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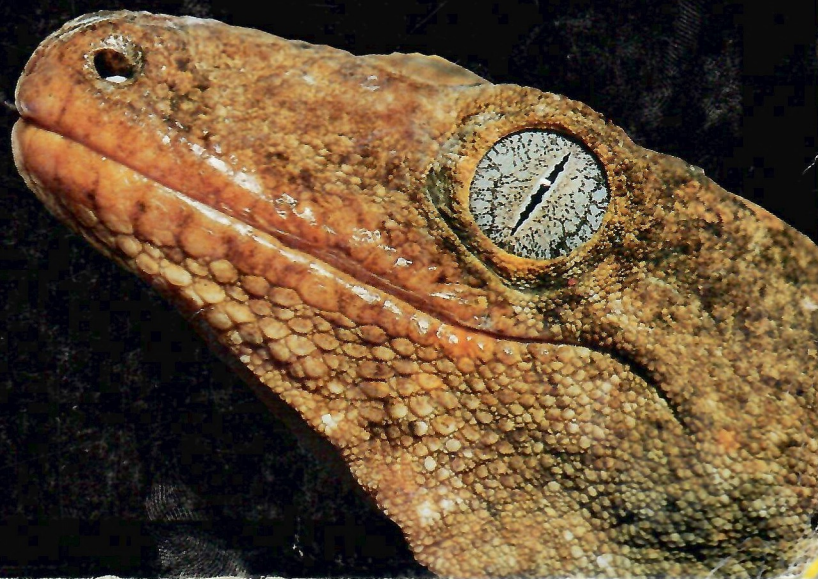
Vol. 8 No. 2

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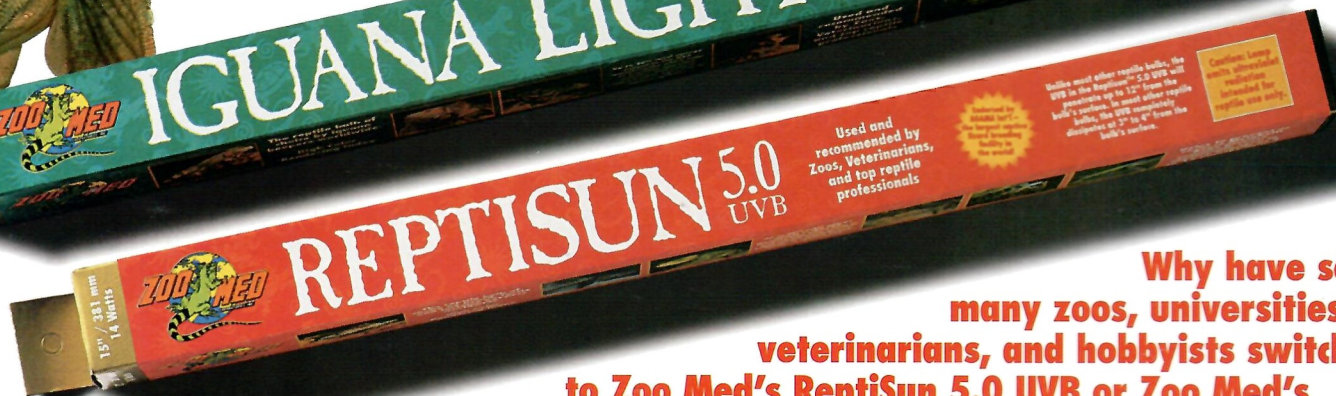


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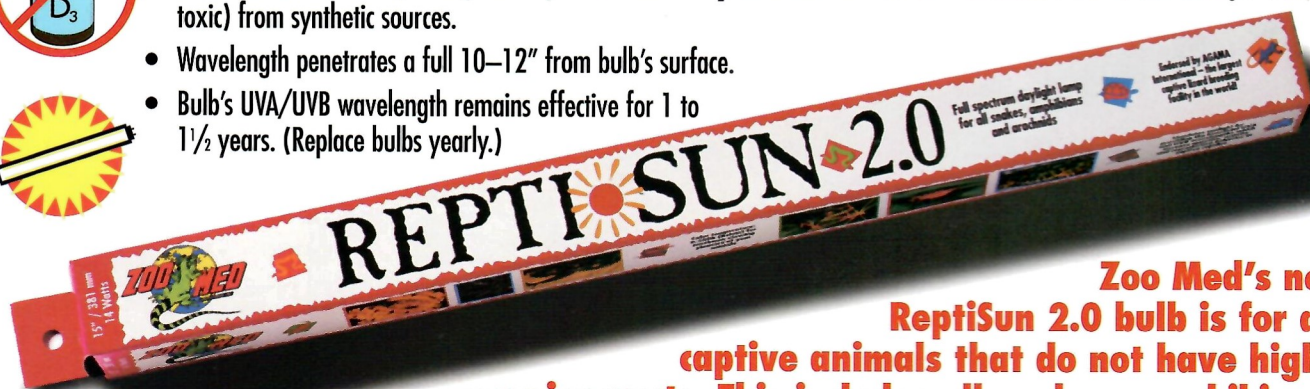
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Mission Statement of the American Federation of Herpetoculturists

The American Federation of Herpetoculturists (AFH) is a nonprofit national organization whose purpose is to represent the interests of herpetoculturists, those involved in the captive husbandry and propagation of amphibians and reptiles, through the dissemination of essential information to individuals, societies and institutions; to document the accomplishments in herpetoculture through our official publication, *The Vivarium*; to promote responsible herpetoculture through education and legislative action; and to establish a general philosophy of herpetocultural education that could contribute to the conservation of biological diversity.

On the cover:

Top left: New Caledonian big-eyed gecko, (*Rhacodactylus chahoua*). Photo by Frank Fast.

Top right: Boelen's python (*Morelia boeleni*). Photo by Dave Barker.

Bottom right: New Caledonian giant gecko (*Rhacodactylus leachianus*). Photo by Frank Fast.



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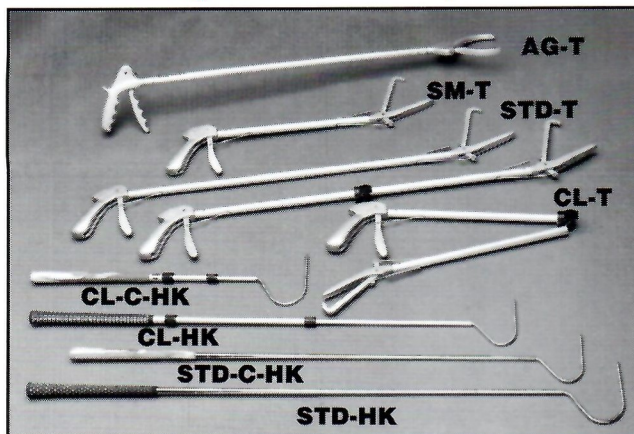
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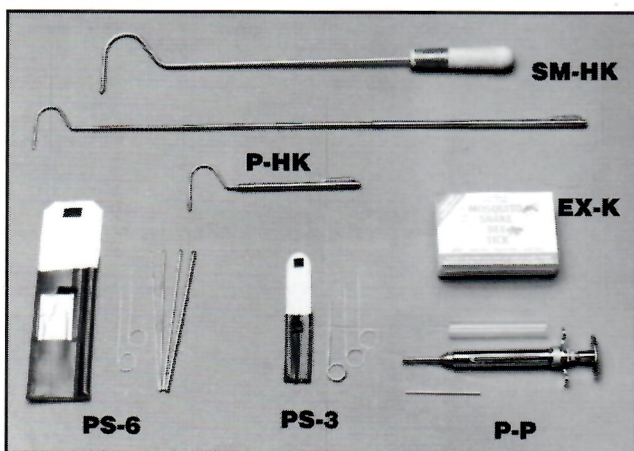
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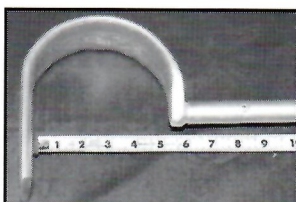
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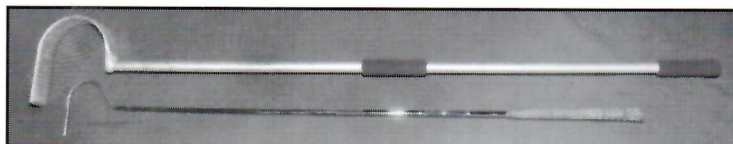
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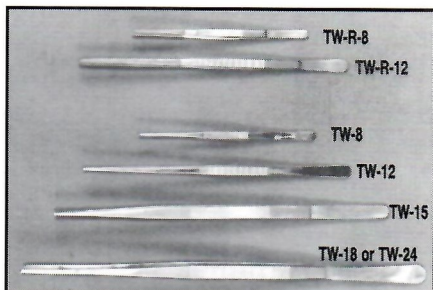
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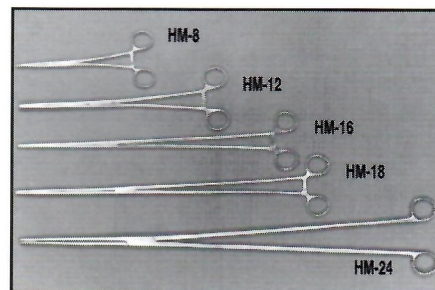
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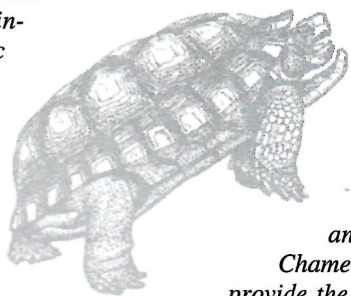
THE FUTURE OF HERPETOLOGY

We asked several of the cutting edge experts in herpetoculture to present their views on the future of keeping amphibians and reptiles, a field that is changing at a dizzying pace.

Gary W. Ferguson Ph.D. in Zoology

- Herpetologist.
- Professor, Texas Christian University.
- Author of numerous papers and articles on lizard behavior and ecology, and on the dietary and light requirements of the panther chameleon (*Chamaeleo pardalis*).

"The most important challenge to herpetoculture is the reconciliation among diverse groups of people that share a common bond, the love of living reptile and amphibian diversity. Currently, some view herpetoculture as negative for at least two reasons. First, herpetoculture stimulates interest in procuring "new or novel" creatures. This can stimulate over-harvesting and mistreatment of fragile wild animals for profit. Second, the production of domesticated/designer captive populations can at best have no value for preservation of natural diversity and at worst can harm natural populations through disease introduction or genetic pollution, if they are released; or these can become exotic pests themselves. On the other side some view the above attitude as unrealistic, elitist, and insensitive to the human need to develop personal bonds with living herps. For those unable to "live amongst them in the wild" like a "Grizzly Adams" or study them in the field as a professional, this means a captive collection. Certainly, there is an acceptable middle-ground. The potential benefits of developed herpetoculture to scientific and conservation efforts can be considerable. Hopefully, this will be more fully appreciated in the future.



Another challenge to herpetoculture is to reconcile the following two views. The first is the attitude that pervades the western corporate world of business, i.e. make it new, make it the best, but above all make it FAST. The second is the attitude of the "scholar", i.e. gather the facts, generate the hypothesis, test the hypothesis, refine the hypothesis, retest and refine the hypothesis until it has a high probability of being true, then and ONLY then apply the new knowledge. The first attitude implies haste, secrecy and competition with your peers. The second implies slow methodical progress and openness.... the more heads together during the developmental process, the better. In my opinion the development of fool-proof technology for herpetoculture is a trial-and-error process that progresses at its own rate. It requires a combination of both subjective artistry and rigorous scientific study. Input from and dialogue among both the professional (scientist, veterinarian, zoo herpetologist, commercial herpetologist, herpetoculturist) and the dedicated amateur is critical. The term "expert" may apply equally to amateurs and professionals. The fast generation of new commercial products for herpetoculture is a necessary part of the process. However, the utopian claims of superiority based on successful testing, which may be incomplete or nonexistent, can be counterproductive. Open forums such as the pet care chats and message boards provided by the computer on-line services and new organizations like the Chameleon Information Network can provide the feed-back instruments necessary to separate the wheat from the chaff and quickly pass on new information and insights across social-status lines.

On the more "nitty gritty" level I see an expansion on the horizon of the concept and technology of herps in "living terraria" or "captive ecosystems." Some chameleon species will take on the status (like leopard geckos) as lizard "white rats" or "guppies." Hopefully, this will reduce the current pressure of overcollecting from the wild. The feasibility

of herp farming in exotic countries will rise or fall on its own merits."

Future Projects: Continue refining understanding of light and nutritional requirements of the panther and other chameleon species. I also plan to begin field surveys of vitamin and mineral content of natural prey of insectivorous herps to provide much needed baseline knowledge of nutritional requirements and tolerances. Another goal is to expand investigation of natural exposure to ultraviolet light and UV requirements of diurnal and nocturnal insectivorous herps.

Philippe de Vosjoli

- Author of many of the best-selling books on herpetoculture.
- Co-founder and President of the AFH.

"Herpetoculture until recently has been propelled by a farming drive and a fascination with the mystery of reproduction and the potential rewards of production. That particular novelty wave has passed its peak and will probably decline until it reaches an equilibrium level with demand. I predict that 1997 will see a crash in the live reptile trade because supply will significantly exceed demand. The new rising novelty waves will emphasize the display appeal of captive environments. This will in fact broaden the interest in amphibians and reptiles and cause a surge in the market probably in 1998. I think we will also see amphibians and reptiles have a greater impact on culture with consequences that are not so easily predicted."

Personal goals: Complete my many books in progress including : *Casting Nets into the Sea of Mind* with Terence McKenna, *The Further Reaches of Herpetoculture*, *Great Tales of the Mad Gecko Hunters*, *Herpetoculture and Education* with Dan McCarron and others. Ongoing research focuses on odd lizard, snake and frog species not yet established in herpetoculture and investigations into new approaches for displaying herps including naturalistic vivarium design.

Susan Donoghue, VMD, MS, DACVN

- One of the leading reptile nutritionists, author of numerous articles, nutrition research, and product consultant, herpetoculturist, and the new Editor of *The Vivarium*.



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"This next year will hopefully bring improved formulation of commercial dietary products (diets and supplements) for reptiles and amphibians because of increased competition and demands from informed consumers. More attention will be given to nutrients and nutrient interactions that have been neglected hitherto but may be important for herps."

Personal projects: Continue research on bearded dragons and tortoises to gather nutritional data on growth and reproduction. In partnership with Scott Stahl DVM, perform similar research on various species of chameleons. Continue other research and the ongoing development of nutritional products. As the new Editor of *The Vivarium* to create with Philippe de Vosjoli a new format and magazine concept which will sustain *The Vivarium* as the most exciting herpetological publication on the market.

Danté Fenolio

- Graduate student at UC Santa Cruz.
- Director of the Amphibia Research Group.
- Amphibian specialist. Author of many articles on amphibians and on experiences in Central and South America.

"For amphibiaculture (a term I have coined), the upcoming year will be an exciting one. Charles Powell and the American Dendrobatid Group is organizing another Frog (Amphibian) Day for next September and has done a great job with this annual event so far. I strongly recommend all amphibian enthusiasts to participate. There may be some previously unavailable varieties of captive-produced frogs on the market in the near future but it is a bit early to say for sure. 1997's International Herpetological Symposium meeting in Costa Rica is shaping up to be one of the best ever. I would encourage anyone who has an interest in tropical amphibians to consider visiting the tropics in 1997 while there is still a great variety of things to see."

Personal projects: Continue writing articles on amphibians in collaboration with Michael Ready for magazines and semi-technical journals. Research the husbandry and propagation of phyllomedusine treefrogs. Pursue graduate work on the casque-headed treefrogs of the genus *Hemiphractus*. Finish a book with

Michael Ready on the captive maintenance of amphibians.

Fredric L. Frye, DVM, Msc, CBiol, FI BIOL

- Fellow Royal Society of Medicine.
- Pioneer of herpetological medicine and author of many of the most important reference books on the subject including the massive two volume *Biological and Surgical Aspects of Captive Reptile Husbandry* (1991, Krieger).

"Within the past two decades, we have witnessed a substantial increase in the number of veterinarians who have interest and expertise to render accurate diagnosis, medical treatment, surgical intervention, and diagnostic pathology for amphibians and reptiles. The reasons for this increase are manifold, but the future should be bright for clinicians engaged in this area of specialized practice, for their patients and for the owners of those patients. Many amphibian and reptile owners now appreciate that properly delivered veterinary services are a wise investment in assuring that captive amphibians and reptiles remain healthy."

Personal projects: Current projects include collaborating with my colleague Professor John E. Cooper, on developing highly compact, yet fully functional, diagnostic medical and pathology laboratory equipment that can be used by indigenous personnel in the field far away from avail-



able electrical and water supplies. I am also collaborating with colleagues on several research projects dealing with captive reptiles.

William Gehrmann, PhD

- Specialist and researcher on the biologic effects of light in reptiles.
- Author of numerous articles on the subject of light and its effects on reptiles.

"My interest in the biologic effects of light extends back to the 1960's and developed a practical twist in the 1980's

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when I met Joe Laszlo and Gary Ferguson. Since that time I have been exploring the question of what features of light are "best" for a particular species living in a given captive environment and receiving a specific diet. I expect that 1997 will see the publication of new experimental data contributing to the resolution of this complex question"

William W. Lamar

- Adjunct Professor of Biology at University of Texas, Tyler.
- Herpetologist. Herpetoculturist.
- Co-author with Jonathan Campbell of the immensely popular book, *The Venomous Reptiles of Latin America* (1989, Cornell University Press).
- Co-founder and primary tour leader of Green Tracks, Inc., an ecotourism company.

