

THE VIVARIUM

American Federation of Herpetoculturists Vol. 7 No. 1

\$5.95

Dwarf Python of Angola and Namibia
The Pinocchio Toad - *Bufo dapsilis*
Limbleless Amphibians - Caecilians

Prehensile-Tailed Skink
Corucia zebrata

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Manufactured and Printed
in the United States of America.

THE VIVARIUM, (ISSN 10472665) is published six times a year January/February, March/April, May/June, July/August, September/October and November/December issues. Subscription price is \$26 for U.S. and \$32 for all foreign countries per year. Published by American Federation of Herpetoculturists, 120 W. Grand, Ste. 106, Escondido, CA 92025 Tel# (619) 747-4948. Second-Class Postage Paid at Escondido, CA and additional mailing offices. POSTMASTER: Send address changes to THE VIVARIUM, P.O. Box 300067, Escondido, CA 92030-0067.

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On The Cover: Adult female Solomon Islands prehensile-tailed skink, *Corucia zebrata*. Photo by Donal M. Boyer: Cannon AE Program, 28mm lens @ f5.6 in natural light with Fuji Velvia film. Courtesy of the Dallas Zoo.

FEATURES

Husbandry and Breeding of the
Solomon Islands Prehensile-tailed Skink
Corucia zebrata

by Michael J. Balsai

4

Treasure of the Sierra Madre Orientals:
The Northern Mexican Pine Snake
Pituophis deppei jani

by Alan Kardon

18

Some Notes on
the Pinocchio Toad
Bufo dapsilis

by Danté Fenolio and Michael Ready

50

COLUMNS

Q & A COLUMN

Ask the Expert

by Winston Card

24

THROUGH THE EYE OF THE AMPHIBIAN

Limbleless Amphibians: Caecilians

by Danté Fenolio, Michael Ready and Jim O'Reilly

26

PYTHONS & BOAS

The Maintenance and Reproduction of the
Dwarf Python (*Python anchietae*)
of Angola and Namibia

by Dave and Tracy Barker

30

INTERVIEW

An Interview with Dr. James B. Murphy

by Winston Card

38

DEPARTMENTS

BOOK REVIEW: *Mediterranean Turtles* by Brian Pursall
—Reviewed by Charles Innis

12

HERP NEWS FROM AROUND THE WORLD — by Ellin Beltz

14

AFH BUSINESS

44

COMING EVENTS

45

CLASSIFIEDS

46

ADVERTISER'S INDEX

47



5

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.

Husbandry and Breeding of the Solomon Islands Prehensile-tailed Skink

Corucia zebrata

by
Michael J. Balsai

Natural History

The prehensile-tailed skink, *Corucia zebrata*, is fast becoming one of the more popular of the larger lizard species with herpetoculturists. This skink is also sometimes referred to as the monkey-tailed skink, zebra skink, or the Solomon Islands giant skink. The peculiar tail is prehensile and marks members of this species as arboreal specialists. This tail is incapable of autotomy (breaking off for defense). If a portion should be lost, it will not regenerate (Hediger, 1937; Klemmer, 1974). Described by the British naturalist John Edward Gray in 1855, the genus name *Corucia* lacks any

appropriate meaning, while *zebrata* is in reference to the broad stripes or bands seen on many specimens (Sprackland, 1992, 1993). Interestingly, these animals are primarily herbivorous (very unusual for skinks). This lizard is one of the two or three largest living skinks. These lizards are found only on the Solomon Islands, on Choiseul, New Georgia, Isabel, Guadalcanal, Ngela, Malaita, San Cristobal, Ugi, Santa Ana, and Shortlands, as well as on Buka, and Bougainville (both presently part of Papua New Guinea) (McCoy, 1980; Gibbons, 1985; de Vosjoli, 1993). In the wild, specimens can grow to total lengths of about 30-32 in (75-80 cm) about half this length is tail (up to 14 to 18 in), but most captives tend to be slightly smaller in size (Mattison, 1989, 1991; Sprackland, 1992; Shaner, 1994).

The systematic relationships of these skinks is uncertain, but it is probable that their closest affinities lie with the blue-tongued skinks and their allies, from Australia and New Guinea (Iverson, 1982; Mattison, 1989, 1991). In fact, these lizards are notable for having large wedge-shaped heads similar to those of the Lygosomatid skinks. The snout is rather blunt, and the body is robust. Limbs are well developed, and all digits bear powerful claws. The largest of the head shield scales is the frontonasal although the head shield scales are often irregular and widely variable (Schmidt, 1932). The lower eyelids are scaly.

The dorsal ground color of these skinks is variable, ranging from pale olive green to a more grayish green, with some even exhib-



Adult *Corucia zebrata* grasping branch with prehensile tail. Photo by Jim Bridges and Bob Prince.



Adult *Corucia zebrata*. Photo by David T. Roberts, ©Nature's Images, Inc.

iting a khaki-like color. There are light and dark speckles (in some specimens they are black) on the back and sides which can converge into stripes. The frontal and nasal scales are cream to pink in color, and . . . frequently . . . so are the frontonasal scales. The tail is olive-green or brown with little or no markings of any sort. The bellies are usually yellow-green to a light gray-green. Specimens from Malaita Island are darker in color than specimens from elsewhere on the Solomon Islands (McCoy, 1980; Shaner, 1994). The degree and intensity of the striping and speckling varies quite a bit between skink populations on the different islands (see Schmidt, 1991). While debate rages as to whether these variable color and scale patterns merit subspecies designations for some of these populations, it is possible that the fertility of cross-bred animals from widely separated populations may be low, as a result of genetic drift-induced divergence between these geographically separated groups (Schmidt, 1991; de Vosjoli, 1993; Wright, 1993a; see also Mayr, 1942 and Endler, 1977 for further general discussion of species and geographic variation). Iris color can vary from an orange-brown, to a golden-yellow, to a pale lime green. Interestingly, the prehensile-tailed skinks found on Bougainville are claimed to have yellow irises (de Vosjoli, 1993).

McCoy (1980) claims that these lizards are fairly common on the Solomons, but are rarely seen by most human inhabitants because these lizards are crepuscular and nocturnal. He notes that during the day the lizards will shelter in tree hollows. Kinghorn (1928) (see also Parker, 1983) reports that these lizards lead the same kind of life as the marsupial possum and are often found asleep with or at least in close proximity to possums! Parker (1983) notes that on Bougainville they are fairly common in the lowlands and foothills below about 900 ft. (300 m) elevation, though in the Guava area (west of Kieta) villagers report the presence of these lizards on the plateau at approximately 2950 ft (900 m). On Buka, local people report that these lizards are restricted to undisturbed forests on the southwest coastal low mountain ranges. Recently, however, this animal has been upgraded to CITES Appendix II. This is in response to their being over collected to supply the foreign exotic pet trade, and because of recent logging on the Solomon Islands (Wright, 1991, 1993a; de Vosjoli, 1993; McKeown, pers. comm.).

Parker (1983) claims that these skinks prefer the oldest trees in primary forest (including swamp and littoral habitats characterized by *Casuarina* species, a type of



Close-up of head showing interesting ocular scales. Photo by David T. Roberts, ©Nature's Images, Inc.



Close-up of front hand. Note ring scar on fourth (longest) digit as a result of adhering ringlets of improperly shed skin. Photo by C. M. Garrett.



Close-up of underside of foot showing granular scales specialized for grasping. Photo by C. M. Garrett.

evergreen found in Australia and parts of Melanesia). This may be due to the fact that these trees are the ones with dense foliage and extensive epiphyte cover. He also notes that *Corucia* is not found in secondary forest where the large trees have been removed for traditional gardening practices or timber (see Honegger, 1975 for an alternative opinion). The lizards are sometimes eaten by some of the indigenous peoples (Kinghorn, 1928; Hediger, 1937; Parker, 1983; but see Honegger, 1975). The larger islands of the Solomons have very similar habitats (as defined by their cohabiting plants and animals) and consist of a mountainous spine covered by lush tropical rain forests (Wright, 1991).

The strangler fig tree (*Ficus* sp.) is one of the preferred trees of *Corucia* on the

Solomons. On occasion, these lizards can be seen, nocturnally foraging on the ground (McCoy, 1980; but see Parker, 1983 for a discussion of the extreme rarity of terrestrial foraging). A wide variety of plants are eaten, but it shows a preference for the leaves of a creeper known as *Epipremnum pinnatum*, fruits and leaves from the epiphytic *Scindapsus*, the various *Piper* species (Honegger, 1975; McCoy, 1980; Parker, 1983) and new leaves of the split-leaf philodendron, *Monstera deliciosa* (McKeown, pers. comm.). Food is carefully cropped in bite-sized portions (Kinghorn, 1928; Parker, 1983). These skinks defecate frequently, and their feces have a characteristic odor. Portions of undigested leaves as well as shed

skin can be seen in the feces (Honegger, 1975).

Like other large herbivorous lizards, *Corucia* show interesting hindgut adaptations for herbivory. In particular, these lizards have a partitioned colon, which differs markedly from that of all other skinks including members of the possibly closely related genera *Egernia* and *Tiliqua*. The functional significance of this colic specialization is uncertain, however, passage time for the food is slower and absorptive surface is increased. One other possible advantage to this partitioning is that it may provide important microhabitats for colic cellulose-digesting symbionts. These symbionts appear to include bacteria, protozoans and nematodes (Iverson, 1982).



Neonate *Corucia zebrata* just after birth. Note the birth membrane and partial umbilicus. Photo by Sean McKeown.



Adult male with everted hemipenes. Photo by David T. Roberts.

Some local people claim that these lizards occasionally practice communal torpidity (Kinghorn, 1928). It is claimed that if more than one lizard dwells in the same tree hollow, the topmost animal comes out to feed, while the others, underneath, remain and feed on the excrement from the top one (coprophagy). Under such circumstances, the top one is fat and healthy while the lower ones show varying degrees of thinness. Parker (1983) states that he has never observed this behavior during his four years of

field work, nor did any of his native assistants. He has no idea if there is a seasonal component, or any kind of regularity to this phenomenon. Parker does note that 6 from more than 20 language groups of local inhabitants on the Solomons report this behavior. His experience has shown that when reports of such animal behavior are obtained from several different language groups residing in the animals' range, they tend to be reliable. Ordinary coprophagy has been confirmed by several workers including Honegger (1975).

The natural predators of this lizard on the various islands are unknown. Loveridge (1946) reported the supposed presence of this lizard among the stomach contents of an 11-ft salt water crocodile, but Gritis (1990) makes a good case of this being based upon shaky evidence derived from H. B. Guppy's 1887 travelogue, and that this story's continued reporting is totally based upon Loveridge's authority. It is possible that the native people of many of these islands continue to exploit this lizard as a food source. Honegger (1975) reports that the natives of the Solomons have become "modernized" in their dietary preferences and this lizard is no longer highly esteemed as food, especially in the towns.

***Corucia zebrata* as Captives**

Until late 1980s, this skink was rarely available through the exotic pet trade. Now they have become commonplace in pet stores and private collections (Sprackland, 1992, 1993; de Vosjoli, 1993). According to de Vosjoli (1993), these animals are often housed and maintained in "atrocious conditions" before they are exported from the Solomons. Thus, diseased and moribund animals often end up arriving

to dealers for sale to potentially unsuspecting herpetoculturists. Even though the government of the Solomon Islands claims to regulate the collecting and exportation of these lizards, the numbers coming out made it necessary, in 1992, to list this reptile as CITES Appendix II. Due to the apparent dependence upon primary growth forest, low reproductive rate, and restriction to a limited geographic region, the prehensile-tailed skink is an animal that could be very sensitive to heavy collecting pressure (de

Vosjoli, 1993; Sprackland, 1993). De Vosjoli goes as far as to recommend that the government of the Solomon Islands implement strict export quotas and improved captive holding conditions if trade in this species is to endure, and he projects that at least twice as many healthy animals would reach the U.S. if such standards were enforced in the Solomons. It is hoped that captive-breeding can eventually supply most or all of the specimens required by the pet trade.

Prehensile-tailed skinks do best in enclosures that will allow them to climb, thus, large tall enclosures with many branches are strongly recommended. While minimal conditions are never recommended or encouraged, an enclosure of about 4 ft L x 2 ft W x 4 ft H (1.5 m L x 0.7 m W x 1.5 m H) could be envisioned as the smallest cage that could house a single adult skink.

Substrates should be easy to replace and cheap because these lizards defecate frequently. Substrates such as Astroturf and newsprint are a good choice. Groves (1994) mentioned that at the Philadelphia Zoo, several different substrates were tried, including small round stones, various mulches, and newspaper. Groves eliminated stones because of the difficulty in cleaning them, and mulches because they were a popular hiding place for roaches, even though mulches held humidity very well. He uses newspaper because it is inexpensive, easy to replace, and it provides hiding places for the lizards.

De Vosjoli (1993) argues that shelters should be provided, as many as one per animal. They can also be large enough to accommodate more than one skink. He recommends providing above-ground, elevated shelters, but notes that ground-level retreats are certainly adequate. He prefers cork rounds (hollows) as a means of providing shelter. Hollow logs, hide boxes, and cockatiel nestboxes have been described as other possible cage furnishings (Bowler, 1981; Wright, 1991, 1993a; Moser, 1992; Speer, 1993).

Because these lizards come from tropical islands that lie very close to the equator, they should be given a 12-hour photoperiod. A combined use of natural light, incandescent lights and fluorescent lights are used by many herpetoculturists (Honegger, 1975; Bowler, 1981; Groves, 1994; Wright, 1991, 1993a; de Vosjoli 1993).

As tropical animals, these lizards require daytime temperatures of 82–90°F [26–30°C] with lows at night in the mid 70s [20s°C]. They prefer humid microclimates. De Vosjoli (1993) suggests that these lizards should be kept at a humidity of about 70%, and several authors pointed out that they provide a daily misting of the enclosures.

Wright (1991, 1993a, see also Dulin, 1991) noted that he provides a "wet" season from November to April by daily saturation of the cage. If a drip system is used, prevent access to the drip line, as the skinks may chew through the lines. All skinks require a bowl of standing water in the cage. The container should be checked often because these lizards are prone to defecating in them. The water in the bowls will increase humidity in the cage, via evaporation. Water quality is an important consideration for the long-term health of these lizards, and if the quality of the tap water is in doubt, filtered or bottled water should be used.

It was also stressed by several authors that humid conditions seem to be needed for proper shedding. If the humidity is too low, the skin will be too dry to come off easily. One can mist animals in the process of shedding. Young skinks may shed as often as every six to eight weeks, while adults will do so less often. Shedding around the toes and feet can sometimes be problematic. Any loose skin clinging in these areas should be removed. Generally, though, healthy skinks have no difficulty shedding.

The ideal diet for this species is unknown, but they readily accept a variety of foods; these include: raw endive, escarole, raw kale, apples, carrots, bananas, hard boiled eggs, pears, cherries, lettuce, kiwi, papaya, plums, collard greens, turnip tops, mulberry



Close-up of mouth showing flattened, angular teeth specialized for herbivory. Photo by C. M. Garrett.

Some authors believe coprophagy is important to provide the juveniles with the proper flora for digestion, but babies removed from the mother after birth, with no access to skink feces can successfully mature (de Vosjoli, 1993). Wright (1991) postulated that the redigestion of the feces may provide vitamins B and K (normally produced by vertebrate intestinal microbes). He also notes (1993a) that it is difficult to prevent coprophagia and is probably not detrimental if the animals have been deparasitized. In addition, these lizards will commonly eat skin sheds (keratophagy).

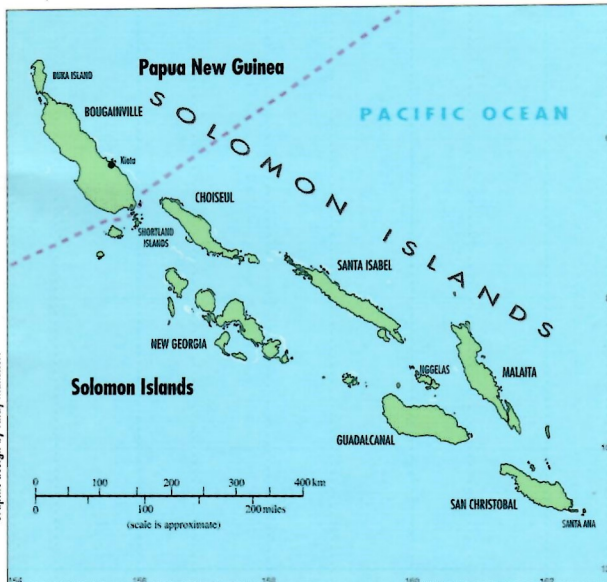
Handling of these skinks is a tricky proposition. When picked up these lizards will attempt to seize an object with the limbs and tail. The grasp is strong and the claws are usually quite sharp. Tame or calm animals will usually relax their grip if they feel secure in their perch, but this will instantly alter if the animal feels the need for greater stability. These skinks do not tolerate handling by the tail very well and attempt to grasp with the limbs

or curled over where they become a detriment to the lizard.

The "personalities" of these lizards vary widely. Some are incredibly calm, some are nervous or shy, some are unpredictable, and some are downright aggressive. There are also instances of long-term cohabitants suddenly fighting with each other. In addition, males will usually fight violently (Lilley, 1985; Spiegel-Hoffer, 1990), though it is not unusual to see two females go at it as well. All sorts of opportunities for aggression can arise. Violent scuffles between cagemates can result in serious injury and even death for one or both animals (Moser, 1992; de Vosjoli, 1993; Wright, 1993a). It is best to separate such incompatible animals, though sometimes very large quarters can allow one animal to escape the other's territory. It may be best to place a "new" addition to any long-term established group within the safe confines of an "introduction box," though this does not ensure success by any means. If the animal is not accepted upon eventual introduction, it is possible it may never be. Careful observation at these times is always prudent. New arrivals should be quarantined for a minimum of one to two months and deparasitized before introduction to the colony.

Breeding *Corucia zebrata* in Captivity

There have been many reported instances of successful captive breeding of these lizards. There have also been several reports from the Philadelphia Zoo of second-generation births within their colony (Groves, 1982; Anon, 1990). In some instances, though, it is difficult to discern if the babies



Graphic design by Andy Munster.

leaves, spinach, yellow squash, sweet potatoes, melons, grapes, hibiscus flowers, roses and soaked monkey biscuits. It is of particular interest to note that golden pothos may be useful in getting stubborn skinks to begin eating (Speer, 1993; Wright, pers. comm.) Skinks should be offered a wide selection of these foods 2-3 times per week.

pretty much constantly. They will also get angry when handled in such a manner, thus many handlers run a high risk of being bitten when carrying or lifting the skink by the tail. It is my opinion that nails do not normally need to be trimmed on active animals, since frequent climbing about helps keep them sharp enough to climb but not too long

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were actually a result of captive breeding or whether the females were gravid upon receipt (e.g., Honegger, 1975; Spiegel-Hoffer, 1990). Groves (1994) reported that at the Philadelphia Zoo, as of 1990 (the first birth occurred in 1977), there were about 44 young produced, and 10 were second generation. Of these 44, 26 were either stillborn (6) or died within about a month (20). Apparently, those that died had large amounts of "unabsorbed" yolk in the body cavity. Of the 21 births at Zurich (over a period of about 11 years, up to 1985), 7 were stillborn and no neonatal death was reported (Honegger, 1985). Honegger also reported that most of the births at Zurich occurred at night.

Sexing these skinks is moderately difficult. When several animals are available, males can often be distinguished by their large "jowls" (Wright, 1993b), though it may be that the male does not have "jowls" so much as their heads are larger and broader when compared to the body (Speer, pers. comm.). Wright also notes that mature males show a bulge behind the cloaca as a consequence of the size of their hemipenes. Many mature females will bear scars on their neck and pelvis where they were bitten by male skinks during courtship and copulation (unless the female has shed many times since she last mated). Wright (1993b) notes that probing is usually "unrewarding," but anesthetized skinks can easily have their hemipenes everted. This can be done by applying a gentle firm pressure on the ventral tail surface about 1.25 in (3 cm) behind the cloaca. Sliding the thumb forward while applying pressure causes eversion (this can be assisted with the use of sterile water-soluble gel in the cloaca). Wright (pers. comm.) notes that this technique can be useful to sex juveniles. In addition, he adds that two purplish genital "nodes" can be everted from deeply anesthetized females. These structures are small (about 2 mm) and easily differentiated from the larger (about 20 mm or nearly 1 in) flesh-colored hemipenes. Schilder (1987) described using endoscopy (laparoscopy) to successfully sex these skinks.

Stimulating the skink to breed in captivity has been described by Wright (1991, 1993a), and he proposed that the simulation of wet and dry seasons coupled with suitable temperature fluctuations will initiate breeding behavior. He further added that some skinks may be stimulated to copulate by "drenching the cage with water, periodically during the 'wet season'" (1993a, p. 20). In addition, the presence of large hollow logs seemed to be desirable. He notes that copulation tends to decrease when the tempera-

tures exceed 88°F. De Vosjoli (1993) claims that there is no evidence of seasonality for breeding by these skinks, and supports this claim with the observation that gravid females are found in virtually every shipment of these lizards.

