Blue Iguana "YOB" (bead tag: yellow-orange-blue), moments after release back into the wild after being fitted with a PIT-tag, bead-tag, and radiotransmitter.

Blue Iguana Update

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Photographs by the author.

"Team Blue 2005," a rotating team of international volunteers, is in the midst of an ambitious field season working with the Blue Iguana Recovery Program on Grand Cayman. As the Grand Cayman Blue Iguanas (*Cyclura lewisi*) reach the peak of the annual mating season, program staff and the Team Blue volunteers are capturing and attaching radio transmitters to wild Blue Iguanas in the deep interior of Grand Cayman's East End, and to 23 captive-bred Blues released in December into the Salina Reserve, a protected area in northeastern Grand Cayman.

The work in the Salina Reserve builds on two months of radio-tracking that commenced immediately after these iguanas were released. At that time, they were still subadults. Now, in May, they have grown to the point that some at least appear to be in breeding condition, and aggressive interactions are driving the males into the rocky shrubland surrounding the small soil patches where we hope the females will nest.

The elusive remnant wild population in the eastern interior is only slowly revealing its secrets to dilligent observers. In previous years, this has been the only known site where unmanaged wild iguanas still appeared to be breeding. Very few individuals seemed to be involved, with possibly only one nest per year — but the nest site(s) and the locations of the breeding adults were completely unknown. This year for the first time in many years, no new young have appeared in this home of the last wild Blues. Most likely, all were drowned in the nest during the floods that accompanied Hurricane Ivan last year.

Team Blue 2005 volunteers (left to right) Ae Nash, Nick Louis, and Lorraine Scotson carrying YOB back to the site of his capture.

BARBARA WATKINS

Male iguana (green-red-blue) receiving a pit tag.

Team Blue members struggled to make the first contact, but in late April eventually managed to trap a young but mature male, who was bead-tagged Green-Red-Blue (GRB), fitted with a radio transmitter, and released. Over the next two weeks, twice-hourly triangulations of his position showed him spending most of his time in six small areas within his large home range, providing the team with indications as to where they should focus their efforts. Using blinds at these locations, two more wild iguanas were first spotted, and then eventually, on 9 May, these also were trapped and radio-tagged. One was a young mature female, laden with eggs, the other a young male scarred from fights, probably with GRB. The female (tagged Green-Green-Red) and the second male (Yellow-Orange-Blue) are now also being tracked by triangulating their radio signals throughout each day, hopefully leading the team to more wild Blues, and to their nesting sites in June.

By the end of June, the Blue Iguana Recovery Program hopes to be incubating eggs from these wild iguana nests, as well as from nests in the Salina Reserve and from the released and captive populations in the QE II Botanic Park.

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Hellshire Blues

Rick Hudson

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Whenever I take someone to the Hellshire Hills in Jamaica to see the iguana field project, I describe the habitat as someplace where they definitely don't want to fall down. The brutally sharp limestone rock, known as karst, can inflict grievous bodily harm to someone unfortunate enough to take a tumble. However, after seven years of trekking around Hellshire without serious injury, I took that tumble in June 2000, when we had gathered a field team to search for new nesting areas. I was wearing a new pair of boots and not at all confident of my stride. Without my "field legs," I predictably stumbled and hit the uncompromising karst with both hands and knees. Deep puncture wounds in the heels of each hand plus some nasty knee injuries kept me laid up in the hammock for a day recuperating and ingesting pain pills and anti-inflammatory drugs. Although it could have been a lot worse, to this day I wear thick leather gloves when traversing the karst of Hellshire. That way, if I feel myself going down, I can at least break my fall with my hands without risking serious injury.

As painful as that day in 2000 was, it absolutely does not compare to the indignity suffered on my recent February 2005 trip. A record (my personal) three iguana bites over three days, combined with walking out of Hellshire in the dark (which can be dicey even in broad daylight), topped off by getting mired past my knees in swamp mud, all resulting in what I consider my roughest trip yet. Maybe not the roughest physically, but certainly the most damaging to my psyche.

