scenery in the open during the daytime hours, allowing viewers the pleasure of observing their serpents in appealing surroundings. The small size of these snakes makes it possible to use many plant species that would be otherwise crushed by larger colubrids. The only drawback for this option is obviously the potential for laborious maintenance, but it is well worth the effort if one keeps only a few specimens.

Life Cycle

Wild specimens usually retire to their dens in early October, only to emerge in mid-April, some two or three weeks before the last snows vanish in southern Quebec. Mating then takes place, mainly at the den site right after emergence, as "mating balls" form around receptive females in a less spectacular version of the notorious Manitoba snake pit phenomenon (implicating *T. s. parietalis*).

47:158-171, November 1982). This leads to a "window of fertility" lasting



Birth of axanthic neonate (note nearby slug).

from about three weeks after emergence until new sperm is restocked some three months later. During this reloading period, males do not show any libidinous slowdown and still mate readily, with often dismal breeding results, such as the dreaded *bucket-o-slugs*.

Females - After mating, the females disperse to migrate to their feeding grounds, but may loosely congregate again in late June until parturition (three to four weeks later) at specific

study in better detail, since social inclinations in snakes outside of breeding or brumation aggregations are such rare occurrences.

Breeding

Captive-raised males can reach sexual maturity as early as nine months of age, while most females can breed at 18 months. Some females, however, will not breed until a year older, even if they

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Lizards in The Land of Enchantment

A Visit with Bruce Elfstrom

by
Randall L. Gray

My wife Anna and I have a long drive through west Texas to reach our destination in Arizona. The immensity of Texas can be frustrating for those who measure traveling progress by the number of state lines they cross in a day. But if you focus your attention on the landscape and its natural history, the drive can be a treat.

We presently live in north central Texas where the west and east meet. Near our home you can find mesquite trees intermingling with pecans, hackberries and eastern oaks. You can see road runners chasing anole lizards (*Anolis* sp.) and at night ringtail cats and western diamondback rattlesnakes (*Crotalus atrox*) prowl the area with cottonmouths (*Agkistrodon piscivorus*), copperheads (*A. contortrix*) and armadillos. As we drive west, the eastern species disappear and western species, such as the gray-banded kingsnake (*Lampropeltis alterna*) and Trans-Pecos ratsnake (*Elaphe subocularis*), can be found. The species found along the route are a function of geography and climate. For example, as we head west the rainfall decreases and the vegetation slowly changes into Chichuan desert which support different communities of plants and animals.

A day's drive is behind us and we are almost to El Paso. To the south are rugged mountains and I wonder if gray banded kingsnakes can be found in the



Adult male "banana" spiny-tailed, (*Ctenosaura pectinata*)
Photo by Bruce Elfstrom

rocky talus slopes. My mind then drifts, asking why chuckwallas (*Sauromalus obesus*) are not found this far east. There is always enough to keep the mind of a naturalist occupied, and always amazement at those who say the drive is boring and the country desolate.

Unfortunately, most travelers on Interstate 10 are not thinking about snakes or lizards, nor most things biological. They are only in a hurry to make their destination and give little notice to the surrounding landscape. Many years ago I taught a course in wildlife management at a community college where I asked my students to keep a list of the birds observed each day while they were driving to campus or work. When the exercise was over, most students were amazed at how many different birds they had observed along the road. Of course this was nothing unusual, it was just the first time they really looked. What a pity most travelers don't observe their natural surroundings. Their lives would be enriched and maybe they would help to slow the loss of wildlands which support the biodiversity that most naturalists

and herpetoculturists spend a lifetime exploring.

Visiting Bruce

On this trip to southeast Arizona, I have made arrangements to visit Bruce Elfstrom in southern New Mexico. Bruce has a reputation as an expert on the husbandry of spiny-tailed iguanas, genus *Ctenosaura*. These large lizards range from northern Mexico south through Central America. Since Bruce has lizards as well as the good sense to live in the *Land of Enchantment*, he is definitely a person I want to meet.

I first saw Bruce's name on the internet, where he was sharing information on the care of spiny-tailed iguanas. I also noted that he was planning a trip to southern Mexico to seek Yucatan spiny-tailed iguanas (*Ctenosaura defensor*), a relatively small and colorful lizard which is seldom seen in this country. I knew then that our paths would cross eventually.

We arrive at Bruce's adobe house and immediately feel the ambiance of the classic southwestern architecture. The



Bruce is doing is doctoral research on the demographics and evolution of *Ctenosaura hemilopha macrolopha* in northern Mexico (Photo by Bruce Elfstrom)



Ctenosaura similis from Costa Rica (Photo by Randall Gray)



Bruce Elfstrom shows off his *Ctenosaura palearis* (Photo by Kacey Elfstrom)

house is surrounded by an adobe wall which gives privacy to the house and yard. Bruce greets us at the door and we move inside where his wife Kacey joins us in the living room. As we visit, I notice that their house is decorated with various forms of lizard art.

Early years - Bruce was originally from Connecticut, and spent several years living overseas. His mother, a journalist, was stationed in Beirut, Lebanon and worked for the United Nations. Bruce's dad, a documentary film maker who

worked for National Geographic, the Smithsonian Institute, and other organizations, provided Bruce the opportunities to visit Europe, Central America, and the Middle East.

After graduating high school, Bruce went on to college but could not focus on his studies, so he dropped out and became a logger in northeast Maine. While in Maine, he was arrested for owning an adult Burmese python. The arrest changed his life for the better. While visiting his confiscated python at the Acadia (ME) Zoological Park, Bruce obtained a job as head keeper of reptiles. His experiences as a keeper motivated him to go back to college and obtain a bachelor of science degree in biology.

Bruce met Kacey while traveling in Africa's Okavongo Delta in Botswana. Kacey, an elementary school teacher, shares Bruce's interest in lizards. In 1993, Bruce and Kacey moved to the southwest United States so Bruce could obtain a masters degree in ecological behavior at New Mexico State University. His master's thesis addressed the behavioral ecology of the tree lizard (*Urosaurus ornatus*). Bruce is now pursuing a doctorate. His dissertation addresses the demographics and evolution of the spiny-tailed iguana (*Ctenosaura hemilopha macrolopha*) in northern Mexico.

The Herp Tour

After getting acquainted, we begin the lizard tour. As we move through their home (or is it a southwestern approach to a herpetarium?), I learn that almost every room in the house has a cage or two filled with lizards. There are enclosures everywhere, even some of the furniture serves as lizard habitat.

A small room off the living area is lined with vivaria. A few larger enclosures are occupied by Mexican spiny-tailed iguanas (*Ctenosaura pectinata*), garobos (*Ctenosaura similis*), three subspecies of Baja spiny-tailed iguanas (*Ctenosaura hemilopha*), and an unusual spiny-tailed iguana (*Ctenosaura palearis*) which has a large dewlap and blue color.

The juvenile Mexican spiny-tailed

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TURTLES AND TORTOISES

CHOOSING A CHELONIAN, PART 2 FINDING THE RIGHT TORTOISE

by Susan Donoghue and Sean McKeown.
Photos by Sean McKeown.

So you want to buy a tortoise. Which species is best for you? That depends on factors such as climate, space, time and budget constraints. In the previous issue (*The Vivarium* 9.5), we introduced some of the easier to keep, more readily available types of hatchling tortoises offered for sale in shows and expos, and by private breeders throughout the U.S. Here, we'll cover some of the other forms that are readily available and which, depending on the species, vary markedly in price.

Hinge-backed tortoises of genus *Kinixys* are uniquely appearing chelonians that occur over much of sub-Saharan Africa. They are distinguished by a hinged carapace. Hinge-backs come in two types — those that live in savanna and rocky arid areas, and those that reside in forests.

The Bell's or savanna **hinge-back tortoise**, *Kinixys belliana*, is a wide ranging savanna and savanna-edge species that is still imported into the U.S. in some numbers. There are several distinct subspecies and they come in a variety of color patterns. Several forms are even patternless. Wild-caught adults, usually from west Africa, are offered on retail outlets at extremely reasonable prices. A relatively small number of offspring are also produced by breeders.

Bell's hinge-backs have a curved, elongated carapace, up to about eight to ten inches (20–25 cm) in length. During warmer months of the year, they should be maintained outdoors. They do best if kept in yards that have both heavy planting and open, grassy areas. The portion with shade plants should be moderately moist, and the grassy areas in the enclosure should be kept drier. The goal is to create variety to allow the tortoise to make choices of microhabitat use at different times of the day. If housed in groups, include only one male per enclosure. Bell's hinge-backs are omnivorous, preferring invertebrates such as worms, slugs and snails, as well as grasses, vegetables, ripe fruit, edible flowers and mushrooms.

The **elongated tortoise**, *Indotestudo elongata*, is an inexpensively priced, mid-sized tortoise (up to about 11 inches, or 28 cm) from the grasslands, forest edge, subtropical and tropical forests of India and southern Asia. It frequently has a creamy yellow head and yellow to olive limbs. Males, especially, may have pink areas of skin around the eyes and nostrils. Adults of some populations may be more drab. However, juveniles are typically very attractive.

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A juvenile Bell's hinge-back tortoise (*Kinixys belliana*)



An adult elongated tortoise (*Geochelone elongata*).



Adult Central Asian Steppe tortoise. (*Testudo horsfieldi*)

Hawaii's War on Herps

Continued from page 8

sphere very comparable to the McCarthy era purge of "suspected Communists" on the U.S. mainland during the early 1950s.

Well-meaning, but uninformed State Dept. of Land and Natural Resources officials with heavy pressure from the Bishop Museum entomologists and local eco-extremists have decided since the brown tree snakes are "reptiles," then all reptiles and amphibians must be very, very, bad and now is the chance to declare them all *persona non grata*. One of the real dangers of this is, while Hawaii State officials are out confiscating and destroying local herps, less time will be available for keeping out brown tree snakes.

Mankind, of course, is responsible for most of the damage to Hawaii's fragile ecosystems and endemic animals including the 20+ species of now largely endangered Hawaiian honeycreepers.

The first Polynesians arrived from Tahiti about 1,500 years ago. They brought a variety of introduced animals with them including pigs, chickens, dogs, Polynesian rats and four geckos and three skinks in their remarkable open ocean voyaging canoes. They soon totally transformed the lowland areas on all the main islands and used the native birds for food and cultural ornamentation. This resulted in the first great wave of bird extinctions from the Hawaiian Islands. After discovery by Captain James Cook, the sailing ships that followed brought more non-native animals including brown and black rats, cats, goats and mosquitos, the latter of which were capable of spreading avian malaria which further devastated native wildlife. During the American period, huge tracts of land were clear cut or burned and replanted with pineapple and sugarcane, or grazed with livestock; areas in which native birds and insects used to live.

So today, with a human population of well over a million, high rise hotels, condos and big-time agriculture, plus avian disease from introduced birds, Hawaii's endemic birds remain only at mid and high elevation in pockets of native vegetation. In addition to the native birds, there are many endemic species of fruit flies, land snails and happy face spiders and a great many entomologists on the islands studying these invertebrates. Happy face spiders live deep in lava tubes where no self-respecting lizard or frog would go. The land snails are active at night when the potentially predatory lizards are sleeping. The endemic fruit flies have wings and, for the most part, can easily avoid the odd reptile that ventures into their habitat.

Yes, it would be nice to go back in time 1,500+ years before Hawaii was discovered by humans, but that is not possible. Yes, some local Hawaiian purists think it would be nice to send

all of Hawaii's human inhabitants back to every area of the globe where they came from and dynamite and bulldoze their skyscrapers, houses and burn all the sugarcane, pineapple, orchids, macadamia nuts and other crops, but that is hardly practical or desirable. So what's left?

What's left is keeping out legitimately injurious "super-tramp" species of animals including mongooses, bulbuls and brown tree snakes and properly managing Hawaii's remaining endemics. It certainly wouldn't hurt to slow down Hawaii's tremendous human growth and to better protect the natural areas that still remain from the onslaught of large scale development.

Harmless species of fully established amphibians and reptiles, many brought in years ago by the Hawaiian government or on permits, and a few as escaped pets should be treated in a live-let live manner just like the majority of the thousands of species of non-native exotic vegetation including a vast array of flowering plants. Many non-injurious types of introduced birds including barred doves, red crested cardinals, Kentucky cardinals and shama thrushes are looked at in a positive way by Hawaii's residents. Benign species of existing introduced amphibians and reptiles should be afforded the same courtesies. Calling the overwhelming bulk of Hawaii's plants and wildlife "alien species" is overly simplistic.

The state agencies need to redirect and focus resources on keeping brown tree snakes out of Hawaii because, if they do become established, brown tree snakes will eat **everything** (native and non-native) that's there now. Call off the Commie witch hunts on unrelated, established herps — eh brah? Let's hang loose a little!

So, who is responsible for this new law? According to state officials, this warped vision of a "reptile-free Hawaii" is the brain child of one Fred Krause, a relatively recently appointed mid-level "wildlife specialist" employed by the Hawaii Department of Land and Natural Resources. It is Fred Krause who is responsible for designating most of Hawaii's land and semi-aquatic reptiles as "potentially injurious wildlife."

If you disagree with Mr Krause's designation for Hawaii's established herpetofauna and believe these new listings

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MADAGASCAR:

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Travel with the **CHAMELEON information Network** to the wilds of MADAGASCAR in search of chameleons in this 110 minute video [VHS, NTSC]. You will see sixteen species of chameleons and eighteen color variants of the Panther chameleon are represented! We also recorded many species of lemurs, snakes, geckos, lizards and lots of insects. Witness the grandeur of some of the last remnants of the eastern and northern rainforests and the beauty of the protected lands that still echo the Madagascar of long ago.



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Herp News from Around the World by Ellin Beltz

Indiana targets animal-traffickers

After realizing that its native wildlife was essentially unprotected and exploitable, the state of Indiana enacted an emergency rule forbidding the sale of native amphibians and reptiles in January. *The Courier-Journal* reports that two people in Clark County were arrested on charges of unlawful shipment or sale of live animals and six counts of possession of state endangered animals. A snapping turtle and five alligator snappers were seized from one location, 19 Blandings turtles, spotted turtles and ornamental box turtles were seized from the other man. In addition, conservation officers arrested, cited or served warrants on more than 25 other people in the state, while in Indianapolis, the Midwest Swap meet was shut down. Two bog turtles were among the animals seized in that action. In addition, 13 other states cooperated and people were arrested, cited or served with buying or selling reptiles and amphibians from Indiana. [June 29, 1998 from Gary Kettinger].

Wine warning

The Pietersburg, South Africa *Mail and Guardian* reports that some mechanical harvesting devices in use in some vineyards in the Western Cape are incidentally killing chameleons. The President of the Western Cape Traditional Doctors, Herbalists and Spiritual Healer's Association said that wine contaminated by chameleons is poisonous to humans. Residents, students and members of the Food and Allied Workers' Union planned to picket outside a winery which uses the imported mechanical harvesters instead of local labor. The protest leader said, "Cape dwarf chameleons are among the species being decimated by the harvesters. They are listed on Appendix II by CITES... Quite apart from anything else, chameleons are of benefit to the vineyards in term of insect control, so they should be nurtured rather than wiped out." [February 20-26, 1998 from Harold Lemke].

Secret agent snake?

A 53-year-old man in rural Burrton, Kansas was bitten by a rattlesnake while mowing his yard. When the story and his picture were published in a Hutchinson newspaper, law enforcement officers recognized him. Seems he'd blown a court date on various charges. He now has a new court date on charges of driving under the influence of alcohol, suspended license and illegal transportation of liquor. [United Press International wire, May 19, 1998 from Kim and Wes von Papineau].

Welcome back

• About six years ago "Bubble" the sea turtle was hit by a boat propeller and an air bubble got trapped under his shell, and he couldn't make long dives for food. Judged to be unable to survive in the wild, he was kept at the Marathon Turtle Hospital in Florida until he disappeared. A reward was offered, but it was feared someone copying the movie "Free Willy" had put the turtle in the ocean in a misguided effort to "set him free." Volunteers and staff who had been hand-feeding Bubble every day for years were devastated. [*Miami Herald*, April 10, 1998]. The same paper on May 7 reports that the animal was spotted struggling at the seashore of Vaca Cut by two turtle volunteers, was rescued by the Turtle Ambulance and returned to the hospital. [both from Alan Rigerman].

• Two Kemp's ridleys turtles were found nesting on Padre Island National Seashore. One of them had a tag showing that it was born in 1984 and was one of the 13,500 headstarted Kemp's ridleys released in the Gulf of Mexico by that popular but closed federal program. [*Amarillo Globe News*, April 27, 1998 from Kim and Wes von Papineau].

The few, the proud, the green

• *The Star*, a tabloid from the United Kingdom, reports: "Frogs eat small pets. Carnivorous amphibian rampage. Giant meat-eating killer frogs have Britain's garden lovers ribbeted with fear... Conservationists warn that pond owners who had bought North American bullfrog tadpoles may have bitten off more than they can chew. Forget Ninja Turtles. These vicious frogs, which grow to be as big as footballs, are the *Tyrannosaurus rex* of the reptile world. They can gobble up pets the size of kittens and guinea pigs... The ferocious cannibals eat snakes, bats and small mammals... [a] nature park warden... said... "We know some have escaped to breed in the wild, devastating ponds and eating everything in sight." [May 28, 1998 from Kim and Wes von Papineau].

• The record jump (in three hops) for the Calaveras County Fair and Jumping Frog Jubilee was 21 feet, 5 inches in 1986. This year's winner sprang a mere 19 feet, 4 inches but beat 2,000 other frogs in the 70th annual event. [*ABC News*, May 18, 1998 from Kim and Wes von Papineau].

• The debate about deformities (natural or unnatural) continues. *The Miami Herald* reports: "... for the record, [a federal biologist in Gainesville, FL] has never seen a frog with a fifth leg or any other deformity and he has handled tens of thousands of them... the federal government logged its first official report of deformed frog in Florida — a southern leopard frog with an extra foreleg — in Jackson County in 1954." The U.S.

Geological Survey collected 15 more reports last year. C. Kenneth Dodd, Jr. who also chairs the Declining Amphibian Task Force in the Southeastern U.S. said, "There's been a tremendous loss of frogs going on in Florida because of the loss of its wetlands. When you pave over all the wetlands, frogs are going to disappear. No mystery in that." [June 22, 1998 from Alan Rigerman].

• Police arrested a Long Island, NY man on charges of selling animal snuff films including scenes of women in high heels stomping frogs and rodents to death. A spokesman for the Suffolk County Society for the Prevention of Cruelty to Animals said that the tapes were intended as a "foot-fetish type of thing." The man was released on \$750 bail and faces "thousands of counts of animal cruelty, each of which can carry up to a \$1,000 fine and a one-year jail sentence," according to *Fox News Network*. [May 5, 1998 from Kim and Wes von Papineau].

• "[A] wildlife conservationist at the University of Florida's Institute of Food and Agricultural services said, 'If someone destroyed a work of art, we would decry the act, and we should be equally upset by the declines we're seeing in frogs and toads.'" [*Sun-Sentinel*, April 17, 1998 from Alan Rigerman].

• People in Oregon either love or hate Pacific treefrogs in breeding season. The warm, wet spring due to the El Niño weather system resulting in lots more frogs breeding in lots more ponds, and lots more people complaining about "the noise." One biologist at the Oregon Department of Fish and Wildlife said, "I can't believe the irony. I mean, here you have residents complaining about this wonderful, musical little native animal that's doing well in spite of us. They're complaining about a success. Some people actually go out and buy CDs just to bring these noises inside their homes." [*The Oregonian*, June 6, 1998 from Kim and Wes von Papineau].

• Meanwhile people in England are concerned that noise from two new nightclubs is bothering the breeding patterns of birds, frogs and small mammals in a London Nature Park. One councilor said, she was "very upset" that the noise made by the young people were a danger to the wildlife, "Frogs and so on make their mating calls at night. High levels of noise obscure their mating calls and they can misunderstand each other, which can cause a decline in the population." Her worries "were greeted with a degree of hilarity among other councilors, who heckled from benches on both sides of the council chamber," according to *The Hamstead and Highgate Express*. However, environmental health officers will be monitoring noise levels. [June 5, 1998 from Kim and Wes von Papineau].

New species

- The Wyoming toad, found in only a small area of Albany County (and in several zoo recovery programs) has been elevated to a full species and is now to be known as *Bufo baxteri*. The specific name honors George Baxter of Laramie who discovered the toad in 1946. [*The Star Tribune*, Caspar, Wyoming, April 3, 1998 from Kim and Wes von Papineau].

- "... For years it was believed frogs on Maud and Stephens Islands in the Marlborough Sound were the same species. But genetic testing has revealed the 10,000 frogs on Maud Island are in fact a separate species. That means that the 300 frogs on Stephens Island are all that remain of the *Leiopelma hamiltoni* species," reports the Christchurch, New Zealand Press. [June 19, 1998 from Kim and Wes von Papineau].

Check your connections today

- "Dozens of fish made the ultimate sacrifice when a smoldering blaze at a pet store was doused by water from an exploding aquarium... heat from an electrical fire shattered its glass... lost [were the] fish, a few birds and some lizards... the fire apparently started in an area behind the fish tank littered with strip plugs and electrical outlets." [Lancaster, PA *New Era*, April 18, 1998 from Michael J. Shrom].

- More than 200 animals died in a fire which burned the Cape May Court House zoo reptile house to the ground. The fire was believed to be electrical in origin. The one-story wood frame building which had housed lizards, snakes, turtles, tortoises and insects was burned to the ground. [*The Sun News*, Myrtle Beach, S.C., May 29, 1998 from Linda A. Hauser].

Deja vu all over again

- "Researchers will monitor loggerhead turtle nests in the Florida Panhandle this summer to further study how temperature determines whether hatchlings are male or female." [*Miami Herald*, June 23, 1998 from Alan Rigerman].

- A 14-year-old Manhattan high school student was bitten by the school's Burmese python while he was trying to feed the snake a mouse. There was no teacher present at the time of the bite. The student was taken to Jacobi Medical Center in the Bronx where he received five stitches and was released. The student said, "I don't think it was the snake's fault, and I don't think it's my fault. It think it just got scared and reacted the way any animal would." [*The New York Times*, April 29, 1998 from Jim and Kathy Bricker].

- The Florida Game and Fresh Water Fish Commission is seeking anyone with information relating to the shooting deaths of eight alligators on Lake Trafford on May 22nd.

Call their hotline at 1-800-432-2046 any time if you know anything about the case. One agent said he believes that "this was simply slaughter for no purpose... a gross act of nature vandalism." Illegally killing a gator in Florida can result in up to five years in jail or a \$5,000 fine if convicted. Florida has a legal gator season for tagholders. [*Immokalee Bulletin*, June 25, 1998 from Alan Rigerman]. Four more alligators were poached, "apparently killed for mere blood sport... in the Big Cypress National Preserve east of Naples," according to *The Miami Herald*. They were shot, but — as in the case in Lake Trafford — nothing was removed from the corpse. Law enforcement agents say that it is not unusual for illegal hunters to remove the skin or tail. [May 29, 1998 from Alan Rigerman].

- A man who has been charged with the same crime six times in the past has been arrested again for stealing 388 sea turtle eggs from Florida beaches. According to *The Miami Herald*, "Marine Patrol officers, using night vision goggles, confiscated 388 marine turtle eggs when they arrested [the man] before dawn... [he] dropped a canvas bag full of eggs and fled into the ocean, but he emerged minutes later... [he] was charged with possession of marine turtle eggs, molesting a marine turtle [by moving her to get at the eggs] and resisting arrest without violence." The man could face three years in jail and up to \$3,000 in criminal penalties as well as up to \$38,300 in civil penalties. Federal charges are also being considered. They carry maximum penalties of five years in jail and a \$10,000 fine. [May 31, 1998 from Alan Rigerman].