De Vosjoli (1993) points out that some herpetoculturists reduce the photoperiod to 10 hours per day and reduce daytime and evening temperatures by about 5°F (about 2.8°C) for about 4 to 6 weeks. Additionally, the number of feedings is reduced to about twice a week during this time. After a return to normal conditions, feeding is increased and the animals are misted daily for a few weeks. An alternative is to keep the animals under the same conditions all year, but misting them daily for several minutes over a period of several weeks during the "spring." De Vosjoli also notes that success is often obtained by keeping the lizards separately and introducing the female into the male's quarters, separating them after copulation and visual confirmation that the female is gravid.

Courtship and copulation are frequently somewhat traumatic for female skinks because the male will often bite the female on the neck and pelvic area. This often leaves scars on the female which usually fade after several sheds if the female is not exposed to other males (Wright, 1993a). Males may also stroke the female's back and pelvic region with a hind foot. This may cause the female to arch her back and tail somewhat. The male then twists his cloacal region to copulatory position. Honegger (1985) notes that during copulation the tails are bent slightly (at best) and not anchored. Copulation time for these lizards is rather short, lasting only about 7 or 8 minutes.

While it is okay to house gravid females with the colony if there are enough shelters and the enclosure is large, it is probably prudent to isolate them and house them singly during gestation. However, McKeown (pers. com.) feels *Corucia* are extremely social. If the group or pair is normally housed together, he recommends leaving them together while the female is gravid. The actual gestation period is about 6–7 months. Another difficult bit of data to pin down is how often a female skink will breed. De Vosjoli (1993) suggests that the pattern might be like that of northern blue-tongued skinks, where females usually breed each year during the first 2 or 3 years of life, after which they breed biannually. Honegger (1985) reported that a female skink bred at about 10–11 months post-partum.

Corucia zebrata are viviparous (Shine, 1985; Wright, 1993a; and probably not ovoviviparous as stated by de Vosjoli, 1993)

as defined by Yaron (1985). These skinks give birth to one or two young at a time. The young are large at birth (as much as a foot [30+ cm] in total length) and can weigh as much as 3 oz [ca. 85 g] with twins weighing between 1.2 and 1.8 oz (35 and 50 g). It should be noted that young are normally born at night and females may lie in their water 2 or 3 days before giving birth (beware of possible drowning of the baby). This desire to soak in water by females about to give birth correlates with a report that female *Corucia* will give birth during rainstorms when housed outside (Speer, pers. comm.) It is reported by many authors that the young do not eat until after their first shed, 9 to 11 days after birth (though Zelenski, 1993 reported his specimen eating right away). Neonates have been reported to be cannibalized (Honegger, 1985), and it is probably wise for the herpetoculturist to carefully observe the neonates if they are kept in communal cages. Parental care, particularly protective behavior has been reported many times though exceptions occur (see Moser, 1992 for example). Groves (1994) reported seeing mothers nudge and push their young to food. Young skinks may be aggressive for a time after being born. McKeown (pers. comm.) reported guarding behavior by the entire adult living group of *Corucia* at the Honolulu Zoo. Further, he reports that their protective behavior may last from several days to up to a month.

While some authors have reported that the mothers eat the birth membranes (see Wright, 1991, 1993a; Groves, 1994), this behavior has not been visually verified by anyone. Wright (1993a) also reported that young blue-tongue skinks will eat their own birth membranes. Perhaps newborn *Corucia* also eat their membranes, and might even need to do so.

Some neonates do not survive longer than about a month. Reasons for mortality are not known, but could arise as a result of improper husbandry or poor maternal condition. Groves (1994) suggests that the majority of neonatal deaths associated with malabsorbed yolk sacs were a result of being born during the cooler months of the year (November–April) and that the gestating females may not have had adequate warmth to allow the young to develop adequately.

Postnatal care at the Zurich Zoo consisted of multivitamin shots and separate enclosures for several weeks (Honegger, 1985). At the Philadelphia Zoo, the mother and young are kept together at all times in the colony (Wright, 1993a).

Diseases and Other Veterinary Problems

De Vosjoli (1993) notes that it may be difficult to get a really accurate estimate of

mortality among imported *Corucia* during their initial year as captives, but he reasoned it could be as high as 40%! He notes that in their country of origin, these animals are often not fed or watered properly, horribly crowded, and often kept in filthy conditions. As a result, many arrive to the U.S. in poor condition. He also notes that they seem to be vulnerable to respiratory ailments and it may be unwise to keep them in the same room with other animals (for normal physiological and hematological data, the reader is referred to Wright, 1993b and Wright and Skeba, 1992).

These skinks can become victims of a number of microbial disorders, including infectious stomatitis, salmonellosis, amoebiasis, microbial-induced respiratory infections (including pneumonia, which is rare according to Wright, 1993b), various external and internal abscesses, peritonitis, tetanus (Jarchow, 1990) and possibly some others (Wright, 1991, 1993b; de Vosjoli, 1993). Many of these disorders can arise from poor husbandry, conspecific induced trauma, and, of course, the poor conditions under which many are kept prior to exportation. De Vosjoli (1993) notes that "tail rot," a necrotic condition of the tail, occurs with great frequency among these skinks. Parker (1983) reported that on Bougainville, these lizards can be seen tied to sticks and poles; this may be the cause for this problem among freshly imported skinks. It is also possible that some cases of "tail rot" arise as a result of fighting between cagemates (Wright, 1993b). In addition, some of these lizards may show infections on the feet as a result of bad husbandry and/or adhering shedding skin. This can be prevented by maintaining clean conditions and monitoring and removing from the feet adhering ringlets of skin.

One common problem seen among these lizards is aggression between enclosure-mates. The extent of damage inflicted can be horribly severe in many cases. Wright (1993b) noted an instance where one animal bore lacerations, varying between about a half inch and almost 2 in (5cm) all about the abdominal area. When the wounds were cleaned and examined, he discovered that some had penetrated through to the viscera. This animal eventually died from an "overwhelming septicemia." In instances where lacerations were visible but not "dangerous" (as is normally the case after mating), they will disappear after several sheddings.

Wright (1993b) noted that a chronic dermatitis affected several skinks in the Philadelphia Zoo colony. The scales on the back and tail become quite rough and can crack, thereby exposing the underlying der-

mis. Several species of bacteria have been cultured from the surface of these affected scales but it is not known whether these organisms are involved in the condition. Wright noted that this syndrome developed on skinks that had newspaper as a substrate but not with those kept on damp sphagnum moss (I use newspaper and have not, so far, observed this condition). Although no records were kept concerning humidity or temperature, Wright suggests that low humidity may be the culprit for this disorder. He further noted that the condition does not respond to parenteral antibiotic therapy, but topical tolinaftate (in the form of Tinactin™) seemed to have some positive effect (Wright, pers. comm.). While the skinks seem to be otherwise relatively unaffected by the condition, the exposure of these underlying tissues obviously sets them at risk for systemic infections.

Various parasites can also be a source of trouble. One relatively common external parasite is the snake mite (frequently found on lizards in captivity). These skinks are commonly infested, and can possibly become anemic if left untreated. At the Philadelphia Zoo, mites and other problem arthropods are controlled with the use of pyrethroids and growth regulators (Wright, pers. comm., see Mader and Palazzolo, 1993 for description of use). Ivermectin has been reported as a treatment for mites at a dose of 0.2 mg/kg (Roskopf, 1992) or as a spray on the animal and its cage at a concentration of 5 mg in one qt of water (Abrahams, 1992).

It is also a good idea to have newly acquired skinks checked and treated (if necessary) for parasitic worms and/or protozoans. De Vosjoli (1993) notes that because these lizards are coprophagic, such parasites can be easily spread through a colony. There are conflicting reports of ivermectin sensitivity and toxicity. Boyer (1992) reported that the prehensile-tailed skink he treated for nematodes at the standard dose of 0.2 mg/kg died in 24 hours. Stahl (1992), however, also reported treating several *Corucia* for nematodes with the same dose and saw no apparent side effects. He also noted the use of several other anti-helmenthic drugs with no ill effects. Be aware that some nematodes may be a regular and possibly beneficial inhabitant of the gut of *Corucia*. Though not specifically mentioned for *Corucia*, Iverson (1982) mentions removing huge numbers of nematodes from the proximal colons of adult *Cyclura nubila* (Cuban iguanas), and that these heavy worm burdens are typical of herbivorous lizards whereas such burdens are not found in omnivorous or carnivorous lizards.

Conclusions

Corucia zebra are among the most interesting lizards available as captives. They adjust to the "proper" captive conditions relatively easily and can readily live many years with proper care. That *Corucia* breed fairly easily under captive conditions offers hope that the "need" to take wild animals for the exotic pet trade will diminish. It is hoped that the government of the Solomon Islands will make greater efforts to try and protect this species. Because of continued harvesting for the pet trade, and the ever increasing destruction of the habitat of this species, the future for this lizard does not look very bright. It would be sad, indeed, if this, one of the largest living skink species, ends up like another insular giant skink, the now apparently extinct *Macroscincus coctaei*, from the Cape Verde Islands; it is believed to have vanished in the 1940s (Balouet, 1990).

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Acknowledgments

The author gratefully appreciates the efforts of the following individuals for providing references and/or other indispensable assistance: Mark Bayless, Philippe de Vosjoli, Deborah Francis, Edward Gilmore, Dr. Paul Gritis, Dr. Gregory Lewbart, Sean McKeown, Rebecca Speer, Peter Strimple, and Dr. Kevin Wright.



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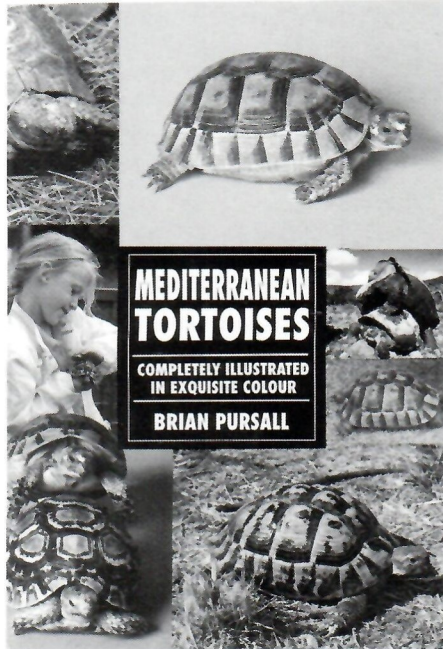
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reviewed by Charles Innis

Mediterranean Tortoises

Mediterranean Tortoises, by Brian Pursall. 1994. T.F.H. Publications Inc., Neptune City, NJ. 35 color photographs, 10 black-and-white photographs, 15 line drawings and figures, 1 table. 95 pp. ISBN 0-7938-0284-9. \$6.99.



North African and Southern European tortoises of the genus *Testudo* have been popular pets in both Europe and the United States. Their small size, tolerance of temperate climates, and generally relatively inexpensive purchase price make them an ideal group for herpetoculture. Unfortunately, only a few English-language texts on the captive husbandry of *Testudo* species have been written. The 1990 *Keeping and Breeding Tortoises in Captivity*, by Andy Highfield, was the first, well-referenced, well-written book devoted to the captive husbandry of tortoises, with the main emphasis placed on *Testudo* species. It remains an excellent and important reference, not only for its husbandry information, but for its lively discussion of the taxonomy of *Testudo*. The recent book, *Mediterranean Tortoises* by Brian Pursall, is the first since Highfield to focus on species of *Testudo*.

The author begins the text with a note informing the reader that the book is intended for the average Mediterranean tortoise pet owner, and asks that any scientist reading the book, "will not reject the science contained herein because of

the way it is expressed." A reader looking for data, statistical analyses, and references may be disappointed.

The first chapter, "Zoogeography and Evolution," describes the distribution of Mediterranean tortoise species in relation to both climate and calcium availability. Several maps are provided as references. While it is generally known that climate limits the distribution of tortoises, the author's hypothesis that tortoises only inhabit calcium-rich areas has not been described, to my knowledge, in any previous popular literature. It will be interesting to see whether this hypothesis gains general acceptance.

An introduction to the species of *Testudo* describes Greek (*Testudo graeca*), Hermann's (*T. hermanni*), marginated (*T. marginata*), Horsfield's (*T. horsfieldi*), and Kleinmann's tortoises (*T. kleinmanni*). The descriptions are generally clear and accurate; however, one inaccuracy exists. The presence of a divided supracaudal scute cannot always be used as a distinguishing characteristic of *T. hermanni* as this can also be seen in some specimens of *T. graeca*.

The discussion of sexual dimorphism focuses on the differences in tail morphology and on plastron concavity. The author notes several interesting specimens that did not clearly possess typical male or female characteristics. Further research on the development of secondary sexual characteristics and on possible hermaphroditism is needed.

The remainder of the book is largely dedicated to the Greek tortoise (*T. graeca*). Thus, one major shortcoming of the book is the lack of information on husbandry and breeding of the other four *Testudo* species. The description of *T. graeca* subspecies relies on the classically accepted taxonomy, yet points out that significant controversy exists in this area. No further discussion of the controversy is provided (see Highfield, 1990 for a more detailed discussion). Also, the descriptions of the different subspecies listed in the Pursall book would be greatly enhanced by photographs, as it is difficult to envision subtle differences in shape and color based on the text alone.

In "Temperature Control," the author clearly describes thermoregulatory behavior of various tortoise species and emphasizes that overhead incandescent lighting provides the best means of thermoregulation (rather than natural sunlight) for Mediterranean species. The use of substrate heat is discouraged. The rec-

ommendation of daytime and nighttime temperatures of 68–77°F (20–25°C), and 50–59°F (10–15°C), respectively, are too low, in my opinion.

Winter cool down, listed as "hibernation," is addressed adequately, and several methods for brumation are described. My only criticism of this section is that the extrapolation used to propose that a tortoise could *theoretically* hibernate for 19.5 years is somewhat baffling.

The discussion on nutrition I found quite interesting. Highfield supports the use of substantial amounts of calcium (calcium-to-phosphorous ratio of 4:1 to 6:1), citing data from the analysis of wild-tortoise diets. Pursall proposes crushed egg shells as one calcium source; but fails to point out the possibility of exposing tortoises to harmful gram-negative bacteria unless the eggshells are first baked or boiled. No mention of the controversy regarding ultraviolet light requirements of tortoises is given.

Regarding water consumption, the author makes the generality that "healthy tortoises do not drink." I believe this statement is incorrect, and many Mediterranean tortoises, including some specimens of *T. graeca*, will drink if water is offered. While an increase in water consumption could theoretically indicate disease, one should not assume that any tortoise that drinks is ill. Most tortoise keepers provide water several times weekly, if not constantly.

"Senses and Behavior" provides a good description of exploratory, territorial, and sexual behavior. The author correctly emphasizes that Mediterranean tortoises are generally solitary animals that should not be kept in large groups. However, the author incorrectly generalizes that tortoises suffer behavioral problems if kept in large groups, using a photograph of a group of captive giant tortoises to illustrate the point. This is clearly not true for most species of tortoises including Galapagos (*Geochelone nigra*), Aldabra (*Aldabrachelys elephantina*), and pancake tortoises (*Malacochersus tornieri*) which seem to breed best in groups, and are often found in groups under natural conditions. The key to maintaining groups of tortoises in captivity is having sufficient space, correct sex ratios, and maintaining individuals of similar sizes together.

The chapter on breeding provides a useful discussion of breeding techniques, management of gravid females, incubation, monitoring egg development, and

care of hatchlings. The mention of oxytocin as the hormone that naturally stimulates oviposition is slightly inaccurate, as reptiles produce vasotocin, a similar, but distinct hormone. Incubation is described in terms of temperature and humidity requirements, but no information is provided regarding the effect of oxygen and carbon dioxide on egg development (see Highfield, 1990).

In "Growth and Age," the author makes several assertions that I find difficult to accept. The first is that the maximum size of wild tortoises is not controlled by an internal mechanism (i.e., genetics), but by a decrease in food intake caused by territorial defense behavior that begins at about age twenty. The second is that, since tortoises grow continuously, a previously ill tortoise can grow "a new organ" to replace one that had been damaged. While tissue is capable of healing and regenerating, I feel that stating that "a new organ can grow" is misleading. The third assertion that I cannot accept is the author's belief that tortoises do not die from old age, but from disease, accidents, etc. The author implies that a tortoise may live indefinitely if it is not afflicted by illness. Aging occurs in all organisms, eventually leading to dysfunction of biological processes. It is a bit of a semantical argument, but if a 100-year-old tortoise dies of liver failure, did it die from disease or old age?

A large portion of the book is devoted to illnesses and their treatment. British names for several drugs are given, so the American tortoise owner seeking these drugs from his/her veterinarian may not be successful. The first section discusses anorexia (loss of appetite). A good description of the effect of improper husbandry and elevated blood urea levels on appetite is provided. In discussing treatment of anorexia, the author states that veterinarians have traditionally used vitamin injections in reptiles as an extrapolation of their use in mammals because "mammalian anorexia normally is either a mental condition or caused by a vitamin deficiency." This is false, and while vitamin injections do not help some tortoises, they may be useful in some cases. A clear description and illustration of tube feeding is provided, but the usefulness of a surgically placed pharyngostomy tube is not discussed. Nor are specific recommendations made for the ingredients of the tube-feeding diet.

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Accident prevention, quarantine procedures, runny-nose syndrome, pneumonia, mouth rot, eye diseases, and reproductive problems are covered fairly well. A good, basic discussion of parasitism is provided. The coverage of blood testing is incomplete, referring only to blood chemistry analysis and not mentioning the evaluation of blood cells themselves. While the author states that blood levels of urea and ALT are the main indicators of kidney and liver function, respectively, many veterinarians feel that uric acid and AST provide more useful information about these organs.

"Housing" is awkwardly placed near the end of the book and provides very little information on indoor enclosures, focusing mainly on keeping tortoises in gardens or yards. It would seem more logical to discuss housing at the onset before discussing breeding, illness, etc.

The final chapter, "Other Species and Other Places," gives a quick, nonspecific, but useful guide for owners maintaining tortoises other than *Testudo* species.

The photographs throughout the text vary tremendously and are from poor to

excellent quality. I am perplexed by the large number of photos of non-Mediterranean species. For example, the front and back covers have several photos of *Testudo* species, but also show Galapagos tortoises (*G. nigra*) mating, a young leopard tortoise (*G. pardalis*), and a ceramic sculpture of a hatching bog turtle (*Clemmys muhlenbergi*). Within the text, there are seven photos of Galapagos tortoises and no photos of marginated or Kleinmann's tortoises, species that are the topic of the book! Only one of the many photos of *T. graeca* and *T. hermanni* is identified on a subspecific basis.

Overall, *Mediterranean Tortoises* is fairly useful, particularly for the casual tortoise keeper, and at \$6.99 is worth purchasing. A second edition containing more detail, relevant photos, data, and references would be much more useful for serious keepers, researchers, and veterinarians.

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HERP NEWS FROM AROUND THE WORLD

by
Ellin Beltz

BOX TURTLES NOW APPENDIX II

Delegates at the Convention on International Trade in Endangered Species of Flora and Fauna (CITES) voted to list American box turtles on Appendix II of the international treaty. This listing allows for strict monitoring and more humane transportation. The U.S. Fish and Wildlife Service stated that between 1988 and 1993 at least 55,000 American box turtles were exported to Europe for pets; but that is merely the reported amount. Almost all the animals suffer in shipment. Up to 75% may die in any one shipment, and the remainder are weakened after days with no food and no water, while crammed into a container with dead and dying turtles. Now, exporters will have to obtain federal permits before dealing in box turtles. [*The Sun-Sentinel*, November 18, 1994 and *National Geographic*, January 1995 from Alan Rigerman]

TEXAS ENFORCES WITH FORKED TONGUE

The Sweetwater, Texas Rattlesnake Roundup "tourist attraction" has killed nearly 300,000 pounds of rattlesnake in its 37-year history and has created lots of skins for hatbands, boots, and other noxious paraphernalia. In addition, the event specializes in anti-snake propaganda, snake sacking, snake beheading, and venom "milking" demonstrations. John Herron of the Texas Parks and Wildlife Department was quoted: "What little data we have indicates that rattlesnakes are not in any danger—they're just like deer, able to survive a moderate harvest. We probably have well over 20 million rattlesnakes, and reports of 200,000 a year harvested—that's only 1%. You figure more snakes get run over by trucks or eaten by hawks than killed by these guys running around with their gunny-sacks for a couple of days." [*The Washington Post* and the Tacoma, WA *News Tribune* (both March 13, 1995) from Linda A. Hauser and Alan Tuley] Stop me if I'm missing something here, but isn't this the same state that got real uptight about some people running around scooping up gray-banded kingsnakes last year? So upset that herpetologists got followed, photographed, and busted?

WHATEVER HAPPENED TO SUNNY CALIFORNIA?

My husband and I spent a couple of weeks in mid-March in the "sunshine state" except it ought to be renamed the wet, wild, and woolly state instead. It never stopped raining! And all the hillsides in northern California were trying to become flat land! The rivers looked like all the café au lait in Marin had run down the drain, and we saw more "road closed" signs per linear mile than I've ever seen in my life. However, the rain brought out all the salamanders and newts, so my husband was in his glory. The rain apparently brought out the worst in some Pajaro, California *Homo sapiens*, too. They blame the Santa Cruz Long-Toed Salamander for the rain! No, the

poor little critter did not go out and do the rain dance just to sprinkle on their parade; they think that environmental regulations contributed to the flooding of their town. One resident said, "The biggest problem out here is the goddamn environmentalists worrying about a stupid lizard (sic!) and snails in the river bed." After unleashing an expletive-laced series of comments at a sheriff's deputy, another resident was quoted as saying "... the river should have been dredged and the levee should have been checked." In other words, damn the salamanders, full speed ahead! [*San Francisco Chronicle*, March 14, 1995 from Matthew and Laurie Aikawa] On a happier note, we visited the East Bay Vivarium and I highly recommend it to anyone in the Berkeley area. They have a marvelous collection of clean, well-fed, properly cared-for and happy looking herps. In fact, I've never been in a reptile shop I've enjoyed more. Both owners and staff deserve high praise for all the hard work they've put into the place. It shows!