"Herp livestock is taking the route taken by the tropical fish industry, with an increasing number of species becoming available at low prices. Solid captive care information is also on the increase as are products and dry goods. In short, what was for many years an esoteric hobby has

become a mainstream industry. I see a steady rise in the number of herpetoculturists who travel to see herps in their native habitats as well as an increase in the demand for literature and audio-visual materials. The expanding popularity of herpetoculture and the growing amount of information becoming available should help combat the ignorance that has given rise to so much repressive legislation regarding herps in captivity."

Personal Projects: Continue my bioinventory work in tropical America. Complete two additional books along the lines of *The Venomous Reptiles of Latin America*. Continue leading Green Tracks tours.

Douglas Mader, MS, DVM

- Leading reptile veterinarian and researcher.
- Author of numerous articles and editor of the highly praised *Reptile Medicine and Surgery* (1996, W.B. Saunders Company).

"As far as the future of veterinary herpetology goes, I would like to see a day



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where herp owners can look forward to receiving the same quality of care for their herp pets as they currently get for their dog and cat pets. I think there will come a day when owners who are looking for the best medicine possible will be able to get it. It will mean herp veterinarians taking an active role in their continuing education, but with an effort, I believe that high levels of competency and service are possible."

Personal projects: Current projects include evaluating and refining anesthetic techniques in reptiles (in particular the green iguana) and understanding the

pathogenesis of kidney disease also in the green iguana.

Dan McCarron. M.S.

- Life Science Teacher.
- Board member and Education Coordinator for the AFH.
- The mind behind the Herpetoculture in the Classroom workshops for teachers.

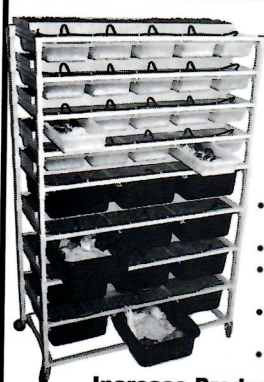
"Sadly, I think we will see more attempts from various governmental agencies to restrict herpetoculture in a variety of ways. This means that we will all need to be intelligently organized in the future. If we ever needed a national organization like the AFH, we need it now."

Personal projects: To continue research on the herpetoculture of *Crotaphytus* and *Uromastix* and the completion of two books including *Herpetoculture in the Classroom* with Philippe de Vosjoli. I will continue developing methods for applying herpetoculture in the context of teaching to broaden and hopefully enlighten young minds.

Erica Ramus

- Publisher
- Owner and editor of *Reptile and Amphibian Magazine*.

"In 1997, I see the profit-only seekers dropping off. The weakest of the shows will disappear (there are too many out there now, and vendors complain they have to go to three times as many shows just to make the same amount of money as they did a year or two ago at one show). Many of the Johnny-come-lately breeders will not have the patience to wait three years for a pair of pythons to reach sexual maturity or will be put off when they real-

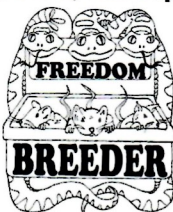


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ize the babies sell for half what they paid for them a few years ago. The strong, established shows and herpetoculturists will survive and even thrive throughout 1997. And once some breeders drop out prices for animals will bounce back, maybe not to pre-1992 levels but at least they will stop the downward spiral."

Personal projects: We will publish 8 issues of *Reptile and Amphibian Magazine* starting in 1997 and will continue to send the *R & A Directory* free to all subscribers. We will also continue to publish reference books like *A Complete Guide to Scientific and Common Names of Reptiles and Amphibians of the World* (Frank and Ramus, 1995) and our new line of "popularized scientific papers" such as the work by Hobart M. Smith and David Chiszar on *Pliocercus*, which are written by respected herpetologists but for some reason do not fit the "cookie cutter" mold of other publishers.

Bob Clark, BS, MS

- Herpetoculturist with a Master of Science degree in herpetology.
- Leading breeder of pythons, specializing in color and pattern mutations.

"Ten years ago the first albino Burmese pythons created a stir in the new field of herpetoculture. Since then, several new color and pattern mutations have been de-



veloped in this and other pythons. This year should see the commercial availability of the granite Burmese python. This attractive new mutation exhibits an intricate pattern of small angular blotches on a high contrast golden background."

Personal projects: I've been producing various combinations of color and pattern mutations in Burmese and reticulated pythons. The heterozygous tiger phase of the reticulated python is beautiful and variable, and the snakes are invariably tame. I'm working with several geographic vari-

ants of this species. I've hatched heterozygous offspring from an albino reticulated python, and work is underway to produce an albino tiger retic.

Phillip Samuelson

- Founding editor of *Reptiles Magazine*.

"In the next several years herpetoculture will experience additional growth and become even more mainstream. Through captive-breeding efforts, a great number of today's seldom bred herps will become available to hobbyists in increasing numbers. We can look forward to significant advances in breeding and husbandry practices, and I believe that there are many exciting things on the herpetocultural horizon."



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HERP NEWS FROM AROUND THE WORLD

by
Ellin Beltz

TRIPOD WINS CALAVERAS

• In the story, "The Celebrated Jumping Frog of Calaveras County" Mark Twain wrote: "You never see a frog so modest and straight forward as he was, for all he was so gifted. And when it come to fair and square jumping on a dead level, he could get over more ground at one straddle than any animal of his breed you ever see." This year an appendage-challenged frog named "Three Legs Are Better Than None" beat 49 other entrants to win the \$750 first prize at the 1996 Calaveras County Fair and Jumping Frog Jubilee. The handler found TLABTN in a canal a week before the contest. "He theorized that having only three legs had helped the frog develop stronger hind legs," reported *The New York Times* [May 21, 1996 from Karen Furnweger]. The winning jump composed of three hops measured 20 feet 11 inches.

SING SONGS OF LOVE

• An attempt to encourage endangered Pine Barrens tree frogs to use man-made breeding ponds may help to settle a 10-year-old lawsuit between a cranberry farm and the state of New Jersey. The farm has been trying to expand its 22-acre operation, and has had to file a foot-high pile of paper with various federal and state agencies because the endangered frogs were found on the property. If the frogs can be encouraged to use the new ponds, the farm can expand the cranberry bogs and everybody may end up happy. Researcher Joel Gove will survey the ponds for three years. "My wife's a biologist, so she'll come too," he said. "We'll make it a romantic outing." [*The Philadelphia Inquirer*, November 26, 1995 from Wayne Brown]

ARRIBADA! AT AN IMAX NEAR YOU...

• The Bundasberg, Australia *Newsweek*, January 8, 1996 editorial: "This city attracts the international attention of scientists and tourists because it is near the site of one of Australia's largest sea turtle rookeries. Turtles nest all along our coast but particularly on Mon Repos Beach... a diligent band of... staff and volunteers spend the nights telling anyone who will listen just how tenuous a grip the turtles have on life... However... the most important thing for the future of our turtles is how much money they are worth to us alive. We need to keep the focus on the economic benefits of the turtles' nesting habitats if we are to provide long-term protection... The Mon Repos turtles represent a major tourist attraction for the domestic and international market. And, in the final analysis, the continued nesting of the turtles on our beaches is worth more than the cash value we give it. But it is the cash value and not the intrinsic worth that offers the turtles their best insurance that we will keep working for their preservation." [From Peter Richardson]

SUPERTRAMP BY STEPHEN KING

• Two Florida biologists worry that the brown tree snake which has taken over the island of Guam's ecosystem since its accidental introduction during or after World War II may get loose in their state. Writing in the Reader's Forum of *The Miami Herald*, they argue that the funds cut from the Pentagon budget for brown tree snake study may result in *Boiga irregularis* arriving on the continental US: "... [it] is a frequent stowaway on cargo leaving Guam. It has already reached at least 10 Pacific islands in less than 15 years... Florida military bases serve as home ports... The snake's high densities [from] 10,000 to 15,000 per square mile, near villages, seaports, and airports plus Guam's large volume of international traffic, create ample opportunities for snakes to be passive stowaways... [they] have arrived alive in such distant sites as Southern Japan, Hawaii, and even Corpus Christi, Texas... [it] could devastate Florida's native rodent, lizard, and bird populations, as it has done in Guam... Can you imagine what would happen to Florida's tourism industry when a visitor happens to get up in the middle of the night and finds an aggressive brown tree snake in the hotel bathroom?" [April 11, 1996 from Alan W. Rigerman] I suppose it would depend on whether the tourist in the bathroom was a herpetologist or not.

• In Broward County, residents are terrified that a mysterious dog-lizard named *chupacabra* is responsible for a recent spate of mysterious deaths of dozens of animals including chickens, goats and geese in Sweetwater. The *chupacabra* is called the "bigfoot of the Caribbean," has hideous red, fiery eyes, stands on two legs and sucks blood from living animals according to the report in the *South Florida Sun-Sentinel* [March 19, 1996 from James M. Abel]. A local disk jockey recorded "Goatsuckers" to the tune of "Ghostbusters" and "Chupacabrafragilistic-expialidocious" after the Mary Poppins song of a similar title. No one, so far, has suggested that *Velociraptor* really did escape from Jurassic Park to the mainland.

CASH VALUE NOT INTRINSIC WORTH

• Alligator meat in the U.S. is bringing about \$10 million-a-year; sale of hides at an average \$20 per foot is not included. "Eggs are taken from the wild and hatched, then the tiny reptiles are put into dark hothouses where they are raised about 16 months, or until they reach four or five feet." Hides go to France, Italy and the Pacific Rim. Finished articles from raw hides can sell for thousands of dollars. One farmer said, "We can't even begin to meet the demand." Florida wildlife regulators are considering removing alligators from that state's protected list. [*Miami Herald*, March 12, 1996 from Alan W. Rigerman]

• A woman in Arkansas City, KS "was bitten by an Osage copperhead approximately two feet long [while she] was working in her yard... just after dark [about three years ago]" writes contributor Marty Capron who sent a clipping from the March 22,

1996 *Winfield Courier*. The victim's husband filed suit against medical personnel, Wyeth-Ayers Laboratories and American Home Products Corp. Each of ten charges asks for \$50,000 to settle.

• Police detained a 10-foot long boa constrictor and two 2-foot lizards when they responded to a Narcotics and Hazardous Materials problem at a Tacoma, Washington home. Equipment and chemicals for the production of methamphetamine were found in a garage behind the house. Also arrested were two residents on suspicion of drug manufacture. [*Tacoma, WA News Tribune*, March 30, 1996 from Alan Tuley]

HARD TO SWALLOW DEPARTMENT

• Sick villagers were cured after a python was found under a Cambodian house. Locals have added the python to the pantheon and are worshipping it according to a report in the January 24, 1996 *Daily Telegraph* from Wes von Papineau and Kimberley Heaphy.

• Reuters reports that a Boca Raton, FL pool cleaner was unpleasantly surprised when what he thought was a dark toy on the bottom swished its tail. "I don't even think my feet hit the patio," he said. Trappers hoisted the seven-foot gator out of the pool. The alligator apparently got in through a hole in the fence. Mating season has started; perhaps it thought it had found new habitat. [*The Seattle Times*, March 31, 1996 from Alan Tuley]

• A three-foot alligator removed by five Metro-Dade police cruisers, a Florida game officer and a freelance trapper apparently changed size during capture. "When it walked, it was bigger," said a bystander who helped police chase the gator under a car and into a garbage can. [*Miami Herald*, April 5, 1996 from Alan W. Rigerman] Wildlife trapper Todd Hardwick said, "For me this is a signal of spring time."

• "Poisonous cobras" escaped from a snake-farm in Semarang, Borneo and prompted dozens of letters of complaint to the snake-farm according to the *Jakarta Post*. [Lisa Marie Post, Freehold, NJ from the *Asbury Park Press*, March 17, 1996] When will the newspapers ever get it right? Poison is when you eat it. *Venom* is when it is trying to eat you.

RIBBIT AND WEEP

• "Although some states permit there [sic] citizens to be exposed to obscene amphibians, at least one has stepped in to defend Western civilization: Ohio has banned [Bad Frog Beer] because of its label." [*Ottawa Sun*, Marc 17, 1996 from K & W Herp Haven] Apparently, the frog has some central digit extended. The question is, with only four fingers on the front appendages, which is "the bad finger"?

WELCOME TO GLOBAL WARMING

• Almost a hundred pythons were rounded up in three-weeks by authorities in Bangkok, Thailand after the snakes were flushed from their holes by flooding. [*The Fairfax Journal*, February 22-23, 1996 from Bryan McCarty]

• In Durban, South Africa flooding flushed a two-headed herald snake into a garden in the southern part of the province of KwaZulu-Natal. Some are concerned that the snake is a harbinger of great misery and have asked the owner of Fitzsimons Snake Park to permit them to release it in the wild. [*The Ottawa Citizen*, March 4, 1996 from K & W Herp Haven]

• In Bolivia, drought apparently forced thousands of toads out of their usual habitats into farmland and villages in search of water. "Radio reports from the [three] villages... said that the main road connecting the region with La Paz is coated with a thick layer of dead toads, and that the stench is unbearable... farmers in the area reportedly feel that the onslaught is a sign of impending tragedy." [*San Francisco Chronicle*, March 9, 1996 from Grizzly Gibson]

HAWAIIAN CLEANUP NETS REPTILES

• The state of Hawaii has long been concerned by the potential threat to agriculture and tourism from illegally imported and maintained exotic animals. In three separate reports from *The Honolulu Advertiser*, contributor G.E. Chow of Kaneohe shows just how common this problem really is in the islands. March 18, an 18-inch corn snake was turned in by an Oahu resident after a Big Island man was sentenced to a \$25,000 fine and a year in jail for possessing a ball python. Jackson's chameleons were turned in by two separate owners on Kauai the day before. March 22, a Haleiwa woman surrendered a 28-inch iguana and March 24, a 6-foot 1-inch Burmese python and a 15-inch monitor lizard were turned in to the plant quarantine station of the state's Department of Agriculture during an amnesty drive.

CANE TOAD PREDATORS

• Snakes, birds and water rats around Townsville, Australia have learned how to kill and eat cane toads without fear of the toxins secreted by the noxious and notorious amphibian pigeon equivalent. The researcher said, "I've found toad skins in nests and dozens of skins hanging off tree branches. The kite appears to be able to flip toads over on their backs and peck their guts out. They can avoid the poison glands on their backs that way." [*Brisbane Courier-Mail*, September 8, 1995 from K&W Herp Haven]

CALL WAITING WITH A BITE

• "Bundaberg [Australia] herpetologist Peter Richardson accepts snake bites as an occupational hazard... was bitten by a taipan in 1988... correct first-aid measures were carried out and he was in hospital within seven minutes... 'Having the [first-aid] certificate certainly made a big difference and having a mobile phone is handy, if you don't have to move to alert help, it is beneficial... Our research showed that in this industry [in Queensland] you can expect to get bitten every three years by a highly venomous snake.' The survey was originally prepared for the Second World Congress of Herpetology held a year ago in Adelaide. [*Bundaberg Newsmail*, November, 1995 from Peter Richardson]

Thanks to everybody who contributed for this issue and to Matthew and Laurie Aikawa, Philip Averbeck, Dale McDonald, Sean McKeown, Jett, Marine Mammal Stranding Center - Brigantine, NJ, François leBerre, Robert Innes, Wes von Papineau and Kim Heaphy, Alan Tuley, and Alan W. Rigerman for more and duplicates. You can contribute, too. Send either the whole page or clippings with the date/publication slug and your name on each page to "Ellin Beltz, Herp News Around the World" in care of the AFH at the address on the masthead.



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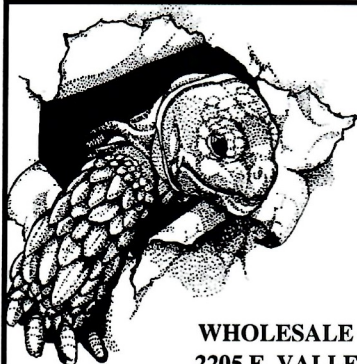
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Great Tales of the Mad Gecko Hunters: ISLAND X AND RIDING THE WAVES AT THE MOUTH OF DEATH

by
Philippe de Vosjoli

The following is the true and continuing story of my adventures with intrepid gecko collector and researcher Frank Fast. It is a tale which deserves to be told possibly as a warning or maybe as a tempting carrot dangling at the end of a stick. That will be for the reader to decide. It's been nearly two years since that fateful day and I am only now sitting down to write about it. To the best of my ability to recollect those particular events, this is an accurate account of the 48 hours leading to the day we sailed the edges of the mouth of death. Island X is off the coast of New Caledonia. Its identity will not be revealed to assure that it will not be plundered by illegal collectors or damaged by tourists.

Island Z: three days before..

We had just come back from an exciting trip on island Z. Besides the giant geckos, Island Z had several kinds of land hermit crabs including a brilliant red hairy species, giant coconut crabs, hundreds of butterflies and beautiful wet forest with attractive shelf mushrooms, miniature orchids and odd bluish algae growing on the trunks of trees. By an exposed section of coral rock we also found banded sea snakes, black and blue and shiny and just about as pretty as any snake you would want to see. It had been a grand trip except for one thing: we had had little sleep in the previous 72 hours and it was hot and humid. We were exhausted by the time the small motor boat dropped us off on Island Z's sandy shore.