- The homeowner wasn't too worried when she ran over one snake with the lawnmower. Then her dog was bitten by another snake which she claims is a "poisonous copperhead," and says that development across the way from her house is shaking so many snakes and rats loose that it's too dangerous to let her children play outside anymore — so instead she lets them play Nintendo all day. [*The Courier Journal*, June 8, 1998 from Gary Ketting].

The shape of things to come?

"A major senate inquiry into commercial use of Australian wildlife is likely to recommend that export controls on native birds and fauna be loosened. The inquiry, due to report later this month, is sure to ignite debate about the best way to control fauna smuggling, as well as the use of kangaroos, opossums and emus for meat. It is likely to recommend that export bans be lifted for the first time, but only for birds and animals which are bred in captivity. Evidence put to the inquiry suggested that captive breeding and overseas breeding could assist conservation by reducing the market for smuggled birds, reptiles and, less often, other animals. Committee chairman John Woodley said the

report had not been completed but would be monumental and controversial. Senator Woodley said the committee was still considering all the evidence but the export question was one of the issues that would be addressed. Export of captive bred animals was being considered. "In terms of evidence we heard, that's the way the argument is going, but at this stage I need to review the evidence" he said. Reptile expert and author of two books on wildlife smuggling, Raymond Hoser, said he would be delighted if the committee recommended that exports be allowed. Mr. Hoser said the best system would be to apply a hefty tax on each animal sent out of Australia to ensure that the trade was kept at a low level. Overseas owners would then look after their exotic Australian animals and attempt to breed them, he said. "The only way to stop the corruption and cruelty is legalizing exports" he said. [Sydney, Australia *The Sun Herald*, July 6, 1998, from Raymond Hoser <adder@smuggled.com>].

Don't drink the water

- Why 54 alligators died in Central Florida's Lake Griffin remains a mystery. "An earlier alligator die-off of this scale in another Florida lake was traced to man-made chemicals that mimic hormones which resulted in underdeveloped genitalia in male alligators. Alligators' position at the top of the food chain makes them a bellwether for contamination." "Alligators are doing things that people don't do," said University of Florida scientist Perran Ross. "I don't know anyone who has been sitting in the bottom of a lake eating fish for 20 years." [*GREENlines* quoting the *St. Petersburg Times*, June 10, 1998 from Roger Featherstone <<http://www.defenders.org/grnhome.html>>]. Additionally, 96 percent of alligator eggs at Lake Griffin have died within ten days of being laid. Four causes are being examined: a blue-green algal bloom, disease, chemical pollution and poor nutrition. [*Miami Herald*, June 8, 1998 from Alan Rigerman].

- "...The National Park Service decided to ban personal watercraft from Washington State's Olympic National Park, citing the need to protect "natural and recreational resources." The Park originally favored limiting the watercraft to portions of Lake Crescent, but after public hearings and over 1,000 comment letters opposing the plan, the Park opted for a ban. "Clearly, any technology that dumps raw fuel into park waterways [and] disrupts the natural state of wildlife... is wholly incompatible with the natural, cultural, and wilderness resource values legally protected under the National Park mission," said a local environmentalist. [*GREENlines*, June 9, 1998 from Roger Featherstone].

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Bruce Elfstrom

iguanas are about a year old and were produced by another herpetoculturist in the Canary Islands. Bruce comments that yellow is beginning to show on them but I do not understand the significance of this comment until later.

Bruce points out that one of the green color morphs of the Mexican spiny-tailed iguana was hatched at his facilities only ten months ago. However, it is already 22 inches (56 cm) long. Bruce indicates that this individual was an exceptionally fast grower.

All of the lizards are housed in spacious enclosures. They are fed a diet of manufactured iguana food and vegetables which Bruce believes accounts for their healthy appearance.

We move into a small greenhouse and planting area attached to the house that has been converted to maintain a pair of attractive green iguanas (*Iguana iguana*). There is a large wooden box filled with moist sand and a hole cut in the side. This provides a site for the female to lay her eggs. We learn that the female has produced fertile eggs which have successfully hatched three years in a row.

I look up on the wall and notice a brown anole (*Anolis sagrei*) and a bark-ing tree frog (*Hyla gratiosa*). These herps are used to control flies and cockroaches. My wife relates how I once introduced a tokay gecko (*Gekko gekko*) into our house to control the crickets which were always escaping. Unfortunately, the tokay's temperament and large mouth caused his employment to be terminated.

When we venture into the studio I notice a cage built adjacent to an outside wall. An opening in the wall allows the resident garobo (*Ctenosaura similis*) to move into an outside area with a vertical tunnel leading to the roof where another cage has been placed. Access to the roof ensures that the garobo can always find a good basking site.

As we move between rooms, I notice an enclosure with a lone male spiny chuckwalla (*Sauromalus hispidus*), a vivarium containing Lesser Antilles anoles (*Anolis bimaculatus*) that have

produced young the last two years, and a sweater box rack containing snakes. The snakes seem so out of place in a facility otherwise housing lizards that I pause and ask Bruce what species he keeps. It turns out that he has a fondness for unusual rat snakes. He keeps Mexican rat snakes (*Elaphe flavirufa*), Central American rat snakes (*Senticolis triaspis mutabilis*), Central American tiger rat snakes (*Spilotes pullatus*), and redtail rat snakes (*Gonyosoma oxycephalum*). Adjacent to the snake cages are two very large walled off areas on the floor which are the winter home for his rhinoceros iguanas (*Cyclura cornuta*) and Cuban rock iguanas (*Cyclura nubi-la*). These lizards, along with many of his spiny-tailed species, are now outside enjoying the summer sun.

In the yard - As we enter the backyard, we are confronted by a number of large enclosures housing spiny-tailed iguanas (*Ctenosaura palearis*, *C. bakeri*, and *C. hemilopha conspicuosa*), rhinoceros iguanas, and Cuban rock iguanas. These lizards aren't small. The rhinos appear more like something out of Jurassic Park. Kacey tells us that on many mornings she looks out the window and observes Bruce with a cup of coffee in hand, sitting among these oversized saurians. These lizards are impressive and Kacey enjoys hand-feeding them edible flowers. As I enter the enclosure, the rhinos take a defensive stand that maximizes their size.

In with the Cuban rock iguanas, I notice a strikingly yellow spiny-tailed iguana. Now I understand why Bruce was quick to note the yellow coloring on the several young *Ctenosaura pectinata* we

saw earlier in the house. These "banana" spiny-tailed iguanas are uncommon and come from an isolated locality in Mexico. Bruce's goal is to establish a breeding group of this beautiful lizard, as well as enlarge his breeding groups of other species.

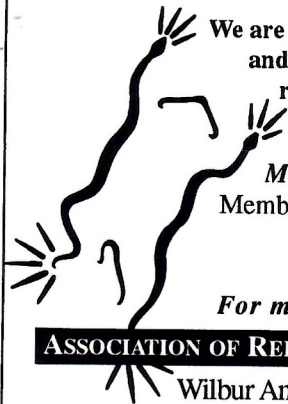
Bruce is working with six species of *Ctenosaura* as well as three subspecies of the *C. hemilopha* group. His efforts are filling a void in the herpetoculture community. We learn that Bruce has already bred four species of spiny-tailed iguanas (*C. pectinata*, *C. palearis*, *C. similis*, and *C. quinquecarinata*). Hopefully his breeding techniques will become widely known and ensure the successful propagation of this genus in captivity in the United States. Bruce is eager to share his information, which is obvious by the papers he has written for the *Journal of the International Iguana Society* (formerly the *Iguana Times*).

As we wander along, Bruce also points out the Greek tortoises (*Testudo greca*) and other chelonians that have free rein within the adobe walls of the enclosed yard.

I notice the time and realize Anna and I must get back on the road. After a New Mexican green chile lunch at a favorite nearby restaurant, we head west. As the mountains of Arizona grow larger ahead of us, I think about how many times I had passed Bruce and Kacey's home and was not aware of kindred spirits who also enjoy the company of lizards. I wonder how many more are out there along Interstate 10.



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Wilbur Amand, VMD, P.O. Box 605, Chester Heights, PA 19017

Flame Garters

Continued from page 13

have attained sizes considerably greater than some of their already breeding wild counterparts. I know of at least one captive female specimen that reached an adult size of over 32 inches (81 cm) in its first thirteen months of life, *without* giving anabolic steroids (Chambers, pers.comm.).

Breeding stock should be off-fed at least two weeks prior to brumation. This pre-brumation period should involve cooler temperatures, in the lower 60's F (16°C). Brumation is most simply accomplished in a refrigerator at about 40° F (4.4°C).

Breeders can all be housed together at this point in a standard plastic container, on newspaper. A large water bowl should be included. Indeed, many individuals will tend to spend much of their fridge time submerged in water. This well known behavior tends to slow down metabolism considerably, an adaptation to long northern winters in all probability.

Duration of brumation can be anywhere from two to four or more months, depending on the breeder's choice, but it is arbitrary since a mere six weeks is sufficient to induce reproductive behavior in most cases.

To end brumation, a 24-hour transition period at intermediate temperatures is all that is needed before bringing them back to their usual quarters. A direct transition can lead to severe head shaking that can last for several weeks or longer, so should be avoided.

Most females will be receptive to mating shortly after brumation has ended. Courtship proceeds in the usual ophidian scheme, although in a more frantic manner.

First-time males may be quite inefficient, often trying to ride the enclosure walls or the water bowl's rim, anything that smells of females (even other males). Once intromission is achieved, females may drag their mates around by their you-know-what throughout copulation, and some seem so annoyed by their suitors by the end of their ten to 15 minute embrace that they resort to bar-

reling around to loosen their cloacal grips. Males are quite adept at avoiding getting snagged in the decor while being forced into such an awkward backward motion.

Some females will only allow copulation after having had a few meals or after their first spring shed. Most females allow only a single copulation per season, but occasionally a female will allow more to take place during the following weeks. Freshly mated females can be easily spotted by the give-away cloacal gaping caused by the bean-shaped cloacal plug left there by the male. This structure has the look and feel of a partially cured silicone glob, persists for a few days, and can be palpated easily.

Parturition can be expected as early as six to seven weeks after the ovulation shed, if females are allowed to bask freely. Gravid females must be able to bask at least during the latter half of their pregnancies, or a high incidence of stillbirths can be expected.

Males seem always eager to mate with any freshly shed female during the remainder of the year, and the odd female may allow this, but only spring matings result in ovogenesis (although this event can be much delayed in the season if a female is ill). In captivity, males kept communally with females are regularly seen courting females at any time. Even gravid females can be subjected to such harassment, oddly enough.

Average-sized adult females can drop anywhere from one to three dozen babies or more. Oddly, captives tend to produce significantly less offspring than similarly sized wild ones, and usually don't look as deflated after giving birth as the latter.

Perhaps captives don't convert their entire fat stores to ova. Differences in diet may also be one of the underlying causes, but research needs to be done for a definitive answer.

Another phenomenon observed in my captive-bred litters is a higher number of runts and malformations (mostly involving the rostrum, jaw or eyes (microphthalmia) and that old standby, the spine). Perhaps this could be related

to an aberrant diet, but artificially high basking temperatures in the first stage of pregnancy could be involved, in my opinion.

Sex ratios of neonates seems to be regularly skewed in favor of males (the herpetoculturist's *Murphy's Law*). Like all live-born babies, they waste no time shedding their first skins as soon as they are free of chorionic membranes.

Most newborns will accept appropriately sized worms or small guppies before their first week of life is over. They should be fed daily or at least every other day if any substantial growth is to take place. The young snakes can be transferred easily to pinky parts after their second shed, sometimes even before their first.

Conclusion

Garter snakes in general possess many of the attributes that make a taxon desirable to beginner herpers as well as advanced hobbyists — manageable size, good temperament, wide-ranging feeding habits, big litters and fast growth. This last quality makes them excellent candidates for fast-paced selective breeding projects aimed at refining certain physically appealing traits.

Few North American species of colubrids offer such a wide range of variations throughout their distribution, not counting a substantial amount of occasional wild-caught freaks such as albino, patternless, melanistic, calico or even scaleless specimens. The blue stripe, spotted, Santa Cruz, Texas and the already popular checkered garter seem to have good potential for select breeding ventures.

I hope that this article might help to coax a few herpetoculturists to turn their attention away from far-away-land exotics long enough to rediscover these neglected backyard gems.

Acknowledgements: I thank Mrs. Carol Thibodeau for so patiently typing my horrible handwriting, my enthusiastic colleagues Don Pogue and David Rodrigue for their precious pictorial contributions, and Dr. Francois Saint-Maurice for bailing me out of my photographic abyss of despair.

Continued on page 29

"ANIMAL TALK"

BY MARK "THE ANIMAL" HONAS

Co-host of "Animal Talk" Radio Show

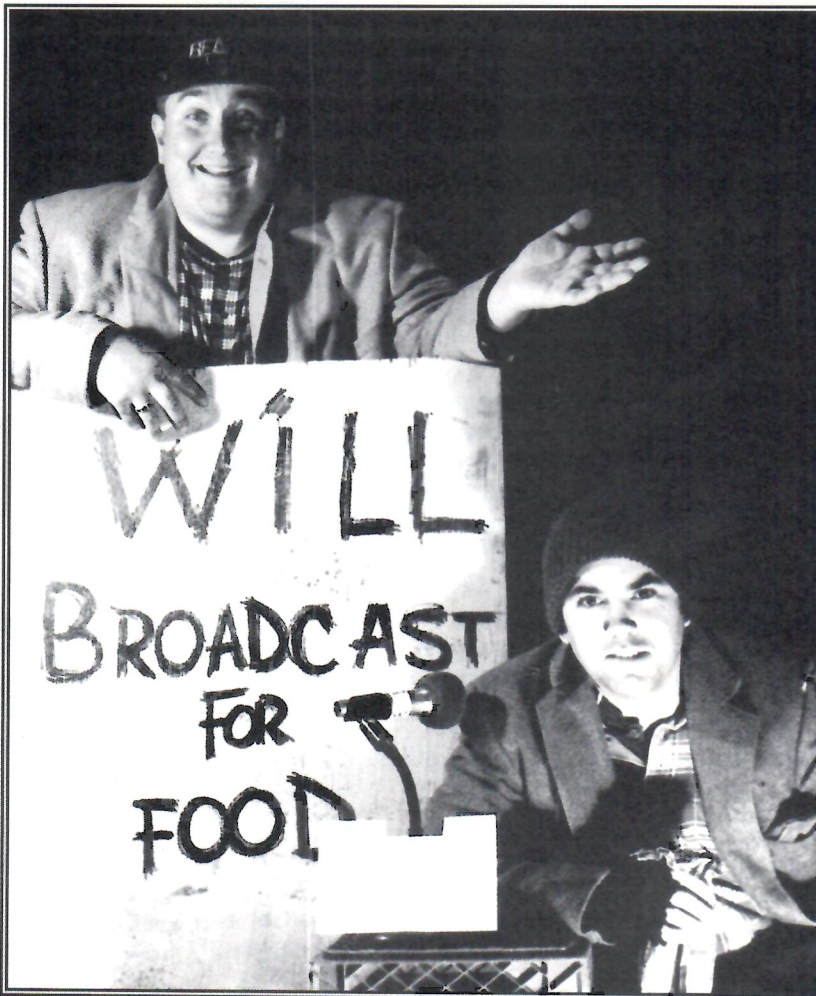
Hello there everyone! I'm the new kid on the block and I just have to say I am extremely happy to be a part of *The Vivarium* family. I am going to take a moment to tell you about myself. I hope it will be therapeutic and maybe I can help others at the same time.

It all started when I was a little child. I began my pet keeping career by collecting dust bunnies and mold spores, but that was not enough — my pathology was already becoming clear. Soon I graduated to keeping the frogs, turtles and snakes I could catch in my native Michigan. My collection of the local fauna grew quickly and then one day it was too late. I was hooked. I had become a junkie. I don't know how it happened. I had become an addict. I admit it. I am here to tell the whole world that I am a **herp-a-holic**.

I am always looking for that next fix. I crave that new serpent or maybe a poison arrow frog or two. There are days when I just *have* to bring a home a new tortoise.

My poor wife has to track me down and we all know where she'll find me — lost in some seedy basement where I am looking with envy at a buddy's herp collection. At other times she'll find me in a local pet shop with my hand in my wallet digging out the cold hard cash that I will use to purchase a new newt.

Show me the money. I live for my next paycheck or bonus. Some days, it gets so bad that I collect soda cans to get the money to buy crickets to feed my cold-blooded children.



Mark Honas and Brian Donovan, co-hosts of "Animal Talk" radio show.

I now know that I **work for herps**. All my money is used to buy that new *sheltipuski* or some other scaly temptress that passes by. Some times I find myself just standing there, all slack jawed, gazing with wild wonder at that emerald tree boa that I want with my whole mind, body and soul.

I am a reptile lover. I have a screaming passion for our cold-blooded friends. This passion has gripped me ever since I held my first toad in the backyard of my childhood home. Ask my mother about my snakes. The story about the four-foot long hog-nose was a scream, literally.

I am also a fish-head. That is to say that I have kept, and still do keep, almost every type of fresh or saltwater animal I can find. I guess you could say, if it has scales and is cold blooded, I'm there. I'm hooked.

My addiction led me into a career in the pet industry, working in every aspect of the pet trade. I've managed retail pet stores, been the sales manager for a pet product distributor, and am currently the executive vice president of sales for a pet product manufacturing company called Delca Corporation.

I'm also the co-host of a syndicated radio talk show called "ANIMAL TALK" based in Detroit. ANIMAL TALK is a call-in talk show where people can have their pet related questions answered and be entertained at the same time. ANIMAL TALK is a cross between Saturday Night Live and Mutual of Omaha's Wild Kingdom.

We have just started our syndication drive, and we expect to have broad national coverage by the end of the year. This means as we grow, we will keep you posted, so that you will

know what radio stations carry ANIMAL TALK. If "Animal Talk" is not available currently in your area please give us a call at 1-800-PET-1886, and we will contact your local AM talk-show station for you.

I do all of this work just to have a house to keep my critters in. You see, I need money to feed my addiction. I'm not a bad guy — I let my wife and two kids share the house with my ever-growing collection of cold-blooded friends. I even buy food and clothes for my wife and kids. What more do you want?

Well, I know I am not alone. I believe it is time that we herp-a-holics help one another to deal with the unique problems that we face. So I am going to start a new 12-step program that will help those of us who are herp-a-holics. The program will be called *Herp-a-holics Anonymous*.

This new program will help herp-a-holics to find more money in their budget to buy more herps and we will teach herp-a-holics how to house and maintain their collections more efficiently.

We also need to create *Herp-a-non* for family members and loved ones of the herp-a-holic. They need to open their hearts and minds to understand our special world. We need their love and support.

I can see it now; we need a telethon to raise money to buy more frogs, turtles, snakes and lizards. The public support could be overwhelming. I think I'm going to cry. The world could be a beautiful place with more herps.

How was that for stream of consciousness writing? Now that you know more about me, you can begin to see what I am going to write about. I'll devote my articles to the love of the hobby, profile the hobbyist's themselves, and explore the proliferation of cold-blooded pets around the world. I'll write about the full-blown, *Love me love my gecko* type of herpophile, and also deal with the *Yuck, snakes are slimy, I think I will start with a frog or a newt* novice reptile keeper.

Send me your funny stories about your herp addiction. I also need the help of your spouses, parents, and significant others. Tell them to send me their stories of terror and frustration. Stories about the good times and the bad times, what it is like to deal with us hardcore, cold-blooded connoisseurs.

So pick up your pens and write me a letter or send me an e-mail at *The Vivarium*. Heck you can even draw me a picture. Don't be afraid to send me your stories, we are all addicts. Hello, my name is Mark... and I am a **herp-a-holic**.



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Coaxing Stubborn Starters

by Kathy Love

But it's been two weeks, and he still won't eat! lamented the new "foster mother" after hatching her first-ever baby corns. I've tried everything — frozen pinkies, live pinkies, even feeding at night instead of the day. Nothing works! Should I force-feed him yet?

This persistent and annoying annual problem can be dealt with in a variety of ways. I try to begin with the least difficult and invasive methods, progressing to force-feeding only as a last resort. Most babies won't eat until after they shed about a week or so after hatching, so there's no need to even start thinking about it before then. I usually keep half of a litter together (males and females in separate starter cages) before their first meal. The activity generated by a handful of live pink mice thrown in creates immediate interest and excitement; even normally timid feeders may be stimulated to "go for it." However, it's crucial to closely monitor the snakes and remove each one as it feeds. There will be inevitable confrontations between two babies, each trying to eat the same mouse. If you fail to separate them, there will be fatalities. After the first feeding, all babies are kept in their own cage. I continue this practice until about four weeks of age, at which time almost all babies are voluntarily feeding; those still not feeding are considered potential problem feeders, ready to receive my bag of tricks gleaned over the years.

Tricks of the Trade

My favorite easy trick is *cup feeding*. It's amazing how many stubborn feeders will eat when left overnight in a deli cup with only a live or thawed pink mouse and nothing else (not even substrate) to look at or think about. Many people have had good luck with "brained" pinkies, created by opening a small area



This neonate snow corn snake has just grabbed a tease-fed pinkie; now you must remain motionless while it decides whether things are calm and safe enough to continue the swallowing process. Photo by Bill Love

on the skull of a dead pinkie. Although one may find it gruesome, certain snake-lings seem to be attracted to the texture and/or odor of tissue oozing out.

If these tricks don't work, try varying the type of food offered. Sometimes the odor of a different baby rodent, such as a gerbil, hamster, or wild native mouse, or even rat legs, will excite a particular snake's appetite. Some kingsnakes are expected to prefer lizards, snakes, or frogs, but keepers are often surprised to find that ratsnake babies occasionally hold out for these items too. In my experience, reluctant feeders of eastern forms of common kings (*Lampropeltis getula*) often prefer only snakes, but problem milk and rat snakes usually prefer lizards.

If possible, place a small specimen of a non-snake eating species of prey in a deli cup overnight with the snake. If one species of prey (lizard or snake) doesn't work, try another. I often successfully use anoles (*Anolis* sp.) because they are abundant in the southeastern U.S. where I live, but I'll try imported or introduced 'house' and Mediterranean geckos when necessary. Rat snake hatchlings with kinks or deformities can be offered too, or frozen for future use as kingsnake "starter" feeders if not needed immediately. Be creative enough to

consider items not usually thought of as food for your snake species. They may surprise you! If only large feeder specimens are available, try just the tails, or go directly to scenting rodents as described below.

Scenting

Once the stubborn feeder has fed on a live or thawed non-mouse food item, the battle is almost won. Now, you're ready to apply artificial scenting to switch the snake over to a more convenient rodent diet. The strongest feeding response to scenting is usually obtained by beginning with frozen food items. When needed, thaw them just enough to make an incision in the mid-section or to break off the tail. Rub the animal's blood or body juices and condensation onto a washed, pre-killed rodent of appropriate size. This task sounds worse than it is, and you can always resort to disposable plastic gloves if you're squeamish.

Subsequent feedings involve increasingly less intensive rubbings, until the rodent alone suffices to rivet the snake's attention. If the availability of tempting food items, such as skinks or geckos, is in short supply, this tactic can be tried first, but it's even more successful *after* the baby has already become established on the item.