The misadventure began at the Hope Zoo in Kingston, home of the Jamaican Iguana headstarting program. We were preparing another cohort of 16 iguanas for repatriation into their native habitat, and I was joined by a veterinary team from the Fort Worth Zoo plus two Ministry of Agriculture veterinarians. During the next three days, we would be conducting pre-release medical screening exams on 22 mid- to adult-sized iguanas to certify them healthy for release. This includes weighing and measuring, collecting blood and cloacal cultures, physical exams, and attaching bead tags for visual identification in the field. My job was to restrain the iguana during much of this process, which is something that I have done so routinely that it has become *second nature* — or so I thought. The first bite on my right thumb from a small female was minor; I covered the wound with a band-aid and we were underway again in no time.

The next day, with our performance under the glare of a graduate biology class from the local University of the West Indies, I sustained my second bite. With a hood over the iguana's head and eyes to relax it, and using a rather cavalier one-handed restraint, I somehow managed to pass my left hand in front of the iguana. With a quick lunge and shake of the head, I had a perfect, U-shaped bite on top of my hand that was bleeding profusely. I took this latest injury in stride and began trying to staunch the flow of blood. The class was amused, except for one student who couldn't handle the sight of blood and had to leave the building. Fortunately, the veterinary team was amply prepared with a range of first-aid supplies, and Veterinary Technician Kim Evans dutifully (again) bandaged my wound. No band-aid was adequate, and, for the rest of that trip, my hand was bound in green veterinary wrap.

However, the clincher came on Friday, 25 February, our first day in Hellshire. With eight pairs of iguanas in hand, we hit the beach at Manatee Bay around noon and set up camp. Around 4 PM, three of us (field biologist Rick Van Veen, Kim, and me) decided to make the trek to South Camp to release a few males. We tend to release males in a somewhat random manner in order to disperse them in hopes of reducing conflicts. In contrast, females are always released at one of two primary nesting sites so that they have an opportunity to imprint on the

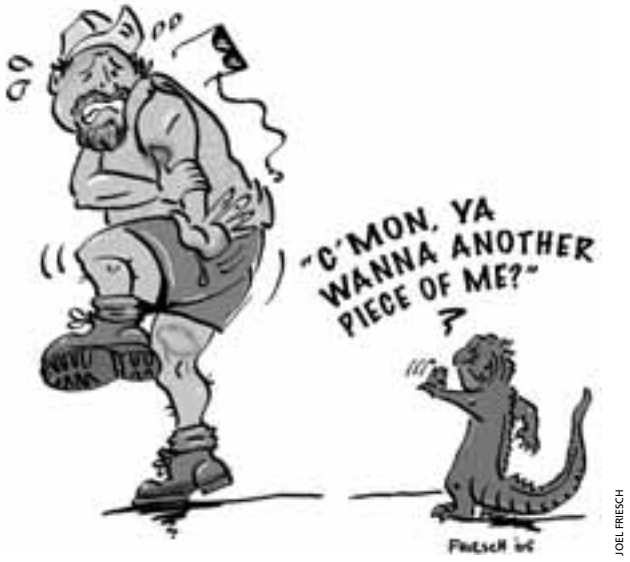
KIM EVANS

This iguana bite would later seem insignificant, but only two hours later we were mired deep in the mud and muck of a "dried-up" salina. The word "salina" means swamp, but is designed to avoid a sense of dread. Don't be fooled; if you hear this word, and it involves your walking through it, be very afraid.

KIM EVANS

Nothing is capable of consoling a person who has just emerged, iguana-bitten, beaten down, and exhausted from a night of wandering in a swamp — but an ice-cold Red Stripe was about as welcome a sight as any I could have imagined. Now that's proper planning!