Initial attempts to nap in our tent proved hopeless. The inside of the tent felt like a sauna and sleep was out of the question. So we stretched out in our shorts by the ocean's edge. The sky was overcast and a comforting breeze was blowing. We tried to doze but woke up within an hour and decided to explore the shore and later the interior of the island, still too warm to even wear shirts. The next day we paid the price. We were sun-baked to the point where every little movement and the

slightest contact with the skin felt like torture, especially for fair-skinned Frank.

And so it turned out that the following morning after a restless night we visited the local infirmary on the large island which was our base camp to get Frank a topical salve with painkiller. Sunburn is a common occurrence in the area and elicits an "eyes to the sky" expression meaning something like "Ah those dumb tourists." The day before, Frank and I had commented on the bright red color of pale-skinned Japanese tourists sitting around the hotel pool looking like lobsters around a lobster pot. "Boy are they in for an experience" we commented to each other. Sometimes the universe doesn't let you get away with being a wiseass . . .

After our brief stint at the infirmary we went to the small local market to pick up supplies for our two day exploration of Island X: cookies, granola bars, canned ham, bread and bottled water. Gourmet dining was definitely not the focus of this trip.

24 hours on ISLAND X

On the way to island X, bouncing up and down on waves about six feet high, the captain explained to us the skills necessary to navigate between the coral reefs and how large boats with large keels can usually not make it safely to these small atolls. We were dropped off on a sandy area where previous visitors had cleared a spot for setting tents or fixing meals. For skin-diving and scuba-diving aficionados the coral reefs surrounding this small island were considered a prime spot for observing reef animals and spear-fishing. Obsessed as we were, the only thing that really interested us was whether the island had any *Rhacodactylus* geckos.

As soon as the boat left we started setting up camp which basically meant putting up and anchoring a small tent so that our supplies would in some way be protected from the elements. Within a half hour we set out for an exploratory walk so that we would have some sense of bearing when we explored the island at night.

It became obvious as we walked across the sand dunes that sea birds had their

burrows here and we did our best to avoid them on our way to what seemed a tall forest close to the shore. That forest was a revelation. It was the first red mangrove forest we had encountered in New Caledonia and it was0 breathtaking in its beauty -- from the tall handsome red mangrove trees to the clear pools of water and the colorful litter of dying red mangrove leaves and blossoms. Along the edges were coral rock outcrops with large birdsnest ferns (*Asplenium nidus*) growing out of their tops.

Toward the back end of the forest, I spied a fallen dead mangrove tree with peeling bark and started to lift bark sections whereupon I discovered a species of *Bavayia*, a genus of small geckos endemic to New Caledonia. I called Frank over since he is such a great fan of these little geckos. He proceeded to collect them while I turned more bark. A few minutes later Frank called to show me a scorpion species and then again later to show me a subadult New Caledonian giant gecko (*Rhacodactylus leachianus*) which he had found under a section of bark less than two feet above the ground. This was the first *leachianus* we had collected during the day and the closest to the ground that we had ever found one. I was thrilled and also cursed the fact that Frank was to have such good luck. Why doesn't this happen to me, I thought.

After about a half hour we decided to explore a forest area where the ground had been all cleared of vegetation and where shearwater burrows abounded. Shearwaters are medium sized seabirds that resemble petrels. They are amazing little flyers when encountered out at sea that often just zip along above the ocean surface which I figure is how they got their name. Possibly because of their high density the shearwaters on Island X had to build burrows inland from the shore, invading an area of forest and clearing all but the primary vegetational stratum. The ground was bare of any weed or shrub. One of the consequences is that without the lower vegetational strata and with the soil instability of burrows, the soil tends



Intrepid mad gecko hunter Frank Fast on Island Z meeting fishermen who had stopped for a visit.



Red shelf mushrooms on Island Z. The forest was a mix of *Araucaria* trees and various tropical hardwoods.



New Caledonian Giant Gecko (*Rhacodactylus leachianus*) from Island Z.

to erode and trees can lose their anchor and fall. Interestingly all the trees in the area were like natural bonsai around fifteen to twenty feet in height and contrasting sharply against the tall trees of the surrounding primary forests.

We walked through this area and along the primary forest edge. It was while

trampling through that bonsai forest that I accidentally put my hand on a small *leachianus* hanging head down on a small tree trunk about three and a half feet above the ground. I was reaching to stabilize myself when suddenly, as I felt the soft body against my hand, I called out "I'll be damned, a leachie in broad



The author at the edge of the red mangrove swamp. Photo by Frank Fast.

daylight." This was to be the first specimen of this species we would find during the day basking head down. Later on another island, Island Y (another story worth telling) we would find three more, all small immature specimens. This finding upset our previous opinion that *leachianus* only come out at night, usually after 9 pm. It caused a revision of our views on the behavior of *leachianus*. This species may bask early in the day or later in the day or on partially overcast days. The folds of skin that extend from the limbs may play a role at eliminating shadow when these lizards are resting on tree trunks, as they do in other gecko species such as the leaf tailed geckos (*Uroplatus*) from Madagascar. These folds may be useful in providing extra air resistance and balance when jumping from branch to branch. The role of the cryptic coloration also becomes clearer when one considers that these animals may be out during parts of the day.



Fecal sample from *R. leachianus*. This was representative of the fecal samples of the *leachianus* and *trachyrhynchus* geckos we found. The feces contained large numbers of seeds as well as nematodes worms. The seeds were analyzed by the botanical department of ORSTOM in Noumea.

Later these behavior patterns were confirmed with captive animals with morning basking being common in both juveniles and adults.

After a couple of hours of hiking we had a good idea of the topography of the area we were going to explore that night

and went back toward the tent and walked along the shore.

We had our usual New Caledonia field trip dinners; in this case the main course consisted of granola bars topped with lukewarm water. We talked of hamburgers and Japanese food as we ate.

As is our usual schedule for nighttime gecko hunts, we took a nap in the early evening to kill time and get some rest before going out for the three to five hours our gecko searches typically last. Usually by one or two in the morning

cloth bags, mosquito repellent, jackknives, rope, backpacks, and water bottles and set out first toward the red mangrove swamp we had been in earlier. Within a few yards from our tent I stepped through a shearwater burrow which fortunately was empty except for fecal material or dead rotten eggs. In any case it stunk to high heaven and after extricating my foot from the burrow I had become the vehicle for a possibly new form of chemical warfare, and I was going to become the first victim of it. I promptly dug my foot in clean sand and tried to rub as much of the stuff off before setting out to catch up with Frank. This was to be the first olfac-

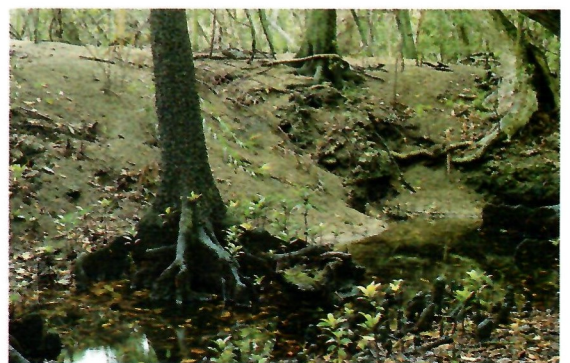


Red mangrove litter.

we get too tired and our eyes are too strained to see much of anything. And then through the haze of being half-asleep we started hearing them. The shuffles through the sand, the soft landings, the bickering squabbles and the characteristic wail: shearwaters, these odd petrel-like birds that spend the day flying and hunting for food and by nighttime return to their rookeries. Their wailing sounds like a distressed baby crying and we were told that New Caledonian women were particularly distressed by the call of these birds. As the night progressed the wails increased in number and became louder. Sleep was once again no longer an option.

At around 8^{PM}, we got up and put on our gear including flashlights, head lights,

tory test of the evening. New domains of olfactory challenges lurked just ahead.



Red mangrove swamp on Island X.

We returned to the red mangrove area, carefully illuminating the trunks and searching for geckos with little success. Mosquitos in that area were also quite dense and we soon decided to go check out the low forest area. As we entered the



The background tall primary forest on Island X which we never had a chance to explore. We suspect we would have found more of the same.



Entrance of the forest denuded by shearwaters. The density of *Rhacodactylus* in this short forest was surprisingly high.

area we heard hundreds of shearwaters wailing that sound of distressed children. Using our flashlight we carefully moved between the burrows as best we could. Birds occasionally ran out of our way. They bickered between each other, they cried like babies and the area stank of fishy bird crap. Oddly enough the continuous wailing soon started to get on our nerves; it was like a chorus of crying children. We could now perfectly understand the despair of New Caledonian women hearing these birds. They may have been

birds but they sounded like human babies, hundreds of them and some human instinct was emotionally responding to those sounds. It was to me so annoying that concentrating was becoming difficult. I can remember having the perverse thought that the CIA should record these sounds. They could have been weapons of torture or interrogation used in the proper setting. After about an hour of this I was feeling like I had to get out of there—it was going to drive me bonkers.

After a while our eyes had adjusted enough that we didn't have to focus so much on where we were walking and we started our methodical investigation of tree trunks, running our flashlights up and down the trunks and along the major branches, one tree at a time, scanning dozens of trees, eventually a couple of hundred. It wasn't long after entering shearwater hell that Frank called me to spot a gecko with my flashlight while he climbed a small tree to capture it. I could tell Frank was pretty excited. "You won't believe this, a *trachyrhynchus*!" he called out. I looked up to where he was pointing and brought my beam to the same spot

while he climbed up to grab the gecko. He came down gecko in hand to show it to me and the thing turned around and latched onto him, which taught us one lesson about *trachyrhynchus*. They have relatively large sharp teeth and powerful jaws that will readily break the skin. In our minds a new rule was established: do not let *trachyrhynchus* bite you.

Rhacodactylus trachyrhynchus is one of New Caledonia's most interesting geckos. They are the second largest gecko of New Caledonia after the giant New Caledonian gecko, *Rhacodactylus leachianus*, reaching on the mainland a length up to 13 in (34 cm). Like *R. leachianus* they are found only on primary forest trees, and fruit, when available, makes up a signifi-



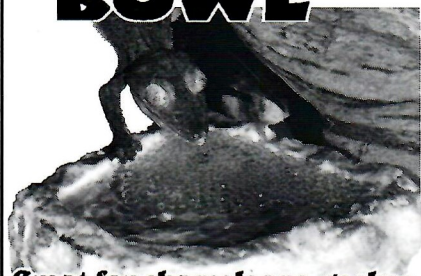
The dwarf form of New Caledonian live-bearing gecko (*Rhacodactylus trachyrhynchus*) we found on Island X.

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cant component of their diet. In addition, this is the only live-bearing gecko of New Caledonia giving birth to litters of two rather large babies. This species is unusual in appearance with the rough scales on the head and the enlarged labial scales being the most noticeable characteristics. In addition it seems that they live in small colonies. What was interesting about Frank's find was that this species to date

around 10 PM, we started seeing *leachianus* on these rather small twenty foot trees with small diameter trunks. In some cases we found on the same tree a pair of leachies and a pair of *trachyrhynchus*. As with the *trachyrhynchus*, we started finding giant geckos about every five to ten minutes on trees that made them easy to reach often without any climbing. We also set a limit



A baby New Caledonian live-bearing gecko from Island X.

had only been described on the mainland and here we had just found it in a heretofore undescribed locality. Within 5 minutes I spotted another *trachyrhynchus* and within another five minutes Frank had spotted another and this went on for a while. We collected several pairs and then after having reached our established limit we simply observed them and went on to other trees.

As we walked we would occasionally hear a crash through the tree canopy as shearwaters returning from a flight out would drop down into the rookery. If you are picturing kamikaze birds crashing through the treetops, you have the right image. There were times when walking through that forest we would catch a stench that made us want to gag and looking around we would find a dead shearwater with its head caught in the crook of a branch, rotting away. I imagined what it must have been like for that poor little bird. "Think I'll just drop on home" it must have thought. Dead birds hanging from their necks in trees. It had a weird surreal feeling to it but Island X was pretty much like that and it turned out to be one of the more extraordinary places I've visited in my lifetime. A little later,

on the number of pairs and then kept on investigating in case any other gecko species were present.

We returned by one in the morning with bags full of geckos, relieved to be away from the deafening noise and in good spirits. Later, having reached the tent, we turned on our flashlights and examined our catch more carefully. The *leachianus* were what we would call the island form which recently has been described as *Rhacodactylus leachianus henkeli*. The specimens of Island X were somewhat different from the specimens of other islands. There is little doubt that geographical isolation, as well as island specific ecological pressures, are leading these various insular gecko populations toward differentiation that from at least a herpetocultural standpoint should be recognized. The *trachyrhynchus* however were the most interesting find because the island population was dwarfed compared to the mainland animals and possibly deserved to be recognized as a separate subspecies based on geographical and genetic isolation and the characteristic small size. We were thrilled and I suspect too charged up to get much sleep but lack of sleep is pretty much a standard compo-

nent of these field trips. If things get too bad you take a nap in the afternoon or skip a day in the field altogether. For the women back home who wonder about what men talk about during these trips besides geckos, reptiles and other little boy things, when we couldn't fall asleep we'd talk about our lives, ideas, hopes, aspirations, poor and failing relationships (in my case) and missing one's wife and family (in Frank's case). Outside we could still hear the shearwaters, some just a few yards from the tent. They didn't stop until three in the morning. Possibly in that bird brain of theirs they may realize that they too are unlikely to get any sleep until they shut up. We slept three hours or so... maybe.

Stepping out of the tent in the morning, something felt different—maybe a change of ions in the air, maybe the wind that was picking up or the strange combination of dark clouds and sunshine. We took down the tent and gathered together all our supplies and I returned to the red mangrove swamp for some last minute photography. After about 20 minutes I heard Frank and the captain of the boat calling me with a certain sense of urgency. I rushed back and the captain informed me that the tail end of a tropical storm was coming our way. He knows it was crazy to come get us but he



A sampling of *Rhacodactylus leachianus* from Island X photographed in our tent on the night before the tropical storm.

had been worried about how we would have fared stuck on the island with not enough food, not enough fresh water and a tent which would have flown the coop literally as soon as the wind would hit. In the meantime it was getting darker and the wind was picking up. Something was coming.

The first part of the trip across the bay enclosed by coral reef was rough but nothing much to worry about until we started getting to the edge of the open ocean. It was then that the realization of what we



An Island X *R. leachianus*.

were about to undertake struck me. In front of us were walls of water 20 or more feet high spreading as far as one could see. A large boat would not have willingly sailed that ocean. At least not a large boat with a sane captain. We were in a 14 foot boat with an outboard motor. No life jackets, no radio. The ominous possibility of oblivion loomed. If we were to disappear it would be without a trace, swallowed by maritime walls of hell. We, all of us, must have been crazy but we rode out of that coral atoll into that domain where the probabilities of life and death start to equal out. The only way to even have a chance

of surviving these waves is to ride into them head on, which we did, motor at full throttle as often as possible. I can still remember that terrifying moment standing at the crest of a wave twenty feet into the air where you can see far away the wave walls ahead followed by the mid air take off before crashing several feet below. It was during a moment in

between those waves, looking up to the next twenty footer, that we had to tackle the real possibility of dying. This was how many had died at sea and it did occur to me this could be the day I could bite the big one. Strangely enough I was scared but not terrified and I thought the life I had lived had been all worth it. All and all I was ready.

I was drenched and holding on to the boat as best I could, my knuckles white from the pressure of gripping. The ocean spray powered by the wind slapped our faces. Frank was in the back holding on as best he could, watching our gear and precious cargo, not quite aware of what raged

in front and not understanding what the captain was telling me. He and his wife had been caught in a similar storm a few years ago and his wife had been so terrified of the prospect of death that she no longer would ride in a boat with him.

Of course we were the only idiots out on the ocean, the captain doing a great job considering the circumstances and I trying to make small talk to keep our attention away from that dreadful unspoken possibility. This went on for one of the longest half hours in our lives until we reached the calmer sea enclosed by the small bay surrounding the docking area. Landing was a challenge because the ocean was so rocky that we were bobbing several feet above or below the dock. But we did make it back, alive, shaken, thrilled and already planning for another island trip the next day but that's another story altogether..

Special thanks to Mr Marcel Boulet Director of Parques and Reserves, Dr. Jean Chazeau from ORSTOM and Mr Charles Holu  for their help and support in making this expedition possible. We are also deeply indebted to the captains of the small boats we hired. We did after all make it back to tell our tale.



THE CUTTING EDGE OF HERPETOCULTURE

Written and assembled by
Philippe de Vosjoli and Staff

Novelty: 1. *The quality of being novel; newness* 2. *Something new and original; an innovation.* American Heritage Dictionary of the English Language. Third Edition. 1992.

Novelty wave: 1. A rising and eventually falling pattern or trend in novelty associated with specific organisms, things, technology, ideas etc.. 2. A source of novel perturbation in a field of habit.