Tease-Feeding

Is your little serpent really, *really* stubborn? That kind of attitude calls for more persuasive techniques. Next in my arsenal of tricks is tease-feeding. Best performed while viewing an only semi-interesting television show, it requires an investment of time and patience. The description below is the easiest way I have found to conduct the procedure.

Hold the snakeling in one hand with about the front third unrestrained. Using a small, dead pinkie in the other hand (or held by forceps), gently slap the snake near the tail to elicit an anger strike. It is very important that it is a reaction of anger, rather than the fright response that slapping the head may cause. Fear will merely make it want to bolt and hide. Even though the fearful snakeling may also strike, it is less likely to follow through with eating. Stimulation to the tail triggers a feeding strike in many kinds of baby snakes, even in those species not known for possessing brightly colored tail tips (caudal lures) as juveniles.

If you are careful to point the food item's head farthest forward, the lunging snake will grab the intended target — the pinkie's head — and then come to a complete standstill. Now you must hold your breath and resist the urge to scratch your nose while the little snake considers its options. Will the mouthful of food enhance the sensation of hunger and tempt it to continue swallowing, or will it suddenly realize its precarious situation in your hand and spit out its newly-encountered potential meal?

I find this method especially suited to baby rat snakes (*Elaphe obsoleta* ssp.), which often resist taking their first meal from the cage substrate but often eagerly rip it from my fingers when offered. Non-feeding corns (*E. guttata*), on the other hand, usually grab and release baby mice many times before deciding to actually eat them.

This tease-feeding procedure should be repeated until the snake decides to eat, or until you fear you can't resist the urge to MURDER the creature on the spot. That's where a T.V. comes in handy — try to hold still and watch something while the snake sits frozen in place. If you have enough patience, it usually works, eventually. Fortunately, tease-feedings become easier each time as the

snake becomes used to eating. I continue trying to initially cup-feed each snakeling each week, and am extremely relieved when the first lump is noted in a new, voluntary cup-feeder!

Force Feeding

Now, to the methods of last resort — force feeding. Over the past couple of decades, I've tried several different procedures. Straining whole prekilled pinkies through a steel syringe with a built-in grinding/straining grill (such as a Pinkie Pump®) is a quite nutritious method since whole food is fed. I've found the device's end to be a little large for inserting down the throats of some of the smallest hatchling colubrids. For ease of use, though, it's great.

Tube feeding various concoctions of raw egg, pureed meat-based human baby food, and certain finely-ground gourmet dog or cat foods through a plastic medical syringe works as a quick and temporary boost, but is messier, and is still not a balanced diet over long periods. The slight advantage is that thinner diameter, rubber catheter tubes, or stainless steel lab animal feeding tubes, can be connected to the syringe to make insertion down the snake's esophagus a simpler task.

I would very much like to see a liquid or semi-liquid diet developed that would be suitable for both babies and convalescent adult snakes on a long-term basis. Anyone willing to take up the challenge?

Building Better Snakes

I generally avoid long-term force-feeding. If the baby is really important to my breeding projects, I will do whatever is necessary to ensure its survival. However, I believe that behavior, including feeding response, is heritable, thus I generally try to select future breeding stock displaying such beneficial behavioral traits as well as the more obvious physically appealing ones. It may sound harsh, but nature accepts that many less-hardy specimens will literally be gobbled up solely as food for other animals in the overall scheme of the great ongoing experiment called evolution. Serious captive breeding programs, and the eventual full domestication of some forms to replace their wild counterparts in the pet trade, will be enhanced by selecting against "defective" stock —

those not recognizing newborn lab rodents as first prey items — to build upon the solid foundation we as herpetoculturists have begun.

About the author: Kathy Love has been propagating colubrids and other herps for over two decades. She, with husband Bill, specialize in the highly variable color and pattern morphs of Elaphe and Lampropeltis, which are offered through BLUE CHAMELEON VENTURES in Fort Myers, FL.

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Prepping for Medical and Hygiene Concerns in the Field

by Bill Love

In previous columns, I've interspersed "fun" stories with discussions of getting ready for the trip mentally (volumes 8.5 and 8.6), handy field gear to bring (9.1), and suitable field apparel (9.3). To round out the preparations, the following list of health and hygiene ideas is offered.

Before your adventure begins, ask your local health department what disease immunizations, if any, are recommended for the country you'll be visiting. They can reference an up-to-date list, and either stock, or can quickly order in, any inoculations advised. Malaria, tetanus, and a couple strains of hepatitis are three prevalent diseases which are still good to guard against with extra protection when away from home.

Travel guide books may also offer helpful suggestions from people who've been to those destinations recently, and the internet is a wealth of current health warning info. Try the U.S. State Department's Travel Advisory site at: <http://travel.state.gov/travel_warnings.html>, or telephone them at (202) 647-5225. Also, check with the Centers For Disease Control and Prevention's (CDC's) international travellers hotline at (404) 332-4559, or check their website at: <<http://www.cdc.gov/travel/travel.html>>. **Notice:** You may acquire the feeling, after perusing these sites, that the world is a germ-infested, scourge-ridden, unhealthy kind of place; just try to keep in perspective that they're only trying to do their best to warn you about *every* conceivable hazard at these sites. If all or even most of those things were likely to affect you on any given trip, no one in America would ever venture beyond their front doorstep!

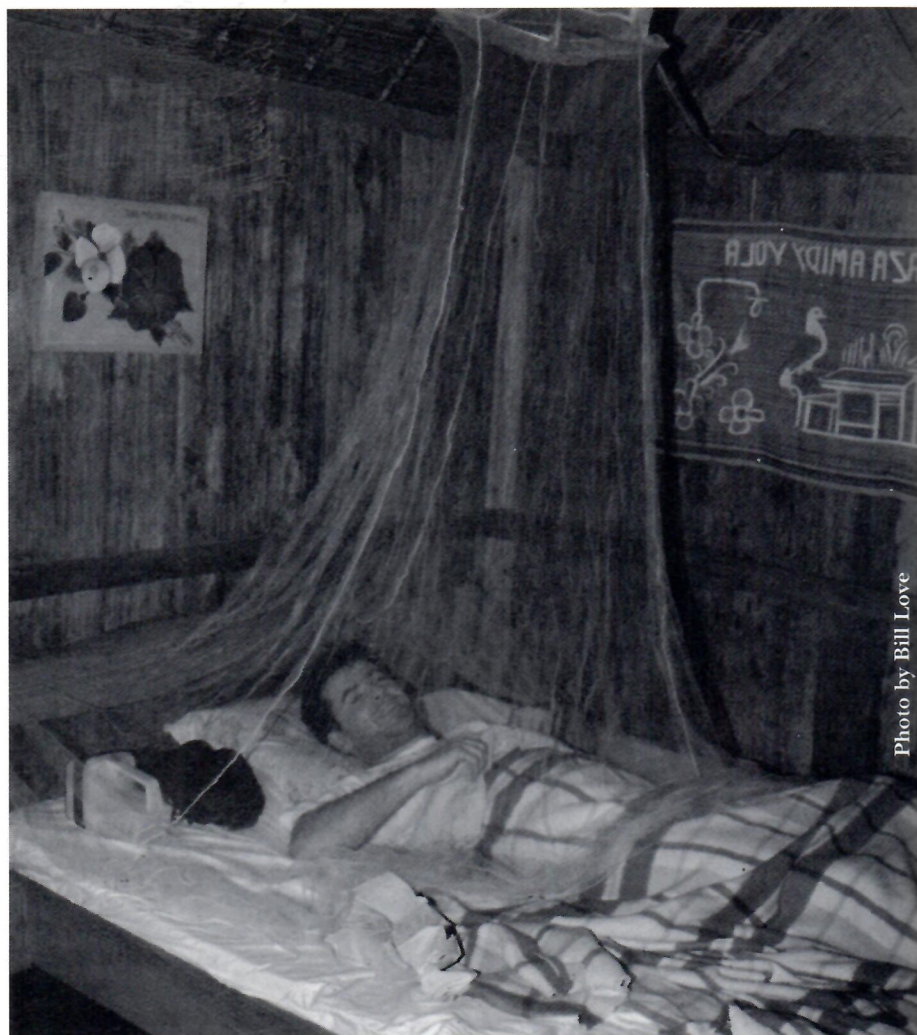


Photo by Bill Love

My friend Matjaz Rojc chose the shelter of a hanging netting above his bed at one quaint chalet where the gaps in the walls were wider than the resident mosquitos.

I carry a compact pouch of basic first aid supplies together with my overnight kit. Included in it are gear such as Band-Aids® and Neosporin® ointment for cuts and abrasions. I sometimes treat things that I'd ignore at home, such as non-venomous snake and lizard bites, because the chance of infection is greater in hot, sticky climes. My awkward middle finger once had to work my camera for a week due to my usual trigger (index) finger being sore, infected and swollen stiff from a *harmless* chameleon bite.

Complementing the above are anti-itch creams with cortisone for rashes from plants or animal-exuded chemicals. An anti-fungal lotion like Absorbine Jr® is especially soothing to tired, itchy feet, and powder to battle athlete's foot makes a worthwhile daily additive to the insides of shoes. You haven't met pure misery until you've endured a long hike with ailing feet.

Bug spray may save the day (or more likely, the night) at certain venues. Mosquito repellents with DEET (N,N-diethyl-m-toluamide) work well, although the chemicals occasionally irritate or adversely affect some people after heavy usage. Read the package warnings carefully on products containing DEET, especially relative to kids. Applying it to clothing may be a viable alternative to direct skin contact.

Citronella candles and burning mosquito coils dissuade flying insects after dark around the campsite. I've used them *inside* hotel rooms in some "quainter" locales.

Modern mosquito netting comes in very sheer, light-weight material that may be worth having along to cover a bed. It should be at least 12 feet (3.6 m) square to work for all situations.

Sunscreen cream for face and neck,

and for whichever arm habitually hangs out the vehicle window in the sun, is worth the tiny space it takes up. Sunglasses also come highly recommended for noontime hikes on bright sunny days.

I stock an assortment of analgesic tablets (such as aspirin and Tylenol®); I can't afford to sit out any adventures with a common headache. Carrying Imodium® capsules for "the runs" is *never* a wasted effort; at some point it will almost certainly be used (and appreciated) while exploring the tropics unless you seal yourself in a glass bubble for the duration. Where's the total pleasure of experiencing new lands when you're afraid to partake of the region's culinary delights for fear of a little diarrhea? Unfortunately, this malady doesn't always draw the line at "a little," and on rare occasions threatens to disrupt your entire routine with cramps, nausea, and, more seriously, dehydration.

Certain natural foods yield medium to good results in helping your digestive system cope with some milder kinds of bacteria likely to invade you with strange new foods. Cayenne pepper, some hot sauces, garlic, and red wines have all been claimed to offer protection against such maladies. It's probably why these items are particularly popular with people inhabiting warmer climates of our planet.

Antibiotics like Cipro® (ciprofloxacin hydrochloride) require a doctor's prescription but can be a trip-saver when what I dolefully, but realistically, consider the inevitable finally catches up with you. Stock up on any prescription drugs before leaving home. While many are becoming increasingly available overseas, tracking them down can be a major hassle and is far from being a certainty.

I've seen tour members bring water purification tablets and filtering systems that were purchased at sporting goods stores. These may genuinely help, particularly on outings of longer than one day. For the most part though, I've slowly (and unashamedly) gotten used to the fact that clean bottled water, and ubiquitous Coca-Cola® drinks, can now be found virtually worldwide and easily acquired before each day's excursion out away from "civilization."

You are left to decide your own per-

sonal items like shaving equipment, dental, nail, and hair care, mouthwash, deodorants, and feminine products. They're just things to remember to bring generally, which may or may not be found handily in stores abroad. For soaps and shampoos, I choose the antibacterial types just as extra cheap insurance since nightly showers are sometimes luxuries only to be resumed again once you've returned home.

Plan to take only the quantities of goods you'll need for the number of days you expect to be gone. You don't want to lug heavy jars and bottles as unnecessary burdens along the entire trip just because the shampoo was on sale in ultra-economical two gallon plastic jugs. Try the toiletry area in Wal-Mart® or the campers' supplies aisle at big sporting goods stores, for a handy assortment of little jars. Tighten all container lids, and store in resealable plastic sandwich bags if necessary, so gooey stuff doesn't ooze out all over cameras or clothes in jostled luggage.

The precautionary provisions you can take are infinite — cough drops to Visine® eye wash, and snakebite kits to

epinephrine injections! You must individually weigh the hassles of hauling too much "junk" around constantly versus the benefits of having those conveniences at your beck and call. Don't forget a currency converter if you're bringing an electric shaver, hair dryer, fan, etc. because most of the rest of the world is on 220 voltage.

As always, I welcome readers to send me their great travel aid and comfort ideas to be shared in future installments of this column.

About the Author: Bill Love is a photographer, writer, herpetoculturist, lecturer, and staunch enthusiast of and participant in eco-travel. With wife Kathy, he operates BLUE CHAMELEON VENTURES in Florida.



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Science Sampler

by *The Vivarium staff*

Science contributes to the keeping and breeding of reptiles and amphibians. The Science Sampler gathers titles of recent articles from the scientific literature. Readers can find most of these journals in university libraries and abstracted on the internet.

Featured Article

As herpetoculturists gain more knowledge in the care of their reptiles and amphibians, successful reproduction of captive herps becomes more routine. One concern that has arisen, however, is the vigor and viability of fourth and fifth generation offspring from captive-bred herps. Do they grow as well as wild-caught juveniles? Can they mount appropriate immune responses? When we select for color or size or disposition, are we still producing vigorous animals? It has been known that female gray tree frogs (*Hyla versicolor*) select males with the longest duration calls. A recent study documents that those males with the longest calls also pass along the most metabolic vigor to their offspring. Their juvenile offspring grew better whether food supply was plentiful or sparse. Sire selection by females may play as important a role in the health and vigor of captive-bred herps. For details of the study: Welch, A. M., Semlitsch, R. D. and H. C. Gergardt. 1998. Call duration as an indicator of genetic quality in male gray tree frogs. *Science* 280:1928-1930.

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Herp News

Continued from page 19

Caiman and goin' for years

"For years there have been sporadic, unverified reports of some sort of sea serpent cruising along the ocean side of Key Biscayne [Florida]. Then on Thursday morning [a] Crandon Park Lifeguard... jogged right by it... 'He saw about a four-foot alligator or crocodile coming out of the water and taking a breath and going back in the water,' said the woman who took his call. A naturalist responded to the report, then a professional wildlife remover arrived, and the supervisor of the crocodile nesting beaches near the local power station. After a couple of hours, they saw it again at dark, but couldn't catch it. They think it's a caiman which was stolen from temporary housing during the Metrozoo remodeling in 1981 and used to belong to the croc nesting supervisor! [Miami Herald, June 13, 1998 from Alan Rigerman].

Thanks to everyone who contributed this month and to AFH members Lisa Marie M. Post, Chris Hannaford, Catherine Johnson, and Robert Innes for repeats of stories, cards, letters and material I enjoyed, but was

unable to figure out how to summarize! As always many, many thanks to Alan Rigerman and Kim and Wes von Papineau for their unflagging support and contributions. You can contribute, too. Send the whole page of newspaper or magazine with your name firmly attached with a label or tape. If you clip, please minimize the origami. Tape everything together and mail to me at the address on the masthead. See you next issue!

Flame Garters

Continued from page 21

About the Author: When not working in the medical field, Dr. Blais devotes much of his spare time to the study and breeding of many animals, including colubrids. He is a licensed wildlife rehabilitator and also participates in the long-term census of Quebec herpetofauna, in conjunction with the Saint Lawrence Valley Natural History Society.

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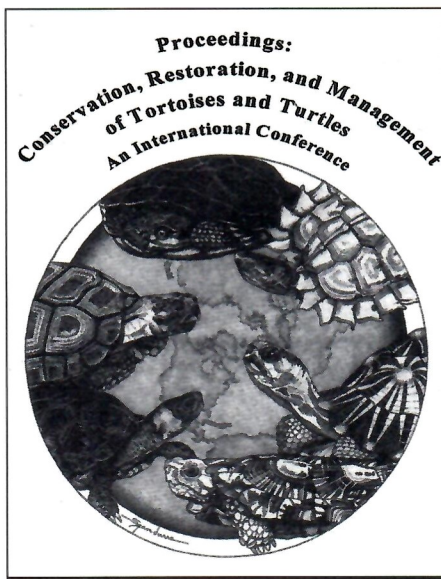
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Proceedings: Conservation, Restoration, and Management of Tortoises and Turtles — An International Conference

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New York Turtle and Tortoise Society,
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Do you own a turtle or tortoise? If you're like us, you admire their carapace designs and personable attitudes, are challenged by their requirements for husbandry, and gratified by reproductive successes. Now may be time for those of us who fill the ranks of turtle and tortoise aficionados to look beyond the horizon of our turtle tanks and tortoise pens, and consider chelonians on a global scale. There is no better place to start than here, with this Proceedings.

This book of almost 500 pages is a compilation of papers from a 1993 conference and represents a joint effort of the New York Turtle and Tortoise Society and the Wildlife Conservation Society's Turtle Recovery Program. The 77 papers presented here have been updated (to 1997) with new information and all were peer reviewed. Topics include threats to habitats, direct losses to populations, breeding and repatriation programs, applications of various biological sciences to conservation, status reports from regions all over the globe, species recovery and management strategies, specific reserves and programs, integrated management strategies and public policy. Whether it's learning about the illegal trade of pancake tortoises (*Malacochersus tornieri*) in Tanzania, results of sustainable exploitation of snapping turtles (*Chelydra serpentina*) in Canada, or efforts for captive breeding

of the large softshell (*Aspideretes gangeticus*) in India, the articles are well written and packed with useful information. Reading this book, however, won't leave you with warm and fuzzy feelings. It's a sobering look at the status of chelonians worldwide, and how humans in this century have impacted this most unique and ancient group of reptiles. In his introductory *Troubled Time for Turtles*, John Behler observes that "... our 270 [species of] chelonians, as a consequence of burgeoning human numbers and their insidious activities, are facing the greatest challenge of their evolutionary history." The threats to declining populations of turtles and tortoises include massive habitat loss, collection for domestic and foreign food markets, introduced diseases, and severe climatic changes as well as collection for the pet trade. This book provides in-depth coverage of the exploitation of turtles and tortoises, and the ongoing efforts of those attempting to fix the problems.

The book might be considered at first glance to be expensive, but for the price of a hatchling *Geochelone sulcata*, the owner of this Proceedings gains an in-depth understanding of chelonian status globally, and takes a step toward helping these reptiles meet their "greatest challenge."

The Amphibian & Reptile Cookbook by Ernie Liner 838 recipes, 384 pages Ramus Publishing, Inc., 1998

In the introduction to *The Amphibian & Reptile Cookbook*, author Ernie Liner writes: "At the 2nd World congress of Herpetology in Adelaide, Australia in 1993-94 a "menu" was prepared consisting of soups such as Filesnake Slough Consomme and Frog Spawn Soup; entries of Hemipenis Cocktail with Parotid Sauce, Froglegs au Adelaide, maincourses of Grilled Fillet of Sleepy Lizard, Hatchling Turtle Casserole, and Sphaerodactylus Omelette followed by a dessert of Spermatophore Custard—all mouth-watering recipes written with tongue-in-cheek." The Louisiana herpetologist got a kick out of this parody

menu, especially considering the fact that he had been collecting genuine herp recipes for over 15 years by then.

Liner's first compilation of herp recipes, *A Herpetological Cookbook: How to Cook Amphibians and Reptiles*, was published as a little booklet in 1978 and quickly sold out of two printings. Since then, he's accumulated over 800 herp recipes (and almost 100 "auxiliary" recipes for sauces to be used in these dishes), and 20 years after his first booklet appeared, Ernie Liner's *The Amphibian & Reptile Cookbook* is due off press this fall.

The author emphasizes that his "intention is not that these animals be decimated in the wild." Many of the recipes are of "historical value and become strictly academic. So be it." However, he points out that some forms are available on the market—including frog legs and alligator meat. In fact,

commercial farming of alligators has made "the other other white meat" available to the public.

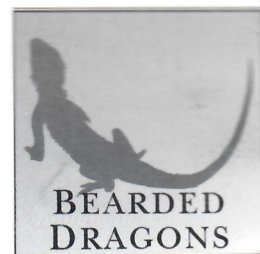
The publisher says only 1,000 copies of Liner's cookbook will be printed on the first press run. With this in mind, *The Amphibian & Reptile Cookbook* will be snatched up by book collectors, and herpetologists and hobbyists alike also will find this an entertaining read. Even if you don't plan on cooking any reptiles, pick up a copy and read how to prepare Crock Pot Turtle or Toad Legs in Beer Batter. Besides being an interesting study in how reptiles and amphibians are used (or have been used) as a food source, some are sure to make you smile.

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COMMON DISEASES OF BEARDED DRAGONS, PART 3: ADENOVIRUSES

by Roger Klingenberg, DVM



In parts 1 and 2 [in *The Vivarium*, 9(4) and 9(5)], I discussed the parasitic and nutritional diseases seen commonly in bearded dragons (*Pogona vitticeps*). We discussed how bearded dragons are not always "bullet proof" lizards. As if these afflictions weren't enough, an adenovirus is now being diagnosed with increasing frequency. While this virus appears to primarily take advantage of the young and weak, all ages can be affected. Let's discuss some aspects of this viral disorder.

Adenovirus disease in bearded dragons is poorly understood for the same reason many reptile disorders are not well delineated — lack of funding for critical research. Here's what we know.

Signs of Adenovirus Infection

In bearded dragons that are sick with adenoviruses, there are unfortunately no specific signs to watch for. Most of the bearded dragons that have been diagnosed with adenoviruses have had a history of being poor doers, sometimes showing poor appetite, and sometimes exhibiting diarrhea. Sometimes, they die. The young, especially those four to 12 weeks of age, appear to be affected more often than older specimens. Rather vague signs, wouldn't you say?

A typically affected lizard would be difficult to differentiate from those with coccidiosis, or hypocalcemia without muscle twitching. To further complicate matters, we can mix and match disorders. A young bearded dragon with adenovirus could also have coccidia that may or may not be causing problems at that moment. The young dragon could, or would, certainly develop nutritional disorders including hypocalcemia as poor food intake (anorexia) becomes a factor. These mix and match scenarios could go on and on, with one factor affecting another or making no difference. It's important to know if adenovirus is present in a sick dragon, but how do we accomplish this task?

Diagnosing the Disease

The only currently available method to diagnose adenovirus is, unfortunately, by necropsy (animal autopsy). Most of the dead bearded dragons with adenovirus infection do not demonstrate significant gross (visual) abnormalities of the internal organs. It is only with histopathology (examination of tissues and cells with a microscope) that the presence of intranuclear inclusions (material characteristic of virus infections) are found, primarily in dead areas of the liver. Such inclusions are *presumptive* evidence of adenovirus, but electron microscopy is required to *confirm* the diagnosis by demonstrating typical virus particles. Before you jump to the wrong conclusion, this is *not* the same inclusion body disease that afflicts boids and pythons. Both are viral diseases, but involve entirely different groups of viruses. The only similarity is the potential usefulness of a liver biopsy as a diagnostic test, which could be done prior to the animal's death. While the technology exists to produce a serologic test (a simple blood test), this won't happen until it is demanded by you, the bearded dragon owners and veterinary clients.