MORE SALAMANDERS . . .

- Wes von Papineau and Kimberley Heaphy sent a copy of the children's book "The Salamander Room" from Alfred A. Knopf publishing company. For anyone with children and salamanders, this book is a must! A little boy decides to get a salamander and mentions all the things needed to take care of them well. I can't say any more than that, or I'll spoil it for you!

- An AFH-er who shall remain anonymous, e-mailed me: "News from Washington, DC, there's a giant newt on the loose, watch your children!" Others have noted that wild newts also have toxic skin secretions and abandon their young.

HERP HEAVEN!

Part of the flood plain of the Adelaide River near Darwin, Australia has the highest density of predators-to-prey of any place on earth. The predator is the water python, and the density is 400 kilograms of snake per square kilometer according to Richard Shine of the University of Sydney. The biomass of rats in the same area is from 1 to 5 tons per square kilometer which works out to between 15,000 and 75,000 rats. [*New Scientist*, Vol. 141, March 12, 1994 from Robert Knight]

LAWYER-LAND

- The Burnet Park Zoo in Syracuse, New York may face a \$100,000 suit brought by a woman who claims to suffer post-traumatic stress disorder from an alleged event wherein the reptile staff member "chased her with a 10-foot boa constrictor." The staff member claims she became irrational and ran away. [*USA Today*, January 13, 1995 from David A. Webb]

- A 28-year-old resident of West Hills, California who allowed more than 760 turtles to die in a warehouse and van was sentenced to 60 days in jail after being convicted of animal cruelty and possession of a prohibited species—snapping turtles. [*Hayward Daily Review*, March 9, 1995 from Mike Kilby]

- Fifty exotic snakes, including boas, pythons, and kingsnakes were stolen from a reptile store in Rochester, New York. Police are investigating the loss which is reported to be in the "thousands of dollars." [*USA Today*, February 3, 1995 from David A. Webb]

- A 65-year-old man and his 39-year-old wife were sentenced to six months of house arrest after being convicted of importing and selling sea turtle eggs at their Miami, Florida restaurant. [*USA Today*, February 10, 1995 from David A. Webb]

- A 33-year-old San Jose, California man was arrested after state humane officials "caught him trying to sell an Egyptian cobra for \$600... charged with possession of prohibited reptiles for allegedly owning the cobra, a mamba, and a rattlesnake—three extremely dangerous and prohibited snake species... [The man] had advertised the snakes for sale..." [*San Francisco Chronicle*, December 17, 1994] The snakes were scheduled to be destroyed, but were sent instead to Zooherp in Utah along with a baby caiman seized in the same raid. [Same paper, December 19, 1994 both from Matthew and Laurie Aikawa]

- A Wellington, Florida man who shot an alligator which had threatened to make his family's pet dog its supper has been acquitted of charges stemming from the incident. The Palm Beach County game authorities had charged the man with a misdemeanor count of unlawful possession of an alligator. [Naples, FL *Daily News*, November 24, 1994 from Alan W. Rigerman]

- A Visalia, California Municipal Court Judge threw out charges against a local reptile dealer and his wife and ordered more than 300 snakes confiscated by state Fish and Game Department officials returned. The arrests were part of "Operation Ranching for Reptiles" a two-year operation intended to defang black-market reptile poaching. The couple say it has cost them more than \$27,000 in legal fees and alleges the state has not taken good care of their animals. Fish and Game officials argue that the couple's snakes are still illegal because their permits were revoked by the agency when the snakes were seized. [*Visalia Times-Delta*, February 18, 1995 from Ray Shields] Can we say "Catch-22"?

- A 15-year-old Saline, Michigan boy faces charges of illegally possessing protected species of Michigan turtles and engaging in pet trade without a license. According to the Provo, Utah *Daily Herald* [March 2, 1995 from David A. Webb], the boy kept more than 200 turtles in buckets and a basement "pond." However, he may have released some less than healthy animals back into the wild, and experts are concerned that local populations may have been put at risk by his actions. A conservation officer was quoted, "It looks like a true interest that turned into a profit. This kid is an absolute whiz regarding reptiles and amphibians. He can do somebody a lot of good in research. He just got a little wayward and didn't consult any state law." The state Department of Natural Resources confiscated 220 turtles, of which, 35 are reportedly on their protected list, as well as several frogs and toads.

TAKAPOUREWA TUATARA TERRITORIAL TREATY

The Ngati Koata tribe of Maoris in New Zealand recently signed a historic agreement giving the Stephens Island tuatara sanctuary in Cook Strait back to the Crown as a nature reserve to be managed by Conservation Department officials in consultation with the tribe. The land had been taken from the

tribe under a Public Works Act in 1891 for a lighthouse reserve. After the lighthouse was automated in 1988, the Ngati Koata reclaimed Stephens Island (Takapourewa). That treaty agreement was superseded by the most recent document in which the tribe recognizes the island's international significance as a nature reserve. [New Zealand News UK, January 18, 1995 from R. G. Sprackland] Thanks to Jim Gillingham for the tongue-twisting headline!

PARTS AND PIECES

- U.S. Customs agents in Oakland, California report they've broken up what they "believe is a Chinese medicine smuggling ring that illegally imported items including deer parts and dead scorpions" into the states. Truckloads of records and merchandise were hauled away, including three types of dead snakes. [Hayward Daily Review, October 7, 1994 from Mike Kilby] More Chinese medicine was featured in a *Toronto Star* story [November 24, 1994 from Captain Wes von Papineau] which said that Shanghai's Li Zhi-ping's best selling herbal tonic is called "Turtle-Tortoise" and is made from soft-shelled turtles. They're supposed to nourish your yin and suppress hyperactive yang, otherwise known as "hemorrhoids," adds the article. Li also sells Longliqi Pure Snake Powder "rich in protein, fat, carbohydrate, calcium and phosphorus."

- The "retail bone king" of New York's Columbus Avenue reportedly sells alligator skulls for \$34-an-inch, desiccated lizards, and other fossils, butterflies, beetles and bones. [Daily Herald, Provo, UT, November 24, 1994 from David A. Webb]

- The *Toronto Star* reports "about 160 kilometres south of Kansas City [Missouri]" is a restaurant which offers everything "from alligator to zebra ... If you don't see it on the menu ... Owner-chef ... will

try to track it down and cook it." [February 18, 1995 from K & W Herp Haven]

- Florida's alligator industry is experiencing an upturn after two lean years. Hide prices are up to \$34 per foot, compared to a low of \$10 in 1991. Last year, trappers and farmers earned \$4.43 million from sales of about 38,000 hides and meat at about \$5 per pound. Incidentally, a \$150 skin will be fashioned into a purse that sells for around \$4,000 according to the director of the state's alligator management program [Daily Herald, Provo, UT, October 20, 1994 from David A. Webb]

- Alligator meat is low-fat according to the *Toronto Globe and Mail* [September 13, 1994 from Captain Wes von Papineau] containing as little as 1% of the slimy stuff. In contrast, beef rump is about 25% fat and chicken has about 6%.

- Cuban crocodiles are being harvested on an island west of the Bay of Pigs; one of the few places in Cuba where the large greenish-brown crocodilian occurs. After a visit from a University of Florida researcher under contract to CITES, an export program for captive-bred croc parts was approved. [The Denver Post, January 15, 1995 from Ivan Martinez and The Deseret News, January 1, 1995 from David A. Webb]

- A refugee in Australia went to the doctor complaining of seizure and numbness. They found and removed a tapeworm larva from his brain. How did he get such an awful thing? The report in the *Toronto Star* says he "survived on uncooked frogs and snakes while running from Indonesian authorities." Contributor Captain Wes von Papineau wrote "revenge is sweet!"

- Amazonian Hixkryana Indians once complained that there were so many alligators (caimans) that humans could be considered an "endangered species" in their neck of the rain forest. However, smugglers have killed so many in the last three years

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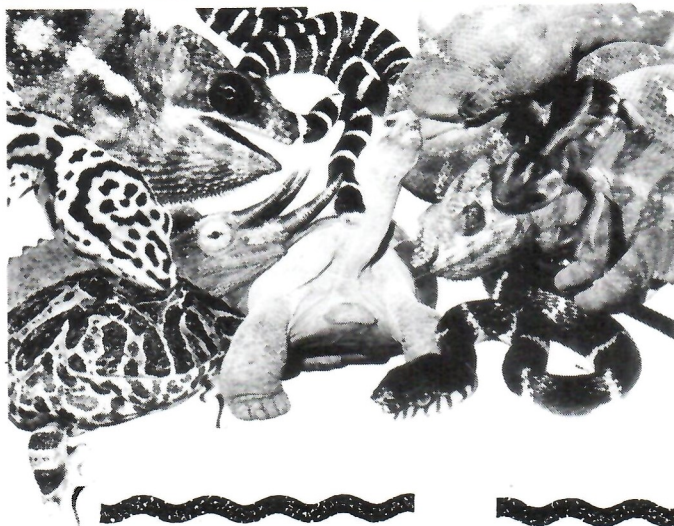
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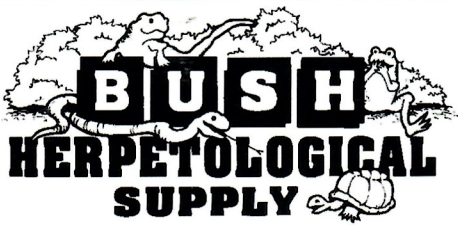
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that "it's hard to even find a small gator to eat," according to the chief. [*The Salt Lake Tribune*, January 9, 1995 from David A. Webb]

CREATURES WHO LIVE IN GLASS HOUSES . . .

• The Kingston, Canada *Whig-Standard* reported: "A 'darling' metre-long lizard was saved from a smoky grave by surprised and somewhat hesitant fire fighters in Brantford, Ontario this week. Bud, a three-year-old pet green iguana, set his bedding material on fire after he knocked over a heating lamp in his glass cage . . . [the] owner wasn't home . . . neighbors smelled smoke and called fire fighters." [November 22, 1994 from Captain Wes von Papineau]

• In a similar incident reported in the Frederick, Maryland *Post* [February 9, 1995 from Linda A. Hauser, West Maryland Herpetological Society] a pet iguana knocked over a heat lamp, igniting a pile of clothes. The iguana owner's son returned home and saw smoke coming out of a bedroom. The fire caused \$7,000 in damage, but no one was injured—

including the iguana who was taken to a vet for a checkup.

• Sadly, in New Hanover County, North Carolina an iguana running loose in a bedroom knocked over a heat lamp. The fire which followed killed two iguanas and a boa constrictor and caused \$30,000 in damage to the house. [*The Wilmington, NC Morning Star*, December 13, 1994 from Grady Ormond]

JAWS, PART XIX

No, it wasn't a shark. But bathers and lifeguards knew something wasn't right at a Fort Lauderdale, Florida beach. It was an alligator, probably swept into the sea by runoff from drainage canals. A resident of a nearby town said, "The little guy just got lost and is trying to find his way." The six-foot gator was caught by four construction workers with an orange plastic net and a pole. They took it to a nearby shower and washed the salt off and took it to a state recreation area. Everybody breathed a sigh of relief; the alligator had been saved. How wrong they were.

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Trappers from the Florida Game and Fresh Water Fish Commission picked up the gator a few hours later. It's current whereabouts are unknown, but my guess is it's a purse. [*The Herald*, December 10, 1994 from Alan W. Rigerman]

AMPHIBIOUS ASSAULTS

• Marines landed on Pacific Islands 50 years ago with more thought given to enemy soldiers than to the ecosystems of the coral atolls. But times change . . . Hundreds of Marines staged a mock assault on Tinian and their supplies included detailed maps showing the habitats of rare birds and turtles which are to be avoided at all costs. An environmental impact study was done before the landings. [*Seattle Times*, December 7, 1994 from Jett]

• A man pleaded guilty to public drunkenness after chasing his girlfriend with a snapping turtle during an argument about their recent breakup. The turtle was set free. [*The Morning Call*, January 11, 1995 from Jo Ann Dalcin]

Thanks to everyone who contributed to this column and to Mark Paul Henderson, David A. Webb, Allison Alberts, Mike Kilby, Adam Smith, George T. Vesper, Dale McDonald, Dan Leavitt, Jett, Linda Hauser, Bryan McCarty, and Marty Marcus for articles used and articles filed. You can contribute, too! Please send article with date/publication slug and your name firmly attached (with tape—or send the whole page) to me at the address on the masthead. Just please take pity on the lonesome scrivener, no staples, no self-adhesive notes, and as few folds as possible!



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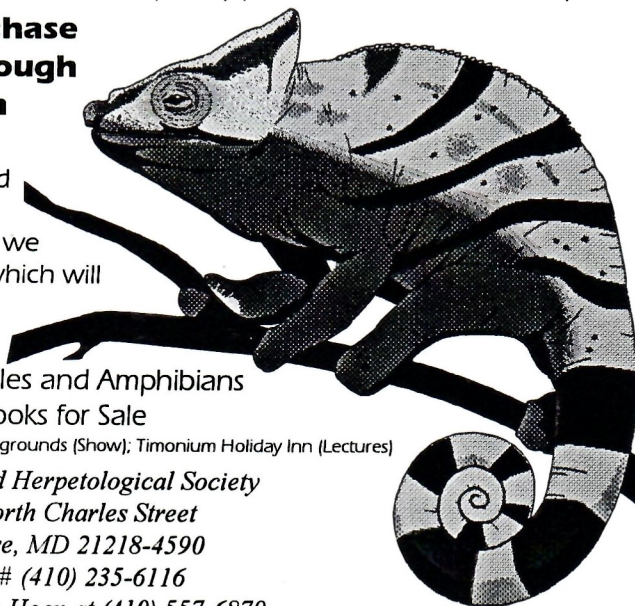
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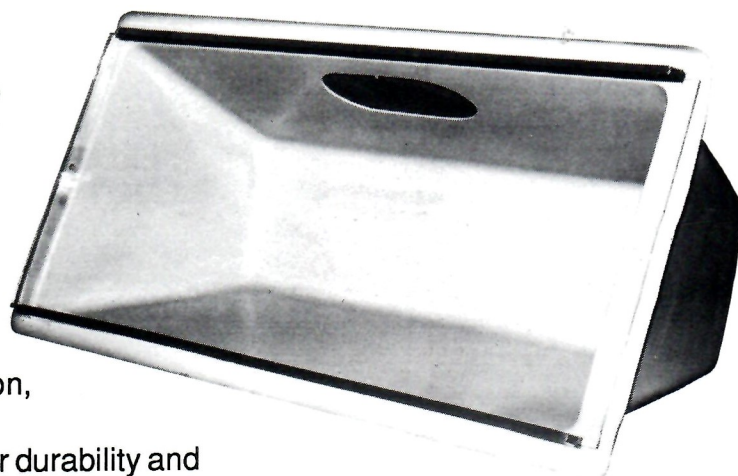
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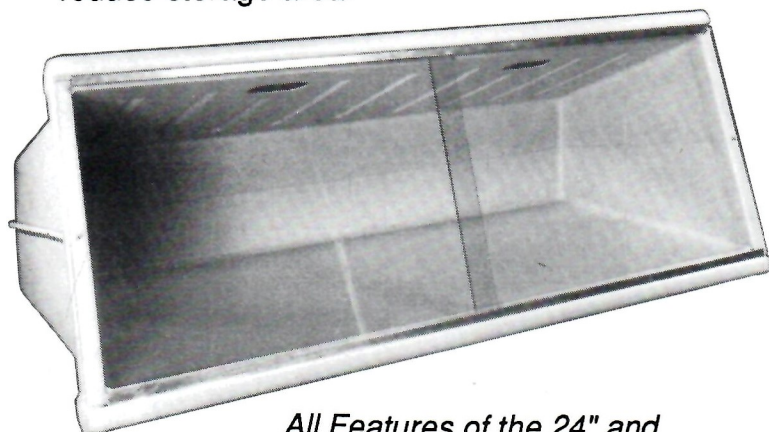
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The Northern Mexican Pine Snake

Pituophis deppei jani

by
Alan Kardon

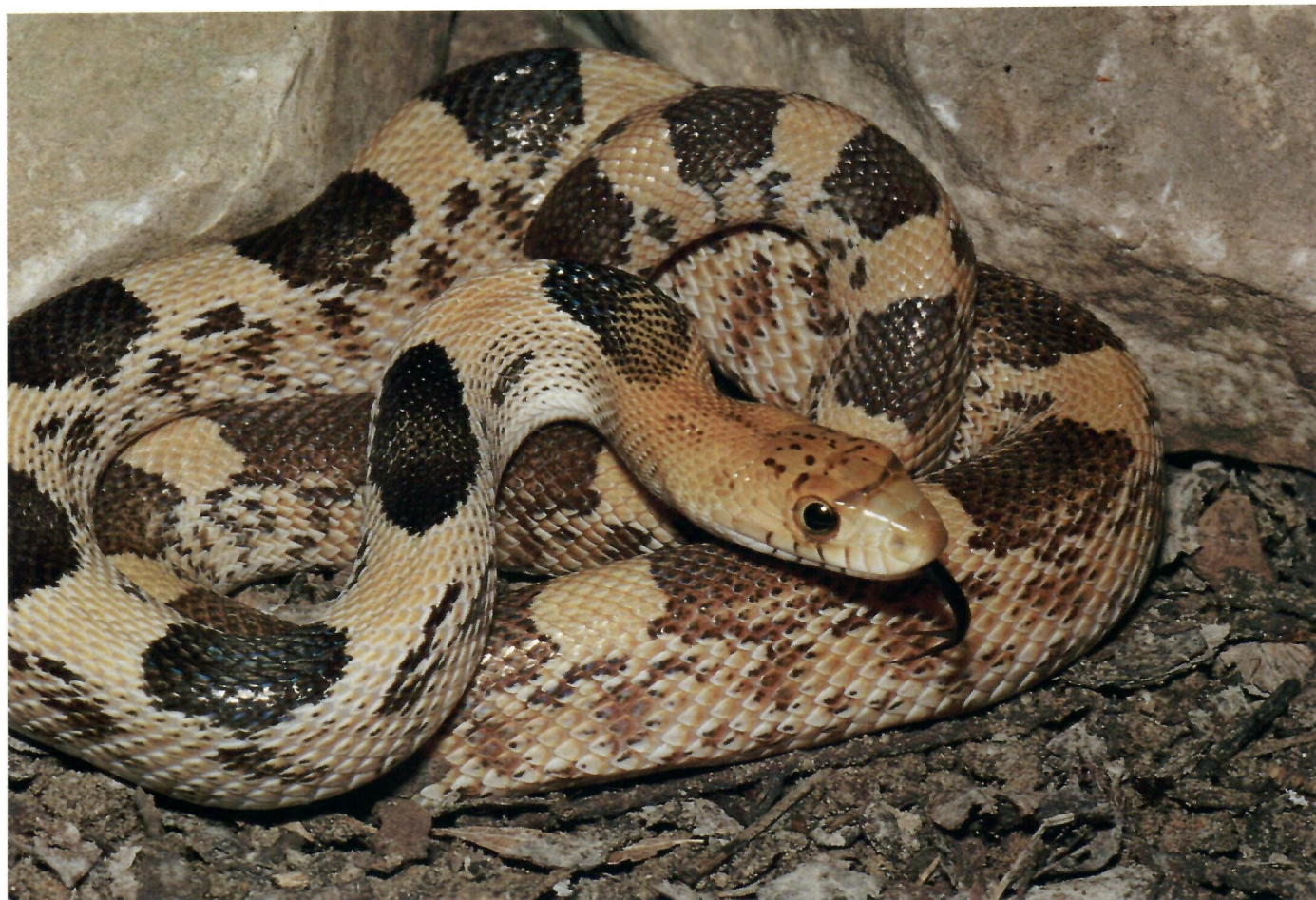
The Northern Mexican Pine Snake, *Pituophis deppei jani*, has been recorded from northern Hidalgo to southeastern Coahuila, south central Nuevo Leon, and western Tamaulipas, Mexico (Smith and Taylor, 1945; Duellman, 1960). Although members of the genus *Pituophis* are not venomous, local residents have named this species "Alicante" which means "very venomous snake." They are definitely very attractive snakes. Adult *P. d. jani* have orange to red-orange heads, solid-black anterior dorsal blotches, fading to light brown or pink posterior blotches. Their ground color can vary from orange, to yellow, to white, or combinations of all three.

Why has such a beautiful snake been ignored by the hobbyist community? One reason may be that this species is found in the same areas as the variable kingsnake, *Lampropeltis mexicana* ("thayeri") and the San Luis Potosi kingsnake, *Lampropeltis mexicana* ("mexicana"). There was quite a frenzied interest in collecting these kingsnakes during the mid to late 1970s, while other species in the area were ignored. Another reason may be that neonates and subadults of *P. d. jani* are most often encountered, and these have a drab tan background with uniform brown blotches, quite unlike the attractive adults.