Herpetoculture is a fast changing field very much dependent on the production and availability of novel amphibians and reptiles. Novelty here is relative to a culture and, in the case of herpetoculture, this means primarily relative to industrialized cultures from northern temperate climates. Humans dream and fantasize about what they are not normally exposed to and for northern temperate humans, it is the tropical and exotic that fulfills that particular psychological niche. More than just about

any other group of animals, it is the amphibians and reptiles that challenge our preconceptions of what living beings should look like; not only are they beautiful but their "alien-ness" holds us in fascination. This "wonderment in face of the alien" is the domain of mind that herpetoculture caters to. Novelty is the name of the game and the economics and dynamics of herpetoculture are driven by novelty whether new animal species or morphs or new products. In this issue we have attempted to assemble the animals and products that are giving momentum to the emerging novelty waves as we near the end of the millennium.

Selecting amphibians and reptiles for our first Cutting Edge issue was a difficult task and unfortunately limited to what was available to us within the narrow time constraints of the decision to start

1997 with this special issue. To those herpetoculturists omitted in this feature we offer a sincere apology. If we have missed animals that are in the forefront of novelty in herpetoculture we again must resort to the excuse of time limitations. We'll do our best to get it better next time. Selecting products was an even more difficult task. How much is really new? Should we include established products that may play a role in the future trends of herpetoculture? The next Cutting Edge issue targeted for 1998 will almost certainly be better and more thorough for the simple reason that we'll have an entire year to prepare for it and examine submissions. In spite of these shortcomings we think that our readers will be in for a treat and visual feast extracted from the very edges of the novelty landscapes of herpetoculture.

SNAKES

The most saturated area of herpetoculture is snake breeding. Too many breeders, too much of the same, too much overall and a market decline is predicted for 1997. Yet there are still numerous novelty landscapes to explore in this particular branch of herpetoculture with the growing interest in naturalistic vivarium design and an increased focus on environmental design to enhance the display of

snakes. In general arboreal species are "in" whether tree boas and tree pythons, jungle carpet pythons, ratsnakes or other species that will rest on branches. However, new approaches to displaying a wide range of snake species are causing people to look at snakes in a new light. Few herpetoculturists are more novelty driven than snake breeders and if you think you've seen it all you're in for a surprise.



Albino Radiated Ratsnake, *Elaphe radiata*
Captive-Bred Snakes. Photo by Michael Thorn.



Xanthic Radiated Ratsnake, *Elaphe radiata*
Captive-Bred Snakes, Photo by Michael Thorn.



Mandarin Ratsnake, *Elaphe mandarina*
Photo by David Northcott.



100 Flower Snake, *Elaphe moellendorffi*
Mark Bell. Photo by Mark Bell.

Asian Ratsnakes

Some of the most beautiful ratsnakes come from Asia. Unfortunately, most imports have proven difficult to establish and keep alive for any great lengths of time. Captive breeding is changing all that. The babies are generally hardy and are they ever beautiful! Mark Bell's captive breeding of the 100 Flower Snake may mark a turning point at establishing this large, beautiful and difficult ratsnake in captivity.



Hypomelanistic Honduran Milk Snake, *Lampropeltis triangulum hondurensis*.
Seven Generations Reptiles. Photo by Don Wilson.



Albino Nelson's Milk Snake. *Lampropeltis triangulum nelsoni*.
Seven Generations Reptiles. Photo by Don Wilson.



"Applegate" Huachuca Mountain King Snake, *Lampropeltis pyromelana woodini*.
Applegate Reptiles. Photo by Bob Applegate.



"Applegate" Mexican Milk Snake, *Lampropeltis triangulum annulata*.
Applegate Reptiles. Photo by Bob Applegate.



Albino Blair's x Queretaro Kingsnake, *Lampropeltis alterna x ruthveni*. Wide saddled orange and double-white phase.
Steve Osborne. Photo by John Walling and Stokely Wilson.



Hypomelanistic Red Milk Snake. *Lampropeltis triangulum syspila*.
Seven Generations Reptiles. Photo by Rick Reed.

Milk Snakes and Kingsnakes

Just when you thought you've seen it all, breeders of milksnakes and kingsnakes come up with surprises so beautiful they hardly seem real.



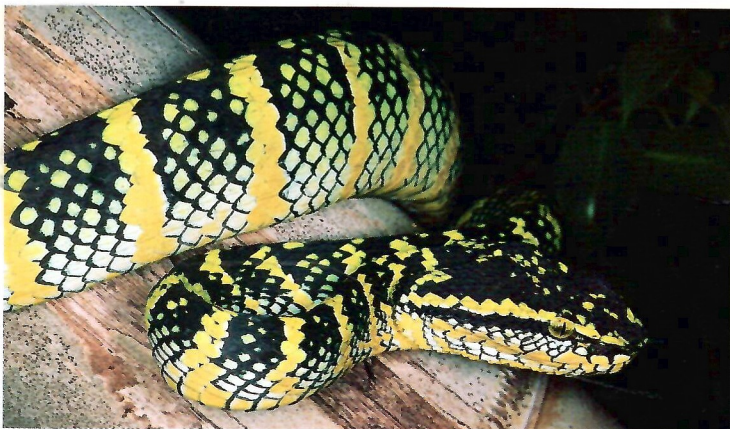
"Snow" Southern Pine Snake, *Pituophis melanoleucus mugitus*
Mark Bell. Photo by Mark Bell.



Silver Trans-Pecos Ratsnake, *Bogertophis subocularis*
Mark Bell. Photo by Mark Bell.

Other Colubrids

Pituophis although less popular than a few years ago are still among our great native snakes and should be considered by anyone wanting a large impressive and hardy colubrid. Many other native species such as the Trans-Pecos ratsnake have their following and some striking new morphs are appearing on the scene. Few snakes have such crisp attractive lines and pattern combined with large intense eyes. They make beautiful desert vivarium displays too!



Wagler's Tree Viper, *Tropidolaemus wagleri*
Photo by Bill Love.



Bush Viper, *Atheris nitschei*
Photo by Bill Love.



Eyelash Viper, *Bothriechis schlegelii*
Photo by Bill Love.



Sri Lankan Tree Viper, *Trimeresurus trigonocephalus*
Photo by Bill Love.

Tree Vipers

Yes they're venomous and they're not for minors or the inexperienced and many states have restrictions on keeping them. But bites from most of the tree vipers are less likely to cause death than those of many other venomous species. These arboreal snakes are also relatively easy to maneuver using a snake hook. They are among the most beautiful of snakes and make outstanding displays. They are generally a good choice for the adult, serious and experienced herpetoculturist interested in keeping venomous species. Note: Check local and state laws before purchasing a venomous snake. Keep the snakes in locked cages in a locked room. Learn husbandry techniques and protocols from a herpetoculturist experienced with venomous snakes.



Black-headed Python, *Aspidites melanocephalus*.
Dick Goergen. Photo by Dick Goergen.



Angolan Python, *Python anchietae*.
Vida Preciosa International. Photo by David Barker.



"Granite" Burmese Python, *Python molurus bivittatus*.
Bob Clark Captive-Bred Reptiles. Photo submitted by Bob Clark.



Albino Reticulated Python, *Python reticulata*.
Bob Clark Captive-Bred Reptiles. Photo by Al Baldogo.



"Clown" Ball Python, *Python regius*.
Vida Preciosa International. Photo by David Barker.



"Arabesque" Boa Constrictor, *Boa constrictor imperator*.
Exceptional Exotics. Photo by Steve Hammond.



Albino Blood Python, *Python curtus brongersmai*,
Vida Preciosa International. Photo by David Barker.



Hypomelanistic Panamanian Boa, *Boa constrictor imperator*,
Vida Preciosa International. Photo by David Barker.
Also, Captive Bread Wildlife Foudation.



"Blood" Boa Constrictor, *Boa constrictor imperator*,
Ron St. Pierre. Photo by A. Garcia-St. Pierre.



Albino Sand Boa, *Eryx colubrinus*,
Mark Bell. Photo by Mark Bell.



"Mofley" Boa Constrictor, *Boa constrictor imperator*,
Ron St. Pierre. Photo by A. Garcia-St. Pierre.



Albino "Whitewater Phase" Rosy Boa, *Lichanura trivirgata roseofusca*,
Vision Herpetoculture. Photo by David Northcott.

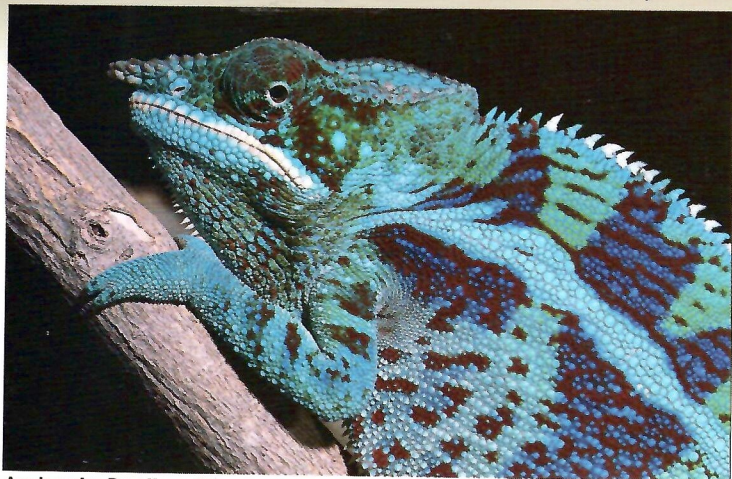
Boas and Pythons

The time when all pythons and boas are bred in captivity is almost upon us except for the few species not available to herpetoculturists. There are also diminutive species which may never catch on that are unlikely to be bred in large numbers or to become established in herpetoculture. As could be predicted the current trend with these popular snakes is to isolate, selectively breed and fix spectacular morphs of the most popular species. The results are living works of art!

LIZARDS

Perhaps nowhere in herpetoculture is more diversity seen than in the myriad of lizard species. With lizards, there is truly something for everyone—from carnivorous monitors to herbivorous iguanas, from velvety day

geckos to resilient bearded dragons and from inexpensive leopard geckos to expensive color morphs of rarer species. Here is a sampling of some of the hottest lizards in herpetoculture today.



Ambanja Panther Chameleon, *Chamaeleo pardalis*.
Glades Herp.Reptile Specialties. Photo by Philippe de Vosjoli.



Armored Chameleon, *Brookesia perarmata*.
Reptile Haven. Photo by David Northcott.

Chameleons

They're beautiful, they're wild looking and some of the hottest animals in herpetoculture. There is much ongoing research to improve and facilitate their husbandry and diet. Efforts are being made to establish new species and preliminary efforts at selective breeding are in effect. If one thing is certain it is that humans want these creatures as part of their experience of living. Few creatures are as alien and fascinating as these wacky lizards.



Cape Dwarf Chameleon, *Bradypodion pumilum*.
Agama International Inc. Photo by Russell Pearl.



Malagasy Diving Skink, *Amphiglossus waterloti*.
Reptile Specialties. Photo by David Northcott.



Armored Skink, *Tribolonotus novaeguineae*.
Reptile Haven. Photo by David Northcott.

Skinks

Many of the giant species are now established in captivity and a few others are so exciting that we will kick ourselves if they one day become unavailable. There is great need to diversify in this area of herpetoculture and to work on establishing new species. There are gems out there.



Anerythristic Irian Jaya Blue Tongue Skink,
Tiliqua scincoides ssp.
Peter Weis. Photo by Peter Weis.



Prehensile-tailed Skink, *Corucia zebrata*.
Reptile Haven. Photo by David Northcott.



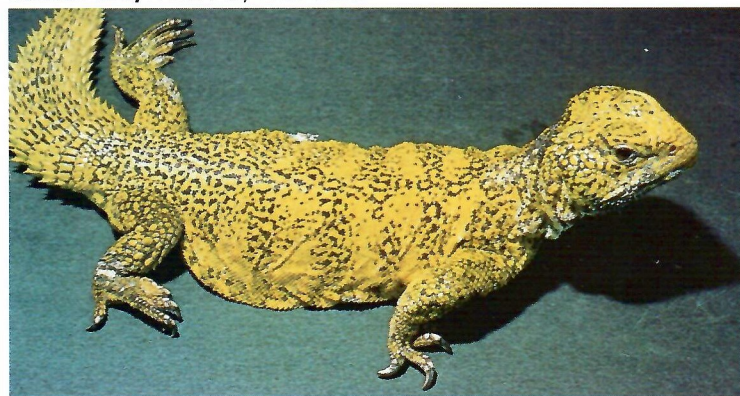
Argentine Black and White Tegu, *Tupinambis tegulxin*.
Agama International Inc.. Photo by David Northcott.

Tegus

They're among the largest of South American lizards, impressive and easy to keep. Increasing numbers of the beautiful Argentine Black and White Tegu and the Red Tegu are being bred in captivity and some surprises lie ahead such as the Blue Black and White Tegu. There are also rumors that a couple of new species may lie on the horizon.



Mali Uromastix, *Uromastix maliensis*.
Randall Gray. Photo by Rick Reed.



Moroccan Uromastix, *Uromastix acanthinurus*.
Saurus. Photo by Mathew Moyle.

Uromastix

These beautiful herbivorous heavy-bodied lizards are becoming increasingly popular and a number of hobbyists are now working on establishing these species in herpetoculture. The Moroccan Uromastix is probably the easiest species to breed indoors and selective breeding for some striking morphs is already in progress. The brilliantly colored Ornate Uromastix and the recently described Mali Uromastix are two other spectacular species breeders are focusing on.



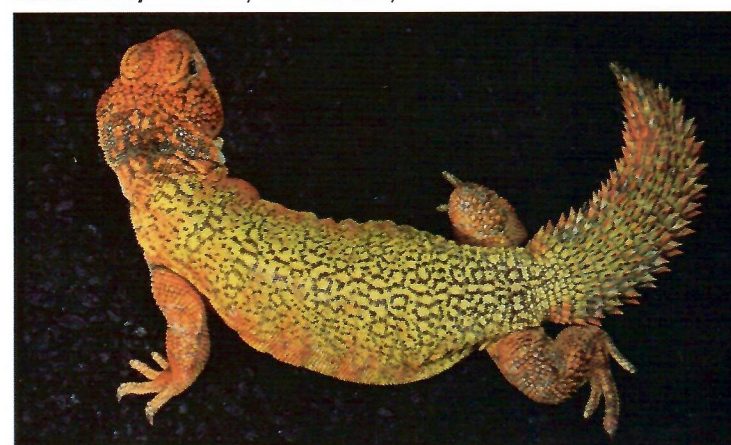
Red Tegu, *Tupinambis rufescens*.
Ron St. Pierre. Photo by David Northcott.



Blue Black and White Tegu, *Tupinambis* sp.
Ron St Pierre. Photo by A. Garcia-St. Pierre



Ornate Uromastix, *Uromastix ocellatus ornatus*.
Randall Gray. Photo by Randall Gray.



Moroccan Uromastix, *Uromastix acanthinurus*.
Saurus. Photo by Mathew Moyle.



Freckled Monitor, *Varanus tristis orientalis*.
Goanna Ranch. Photo by Frank Retes.



Ridgetail Monitor, *Varanus acanthurus*.
Goanna Ranch. Photo by Frank Retes.

Monitors

Just a few years ago the idea of monitors being bred in captivity in large numbers would have seemed a fantasy but that day is now here and several species will in the not so distant future become as common as leopard geckos. This is one area of herpetoculture bustling with activity and excitement and generally at the very edge of novelty waves.



Cochran's Forest Lizard, *Goniocephalus abbotti*.
Photo by David Northcott.



Leucistic Nile Monitor, *Varanus n. niloticus*.
Reptile Haven.
Photo by David Northcott.



Albino Nile Monitor, *Varanus n. niloticus*.
Reptile Haven.
Photo by David Northcott.



Reticulate Gila Monster, *Heloderma s. suspectum*.
Yavapai County, Arizona line.
Steve Osborne. Photo by John Walling.



Australian Water Dragon, *Physignathus lesueurii*.
Bert Langerwerf/Agama International.
Photo by Russell Pearl.



Red-headed basilisk, *Basiliscus galeritus*.
Bert Langerwerf/Agama International Inc.
Photo by Bert Langerwerf.



Arboreal Alligator Lizard, *Abronia graminea*.
Photo by David Northcott.

Other Lizards

Lizards probably represent the greatest novelty pool in herpetoculture. They are becoming the most popular of all herps kept in captivity and every year several new species are introduced in herpetoculture. Members of the genus *Abronia*, the prehensile-tailed alligator lizards, are some of the most beautiful and threatened species of the New World. It is critical that herpetologists negotiate with agencies in the countries of origin to obtain small numbers so that they can be bred in captivity.



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Geckos

Few lizards are as rewarding as geckos. Many species are easily kept and breed readily in captivity. With their velvet skins and bright eyes they're hard to beat. 1995 and 1996 opened up a wide range of new landscapes for gecko breeders, and the field is still in its infancy. Every year brings new surprises. New species are being established on a regular basis and selective breeding for appealing morphs is just beginning.



New Caledonian Gargoyle Gecko, *Rhacodactylus auriculatus*.
Photo by David Northcott.



New Caledonian Crested Gecko, "Fire" Morph, *Rhacodactylus ciliatus*.
Frank Fast. Photo by Frank Fast.

