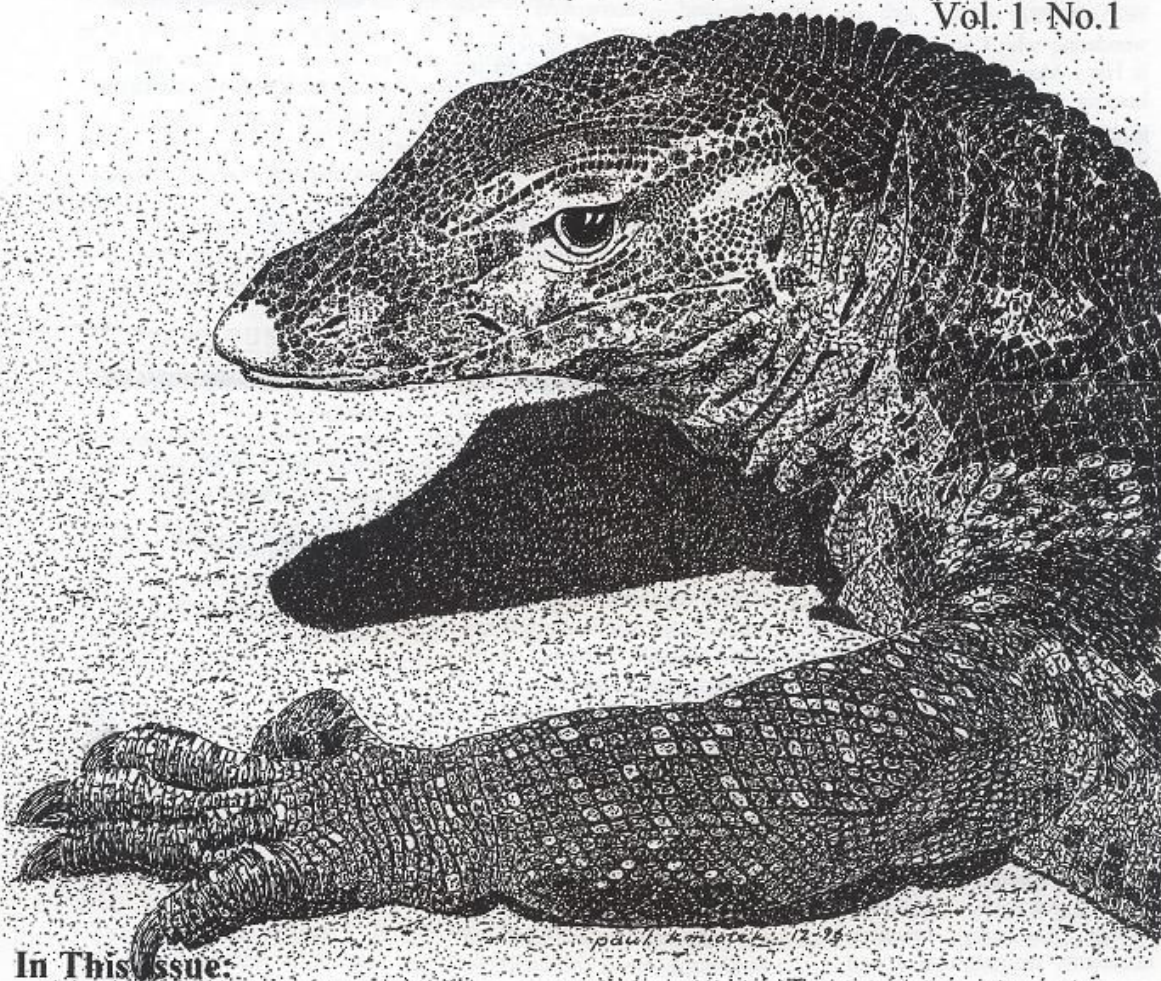


The Varanid Society Proudly Presents:

VARANIDS

A Newsletter Dedicated to the Advancement of Monitor Research
Vol. 1 No.1



In This Issue:

Black Tree Monitors

Monitor Husbandry & Medical Problems

The Editor's Desk

By: Hany Morsi

Dear Friends,

I am very pleased to present to you the inaugural issue of "Varanids", the newsletter dedicated to the advancement of monitor research. For those of you wondering who I am, my name is Hany Morsi and I have been keeping monitors for a number of years. I personally feel that they are magnificent creatures and I wanted to help spread as much information about them as I could.

I first came up with the idea to publish a newsletter about a year ago. I felt there was a void in the amount of information being published about varanids. Feeling a little frustrated about the lack of information I decided to publish my own publication with the goal of being an information source for both the public and private sector. It's my hope that the newsletter will grow in both readership and quality. The format will remain basically the same, with a few minor changes here and there. There will always be a "Monitoring the World" section which will cover any little bits of information that comes my way. We will have articles covering all aspects about varanids including biology, husbandry, breeding, taxonomy, natural history and conservation. We will also always have a classified section, for those interested in advertising. We hope to add a

book review section, a section with translations of some foreign articles, a letters to the editor section and we also hope to add photographs. This publication will be as good as the readership allows us to be. Obviously, the more subscribers we have the more we can use our resources to make "VARANIDS" better.