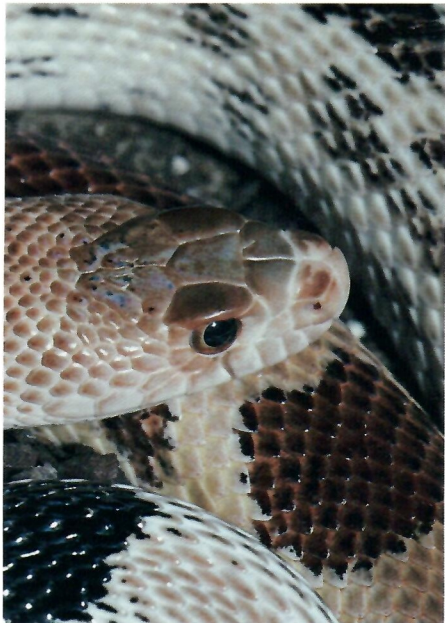
In 1982 I saw my first adult *P. d. jani*. I was visiting David Lazcano at Universidad Autonoma de Nuevo Leon in Monterrey, Mexico. He took me to the Monterrey Zoo and showed me a 6-ft, 6-in

(2 m) specimen. I could not believe that this was the same species I had been moving off to the side of the roads while looking for *Lampropeltis* in years prior!

Since that time, David Lazcano, Karl Peterson (Houston Zoo), and I have made many trips to south central Nuevo Leon, Mexico. These trips are part of a statewide survey of the herpetofauna, initiated by David Lazcano. We have collected numerous young *P. d. jani* during our summer trips. Specimens collected thus far have been below 4500 ft (1500 m) in elevation, and all the neonates we have found were road collected after sunset. They have been active from 66 to 78°F (18 to 24°C). We have seen adult snakes DOR (dead on road) only during the early morning hours. Their habitat ranges from high-elevation desert to pine-oak forest (1500–2200 m).



Adult N. Mexican pine snake, *Pituophis deppei jani*. Photo by Toby Hibbitts.



Close-up head shot of an adult *P. d. jani*. Photo by Terry Hibbitts.



Adult female *P. d. jani* laying eggs in a nest box. Photo by Alan Kardon.

With literally hundreds of hours spent looking, walking up and down hills, through canyons, and flipping endless numbers of rocks, we have yet to collect a neonate or an adult in the field. We have found many species of lizards, rattlesnakes, and garter snakes. There are numerous rodent burrows throughout their habitat, and we speculate that they are occupied by *Pituophis* during the heat of the day. We never attempted to excavate the burrows due to their complexity and the rocky nature of the soil. We were also unwilling to disturb microhabitats when the snakes can be road collected.

In captivity *P. d. jani* can be a hardy species. I use the word *can* because neonates are sometimes a problem. They will take pinks (newborn mice) without difficulty, but do not handle "pushing" (a feeding every 3 to 5 days) very well.

They will regurgitate if put on too rigorous a feeding schedule. A meal of one



Close-up head shot of a juvenile *P. d. jani*. Photo by Toby Hibbitts.



Habitat for *P. d. jani*, Nuevo León, Mexico. Photo by C. M. Garrett.



Century plants in pine-oak forest, Nuevo León, Mexico. Photo by C. M. Garrett.

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pink a week is best, gradually increasing the size (but not the number) of the food item as the specimens grow. They grow rapidly and can reach sexual maturity in two to three years. Because *P. d. jani* comes from areas above 4900 ft (1500 m), a daytime air temperature of 78–84°F (24–27°C) with a basking area (via overhead spot lamp) is sufficient. A nighttime temperature drop to 70°F (20°C) is probably beneficial, but not mandatory. As long as there is some fluctuation between day and night temperatures within the parameters listed above, specimens do well.

In my experience, breeding occurs during the spring. This can be accomplished by:

- 1) Hibernating adults at 54–58°F (12–14°C) for a period of 2.5–3.5 months.
- 2) Varying the light cycle using short day lengths (11 hours of light, 13 hours of darkness) during fall and winter, and long day lengths (14 hours light, 10 hours dark) during spring and summer (Kardon, 1979).
- 3) Combating males prior to introducing the females. However, use caution as males can be quite aggressive with each other; biting and violent coil throws are

not uncommon. Combatants should not be left unattended.

4) Combining all of the above techniques increases chances for successful reproduction.

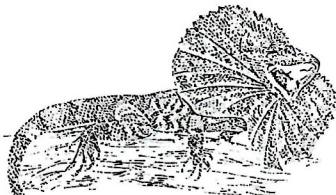
Like other members of the genus, *P. d. jani* is an egg layer. A nest box should be provided, one that is large enough so that the gravid female can get inside and feel secure. Damp sphagnum moss works well as an egg-laying medium. Like other colubrids, they will shed 7–14 days prior to egg laying. Eggs can be set up like most other colubrid eggs, for example: in plastic shoe boxes with vermiculite as a medium, at a 1:1 ratio by weight of vermiculite to water (Tryon, 1975), and incubated at a temperature of 80–84°F (25–27°C). Temperatures above 86°F (28°C) are too high, and have caused abnormal patterns, deformities, and death. Hatching at the recommended temperature takes place in about 70 days after laying. Neonates should be offered food following their first shed, which will take place 7–10 days after hatching. For additional reproductive data, see Lazcano et al. (1993).

The "Alicante" is a beautiful snake with a mild disposition. Hopefully, more people will rediscover and begin to appreciate this overlooked Mexican treasure.

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Acknowledgments

I thank Kathi Kardon for proofreading and typing the manuscript. Thanks to Karl Peterson and David Lazcano for reviewing and adding input to this article and for spending countless hours in the field on numerous Mexico trips. Thanks also to the Silvestre de Fauna for allowing me the opportunity to study in Mexico. And finally, thanks to the late Jozsef Laszlo for encouraging me to "go south" many years ago!

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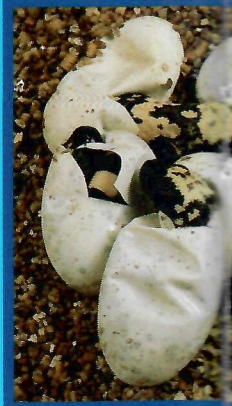
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Ask the Expert

by Winston Card



Q. I purchased an emerald tree boa (*Corallus caninus*) about six months ago. Recently, this specimen shed, but I had to remove most of its shed manually. I have never observed the animal drink from its water bowl, and I am getting concerned about its level of hydration. What can I do to improve my snake's condition?

Chicago, Ill

A. The skin of most squamates (lizards and snakes) is heavily keratinized and provided with a heavy concentration of lipids in the mesolayer (middle layer) of the epidermis. Although these characteristics provide reptiles with some protection against desiccation, the skin is still the major water loss surface, representing about two-thirds of the total loss. A smaller percentage of water is lost through respiration and excretion of waste.

To compensate for water loss, reptiles have evolved some interesting behavioral, physiological, and morphological traits. Nitrogenous wastes, a by-product of metabolism, requires a liquid medium for removal from their system. Water is conserved by converting ammonia, the basic waste by-product, to uric acid, a non-toxic and insoluble compound. This allows elimination of waste with very little wasted water. Lizards also store water in the bladder and can reabsorb it to reduce desiccation. Squamates (lizards and snakes) cannot, however, absorb water through their skin. A few species have integumentary adaptations and behaviors that enable them to capture rain and dew on body surfaces and direct it to the

mouth. In general, water loss doesn't present a serious problem for reptiles, as long as water loss is sufficiently low enough that they can compensate with intake.

In the captive environment, specimens are dependent on artificial water sources that may be unfamiliar to them. In some cases, with large diverse collections, the watering technique is similar for many species. This usually consists of a water bowl that is replenished as needed and cleaned during normal cage maintenance. It appears as though many reptiles recognize and refuse to drink stale water. Many reptiles, especially snakes and varanid lizards, depend on chemical cues in their environment to aid in finding food, locating conspecifics (members of their own species), and in some cases avoiding predators. It is possible that animals with such highly evolved chemoreceptive abilities are able to discriminate between fresh and stale water. Many readers can probably recall seeing a specimen drink after being offered fresh water even though water was available before servicing the animals enclosure. So the question is, how often should you clean stagnant water bowls? I'm going out on a limb here and say at least every couple of days. For some large collections this may seem excessive. It is true there is no one offering these animals fresh water everyday in nature. However, your animals are not in a natural environment, and the various mechanisms that have evolved allowing them to compensate for water loss, may not be as functional in an artificial environment.

Additional water intake may be necessary to off-set the challenges imposed by an alien environment.

Many arboreal species will often refuse to drink from standing pools of water. These animals usually drink during periods of rain. For these species, a rain or drip system may be necessary. In some cases, when water is allowed to drip into a dish or pool, specimens may eventually learn to recognize standing water. Adding broad-leaf tropical plants to your snakes enclosure will also help to raise the relative humidity, which should reduce the amount of dermal and respiratory water loss.

Suggested References

Fox, H. 1977. The Urinogenital system of reptiles. In C. Gans and T. S. Parsons (eds.), *Biology of the Reptilia*, pp. 1-122. Academic Press, New York.

Boyer, T. H. 1989. Treatment of dehydration and starvation in reptiles. In M. J. Uricheck (ed.), *Proceedings of the 13th International Herpetological Symposium on Captive Propagation and Husbandry*. Western Connecticut State University. pp. 11-18.

Q. My son recently purchased a veiled chameleon (*Chamaeleo calaptrytus*). He has been looking for information on how the tongue mechanism in this group works but has not found much. Can you please help?

Rowlett, TX.

A. In most species of chameleons the tongue is about one and a half times as long as the snout-vent length of the animals. When not in use, the tongue is folded like an accordion around the hyoid bone. You can usually see this bone moving up and down in the neck region when the animals are chewing. The tongue is surrounded by a band of muscles that constrict and force the tongue out of the mouth, similar to the action of squeezing a wet seed between your fingers. Just before this action occurs, specimens focus both eyes on the potential prey item in an attempt to triangulate the distance to their prey. This is necessary because once the tongue leaves the mouth the animals have little control over where the tongue goes. Once contact is made, the fleshy, sticky tip of the tongue partially envelops the prey. It is then drawn into the mouth.



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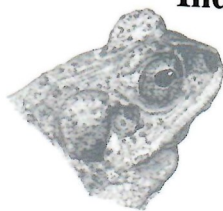
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LIMBLESS AMPHIBIANS CAECILIANS

by
**Jim O'Reilly, Danté Fenolio
and Michael Ready**

Natural History

All herpetophiles are familiar with salamanders and frogs but the mention of the third major group of amphibians, the caecilians, invites a questioning look from all but a few. This is not surprising, as caecilians are certainly the lineage of tetrapods about which science knows the least (Duellman and Trueb, 1986). The sight of a living specimen is a thrill to even the most experienced professional herpetologist, and, with the exception of a single species frequently imported in the fish trade, very few hobbyists have seen one.

Caecilians are elongate, limbless amphibians that are known to inhabit most of the humid tropics with the exception of central Africa, Madagascar and North of the Wallace line in Southeast Asia (Fig. 1). Most species

are fossorial (subterranean), but a few are semiaquatic, and two South American genera, *Typhlonectes* and *Potomotyphlus*, are completely aquatic (Taylor, 1968; Moodie, 1978; Wilkinson, 1989). Caecilians are placed in their own order, the Gymnophiona. Prior to 1968, all caecilians were classified in a single family, Caeciliidae, until a major taxonomic reorganization by Taylor (1968).

The Gymnophiona is currently divided into 23 genera and about 160 species (Nussbaum and Wilkinson, 1989; Table 1; see also Hass, et al., 1993 and Hedges, et al., 1993 for information on evolutionary history and phylogeny). However, the extreme elusiveness of these creatures means that there are undoubtedly many forms yet to be described.

Caecilians have many morphological specializations for a burrowing lifestyle. The most obvious is their elongate, legless body form. Legs would only get in the way when constructing burrows or squeezing through tight spaces. In fact, no remnants of limbs or

limb girdles are found in living caecilians, not even during early development. The last caecilian ancestor that is known to have had limbs was *Eocaecilia* which lived during the Jurassic and is known only from the fossil beds in the Keyenta formation of northern Arizona (Jenkins and Walsh, 1993). The energetic cost of constructing burrows increases exponentially with increasing diameter. It is therefore not surprising that many caecilian species are extremely elongate. The thinnest caecilians have a length-to-width ratio of over 100 to 1 (Taylor, 1968). Unlike many legless reptiles, caecilians have either a very short tail or no tail at all. Their elongate form has evolved through a massive increase in the number of trunk vertebrae rather than an increase in the number of caudal vertebrae. The elongation of the trunk is correlated with the reduction of the left lung in most species and unlike other amphibians, the liver and kidneys are serially segmented to allow the trunk to bend sharply during locomotion.



This is a species of *Typhlonectes* from the Peruvian Amazon. Photo by W.W. Lamar.



Figure 1. Known range of living caecilians. Note the gaps in central Africa and parts of southeast Asia where caecilians are likely to be found.

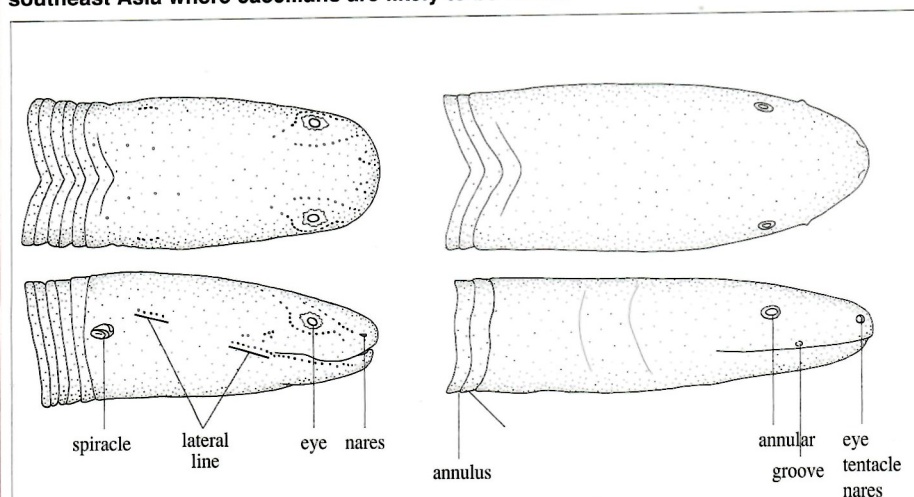


Figure 2. Top and side views of the heads for a larval (left) and an adult (right) *Ichthyophis bannanicus*. The pictures are not drawn to scale and the adult is several times larger than the larvae. Note that the spiracle and lateral line organs are lost at metamorphosis. The tentacle organ does not appear until metamorphosis. Illustrations by Loreé Harvey.

Caecilians range in length from the west African *Idiocranium russeli* at 4.56 in (11.4 cm) and Seychellian *Grandisonia brevis* at 4.48 in (11.2 cm) to the South American *Caecilia thompsoni* at just over 60 in (151.5 cm) (Taylor, 1968). Their long bodies are divided into segments called annuli that are separated by annular grooves (Fig. 2) which gives them a worm-like appearance. In many caecilians, each annulus corresponds to one vertebrae. However, in basal caecilians such as *Ichthyophis*, these primary annuli are subdivided into secondary and tertiary annuli. We usually associate scales with fish and reptiles, but caecilians are unique among amphibians in that they have scales.

They are not visible externally, but are vertically oriented in the annular grooves and completely covered by skin. They resemble the scales of teleost fish when observed under a microscope.



Newly born *Typhlonectes* have their external gills attached for a short time. Photo by Robyn O'Reilly.

The coloration of most caecilians is largely drab. Shades of gray, steel blue, brown, and black are commonplace. There are, however, some species of brightly colored caecilians as the photographs of *Schistometopum thomense* and *Boulengerula boulengeri* exemplify. All species of caecilians have typical amphibian skin, and poison glands are present. The bright coloration of some species may be aposematic (warning coloration), expressing to would-be predators that these animals should be avoided as a meal.

With a few exceptions, caecilians have extremely ossified skulls that are streamlined to facilitate penetration during burrowing. The superficial bones of the skull form a solid roof with only tiny holes for sensory organs. The tear duct is modified into a chemosensory organ called the tentacle (Fig. 2) that is directly connected to the vomeronasal organ. In the basal caecilians *Rhinatrema* and *Epicrionops*, the tentacle is no more than a pit directly in front of the eye. In a common ancestor of the rest of caecilians, the tentacle shifted to a more forward position between the eye and the nostril. In some caecilians, it has become protrusible

Text continued on page 35



This is the egg and developing embryo of a *Typhlonectes*. Photo by Curt Anderson.



This is a clutch of juvenile *Schistometopum thomense*. Photo by R. A. Nussbaum.



Ichthyophis kohtaoensis was regularly imported through the pet trade a few years ago. This specimen is eating a worm. Photo by Dan Boone.



Accepting of quite a variety of food items, *Dermophis mexicanus* is a good candidate for someone interested in beginning keeping of caecilians. Photo by Danté Fenolio.



A species of *Epicrionops* from Ecuador. Photo by R. A. Nussbaum.



Osaecilia bassleri is from the Amazon basin in Ecuador and Perú (Frost, 1985). Photo by W. W. Lamar.



A species of *Ichthyophis*, possibly *I. kohtaoensis*. Photo by R. A. Nussbaum.



Siphonops annulata is an attractive bluish species from South America. Photo by W. W. Lamar.



This specimen of *Scolopocryptus* from the Usambara Mts. of Tanzania.



Typhlonectes compressicaudus is available to hobbyists through the fish trade when they are sometimes called "rubber eels." Photo by W. W. Lamar.

LIANS

Vol. 7, Number 1



This specimen of *Boulengerula boulengeri* is from the Usambara Mts. of Tanzania. Photo by Dan Boone.



Potamotyphlus vittatus is from the Photo by Dan Boone.



Hypogeophis rostratus is from the Seychelle Islands. Photo by Dan Boone.



The attractive coloration of *Schistometopum thomense* may be aposematic (warning coloration). Photo by R. A. Nussbaum.



Many species of caecilians have evolved to the point where their eyes are not visible externally as this *Boulengerula boulengeri* depicts. Photo by Dan Boone.



This is a species of *Caecilia* from the Pacific slopes of the Andes Mts. of Ecuador Photo by Robyn O'Reilly.



Potamotyphlus kaupii inhabits the Amazon and Orinoco drainage systems in South America (Frost, 1985). Photo by W. W. Lamar.



Schistometopum thomense has reproduced successfully in captivity. Photo by Robyn O'Reilly.

The Maintenance and Reproduction of the DWARF PYTHON OF ANGOLA AND NAMIBIA

by
Dave and Tracy Barker

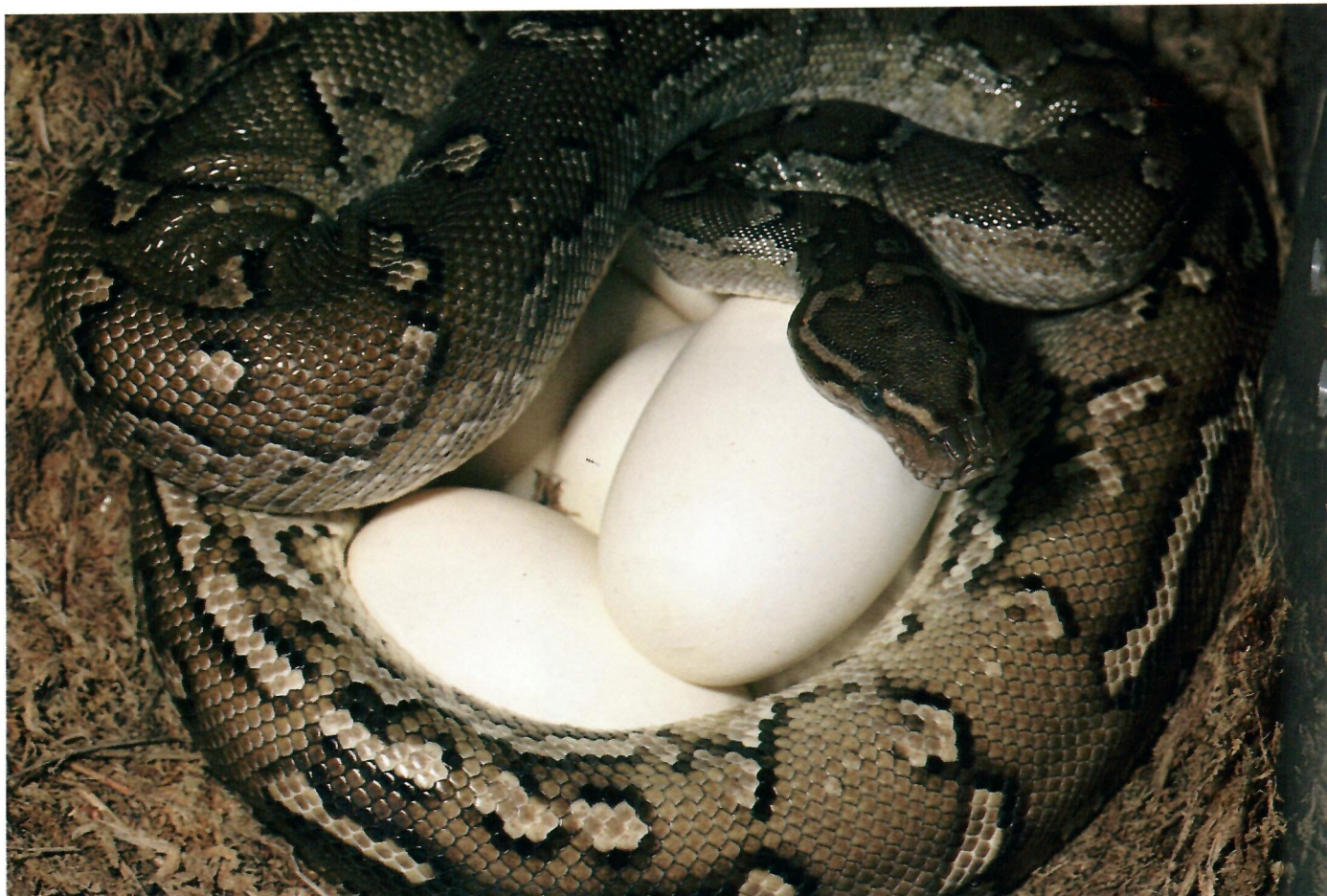
There are few things more exciting to herpetoculturists than receiving some new taxon of reptile or amphibian, especially some particularly coveted animal, one of the "dream species" that we each hold in our fantasies. Raising these animals to maturity and then to successful reproduction is one of the most rewarding experiences that any with our interests can accomplish. And regardless of the species, the success of any such project speaks an eloquent testament to the dedication, patience, and sometimes the luck of the person who is able to raise and propagate the animals in his or her care.