New Caledonian Geckos

Both legally and illegally a number of these geckos have been imported into the U.S. in the last two years. The bad side is that the activity of smugglers could result in the listing of these geckos under CITES Appendix II making it more difficult for those of us involved in research with these animals. If there is a good side, it is that the most smuggled species *R. ciliatus* will very likely no longer be illegally collected or smuggled in the future. It has proven as prolific and as hardy as the leopard gecko. In addition, selective breeding is resulting in spectacular morphs that will doubtlessly become more in demand than typical wild morphs. Other species are also being bred in some numbers making illegal collecting uneconomical and obsolete.



Rough Knobtail Gecko, *Nephurus asper*.
Casey Lazik Enterprises. Photo by Casey Lazik.



Smooth Knobtail Gecko, *Nephurus l. levis*.
Casey Lazik Enterprises. Photo by Casey Lazik.



Pilbara Smooth Knobtail Gecko, *Nephurus l. pilbarensis*.
Casey Lazik Enterprises. Photo by Casey Lazik.



Albino Pilbara Smooth Knobtail Gecko, *Nephurus l. pilbarensis*.
Casey Lazik Enterprises. Photos by Casey Lazik.



Chinese Leopard Gecko, *Goniurosaurus lichtenfelderi*.
Sandfire Enterprises. Photo by David Northcott, Nature's Lens.



Carrot-tail Viper Gecko, *Teratolepis fasciata*.
Photo by David Northcott, Nature's Lens.

Other Geckos

Several *Nephurus* species originally produced in Germany are now being bred in small numbers in the U.S. Other uncommon species such as the small but attractive Viper Gecko (*Teratolepis fasciata*) from Pakistan are becoming available. The Chinese eublepharid (*Goniurosaurus lichtenfelderi*) has been recently imported in some numbers and will very likely become standard herpetocultural fare. Many more species of geckos will become established in the near future.

AMPHIBIANS

The slowest growing area in the field has been the captive breeding of amphibians. It is a steep and costly learning curve and one that few are willing to tread. There are many first time breedings of many species but few are repeat or multigeneration breedings. In addition, most people aren't willing to spend much for amphibians which further limits herpetocultural development. The most exciting work

in amphibian herpetoculture is being done by breeders of tree frogs and some uncommon species should become available in the future. Poison frogs deserve mention simply because their popularity is at an all time high and growing. Most poison frog species offered are also now captive-bred. We also threw in a couple of knock your eyes out species, rarely bred in captivity but that we'd like to see more often.



Amelanistic Albino Pacific Chorus Frog, *Pseudacris regilla*
Sandfire Enterprises. Photo by David Travis.



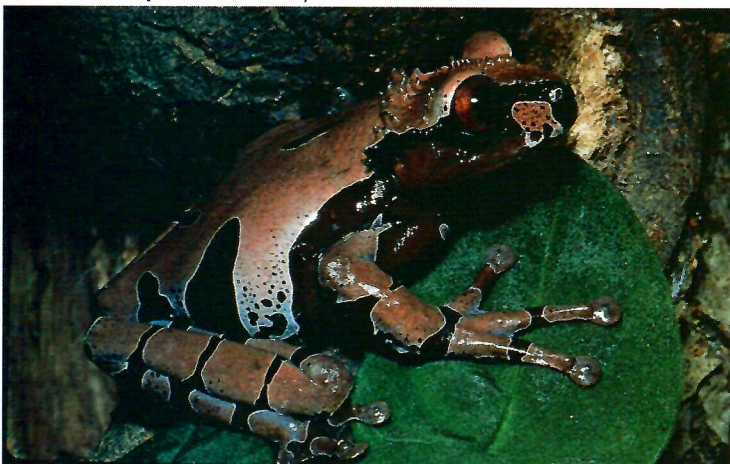
Albino Pacific Chorus Frog. Type 2., *Pseudacris regilla*.
Sandfire Enterprises. Photo by David Travis



Axanthic Green Tree Frog, *Hyla cinerea*.
Sandfire Enterprises. Photo by David Northcott.



Tiger-striped Monkey Tree Frog, *Phyllomedusa tomopterna*
Amphibia Research Group, Photo by Danté Fenolio.



Crowned Tree Frog, *Anoteca spinosa*
Amphibia Research Group. Photo by Danté Fenolio.



Orange-legged Monkey Tree Frog, *Phyllomedusa hypochondrialis*.
Amphibia Research Group. Photo by Danté Fenolio.



Blue-sided Leaf Frog, *Agalychnis annae*.
Amphibia Research Group. Photo by Danté Fenolio.



Dyeing Poison Frog, *Dendrobates tinctorius*.
Reptile Specialties. Photo by David Northcott.



Australian Red-eyed Tree Frog, *Litoria chloris*.
Sandfire Enterprises. Photo by David Travis.



Silverstone's Poison Frog, *Epipedobates silverstonei*.
Reptile Specialties. Photo by David Northcott.

Poison Frogs

Few herps are as enjoyable to keep as poison frogs of the family Dendrobatidae. They're beautiful, relatively easy to care for, and can be kept in spectacular tropical forest vivaria. Their popularity is soaring and most of the animals sold in the trade are captive-bred.

TURTLES AND TORTOISES

Like the tortoise in the famous fable, the herpetoculture of chelonians progresses slowly but surely, and more and more species are being offered in the trade as captive-bred hatchlings. Where turtles and tortoises are concerned it's in some ways all cutting edge. The ultimate achievement would be to reduce or end large scale collection of turtles in the wild if such a thing was

possible. More than collection for the pet trade, the exploitation of turtles as food and habitat destruction threaten most species. More than conservation efforts, changing the cognitive projections of humans is probably our only real hope to save many of these creatures.



Pancake tortoise, *Malacochersus tornieri*.
Courtesy of Nathan Manwaring. Photo by Susan Donoghue.



Indian Star Tortoise, *Geochelone elegans*.
Photo by Susan Donoghue.



Galapagos Tortoise, *Geochelone elephantopus*.
Photo by David Northcott.



Albino Eastern Box Turtle, *Terrapene c. carolina*.
Reptile Haven. Photo by David Northcott.

Acknowledgments

Special thanks to all the breeders and photographers who came through at the last minute to help us with this issue especially David and Tracy Barker, David Northcott, Danté Fenolio and Bill Love. Your support of the AFH is greatly appreciated.



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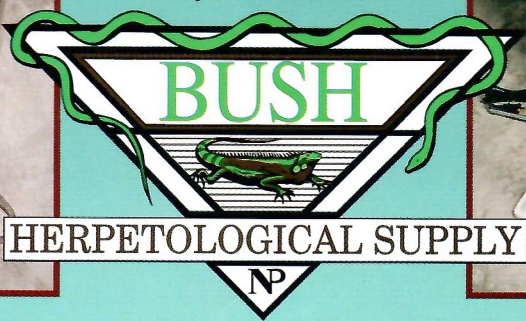


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CUTTING EDGE OF HERPETOCULTURE

Directory of Breeders, Dealers and Photographers

Note: Some individuals did not wish to have their names and addresses published. In addition, many breeders and dealers have submitted photos of animals and morphs in the earliest stages of development. Please be patient and do not insist or aggravate these individuals if they do not have the animals you want on hand. Good things take time. Do not take up people's time on the phone if you are not serious about purchasing animals. Do not expect individuals to return long distance calls at their expense. Courtesy and patience are essential in the herpetocultural trade.

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Bill Love

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Alva, FL 33920
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David Northcott

Nature's Lens

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HERP TECHNOLOGY ON THE CUTTING EDGE

The following products were selected by the AFH staff as leading the way in the fast growing technological arsenal of herpetoculture. This is an area where things are changing so fast it's hard to keep up. It's a competitive market and manufacturers are continually trying to upgrade or design new products. All and all the surge in reptile-oriented products has revolutionized herpetoculture and allowed the keeping of amphibians and reptiles to enter the mainstream of culture.

Disclaimer: Although selected as examples of cutting-edge technology, these products have not been tested by the AFH in the field or laboratory. These product reviews are not intended to be endorsements or guarantees; information has been provided by the manufacturers.

ENCLOSURES

HEATERS

SUPPLEMENTS

THERMOSTATS

VIRTUAL NATURE VIVARIA



Virtual Nature vivaria by Vivarium Research Group Inc are considered the top of the line herp enclosures on the market. Carefully assembled by hand with anodized aluminum frame, waterproof base, screen top and sliding glass front, they are the vivarium of choice for those who place a premium on naturalistic displays and practicality. Custom enclosures are standard fare for this innovative company. VIVARIUM RESEARCH GROUP

REPTARIUM ENCLOSURES



Reptarium enclosures have the great advantage of being easily transportable. Ideal if you need to take an enclosure while traveling and collecting. The soft screening can help prevent rostral abrasions in species notorious for snout damaging behaviors. Special inserts allow for the creation of a neat tropical forest display. Also great if you need to move animals outdoors for periods of basking. APOGEE INDUSTRIES

REPTILE RACKS



Reptile Racks from Freedom Breeder have grated tops for improved air circulation and back heat panels with rheostat for thermoregulation. They are modular and made of high quality materials. FREEDOM BREEDER

CREATE A CAGE



These large plexiglas-sided vivaria are a bargain and ideal for those who want an easily transportable vivarium whether for shows or when travelling. They're easily assembled and look great! Good for naturalistic vivaria but not for large species likely to scratch the sides. ESU REPTILE

CALCIUM SUPPLEMENT AND CALCIUM PELLETS

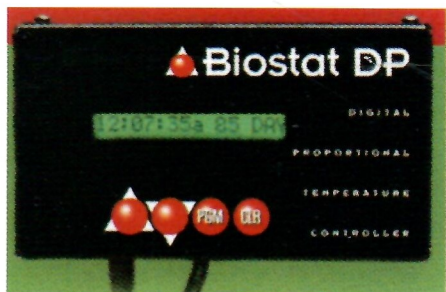


These new Herp Care products by Mardel are a useful source of calcium for many species of herps. The calcium powder adheres well to food insects and the pellets can be offered in shallow dishes to geckos and tortoises. MARDEL

VITAMIN/MINERAL SUPPLEMENTS

Vitamin and mineral supplements in both liquid and powdered form in the Mardel Herp Care line are formulated to reduce the risk of overdosage. We particularly liked the detailed and informative pamphlets included with each product. MARDEL

BIOSTAT DP



Biostat DP is a digital, proportional temperature controller that allows you to program both day and night temperatures. A high quality analog thermostat, the Biostat AT is also available from the distributors. Perfect for controlling the temperature of vivaria and incubators. BOB CLARK CAPTIVE-BRED REPTILES/ BUSH HERPETOLOGICAL SUPPLY

REPTISUN 5.0 REPTISUN 2.0



These high UVB and UVA full spectrum fluorescent bulbs designed for keeping reptiles are considered among the best on the market. A valuable tool in the herpetocultural arsenal. ZOOMED.

SOLAR DROPS/MOON DROPS



This liquid form of vitamin D₃ has allowed herpetoculturists in Great Britain to keep and breed indoors many species of lizards including bearded dragons. The delivery system makes this form of D₃ less subject to oxidation and allows better control of dosage. Must be used in conjunction with a vitamin/mineral supplement with little or no vitamin D₃. T-REX/OCEAN NUTRITION

NEW REPTILE DIETS



New Reptile Diets from Rep-Cal were developed and formulated by some of the best people in the field of reptile nutrition, and they are under continuous testing with veterinary supervision. Diets are available for green iguanas, tortoises, box turtles, aquatic turtles and for gut-loading crickets. REP-CAL

UVB AND UVA RADIOMETERS



Ever wondered what the UV output was on your lights or through windows. Are your UV generating bulbs getting too weak and in need of replacement? How much UV is getting through the window pane you just replaced with Mylar? If you've asked yourself these questions, Zoomed now offers the tools for you to get the answers. ZOOMED

DNA TEST FOR IGUANAS

Is it a boy or a girl? PE Zoogen now has a DNA test for sexing green iguanas. Hopefully this company will also focus on hard to sex species such as some of the monitors. PE ZOOGEN

MINER-ALL



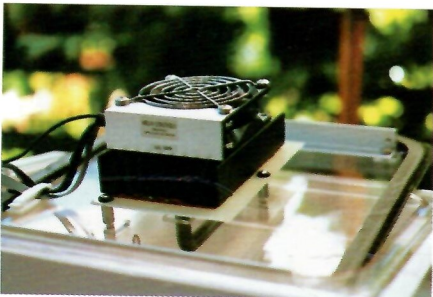
This mineral supplement which contains trace elements not usually available in other mixes has gotten high ratings from many lizard keepers. It should be used with a multivitamin mix. It is available both with vitamin D₃ and without. STICKY TONGUE FARMS

INFRARED HEATING PANELS



Infrared Heating Panels from RAM Network produce an even heat, are economical and safer than many other heating methods, and ideal for larger enclosures, screened enclosures and wire enclosures. They are a perfect choice for heating shelters of large herps kept outdoors. They can be connected to a rheostat or a thermostat to control temperature. RAM NETWORK

HELIX SPACE HEATER



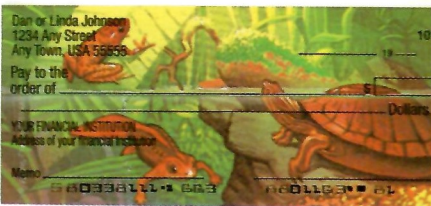
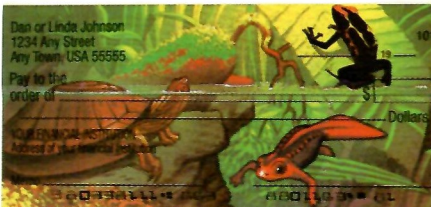
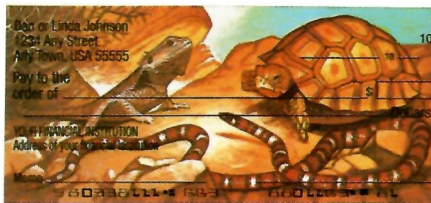
THE HELIX SPACE HEATER is a mini-space heater ideal for larger vivaria when a uniform air temperatures is desirable. It should be used in conjunction with a modified Helix Control Basic System thermostat. Designed for mounting on a cage wall or ceiling the heater measures 6 x 3.5 x 2 in and has a maximum output of 75 watts. HELIX CONTROLS

HELIX CONTROLS THERMOSTATS



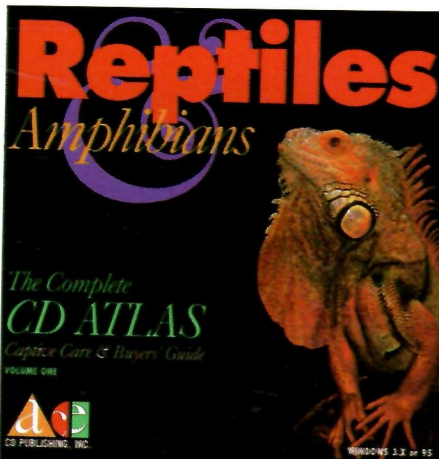
Thermostats and other temperature control systems from Helix Controls have gotten high ratings from many of the people we talk to. The company even has a system with a small heat pump for cooling small enclosures such as incubators. HELIX CONTROLS

REPTILE CHECKS



If you want checks that express your interest in amphibians and reptiles, consider the colorful and detailed checks from the STYLES CHECK COMPANY

HERP CD-ROMS



Herp CD-Roms from ACE CD Publishing give you a lot for your money and were professionally and meticulously designed. We looked at Reptiles and Amphibians: The Complete CD Atlas-Volume One. Over 600 species of reptiles, amphibians and invertebrates are covered and illustrated by photographs taken by famous reptile photographer David Northcott. There are over 1000 color photos, sections on herpetocultural methods and technology as well as brief information on respective species including common name, scientific name, distribution, size and captive care. ACE CD PUBLISHING

BIG SNAKE HOOK



Midwest Custom products has designed a hook for handling giant snakes. The broad "hook" reduces possible injury when lifting heavy snakes and the handle is light but strong with sponge rubber grips. This company offers a wide range of reptile handling equipment including collapsible hooks and tongs as well as tweezers, hemostats, sexing probes and stainless steel feeding syringes. MIDWEST CUSTOM PRODUCTS

WALKABOUT MIXES



Walkabout Mixes developed by reptile nutritionist Susan Donoghue are a unique concept in reptile feeding. They are designed to be mixed with greens to provide a complete natural diet for herbivorous reptiles. These mixes have passed rigorous long-term feeding trials, surpassing other commercial diets. They are ideal for iguanas and tortoises. NUTRITION SUPPORT SERVICES, INC.