Outcomes

Do all bearded dragons exposed to adenoviruses die? No, some become chronic poor doers that come around slowly, but can eventually recover, or at least appear to recover. How long does a bearded dragon that has recovered from adenovirus disease carry and shed the virus? No one knows. Supportive care techniques including force feeding, fluids, and occasionally antibiotics for secondary infections will increase the survival rate of those affected.

What else do we know? The route of transmission has not been determined, but is most likely by fecal and/or oral exposure.

There are lots of questions without

answers at this point in time. As always, we'll do our best keep you informed as new information becomes available.

The Bottom Line on Dragon Health

Bearded dragons — bullet proof? Obviously not. However, bearded dragons are very hardy lizards and in no way am I discouraging a potential owner from pursuing their opportunity to own and care for one of the best lizard species. My family's bearded dragon is the easiest lizard to care for that we've ever had. These lizards are extremely entertaining, gentle, and well-suited for lots of hands-on activities.

Purchase your dragon from a reputable source. Every new dragon owner should have their lizard examined by an experienced reptile veterinarian. At the very least, the lizard needs a fecal examination for parasites. Eliminate any and all parasites. Quarantine (for parasites and viral diseases) any new bearded dragons for a minimum of two to three months.

If you own a group of bearded dragons and one dies, then refrigerate it until it can be necropsied by your reptile veterinarian. There is no use guessing what happened to it when you can know for certain. It may be cheaper in the short run to simply replace a dead lizard with a new one, than to pay for medical tests. But to do so puts a new dragon at risk, or adds a risk to an already established group. If we work together, there should be plenty of healthy bearded dragons to go around.

Acknowledgement: The author thanks Dr. Dan Wentz's help in discussing adenovirus outbreaks he has dealt with in his practice.





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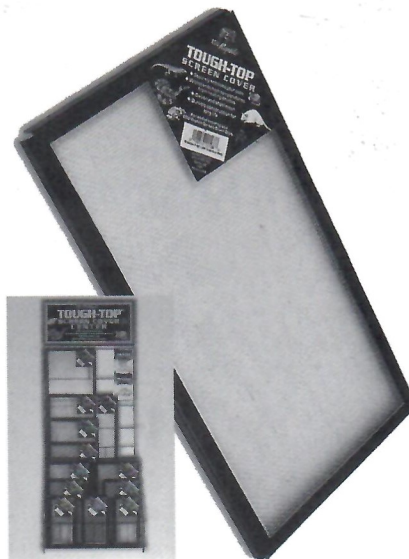
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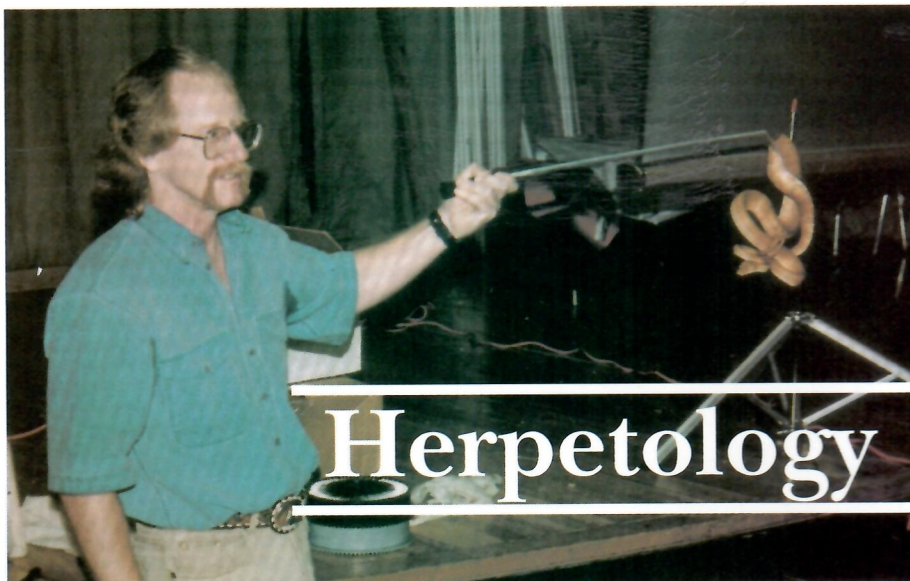
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Enters the High School

Curriculum

by Gregory D.
Mayberry, M.Ed.

No biology or zoology course would be complete without a unit introducing the classes Amphibia and Reptilia. How much time should a teacher devote to those animals described in the 18th century by the Father of Taxonomy, Carolus Linnaeus, as "abhorrent, foul and loathsome?" The answer at one Oklahoma high school is 36 weeks!

Located approximately 35 miles east of Oklahoma City, Shawnee High School includes *Introduction to Herpetology* as one of its lab science course offerings. Now in its third year, the class is proving to be a popular option among students. Although the class was available to any interested student during the 1995-96 school year, an overflow of requests necessitated limiting enrollment to juniors and seniors in 1996-97. In the third year, two sections of the course materialized with a combined total of 63 students.

In the Beginning

Initially, *Introduction to Herpetology* entered the curriculum at Shawnee High School as the result of a clerical error. In the spring of 1995, the school principal responded to requests from students for more elective classes by

Photos by Ed Blochowiak and The Shawnee News-Star

Above Dr. Laurie J. Vitt talks to club about (*Corallus e. enydris*)



Temika Berry prepares to sketch the musculature of a frog in lab.

soliciting proposals for new classes from the faculty. At the same time, she and the assistant principal asked teachers to suggest ideas for short enrichment seminars which would be conducted in two-hour blocks on Friday afternoons

As an amateur herpetoculturist and special education teacher with certification to teach all life sciences, I answered the call by submitting a proposal to teach *Field Zoology* as well as a mini-seminar, *Herpetology*. For reasons unknown, the list of potential offerings submitted

to the student body for consideration included *Herpetology* on the list of credit classes, not the list of two-hour enrichment seminars as intended. While *Field Zoology* failed to acquire the minimum 12 students necessary, *Herpetology* secured enough votes for inclusion in the list of course offerings at the school.

When the school year began in August 1995, the one-semester *Introduction to Herpetology* class was scheduled in the 7:00-8:00 A.M. time slot. The first day of class saw enrollment drop to eight students, and I was informed that the district could not justify the cost of providing such a specialized class for so few students. An appeal resulted in permission to teach the class during my afternoon planning period, when the need for a minimum number of students would be negated. *Introduction to Herpetology* was finally a reality for the teacher and three students. As word spread about the class, additional students filtered in until the first quarter ended with 21 students.

About half way through the semester, I was asked to offer an advanced section of herpetology in second semester to accommodate the needs of the students. This request completely unraveled my lesson plans! While a large portion of the summer had been spent carefully planning for 18 weeks, I had not counted on providing an additional semester for these same students!

What had initially evoked a sense of panic over how to fill an additional 18 weeks quickly turned into a realization of tremendous opportunity. I was able to expand the units on anatomy and genetics as well as add units covering the use of a microscope and several other aspects of herpetology.



Students set up a tank for *Phelsuma laticauda*.



Kay Bachues, D.V.M. demonstrates necropsy techniques on a python.

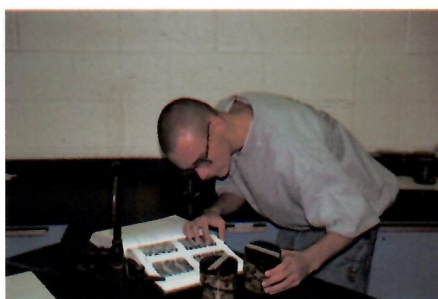
Supplies and resources - That maiden year was taught utilizing material from dozens of resources with a heavy emphasis on 35mm slides from my personal collection as well as slides from numerous other herpers in the area. While the lack of a formal textbook did not pose any problems for students, it did mean many hours of typing and copying for me.

Aside from written text, securing other supplies for the class presented little problem. Friends and local businesses were eager to help. An Oklahoma City pet store owner donated dozens of dead, frozen specimens for preservation. A pet wholesaler donated several living specimens to the school for use in the classroom.

Not only was help readily available from the local herpetoculturists, but a substantial amount of assistance came from within the school itself. The chemistry teacher gladly offered advice and use of safety apparel during labs requiring the hazardous chemicals used for fixing tissue. The microbiology instructor has always availed herself whenever we've needed to have cultures incubated and identified. Others in the science department have offered the use of microscopes, balances, dissecting supplies and a myriad of other services and equipment.

On two occasions I've asked the building principal for money to buy supplies; both requests were met with unquestioned approval. My first request was for

specimen jars, ethanol and formalin to preserve donated specimens which had been frozen. The second requisition was for specimens for dissection. As this was a trial year for the class, I opted to wait before asking for funds for textbooks.



Phillip Collins attempts to distinguish subspecies of *Aghistrodon contortrix*

Live herps - Naturally, I wanted to have living specimens available for examination whenever possible. The use of live animals in the classroom presented a few problems. Issues that needed to be addressed included assurances to the faculty and (especially) custodial staff that all animals were securely caged, which minimized risk of zoonoses (diseases which can be transmitted from animal to man), and pacified the Oklahoma Veterinary Medical Association (OVMA), which frowns on live vertebrate animals being kept in any classroom at elementary and high school levels.

My most pressing concern was being able to assure the parents and administration that the issue of zoonoses was

adequately addressed. The school district approved a week's leave for me to go to the National Wildlife Rehabilitators' Symposium in Houston for the purpose of attending their training on zoonoses. Rules were established for the classroom regarding hand-washing with an antibacterial soap after handling animals, cleaning cages, etc. Latex gloves are worn whenever chelonians are handled. In addition, animal dissections are performed only on properly preserved specimens purchased from established biological supply companies. Food and drink are prohibited in the lab.

Housing of animals was another concern of the OVMA and school administration. Keeping all animals securely caged is easily accomplished through the use of locking, molded plastic cages. The cages, manufactured by Neodesha Plastics, feature double screening in the vent and a sliding door which provides complete visibility while remaining locked with a padlock. This type of cage has the added convenience of being non-porous and easily cleaned and disinfected.

Soiled substrate and shed skin are removed from cages, and the cages cleaned, immediately upon discovery. Otherwise, cages are cleaned and substrate changed on a weekly basis. The



Measuring and recording data are vital to any research project.

Continued on page 59

More Tales of The Mad Gecko Hunters

by Philippe de Vosjoli

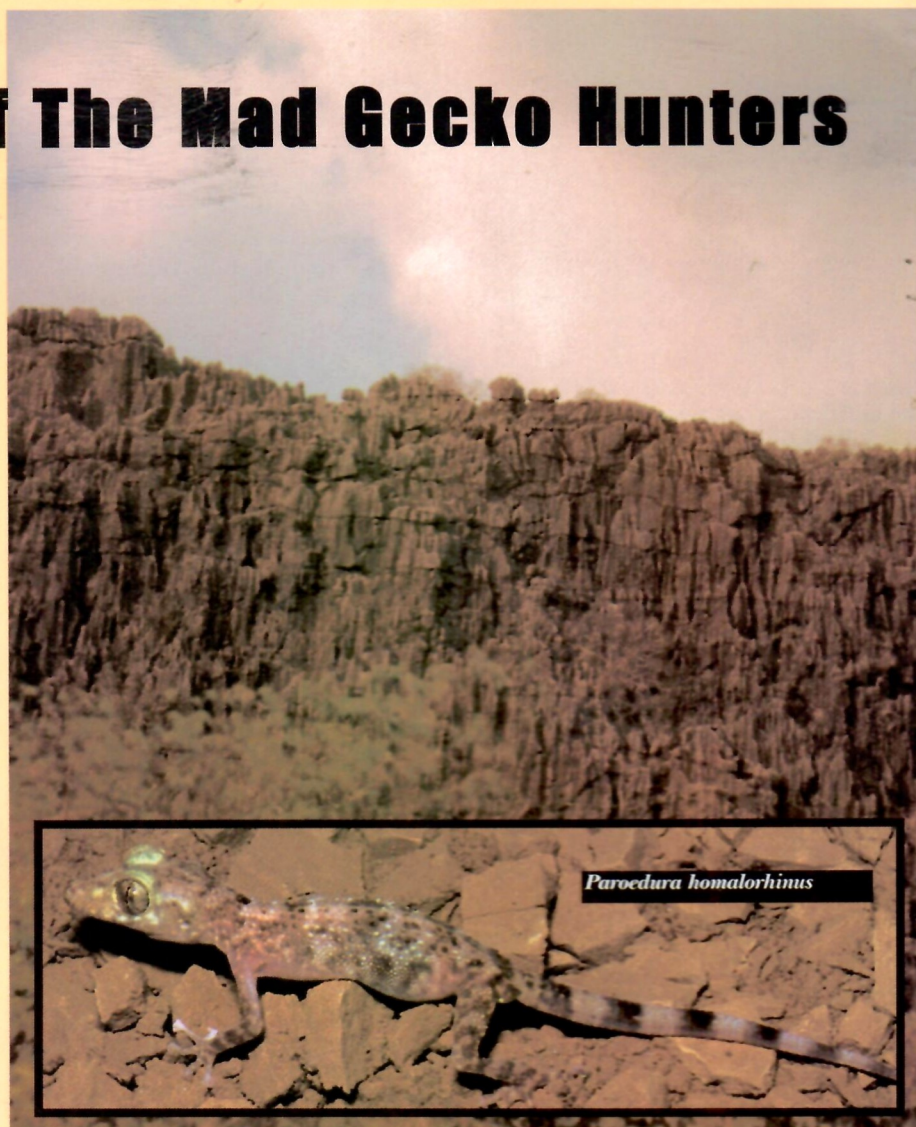
*Photos by Bill Love unless otherwise noted.
All animals are from Ankarana.*

We had just spent two days in Diego Suarez in the northeast of Madagascar, a post-apocalyptic city right out of a science fiction movie set with dilapidated buildings, colorful Malagasy markets, tropical aromas and the ever-oppressive poverty. Our headquarters was a hotel called Paradis du Nord (Paradise of the North) with its air-conditioned cell-like rooms, the windows barred to keep out thieves and prowlers. The bonus of this hotel was that, in contrast to other places we'd stayed, the restaurant offered a wide selection including tasty Chinese food. On this morning, we are to leave for one of the geographical highlights of Madagascar, the northern limestone plateau known as Ankarana with its sculptured pinnacles called *tsingy*, dense forests, streams and underground rivers.

We are thrilled with the idea of exploring this area and pack our gear in the two vehicles reserved for the outing. The Malagasy driver, Bill Love, Roger Klingenberg, Mike Pierce, my wife and I stuff ourselves into what looks like an all-terrain vehicle. The others pile into a truck with an open back. Other than a flat tire, all is well until we take the turn that is to lead us to the American camp, an area used by wildlife biologists brave enough to venture into this hazardous no man's land. With its potholes, pits, and exposed rocks, the road is hard on bodies and minds and seems unbearably

long. It is as if we've ended up the inadvertent subjects of experiments by mad doctors wanting to uncover the pain limits of human backs and the pounding tolerances of our gluteus maximus muscles. Our biggest problem is a dilemma — do we keep the windows open to get some cool air in (it's in the 80s° F outside and nearing 100° F inside) and be smothered by clouds of red dust or do we keep the windows shut and simmer in the heat? Bill and our driver, being in front and protected by the windshield, are spared the dust bath

and opt to open their windows, which hypothetically should allow cool air to flow toward the back. The actual result is that the four of us in the back are sprayed with red clay dust that sticks to our bodies, clogs our nostrils, and covers supplies such as camera bags. All of this, combined with heat radiating through our closed side windows, makes for a hell of a ride. By the time we arrive at the camp several hours later, our bod-



Paroedura homalorhinus

Paroedura stumpfi



New Mantella from mouth of cave



Human skeleton with homage basket of Malagasy money





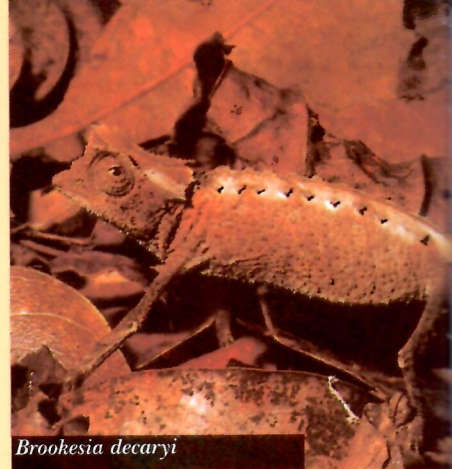
Cave spider

ies feel beaten, our mouths parched and we look like red ghostly mudmen that blend readily with the landscape. By the time we set up our tents and have dinner, it's late enough for a night hike which reveals panther chameleons, mouse lemurs, *Mantella* species and other frogs, tenrecs (Malagasy hedgehogs), scorpions in astonishing numbers and a *Paroedura stumpfi*.

The next day we plan a trip into a cave at the base of the mountains that runs through a rocky outcrop and opens up in a forested area between two mountain walls. Caves are always exciting to explore if, like me, you're into bats and odd arachnids and insects. Sure enough, soon after we enter, we spot

furry brown bat bodies cuddled in corners and long-legged cave spiders. We continue our venture, flashlights in hand, slowly moving away from the entrance light toward the pitch darkness. Some of the members of our group have moved ahead, but a few of us are searching the walls for interesting animals. Suddenly Bill, flashlight toward the ground, points a finger at a little creature caught in his light beam. My wife and I converge on what appears to be an odd, pale lizard no doubt blinded by the bright light and temporarily dazed.

It's a gecko but we can't initially identify it. The gecko has huge eyes, and stands high on thin legs. I examine its feet and notice the reduced toe pads, so we tentatively figure it's not a type of *Paroedura*, but honestly, I'm not sure what it is. Bill shoots some pictures of it and I aim my camera behind us to record the distance from the entrance and the light level reaching us. After we are done, we get up and set to join the group when, just a few yards ahead, we spot another one, the same species, a cave-dwelling gecko. I turn to look back. In the distance the entrance is now barely visible. We are excited and wonder if



Brookesia decaryi

this might be a new species.

After the initial discovery, my plan is to search the sides for more of these geckos, assuming they probably live near cracks and walls to take advantage of the arthropods that reside there. The big question in my mind is *how dark-adapted is this gecko?*, but we find no others and there is little doubt, that the distance from the entrance is a limiting factor. If it has large eyes, it needs light to make its way around. Obviously there is research to be done on this species with regard to its diet, population density in the cave, and the factors that may limit its behaviors. The possibility that it might occur outside the cave, where it might be active at night, needs also to be considered. If for whatever reasons the Ankarana populations are limited to cave entrances, this would be one of the rarer geckos in the world.

After our initial discovery, the trek through the cave proves anticlimatic, although the other side exposes us to spectacular scenery, the kind of view that makes you think *I have seen what few others have*. That night we crack open our Glaw and Vences and under *Paroedura* we find mention of the odd cave-dwelling gecko. Its name is *Paroedura homalorhinus*, a relative of *Paroedura picta*, the species now bred in large numbers and sold in the trade under the name of ocelot gecko. *Paroedura homalorhinus* was initially described from a cave at the base of the Ankarana mountains, most certainly the cave we had just visited. Like other *Paroedura*, it is characterized by a broad head and digits that end with claws and small toe pads formed by two leaf-like adhesive lamellae. What is puzzling is that this species was also discovered at night wandering in the forest on the island of Nosy Mangabe, off the east coast of Madagascar (Raxworthy 1988).

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This of course leads to all sorts of speculation about its origin and distribution, a subject which will not be cleared up until further field work is done.

All and all, it turned out to be just one more exciting chapter in the great tales of the mad gecko hunters. In this case, besides yours truly and his wife who will follow him to the ends of the earth, "Wild" Bill Love, Mike Pierce, Roger Klingenberg, Coleman Sheehy and Tim Schuetz, all good friends and madmen in the very best sense of the word. A special thanks to Blue Chameleon Ventures for promising the goods and delivering them, actually embedding them in our memories with red clay dust.

Note: The Ankarana plateau is a Special Reserve and its fauna and flora are protected.

Source Materials

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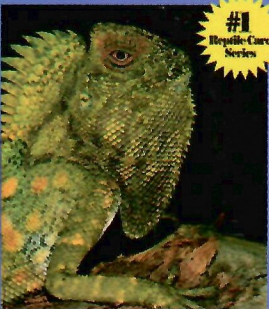


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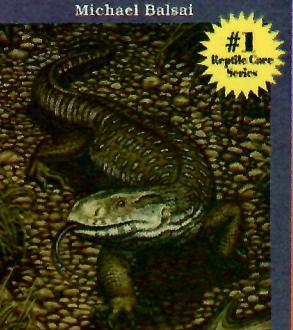
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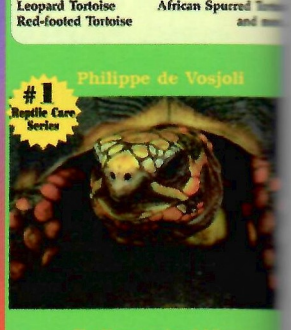
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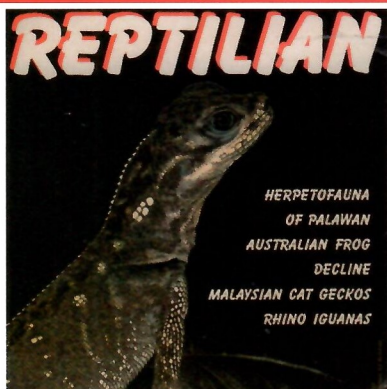
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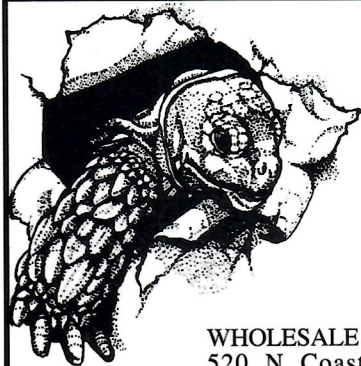
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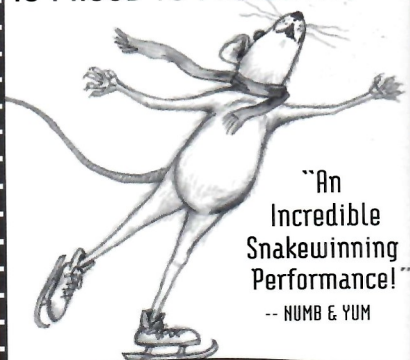
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CAPTIVE CARE AND BREEDING OF Collared Lizards

BY THOMAS A. JONES, M.D. Photos by Barney Oldfield D.V.M., Lizards by Thomas A. Jones M.D.

Collared lizards — the jewels of North American deserts. What lizard fan has ever seen a wildlife photo of this eminently photogenic animal and not marveled at their beauty? And yet, how often have we been disappointed in their appearance when observed in captive environments? Perhaps because of this, collared lizards have had the reputation of being difficult to keep. Those of us, however, who have been keeping and breeding these lizards know that with a little effort and expense, these animals can thrive in captivity. In fact, with their combination of manageable size, handleability, and individual beauty, collared lizards make an ideal desert vivarium subject, interesting to watch and fun to hold. Moreover, we have only just scratched the surface of the untapped genetic diversity in this genus.

Natural History

Collared lizards are native to the western United States, Baja California and mainland Mexico. Present taxonomic concepts place collared lizards as a separate family of Iguanian lizards, Crotaphytidae, shared by both leopard lizards (*Gambelia*) and collared lizards (*Crotaphytus*). There are at least four species of leopard lizards and nine species of collared lizards currently recognized.