area in case this becomes important later. So, with the sun low in the sky, and with the full realization that it would begin setting in two hours, we began our ascent into Hellshire. To lighten my load, I had removed most non-essential field gear — including a headlamp that had to weigh all of eight ounces. What a relief that was! After reaching South Camp, we caught our breath, had a drink of water, and started unbagging the males for release. These were all large adult males, well within breeding size. Whether it was a lapse in judgment, carelessness, or just a slip of my hand, I somehow managed to allow one of these big boys to clamp on to my right thigh, way too high for comfort. To make things worse, he didn't just lunge and bite, he held on with a tenacity that I thought was reserved for wolverines and alligator snappers. Registering pain beyond anything iguana-related I had previously experienced, and with blood streaming down my leg into my boot, I issued an expletive-laced cry for help. Rick was quick to respond, but not in the way that I had expected: between bouts of wicked laughter and mumbling about not having batteries for his flash, Mr. Van Veen (formerly known as my favorite Aussie) searched for his camera. He couldn't resist the urge to catch the famous iguana man in such a compromising situation. Kim busied herself finding the first-aid kit, and extracted some cotton balls and a few band-aids. Fully expecting a gaping flesh wound in need of suturing, I thought to myself "that ain't gonna cut it, honey; you better look for some #2 cat gut." Rick had finally managed to stifle his laughter and began the task of trying to extricate the iguana that was so intimately involved with my upper thigh. Each attempt to loosen the jaws would produce another chomp and another surge of intense pain. With Kim working the back and Rick the head, he finally managed to pry the jaws loose. First aid included application of some primitive foul-smelling wound dressing that Rick had in camp (I remember something like Dr. Percival's bitterroot swamp tonic) followed by an elastic bandage. With this unexpected event taking up valuable time and the sun quickly setting, we released the four males and began heading back to camp. Only halfway there and visibility was already extremely poor; three-fourths of the way and the three of us had to hold hands to stay in contact as we maneuvered the rocky trail. I lamented not bringing my headlamp, to which Rick replied: "If I'd thought of it, mate, I could have brought one from South Camp." Although I wasn't sure what an aneurysm felt like, I was pretty sure I was about to add that to my list of the day's maladies. My only comment to Rick was that killing his primary sponsor and #1 champion for his project was not a good career advancement strategy.



JOEL FRIESCH

When we finally reached a point where continuing on the trail was becoming hazardous, and facing a final stretch to the beach that meant stepping from one large boulder to the next, we opted to walk through the "dry" salina. With no tree canopy to block the new moon, the salina was better lit but no more hospitable. Kim and Rick would leave shallower footprints than my 210-pound bulk, but they were already sinking to their ankles. Not long thereafter, I punched through and began sinking. Once the mud goes past your knees, any hope of an unassisted escape is gone, and, on at least three occasions, I had to be unceremoniously extracted from the swamp (I'll never call it a salina again) — only to take a few steps and sink again. Something about crawling helplessly in the mud is very humbling — and I can say with absolute certainty that I never want to feel that humble again.

HUSBANDRY

Captive Care of *Uromastyx*[1]

Thomas Wilms

Bad Dürkheim, Germany

Photographs by the author except where noted.

Recommendations for Purchase and Acclimation

Ideally, one should acquire captive-bred animals directly from a breeder. These animals are already accustomed to humans and tend to be free of pathogens. Most breeders also are willing to provide helpful advice on how to care for young *Uromastyx* and continuing support should any problems arise later. In contrast, wild-caught animals are usually highly stressed by capture, transport, and handling by retailers. They often are suffering from illness, parasites, and dehydration. Sick animals often have sunken eyes, jutting pelvic bones, muscle wasting of the tail and extremities, and poor color. However, regardless of the source from which the *Uromastyx* is purchased, the following ground rules should be followed:

1. The *Uromastyx* should be alert, moving normally, and interested in proffered food. Newly imported *Uromastyx* display obvious defensive reactions when handled. Obviously "tame" behavior in a recent import is an indication of possible illness. Missing toes and tail tips are usually not a problem; however, any injuries should be well healed.
2. The animals should not have any signs of infection, abscesses, or burns on their bodies, extremities, or tails. Special attention should be paid to skin folds. Mites are known to inhabit skin folds of the neck and limb insertions as well as the areas around the eyes and in ear openings. Limbs should not exhibit any swelling. *Uromastyx* tend to have shedding problems, particularly on the spiky scales of the tail. No old skin layers should be present anywhere on the body.
3. The mucous membranes of the mouth should not exhibit any injuries, crusting, or infection. Under no circumstances should any parasites be visible in the mouth and the breath should not smell unpleasant.
4. Eyes should be clear. Nasal openings should be dry and without mucus discharge. Nasal glands may produce a watery salt solution, which, when dry, forms a white salty crust around the nasal openings.
5. The animal should appear properly nourished. The base of the tail should not be concave and pelvic bones should not be obvious.
6. Breathing should not be labored. Any whistling, coughing, or sneezing can be an early sign of illness. Note, however, that even healthy *Uromastyx* will sneeze occasionally to expel excess salts (see point 4 above).