ALCO-GEL



Alco-Gel is a hand cleanser and sanitizer that will kill a wide range of bacteria on contact including *Salmonella*. No water or towels are required. This product is ideal for hand disinfection following handling of animals both in pet stores and in the home. ESU REPTILE

REPTI-TEMP 500



Repti-Temp 500 is a new direct contact thermostat from ZooMed which monitors the inside air temperature through the glass. It automatically regulates multiple heating devices to give precise temperature control within the range of 70°F to 100°F. ZOOMED

ROLLERPOSTERS



Rollerposters were designed by famous wildlife artist Margaret Hawley and they are outstanding. Adults and children will find these finely drawn posters a source of artistic inspiration and information. They were produced to allow budding herpers to color them and the end result can be suitable for framing. For each poster category (amphibians, lizards, snakes, turtles) a member of every family is represented and an informative key is included. Great tools for biology teachers! ROLLERPOSTERS

Products Directory

ACE CD Publishing
(818) 360-3503

Apogee Industries
1-800-752-1034

Bob Clark Captive Bred Reptiles
12316 Val Verde Drive
Oklahoma City, OK 73142
(405) 722-5017

Bush Herpetological Supply
P.O. Box 539
Neodesha, KS 66757
(316) 325-2250

ESU Reptile
910 East Sandhill Ave
Carson, CA 90746

Freedom Breeder
38 Beta Court Bldg A-3
San Ramon, CA 94583

Helix Controls
8535 Commerce Ave
San Diego, CA 92121
(619) 566-8335

Midwest Custom Products, Inc.
8608 E. 32nd Street
Kansas City, MO 64129
(816) 861-3351

Nutrition Support Services, Inc.
Walkabout Farm, RT 1 Box 189
Pembroke, VA 24136
Fax: (540) 626-3564

Sticky Tongue Farms
26900 Newport Rd, # 121-141
Menifee, CA 92584
(909) 672-3876

PE Zoogen
(800) 406-6446

RAM Network
6860 Canby Ave., Suite 115
Reseda, CA 91335

Rep-Cal
P.O. Box 727
Los Gatos, Ca, 95031

Rollerposters
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Modjeska Canyon, CA 92676
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ZooMed Laboratories, Inc.
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REPTILE LIGHTING: A CURRENT PERSPECTIVE

by
William H. Gehrmann, PhD

I recently called a store to inquire about a lamp (lamp A) which I wanted to examine for this article. I was told that they didn't have lamp A but they did have lamp B which was far superior, especially for iguanas. After a bit more discussion it transpired that the clerk had never heard of lamp A, but he knew lamp B was better. Unfortunately, this anecdote can serve as a metaphor for the general state of affairs in selecting lamps for reptiles; a clean-cut resolution to this problem based on experimental data is not yet available.

Although various investigators have explored the effects of light on a variety of physiological processes in reptiles (see Gehrmann, 1994A for a review) it was Joe Laszlo who called the attention of the herpetocultural community to the importance of temperature (Laszlo, 1979) and light quality (Laszlo, 1969) for health and reproduction in captive reptiles. He consulted representatives in the lighting industry and found a relatively new lamp by Duro-Test Corp. with the brand name of Vita-Lite® which was a close match to natural light. The reptiles he exposed to these lamps seemed to fare better than those illuminated with cool white tubes or incandescent lamps. His brief publication in *International Zoo Yearbook* quickly led to the almost universal use of Vita-Lite® which held sway until about 1990. Joe was especially interested in ultraviolet (UV) light and for a number of years until his untimely death in 1987, we collaborated with a view toward designing a reptile lamp with a greater but safe level of ultraviolet B (UVB) or midwave UV than found in Vita-Lite® and other lamps (Gehrmann, 1987). During this time in the 1980's, two students of Duane Ullrey at Michigan State University, Mary Allen (1989) and Joni Bernard (1995), began studies exploring the importance of vitamin D and UVB to the health of reptiles, with particular reference to calcium metabolism and bone formation. These studies contributed to the development of the variety of reptile lamps available today.

The purpose of this paper is to clarify some issues related to lamp selection and reptile lighting. I particularly refer to lizards, perhaps the reptile group most sensitive to lighting conditions.

What is Full-Spectrum Lighting?

The term was first applied to the Vita-Lite® lamp produced by Duro-Test Corp. and was defined as any lamp that had a color-rendering index above 90, a corre-

further information pertaining to light characteristics). As used today, "full-spectrum" applied to fluorescent tubes generally implies that all colors (wavelengths) of the visible spectrum at similar energy levels contribute to the emitted light; UV irradiance is no longer implicit in the definition. Tungsten filament lamps, with glass that contains neodymium, are often referred to as "full-spectrum." The light emitted from these lamps is the same as that emitted from a household tungsten bulb but with the yellow colors removed. This "brightens" the light but the SPD is considerably different from natural light and full-spectrum fluorescent light. As herpetoculturists, we want the colors of our charges shown to best advantage.

Table 1. Measurements of various lamps using a Spectrolite UVA radiometer, a Spectrolite UVB radiometer and a General Electric Type 214 light meter. All fluorescent tubes were 20 watt, F20/T12 types and measurements were made 30cm (12 inches) from the sensors except where otherwise indicated.

Bulb	Manufacturer	UVA ($\mu\text{W}/\text{cm}^2$)	UVB ($\mu\text{W}/\text{cm}^2$)	Illuminance (lux)
Reptisun UVB 310 ¹	(Zoo Med Labs)	23	10	398
Reptile D-Light	(National Biol. Corp)			
	8% Type	7	9	409
	3% Type	6	4	430
Reptile Daylight	(ESU, Inc)	3	3	398
Sylvania 350 Blacklight	(Sylvania Lighting)	153	2.6	86
Metal Halide, 100 Watt, 5500 K	(ESU, Inc)	40	1.9	2260
Vita-Lite	(Duro-Test Corp)	6	1.3	452
VLX Full Spectrum	(Verilux, Inc.)	3	1.2	490
Repta Sun	(Fluker Lab)	5	1.1	538
Chroma 50	(General Electric Co)	2	1.1	495
Colortone 50	(Philips Lighting Co)	2	1.1	484
Lumichrome Full Spectrum ²	(Lumiram Corp)	4	0.9	527
Ott-Lite	(Environmental Lighting Concepts)	2	0.9	479
Repti-Glo	(Rolf C. Hagen Corp)	1	0.9	829
Cool White	(Sylvania Lighting)	2	0.1	527

¹ Currently marketed as "Reptisun 5.0" or "Iguana Light 5.0" according to Zoo Med Labs.

² 18 watt; distance adjusted to produce the reported illuminance.

lated color temperature (CCT) between 5500°K and 6800°K, and a spectral power distribution (SPD) for visible and UV light similar to that of open-sky natural daylight (Note: color-rendering index refers to the ability of light to produce the "true" colors of an object as they would appear in natural light; color temperature is a measure of the distribution of colors (wavelengths) comprising the light emitted by a lamp; see Gehrmann, 1994B for

However, short or long term health benefits attributable to the use of full-spectrum light have not been experimentally demonstrated.

How Important is Ultraviolet A (Blacklight)?

UV radiation is divided into UVA (longwave), UVB (midwave), and UVC (shortwave). Blacklights are a strong source of UVA. It has been demonstrated that UVA can influence agonistic, reproductive, and signaling behaviors in some species of lizards (Gehrmann, 1994A) as well as inhibit growth in female panther chameleons, *Chamaeleo pardalis* (Ferguson, et al., 1996). A UVA requirement for long-term health and reproduc-

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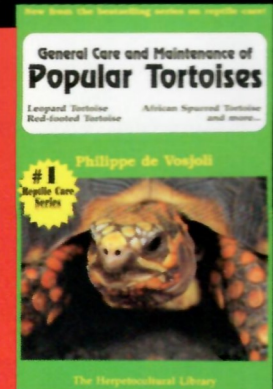
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tion of captive reptiles has *not* been demonstrated. However, because UVA is a component of natural light in many environments, e.g. deserts, appears to stimulate social behavior, and does seem to be nondetrimental even at high irradiances, some herpetoculturists may elect to use a blacklight in conjunction with some other visible light and/or heat emitting lamp.

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Continued on page 62

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NUTRITIONAL STATUS OF TORTOISES

USING MORPHOMETRICS TO ASSESS BODY CONDITION

by
Susan Donoghue, VMD, MS, DACVN

Veterinary patients show improved recovery from diseases and injuries if provided with optimal nutrition. Although data from controlled trials are nonexistent for sick reptiles, provision of calories and essential nutrients would likely show similar benefits to those documented for mammalian species (Donoghue, 1989; Donoghue and Langenberg, 1996). Nutritional support results in the minimization of nitrogen losses and restoration of positive nitrogen balance, improved cell and

organ functions, better immunity, and accelerated wound healing.

Tortoises in need of nutritional support are often underweight, and the extent of their loss in body condition determines the nutritional management of the patient. Body condition may be assessed readily in other reptiles because their losses of body fat and lean tissue result in protruberant bones, poor muscling, and excess skin folds. In tortoises, however, losses of body fat and lean tissue are more difficult to assess because the carapace and plastron conceal much of the patient's soft tissue.

When assessing body condition of tortoises, we often use subjective evaluation — does the patient lack heft? Although subjective evaluation improves with experience, a quantitative method of assessing body condition would allow rapid identification of tortoises in need of nutrition support, estimate the extent of loss in body condition (is the patient, say, 5% or 25% underweight?), reduce the risks of observer bias, and permit accurate transmittal of information between herpetoculturists. We know more about a sick tortoise, and can provide more effective nutrition support, if we know that the patient is, say, 25% below ideal weight rather than knowing that the animal is "light for its size."

Morphometrics are the measurements of the structures of an organism. In clinical nutrition, morphometrics are measures of a selected body part, such as skinfold thickness, which then estimate, through extrapolation, the amount of a larger, clinically important part of the body, such as fat stores.

For tortoises, we may use morphometrics to assess body weight for a given body size. Is a tortoise's weight appropriate for its size? Morphometrics may provide quantitative answers.

Carapace length has been the most common morphometric measure for captive and wild tortoises, with reports published for *Testudo graeca* and *T. hermanni* (Jackson, 1980), *Geochelone sulcata* (Mahmoud et al., 1986, Meek and Avery, 1988, Lambert, 1993), and the four *Gopherus* species (Germano, 1993; Mader, as reported in Donoghue and Langenberg, 1996; Mushinsky et al., 1994; Turner et al., 1987). Other morphometric measures reported in many of the above studies include plastron length, carapace width, and scute width. Further data collection and appropriate statistical testing will indicate those morphometric measures which most accurately and reliably assess body condition in tortoises. For now, we use carapace length, for it is simple to perform and appears to be reliable in clinical use.

Clinical trials. Our goals have been to determine the validity and reliability of a

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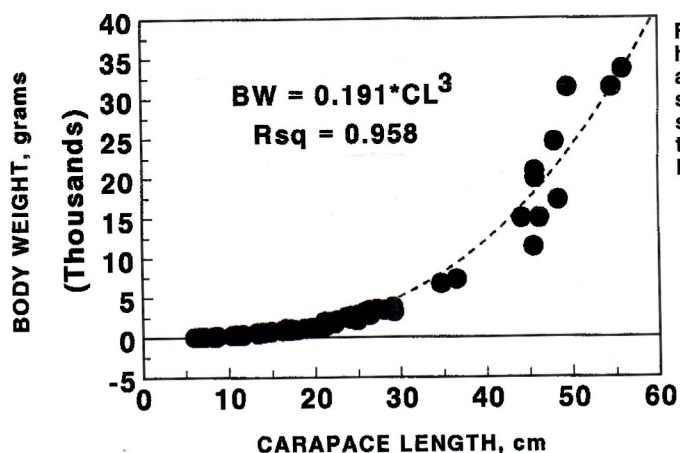


Figure 1. Data from 76 healthy juvenile and adult tortoises representing 11 species show excellent correlation between carapace length and body weight.

TORTOISE MORPHOMETRICS

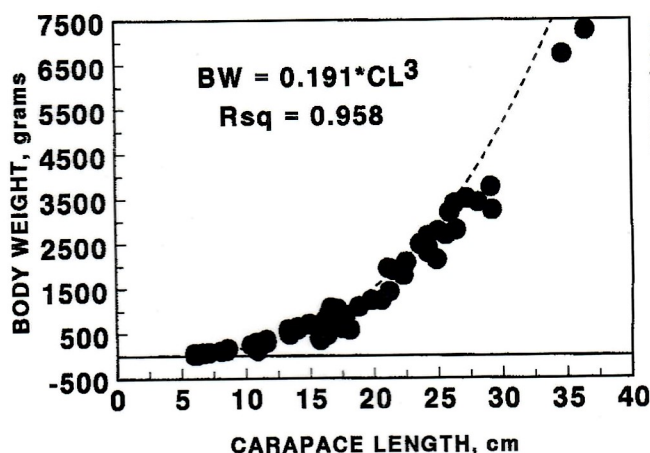


Figure 2. Further detail of the relationship between carapace length and body weight in tortoises less than 35 cm long.

single correlation between carapace length and body weight for the species of tortoise maintained in captivity. Most prior reports examined only one or two species and, moreover, used linear ratios between carapace length and body weight. Morphometrics may be more appropriate for clinical use if two usual assumptions in dimensional analysis — similar shapes and weight proportional to volume — are utilized. Hence, instead of a linear correlation, we related body weight to carapace length cubed, which takes into account the volume of tortoises.

We began with measures from healthy tortoises in our collection and developed a preliminary equation, using data from 42



Figure 3. A recently imported, parasitized adult female *Geochelone denticulata* with body weight only 58% of calculated ideal weight.

Measuring Carapace Length

- ❑ Secure a measuring device (such as a tape measure, ruler or yard stick) to a table-top or floor. We use clear shipping tape to secure measuring tapes, so that the numbers are unobscured.
- ❑ Gently place your tortoise on the measuring device, with its foremost (gular) plastron scutes at "zero" and its plastron's (ventral) midline extending along the ruler.
- ❑ Use a straight-edge (such as a ruler) held at a 90-degree angle to the measuring tape at the posterior edge (supracaudal scutes) of the tortoise's carapace.
- ❑ Taking care to hold the straight-edge steady, remove the tortoise and read its length off the measuring device.

tortoises representing nine species, which correlated carapace length and body weight (Donoghue and Langenberg, 1996). The collection has grown and we've now gathered data from 76 healthy juvenile and adult tortoises representing

eleven species (*G. sulcata*, *G. pardalis*, *G. carbonaria*, *G. denticulata*, *G. elegans*, *T. hermanni*, *T. graeca iberica*, *Indotestudo elongata*, *Manouria emys*, *Malacochersus tornieri*, and *Terrepene ornata*) that were used to derive this equation:

$BW = 0.191CL^3$ $R_{sq} = 0.958$ where
 BW = body weight in grams, CL = carapace length in centimeters, and R_{sq} = R-squared, the coefficient of determination,

which tells how much variation in BW is accounted for by variation in CL (an R_{sq} of 0.958 implies an excellent fit of data). The data for all 76 tortoises are shown in Figure 1. Carapace length ranged from 6 to 56 cm. Body weight ranged from 50 grams to about 34 kilograms. Detail on the smaller tortoises less than 40 cm long is provided in Figure 2. This equation may be used to compare actual body weights to

TORTOISE MORPHOMETRICS

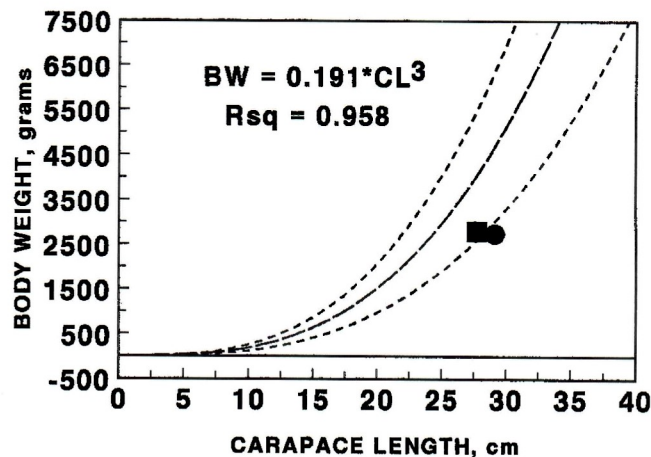


Figure 4. Two standard deviations (dotted lines) above and below average body weights (dashed line) of healthy tortoises. Body weights for a recently imported *G. denticulata* (circle) and sick *G. pardalis* (square) fall about two standard deviations below their calculated weights, signalling the need for nutritional support.



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calculated (from the equation) body weights for a given carapace length. It may be useful for tortoises which are ill, eating poorly, or recently introduced into collections, and can be included as part of a preventive health program. Further data collection and statistical analyses will determine with precision the extent of variation to expect among healthy tortoises. Here, for illustration, I've used two standard deviations as the cut-off weight, and present two examples of the ways I use this equation.

Example 1: An adult female yellowfoot tortoise (*Geochelone denticulata*) was added to the collection and began a standard 90-day quarantine (Figure 3). She had been imported about two weeks prior to purchase, and had not been wormed, nor received veterinary attention. Physical examination revealed an alert, apparently healthy tortoise with a good appetite. Fecal examination revealed pinworms, roundworms, and hookworms. Her carapace length was 29.1 cm and body weight 2,749 grams (Figure 4). Using our equation, this tortoise's calculated body weight should be about 4,700 grams ($BW = 0.191 \times (29.1)^3 = 4,707$ grams). Instead, it was only 58% (2749/4707) of the calculated value. Her actual weight was near two standard deviations from the average (Figure 4), indicating that there was only one chance in 40 that this tortoise's actual weight was healthy for this individual.

The tortoise was wormed several times and, because her weight was lower than expected from the equation, special attention was given to her food intake. She was offered ad libitum intakes of complete and balanced salads, soaked every other day in warm baths, and weighed weekly. After 90 days, her fecal examinations were negative and her weight was 3,954 grams — a much improved 84% of her calculated weight. She was then placed outside on pastures of mixed legumes and grasses, and her complete return to good health was uneventful.