Species - Of the nine collared lizard species, three are found only in Mexico. The reticulated collared lizard (*C. reticulatus*), occurs along the Texas-Mexico border. It is rarely, if ever, found in the pet trade.

Contrary to early literature, collared lizard species will interbreed with each other, and captive-bred hybrids exist. Even in the wild, there is an area in northwest Arizona where natural hybridization has occurred between *C. collaris* and *C. bicinctores*.

The common collared lizard, *C. collaris*, is perhaps the most well known species of the group. Its range covers nine western states, from Arkansas to

profound that *colored* rather than *collared* might be a more appropriate common name. In fact, the trademark black and white collar is by no means unique to these lizards and is found in a number of other species.

Habitats - Collared lizards live in rocky habitats with sparse vegetation. Boulder strewn hillsides and rocky outcroppings characterize their environments. They dig burrows under boulders for sleeping and egg laying.

Although collared lizards may be observed uncommonly in the wild, they are not rare and, in most cases, not threatened. Indeed, certain species and populations can be quite numerous in specific locales. Seeing them in the wild, however, requires knowledge of their range, habitat type, seasonal and diurnal behaviors, and preferred weather conditions.

Sources - Many states have specific laws regarding collection of collared lizards. Collection may be prohibited within state and national parks and wildlife preserves.

Collared lizards may be legally collected and exported from Nevada and Texas, and this happens in relatively great numbers. Wild-caught specimens in the pet trade, however, often do poorly — in part because of the length of time between collection and retail marketing, and because of a general lack of husbandry knowledge at both wholesale and retail levels.

In contrast, captive-bred collared lizards thrive in captivity. Moreover,



An Oklahoma male common collared lizard (*Crotaphytus collaris*)

Arizona. A number of subspecies have been described, however taxonomists debate subspeciation in *C. collaris*. Colors and marking patterns are diverse in this species. Within populations, males are mainly green, but others are brown or yellow, and still others are a surprising blue. Vivid yellow and orange head coloration is often seen in this species. Females are usually less colorful, although during breeding season they exhibit flaming orange sidespots or bars. Some populations show a bold pattern of dorsal spots and bars, whereas others exhibit a finer, more speckled pattern. This degree of diversity is so



Crotaphytus vestigium, male

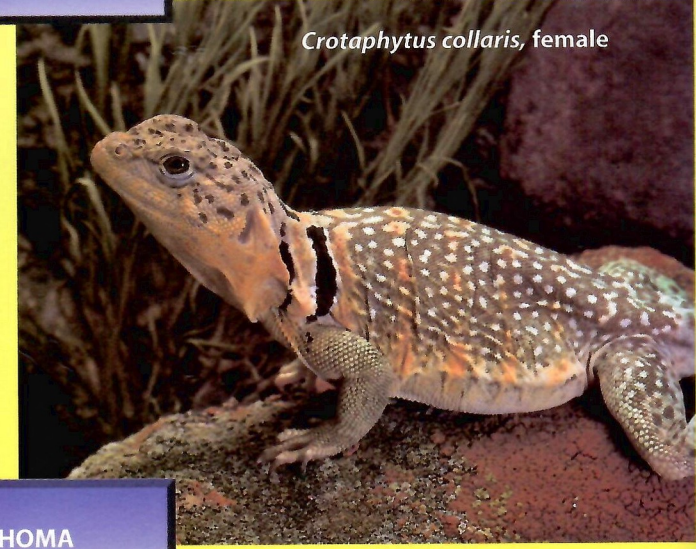


Crotaphytus vestigium, female

BAJA CALIFORNIA



Crotaphytus collaris, male



Crotaphytus collaris, female

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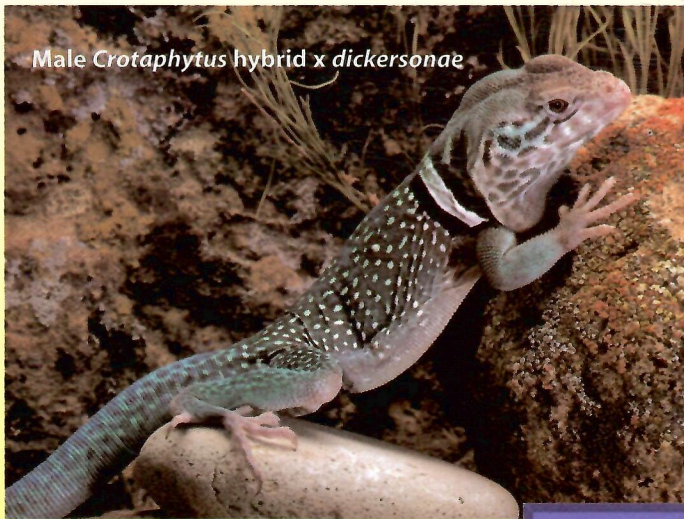


Crotaphytus collaris, male

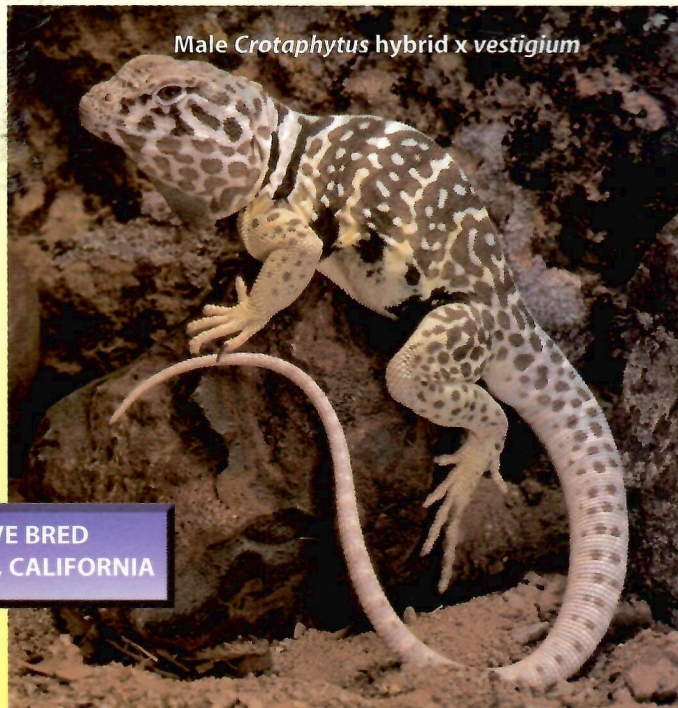


Crotaphytus collaris, gravid female

SAN JUAN, COLORADO
AND NEW MEXICO

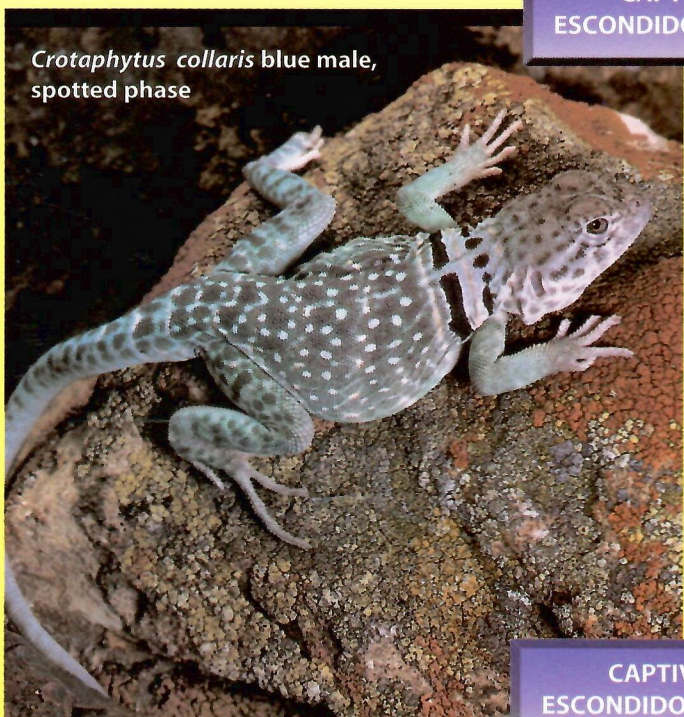


Male *Crotaphytus* hybrid x *dickersonae*



Male *Crotaphytus* hybrid x *vestigium*

CAPTIVE BRED
ESCONDIDO, CALIFORNIA



Crotaphytus collaris blue male,
spotted phase



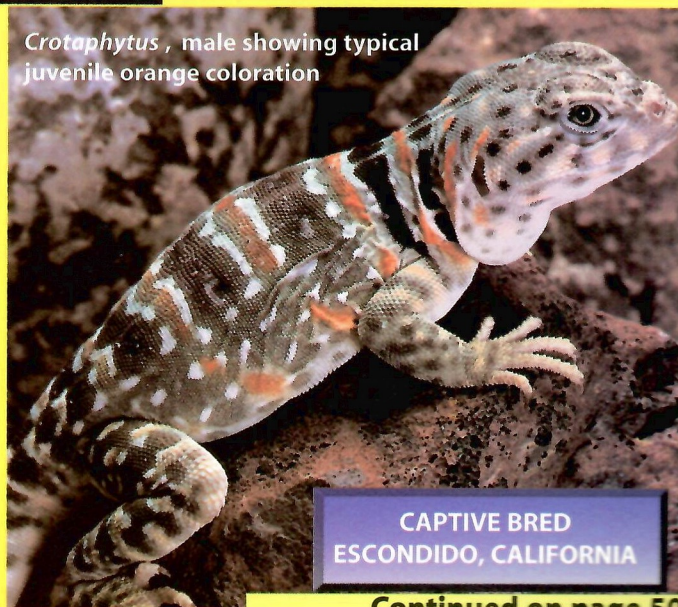
Crotaphytus collaris, female, spotted
phase

CAPTIVE BRED
ESCONDIDO, CALIFORNIA



Crotaphytus collaris, male

EASTERN NEW MEXICO



Crotaphytus, male showing typical
juvenile orange coloration

CAPTIVE BRED
ESCONDIDO, CALIFORNIA

Continued on page 50

Wild Caught-Versus Captive Bred

by Frank Retes

We are at the beginning of a new era - the era of the captive-bred monitor. Just a few years ago, well maybe five to ten years ago, there were very few monitors produced in captivity. Yes, there were several *species*, but not many *individuals*. Not enough numbers to supply the desires of monitor keepers. Most of the monitors sold back then, and even now, were wild-caught.

Now, there are a variety of species being bred, and many more captive-bred individuals of these species offered for sale. A few species, such as ridge-tailed monitors (*Varanus acanthurus*) and freckled monitors (*V. tristis*) are more commonplace and I suspect that every few years another species or two will continue to enter this arena.

Wild-caught versus captive-bred: the tables are turning for monitors. Yet, when I observe the monitor-buying public, I'm concerned about the lack of interest or knowledge about the source of the monitors being purchased. As I look around, the majority of the monitor-buying public seems to be unaware of the advantages of captive-bred, and the drawbacks of wild-caught.

Let's look at some of the differences between captive-bred and wild-caught monitors. Captive-bred monitors are initially more expensive to purchase, but in the long run less expensive to keep. Wild-caught monitors usually spend more time with the vet, running up expensive bills. They also have to be replaced more often, because they have a higher mortality rate. And yet, while this may be true, it's *not* what I think is most important.

What concerns me most is that there are very few expectations with wild-caught monitors. Most people just hope



Ridge-tailed monitor (*Varanus acanthurus*) c.b. juvenile. Photo by Bill Love

these lizards will eat and live a few years. Both the monitors and their owners deserve so much more. If you give captive-bred monitors just the minimum of appropriate care, you will observe the entire life cycle of the animal. You will see feeding behaviors and growth, pairing of males and females, breeding and egg laying. In short, all the things that monitors do.

Wild-collected monitors, particularly adults (who have had enough experiences to make them wary of people and other large potential predators), are typically nervous and stressed. Defensive behaviors such as fight or flight responses are common in many wild-collected monitors. If they are to establish, many wild monitors require lots of work and, most likely, medical care. Many invariably require long periods before they become tolerant of humans, without madly dashing into the sides of enclosures. Being stressed will make captive reproduction very difficult or unlikely in many imported monitors. In sharp contrast, captive-bred monitors will have known nothing other than human environments, where interaction with people is standard fare. They will typically be more

tolerant of handling and human activity. Adapted to their captive conditions, they will often breed readily. As a general rule, owners will derive much more enjoyment from a captive-bred monitor.

Hopefully, with the help of this column and of other people who are working with monitors, we will be able to continue to improve the art of managing and breeding these fascinating creatures. Please send me suggestions and questions you would like to see addressed in upcoming columns.

About the author: Frank Retes is owner of the Goanna Ranch in Arizona, and one of the most recognized Varanid breeders in the world.



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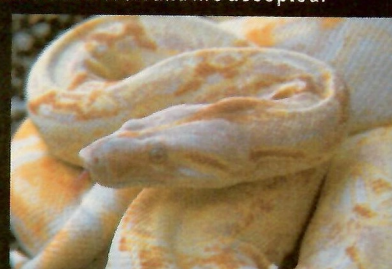
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Managing Humidity in a Captive Chameleon's Environment

By Ardi Abate

Humidity in Nature

Most species of chameleons originate from regions with at least seasonally abundant rainfall and relatively high humidity. Dense foliage in natural habitat and the proximity to oceans and inland bodies of water also contribute to elevated humidity levels. There are some notable exceptions, chiefly *Chamaeleo namaquensis*, from arid regions including the Namib Desert in Africa. The veiled chameleon, *C. calyptratus*, is found in semi-arid regions in Yemen and Saudi Arabia, but inhabits those areas of highest rainfall and congregates near streams that provide condensation. In Madagascar, several species such as the Oustalet's, chameleon *Furcifer oustaleti* and *F. verrucosus* live in the western, southern and northern regions which have distinct dry seasons. During the dry periods, these chameleons are believed to retreat into dense vegetation or become dormant until the rainy season begins. In captive environments, maintaining appropriate humidity levels is essential to the health of chameleons.

What is Humidity?

Air contains water that is separated into microscopic particles invisible to the naked eye. When air is full of water vapor, or saturated, the humidity is considered to be 100%. The relative air moisture is measured with an instrument called a hygrometer. Mounting a hygrometer near your chameleon's cage will help you to monitor humidity levels.

Controlling humidity

To assess the optimal levels of humidity, it is necessary to research the natural environment of each species and approximate it within reason. Some literature recommends that certain species be maintained at 100% humidity, but this may be difficult to achieve

indoors and may result in environments that are too wet. Humidity levels above 75% may require a room fan to keep air circulating to avoid the growth of bacteria and molds, which can be detrimental to the health of a chameleon. Some of the common manifestations of overly wet environments are respiratory disease and fungal infections of the skin and feet. For most species, relative air humidity of 50–60% indoors is a safe, adequate level.

I don't advocate the use of aquariums or other solid-walled enclosures as a means of raising or maintaining humidity for chameleons, primarily due to the lack of air flow and solid floor which prevents drainage of excess water from drip or misting systems. The preferred method of housing is screening on all four sides, top and bottom of the cage. Using this environment, here are some methods to increase humidity indoors or outdoors:

Ultrasonic humidifiers - These humidifiers emit a fog of cool, moist air. Most of them are equipped with a directional output that can be aimed toward the cage. These units can raise the air humidity by 10–15% in an average-sized bedroom. The water reservoir should be disinfected monthly with a mild bleach solution to prevent bacterial contamination.

Misting systems - This equipment generally consists of hosing with inline fogger heads that emit a fine, fog-like mist. They can be attached to a timer or simply attached to a faucet head. If allowed to run for extended periods, sufficient water will collect and drip, providing drinking water as well as increased humidity.

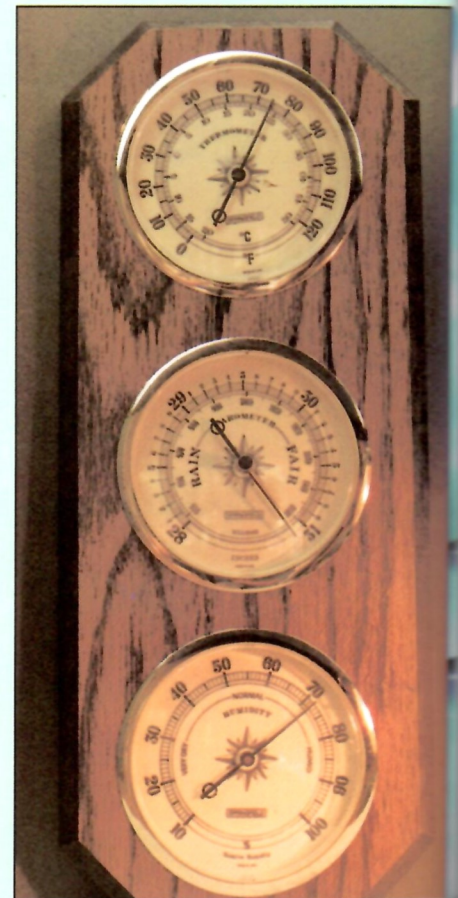
Spray bottles - Spraying enclosure foliage twice daily and frequent watering of the plants will raise humidity significantly. Packing sphagnum moss over the dirt at the base of the plant or tree

in the enclosure will absorb water and evaporate slowly, raising humidity.

Humidity and Health

Proper humidity plays a role in preventing dehydration. Adequate humidity also helps to keep the chameleon's mucous membranes moist and the skin supple, thereby facilitating shedding.

For more information or consultation, contact the Chameleon information Network, 13419 Appalachian Way, San Diego, CA 92129 or call (619) 484-2669.



Humidity gauge. Photo by Ardi Abate

The Search for Fire and Alp Salamanders

Salamandra salamandra

by Thurgess and
Eunice Cranston.

Photos by the authors.

"BAM!" Once again Thurgess was painfully awakened from a tenuous sleep by the drink cart hitting his knee. This time he caught the sadistic look of glee in the eye of the stewardess as she passed by. She and Thurgess had been playing this one-sided form of tag for the past three hours. The seats of a 747 airplane are not designed for a typical human being, let alone a six foot five inch adult man! Each time Thurgess fell asleep, his folded body would unfold and his knee would protrude a couple of inches into the aisle. This afforded the stewardess an opportunity to use her drink cart with efficiency.

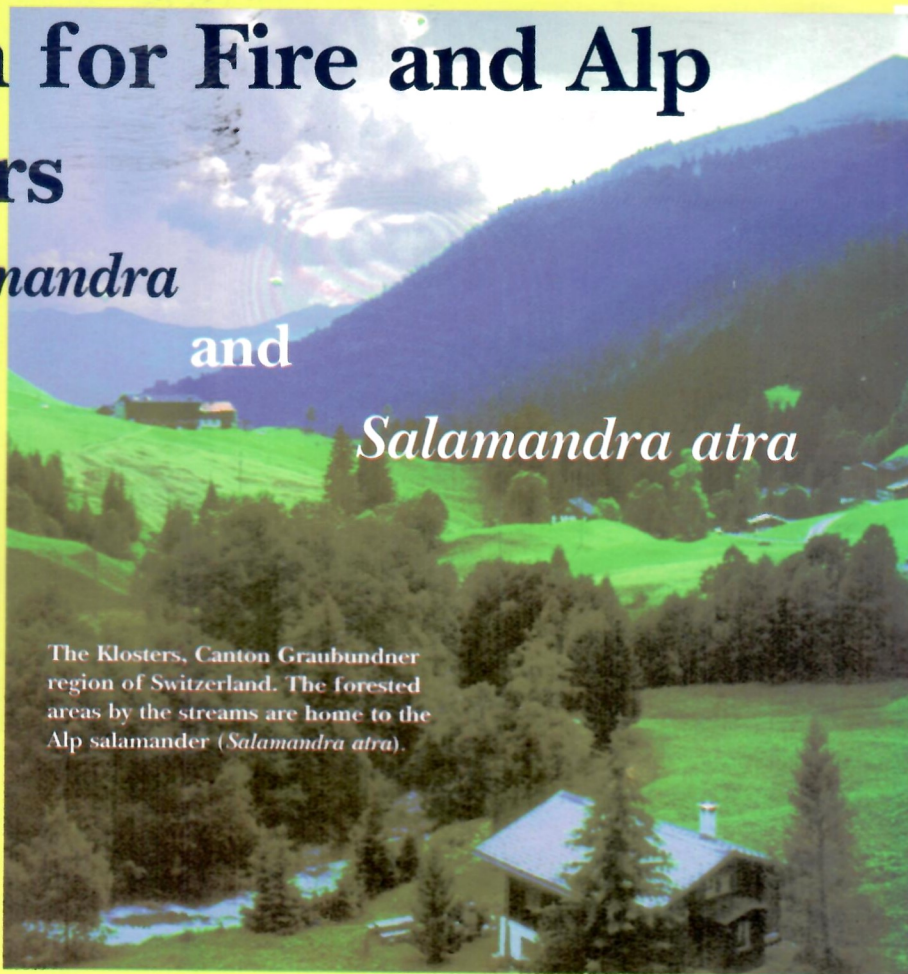
What was a true-to-his bones herper doing on a flight to Switzerland — the land of milk chocolate, watches and strict laws prohibiting the collection of native herpetofauna? The answer was simple. We felt it was time for our three lads, Gern, Francis, and Eugene, to meet the Swiss side of the family.

All of Thurgess' relatives, excluding

his parents and an aunt in Guatemala, live in Switzerland. In fact, his parents would be sharing a house with us in Klosters, high in the Alps. This short trip would also allow Thurgess an opportunity to play Swiss folk music with his father, a hobby he has enjoyed for the past 30 years.

We were also going to photograph several forms of herpetofauna, in par-

ticular the fire salamander (*Salamandra salamandra*) and the Alp salamander (*Salamandra atra*). Both were animals in which Gern had been fascinated since reading an article on European salamanders by Peter Mudde (1994). Armed with that issue of *The Vivarium*, we hoped to observe and photograph these animals in their native haunts, if possible.



The Klosters, Canton Graubundner region of Switzerland. The forested areas by the streams are home to the Alp salamander (*Salamandra atra*).



A fire salamander (*Salamandra salamandra*). The body shape is similar to the Alp salamander. However, an obvious difference is the bright coloration, which is thought to dissuade potential predators from feeding on these animals (Zimmerman, 1986).



This Alp salamander (*Salamandra atra*) is at its site of capture. The animal was released exactly where it was found.



Fire salamander (*Salamandra atra*)

Hunting Salamanders

Finding a likely location for the Alp salamander (*S. atra*) proved easier than we initially thought possible. We hiked the region of Klosters in the Swiss state of Graubundner. At the base of the towering Alps, we found a small, swift running stream. After checking under several logs, we found our first specimen. We excitedly photographed the salamander in its native haunt and released it where it had been found. A few logs later, we encountered several more specimens. These salamanders are interesting because of where they live — high in the Alps in an area that receives significant snowfall and has very cold temperatures. Perhaps their black coloration allows them to receive increased amounts of solar radiation warming during the summer months, thus increasing their chances for survival in such a seemingly inhospitable environment.

Our search for the fire salamander (*S. salamandra*) was not initially as productive. Thurgess' father told him that as a child he had observed these beautiful salamanders at various locales in the hills surrounding Zurich. We tried several of these areas with no success. As luck would have it, we were able to contact Helmut, a young local herpetoculturist who had just recently returned from the United States. During our conversation, we noted that we would like to see fire salamanders in their natural setting. Helmut knew of an area where the larvae were common. We went with the herpetoculturist to a pond and quickly found many larvae. Looking under rocks, we found several newly metamor-

phosed animals. These were photographed and released at their site of capture. Unfortunately, according to Helmut, the majority of these larvae would end up perishing in the sewage system of the town below with the ensuing rainy season.