An important first aid measure for animals with sunken eyes, jutting pelvic bones, muscle wasting, and poor color is rehydration. A daily dose of 20–30 ml of a physiological electrolyte solution (e.g., Pedialyte® or Gatorade®) per kg body weight should be administered orally. Opening the animal's mouth may present difficulties. Under no circumstances should it be forced. If oral administration is not successful, the alternative is to have a veterinarian inject subcutaneously (under the skin) a sterile electrolyte solution. If the animal refuses food for an extended period of time, an easily absorbed formula such as Critical Care® or Ensure® with added fiber can be administered orally (50 cc/kg body weight daily, divided into three to four meals spread out over the course of the day). Sustained force-feeding can lead to further problems; any animal that does not start eating independently within a day or two should be seen by a qualified reptile veterinarian.

[1] Translated and adapted by AJ Gutman from T. Wilms, *Uromastyx: Natural History – Captive Care – Breeding*. Herpeton Verlag, Offenbach, Germany.

JOHN BINNS

A healthy seven year old *U. acanthinurus* female receives regular exposure to natural sunlight, weather permitting.

Regardless of origin, a newly acquired *Uromastyx* should be quarantined for 6–8 weeks in an easily cleaned habitat. Even though the quarantine habitat is only temporary, the various psychological and physiological needs of the animals must still be met. Temperature must be properly regulated and hiding places provided so that the animals feel secure. During the quarantine period, stool samples should be taken repeatedly and checked for parasites. These should also be cultured for amoebas. A sick *Uromastyx* should always be seen by an experienced reptile veterinarian; self-treatment is not recommended.

The minimum terrarium dimensions for a pair of *Uromastyx* are 5 x 4 x 3 (L x W x H) times the snout-vent length (SVL) of the animals. Thus, for an SVL of 25 cm, the minimum dimensions would be 125 x 100 x 75 cm. In my opinion, these dimensions represent an absolute minimum, but other parameters also play a significant role in providing species-specific care for *Uromastyx*. These considerations include: population density, social structure, terrarium setup, climate, lighting, and nutrition.

Population Density and Social Structure

Adult male *Uromastyx* are territorial and intolerant of sexually mature males of the same species. Adult males should never be kept in the same terrarium. Even females, especially when gravid, can be highly intolerant of each other. *Uromastyx* are best kept in pairs. In many instances, a lower ranking animal will become so stressed by the mere presence of a dominant animal that it will refuse food and cease to exhibit any normal activity. These animals grow slowly, if at all, and are susceptible to bacterial and parasitic infections. Eventually, fights will break out, which, within the confines of a terrarium, can result in damage. Injuries from bites to the toes, tail, and flanks as well as broken extremities can be largely avoided by keeping animals in pairs. Aggression between males and females is much less common. If this occurs, the animals should be placed with different partners. Occasionally, some individuals will display consistently high levels of aggression and must be kept by themselves. In smaller terraria with a high population density, fighting and biting among all species is inevitable. Animals in very small terraria with very high population densities demonstrate virtually no natural behavior. They are unable to claim any territory and give the external appearance of being compatible and "tame." In the past, this has led to the belief that *Uromastyx* are social creatures, which should be kept in groups. However, such animal husbandry does not conform to the biology of the animals and is strongly discouraged. Juveniles should never be kept with adults!

In principle, keeping *Uromastyx* with other species with similar ecological requirements is possible, if enough space is provided. Some examples of suitable species are the Hardun and relatives (*Laudakia* sp.), Fringe-fingered Lizards (*Acanthodactylus* sp.), and Middle Eastern Agamids (*Trapelus* sp.). Keeping different species of *Uromastyx* together is not advisable. The behavioral repertoire of the various species is so similar that crossbreeding between species can occur. Crosses between *U. aegyptia* males and *U. acanthinura* females as well as between *U. acanthinura* and *U. dispar maliensis* are known. Hybridization within a genus is possible; however, to date, hybrids between *U. acanthinura* and *U. dispar maliensis* are known only from captive breeding situations.

Setting Up the Terrarium

Commercially available glass terraria can be used for keeping young *Uromastyx* or species that remain small. However, these do not provide sufficient space to house adult animals of most species. In general, a *Uromastyx* terrarium must be custom built. Laminated wood or plastic boards can be used in combination with glass. Even when used for a desert habitat, wood should be sealed against moisture. Any materials used inside the habitat should be as durable as possible. Large knotted branches as well as natural or artificial rocks are suitable.