Example 2: A female leopard tortoise (*G. pardalis*) was suffering from diseases of her respiratory and central nervous systems (Figure 5). She had been chronically ill for three months and was being treated with antibiotics and fluids, but had not been observed to eat for several weeks. She was 27.7 cm long and weighed 2,804 g. This weight was about two standard deviations away from her calculated weight of 4,060 grams (Figure 4). Because this tortoise was anorectic and her weight was too low, she was started on vigorous nu-

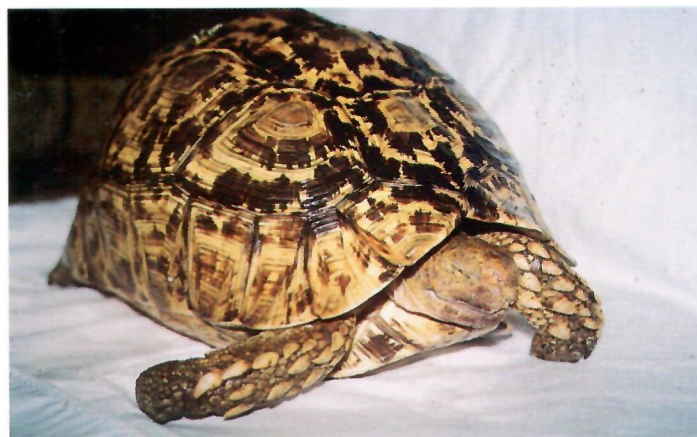


Figure 5. An adult female *Geochelone pardalis* with diseases of her respiratory and central nervous systems. Her weight was 69% of her average healthy weight.

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tritional support utilizing liquid enterals (Donoghue and Langenberg, 1996). This tortoise continues to receive nutritional support, and no further weight has been lost.

Conclusion

Morphometrics show promise as a clinical tool for assessing body condition of tortoises. Significant deviation from an average body weight calculated from carapace length signals those tortoises likely to benefit from nutritional support. Body weights may be read from the curves in Figure 4, which keeps morphometrics ideal for everyday use.

The author thanks Dr David Kronfeld for help with data analyses and Nathan Manwaring for breeding loan of his *Malocochersus tornieri*.

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President's Message

This issue marks a turning point for *The Vivarium* magazine. After a year of struggling in the midst of nearly continuous reorganization and financial difficulties we have assembled a new team which will set *The Vivarium* on a course which we think will firmly establish us as the premier publication in its field. Although this end of the year issue is called the *Cutting Edge of Herpetoculture* and was assembled and designed by our new team to give you a taste of what lies ahead, the new changes scheduled for *The Vivarium* won't be completely in effect until the spring. *The Vivarium* will have broader content with more columns, more diversity of information, more exciting articles, more color photos, strong graphics, higher quality printing, more art and above all information and stories from the very edges of herpetoculture's novelty landscapes. All of us involved with *The Vivarium* are excited about the new creative endeavors that lie ahead. We think our readers will be in for a great surprise.

1997 also has a special meaning for those of us who were involved in getting the AFH and *The Vivarium* started: it will mark our tenth anniversary since the publication of *The Vivarium* Volume 1 Number 1.

Board Members Elected

At the annual AFH meeting in October, the new AFH board was elected as follows:

Vice President

Chris Estep

Treasurer

Bridget Pilcher

Educational Coordinator

Dan McCarron

Chris Estep the new Vice-President of the AFH is the owner of Reptile Haven and a top-notch herpetoculturist, well attuned to the pulses of the herpetocultural industry. His participation and contributions to the AFH should play a key role in the changes that lie ahead.

Bridget Pilcher was reelected as Treasurer of the AFH. She has been one of the most instrumental individuals in the success of the organization having held the position of General Manager from 1990 to 1995. Her continued dedication as a board member is greatly appreciated.

Dan McCarron will continue in his position as Educational Coordinator. Dan has been one of the most active participants of the AFH being the creator and organizer of the highly praised "Herpetoculture in the Classroom" workshops for teachers. Many of the partici-

pants have rated the workshop as one of the best educational experiences of their lives.

The AFH Has A New Editor

Starting with this issue we are excited to announce that the AFH has a new editor, Dr Susan Donoghue, VMD, MS, DACVN, highly respected veterinarian, reptile nutritionist, author and lecturer. We all look forward to working with Dr Donoghue in developing the new format and broadened scope for *The Vivarium*. Welcome aboard Dr Donoghue!

Thanks!

Thanks to Chris Estep and Margaret Hawley of Rollerposters for donating the use of Margaret's drawings for *The Vivarium*. Check out *The Future of Herpetoculture* for samples of Margaret's art found in the Rollerposter series. See page 43 for more information on these posters.

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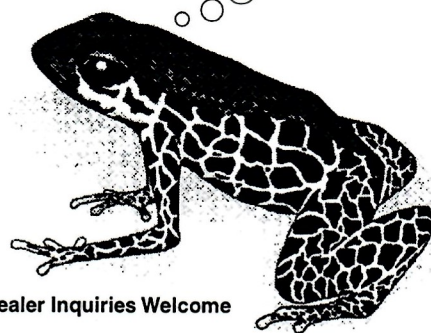
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Coming Events

January 11: The All-Maryland Reptile Show is at the Howard Johnson's Motel, Aberdeen, MD. For info call (615) 264-2583.

January 19: The Midwest Reptile Show will be held at the Indianapolis State Fairgrounds, 1202 E. 38th St., Indianapolis, IN. For info call Brian Hahn (317) 882-8088, 9 am to 4 pm

January 25: The All-Ohio Reptile Show will take place at the Ohio National Guard Armory, 4094 Sullivant Ave., Columbus, OH. For info call (615) 264-2583.

February 1-2: The Ft. Lauderdale Pet Expo & Reptile Show will take place at the Ft. Lauderdale Convention Center, Ft. Lauderdale, FL. For info call Osborne/Jenks Productions (860)563-2111.

February 2: The NY Metro Reptile Expo will take place at the Crowne Plaza Hotel, White Plains, NY. For info call Bruce Lowder (914) 526-4845.

February 8: The All-Maryland Reptile Show will be held at the Howard Johnson's Motel in Aberdeen, MD. For info call (615) 264-2583.

February 9: The Midwest Reptile Show will be held at the Indianapolis State Fairgrounds, 1202 E. 38th St., Indianapolis, IN. For info call Brian Hahn (317) 882-8088, 9 am to 4 pm.

February 15: The All-Ohio Reptile Show will take place at the Ohio National Guard Armory, 4094 Sullivant Ave., Columbus, OH. For info call (615) 264-2583.

March 2: The Midwest Reptile Show will be held at the Indianapolis State Fairgrounds, 1202 E. 38th St., Indianapolis, IN. For info call Brian Hahn (317) 882-8088, 9 am to 4 pm.

March 8: The All-Maryland Reptile Show will be held at the Howard Johnson's Motel in Aberdeen, MD. For info call (615) 264-2583.

March 21-23: The Midwest Exotic Pet Seminars Second Annual Conference will take place at the Hyatt Regency Woodfield in Schaumburg, IL. For info call J. B. Bruederle, DVM. (312) 663-9200.

March 22: The All-Ohio Reptile Show will take place at the Ohio National Guard Armory, 4094 Sullivant Ave., Columbus, OH. For info call (615) 264-2583.

March 22-23: Exotics & Family Pet Showcase will take place at the Prince George's Equestrian Center in Upper Marlboro, MD. For info call (215) 721-7199.

March 22-23: The Rhode Island Pet Expo & Reptile Show will take place at the Rhode Island Convention Center in Providence, RI. For info call Osborne/Jenks Productions (860)563-2111.

March 29-30: The Mid-Western Reptile, Bird & Exotics Fair will be held at Overland Lions Hall, 2358 Lckland, St. Louis, MO. For info call Ken Schwab (314) 427-6341.

April 5: The All-Maryland Reptile Show will be held at the Howard Johnson's Motel in Aberdeen, MD. For info call (615) 264-2583.

April 12: The Spring Eastern Herpetological Expo will be held at the Sunnybrook Ballroom, Pottstown, PA. For info call (215) 257-6088.

April 6: The Midwest Reptile Show will be held at the Indianapolis State Fairgrounds, 1202 E. 38th St., Indianapolis, IN. For info call Brian Hahn (317) 882-8088, 9 am to 4 pm.

April 25-26: Exotics & Family Pet Showcase will take place at the Fort Washington Expo Center in Fort Washington, PA. For info call (215) 721-7199.

April 26: The All-Ohio Reptile Show will take place at the Ohio National Guard Armory, 4094 Sullivant Ave., Columbus, OH. For info call (615) 264-2583.

May 30-June 1: Exotics & Family Pet Showcase will take place at the Allentown Fairgrounds, Allentown, PA. For info call (215) 721-7199.

June 7-8: Exotics & Family Pet Showcase will take place at the NJ Convention & Expo Center at Raritan Ctr, Edison NJ. For info call (215) 721-7199.

June 25-July 2, 1997: The A.S.I.H. (American Society of Ichthyologists and Herpetologists) will meet in at the University of Washington, Seattle, Washington. Robert E. Espinoza Biology Dept., (702) 784-4565, fax 784-1369.

August 2-10, 1997: The Third World Congress on Herpetology will meet in Prague, Czech Rep. Zbynek Rocek, Paleontology, Academy of Sciences Rozvojova 135, 16500 prague 6-Suchdol, Czech Republic 422-24311421, fax: 422-24311578, rocek@gli.cas.cz.

August 30: The Spring Eastern Herpetological Expo will be held at the Sunnybrook Ballroom, Pottstown, PA. For info call (215) 257-6088.

October 4-5: Exotics & Family Pet Showcase will take place at the Garden State Race Track, Cherry Hill, NJ. For info call (215) 721-7199.

November 1-2: Exotics & Family Pet Showcase will take place at the Memorial Hall at York Fairgrounds, York, PA. For info call (215) 721-7199.

Editor's Note: Herpetological societies and non-profit organizations are encouraged to notify AFH of events of interest so they may be included in our Coming Events section.

The International Herpetological Symposium Annual Meeting



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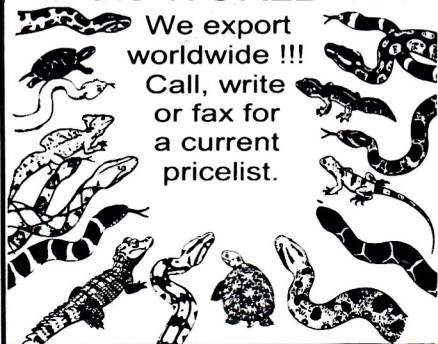
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On the Use of Bark Substrates in Vivaria

by
Vivarium Research Group Inc.

Bark substrates—whether sold for horticulturists as bark mulch, western bark, and orchid bark or more recently packaged and sold specifically for herpetoculturists—are becoming increasingly popular for habitats displaying amphibians and reptiles. In most cases bark substrates work well for a large number of species. In other cases, however, health problems and even death may result.

Most of the commercially sold processed bark chips are derived from the fir tree as a side product of the lumber industry. Usually, the source of the bark is clearly indicated on the label. In rare cases redwood bark may be included. As a general rule any product with red wood should be avoided because the resins contain evaporating (volatile) compounds which can be toxic to amphibians and reptiles. Cypress bark mulch which is available in Florida and other southeastern states is generally safe. Fir bark is however the most widely marketed bark substrate in the trade. Although fir bark is generally considered safe there are certain things one must watch out for:

1) Some fir bark has a strong resinous smell and may contain high levels of phenols which can cause adverse reactions and in some cases be toxic. Airing the bark in a well-ventilated space for several weeks may remove most of the volatiles, but noxious substances may remain. Setting the bark out in the sun and regular washing or spraying with water will also help to clear these resinous compounds.

What kind of problems can you expect from high phenol bark? In reptiles, gaping is a frequent sign which can be misinterpreted as a symptom of respiratory infection. Gaping caused by high-phenol bark is an allergic reaction. Other problems include depression of the animal's immune system, and ultimately death. We have observed this in rhinoceros iguanas and some snakes housed on high-phenol fir bark. With amphibians, redwood bark and/or high phenol fir bark can cause death.

Resinous pine shavings can cause similar reactions. Bark from any species with visible resinous residue should be avoided at all costs. The smell test is a good way to check for evaporating phenols.

2) The grade (particle size) of bark is critical with amphibians and reptiles. As a

rule the bark should be larger than what an animal can ingest but this is not necessarily applicable because many herps will not swallow large pieces of bark if they accidentally get it in their mouths. Small grade (seedling) orchid bark can generally be used with baby reptiles such as hatchling anoles, day geckos and many species of baby snakes. This can also work with species of small wood turtles. With larger species a medium grade is generally recommended.

3) Some barks are crudely processed and have rough almost sharp edges. These should generally be avoided with amphibians and reptiles. To test for this, handle the bark. Grab a handful of bark and squeeze it in your hand while letting it run between your fingers. If it feels rough and as if it could give you splinters then it is probably not a good choice for amphibians and reptiles.

4) Dust is a common problem with commercially sold bark. The bark should be either rinsed of dust and allowed to dry or placed in a wood frame with hardware cloth screening nailed on one side. Gently stir the bark to allow the dust to fall out. High dust bark will discolor your animals, clog the skin of amphibians and with digging herps result in a coat of reddish brown dust in the vivarium and the surrounding areas. It can also be inhaled by humans and cause the inside of your nose to be lined with red dust which will be quite apparent if you were to sneeze or blow your nose. What this can do to your lungs is an unknown but it can't be healthy.

5) Some barks leach out brown or reddish pigment when damp. With reptiles this usually results in a reddish discoloration of the skin which is seldom of any consequence. With amphibians, this may cause dermatologic problems. Rinsing bark and drying in the sun can help remove some of these pigments.

6) When feeding, offer food on trays for vegetarians and in feeding dishes for insectivorous lizards. Food insects can hide in bark which can make feeding problematical. King mealworms (*Zophobas morio*) will burrow in bark and this species will often breed in enclosures with bark substrate.

7) Bark can be intermittently moistened but should never be kept permanently wet or soaking in water. Bark works well, however, with forest geckos, for example, when



A bark substrate vivarium designed for keeping tokay geckos. Photo by Philippe de Vosjoli.



Colombian black and white tegus can be maintained in a simple vivarium with bark substrate. Food should be offered in a dish to prevent accidental ingestion of the bark. Photo by David Northcott.

moist green moss is placed above an area of bark layer.

8) Dry bark is a fire hazard if exposed to excess heat, sparks or flame. Use extreme caution if bark or shavings are placed near heat pads or tapes, light bulbs, and electrical wiring.

With several species of tropical vivarium plants and with burrowing reptiles or amphibians, bark can be mixed with soil to make it more airy. It can also be used as an attractive surface substrate in naturalistic vivaria. With careful preparation, bark is a useful and versatile addition to habitats for reptiles and amphibians.

Vivarium Research Group Inc. is a company that specializes in naturalistic vivaria and manufactures top of the line enclosures as well as researches methodologies and technologies for these kinds of vivaria.



Review by Philippe de Vosjoli

A Field Guide to Reptiles and Amphibians in the Hawaiian Islands

A Field Guide to Reptiles and Amphibians in the Hawaiian Islands by Sean McKeown. 1996. 173 pp. 148 color photographs, 34 maps. Diamond Head Publishing Inc. P.O. Box 7006. Los Osos, CA 93412. ISBN: 0-9650731-0-6 (soft cover; \$14.95) and ISBN: 0-9650731-1-4 (hard cover; \$19.95).

A FIELD GUIDE TO

REPTILES AND AMPHIBIANS IN THE HAWAIIAN ISLANDS



Sean McKeown

The Hawaiian Islands possibly more than any other place in the world deserve the claim to have become herpetologically interesting as a result of introductions by man. Where else can one find cohabiting the same region Jackson's chameleons (*Chamaeleo jacksonii*) originally from Kenya, day geckos from Madagascar (*Phelsuma laticauda*) and Mauritius (*Phelsuma guimbeaui guimbeaui*), poison frogs (*Dendrobates auratus*) originally from Central America and turtles (*Palea steindachneri* and *Pelodiscus sinensis*) from China. For anyone interested in the 33 species of amphibians and reptiles currently found on and around (in the case of marine reptiles) the Hawaiian Islands, Sean McKeown's beautifully illustrated field guide will prove invaluable and a generally good read.

Sean McKeown, former curator of reptiles at the Honolulu Zoo in Hawaii and at Chaffee Zoological Gardens in California, is generally recognized as the foremost authority on the herpetology of the Hawaiian Islands. He has brought his expertise and meticulous attention to the

composition of this thorough and beautifully illustrated work.

The book begins with the history of amphibian and reptile introductions and illustrates representative Hawaiian habitats. This is followed by detailed specific information. Facts are provided for each species in a brief introduction on their natural history and under sections on identification, reproduction, distribution, interesting facts and care in captivity. The extent of herpetocultural information will be of particular interest to the pet owner wanting to keep or breed these animals. In addition, range maps, a glossary and references for further reading are included.

For the price of the book the reader gets more than his money's worth in content alone but this guide also boasts 148 color photographs of the highest quality illustrating all species as well as the principle life stages of most of the various reptiles and amphibians occurring there.

For all these reasons this guide stands out as one of the finest examples of a popular work on herpetology. It is thorough, practical, useful and above all, reader-friendly. Most questions one might have about these animals are addressed. Whether you have an interest in the herpetofauna of Hawaii, in the husbandry of these species or simply want to own an example of a great field guide, this one is a pleasure to read, a feast to the eyes and can simply not be recommended enough.