Herpetoculture

Having had the opportunity to observe the salamanders in their native surroundings, we decided to keep fire salamanders in captivity once we returned to the United States. We wanted to have a couple of these beautiful salamanders on hand as potential photographic subjects. Our son, Gern, was more interested in maintaining these animals as terrarium pets. Soon after returning home we were able to locate and purchase captive-bred specimens for sale in California.

Housing - Our two fire salamanders are kept on damp paper towels in a five gallon (19 l) tank. A hide area is provided by a piece of bark, although we have found that these salamanders do fine without such retreats. We always use bottled spring water to dampen the paper toweling rather than distilled water. This is to prevent any possible osmoregulatory difficulties that salamanders may experience from the use of distilled water in the terrarium (DeNardo, pers. comm.).

Initially, more elaborate terrarium designs were used for our salamanders before settling on the simpler system we use today. Ease of cleaning, ensuring proper moisture levels, and determin-



A typical enclosure set-up the authors use for their fire salamanders. Paper towelling, moistened with spring water and a simple hide area makes for an easy-to-maintain terrarium.



A newly metamorphosed fire salamander (*Salamandra atra*). Note the small size of this amphibian.



The small, swift-moving stream where we encountered our first Alp salamanders.

ing any feeding problems make this a desirable caging solution for us. Scollins (1996) reports that this species may be kept in pairs in a ten gallon (38 l) tank. No territoriality has been observed by us or Scollins in the salamanders housed within such enclosures.

Temperature - One essential aspect of the husbandry of fire salamanders is temperature. We maintain our fire salamanders at 45–50° F (8–10°C) in winter and about 68° F (20°C) in summer. Zimmerman (1986) suggests maintaining them at 41–46° F (5–8°C) in winter, and up to 59–70° F (15–21°C) during the summer months. Scollins (1996) suggests reversing the seasons in areas of extreme summer temperatures. That is, maintain the animals in a cool refrigerator during the hot months, and keep the animals active during the cooler part of the year. Acceptable winter temperatures are reported to be 41–46° F (4–6°C) for these salamanders (Scollins, 1996).

Diet - Feeding our fire salamanders rarely presents a problem. Adults are fed three- to four-week old crickets and the occasional king mealworm. The crickets are dusted bimonthly with Miner-All® I supplement. Several food items are offered two to three times weekly, with a slight decrease in feedings during the cooler winter months. Scollins (1996) reports that these salamanders also feed on wax worm larvae and newborn pink mice in captivity.

Breeding - We have never attempted to breed fire salamanders, although they are frequently bred in captivity (Zimmerman, 1986; Scollins, 1996; Linnley, pers. comm.). Zimmerman (1986) and Scollins (1996) report a ritualistic set of breeding behaviors exhibited by fire salamanders. The courtship of males is extensive and elaborate. During part of the courtship process, the male actually carries the female about on his back. When the courtship is completed, the male deposits a spermatophore that the female picks up with her cloaca.

Fire salamanders are part of a unique group of amphibians that breed on land. During the following spring or summer, the female deposits up to 70 fully formed larvae into a clear, oxygen-rich pond or lake. These larvae have two pairs of legs and feathery gills. Within

five months, the larvae metamorphose and move onto land. The newly metamorphosed larvae, approximately 1.5 inches (3.8 cm) long, have a substantial amount of growing to do before reaching their adult size of approximately 12 inches (30 cm).

Some forms of the fire salamander, as well as the female Alp salamander (*S. atra*), retain the larvae internally until they have metamorphosed. Only then are the neonates expelled from the female's body.

Conclusions

European salamanders such as *S. salamandra* and *S. atra* are unique and interesting. Finding them in the wild was the realization of a dream for our family. Naturally, the carefree hiking with our boys in beautiful Switzerland while searching for amphibians was half the fun. Learning more about the habits and habitats of these beautiful animals was an added bonus. Keeping fire salamanders at home helps teach us the captive requirements of these animals while allowing us to enjoy their beauty. We can almost hear babbling streams and Swiss folk music being played on

our porch in Klosters when we look into their terrariums!

Acknowledgements: We thank Doug Brown, Dr. Dale DeNardo, Mike Linnley, and Helmut Hansen for their help with various aspects of this article. Heritage Photo Lab of Placerville, CA and Terry's Filmworks, Inc., of Sacramento, CA developed many of our photos for this article and for this we are grateful. Finally, we thank Thurgess' parents, Gerold and Adelheid, for setting up many of the arrangements for this trip for our family.

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Collared Lizards

Continued from page 43

captive-bred specimens are often produced from carefully selected or hand-collected parent stock and may also be more colorful and uniquely marked. Beautifully colored captive-bred hybrids which maximize desirable physical characteristics have been produced.

In Captivity

Housing - These active, athletic lizards require spacious housing. A suitable enclosure for one male and one to three females is a tank (30–60 gallons, 114–227 l) with a screen lid. Cage stress is reduced by making the back and sides opaque with photo backdrops or other external coverings. Also, cabinet-type cages with sliding plexiglass front panels measuring 30–48 inches (76–122 cm) long, 18–24 inches (46–61 cm) high, and 18–24 inches (46–61 cm) deep are appropriate for the same number of collared lizards. Screen lids are better than hardware cloth, as the latter is more traumatic to lizard noses.

Collared lizards require places to hide and bask, and enough space to hunt prey. Overcrowding with furnishings should be avoided.

Vertical spacing is a concept in vivarium design particularly suited to collared lizards because of their behaviors and habitat preferences. A slope of the ground elevation from side to side or from front to back provides a terrain which more closely duplicates their natural habitat.

A slope can be made with terraced bricks. A flat rock may be placed over a rectangular tier of bricks, one or two bricks deep, to provide sites for hiding and egg laying. The sand in this area can be three to six inches (7.6–15 cm) deep for defined and controlled burrowing. Substrate over the surface brick need only be deep enough to provide coverage for aesthetic and hygienic purposes. Brick platforms or mesas can be used to place basking rocks under spot lights. The rocks should not rest on loose substrate, for collared lizards will dig under rocks and can be pinned and crushed.

Natural rock is preferred to wood branches. Cork bark makes an excellent cover for hide areas and can also be used to provide vertical spacing in the enclosure.

The best substrate is fine particulate, such as play sand or a few commercial products.

Fecal and urinary pellets should be removed often enough to avoid dangerous bacterial overgrowth in the cage. Depending on the number of animals in the enclosure this should probably be done no less than three times weekly. A small vacuum is effective for this task, and safe if used carefully. Water bowls and rocks should be cleaned regularly.

Heat - Collared lizards are heat lovers. The daytime background temperature in the enclosure should average 95° F (35°C) with a gradient of 85–98° F (29–37°C). Temperatures at night should be no lower than 70° F (21°C), preferably 75–80° F (24–27°C). Hide areas will generally be five to ten degrees F lower than background temperatures in the cage and will serve as escapes if temperatures climb too high.

Background temperatures can be measured with thermometer strips placed just above various ground level points in the enclosure. Two or more thermometer strips located at opposite sides of the enclosure provide a quick assessment of the temperature gradient.

Hot spot basking temperatures up to 110–115° F (43–46°C) are acceptable. Commercial heat rocks which are buried in the substrate may be acceptable as secondary heat sources if an appropriate gradient exists. Temperature control systems with maximum temperature power cutoffs are useful, but generally unnecessary if adequate space in the enclosure is provided and the ambient room temperature is thermostatically controlled.

Heating the hide spot may be necessary, depending on the ambient nighttime temperature drop in the reptile room. Heat tape strips or heated caves may be used for this purpose. When the cage is first set up, frequently monitor the daytime and nighttime temperatures before placing the animals in the enclosure and regularly after the animals are introduced.

Inadequate heat, exemplified by nighttime temperature drops below 60° F (16°C), and daytime high temperatures of less than 85° F (29°C) will often lead to poor feeding, wasting and eventual death. This is probably the most common mistake made by novice *Crotaphytus* keepers. Even so, overheating must be prevented, for background temperatures greater than 110° F (43°C) will lead to rapid demise of animals.

Those who have observed collared lizards in their natural habitats may balk at these temperature recommendations, as wild collared lizards are observed in the spring when daytime temperatures are in the 80's F (27°C) and nighttime lows may be in the 50's F (11°C). Temperate zone lizards, and *Crotaphytus* in particular, efficiently regulate and maintain their core temperature higher than meteorologically recorded environmental temperatures. The black collar efficiently absorbs solar radiant energy. Basking on rocks absorbs solar energy. At night, the lizards burrow under large boulders and often seal off apertures by pushing up earth in order to preserve their thermal mass and core temperature.

Lights - Lighting requirements can be summarized briefly — the brighter the better. A combination of incandescent bulbs for basking and fluorescent bulbs for background lighting works well. For an enclosure 48 inches (122 cm) long, I recommend an 80 watt fluorescent double tube fixture and three clamp lamps for spotlights of 50–100 watts each. Of course, this depends on the overall temperature in the room, proximity to light sources, etc. Metal halide lamps may be ideal additional lights to increase overall brightness, but care must be taken to prevent excessive temperatures within the enclosure, since these lamps generate much heat.

Fluorescent bulbs with high UV ratings are recommended, but no bulb matches the intensity and UV output of the sun. All *Crotaphytus* maintained indoors require regular dietary supplementation with calcium and vitamin D₃ regardless of fluorescent lamp choice.

A photoperiod of 12–14 hours during the spring/summer breeding season is recommended. In the fall, the photoperiod

riod can be reduced to ten hours, and eventually tapered down to no artificial lighting at all, if a period of hibernation or dormancy is desired.

"Cloudy days" can be provided by leaving the spotlights turned off, with only fluorescent lights on. The lizards may not emerge from their hide spots on these days and their caloric requirements will be less. This technique can be utilized when the lizard keeper wants to take a few days away from home without feeding or watering the lizards.

Food and water - In the wild, collared lizards eat insects and smaller lizards. Specific diets depend upon the lizards' locale. For example, where grasshoppers are abundant, these become the primary food source. In the western desert species, smaller lizards such as the side-blotched *Uta stansburiana* make up a substantial part of the diet. Plant matter may be eaten. Reports of captive individuals taking salad items and berries are not uncommon. Some lizards in captivity have even been trained to take pinkies. For practical purposes in captivity, crickets and mealworms are diet mainstays.

Superworms are probably preferable to mealworms, because relative amounts of chitinous exoskeleton in the former are lower. Superworms are now available commercially in smaller sizes (younger ages) and, if appropriately sized, can be fed to younger lizards.

Crickets should be properly fed and dusted with vitamin or calcium supplements at every feeding. I feed my crickets carrots and other orange and yellow vegetables as part of their diet to provide beta-carotene for color enhancement. I use Rep-Cal® and Miner-All® I alternated daily with Nekton® Rep Color.

Babies, juveniles, subadults and breeding female collared lizards should be fed daily. Fully grown adults may be fed less frequently, two to four times weekly. Foods should be offered after the lizards have been warmed up for at least one or two hours. Individual preferences for crickets, superworms, or mealworms, should be noted.

Occasionally, collared lizards regurgitate if overfed. It is more common after

meals of superworms and usually does not represent a major illness. Avoid placing more prey in the cage than can reasonably be consumed in one feeding. Live crickets will congregate in hidespots and under rocks. These should be flushed out during feeding times or removed during cage cleaning.

I offer fresh water by two methods — in a clean, shallow container and dripped over a pock-marked rock to create tiny pools. A plastic cup with a small hole punched in the bottom may be placed on the overhead screen top above the drip rock. Individual lizards will exhibit preferences for water source. Hide spots should be kept moist by lightly watering the substrate at each location.

Handling - Captive-bred collared lizards are easily handled. They may, however, jump away suddenly after sitting calmly in one's hand. Collared lizards don't drop their sturdy tails (which they depend on in the wild for balance when leaping from rock to rock and running at top speed). One can secure the lizard by the tail, if necessary, to prevent escape.

Reproduction

Hibernation - Maintaining collared lizards at cooler temperatures for a period of time is necessary to stimulate breeding and provide optimal health and longevity. The general scheme employed for colubrid snakes may be followed. In September and October, start feeding less frequently and begin to shorten the photoperiod. Stop feeding altogether for about seven to ten days before turning off all heat sources, except for fluorescent lights. Continue to provide fresh water.

After two weeks with only fluorescent lighting, turn off all lights. If possible, lower the temperature in the room to 55° F (13°C). The lizards typically remain in their hide spots as long as the enclosure is dark and temperatures remain below 70° F (21°C). This period may last as long as four months.

When the hibernation period ends, the lights can be turned on, with the fluorescents coming on first, followed by spotlights and other heat sources. Don't feed until the lizards have warmed up

completely for at least two days. Water, however, can be provided immediately.

Breeding - If possible, males should be brought out of hibernation first and allowed to heat up alone for at least one week. Ideally, females should be kept in a separate enclosure and introduced to males individually at the appropriate time.

Two to three weeks after emergence from hibernation, females will ovulate. Round firm ova may be palpated through the abdominal wall. Shortly thereafter, females begin to develop the "nuptial blush" which starts as pink and salmon colored spots or bars around the neck and on the torso, just behind the forelimbs. As the days pass, these colors become more intense.

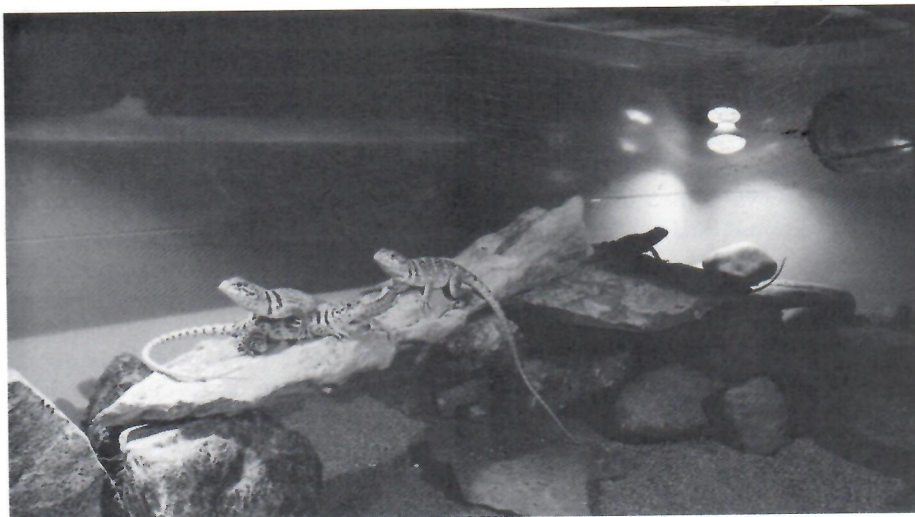
One to two weeks after the orange spots appear, a female can be introduced to a male. By this time, the male will be exhibiting aggressive head bobbing and "push-up" behaviors. He may also drag his hind quarters around in a circular fashion on flat surfaces in the enclosure.

Copulation may occur within minutes of introduction. Alternatively, a non-receptive female will flatten and sway her back, walking on her toe tips. If the male is persistent, a non-receptive female may twist over onto her back, which usually prevents successful penetration by the male.

Following copulation, a male should be allowed to rest one day before the next female is introduced. If separate breeding enclosures are impractical, one male should be kept with only one or two females for effective breeding.

Eggs - During the first two weeks after ovulation and copulation, females become voracious feeders. Heavy calcium and vitamin D₃ supplementation is recommended during this period. Heating and basking conditions should be optimal, and clean drinking water provided regularly.

Feeding tapers off during the last week before egg deposition. Gravid females typically deposit their eggs 21–24 days after copulation. Egg laying sites may be built into the enclosure



Typical desert setup for collared lizards. Photo by Val Brinkerhoff

with bricks or may be provided in modular form with a plastic container, two or three inches (5–8 cm) deep, with a suitably sized entrance hole cut into the side. For egg laying medium, I use a moistened mixture of fine play sand and gypsum.

[Editor's note: Gypsum contains anhydrous calcium sulfate which is used to make plaster of Paris and soil treatments. Because the substance hardens quickly when exposed to moisture, intestinal obstruction has occurred following accidental consumption of anhydrous calcium sulfate.]

Females may begin scratching around in the egg laying site for two or three days before actual egg deposition. Sometimes, the eggs are laid quickly, without much forewarning. At other times, a female may burrow into the egg laying site and "disappear" for two or three days. When she emerges from egg deposition, the female will appear somewhat shrunken in appearance, with loose folds of skin and pelvic bones showing. Her deposited eggs are then retrieved and placed in incubation medium.

Collared lizard eggs are quite soft initially and are susceptible to dessication. I have found dampened perlite to be preferable to vermiculite as an incubation medium.

Incubate the eggs at 80–85° F (27–29°C) [a range of 72–95° F (22–35°C) is acceptable]. Higher average temperatures will lead to a greater number of males, and lower incubation temperatures will produce more

females. Using this incubation scheme, baby collared lizards emerge in 55–70 days.

The sizes of my clutches are typically five to nine eggs, with a range of three to 13 eggs. Females may lay two or three clutches in a breeding season.

Juveniles - Within two or three days of hatching, babies may be fed two-week-old crickets dusted with calcium and vitamin D₃.

Baby collared lizards may average 2.5 inches (6 cm) in length. Juveniles grow quickly, and by six weeks may reach six inches (15 cm) in total length. By three months, they are 8–10 inches long. As early as four to five months of age, collared lizards may attain sexual maturity, and be ready for hibernation and cycling.

Hatchlings are usually vividly marked and colored. By two weeks of age, this coloration has faded somewhat. Then, as maturation progresses to three months and beyond, they become more and more colorful with each passing month. Female offspring may be readily identified by the presence of a melanotic patch or spot on either side of the undersurface of the tail base, just in front of the vent. Color dimorphism is observed in juvenile males by four to six weeks of age, usually starting as blue or green coloration in the tail. Males may also have a more prominent pattern on the chin and eventual coloration on the throat. Both sexes will demonstrate juvenile "red spotting and banding" similar to gravid females. Juvenile males

may retain this orange coloration into subadulthood and, occasionally, after the onset of sexual maturity.

Conclusions

Crotaphytus spp. are some of the world's most attractive lizards, and most are native to the U.S. They are ideal mid-sized vivarium subjects and excellent display animals, well suited as pets and in biology classrooms.

Collared lizards are curious extroverts, remaining outside of hide spots and basking or moving about the cage, examining the environment. Their breeding potential for various colors and patterns is huge and has not yet been realized fully. With modest attention to detail, these beauties can be maintained and bred in a captive environment for many years.

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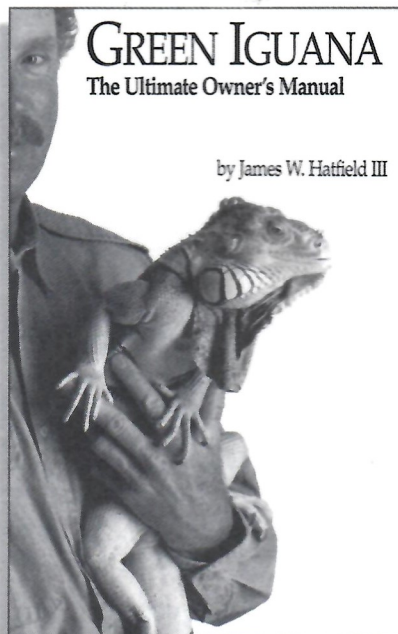
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Sept. 19, 1998: North Bay Herp Society's 2nd Annual Reptile Bazaar, Petaluma, CA. Herzog Hall at Petaluma Fairgrounds. Info: Mat (707) 525-8385 or nbherps@pacbell.net.

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Sept. 19, 1998: Friends of the Animal Shelter Reptile Sale and Show, St. Bernard, LA. St Bernard auditorium. Info: (504) 682-4031.

Sept. 19-20, Dec. 5-6 1998: Texas Reptile Expo. Captive bred. Comfort Inn, 1601 E Division. Info: (903) 862-2291 or e-mail reptiles@koyote.com.

Sept. 19-20, 1998: Mid-Atlantic Reptile Show. Maryland State Fairgrounds 4-H Hall. Info: (800) 235-3297, (410) 557-6879, or www.reptileinfo.com.

Sept 26, Oct 24, Nov 28, Dec 19 1998, Jan 23, Feb 20, Mar 20, Apr 24, May 22, June 19, July 17, Aug 21, Sept 25, 1999: All-Ohio Reptile Show, Columbus, OH. Ohio National Guard Armory, 4094 Sullivant Ave. Info (615) 264-2583.

Sept 26-27, 1998: National Reptile Breeders Trade Association Show, San Jose, CA. DoubleTree Hotel. Info: (316) 325-3096.

Sept 26-27, 1998: Florida International Reptile Show, Tampa FL. State Fairgrounds, Expo Hall. Info: Doug (813) 771-1368 or Dwagner200@aol.com.

Sept. 26-27, 1998: Reptiles Around the World: The Reptile and Amphibian Fair, Seattle, WA. At the Pacific Science Center. Info: Ann (253) 884-2213.

Sept. 27, 1998: Big Apple Reptile Show, Mellville NY. The Mellville Marriott-off the Long Island Expressway at exit 49 N. Info: (516) 338-0551 or www.bigapple-herp.com.

Sept 27, 1998: Reptiles the Right Way Expo and Sale, St Louis, MO. Captive

bred only, Holiday Inn North Airport, 4545 N. Lindburgh Ave. Info: Dave (314) 961-2634

Sept. 27, Oct. 25, Nov. 22, Dec. 20, 1998: Great Lakes Reptile Sale and Swap, Livonia, MI. Ever 7 Hall, 27331 Grand River. Info: (517) 339-7908.

Sept. 27 1998: Nebraska Herp Society Reptile Breeder Show, Omaha, NE.

Ramada Inn, 72nd and Grover (I-80) ex 449. Info: (402) 397-7030 or (800) 228-5299.

Oct 3, Nov 7, Dec 5, 1998: All Maryland Reptile Shows, Havre de Grace, MD. Havre de Grace Community Center, 100 Lagaret Ln. Info: (410) 526-4184 or (410) 838-5876.

Oct. 3-4, 1998: International Reptile Breeders Convention, San Diego, CA. San Diego Concourse, 202 C St. Info: (800) 497-3550 or (619) 263-6898.

Oct 4, Dec 6, 1998: Northern Virginia Reptile Show, Annandale, VA. Annandale Boy's Club, Landmark Shopping Center, 6200 Little River Turnpike, off of I-395. Info: (410) 526-4184 or (410) 838-5876.

Oct. 4, 1998: 8th Annual Midwest Reptile Breeders Expo, Kansas City, MO. Kansas City Airport Hilton, I-29 and 112th Street. Info: (816) 468-5609.

Oct. 10-11, 1998: Southwestern Herp Society, 17th Annual Live Reptile and Amphibian Exhibit, N. Hollywood, CA. North Hollywood Recreation Center, 11430 Chandler Blvd. Info: (818) 764-6124.

Oct 11, 1998: NOAH Reptile and Amphibian Showcase, Cleveland OH. National Guard Armory, 6225 Engle Road. Info: (440) 365-0317 or dragonnews@yahoo.com.

Oct 16-18, 1998: Cleveland Family Pet Show, Cleveland, OH. International Exposition Center, 6200 Riverside Dr. Info: (800) 897-3942 or (216) 265-2657.