Our own "dream species" have all seemed unattainable to us, fantasy crea-

tures impossible to acquire, some impossible even to experience. While not all of the creatures of our daydreams are boas or pythons, certainly it is that group that in recent years has been foremost in our thoughts. The pythons and boas of our fantasies are a rare bunch.

Some day we hope just to see one of the preserved specimens of *Corallus cropanii*, the terrestrial relative of the emerald tree boa from coastal São Paulo state in southeastern Brazil, a boa so rare that it has no common name. Only three specimens are known since its description, and it is said by some to have gone extinct in the 40 years or so since its discovery. A living captive specimen, or even better (since we're fantasizing,) several captive young sexed pairs of this species makes a superior boa fantasy.

Some day we hope to see a living specimen of the rough-scaled python, *Morelia carinata*, an Australian python known to science since 1981; only four specimens are reported. We once traveled to Western Australia to see the only two preserved specimens, deposited in the Western Australia Museum in Perth. What a fantastic python it is, too! It is likely the python species with the smallest distribution in nature, apparently restricted to perhaps as few as a half dozen separated patches of monsoon forest in the bottoms of canyons, and tiny islands of forest surrounded by harsh dry rocky country, each patch smaller than 10 acres. This is a species that desperately needs the establishment of a well-managed captive population, but that's a fantasy that will have to happen in Australia.



The eggs of dwarf pythons are huge. Normally the female coils about the eggs, completely covering them. Here the female has been disturbed to reveal the eggs.

Of course we hold dear the usual boid dreams—the albino blood python, the axanthic Burmese python, an albino jungle carpet python, an albino Madagascar ground boa, a piebald boa constrictor—the list of beautiful possibilities is endless in fantasies. But one of our oldest dreams came true for us when, in 1990, we received in trade from a U.S. zoo hatchling dwarf pythons, *Python anchietae*; two males and a female.

The dwarf python, also known as the Angolan python, has been known to science for more than a century. This unusual small python was formally described in 1887 by J. V. Barbosa du Bocage, Director of the Zoological Section of the National Museum of Lisbon for most of the last half of the nineteenth century. At that time animal specimens from Portuguese colonies were pouring into the Museum, as Bocage built the famous collections in his charge. Though actually better known as an ornithologist than as a herpetologist, from 1863 to 1904 Bocage published 58 technical herpetological papers and described 111 new species of amphibians and reptiles. Most of these new species described by Bocage were from Africa, and many of the taxa he described are still recognized today (Adler, 1989).

The type specimen of dwarf python was named in honor of a relatively unknown Portuguese naturalist, a J. de Anchieta who died in 1897 (Gotch, 1986). It is presumed that this person was a woman, as Bocage chose the feminine possessive suffix "ae" to make *anchietae*, rather than the masculine form *anchietai* or *anchietaiana*. J. de Anchieta was resident in Angola for a length of time, though the length of her stay is unknown to us.

This species has two fairly unusual conditions of scalation for a python. First, it has a large number of very small scales on the top of the head. A pair of internasal scales and a pair of anterior prefrontal scales are typically the only plate-like scales on the top of the head. Second, most of the dorsal scales on the head and body are rounded, slightly domed and not overlapping, or only slightly overlapping. Dwarf pythons have a smooth beaded feel to a hand stroking the body. The body shape in cross-section is flattened and the back is broad, as is seen in many species of rock-dwelling reptiles.

The type specimen came from the vicinity of the town of Catumbela in the Benguela province of Angola (see Fig. 1). The town of Catumbela is located on the coast at the mouth of the Catumbela River. It seems unlikely that dwarf py-



Like most pythons at hatching, hatching dwarf pythons make several slits in their egg shells before emerging. Using small scissors, we often cut connections between the slits to make certain that the hatchling does not drown in the egg.



A diagnostic characteristic of scalation of *Python anchietae* is the numerous tiny scales on the dorsal surface of the head, as can be seen on this subadult specimen.



Captive-bred and -raised dwarf pythons are typically very docile and gentle. It seems unlikely that many wild dwarf pythons will ever be brought into captivity. If so, the future of this species in captivity will depend on the breeding successes of the animals presently in captivity.

thons are found in the immediate vicinity of the town; possibly the type specimen came from a locality upstream along the Catumbela River.

So far as we know, the type locality is the northernmost recorded locality for *P. anchietae*. However, we consider it highly probable that populations of dwarf pythons are found in the rugged Angolan Highlands; suitable habitat and elevations continue north of the type locality into the district of Cuanza Sul and east through the district of Huambo and into the district of Bié. The species occurs south into Namibia to the vicinity of Windhoek, the capital. Dwarf pythons have been found south of Windhoek in the Khomas Highlands and the Hakos Mountains. Again, suitable habitat occurs further south of these localities, and the species may range south into the high rugged country north and east of the drainages of the Fish and Orange Rivers, nearly to the southern border of Namibia. We are told of specimens being found in this area, but we are not aware of museum specimens or published accounts of dwarf pythons from this far



As is typical for most python species, dwarf pythons remain in the egg 12–36 hours after slitting. During this time the remaining amounts of yolk are absorbed into the body.

south. There are so few records of dwarf pythons that it is impossible to clearly delimit the distribution of this species at this time.

The north–south distribution of dwarf pythons extends at least 600 miles (960 km) and perhaps as much as 1100 miles (1760 km). Along the coast in this region of southwest Africa are harsh deserts (including the Namib Desert); moving inland one gains elevation quickly, and 40–100 miles (60–160 km) from the coast the elevation is typically 3250 ft (1000 m) or more. Dwarf pythons occur in a narrow belt along this incline at elevations of 2450–6000 ft (about 750–1850 m) in rocky areas. At the eastern boundary of the distribution the landscape becomes a featureless flat plain.

Most areas where *P. anchietae* occur receive an average annual precipitation of only 4–8 in (10–20 cm). There are exaggerated seasonal changes; summers are very hot (daytime high temperatures exceeding 123°F (55°C!)) have been recorded), and winters can be very cold (below freezing many nights). In such inhospitable country it is a certainty that dwarf pythons are not evenly distributed throughout their range, but occur in scattered populations.

This python is very seldom encountered. There are a variety of reasons it is rarely seen. The area of their distribution is nearly unpopulated, and travel there is difficult and expensive. Most of the known specimens have come from the vicinity of Windhoek, but that is more likely a consequence of Windhoek being the most densely human-populated area within the range, rather than because of any particularly dense python-populations (which is not to say that the Windhoek area is densely populated by world standards). Dwarf pythons are probably crepuscular or nocturnal most of the time (though in captivity they can be quite active in the day), and they are likely inactive during the cold months, the driest times, and the hottest months of the year (in other words, most of the year).

The Angolan half of the range of the dwarf python has been the epicenter of the yet-ongoing Angolan civil war for nearly 20 years. The rebels control the southern portion of Angola, and rebel headquarters are within 60 miles of the type locality of the species; over a million land mines and other explosive anti-personnel devices are believed to be scattered throughout the area. This has effectively excluded snake collectors from the Angolan portion of the range. In the southern extent of the range, Namibia has very strict regulations controlling the collection of snakes. Dwarf pythons receive special legal protection, they have nearly become the national reptile of Namibia, and legal exportation is essentially impossible. This has kept collectors out of Namibia.

For most of the history of this species, nothing other than its existence was known.

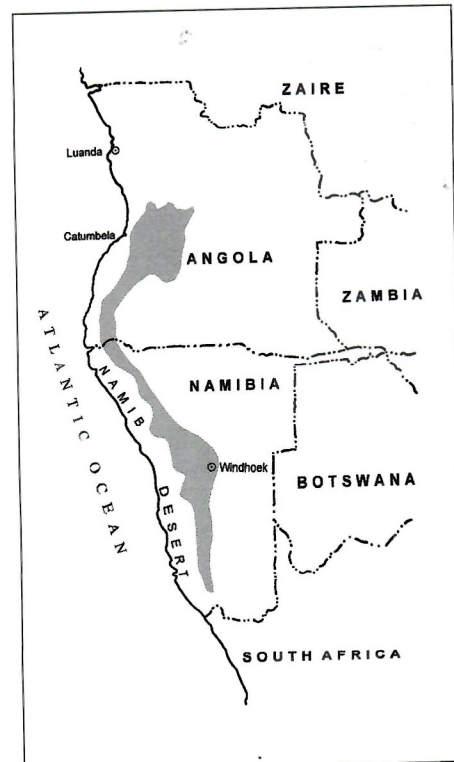


Fig. 1. The shaded area indicates the probable range of the dwarf python, *Python anchietae*, based on suitable habitat and elevations.

However, there has been a growing number of specimens available for study during the past 30 years. FitzSimons (1962) reported there to be 6 known specimens of *P. anchietae*. Finkeldey (1963) examined 7 specimens, including 3 living specimens, making a total of 9 or 10 known specimens. In 1980 we have record of only 9 dwarf pythons in captivity (3 at the Houston Zoo, Houston, Texas, 1 privately owned in a U.S. collection, and 5 at the Transvaal Snake Park, South Africa). Today we are aware of fewer than 20 wild-caught specimens alive in captivity throughout the world, including several of the specimens captive in 1980 that are still alive. Three U.S. zoos have reproduced *P. anchietae* since the first captive breeding



At three months of age, the dark colors of this dwarf python have begun to pale. The dark pattern of hatchlings is uniform chocolate brown.

of the species occurred at the Houston Zoo in 1981; between 10 and 20 of those offspring are living, although there undoubtedly are uncounted specimens of *P. anchietae* in private hands worldwide (though probably very few). There appears to be a world captive population of about 40 dwarf pythons.

We never thought we would be able to acquire dwarf pythons, they're simply unavailable most of the time. When they arrived we couldn't stop looking at them. As hatchlings, dwarf pythons are a dark chocolate brown with lemon yellow markings. Ours were alert, calm, inquisitive little snakes; whenever their cages were opened they would rush forward like little pigs expecting food, always hungry, but seeming to enjoy handling and a change of scenery if food wasn't offered. We were always worried that something would happen to these little treasures because they seemed to be so little trouble and so undemanding.

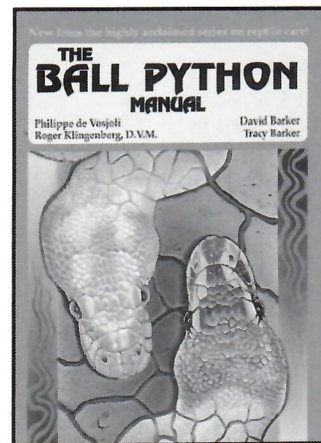
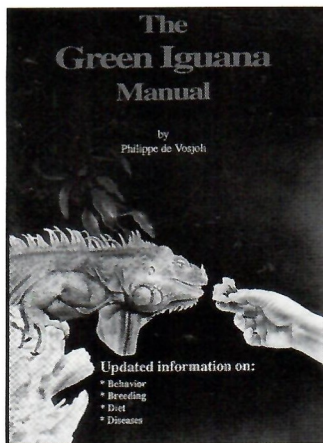
And disaster did strike. In July 1991, one of our males came down with an undiagnosed respiratory infection that did not respond to antibiotic treatment. This male had been an unusually small hatchling, weighing only 41 g when we received him, about 60% of the normal weight of hatchlings. He had not seemed negatively effected by his small size, and had fed and grown normally; at one year of age, about the time of the onset of his illness he weighed 318 g, about 80 g smaller than his siblings. He died in early September. His two siblings were not affected. We'll never know from where the problem came.

Dwarf pythons are prone to grow very heavy, rippled with fat, on an amount of food that would suit an equal size and age ball python; we have seen zoo specimens that appeared to be grossly overweight. Perhaps a python from such a harsh climate has had to become more efficient at storing body fat. In any case, we made the conscious decision to "sparingly" feed our youngsters rather than to "push" them. They were fed weekly one appropriately sized food animal, and in the winter months we occasionally skipped feeding for a week. At approximately one year of age each of the three animals had shed six times; at the sixth shed our second male weighed 402 g and the female weighed 396 g. They both could be described as pudgy and rotund, but not at all obese.

The next two years were uneventful. During the first part of December 1995, we ceased feeding. On 15 December we turned off their heat tape, after which their cage temperatures ranged from daily highs



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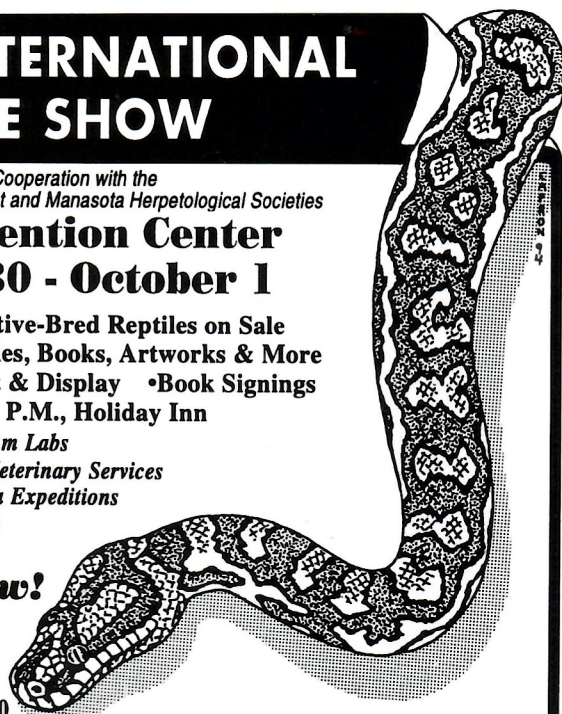
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of 84°F (29°C) to nighttime lows of 75°F (23°C). The photoperiod had also been gradually shortened throughout the fall to the winter minimum of 9 hours of light and 15 hours of dark. On 29 December 1993, our male shed, and was placed in the female's cage.

On 30 December, the pair were observed copulating. Throughout late winter and early spring the pair were separated for several days and then placed together for 7 to 10 days. They were observed copulating two more times, on 31 March 1994 and on 12 April 1994. The female was observed to ovulate 36 days after the last copulation on 18 May 1994, an event signaled by the typical temporary large midbody swelling often referred to as "the lump" [see our column titled "The Mechanics of Python Reproduction" in the March/April 1995 issue of *The Vivarium* 6(5) for a discussion and description of the events of python reproduction]. The pair were separated at the time of ovulation and were not placed back together after the event.

The female went into a shedding cycle about a week after ovulation and shed her skin on 4 June 1994. She was provided a warm basking spot with a heat pad placed under her cage, creating an area on the floor of her cage with temperatures of 90–94°F (32–34°C) where she was often observed laying with the posterior two thirds of her body up-side-down. At this time she was also provided a nesting container containing very slightly damp sphagnum moss; she was often observed in brooding coils in this box, and quickly had packed down an area of moss to perfectly fit her coils.

Egg laying occurred during the day of 2 July 1994, 28 days after shedding her skin. When completed in the afternoon, she was wrapped around six gigantic perfect eggs. We observed the muscular shivers typical of females of several python species when brooding. We measured temperatures using a non-contact remote-sensing temperature gun (no herpetoculturist should be without one) and observed evidence of actual heat generation. Over a 6-hour period we observed temperatures in the nest outside of her coils to remain a constant 83°F (28°C), while the temperature of the eggs inside of her coils was 88°F (31°C). These eggs appeared to be nearly the size of Burmese python eggs, weighing an average of 0.26 lb each (119.7 g each).

The adult pair were measured on the day after egg laying: the female weighed 3.3 lb (1518 g) and measured 58.25 in (148 cm) in total length; the male weighed 3.1 lb (1392 g) and measured 50.75 in

(130 cm) in total length. The relative clutch mass for this breeding was 0.49 (in other words, the total weight of the clutch equalled 49% of the weight of the female), a spectacular reproductive effort for a female python. The female voluntarily fed on a medium-sized rat two days after egg laying.

The eggs were taken from the female late in the evening of the day of egg laying and placed in a container of slightly damp vermiculite. This container was placed in our incubation room at a constant temperature of 90°F (32°C). Incubation was uneventful, and the eggs looked perfect throughout; they hatched after 58 days of incubation, producing six healthy, fat and beautiful little baby dwarf pythons, two males and four females.

The babies have been trouble-free. Measured after their first shed, at about two weeks of age, they weighed about 0.14 lb (62–64 g) and were 17.5–18.5 in (45–48 cm) in total length. After completing their first shed they were offered food and all six ate fuzzy mice. They are growing and thriving, following in the paths of their parents. At four and a half months of age, they averaged 0.42 lb in weight (190 g), very similar to the weight of their parents at the same age.

Python anchietae has been one of the most rewarding species with which we have ever worked. To accomplish the successful captive reproduction of such a rare python is very satisfying compensation for the years of attention, work, and worry that such a project requires, and this has been one of our easiest and quickest projects. Our babies are our pride and joy. It's these successes that motivate us to continue our work to establish and secure this and other python species in captivity.

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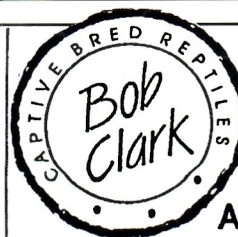


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Caecilians—continued from page 27

and can be extended to sample the surround-
ing environment.

Their eyes are very reduced, incapable of
perceiving images and, in some species, com-
pletely covered by bone (Wake, 1985). In
fact, the name "caecilian" means "blind"
(Nussbaum, 1992). In members of the Afri-
can family Scolecomorphidae, the eye rides
on the tentacle and is always exposed to out-
side light through a thin layer of skin. All
available evidence suggests that caecilians
rely solely on their sense of smell and their
tentacle to find food. As far as is known, all
caecilians are carnivorous and use their jaws
to capture prey (Bemis et al., 1983; O'Reilly,
1994). The major jaw-closing muscles are
tucked behind the skull so they can be greatly
enlarged without increasing head diameter
(Nussbaum, 1977, 1983). Additionally, they
have two sets of jaw-closing muscles
whereas all other terrestrial vertebrates have
only one (Nussbaum, 1992). This adaptation
is a method of fitting more jaw-closing
muscles into the skull without widening it
which would impede burrowing. The extra
muscles are believed to add greatly in captur-
ing prey since the caecilians have no append-
ages to aid in the process.

Relative to frogs and salamanders, we
know little about the reproductive behavior of

caecilians. As far as is known, all caecilians
have internal fertilization. Male caecilians in-
vert the lining of the cloaca into a protrusible
copulatory organ called the phalodeum which
is inserted into the cloaca of the female (Bar-
rio, 1969; Murphy et al., 1977; Billo et al.,
1985). After mating, a female caecilian will
either lay a clutch of eggs or give birth to live
young. The eggs of caecilians are similar to
those of fish and other amphibians in that
they lack the amnion and chorion membranes
of mammals, reptiles, and birds. In species
which lay eggs, the female guards the clutch
until it hatches. This form of parental care is
certainly a timely and energetic expense yet
it likely allows for a more successful survival
rate overall. The primitive life history for cae-
cilians includes an aquatic larval stage. Like
salamanders, the larvae of caecilians look
very similar to adults. Larvae differ exter-
nally from adults in their larger eyes, labial
lobes (flaps of skin that cover the side of the
mouth), a small gill opening called the spi-
racle, and a tiny caudal fin (Fig. 2). Larvae
live in shallow water and tend to feed at night
(Breckenridge et al., 1987; Himstedt, 1991)

Caecilians do not all have a larval stage in
their life history cycle. Some species, such as
Grandisonia alternans, have a short-lived,
non-feeding larval stage. Others, like
Hypogeophis rostratus, lay eggs that hatch
directly into miniature replicas of the adults.