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Notes on the Natural History and Captive Maintenance of the Mexican Hognose Snake

(*Heterodon nasicus kennerlyi*)

by
Thurgess and Eunice Cranston

The monsoon season in the southwest brings out animals one might not otherwise see in this dry region. It is a great time for the naturalist to observe the great variety of wildlife in that region. One animal that can almost invariably be found basking along a dusty back road following a late summer storm is the Mexican hognose snake (*Heterodon nasicus kennerlyi*). This animal's unique death-feigning display, along with its "cute" appearance, make a late afternoon trek through the southwest's grasslands well worth it.

The Mexican hognose snake (*Heterodon nasicus kennerlyi*) is one of the least known members of the western hognose snake clan. Most representatives of this interesting snake we have found in the field have been less than 23 inches (58

cm) in total length with a mass of less than 6 ounces (150 grams). Degenhardt et al. (1996) lists the total length of these snakes as 15 - 25 inches (38 - 64 cm). However, a huge adult female was found DOR (dead on road) in southwestern New Mexico by Tomberlin and Brastad in the fall of 1995. This animal was 76 cm in length and weighed 360 grams (B. Tomberlin, pers. comm.). These animals appear to be sexually dimorphic, because males are usually smaller in size than are the females. Mexican hognose snakes have a spotted dorsal pattern; their underside is heavily pigmented with black; interspersed in the black pigment are smaller regions of orange pigment. The scales are heavily keeled, giving the snake the very superficial appearance of a rattlesnake.

Mexican hognose snakes range from southeastern Arizona through southern New Mexico and into western Texas. This

subspecies is also found in south Texas and northern Mexico (Stebbins, 1987). Habitat includes farmland, prairie, and grasslands. Degenhardt et al. (1996) describes typical habitat in New Mexico as grasslands with a sandy soil. However, animals are also found in creosote bush desert and open montane woodlands in which sandy soil can be found. The one factor that appears to be critical for these snakes is a sandy medium within which they can burrow in search of their favorite prey item, toads (of the genera *Bufo* and *Spea*). Other prey items include frogs, salamanders, lizards, snakes, reptile eggs, rodents, and possibly birds (Stebbins, 1987; Degenhardt et al., 1996). Certain Mexican hognose populations (e.g., southeastern Arizona and southwestern New Mexico) are exposed to dramatic changes in their habitat due to the rains of the monsoon season. That is, in early summer their habitat tends to be dry; after



The Mexican hognose snake spreading its neck region during part of its behavior for predator evasion.
Photograph by Thurgess Cranston.



Habitat in southeastern Arizona during early summer. Photograph by Thurgess Cranston.

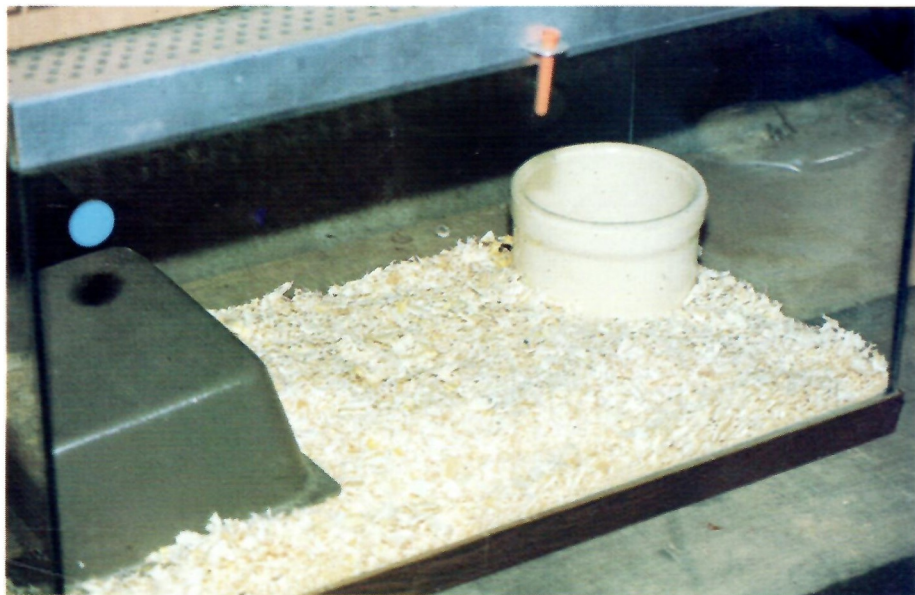


Habitat in southeastern Arizona during late summer, after the onset of the monsoon season. Photograph by Thurgess Cranston.

the onset of the monsoons, the habitat becomes relatively green and lush for a desert area. This greatly influences their activity patterns in these regions. Of the 22 sightings we have made, most have occurred either in the morning hours before 9:00 A.M. or in the late afternoon after 4:00 P.M.. The latest we have observed activity was at 9:15 P.M. in southwestern New Mexico. We have observed these snakes in the wild from mid-April through late September, with the majority of sightings occurring in August and September.

Hognose snakes are renowned for their interesting and unique behaviors when faced by a predator. These snakes are often called the "great actors" of the serpents due to these behaviors. When a predator happens upon them, these snakes initiate a dual behavioral defense. Initially, the snakes spread their necks and produce a loud hissing sound. They will often strike repeatedly and, oddly enough, usually with their mouths closed. This behavior will last for several minutes. If the predator has not retreated, the snake begins part two of its performance. During this act, the snake will roll over on its back and gape with its motionless tongue hanging from its open mouth. Often, this behavior is accompanied by the delightful process of defecating foul-smelling feces and occasionally releasing a small amount of blood from the mouth. The snakes will continue this latter behavior for several more minutes. In general, if the animal is kept in captivity part two of the defense behavior is abandoned after two weeks; however, some specimens, even after years in captivity, will continue with part one of their defensive behaviors!

In west Texas, we have found two gravid females during late June and early July. The former animal was captured and laid eight eggs in late July; the second fe-



Standard caging used by many to successfully house western hognose snakes. The green lid is used as a hide area. Photograph by Thurgess Cranston.

male was noted to have three eggs within her, before she was released. Degenhardt et al. (1996) list clutch sizes in wild western hognose snakes from 4 - 23 eggs.

Mexican hognose snakes are extremely easy to maintain in captivity, and almost any form of enclosure works well. We have successfully kept them in a variety of cages including aquaria, Neodesha® "stacker cages", and sweater boxes. The key to success is to provide the snake with a hide area and a substrate within which it can burrow. We have used pine shavings (as dust free as possible) and CareFresh® bedding with excellent results. Water should be provided at all times, but care must be exercised to prevent excess cage humidity, which can lead to a skin disease known as water blister disease.

We feed our captives exclusively on mice. Unlike their eastern counterparts, the western forms of hognose snakes usually feed readily on domesticated mice. Sometimes, to initiate captive feeding, we

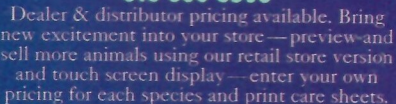
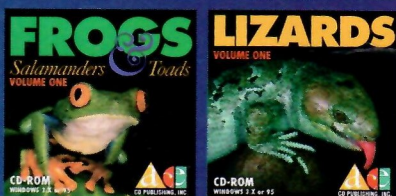
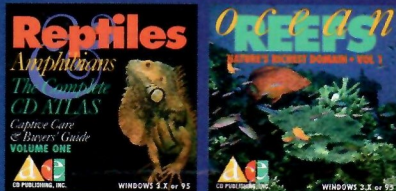
utilized the scenting techniques suggested in Rossi and Rossi (1995). We have found that both toad-scenting and lizard-scenting work well with this animal. On a diet of two five-gram "fuzzy" mice per week, our snakes remain healthy but not obese.

This subspecies was the first snake that we ever captively reproduced. Unfortunately, this was accomplished quite by accident. An adult pair was left together year round. During the second year of cohabitation (1979), the cage was cooled to a lower temperature during the winter months because of a faulty heating system. The snakes were never observed copulating, but around July 27th the female laid seven eggs. These eggs were laid in the substrate next to the water bowl that the female appeared to have moistened by placing water from the water bowl on top of the substrate. We did not discover the eggs until a few days later, when we returned from a two week vacation. At that time, only one egg was still

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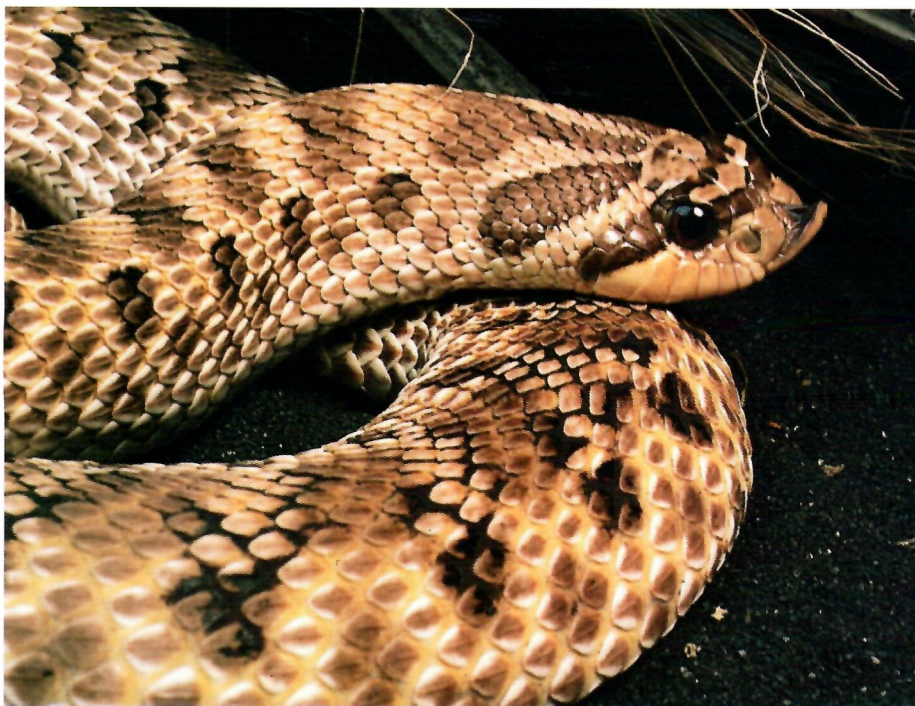
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The Mexican hog-nose snake photographed *in situ* in southeastern Arizona. Photograph by Thurgess Cranston.

fully hydrated. After placing the other six eggs in damp paper towels, three more rehydrated. However, only the one egg that did not dehydrate hatched 73 days later as an exact replica of the mother, only on a much smaller scale. Our neonate measured only 6.5 inches (16 cm), which is 1.75 inches (2 cm) less than the average noted for neonates in Degenhardt et al. (1996). Back in 1979, we incubated the unexpected snake egg on top of our refrigerator, a system we no longer utilize! In subsequent years, we have found that under controlled incubation conditions, where a temperature of 82°F (27 °C) is maintained, these eggs can hatch in as little as 54 days.

The Mexican hog-nose snake is a wonderful species to maintain in captivity. It is a hardy, impressive animal with minimal requirements. We have not bred them for almost ten years, and currently keep our only representative of this species on display in the senior author's classroom! The "smiling" face, upturned nose, and "hissing" sounds all delight, and sometimes astound, his students!

We would like to give special thanks to Barney Tomberlin for kindly relating his natural history information on this sub-species to us.

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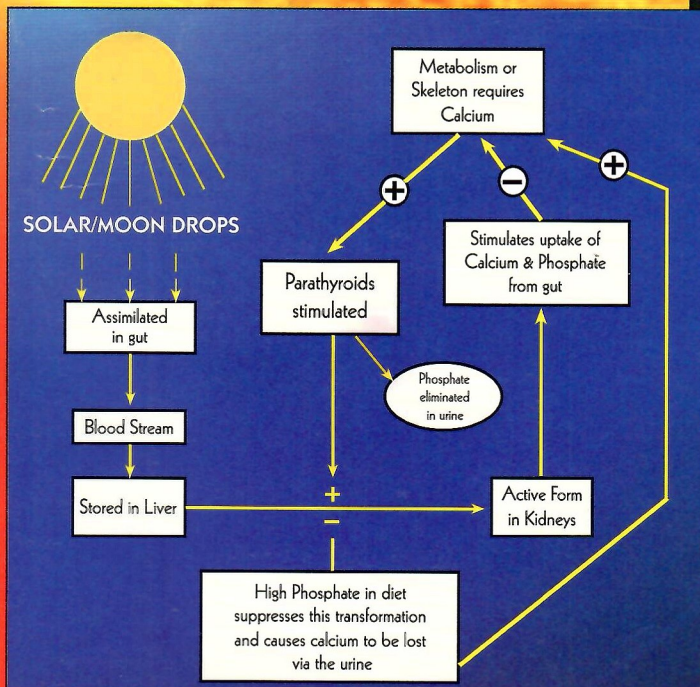
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Vol. 8 Iss. 2 September/October

Reptile Lighting — *Continued from page 45*

moting egg hatchability in panther chameleons (*C. pardalis*).

How Much UV and Visible Light is Emitted by Lamps Used in Herpetoculture?

Table 1 lists fifteen lamps that are available commercially to herpetoculturists. They are arranged in rank order of UVB irradiance.

Are All Wavelengths of UVB Equally Effective in Promoting Vitamin D₃ Synthesis?

UVB is generally defined as the wavelength band from 290-320nm. Based on data by MacLaughlin, Anderson, and Holick (1982), I have calculated that about 60% of D₃ is produced between 290-300nm. Because most D₃ is synthesized within this narrow subdivision of UVB (between 290-300nm), the range has been termed D-UV (Bernard, 1995). The lamps in Table 1 use a phosphor that peaks at about 313nm. Therefore most of the UVB emitted is at wavelengths greater than 310nm. Only about 5% of D₃ results from wavelengths greater than 310 nm.

Does This Mean the Lamps are Ineffective in Promoting Vitamin D₃ Synthesis?

Not necessarily. The effectiveness of a lamp will depend on the species, the length of exposure time, the distance to the lamp as well as dietary and thermal factors. Also, most of the lamps in Table 1 do emit some energy at the ideal D₃-producing wavelengths. The only experimental studies I know of pertaining to the effectiveness of lamps for longterm health and reproduction involve chameleons,

Chamaeleo, and are being conducted principally in Gary Ferguson's lab at Texas Christian University, with several zoos participating in some of the work.

Is There a Reptile Lamp That is Safe and Specifically Designed to Maximize Vitamin D₃ Synthesis?

An experimental lamp using a special phosphor that peaks at about 296nm has been tested and been shown to be effective in promoting D₃ synthesis and elevating blood D₃ metabolites in iguanas (Bernard, 1995). Manufacturing and marketing activities are currently underway and this "Sylvania 2096 Experimental Reptile light" may be available sometime in 1997 (Bernard, personal communication).

What do the Numbers Sometimes Used to Describe Reptile Lamps Mean?

Numbers, such as 2% or 8%, or in decimal form, such as 5.0 or 2.0, refer to the percentage of total energy emitted from the lamp between 290nm and 700nm (UV and visible light) that is UVB (290-320nm). These numbers can be used to compare relative UVB emission among lamps, but can *not* be directly related to the irradiance or the distribution of energy at different wavelengths within the UVB band or the D₃ synthesizing capability.

Can Metal Halide Lamp Systems be Used for Reptiles?

Yes. The light characteristics of a 100 watt metal halide lamp are shown in Table 1. The lamps emit substantial visible light and "respectable" amounts of UVA and UVB. However, these systems are costly (in excess of \$200) and comparable quality lighting can be attained less expensively.

Will Reptiles Regulate Their Exposure to Ultraviolet Light?

Jones et al., (1996) reported that female panther chameleons, *C. pardalis*, receiving low levels of dietary D₃ or preparing to oviposit will behaviorally increase their exposure to UV light, compared to controls, in a UV gradient. This exciting observation requires further exploration with respect to other species and mechanisms. The study suggests that it might be judicious to include shaded areas in vivaria receiving relatively high levels of UVB.

Is There a Component of Natural Light That May Be More Important Than Light Quality?

In a recent issue of *The Vivarium*, Gehrmann (1996) mentioned a considerable body of literature that emphasizes the importance of infrared radiation (heat) for

thermoregulation. Some species, particularly nocturnal forms, may preferentially utilize heat radiated from the substrate rather than from sunlight. Diurnal basking species however receive both light and infrared radiation when they bask. Sievert (1991) has shown that spatial separation of a light and a heat source can lead to alteration of thermoregulatory behavior. While the importance of this for long-term health has not been demonstrated, I suggest that it may be desirable to use a reflector lamp as a combined heat and light source, particularly for basking species, with adjunct light sources placed where convenient.

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Acknowledgments

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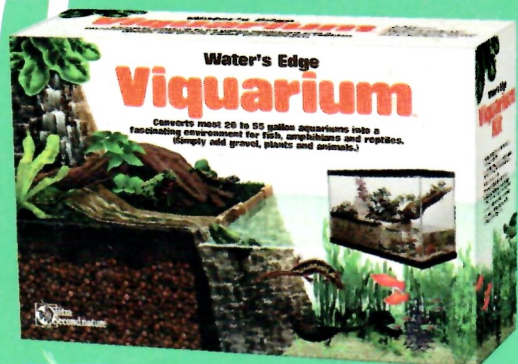
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