The habitat should be structured to provide visual barriers for the animals. Natural or artificial rock can be used to create caves and tunnels. A hide-box can be used or the habitat can be set up with a double floor. As a safety precaution, any cave or hide-box should be high enough that the animal's back will touch the roof when reclining conventionally. The interior should also be large enough for the animal to turn around comfortably. All stone structures should be securely attached, although caves and tunnels should be accessible to the caretaker at all times.

With a little crafting skill, you will be able to create your own artificial rock. A technique that works well for this type of

Healthy male *Uromastyx acanthinura nigriventris.*

Combat between a pair of male *Uromastyx acanthinura nigriventris*.

Juveniles, such as this *Uromastyx dispar dispar*, should be raised separately from adults.

application involves gluing sheets of styrofoam to the back and/or side walls of the terrarium. These can then be modeled to form hiding places and caves. The resulting styrofoam "rockscape" can then be plastered with modeling cement. While still soft, the cement can be colored by stirring in readily available paint emulsions. To avoid cracks, I use a preservative coating, which leaves the cement far more durable and resistant to crumbling. The surface of the cement can also be modeled with a brush while it is still wet and subsequently strewn with sand. Once dried, this produces a hard surface with plenty of traction for the animals. In my opinion, an external coating of epoxy is not necessary in a dry terrarium.

Hiding places allow the animals to fulfill their need for concealment. Without an appropriate retreat, a *Uromastyx* will feel insecure and react to even the slightest disturbance with hectic flight. Wild caught individuals are much more difficult to acclimate without a secure hiding place. Natural sand mixed with clay makes the best substrate. Pure quartz sand is not suitable. A depth of about 5–6 cm of substrate is sufficient if artificial caves and tunnels are present. If you are not using prefabricated caves and tunnels, the animals should have the opportunity to create their own. This requires a substrate at least 25 cm deep and in which they can dig.

Aside from housing *Uromastyx* in a conventional terrarium, they can be maintained in a heated green house, which could provide the animals with nearly optimal light and heating conditions. An open terrarium can be built on a podium approximately 80 cm high. The glass surfaces of the green house should be made of Plexiglas panels which are UV-penetrable.

Climate

The two most important climate parameters for keeping *Uromastyx* are temperature and light intensity that approximate natural seasonal fluctuations. The ambient temperature during the animals' activity period during the day should be from 28–40 °C, in exceptional cases to 45 °C, and from 18–20 °C at night. Basking spots with a localized temperature of 50–60 °C should also be provided. Heating for these basking areas is best provided by radiant heat sources. Emitters should provide both heat and light in the visible spectrum. Pure heat emitters, such as infrared lights or "hot rocks" are not appropriate. *Uromastyx* are heliophilic (sun-loving) and associate warmth with light. "Dark" basking spots do not meet the physiological requirements of the animals. In my experience, many *Uromastyx* species are better kept too cold than too warm.

For appropriate maintenance of species such as *U. aegyptia, U. acanthinura*, and *U. hardwickii,* a brumation period at reduced temperatures is necessary. In the wild, these species can be seen outside their burrows during warmer weather. A brumation period in the terrarium is introduced by a gradual low-

Gravid female *Uromastyx thomasi* in front of her retreat.

Part of the author's terrarium setup devoted to *Uromastyx*.

ering of temperature to 15–20 °C and a reduction in photoperiod and lighting intensity. Throughout the brumation, the animals should have the opportunity to warm themselves to preferred temperatures under a heat emitter. This heat source should be in operation for about 6–8 hours, and the remaining lighting should be operational for about 10 hours per day. If maintained in a greenhouse, species requiring a brumation period should be kept at a temperature of at least 15°C. On sunny winter days, the air temperature can reach values over 20 °C through sun exposure. Also in a greenhouse situation, depending on the weather, heat emitters should be in operation for 6–8 hours a day from mid-September until the end of March.