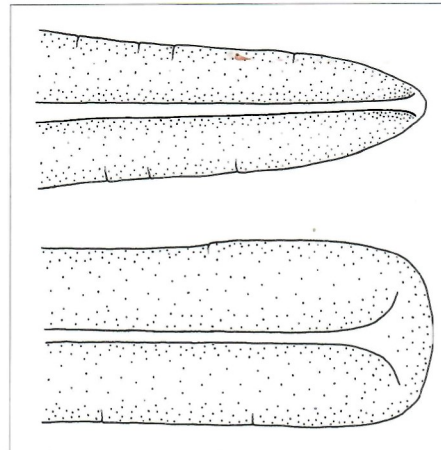


Figure 3. Top view of the tail end of a fe-
male (top) and a male (bottom) *Typhlonect-
es natans*. Note that the male is much
broader. This difference is not apparent in
juveniles which look like adult females re-
gardless of sex. Illustration by Loreé
Harvey.

Many other species are viviparous, giving
birth to miniature adults rather than laying
eggs. No caecilians are known to give birth to
larvae. The young of the aquatic caecilian
Typhlonectes are born with enormous gills
that are shed within minutes of birth (Billo et
al., 1985; Cummings, 1985). The gills are
commonly not found in the cage with the
young because they are often eaten by the
mother (Lyman-Henley, 1993). The gills al-
low gas exchange while the young develop in

Families Genera	Known Ranges
Rhinatrephidae (Nussbaum 1977)	
<i>Epicrionops</i> (8 species)	Columbia, Ecuador, Peru and Venezuela
<i>Rhinatrema</i> (1 species)	Brazil, French Guiana, Guyana and Surinam
Ichthyophiidae (Taylor, 1968)	
<i>Caudacaecilia</i> (5 species)	Borneo, Malaya, Southern Philippines, Sri Lanka, and Sumatra
<i>Ichthyophis</i> (31 species)	India, Sri Lanka, China (Yunnan), Laos, Thailand, Malaya, Western Indonesia, Singapore, and Southern Philippines
Uraeotyphlidae (Nussbaum, 1979)	
<i>Uraeotyphlus</i> (4 species)	India
Scolecophoridae (Taylor, 1969)	
<i>Crotaphatrema</i> (2 species)	Cameroon
<i>Scolecophorus</i> (3 species)	Tanzania and Malawi
Caeciliidae (Rafinesque, 1814)	
<i>Boulengerula</i> (5 species)	Tanzania, Kenya, Malawi and Rwanda
<i>Brasilotyphlus</i> (1 species)	Brazil
<i>Caecilia</i> (32 species)	Southern Central America and northern South America
<i>Dermaphis</i> (3 species)	Central America and northern Columbia
<i>Gegeneophis</i> (3 species)	India
<i>Geotrypetes</i> (3 species)	West coast of equatorial Africa
<i>Grandisonia</i> (5 species)	Seychelles Archipelago
<i>Gymnopsis</i> (2 species)	Central America
<i>Herpele</i> (2 species)	West coast of equatorial Africa
<i>Hypogeophis</i> (1 species)	Seychelles Archipelago
<i>Idiocranium</i> (1 species)	Cameroon
<i>Indotyphlus</i> (1 species)	Western India
<i>Lutkenotyphlus</i> (1 species)	Brazil and Paraguay
<i>Microcaecilia</i> (5 species)	Ecuador, French Guiana, Guyana, Surinam and Venezuela
<i>Mimosiphonops</i> (2 species)	Southern Brazil
<i>Oscacaecilia</i> (8 species)	Southern Central America and northern South America
<i>Parvacaecilia</i> (2 species)	Columbia
<i>Praslinia</i> (1 species)	Seychelles Archipelago
<i>Schistometopum</i> (5 species)	Kenya, Tanzania and islands in the Gulf of Guinea
<i>Siphonops</i> (5 species)	South America
<i>Sylvacaecilia</i> (1 species)	Western Ethiopia
Typhlonectidae (Taylor 1968)*	
<i>Chthonerpeton</i> (6 species)	Argentina, Brazil, Ecuador and Uruguay
<i>Nectocaecilia</i> (2 species)	Venezuela
<i>Potomotyphlus</i> (1 species)	Brazil, Ecuador, French Guiana, Peru and Venezuela
<i>Typhlonectes</i> (3 species)	Columbia, Peru, Venezuela, French Guiana, Guyana, and Brazil

Table 1. Current status of caecilian taxonomy (from Nussbaum and Wilkinson, 1989; Wilkinson and Nussbaum, 1992; Nussbaum and Hinkel, 1994). * Typhlonectidae is nested within the Caeciliidae, and the name is unlikely to survive as more detailed phylogenetic hypotheses become available (Hedges et al., 1994).

the mother's expanded oviduct. After their egg yolk is absorbed, the young feed on nutrients secreted on the inner lining of the oviduct which is sometimes called "uterine milk." (Parker and Dunn, 1964; Wake, 1977, 1978; Wilkinson, 1991). Unfertilized eggs can be found in the oviduct late in gestation and they may be an additional source of nutrition.

One of the primary predator groups of caecilians in the wild appears to be snakes (Taylor, 1968; Nussbaum, 1992). Among others, coral snakes have been noted for feeding on caecilians. Pigs and some birds, like chickens, have been noted preying on caecilians in the Seychelles Islands (Nussbaum, 1992). Shrew-like tenrecs, introduced from Madagascar to the Seychelles have also been noted to prey on caecilians (Nussbaum, 1992). In some parts of Brazil, caecilians are used as fish bait, which suggests that fish may be a predator of caecilians (V. Hutchison, personal comm.). However, Moodie (1978) reported that *Typhlonectes* is toxic to at least some fish in the Amazon. Aside from skin toxins and their secretive lifestyles, caecilians are largely defenseless and are apt to be added to the diets of many opportunistic predators.

Care in Captivity

The only caecilian that we know of that is regularly imported into the United States is

36

Typhlonectes natans. This fully aquatic species is available year round in the aquarium trade under the common name of "rubber eels." *Typhlonectes* are viviparous and pregnant females are often seen from March through July. *Typhlonectes* are sensitive to water conditions and even water treated with conventional chemicals used for tropical fish is often fatal. If water conditions are bad enough, the animals will become agitated and secrete a thin layer of white, sticky slime on their skin, that has the appearance of a fungal infection, and die. We have had good success keeping them in distilled water with some added salts (1.8 g NaCl, 0.05 g KCl, and 0.1 g CaCl₂ in 1 liter of distilled H₂O). *Typhlonectes* can be housed in the same way as tropical fish, but the water in the tank should be shallow enough that they can reach the surface to breath. Flat, smooth rocks or inverted clay dishes should be offered for cover. The water should be filtered in the same manner as for tropical fish. Water temperature should be kept stable between 72 and 80°F (22–27°C). *Typhlonectes* are escape artists and their aquaria should always have a tight-fitting lid.

Male and female adult *Typhlonectes* can be distinguished easily by the morphology of the cloaca (Fig. 3), but all juveniles have the same morphology as adult females. Male *Typhlonectes* are aggressive toward one an-

Species	Prey taken	Prey refused	Sources
Rhinatrephidae			
<i>Epicrionops</i> sp. 1	<i>Lumbricus</i>		
larval <i>Epicrionops</i> sp. 2	amphipods, <i>Lumbricus</i> *	<i>Tubiflex</i> , <i>Artemia</i> **	
<i>Epicrionops</i> sp. 2	<i>Lumbricus</i>		
Ichthyophiidae			
<i>Ichthyophis bannanicus</i>	<i>Lumbricus</i>		
larval <i>Ichthyophis glutinosus</i>	Chironomus larvae		Breckenridge et al., '87
<i>Ichthyophis glutinosus</i>	<i>Lumbricus</i>		Breckenridge et al., '87; Tanner, '71
<i>Ichthyophis kohtaoensis</i>	<i>Lumbricus</i> , <i>Acheta</i> , <i>Galleria</i> larvae		
Caeciliidae			
<i>Boulengerula boulengeri</i>	termites	<i>Lumbricus</i>	
<i>Caecilia orientalis</i>	<i>Lumbricus</i>		
<i>Caecilia</i> sp.	<i>Lumbricus</i>	<i>Acheta</i> , <i>Mus</i>	
<i>Dermaphis mexicanus</i>	<i>Lumbricus</i> , <i>Acheta</i> , <i>Mus</i> , <i>Sceloporus</i> , <i>Galleria</i> larvae		Bemis et al., '83, Moll and Smith, '67, Bennet and Wake, '74
<i>Geotrypetes seraphini</i>	<i>Lumbricus</i>		
<i>Grandisonia alternans</i>	<i>Lumbricus</i>		
<i>Grandisonia brevis</i>	<i>Lumbricus</i>		
<i>Gymnopsis multiplicata</i>	<i>Lumbricus</i> , termites, orthopterans		Bemis et al., '83, Tanner, '71
<i>Schistometopum thomense</i>	<i>Lumbricus</i>		
<i>Siphonops annulatus</i>	<i>Lumbricus</i> , <i>Acheta</i> , <i>Mus</i>		
<i>Hypogeophis rostratus</i>	<i>Lumbricus</i> , <i>Eisenia</i> , adults, <i>Galleria</i> adults,	<i>Tenebrio</i> larvae and	Tanner, '71
<i>Formica</i> pupae, <i>Mus</i> ,	<i>Calliphora</i> larvae, <i>Rana</i> , termites, <i>Tenebrio</i> pupae, cerambycid beetle larvae, raw fish flesh, <i>Galleria</i> larvae and pupae	various moth caterpillars, <i>Calliphora</i> pupae, <i>Anguis</i> , <i>Matrix</i> , <i>Buro</i> , frog eggs, salmon roe, various anuran larvae, slugs, veal	
Typhlonectidae			
<i>Chthonerpeton indistinctum</i>	<i>Galleria</i> larvae		Tanner, '71
<i>Typhlonectes compressicauda</i>	insect pupae (Coleoptera?)		Wake, '78
<i>Typhlonectes natans</i>	<i>Lumbricus</i> , <i>Carassius</i> *, <i>Pseudocris</i> **	crayfish, <i>Tubiflex</i>	

Table 2. Prey known to be taken by caecilians based on observations of captive specimens and gut contents of wild specimens. Prey refused based on observations of captive specimens. Except where noted, all observations made by the authors. *Had to be trained to recognize worms as food (see text). ** Only dead items offered.

other and we recommended that no more than one male be kept in a small tank. Several females can be housed with or without a male. When kept together, males seem to form a pecking order with the lowest members on the totem pole declining into poor health over time. If you acquire a pregnant female, she should be kept in water about an inch deep so that the young can reach the surface to breath after being born.

Terrestrial caecilians are usually only available if you make special arrangements. Pet stores will usually only order them on request and even then, importers only get them infrequently. If you purchase specimens directly from an importer over the phone, make sure the proper precautions are taken during shipping. Caecilians spend most of their lives underground in the tropics where they are exposed to very few, if any, changes in temperature. It is therefore not surprising that they seem to be very intolerant of temperature fluctuations during shipping. Animals should always be shipped in Styrofoam boxes without any holes. They can be shipped safely in damp sphagnum moss but should not be housed in this medium for extended periods. Additionally, it seems to be commonplace for importers to ship and house caecilians in peat moss. This medium is too

Continued on page 52

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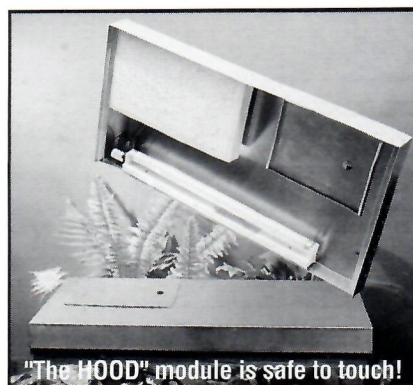
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End of an Era

an interview with Dr. James B. Murphy

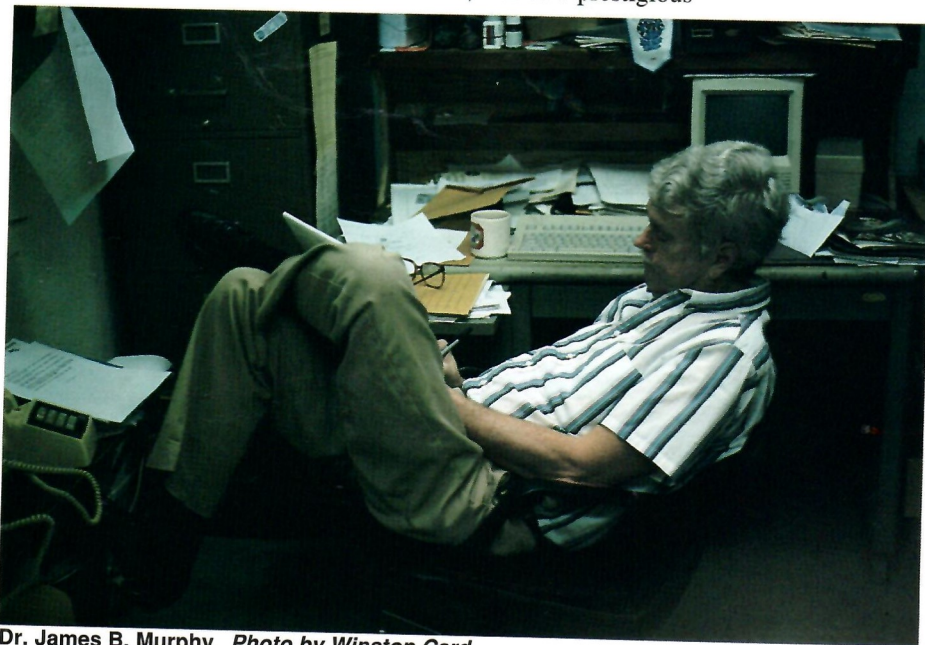
by
Winston Card

In June 1995, Dr. James B. Murphy retires as Curator of Herpetology at the Dallas Zoo. He will be moved to Washington, DC to be with his wife, Judith Block, and plans to embark on several herpetological projects in concert with the National Zoo. Anyone vaguely familiar with the herpetological literature during the past 30 years will recognize that this event marks the end of an era in zoo herpetology at the Dallas Zoo. Although he would be quick to correct this notion, he has likely contributed more to the current direction of zoo herpetology than any other single individual. It would be impossible for me to list all of his accomplishments over the years, but I will at least try to convey some of the highlights.

After graduating from Xavier University with a degree in Philosophy (of all things!), Murphy spent less than a year as a reptile keeper at Zoo Atlanta in 1965. He then moved on to the Department of Herpetology at the Dallas Zoo in 1966, where he became supervisor, and eventually Curator. Over the past 30 years, he has contributed over 100 publications including writing and editing several books. Two of these books were recently published: *Captive Management and Conservation of Reptiles and Amphibians*, co-edited by K. Adler and J. T. Collins, and *Health and Welfare of Captive Reptiles*, co-edited by C. Warwick and F. L. Frye. In addition, Murphy has served on a multitude of committees encompassing everything from the Declining Amphibian Task Force, to serving as president of the Society for the Study of Amphibians and Reptiles in 1981.

During his reign as curator, the Department of Herpetology at the Dallas Zoo has

been responsible for much of the published herpetological research contributed by zoos worldwide. The Department has also been awarded some 29 first-captive-breeding awards by the American Zoo and Aquarium Association, several significant achievement awards, and two prestigious



Dr. James B. Murphy. Photo by Winston Card.

Edward H. Bean awards for reproduction in Bismarck ringed pythons and bushmaster. In recognition of his contribution to the field of herpetology, and through the kind efforts of Drs. David Chiszar and Hobart M. Smith, Murphy was awarded a Doctor of Science Honorary Degree from the University of Colorado in 1989. However, for those of us who know Murphy on a personal level, we know that he considers his major personal achievement to be his status as runner-up for the contest to choose the Gerber baby food representative to be pictured on jar labels in 1939.

The following interview is an attempt to convey, in a personal way, some of his more memorable experiences over the past 30 years in the zoo field.

THE VIVARIUM: *Your academic background is in philosophy; how did you*

wind up as Curator of Herpetology at the Dallas Zoo?

MURPHY: Starting from about the age of seven, I had a strong interest in herps. While in high school, I maintained a pretty extensive private collection which was stressful for my long-suffering parents. At that time, I was living just outside of Chicago, and a friend of mine, Gene Hartz, was Curator of Herpetology at the Lincoln Park Zoo.

He knew that I had an interest in zoos and suggested that I talk to Marlin Perkins, who was then director of the Lincoln Park Zoo. So, I made an appointment with the great man. Perkins did not have the television program *Wild Kingdom* at the time, but he did have a local show called *Zoo Parade*. This was a weekly program so people knew who he was. He had an incredibly large office in the primate building and as I

walked in, I was quite apprehensive. He looked at me and said, "I understand from Gene that you want to be perhaps employed in a zoo." I responded that I had always been interested in live reptiles and amphibians and had maintained them at home over the years and thought this might be a nice way to make a living. He said, "No, don't do it. I nearly got a divorce, my family hates me, I don't make any money, the politicians hassle me constantly, and if I had it to do all over, I would do anything else other than this." So, with that, I stumbled out of his office rather discouraged. Gene said he was just having a bad day.

Later, when I went away to college in Cincinnati, I gave most of my collection to the Lincoln Park Zoo. While in Cincinnati, I began to associate with several people who shared my interest in herps. I

met Joseph T. Collins, who was a fellow collector of herps in Cincinnati, and I knew Kraig Adler in Columbus. The former was a conservative right wing radical who was always neatly dressed in suits and the latter was as well dressed then as he is now. Naturally, I did not emulate their care with clothing. As a former colleague told me years later, "Murphy, you could go to a party wearing formal wear and I could be wearing a bathing suit and I would be better dressed than you." My wife has excellent taste in clothing and is always fashionably dressed. She has warned me that she intends to discard nearly every piece of clothing that I own! At that time, Collins and Adler had developed the Ohio Herpetological Society, which was the precursor of the SSAR (Society for the Study of Amphibians and Reptiles). So, as I met these people and spent more time with them, I became increasingly interested in herps.

Unfortunately, I also began to accumulate a rather large private collection again. I started with a few odds and ends, a boa and some other nonvenomous snakes. Then eventually I ventured into venomous snakes, starting with some cobras, rhino vipers, puff adders, Gaboon vipers, Gila monsters, and that sort of stuff. I wasn't too sharp about antivenom at the time, but I had all these things, and I tried to be careful. In fact, as I became more possessed, I started trading and selling my clothing so that I could afford to get more reptiles. My closet was rather depauperate, but my collection was growing.

At the time I planned to be a college professor in philosophy, because I was interested in the arts. However, as I got into it more and more, I realized that the longest sustained interest I ever had was herps and it made sense to do something with them professionally.

THE VIVARIUM: *Why the zoo field and not academic herpetology?*

MURPHY: When I was an undergraduate, the chairman of the biology department at the time when I was enrolled in biology wanted me to do neurological research on chicks as a senior project, but I really didn't have any interest in that. He was very insistent, and he put so much pressure on me that I finally decided that this was not what I wanted to do. At the time, I had developed an interest in philosophy, so I just changed majors.

When I decided to go back to graduate school in zoology, I went down to the University of Florida. My interest was in living herps, particularly ethology and, at that time, there wasn't a real strong emphasis in that area. I was also interested in

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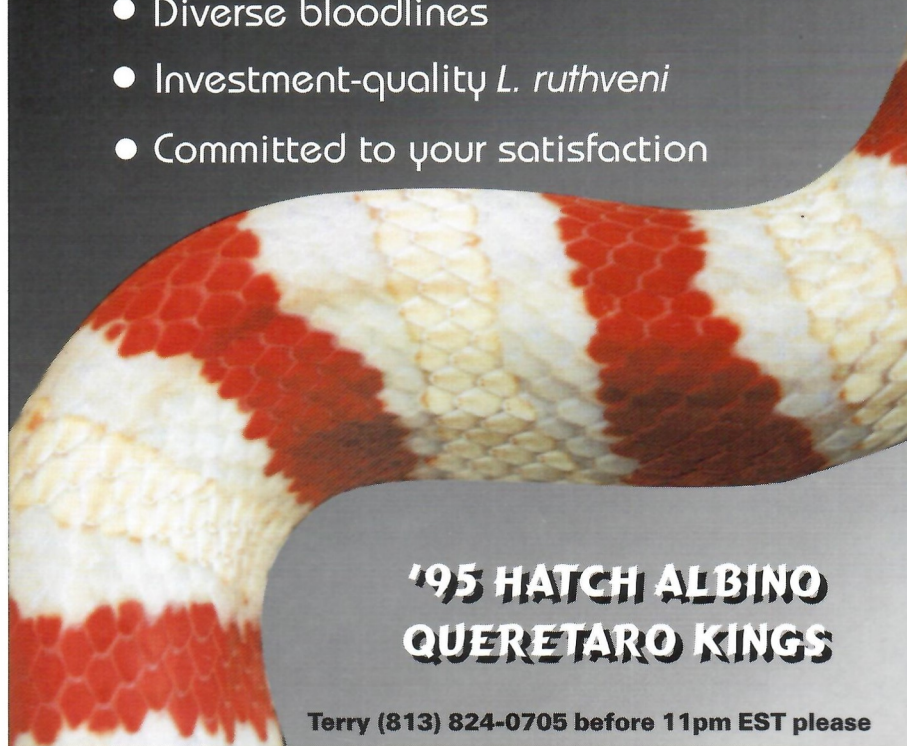
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the diversity of herps, and most universities couldn't accommodate a large living collection. So, I eventually began to see that the best place for me was in a zoo.