Oct 17, 1998, Northwestern Berks Reptile Show, Hamburg, PA. Hamburg Field House, Exit 10 from I-78. Info: Troy (610) 678-2616.

Oct. 17-18, 1998: New Mexico Reptile Expo, Albuquerque, NM. Howard Johnson Convention Center, I-40 & Eubank. Info: (505) 764-9291.

Oct 17-18, 1998: Mid-Kansas Reptile Show, Hutchinson, KS. Captive bred Only. Kansas State Fairgrounds, Eisenhower Building. Info: William (316) 669-5286.

Oct. 17-18, 1998: 4th Annual Captive Bred Reptile and Exotic Animal Expo, Seattle, WA. Puyallup Fairgrounds, Expo

Hall. Info: (206) 363-9095 or fax (206) 333-4205.

Oct 18, 1998: The Pittsburgh Reptile Sale and Show, Monroeville, PA. The Palace Inn at route #48 and #22, exit 16A. Info: Herb (412) 361-0835.

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Nov. 14, 1998: Eastern Herpetological Expo, Downingtown, PA. Info: (215) 257-6088 or www.pythons.com/ehe/.

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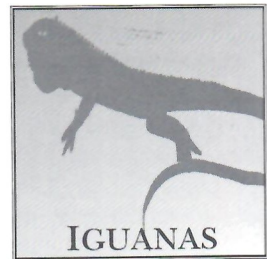
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Breeding Season Problems in Female Iguanas



by
**James W.
Hatfield III**

Last year about this time I wrote an article for this column (*The Vivarium* 9.1) concerning the aggressive problems that sexually mature male green iguanas (*Iguana iguana*) may go through during breeding season. Since breeding season is almost here again, it's time for owners of female iguanas to learn what may happen to *their* lizards.

On the up-side of breeding season, female iguanas are rarely aggressive and "crazy" like their male counterparts can be. But female iguanas can show other behaviors, such as reduced or negligible food intake and mood swings, and may become gravid or possibly even die from egg binding. But let's start at the beginning.

How do I know if I have a female iguana?

It is difficult to correctly sex a male or female iguana until the lizard is several years old (and approaching adult size) because there are no outstanding physical differences between the two sexes. Further complicating the matter, their sexual organs are inside their body, in contrast to a cat or dog.

Very succinctly, a sexually mature male iguana has a larger, broader head with pronounced jowls, and a larger body with longer crest spines. Males are usually more assertive and aggressive. The natural swelling near the base of the male's tail (where the hemipenes are located) is more pronounced during breeding season. Males exhibit prominent femoral pores, often sport bright orange coloration, and may leave semen samples in the habitat. A mature

female can be identified by the absence of these characteristics.

Sexually mature females

Before a female iguana can go into breeding season, she must be sexually mature, which is a function of size, not age. Much research has been done on the breeding behaviors of green iguanas at a special facility at the San Diego Zoo, called CRES (Center for Reproduction of Endangered Species).

I was told by the Deputy Director of CRES, Dr. John A. Phillips: "A female iguana at 250 mm [10 inches] SVL [snout-vent length] is large enough to breed successfully." For all of you who have a female iguana of this length, this is your *sexually mature alert warning*. Start to pay special attention to your iguana's moods during breeding season once this minimum SVL is attained.

When breeding season starts

Breeding season for iguanas in the wild starts about October and ends around December. This is also the normal time for most pet iguanas, but there is some divergence.

It takes 30 days or so for eggs to develop inside the female. After digging a nest in soil, the iguana lays her eggs underground, and about 90 days later (depending on heat and humidity), they hatch. As a side note, female iguanas and chickens have something in common — both can produce eggs without the presence of a male. But of course the eggs can only be fertile if the female has mated with a male.

How to tell if your iguana is cycling

Attitude - The good news is that cycling female iguanas are sweet compared to cycling males, but females still can be "bitchy," restless, and subject to wide mood swings. As an example, females may act nice in the morning and then feign aggressive gestures later in the day, or want to hide or be left alone when they typically don't express

these behaviors. One owner wrote me that his two-year-old female iguana never "head bobbed" until her first breeding season.

Water and food intakes - Most iguanas obtain the majority of their required water from moisture in foods consumed. Once your iguana's eggs start to develop, she may reduce food intake because there is less space in her abdomen. Toward the end of development, the eggs may take up so much space that she may not eat any food.

During this time, it is very important that your iguana *always* has access to clean, fresh water. Leave water out in a bowl with a few pieces of greens in it to attract her. Another sure-fire technique is to gently squirt water directly into the side of her mouth with a plant-type spray bottle. She may pull her head away the first few times, but once the lizard "understands" what you are doing, she may drink spray from the bottle when thirsty.

Abdominal size - A gravid (pregnant) female's abdomen enlarges although she is eating the same amount of food or less. This is a good sign that an iguana is gravid.

Digging behavior - In the wild, an iguana lays her eggs underground. Because of this natural tendency, you may see your lizard frantically attempting to dig in unnatural substrates, such as a corner of her habitat, on household carpets, or linoleum floors. If she has never shown digging behavior before, this is a reliable sign that she may be gravid.

Breeding season dangers

Egg binding - One of the most serious medical problems in female iguanas during breeding season is egg binding. A primary reason an iguana may retain her eggs is because she can't find where her instincts tell her is the proper place

to bury them — soil or sand. Below are other reasons for egg binding:

- ° Eggs may be oversized or odd-shaped, causing blockage in the reproductive tract;

- ° The number of eggs may be excessive for the size and age of the female;

- ° The gravid iguana may be too young, and her body not developed fully for the experience;

- ° Nutrition may be improper; for example, calcium may be deficient.

Egg binding may be prevented by an egg laying box.

Egg trauma - If your iguana is gravid, it is important to reduce the amount of time she is handled to lessen the chance of accidentally breaking an egg inside her, which could possibly kill her.

Breeding season solutions

If your gravid iguana is ill, take her to a veterinarian specializing in reptiles. Following examination and tests, the vet can determine if your iguana suffers from egg binding. Treatment options for egg binding include surgery to remove the eggs causing the problem.

Because of the extra nutritional demands for creating egg shells, your veterinarian may also want to increase the amount of calcium your iguana is consuming.

To permanently eliminate the dangers of egg production and the stress associated with this process, healthy female iguanas can be surgically "spayed" by a veterinarian specializing in reptiles.

Be prepared - Not all female iguanas go through the problems I've mentioned during breeding season, but it helps to know what is possible during this time. With preparation, there will be fewer surprises and less stress for both you and your iguana.

About the author: James W. Hatfield III is an iguana researcher, lecturer and author of the book *Green Iguana - The Ultimate Owner's Manual*.

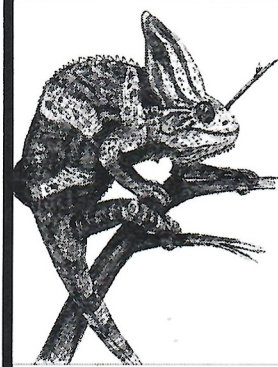
Egg Laying (Nesting) Box

An egg laying box is something you buy or create to replicate an iguana's natural nesting area. Some owners have made boxes out of plywood.

Another option is to purchase a large plastic garbage can and lay it on its side, with moist sand inside. Cut an entrance hole and secure the lid with something like duct tape. The container should be put in place when you see that your iguana is gravid, or even earlier.

Below are some of the characteristics an egg-laying box needs to have:

- An entry hole so your iguana can crawl into the container easily;
- Enough space inside the container for your lizard to move around and deposit eggs comfortably;
- A deep layer of moist sand in the container;
- Darkness within, with a lid that can be removed to check on any eggs that might be deposited;
- Direct, 24-hour access to the container by your iguana.



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With the increase of reptile's and amphibian's popularity as pets, it is essential that quality veterinary care be available. Funding for research investigating disease conditions, new diagnostic techniques, and treatment options is desperately needed, and most researchers work on a shoestring budget whenever funding is available.

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Errata.....

IN VOLUME 9.5 OF *THE VIVARIUM* all photos for the North American Chuckwalla article by Julie Layton Couth were by Mike McKillp.



Coming This Fall: Ernie Liner's

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In 1978, Ernie Liner published a booklet—*A Herpetological Cookbook: How to Cook Amphibians and Reptiles*. Based on recipes he had collected over the years, the publication sold out quickly. Since then, this Louisiana herper has combined two passions—herps and collecting cookbooks—and accumulated over 800 amphibian and reptile recipes. This collection is fascinating to read. Many recipes are from around the world, where herps are used as food sources. Others are strictly academic, as the species used in the recipes may be in sharp decline. *While it is not the author's intention that these animals be decimated as a source of food*, some herptile meat can be purchased at the market, even in the United States (such as frog legs and alligator meat). This book is entertaining to read, and offers a unique perspective on the history of herps as food items. It makes a great gift for your favorite herper!

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Continued from
Herpetology in High School pg 34

cages are washed with a liquid antibacterial dish-washing soap, then disinfected with Rocal® germicide.

Substrate used with reptiles is either newspaper or corrugated brown paper. I prefer the corrugated paper as its texture provides adequate friction to assist with shedding. Also, the brown paper does not react with urine as does newspaper ink.

Amphibians in the classroom are kept on a substrate appropriate for each species. Treefrogs are kept on paper while terrestrial species such as salamanders on peat or sphagnum moss. Aquatic species are kept in aquariums with submersible filters. Water changes are made weekly with well-water, avoiding the chemical additives (chlorine and fluoride) of Shawnee's city water supply.

The safety and well-being of the animals were other concerns of the OVMA. All animals are checked at the beginning and end of each day to assure that each has adequate fresh water, appropriate radiant heat and clean caging free of feces, urine and dead skin.

Tropical reptiles are kept on commercial heating pads in a room which remains at 74° F (23°C). Those animals which require a basking site are provided a clamp-light fitted with an incandescent light bulb ranging from 60 to 100 watts, depending on the species and size of the cage. Lights are on a timer to allow for natural photoperiods.

None of the animals are fed live vertebrate prey. Lizards and amphibians are fed live invertebrates, namely crickets and earthworms. Snakes, as well as some lizards and the tiger salamanders are fed thawed frozen rodents. All prey items are dusted weekly with Reptivite® and a supplement of calcium and vitamin D₃.

The only health problem observed to date has been mites on a Burmese python. The cage was thoroughly cleaned, paper changed and snake treated with a topical application of ivermectin and water.

In order to comply with the guidelines suggested by the OVMA regarding veterinary supervision of the use of live vertebrate animals at the sub-collegiate level, a veterinarian from the Oklahoma Zoological Society agreed to monitor the class and its use of live reptiles and amphibians. She reviewed housing, diet, proposed experiments and final disposition of animals to assure that no animal suffered harm or undue stress. The only dissection of a specimen which had not been preserved was performed by the veterinarian during a necropsy demonstration. The demonstration provided the opportunity for multiple classes to gain from the experience. While the herpetology class received a lesson in gross anatomy, visiting students from the microbiology class took cultures throughout the procedure, with the veterinarian recommending culture sites and techniques.

The Second Year

The 1996-97 school year began with 59 students pre-enrolled in *Introduction to Herpetology*. Since the class had a cap of 30 students and staffing needs in other areas did not allow for any additional sections to be offered at the time, the decision was made to give priority to seniors and work down from there. The result was a class consisting of 30 students — 22 seniors, seven juniors and one sophomore.

This severely limited access to the class was not without its silver lining. Interested students who were turned away from the class were the catalyst for The Herpetology Club, which received the final green light in November, 1996. Open to any high school student, the club is slowly growing in popularity.

Once final approval had been given for the course to be offered a second year, I set about the task of selecting a textbook for the class. While the author did not write the book with the intent of using it as a high school text, one book had a format which was exactly what I was looking for — I chose *Reptiles and Amphibians* by Cogger and Zweifel as my new textbook. Featuring the contributions of eighteen specialists in herpetology, the text follows a logical sequence from the evolution of vertebrate animals during the Cambrian period to modern day specimens.

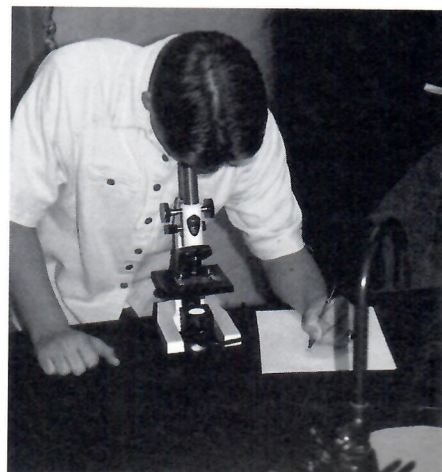
The text's information is accurate and thorough. While "filler" is kept to a minimum, useful information is not sacrificed for brevity.

Although the content of *Reptiles and Amphibians* is perfect for the class, the book is not without its drawbacks. First, its "coffee-table" 12.5 x 10 inch (32 x 25 cm) size makes it rather cumbersome to carry. An open book can cover the majority of a desk top. Moreover, this has to be one of the most poorly bound books I have ever owned. After one semester, many of the books were coming apart. I cannot succumb to the urge to blame this on rough handling by the students since I have the same problem with my personal copies at home.

Later on, I encountered yet another problem with *Reptiles and Amphibians*. The formation of the second section of the class demanded the purchase of more textbooks. A purchase order for an additional 30 books was issued to the Chicago Herpetological Society, but we have been informed that CHS is no longer selling the book. To date, we have located only five additional copies of this text and I understand that Cogger and Zweifel's *Reptiles and Amphibians* is no longer in print. This new development will likely necessitate finding a new class text.

Our Most Recent Class

Enter school year 1997-98. Still growing in popularity, *Introduction to Herpetology* had a pre-enrollment count of 70 students! However, an increase in the number of students with special needs (my primary teaching assignment) required that I could not teach



A student sketches various tissue samples.

another hour of science. The second zoology of the class would go to the Zoology/Botany teacher.

Although initially disappointed that I wouldn't be able to keep both sections of the course of which I felt so possessive, I was still ecstatic that the number of herpetology courses offered at Shawnee High School had doubled. Moreover, the "new" teacher has proven to be a tremendous benefit to the class, as she has evidenced especially strong expertise in the very areas where I am weak.

Funding - As with any course offered in a school district, funding is always a concern. Luckily, the building principals, superintendent and board of education continue to support the class. Aside from salary, the bulk of the expense associated with teaching such a course comes from text books, dissection specimens, and audio-visual aids. This year, several glass aquariums with screen lids were purchased for housing specimens in the classroom. Since the school district provided the aquariums, I provide the animals to correspond

with the scientific order we are studying at the time.

Reference materials - Virtually all of the reference materials available to the students comes from my personal collection of books, magazines, journals, video and audio tapes, and 35mm slides. I find the latter to be crucial in illustrating various concepts throughout the course. Indeed, five of the major exams in the course are identification tests requiring the student to name by common name, scientific name and family the reptiles and amphibians of this state from color transparencies.

It is hoped that, because of the herpetology class as well as the herpetology club, academic interest in reptiles and amphibians will continue to be accommodated at Shawnee High School. It is this author's desire that, as herpetology and herpetoculture continue to grow in popularity, more schools will consider including this high-interest science class among their offerings.

Acknowledgements - A very special thanks goes to the administrators who supported the

class: *The Shawnee Board of Education; Marilyn Bradford, Superintendent; Brenda Hodges, Principal (1995-96); Louis Wolf, Principal (current); Judy Sherman and Larry Penson, Assistant Principals; Billye Sue Hatch, Director of Human Resources; and Carolyn Shirley, Science Department Chair. Thanks also to Sherry Bryant and Ozelle Mills, for proof-reading and correcting this manuscript. I am grateful to herpetology enthusiasts Brian Swinney, Rusty Mills and Kay Bachues, D.V.M. for their donations of time, assistance and specimens. A special thanks goes to Game Ranger Ron Argenbright and the Oklahoma Department of Wildlife Conservation for granting me a scientific collector's permit to take native species. Thanks to Ed Blochowiak, photographer and Mike McCormick, editor of The Shawnee News-Star for allowing me to use pictures from a story they did on the class. Thanks to Joann Clark for patience and assistance in teaching the class. Most importantly, I want to thank my patient (usually) wife, Rita, for her support and my daughter Michelle who started this whole mess by saying "Daddy, can I have a snake?"*

About the author: Gregory Mayberry is a teacher at Shawnee High School, 1001 N. Kennedy, Shawnee OK 74801.

Course Description

Introduction to Herpetology

Prerequisite: None.

Grade Level: 10, 11, 12.

Description: Lectures, lab experiments, field trips, guest speakers, class projects and individual research projects will allow for an in-depth introduction to the field of herpetology, the study of reptiles and amphibians. Hands-on work with live specimens will be involved. Topics to be covered in this course include anatomy, taxonomy, diseases and parasites, field collection and identification, laws and ethics, captive husbandry, genetics, preservation techniques, and conservation status.

Introduction to Herpetology

Course Objectives: The goal of this course is to provide students with a thorough understanding of the field of herpetology, the study of reptiles and amphibians. There are two main objectives: 1. Students will develop a working knowledge of the members of the animal kingdom's classes Reptilia and Amphibia, and the roll they play in our ecology.

2. Students will develop skills essential to scientific observation by conducting

an individualized research project

outside of regular classtime, utilizing accepted scientific procedures and reporting the results to the class.

Optional Texts: *A Field Guide to Amphibians of Oklahoma* by Black & Sievert; \$4.00/\$5.00; and *A Field Guide to Reptiles of Oklahoma* by Sievert & Sievert; \$4.00/\$5.00. While not required, these guides will be of tremendous help on the slide tests!

What is expected of you:

1. You are expected to be in your seat and ready to work when the tardy bell finishes ringing. This means having all necessary materials with you, and having already used the bathroom.

2. You are expected to treat all classmates, teachers, student aids and guests with respect and courtesy at all times. You are *especially* expected to respect the fear some people have of reptiles and amphibians! Having fun at the expense of a classmate's fear will not be tolerated.

3. You are expected to turn in all work on the day it is due. You are also expected to have any assigned reading done by the day it is due.

4. You are responsible for coming to me if you do not understand something, if you need to make up work or if you need additional help in getting your assignments completed.

5. You are expected to remain silent while the teacher or another classmate is addressing the class, during the end-of-the-hour announcements, and while reading in class.

What you may expect from this class:

1. You may expect to be treated with respect, courtesy and dignity at all times.

2. You may expect additional help outside of classtime with any assignment. If circumstances permit, you may expect help during classtime.

3. You may expect to earn a passing grade in this class if you have made a sincere effort to do so. A request for outside help is considered to indicate a sincere effort to pass.

4. You may expect tests and exams to be an honest attempt to evaluate what you have learned, not an exercise designed to "trick" you or "cause you to fail."

5. You may expect to know, in advance, all material that is to be covered on each test.

Jackson's in Jeopardy **Continued from page 17**

should be withdrawn, you may wish to write to:

Myron Isherwood, Plant Quarantine
Branch Manager
Hawaii State Department of Agriculture
P.O. Box 22159
Honolulu, HI 96814

Be sure to mail a copy of your letter to
Fred Krause's boss:
Michael D. Wilson, Chairperson
State of Hawaii Dept. of Land and
Natural Resources
P.O. Box 621
Honolulu, HI 96809

The future of Hawaii's herps may
depend of **your** letter.

Reptiles & Amphibians Are *Persona non Grata*

Jackson's chameleons are not alone in
this Hawaiian mess. The following
herps are listed in the July 15, 1998
Honolulu *Star-Bulletin* as injurious and
banned animals:

- All Frogs • Tokay geckos • Day geckos
- Green iguanas
- Anole lizards • Soft-shell turtles • Red-eared slider turtles

Where's the Science?

There is no mention in the Honolulu *Star-Bulletin* article that field trials have ever been conducted which statistically and biologically show significant negative impacts by Jackson's or other herpetofauna on native Hawaiian fauna. Where are the data which demonstrate that populations of baby birds and native invertebrates (not just leafhoppers, fruit and melon flies, army worms and mosquitos - all introduced pests) are harmed by Jackson's? Where are the data to show that introduced Jackson's and other herps are reducing native species diversity on the islands? In fact, no such field research has been conducted in Hawaii by state officials.

For accurate and detailed information on Hawaiian herps, consult *A Field Guide to Reptiles and Amphibians in the Hawaiian Islands* by Sean McKeown, Diamond Head Publishing, PO Box 7006, Los Osos, CA 93412-2204.