In the terrarium, the duration of the brumation period is 2–4 months for *U. acanthinura*, 3–4 months for *U. aegyptia*, and 4 months for *U. hardwickii*. For species with no significant annual temperature fluctuation, a slight reduction in temperature during the winter is sufficient. For *U. dispar*, *U. thomasi*, and *U. ornata*, experience has shown that a maximum temperature reduction of 5–10 °C is sufficient to encourage reproduction. Other species in this category include *U. princeps, U. benti, U. ocellata*, and *U. macfadyeni*. When maintained in a greenhouse, even winter temperatures must correspond to natural conditions within the range of each species. In addition, lighting must be provided in the terrarium.

Although *Uromastyx* are acclimated to life in desert and semi-desert regions, a minimum of humidity is necessary to maintain them in captivity. In the wild, the animals will spend a significant portion of the day in their burrows, where the moisture content of the air and the surrounding ground is somewhat higher than that on the surface. The humidity requirements also differ according to species. Species originating in extremely arid inland deserts are considerably more tolerant of dryness than species from coastal mountains. Climate tables for each species' point of origin should be consulted. An occasional misting can increase the humidity within the terrarium; juveniles should be provided with a water dish. However, water build-up in the terrarium should be avoided, as this is a known cause of many of the skin diseases that occur in various species of *Uromastyx*.

Lighting Conditions

Lighting in the terrarium should vary seasonally and correspond with the length of the natural photoperiod. In general, a duration of 12–14 hours of light per day in the summer and 8–10 hours per day in winter is beneficial. Fluorescent tubes, mercury vapor lamps, and metal halogen lamps are all suitable for illuminating the terrarium. In a terrarium of up to 65 cm in height, the desired lighting intensity (without heat emitters!) should be about 100–120 W/m^2. In principle, a *Uromastyx* terrarium can never have too much lighting, and it tends to be limited only by financial constraints.

The use of appropriate UV lighting is critical for maintaining *Uromastyx* species. Apart from critical UV rays, the heavy illumination will also positively affect the activity levels and overall well-being of the animals. The distance between the light and the animal will vary depending on the lighting products used; however, the animals must be able to withdraw from proximity to the light if they become overheated. Mercury vapor bulbs such as T Rex's UVHeat and Zoomed's Powersun UV can be operated all day long to provide both heat and ultraviolet light. Specially designed fluorescent tubes also can be used to provide UV (e.g., Zoomed 5.0 Reptisun). In order for these tubes to be

Retreats are important for providing humidity. This *U. acanthinura* guards the entrance to her self-excavated below-ground retreat (bottom left of photo).

Lighting in a terrarium for *Uromastyx* should be fairly intense.

effective for desert reptiles, the animals must be in fairly close proximity to the bulbs. In my opinion, the bulbs should be installed in the terrarium so that they are no more than 20 cm above the basking sites.

Nutrition

A well-balanced and varied diet is critical for maintaining and breeding *Uromastyx*. The species of this genus are omnivorous, with plant matter making up the largest dietary component. Juveniles often prefer animal nutrition; e.g., the diet of juvenile *U. acanthinura* in the wild consists of approximately 75% animal source components. Remnants of tenebrionid and carabid beetles, ants, and grasshopper larvae have been found in the stomachs of young *U. aegyptia*, but animal materials constitute only 1–2% of the total food intake in these lizards.

Plant matter should be offered daily, but with one or two fast days per week. In the winter, escarole, collard greens, romaine, and other leafy greens are available as well as parsley, grated carrots, and sprouted mung beans, lentils, wheat, sunflowers, and other seeds. During the growing season, a wide variety of wild plants should be fed. Apart from common Dandelions (*Taraxacum officinale*), Narrow- and Wideleaf Plantain (*Plantago lanceolata* and *P. major*), as well as several clover species (*Lotus* sp. and *Trifolium* sp.) are eagerly consumed. Both the plumed leaves and the flowers of vetches (*Vicia* sp.) are prized, as are the leaves and flowers of Robinia (*Robinia pseudoacacia*). The animals can also be offered composites (including Hawkweed, *Hieracium* sp.; Goatsfoot, (*Senecio* sp.; various Dandelion species, *Leontodon* sp.), convolvules (including Bindweed, *Convolvulus sepium* and *C. arvensis*), and carnations (including Chickweed, *Stellaria media*). Other appropriate food plants are daisies, alfalfa, coltsfoot, borage, dill, chervil, lovage, rosemary, sage, sorrel, and lemon balm. Various species of grasses and their seeds also may be offered.