THE VIVARIUM: *You seem to have some fairly close ties with the academic community; have you always been accepted in that arena?*

MURPHY: No, when I first came to Dallas, which was in mid 1966, I really didn't know many herpetologists at all. I had read a few papers but I wasn't very familiar with the literature. It just happened that I was elevated into this position because my predecessor left. Although I had always had a strong interest in herps and had read some, I never spent a lot of time looking at things like systematics or physiology, and in fact, I really didn't know that much about the ethology of herps.

Shortly after I was elevated into this position, the Herpetologists' League held an annual meeting in downtown Dallas which was about three miles from the zoo. I wrote to the president of the organization and invited any of the herpetologists who wanted to, to come to the zoo. So we cleaned the place up and got everything all spic and span. I went down and sat in on a few papers and talked to the president at that time, Wilmer Tanner, and he made the announcement, but nobody came out.

I was really struck by that. Here they were three miles away, and nobody took the time to come out to the zoo. I thought part of that was probably because we didn't have much of a reputation.

Another thing that happened, was a friend of mine invited me to go to an SSAR meeting in New Mexico. When I got there, I discovered that I was only one of two or three zoo people at the meeting, and I knew virtually no one. I decided after that meeting that it was incomprehensible that I could be involved in heading up a herp collection and not know the players in the field, and for them not to know what the Dallas Zoo was. So, on the way back from New Mexico, I vowed that I would make an effort to try and interact with these people, and I did that. It turned out that I developed some very close friendships with some of the people I met at those SSAR and other herp meetings, such as Bill Lamar and Jonathan Campbell.

THE VIVARIUM: *What are some of the major changes that have occurred in zoo herpetology since you have been in this field?*

MURPHY: When I came into this field, we spent most of our time talking about how to keep an animal alive. There is very

little of that now. The expertise for keeping herps alive is considerably beyond anything that was happening when I first started. One of the problems was there was very little in the literature about maintaining herps. Today there are many magazines and books devoted to that subject.

Gradually, I saw this profession evolve beyond discussions about how to keep a specific taxon alive. We began looking at broader issues in terms of conservation programs, and broader issues in terms of looking at the ethology of herps. We also began looking at the reproduction of herps which could be used to address some of the more interesting theoretical questions in biology.

I've noticed that the people who come into this profession have changed as well. When I first started, we searched for people who were even interested in herps as keepers. Now the keepers who come in are well trained, they are familiar with the literature, and they have extensive experience. So now, the positions are very competitive. It wasn't like that at all when I first started. I remember absolutely beating the bushes to try and find anybody who was interested in herps, who wanted a job as a keeper, and now we certainly have a much different situation.

THE VIVARIUM: *It has been my experience, having worked with you for a while now, that you have a somewhat peculiar philosophy in terms of people management. Could you talk a little about this philosophy and discuss what part you think it has played in the success of the program at the Dallas Zoo?*

MURPHY: In terms of all of the new philosophies and seminars concerning people management techniques, I don't like recent trends. I don't like a philosophy where people are used as objects to try to get to a point for greater productivity. I think there are inherent problems with various management philosophies, because what they do subliminally is tell people they are part of a great experiment and then they almost become experimental animals in this exercise. Naturally there is resentment and opposition to this approach. This approach may contribute to a leaner workforce, and certainly corporations are moving in that direction, but it also may be brutal, because those people who are not as lean are selected against. So, on the one hand, you can say the bottom line is better, but a lot of people are trashed in the process. I just don't think that is a good way to do things and it violates human dignity. A better way is to

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clearly outline what needs to be done and allow flexibility as to how it is done. Intelligent people can understand the whole picture and their place within the operation. Employees have responsibilities to the Zoo as well. Remember that we work in close contact with one another. So it is important that we balance our own agendas with the needs of the Department. It may be necessary to suppress our own egos and desires for the good of the group. The world is not perfect, and occasionally employees never understand what is needed. If this happens, an employee needs to consider an alternate way of making a living.

Employees in this Department should be well prepared to take on greater challenges in the future. As a result, they should have an opportunity to enhance their résumés by trying and succeeding at a variety of tasks. It is counterproductive for a Curator to micromanage employees. Employees should have ownership in their projects; they don't need constant interference from their supervisors. I like to delegate responsibility as much as possible. On rare occasions, an employee may misinterpret my reasons for delegation, but I'm convinced that this approach is the best way to go. My delegation of duties to the staff does not mean my indifference to the staff and their ability to accomplish goals. It is rather my show of confidence in them.

I believe that people come into this department who have an interest in herpetology, but they are human beings first and herpetologists second. So, what they should be learning in the 40 hours a week they are here is not only herpetology, but life skills. They should be given the opportunity to find out what direction they want to go and how they can get there. We try to set up a working environment that's democratic and we try to build consensus among the group. If we have differing points of view, we take votes. If I feel that there is a real danger in the way we are moving, I may have to step in, but that rarely happens. I can hardly ever think of an instance, really. It just seems the collective wisdom of the group gets us beyond the level any one of us could do alone. Over the years, we have had a wonderful group of co-workers in the Department who have contributed immensely to our success. We've had an interesting mix of skillful and talented folks, including artists, photographers, herpetoculturists, fieldworkers, researchers, lecturers, and so on. The challenge is to integrate this diversity of talents and personalities to ac-

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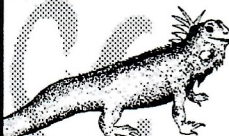


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comply a collective goal. When we sit around the break table, I'm always amazed at the content of our discussions. It is an intellectually rich environment and many of our ideas are generated in this casual setting. I treasure these moments and feel privileged to work with these people.

THE VIVARIUM: *What is your impression of some of the trends you see in the private sector today?*

MURPHY: Well, let me just try and explain it this way. When I was young, some of the strongest and most impressive moments were those where I met herpetologists who were interested in a broad herpetological perspective. They

had a true love of nature and a curiosity about how things worked. What I've seen over the last 10 or so years is something that disturbs me a little bit. Which is this preoccupation with commerce in herps. I've noticed here that people come to visit and spend all of their time looking at the various kingsnakes we have, but don't look at any of the other stuff and don't really want to talk about any of the other stuff we are doing. I get the impression sometimes that people become so involved with commerce and the trading of herps, that the animals take on a commercial value and they don't take on a metaphysical value. I think that's destructive.

I look at my own career, in terms of the most important people in developing my perspective on herpetology, and money was never mentioned. I can't think of an instance when we talked about money, about whether this animal was worth this rather than that; money never came up. Now, I'm sometimes overwhelmed that this is often the main topic of conversation. To me, that just misses the point. So it bothers me that maybe, at least in some cases, people are kind of off the track. What they probably ought to be doing to make this a sustained interest is start looking at the biology of these animals, instead of just their monetary value.

THE VIVARIUM: *During the past 30 years, you have associated with some of the more interesting characters in this field. Is there any one of these individuals who stands out in your mind?*

MURPHY: I must say, that of all the people I've met in this field, probably the most dedicated, but unusual person I knew was Joe Laszlo. I first met Joe when I was a keeper in Atlanta, and he came in wearing this white baker's uniform covered with food stains. I was absolutely enthralled with his interest in herps. I maintained a friendship with Joe for many years; he came to Texas about the same time I did. He worked for awhile as a keeper at the Fort Worth Zoo; then he went down to the Houston Zoo and eventually, to the San Antonio Zoo. So, I maintained a close friendship with him; he was really the first close friend of mine who died.

I was always amazed at two things Joe could do. The first was that he could walk into any room, and, because he was such a warm and interesting person, no matter who was in the room they would be absolutely delighted by him. The second was his enthusiasm. He would constantly call me and tell me about a new paper he had just read, or a new technique he had just tried. He was just extraordinary. It is fit-

ting that the International Herpetological Symposium has an annual award for herpetocultural expertise named in honor of Joe.

THE VIVARIUM: *Do you have any advice for anyone who might be considering a career in zoo herpetology?*

MURPHY: Get as much education as possible. This field is becoming more and more competitive. An interest in herps without an academic background may force a person to stay at a level where he or she does not want to stay. What I would suggest is to hang with the educational process as long as possible, until you burn out. Then try going to a zoo for employment. There are a lot of different avenues a person can pursue in herpetology and zoo work is only one.

Also, go to the herp meetings. Get to know people; we were all students once, so most of us are receptive to young people. Read as much as possible, as well. Don't only read the husbandry literature, because that will only look at a small part of it. Start perusing the herp and biological journals to get an idea of what is going on in herpetology. One of the most moving experiences for me was when I saw the slide presentation entitled "Herpetologists Past and Present" at a SSAR meeting many years ago. This program followed the history of herpetology, and I realized how much we owe to our herpetological predecessors. This is what I hope young people can understand about herpetology; it encompasses intellectualism, art, science, dedication, and commitment, all of which reflect human activity at its highest level.

THE VIVARIUM: *One last question, what will you do now?*

MURPHY: I'm going to DC; I don't have a job. I'm planning on having an office at the National Zoo which has been kindly offered to me by some of the folks there. I would like to get involved in several herpetological projects. I'm always reminded of something Roger Conant told me, which is that he was the happiest when he retired and able to pursue his own herpetological interests. If you ever want to look at a model of productivity after retirement, look at Roger. The contributions he made after retiring are incredible. So, I would like to remember that as a model.



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From the Editor

Change is good. Change brings about new ideas, and new ideas encourage pursuit of new ventures. The herpetocultural journal you hold in your hand is a fine example of a new idea that became a successful venture.

Twenty years ago herpetoculture existed in rudimentary form. Only a few private collectors and zoological institutions succeeded at maintaining specimens for any length of time, and very few of these animals reproduced in captivity. As dedicated herpers learned more about the needs of the animals under their care, husbandry techniques became more refined. With the refinement of husbandry techniques came species longevity and reproductive success. People learned of the successes of others, and this rapid spread of information was a key factor responsible for the development of the art and science of herpetoculture. Herpetocultural interests intensified in the early 1980s, and this set the stage for what would become one of the most rapidly growing science hobbies of the century.

At that time, literature pertaining to the care of amphibians and reptiles was available to a limited number of hobbyists through a few books, and through the proceedings of the newly organized Reptile

Breeding Symposium (later to become the IHS). But what these enthusiasts needed was an organization that would publicize and support their interests; an organization with a vehicle to carry the passion of reptiles and amphibians to the students of herpetoculture. Along came a man with a new idea. The AFH was formed, and after much work and effort, the first issue of *The Vivarium* was published. *The Vivarium* gave both the novice and the accomplished herpetoculturist what they wanted . . . accurate information about fascinating amphibians and reptiles, in full color, on their doorstep, on a regular basis. *The Vivarium* was the catalyst for the numerous herpetocultural magazines available today, and currently, the combined circulation of the herp magazines is somewhere in the neighborhood of 110,000 issues monthly. It has been recently estimated that the number of U.S. households harboring herps is greater than three million; this is likely an underestimate. So, considering the rapidly expanding interest in herpetoculture, what will future demands be regarding herp literature? You can bet that an expanding readership will demand greater variety and updated information.

This first issue of volume seven offers just that. Michael Balsai delivered a great lead article on the Solomon Island skinks *Corucia zebrata*. While articles concerning this species have appeared previously in the herpetocultural literature, this manuscript is without a doubt the most comprehensive published to date. Take advantage of the extensive bibliography, and expect to see a broader coverage of the literature in upcoming issues; literature that will better enable our readers to track down specific information about the ecology of these animals. Our regular amphibian writers, Danté Fenolio and Michael Ready, put together a wonderfully illustrated piece on caecilians. These little known animals have incredible life histories, and are an interesting example of amphibian diversity and adaptation. Never before has there been a color spread on caecilians such as presented here. Dave and Tracy Barker brought us another first with their paper on the captive reproduction of the rarely seen dwarf python *Python anchietae*. Forthcoming in *The Vivarium* are more exciting articles by the "python experts."

As you read through this issue of *The Vivarium*, what's important to remember about its content is not that you saw these articles first in *The Vivarium*, but that they deliver important information about little known animals. They are also a reminder that we still have much to learn about herpetoculture. We at the AFH are dedicated to

Erratum

The Volume 6 Issue 6, page 19, upper right photo caption should read: "This species of *Smilisca* is one of the hylid frogs inhabiting the arid region of Liberia, Costa Rica."

Board of Directors Position

The AFH Board of Director position of President will be reelected in the fall of 1995. Any member interested in nominating themselves or another member should send the members name, address, and telephone number to the AFH Office, PO Box 300067, Escondido, CA 92030-0067 or fax (619) 747-5224 by August 31, 1995. The nominee's signature providing approval of the nomination must be included to be valid. Current nominees are:

Philippe de Vosjoli, current AFH President.

bringing you a variety of new information, and this issue is a glimpse of what's to come.

In future issues our readership can expect new columns, more pages, a greater number of unique, high-quality photographs, and a presentation of herp diversity and natural history information unsurpassed by other herpetocultural periodicals. *The Vivarium* will, more than ever, be an educational resource for those interested in the art and science of herpetoculture.

We should all be excited about the growth and educational thrust of the AFH. However, this growth carries a price. The AFH is a non-profit organization that needs your continued support. As a member of the AFH you not only receive the only herpetocultural journal available, but you are also a part of a fine organization: one that represents the interests of its constituents, one that is actively involved in herp legislature, one that promotes responsible animal care, and one that supports and perpetuates the philosophy that science education is important, and that a passion for, and a greater understanding of, the natural world can only contribute to everyone's overall well-being.

As the new editor, my priority is serving the readership of *The Vivarium*. I look forward to change and to the challenge that new responsibilities present. Thanks to the AFH staff for bringing me aboard and making me feel at home. A special thanks to the Dallas Zoo herp crew (a motley bunch), who for years fostered an intellectual working environment, and were always open to new ideas and change.

Clay M. Garrett, Editor





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Coming Events

July 6-9, 1995: International Congress of Chelonian Conservation will be held in Gonfaron, France. For info, write to Secretariat, SOP-TOM, B.p. 24, 83590 Gonfaron, France.

July 7-9, 1995: Herpetoculture in the Classroom, 2 graduate credit hours from University of Wyoming, will be held in Rock Springs, Wyoming. For more info, contact: Dan McCarron, Science Dept., White Mountain Junior High School, P.O. Box 1089, Rock Springs, WY 82902, ph. (307) 382-4160, fax (307) 382-7351.

July 15-16, 1995: International Reptile Breeders Convention will be in San Diego, California. For info, contact: IRBA, P.O. BOX 85152-279, San Diego, CA 92186, ph. (800) 497-3550, fax (619) 263-6898.

August 5-6, 1995: First annual Captive-Bred Reptile and Small Exotic Animal Show will be held in Seattle, Washington. For info, contact: Rick Sims, Northwest Captive Breeders Expo, P.O. Box 77267, Seattle, WA 98177, ph. (206) 363-9095 or fax (206) 333-4205.

August 5-6, 1995: New Jersey Exotics & Family Pet Showcase will be held in Edison, New Jersey. For info, contact: Vicki Clark, Expo USA, 503 E. Penn Blvd., Woodbury, NJ 08096, ph. (609) 848-3312, fax (609) 384-6704.

August 8-13, 1995: Society for the Study of Amphibians and Reptiles (SSAR) Annual Meeting will be held in Boone, North Carolina. For info, contact: Dr. Wayne Van Devender, Dept. of Biology, Appalachian State University, Boone, NC 28608, ph. (704) 262-2665.

August 19-20, 1995: National Reptile Breeders Expo will be held in Orlando, Florida. For info, contact: Wayne Hill, ph. (813) 294-2235.

August 25-30, 1995: Second International Asian Herpetological Meeting will be held in Ashgabat, Turkmenistan. For info, contact: Theodore J. Papenfuss, Museum of Vertebrate Zoology, University of California-Berkeley, CA 94720.

August 26, 1995: New York Herp Expo will be held in Syracuse, New York. For info, contact: Robert Cunningham, ph. (315) 446-9292.

August 26, 1995: The 1st Annual American Frog (Amphibian) Day will be held in San Jose, California. For info, contact: Charles Powell, 2932 Sunburst Dr., San Jose, CA 95111-2264, ph. (408) 363-0926.

August 27, 1995: St. Louis Reptile Breeders Expo will be held in St. Louis, Missouri. For info, contact: James Brumley, ph. (314) 892-6605 or (314) 845-2038.

August 27, 1995: New York Reptile Expo will be held in White Plains, New York. For info, contact: Bruce Lowder, NY Metro Reptile Expo, 256 Second St., Palisades Park, NJ 07650, ph. (201) 461-0770.

September 2, 1995: Eastern Herpetological Expo will be held in Pottstown, Pennsylvania. For info, contact: Leonard Knapp, 215 Lawn Ave., Sellersville, PA 18960, ph. (215) 257-6088.

September 8, 1995: East Texas Herpetological Society's Fifth Annual Herpetology Conference, Educational Exhibition and Breeders' Exhibition and Sale will be held in Houston, Texas. For info, contact: David Doherty at (713) 367-4963, Russ Walker at (409) 594-5554, or Buzz Jehle at (713) 464-6023.

September 9, 1995: Southeast Ohio Captive-Bred Reptile Show will be held in Athens, Ohio. For info, contact: Scott Marsh, The Southeastern Ohio Society of Herpetologists, 042 Irvine Hall, Ohio University, Athens, OH 45701, ph. (614) 592-4372.

September 16-17, 1995: Mid-Atlantic Reptile Show will be held in Baltimore, Maryland. For info, contact: Tim Hoen, The Maryland Herpetological Society, 2643 N. Charles St., Baltimore, MD 21218-4590, ph. (410) 557-6879 or 235-6116.

September 16, 1995: The Turtle and Tortoise Club of Florida, Inc.'s second annual show will be held in Orlando, Florida. For info, contact: Ed Hughes, PO Box 239, Sanford, FL 32772-0239, ph. (407) 322-9332 after 5:00 P.M.

September 29, 1995: H.H. Backer Associates Inc.'s Twentyninth Annual Pet Industry Christmas Trade Show will be held in Rosemont, Illinois. For info, contact: H.H. Backer Associates Inc., 20 E Jackson Blvd. Ste. 200, Chicago, IL 60604.

September 30-October 1, 1995: International Reptile Breeders Convention will be held in San Diego, California. For info, contact: Ray Busby, IRBA, P.O. Box 85152-279, San Diego, CA 92186, ph. (800) 497-3550 or fax (619) 263-6898.

September 30-October 1, 1995: First Annual Florida International Reptile Show will be held in Tampa, Florida. For info, contact: Doug Wagner, Suncoast Herp. Society, P.O. Box 2725, Dunedin, FL 34697, ph. (813) 736-1368.

October 8, 1995: Northern Ohio Association of Herpetologists (NOAH) Reptile and Amphibian Showcase will be held in Cleveland, Ohio. For info, Contact: Matt, ph. (418) 433-3639.

October 20-22, 1995: Midwest Herpetological Conference sponsored by the Chicago Herpetological Society will be held in Rosemont, Illinois. For info, contact: Michael Dloogatch, Chicago Herpetological Society, 2001 North Clark St., Chicago, IL 60614.

October 22-28, 1995: The Third Latin American Congress of Ecology will be held at the University of Los Andes, Merida, Venezuela. For info, con-

tact: Dr. Jamie E. Pefaur, Executive Secretary, III CLAE, Fax (58) 74 401286; E-Mail CLAE @ ula.ve.

October 26-29, 1995: The Second Annual Conference Association of Reptile and Amphibian Veterinarians will be held in Sacramento, California. For info, contact: Wilbur Amand, VMD, PO Box 605, 1 Smithbridge Rd., Chester Heights, PA 19017, fax (215) 387-2165.

October 28-29, 1995: Illinois Exotic Pet Showcase will be held in Springfield, Illinois. For info, contact: Vicki Clark, Expo USA, 503 E. Penn Blvd., Woodbury, NJ, ph. (609) 848-3312 or fax (609) 384-6704.

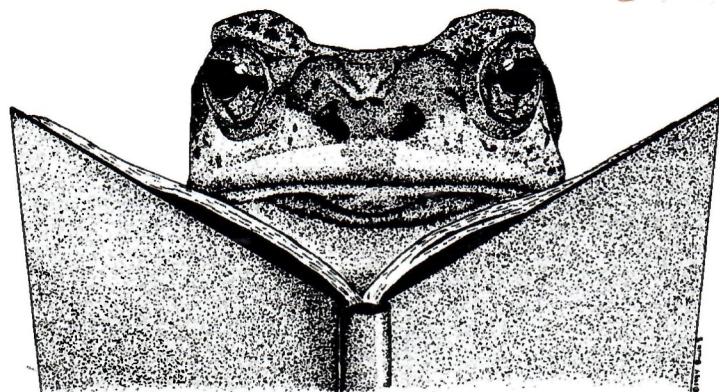
November 2-5, 1995: The Long Island Pet Expo will be held in Long Island, New York. For info, contact: Expositions Inc. ph. (516) 899-6000 or (800) 886-8000.

November 19, 1995: New York Metro Reptile Expo will be held in White Plains, New York. For info, contact: Bruce Lowder, NY Metro Reptile Expo, 256 Second St., Palisades Park, NJ 07650, ph. (201) 461-0770.

November 12, 1995: Reptile Attraction's Annual Reptile and Amphibian Showcase and Sale will be held in Matamoras, Pennsylvania. For info, Contact: (717) 296-5877 or (717) 296-4235.