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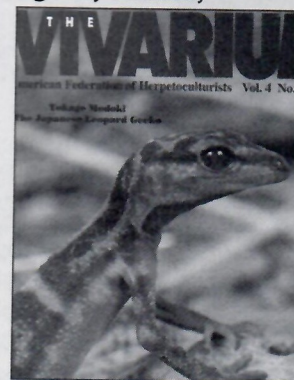
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Issue	Deadline
Volume 10.1	September 18, 1998
Volume 10.2	December 20, 1998

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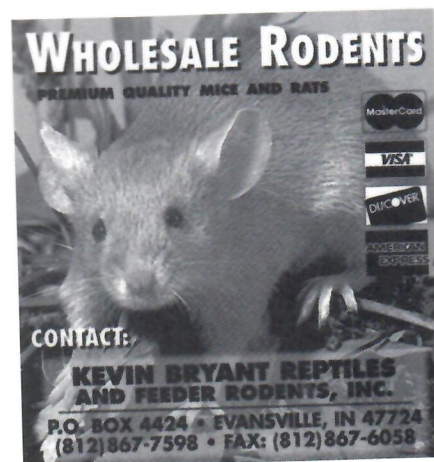
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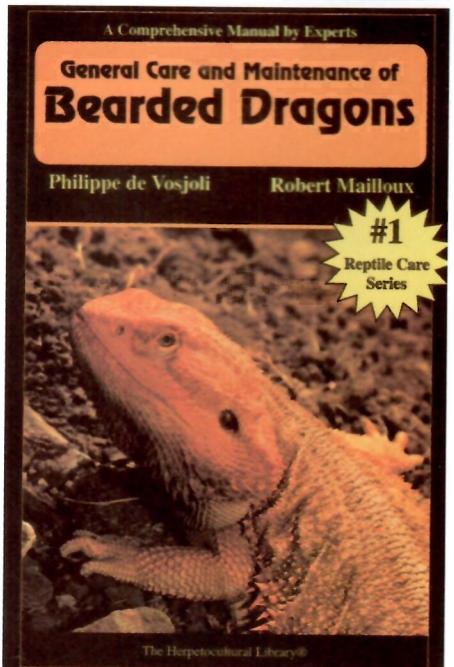
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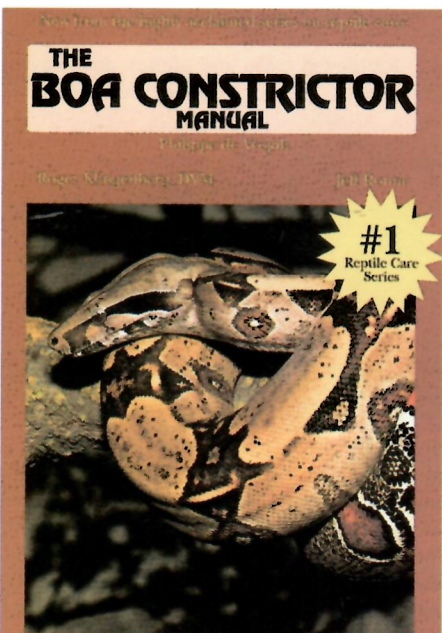
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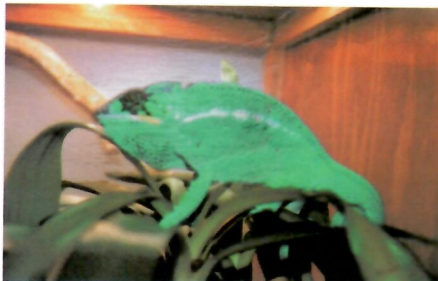
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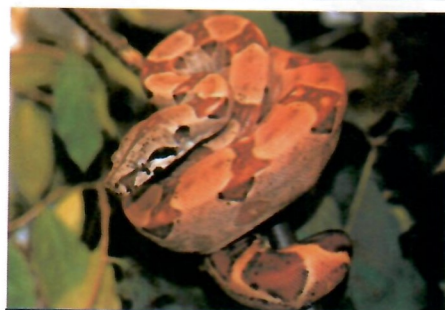
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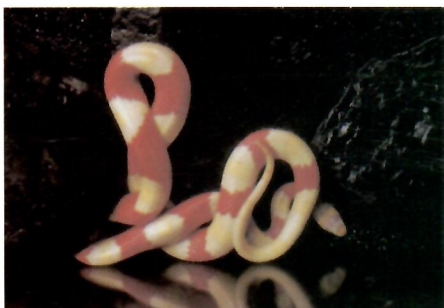
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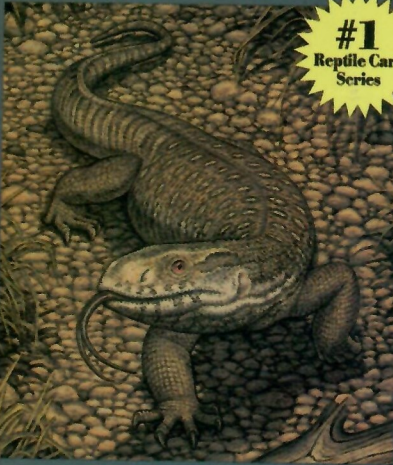
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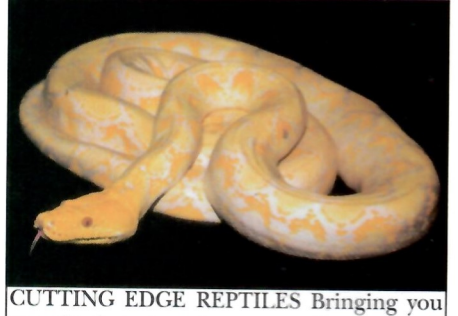
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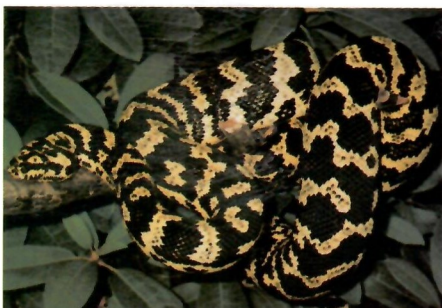
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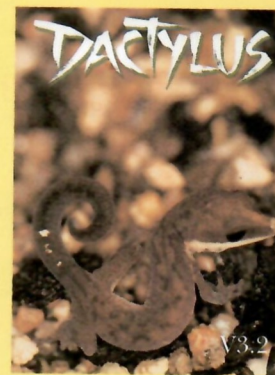
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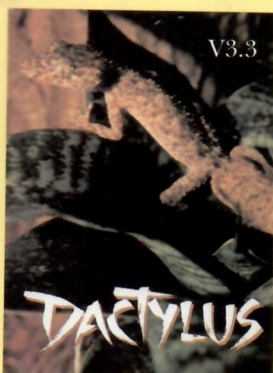
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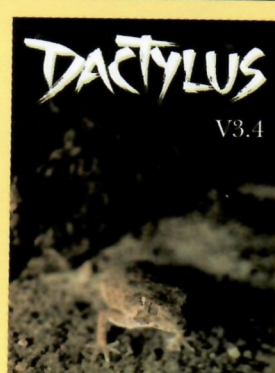
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Choosing a Chelonian
Continued from page 16

Elongated tortoises are hardy and do well indoors much of the year in northern areas of the U.S. They are omnivorous, eating greens, fruit, mushrooms, worms and slugs. Active and personable, these tortoises do well singly or in pairs. Males will fight if housed together.

Testudo horsfieldi, referred to as the "Russian tortoise" before the breakup of the Soviet Union, is now more frequently called the **Central Asian steppe tortoise**, Central Asian tortoise, or Horsfield's tortoise. Large numbers of these tortoises have been imported regularly into the U.S., generally at very reasonable prices. The vigor and charm of these small — up to eight or nine inches, 20–22 cm, for females, and five to seven inches (13–18 cm) for males — chelonians make both captive-bred juveniles and healthy, wild-collected adults extremely desirable pets. They are especially suited for those with apartments and limited backyard space. This species is an excellent choice for first-time tortoise owners and hobbyists alike.

During warm periods of the year, these tortoises do best in backyard enclosures where the grass is encouraged to grow along with edible weeds such as dandelions. They feed readily on a variety of chopped greens, vegetables, fruits and flowers. These herbivorous tortoises originate from a varied, but mostly dry, environment ranging from grasslands around the Caspian Sea, eastward into China and south into Iran, Afghanistan, and Pakistan. The round-shaped carapace is light brown to yellow, with dark brown markings on each scute.

Radiated tortoises (*Geochelone radiata*) are strikingly beautiful, relatively large-sized chelonians, with high domes and flashy markings. They are very long lived and, under ideal conditions, their life span can exceed that of humans. Originating from southern and southwest Madagascar, these tortoises are listed as endangered under the U.S. Endangered Species Act and placed under Appendix I of CITES (the Convention on International Trade in Endangered Species of Wild Fauna and Flora). Large scale habitat destruction and increased consumption threaten native populations in Madagascar.

Radiated tortoises breed well in captivity and several breeders in the U.S. occasionally offer captive-bred juveniles for sale. Purchase prices are high (\$500–1,000 each, depending on the size of the juvenile). Captive-bred offspring can only be legally obtained without federal permits if the breeder lives in the same state in which you reside and you purchase the tortoise within that state. If that is not an option, you must convince the federal government of your expertise with keeping and breeding tortoises and apply for a captive breeding specialist permit from the U.S. Fish and Wildlife Service.

Radiated tortoises need an environment with sustained periods of warm, dry weather. These chelonians can reach straight line carapace lengths of about 16 inches (40 cm). They are primarily herbivores and actively graze on grass.



A hatchling Central Asian Steppe tortoise (*Testudo horsfieldi*) outdoors on grass.



Hatchling radiated tortoises (*Geochelone radiata*) at the Honolulu Zoo



Five year old, large juvenile radiated tortoises housed indoors in a naturalistic enclosure.

Tips for Keeping Tortoises

- Purchase your tortoise in the late spring or early summer so it can adjust to its new surroundings in an *outdoor* enclosure in the yard.

- Weigh your tortoise upon arrival. If the animal appears thin or lacks heft, and does not gain weight, take a fresh stool sample to your vet for examination. Your tortoise may be harboring harmful internal parasites.

- *Always* quarantine new arrivals for at least 90 days in a separate area. Only handle the new animals *after* daily maintenance has been completed for long-term chelonian residents.

- Tortoise yards must offer areas of full sun but also afford a night house and protected areas for shade. Tortoises typically spend the warmest parts of the day inactive and in hiding.

- Never use herbicides, plant sprays, pesticides, snail poison and bait, and keep poisonous plants out of the tortoise yard.

Conclusions

Few other herps can match tortoises for appeal, interaction with humans,

and, when properly housed, suitability for living in modern American yards and homes. However, few pets require a longer commitment. These long-lived animals need knowledgeable owners willing to provide many years of responsible care. And the rewards? Just ask any tortoise keeper!

Suggested Reading

de Vosjoli, P. 1996. General Care and Maintenance of Popular Tortoises. Advanced Vivarium Systems, Inc. Santee, CA. 54 pp.

Donoghue, S. and S. McKeown. 1998. Finding the right hatchling tortoise. *The Vivarium* 9(5):45-46.

Ernst, C. H. and R. W. Barbour. 1989. *Turtles of the World*. Smithsonian Institution Press. Washington, D.C. 313 pp.

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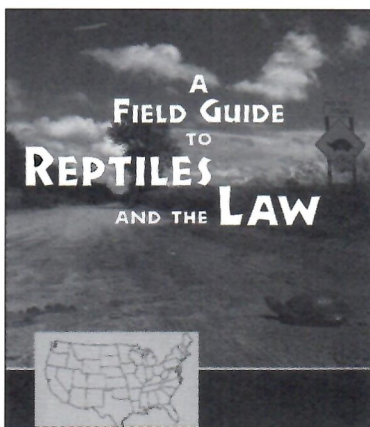
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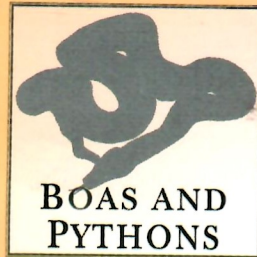
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Desert Vivaria for Boas and Pythons

by Philippe de Vosjoli



Some of the smaller sized pythons and boas come from relatively dry habitats, characterized by sandy soils and scrub/grass types of vegetation, and will adapt well to desert type naturalistic vivaria. Several of these species are now readily available and bred in some numbers by American herpetoculturists. The purpose of this article is to present methods for displaying these snakes in vivaria that, through their design, simulate landscape elements found in nature. As a rule these enriched environments will also allow snakes to display a greater range of behaviors than normally observed in the sterile setups that have become popular in recent years.

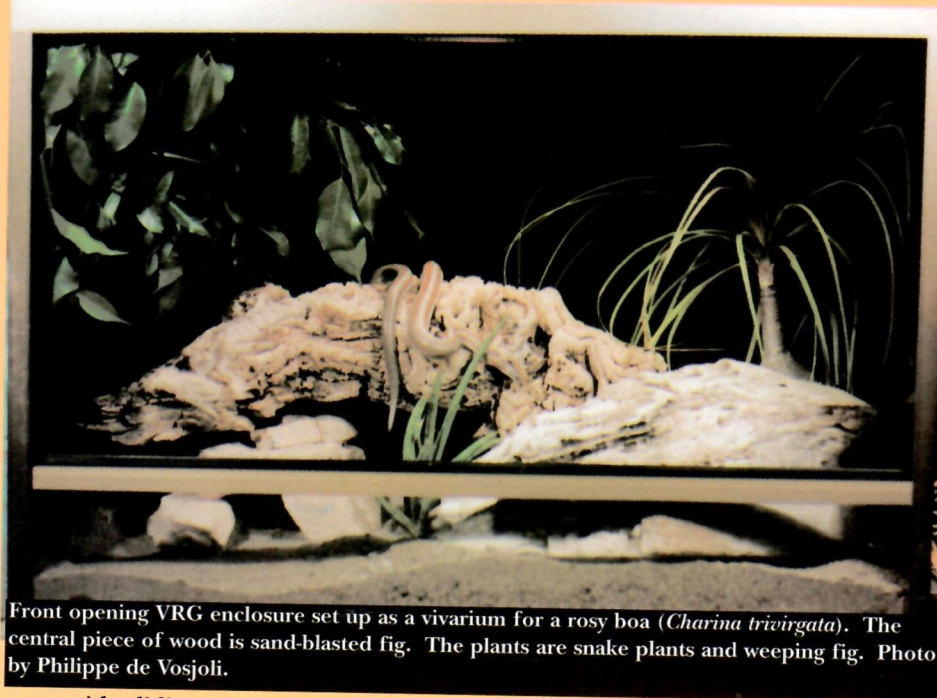
A Brief Overview of Species

The small Australian desert pythons such as spotted pythons (*Antaresia maculosa*), Children's pythons (*Antaresia childreni*) and Stimson's pythons (*Antaresia stimsoni*), because of their size and habits, are ideal candidates for desert vivaria.

Among the boas, the Old World sand boas (*Eryx*) which are normally kept on sand substrates are a natural choice for these kinds of setups. The other dry habitat erycinids that will thrive in desert vivaria are our native North American rosy boas (*Charina trivirgata*). These are now bred in large numbers and have many of the desirable qualities of a good snake pet. They're attractive, relatively slow moving and, in most cases (yes I've heard about the nippy ones), docile as adults.

Enclosures

For a pair of any of the species mentioned here, the minimum size enclosure for a naturalistic vivarium should be 48 inches (122 cm) long and preferably 72 inches (183 cm) long. A wide range of reptile enclosures suitable for vivarium displays are now available in the trade, from all-glass tanks with sliding screen tops to molded plastic enclo-



sures with sliding glass fronts, such as the Neodesha® Plastics cages sold by Bush Herpetological Supply (you can call for custom features such as larger screen top openings).

For those wanting top of the line design and workmanship, Vivarium Research Group Inc. manufactures aluminum-framed, sliding glass-front vivaria with a patented design. For display purposes, all vivaria should be placed on stands at a level that allows for easy viewing.

Substrates

The selection of substrates is important when keeping any of these dry habitat species. Sand and sand-soil mixes (50-50 mixes are commonly used) are the substrates of choice for these snakes in naturalistic set-ups, but there is more to selecting substrate. The kind of sand becomes important, as problems may result if the wrong kind is used.

Hard sharp-edged sands such as coarse silica sand can be abrasive (which is why the latter is used for making sand-

paper). With snakes, sharp-edged sands can cause mild abrasions to the skin and snout that, although not usually harmful, can give snakes a dull or scratched appearance. For this reason, a smooth sand with rounded grains is preferable in desert vivaria. A simple test to evaluate types of sand is to rub a sample between your fingers and feel its abrasiveness. Windblown sand with smooth edges and oolitic limestone sand make good substrates for desert herps.

The grade of sand is also important. Coarse sand that feels like tiny stones will be abrasive and is not recommended. Powdery fine sand may accumulate in eye rims and mouth edges, and give both the animals and landscape structures a dusty appearance. A suitable sand feels smooth between the fingers and runs smooth when it falls from the hand, leaving little powder residue.

Landscaping

Sand boas (*Eryx*) are burrowing snakes that spend most of their time below the soil surface, so rock and wood

won't do much to expand their range of behaviors. A sand boa's concept of shelter is to remain below ground. However, when hungry or looking for a mate, sand boas will emerge above the substrate for short periods of time, tongue-flicking and checking out surfaces, including rocks, for odors.

For decorative purposes, flattened rock can be added along the edges in sand boa vivaria but the rocks should not be placed on the sand surface. To prevent accidental crushing, flat rocks should rest on the floor of the enclosure, or on top of smaller rocks on the floor of the enclosure, before the sand is added.

Dwarf pythons and rosy boas - Rock and wood will add greatly to the appeal of vivaria containing dwarf pythons (*Antaresia*) or rosy boas (*Charina*). These landscape materials should be concentrated on the back and sides of the vivarium, leaving an open front viewing area for the observer. One of the benefits of using rocks and wood is that these types of enclosure furnishings can significantly increase the horizontal surface area within a vivarium, providing snakes with more opportunities for performing a wider range of behaviors.

To prevent injuries and crushing accidents, it is important to anchor all structures so that they can't displace, slip or fall as a result of snake activity. Silicone sealer can be used to anchor various structures in the vivarium (allow 24 hours to dry before introducing animals).

Rocks, although they look natural, can weigh quite a bit and threaten the integrity of a glass vivarium floor. Thinner and flatter rocks that are stacked will weigh less than round clunkers. As a rule, avoid stacking rocks in the center of the vivarium, which is

structurally the weakest point in the enclosure.

As an alternative to rock, natural looking wood is generally lighter and can also be used with good effect. Sandblasted grape and fig wood combined with cork bark creates neat three dimensional structures in a desert vivarium. As a general rule, broad, flat wood pieces are better than thin, twiggy sections, which take up space but are of little use to snakes.

As you will soon discover, dwarf pythons and rosy boas find rock work and large wood sections fascinating. These are the kinds of structures that in nature form shelters and snakes will typically explore areas with crevices and

a children's python which had bred in my vivarium setup and was allowed to maternally incubate the eggs. Being able to observe natural behaviors such as selection by the female of a high humidity shelter and, later, maternal incubation of eggs, made me see these snakes in a new light. No matter how thoughtless and instinctive these behaviors may be, I could not help but feel a certain admiration for the maternal behavior of this species. These are the kinds of voyeuristic pleasures that naturalistic vivaria bring to herpetoculture.

Plants

Plants are optional with these species but add to the display appeal of vivaria. They can be introduced in wide, shallow pots that are buried in the substrate or concealed behind landscape structures.

Good choices include snake plants (*Sansevieria*) and pony-tailed palms (*Beaucarnea recurvata*). Some of the dry-adapted figs such as *Ficus petiolaris* will also fare well. Some aloes that tolerate lower light levels such as climbing aloe (*Aloe ciliaris*) and lace aloe (*Aloe aristata*) are also good selections. The tree opuntia (*Consolea falcata*) with its dark green and nearly spineless pads is the one species of cactus that we have found to consistently fare well under vivarium conditions.



Stimson's python (*Antaresia stimsoni*). This attractive species is now bred in small numbers and commands high prices. Photo by David Barker.

hollows. To varying degrees, they will climb, poke their snouts in openings, investigate the possibilities of shelters, and take advantage of open rock or wood heated by overhead spotlights. It is what snakes do when confronted with three dimensional structures that makes them interesting in naturalistic vivaria. For a vivarist, there is something satisfying in seeing a snake curled beneath a piece of bark or between rocks, knowing that this is what it would probably do in the wild.

Observing for the first time what can only be called a certain curiosity or investigative nature in snakes can also alter one's opinion of serpents being rather dull eating-machines. I once had

Lighting

If the sun shines by day in natural habitats then by all means a substitute should shine on both plant and animal inhabitants of a naturalistic vivarium. As a heat source, spotlights in reflector type fixtures should be placed over flat rock or wide wood sections, with the temperature, when measured at the site closest to the bulb, reaching 90-95° F (32-35°C). A thermostat (place the sensor close to the basking site) or rheostat should be used to adjust the heat level. In vivaria that contain plants, two to four full-spectrum fluorescent bulbs should run the length of the enclosure.

Night lights - I have never used the purplish "night lights" and "moon

lights" now marketed commercially for nocturnal reptiles, so cannot tell you what their effects are. I have used 25 watt red incandescent bulbs and under this lighting have been able to observe the nocturnal behaviors of various herps. This is a night viewing option for these kinds of vivaria. Red incandescent bulbs can also be used to provide heat at night during cool weather.

Heating

In addition to overhead heat lights, many vivarists place a reptile heating pad under 25–33% of the floor surface of a vivarium. Follow directions carefully when installing a heating pad. As a rule, two opposite sides of a vivarium should be slightly raised above a solid surface when using these kinds of heaters unless an open frame stand is used. This provides air flow that prevents dangerous heat build-up beneath the tank. You should also avoid placing thick layers of substrate or rock over the heated section. These may act as insulators that can cause heat to build up to high levels under and over the glass floor, causing the glass to expand and the bottom of the vivarium to crack. As a general rule, a thermostat or rheostat is recommended with subtank reptile heating pads. Placing a shelter over an area heated by a subtank heater will allow heat to build up inside a shelter, a feature which may be useful during the cool winter months. The heat level should be around 90° F (32°C) at the surface of the heated area. Remember to leave at least half of the floor surface unheated to allow snakes to thermoregulate.

Introducing the Snakes

All new animals should be quarantined in a smaller enclosure for up to 60 days before introduction to a naturalistic vivarium. During that time they should be closely monitored for any signs of parasites or disease and treated accordingly.

Following introduction, snakes will show two sets of responses, either they will seek the first shelter available or they will explore the new setup. Often, snakes will defecate soon after being placed in a new tank. Eventually, they will map out their new environment and establish behavior patterns such as moving under a basking area at certain



Children's pythons (*Antaresia childreni*) are a neat small species ideal for display in desert vivaria. Photo by David Barker.

times of the day, hiding in shelters at others, or looking for food in the evening.

Feeding and watering - Pre-killed prey should be offered on paper or a flat rock to reduce the risk of substrate ingestion when a snake is feeding. Sand boas can be offered food on top of a sand substrate. Water should be offered in small containers such as one of the faux-rock plastic reptile dishes now available in the pet trade.

Maintenance - Maintenance is the key to keeping a vivarium attractive and functional. On a daily basis, a quick visual check of the vivarium and its residents should be performed and immediate attention given to urgent problems, such as a snake with a shed problem or a light bulb needing replacement.

On a weekly basis, dedicate a 20–30 minute period to perform cleaning and any design changes necessary to keep a vivarium up to display standards. Fecal matter should be removed, using a scoop, and partial substrate replace-

ments done as necessary. Any shed skins should be removed. The glass should be cleaned. Temperatures should be verified. Plants are pruned and watered or fertilized. Water dishes are washed and disinfected, and water replaced. A water sprayer may have to be used with paper towels to remove fecal smears from rock.

Every two to three months a major overhaul will usually be required, such as substantial replacement of substrates and removal and replacement of unsightly landscape or plants. Over time, a vivarium will usually end up with fairly stable aesthetic elements that will have survived the particular set of conditions one has provided.

Recommended Reading

Barker D, and Tracy Barker, 1994. *Pythons of the World. Volume 1: Australia.* Advanced Vivarium Systems, Santee, CA. A great reference on dwarf pythons including photos of their habitats.



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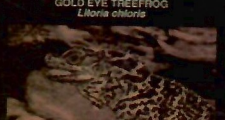
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GREEN IGUANA
Iguana iguana



AFRICAN EGG-EATING SNAKE
Dasypeltis scabra



STANDING'S DAY GECKO
Phelsuma standingi



YELLOW ANACONDA
Eunectes notaeus



GOLD EYE LAVA LIZARD
Erylatia laticeps



BROAD-TAIL GECKO
Tarantula fasciata



CHAIN KINGSSNAKE
Lampropeltis getulus



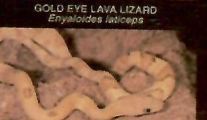
GOLD EYE GECKO
Crotodactylus louisiadensis



TOMATO FROG
Discophagus antonini



SPOTTED RIVER TURTLE
Podocnemis unifilis



TRANS PECOS RAT SNAKE
Eliophis subocularis



GLOBIFER CHAMELEON
Chamaeleo globifer



PANTHER CHAMELEON
Chamaeleo pardalis



GREEK TORTOISE
Testudo graeca



ANGLE-HEADED DRAGON
Gonocephalus godelkroyi



MALAYAN LEOPARD FROG
Rana signata



ISRAELI SAND GECKO
Stenodactylus petrii



ELEPHANT EAR CHAMELEON
Chamaeleo brevicauda



COLLARED LIZARD
Crotaphytus c. baileyi



TWIN HORN CHAMELEON
Chamaeleo iv. potteri



TWIN HORN CHAMELEON
Chamaeleo wilsoni



RED RAT SNAKE
Elaphe guttata



MONKEY TREE FROG
Phyllomedusa savani



FALSE GIRDLED LIZARD
Pseudocordylus melanotus



ROSY BOA
Lichanura t. myriolepis



SAILFIN LIZARD
Hydrosaurus amboinensis



HELMETED WATER TOAD
Caudovibera caudovibera



HONDURAN WOOD TURTLE
Rhinoclemmys p. miami



NILE MONITOR
Varanus niloticus



GEOFFREY'S SIDE NECK TURTLE
Phrynosoma geoffroyi



MARSUPIAL FROG
Gastrotheca marsupialis

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Young Sandfire® Dragon, photographed by David Travis.