Uromastyx also should be provided with a mixture of dried seeds and beans made up of green and red lentils, small grain corn, small green peas, barley, wheat, soybeans, vetch, oats, rice, hemp, mung beans, sunflower seeds, buckwheat, and millet. This dry food mixture should be constantly available.

Fruits are rarely or only occasionally consumed and should generally not be included in the menu. Food plants can be fed whole or chopped into smaller pieces and strewn on the bottom of the terrarium. Food remnants can actually be left in the terrarium, as the animals often prefer dried leaves to fresh ones. In this case, you do need to be careful to avoid the development of rot or fungus.

Apart from this vegetable matter, *Uromastyx* can be fed various insects such as cockroaches, grasshoppers, wax worms, crickets, beetle larvae, etc. Juveniles can be fed insects 4–7 times per week, whereas adults should only receive them once or twice a week.

The composition of the diet should vary throughout the year. In the wild, certain foods are accessible only at certain times of year. Due to the meager and highly seasonal precipitation in their natural habitat, fresh plant material in the form of herbaceous annuals (so-called therophytes) is usually available for only a short time. Most of the time, *Uromastyx* survive on the few perennials plus seeds. In captivity, the dietary proportion of wild plants and sprouts can be increased either following brumation or in the spring for species without a clearly defined seasonal rhythm. At this time, the proportion of animal-based foods in the diet can be increased. Females in particular have an increased protein requirement in order to produce eggs. During mid-summer, the dietary proportion of seeds can be increased. Through seasonal changes in dietary composition and climate regulation, the animals are further encouraged to maintain their natural annual rhythm. During brumation, very little food is consumed. However, fresh drinking water must be available during this period.

To ensure that vitamin and mineral requirements are properly met, various supplements can be used. Combined vitamin and mineral preparations (e.g., Miner-al™, Nekton Rep™, Rep-cal™, etc.) can be used to dust food insects. However, an appropriate mineral supplement should also be mixed in with seeds. Certain preparations can easily be sprinkled on plant food, while others produce a slimy, foul-smelling film and should not be offered to this species in this manner. Fluid vitamin preparations should be administered to each animal individually.

Sprouted seeds make an excellent addition to the diet of this female *U. ocellata*.

Juvenile *Uromastyx thomasi* at the age of six months.

Unfortunately, no guidelines for vitamin dosages are available for *Uromastyx*.

Life Expectancy

To date, little information is available on the life expectancy of *Uromastyx* species. Due to the relatively late onset of sexual maturity in many species (*U. acanthinura* at 4–5 years of age, in *U. aegyptia* at 4–6 years), a certain longevity is expected. So far, the shortest time span to onset of sexual maturity in a *Uromastyx* species is 11–18 months (*U. ornata*).

Life spans have been recorded for *U. aegyptia* (15 years, 4 months), *U. acanthinura* (11 years, 5 months), and *U. ocellata* (3 years, 9 months), and all individuals were still alive at the time of the report. I had a *U. benti* that was imported as an adult that survived for 7 years and a female *U. ornata*, also an adult import, that is still alive after 10 years. A *U. asmussi* that was captured as an adult on 9 April 1954 lived until 23 October 1960, and a *U. acanthinura* survived for 13.5 years in captivity. That this is considerably less than the maximum life expectancy for species of *Uromastyx* is demonstrated by a *U. acanthinura* that was kept for 22 years. This particular animal, which was imported as a subadult, remained in the best of health when the report was made. Yet another *U. acanthinura*, imported as an adult in 1973, survived until 1995.

The presumed longevity record within the genus is held by a *U. aegyptia* living in the wild in Israel. The age of this animal was estimated to be at least 33 years. The animal was captured on 15 June 1980, measured and marked, and recaptured on 19 March 1994. The total length during these 13 years and 88 days increased from 4.3 cm to 74.3 cm. The age estimate is based largely on the calculated growth rate.

Acknowledgments

A. A. Schmidt (pers. comm. 1995) provided longevity records; D. Dix (pers. comm. 1999) provided information on hybrids between *Uromastyx acanthinura* and *U. dispar maliensis* in captive breeding situations; and H. Leslie (pers. comm. 2000) informed me of the onset of sexual maturity in *U. ornata*.

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