November 25-26, 1995: Third annual Pennsylvania Exotics & Family Pet Showcase will be held in Port Washington, Pennsylvania. For info, contact: Vicki Clark, Expo USA, 503 E. Penn Blvd., Woodbury, NJ 08096, ph. (609) 848-3312 or fax (609) 384-6704.

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



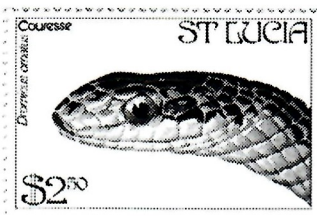
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Advertiser's Index

Advanced Vivarium Systems	33
AFH	25
Arachnomania	40
Bean Farm, the	41
Bibliomania	45
Big Apple Herpetological	41
Breeder's Monthly Journal	46
Burgundy Reptile Traders	49
Bush Herpetological Supply	16
Captive Bred Wildlife	21
Clark, Bob	35
Cornell University Press	16
Critter Corner	24
Crutchfields Reptile Enterprises, Inc.	20
Custom Cages	13
Dunham, Terry	39
Energy Savers, Inc.	55
Exotic Reptile Jungle	44
Fitzgerald, Peter	48
Florida Iguana and Tortoise Breeders ...	41
Glades Herp	51
Gourmet Rodent	25
Hallmark Environments	8
Helix Controls	21
IRBA	15
Jungla Adventures	25
Kahl, Peter	49
Krieger Publishing Company	34
Maryland Herpetology Society	16
Maryland Reptile Farm	44
McElhany, John	15
National Herpetological Alliance	11
Nature's Treasure	33
Nekton USA, Inc.	39
Neodesha Plastics	17
Ocean Nutrition	52, 53
Osborne, Steve	22, 23
RAM	37
Rep-Cal	2
Reptile Attractions	20
Reptile Haven	43
Reptile Resource Inc., the	25
Reptile Specialties	51
San Diego Reptile Breeders	47
Sandfire Dragon Ranch	54
Serpent's Tale Books	11
Sharp, Brian	42
St. Louis Lizard Co.	42
Tetra Terra fauna	56
West Coast Chameleon	43
West Coast Zoological	42

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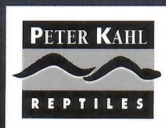
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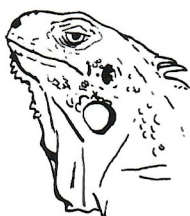


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Undoubtedly, there are few who did not grow up familiar with the age-old story of Pinocchio. As the tale has it, every lie he told caused his nose to grow in length. An even older story tells of a beautiful maiden that kissed a special toad, which then magically turned into a prince. Well, we think we have found a strange story with a mixture of these two tales for you. You see, ages ago, there were very sly toads who told Latin American beauties that if the ladies kissed them, they would transform into handsome princes. Unaware of the toads' trickery at first, kisses were given generously; however, not a single prince appeared. Time and time again the toads told their deceptive lies in order to steal kisses from the maidens. Unaware of their physical changes, the toad's noses began to grow longer and longer as their lies accumulated. Today, these very toads are baffled by their highly unsuccessful

lies and their inability to steal kisses from the ladies. Coincidentally, it has become commonplace for mothers to pass on a special warning to their daughters: should they ever happen upon a toad with the nose of the boy who always lied, remember, neither truth nor prince has ever come from the Pinocchio toad.

Bufo dapsilis was described in 1945 from specimens discovered at the mouth of the Rio Javary, Amazonas, Brazil (Myers and Carvalho, 1945). This amphibian's habits and ecological characteristics are still largely a mystery. In fact, the eggs and tadpoles for the species are presently unknown (Rodr). Its current range is believed to cover the upper Amazon Basin in Brazil, Peru and Ecuador (Frost, 1985). This strange toad is most notable for having a greatly elongated snout for which it is given the common name, the Pinocchio Toad. Male *B. dapsilis* are reported

to attain lengths of 2.6 in (65 mm) while females attain lengths of 3 in (77 mm) (Rodríguez and Duellman, 1994).

The following information was extracted from the descriptive paper by Myers and Carvalho (1945). *Bufo dapsilis* is in the *B. typhonius-ceratophrys* group. This species differs from the other two in that it lacks entirely any bony crests on the head, parotid region, or under the jaw. Poorly developed, rounded ridges are in place of these crests, and are composed of soft flesh and skin. *Bufo dapsilis*'s long proboscis, which the other species lack, is also composed of soft flesh. The fact that almost all of the ridges that occur in the genus *Bufo*, as bone, are present in *B. dapsilis*, but as flesh, is of major importance to the uniqueness of this species as pointed out by Myers and Carvalho. Neither of the describers were aware of any other species of toad, at the time of *B.*

Some notes on the Pinocchio Toad, *Bufo dapsilis*

by Danté Fenolio and Michael Ready

Smooth skin is a key characteristic of *Bufo dapsilis*. Photo by W. W. Lamar.



dapsilis's description, that had this characteristic. The dorsal skin of the Pinocchio Toad is smooth but can be wrinkled whereas *B. typhonius* and *B. ceratophrys* have rough, heavily granulated skin on the dorsum. The only other toad with smooth dorsal skin found sympatrically with *B. dapsilis*, in some regions (i.e., the Iquitos region of Perú), is *B. glaberrimus*, which lacks the fleshy proboscis (Rodríguez and Duellman, 1994). *Bufo dapsilis* can be differentiated from juvenile *B. typhonius*, which also commonly lack cranial crests as juveniles, by comparing the lengths of the fingers. *Bufo dapsilis* has a first finger which is shorter than the second whereas *B. typhonius* has a longer first (inner) finger (Meyers and Carvalho, 1945). Amphibian biologists, however, are not in agreement as to regular differences in toe length for either species.

The tans and browns which comprise the dorsal coloration of *B. dapsilis* are a cryptic feature. When looked down upon, its long nose and triangular head add to its leaf-like appearance. Living within the leaf litter, these toads hide themselves rather well. The amphibians are difficult to discern from the leaf litter, even for those with a trained "search image." The authors hope to learn more about this rare and unique inhabitant of pristine Amazonian rain forest; possibly even collaborating a captive reproduction project.

On a recent expedition into Perú's Upper Amazon Basin, Green Tracks' Bill Lamar and a group of naturalists encountered a series of these toads. The group was making a 100-km hike from the Río Ucayali to the border of Brazil. The toads pictured with this piece are from that expedition. The *Bufo dapsilis* encounter was one of the trip's many highlights as these amphibians are so seldom seen.

Michael Ready and Danté Fenolio would like to thank the following for their assistance photographically and informationally with this piece: Michael Cardwell, Bill Lamar of Green Tracks – naturalist's adventures (1-800-9-MONKEY), Calypso Color Labs in San Jose, California, and Louis Porras of Zooherp Inc.

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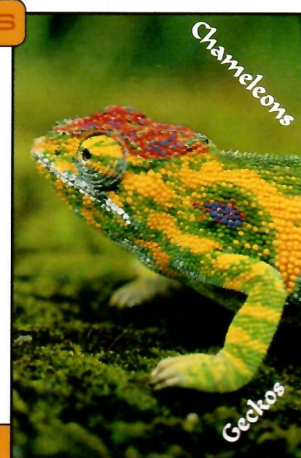
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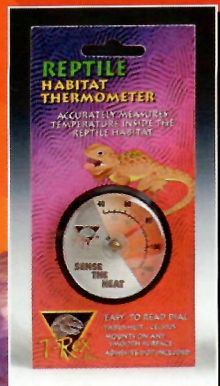
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Caecilians—Continued from page 36

acidic for these amphibians and will greatly irritate their skin. When possible, we recommend shipping caecilians by air freight and picking them up immediately at the airport.

Terrestrial caecilians should be kept in aquaria half filled with soil. The soil should be high in organic content and pH balanced. Commercially available potting mixes seem to work well. Never add peat moss or manure to the soil in their tanks as this will make the soil too acidic. One sign that soil conditions are not proper for the animals is the presence of hemorrhaging on the underside of the specimens. Hemorrhaging will usually be

concentrated around the vent but may cover other areas of the ventral surface as well. Wake (1994) has successfully treated terrestrial caecilians with similar problems by placing them in a clean, plastic box with moist paper towels, leaving crumpled towels for them to hide under, and by adding 10 ml of penicillin-streptomycin solution (Sigma Chemicals). The lack of burrowing is another indicator, as a healthy (normally fossorial) animal should burrow almost immediately. The soil should be moist but not wet. A good rule of thumb is that a hole made by poking your finger into the soil holds its shape but there is no standing water at the bottom. The only exceptions to this rule known to the au-

thors are *Siphonops annulatus* and species of *Scolecophorus*. *Siphonops annulatus* needs to have access to relatively dry soil in order to remain healthy. The best way to achieve this is to house them in a relatively long aquarium, tilting it lengthwise by placing a brick under one end. Water is then added only at the lower end of the tank. This creates a gradient of wet to dry soil from the lower end to higher end. *Siphonops annulatus* kept under such conditions seem to thrive, but they quickly decline if kept in uniformly moist soil. *Scolecophorus* seem to do best on damp (not wet) paper towels with some moist crumpled towels to hide under. The *Scolecophorus* kept by us have shown no interest in making burrows when placed in soil. Instead, they hide under objects on the surface. As with aquatic caecilians, terrestrial species require a tight-fitting lid. A piece of glass cut to fit the top of the aquarium serves this function well. It should be weighted down with a brick as even relatively small caecilians are very strong. Glass is also good in that it keeps the humidity of the air inside the cage high.

After receiving a terrestrial caecilian, it should be placed in its terrarium and carefully observed. A healthy individual will be very firm to the touch when handled and (with the exception of *Siphonops*) very lively. Most species should burrow into the soil immediately after being placed on the surface (Ducey et al., 1993) but as mentioned before, the specimens of *Scolecophorus* kept by us seem to prefer spending time under objects on the surface as opposed to digging burrows. A "happy" animal will spend the vast majority of its time underground or under cover. If your caecilian spends large amounts of time in the open, this is sign of distress. Individuals will lie on the surface when sick, unhappy with the soil conditions, or when bullied by others. The first steps to take if an animal is lying on the surface is to give it a poke with your finger. If it is active but refuses to burrow, it is either "unhappy" with the soil or being bullied. Separate the animal and if this does not remedy the problem, try a different brand of potting soil. If the animal is lethargic, check for other signs of illness. Always wash your hands thoroughly immediately after handling a caecilian as their skin secretions are very noxious. Caecilian slime in your eye or an open cut is an unpleasant experience not soon forgotten. The skin of a healthy caecilian is smooth and moist with no sign of redness or hemorrhaging in the skin. Caecilians have also been seen to develop ulcers on the skin. Recently, the authors have successfully rid a group of *Typhlonectes* of this ailment using strong tropical fish antibiotics. Additionally, one specimen of *Ichthyophis kohtaoensis* survived a bout of

such ulcers and lived for several years afterwards. Caecilians also seem to naturally be infested with nematodes. These are usually not a problem, but seem to gain the upper hand in distressed individuals, causing severe injury to internal organs and even burrowing out the skin. The bumps often felt in the skin of *Typhlonectes natans* may be caused by nematodes.

Individuals of the same species can be housed together, but close observation is required to make sure no bullying is taking place. Fighting can result in obvious physical damage in the form of bite marks. Bite marks have been observed by us in *Epicrionops*, *Ichthyophis*, *Schistometopum*, *Caecilia*, and *Typhlonectes*. Such overt aggression is not necessary to cause problems. When several individuals are housed together, some seem to fare less well than others. This is often remedied by simply separating each individual. Care should be taken to ensure that all of the individuals housed together are thriving and swift action is in order on the first sign of distress.

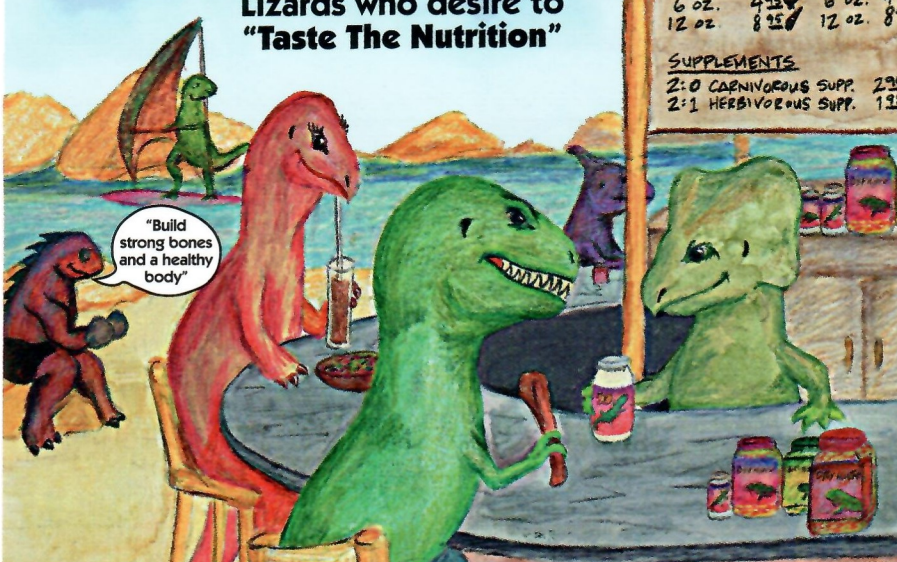
Your caecilian should also have a healthy appetite and should be eating regularly. The African *Boulengerula boulengeri* only eats termites, but all other caecilians that have been kept in captivity seem to relish earthworms. In fact, they seem to do very well on a diet of nothing but earthworms. Some species, such as members of the genus *Caecilia*, will only eat earthworms while others, such *Hypogeophis rostratus*, are opportunists that will readily attack a wide variety of prey. The Central American *Dermophis mexicanus* and South American *Siphonops annulatus* will even eat newborn mice. We recommend experimenting with a variety of food items with any new arrival.

Although there are reports of several species of caecilians being bred in captivity, the only species that has been documented is *Schistometopum thomense*. This is because captive-born individuals have become pregnant and given birth. It is uncertain if caecilians can store sperm or arrest the development of embryos for extended periods, which casts doubt on isolated reports of breeding in imported specimens (e.g., Billo et al., 1985). Several viviparous species have given birth after arriving in captivity including *Typhlonectes natans*, *Typhlonectes compressicaudus*, *Chthonerpeton indistinctum*, *Dermophis mexicanus* and *Schistometopum thomense*. There is a single report of a *Siphonops* laying eggs in captivity, but the eggs did not hatch (Gans, 1961).

Egg clutches of some species have been collected in the wild and successfully hatched in captivity. These include eggs of *Ichthyophis glutinosus* (Breckenridge et al., 1987) and *Grandisonia* (Ron Nussbaum,

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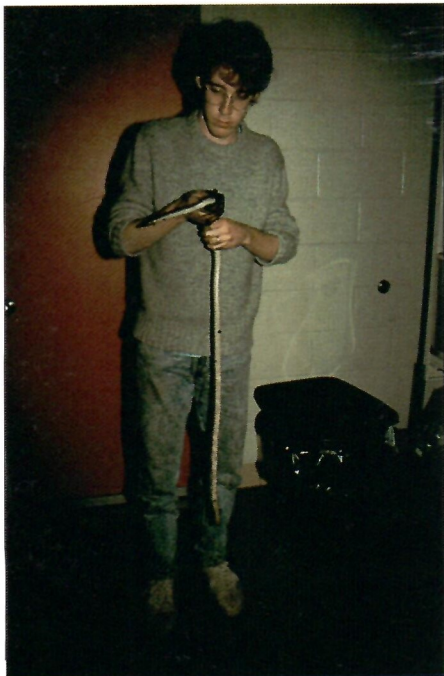
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pers. comm.). The eggs can be kept on wet paper towels in a plastic shoe box and should be rotated on a regular basis. This task is usually performed by the mother and the eggs seem to die if it is not done. The towels also need to be kept very clean. Larvae can be kept in shallow water with unbleached paper towels to hide in. They seem to require active prey such as amphipods to perk their interest in food. Larval *Epicrionops* were trained by us to eat small pieces of earthworm by waving the pieces directly in front of their faces with a pair of forceps. Eventually, they learned to locate earthworm pieces by smell alone. The larval stage may last as long as two years in some species and metamorpho-

sis appears to take at least several days. The head becomes less rounded, the spiracle closes, and the eyes become reduced in size (Breckenridge et al., 1987). If metamorphosis seems imminent, larvae can be moved into a terrarium with a water section at one end. They can then start making burrows and spending less time in the water at their discretion.

Caecilians are certainly a challenge to even the most advanced of amphibian hobbyists. Hopefully, more species will become available for attempts at captive husbandry and reproduction in the future.

The authors would like to thank the following for their assistance with one or a com-



Some species of caecilians (this is a *Caecilia* sp.) attain impressive lengths (this one is 120 cm or 1.2 m) as Jim O'Reilly, depicted in the photo, is 6 ft 2 in tall. Photo by Robyn O'Reilly.

bination of the following: photographs, photographic duplication/manipulation, information, illustrations, acquisition of animals, and computer graphics: Loreé Harvey, Robyn O'Reilly, Ronald A. Nussbaum of the University of Michigan, Dan Boone, Louie Porras of Zooherp Inc., Rob MacInnes of Glades Herp., Art Scott of California Reptile, Bill Lamar of Green Tracks rainforest adventure tours (1-800-9-MONKEY), Dave Rhodes and the Minolta Corporation, Curt Anderson, Calypso Laboratories in Santa Clara, Ca., and Pan Ocean Inc. in Hayward, Ca.

The current address of Jim O'Reilly is Department of Biological Sciences, Northern Arizona University, Flagstaff, AZ 86011-5640.

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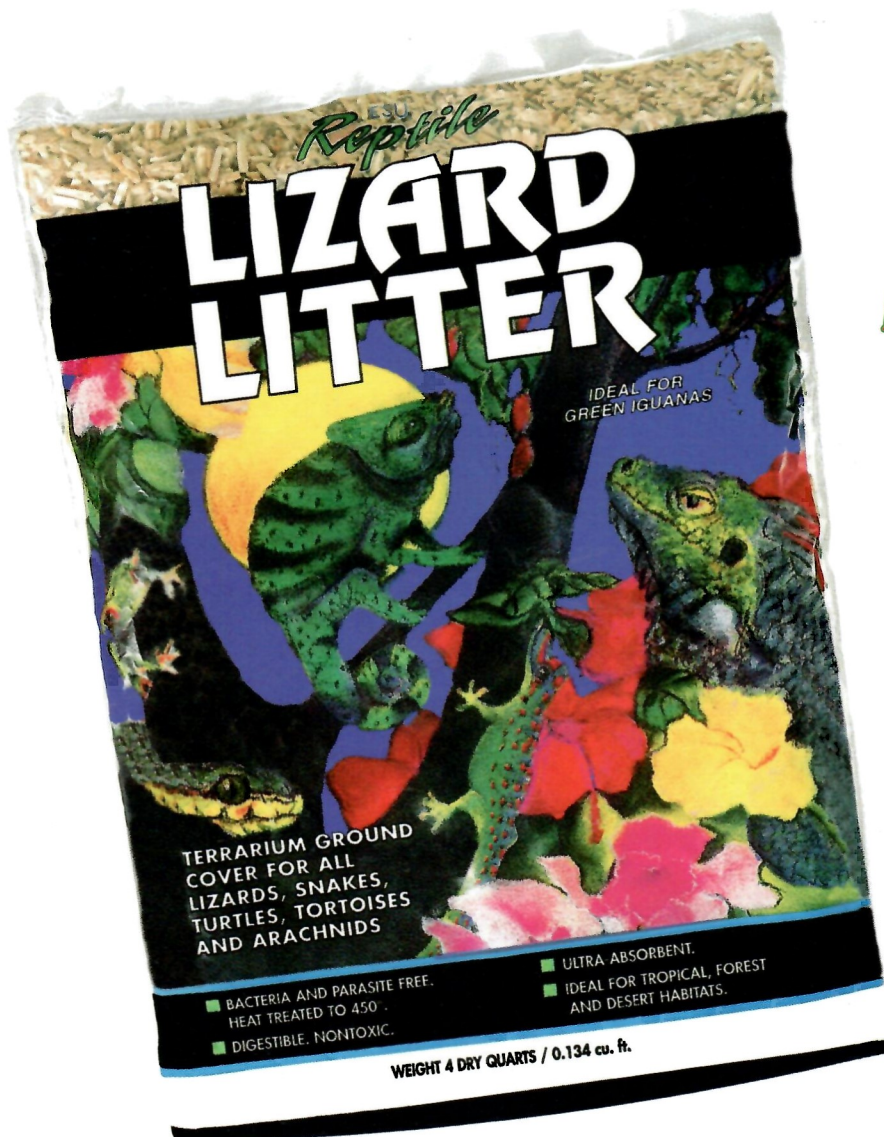
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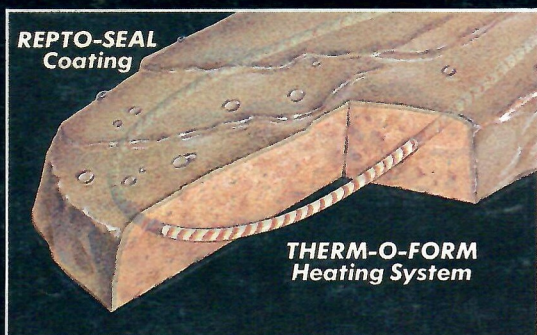
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