We are always looking for people to contribute their thoughts, findings and ideas to us. There are a number of ways people can contribute. Original articles are always welcome as well as bits of news or ideas of how we can better the publication.

There are many people that helped make this publication possible. First of all, I would like to thank my parents, who always supported my interest in herps. Then there is entire Bronx Zoo Reptile House staff. Without their support most of this would not be possible. I would also like to give a special thanks to Mark K. Bayless who pushed me to start this publication as well as Danny Gorman, Jimmy Gorman, Sam Lee, Paul Kmiotek, Bill Holmstrom, Quetzal Dwyer, and last but definitely not least Jim McDougal. He is the backbone of this publication and I appreciate his help a lot. Thanks Jim.

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Monitoring the World

Das Adder ?

One of the more unusual fables surrounding varanids comes from Africa. K.P. Shuker (Shuker, 1996) describes the 'das adder', a creature that an animal with a hyrax-like head and the sinuous body of a viper-like snake. Hyraxes are small, rabbit-like mammals, also known as 'coney's or dassies'. Dr. Andrew Smith of the Cape Town Museum suggested that the Rock Leguaan (*Varanus albigularis*) rather than the Hyrax might be the 'das-adder'. Dr. F.W. Fitzsimons noted that *V. albigularis* could be mistaken for the adder when slipping between the rocks. Hyrax, rock leguaans and adders can be found living very close to one another in rocky regions throughout east and south Africa.

"Mysterious World"

In Arthur C. Clarke's film series "Mysterious World" Volume 1, is a film segment reporting and depicting a very large terrestrial varanid walking along the shores of the Fly River in Papua New Guinea. The only large indigenous varanid known to Papua New Guinea is the crocodile monitor (*V. salvadorii*). The argus monitor (*V. gouldi horni*) attains a length of four to five feet. Let us know what you think of this segment, and your thoughts regarding this specimen. This series can be found at many Blockbuster video stores.

Salmonella

In recent months, daily newspapers have been reporting case of *Salmonella* in people in close contact with varanids. There are a few steps one can take to avoid getting this bacteria. *Salmonella* can be found in common items, including meat, chicken, pigs, dogs, eggs, flies, rats, mice, hamsters, cockroaches, and reptiles. People can become infected in a number of different ways but the most common are by ingesting uncooked or undercooked meat and eggs and by not properly washing their hands after handling reptiles. As a precaution, people

should wash their hands with anti-bacterial soap, or other kind of disinfectant. By following this simple procedure, the chances of transmitting, and/or contracting these bacteria, is greatly reduced. For more information on this subject, contact your physician.

Increases in Breeding

During 1996, several species of varanids were reproduced in captivity. They include the white-throat monitor (*V. albigularis*); mangrove monitor (*V. indicus*); black tree monitor (*V. beccarii*); green tree monitor (*V. prasinus*); bengal monitor (*V. bengalensis*); and the argus monitor (*V. gouldi horni*). Also, egg deposition in the peach-throat monitor (*V. jobiensis*) and the canopy goanna (*V. teriae*) have been reported for the first time! Thanks to the persons who shared their varanid successes with me (R. Williams, D. Durham, R. St. Pierre, B. Speer, B. Eidenmuller, D. Gorman, J. Emberton, Q. Dwyer and S. Irwin).

More Monitor Books

Literature about monitors seems to be on the rise. There is a German and English edition of D. Bennett's book, "A Little Book of Monitor Lizards" (1996) currently being published in Germany, and is forthcoming. 'Rumor' has it that a varanid herpetoculturist is soon-to-publish a book on breeding these animals in captivity. A second edition of "Goanna" by D. King and B. Green is available. Furthermore, a second edition of "Savannah Monitor" by M. Balsai should currently be available. A book on *V. salvator* and S.E. Asian varanids by M.K. Bayless and J. Adragna is nearing first-draft reviews, and the authors hope to make this book available to readers in 1997. Anyone interested in contributing please write to M.K. Bayless.

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Comments on Husbandry and Medical Problems In Captive Varanids

By: Donal Boyer, Associate Curator of Reptiles and Amphibians, Zoological Society of San Diego
and Thomas H. Boyer, DVM.

Introduction

Currently there are approximately 42 recognized species of monitor lizards in the family Varanidae. The number of species varies among taxonomists as varanid systematics are currently in flux. Several new species of monitor have been described in recent years such as *Varanus baritji* (King and Horner, 1987), *V. yemensis* (Bohme, et al, 1989), and *V. teriae* (Sprackland, 1991) and new species are still likely to be described. Monitors are restricted to the Old World occurring in Africa, the Middle East, southern Asia and the Indo-Australian archipelago. Australia was the center of evolution and approximately two-thirds of the species occur there. Monitors are oviparous and largely terrestrial although a few species are arboreal or semi-aquatic (distinguishable by their more laterally compressed tails). There are little to no external differences between sexes. Monitors are diurnal, insectivorous and carnivorous.

Monitors are widely held in captivity, both in zoos and private collections. More than half of all varanid species have reproduced in captivity. However, with the exception of a few species, consistent reproduction remains low. Smaller monitor species reproduce more readily in captivity (Hom and Visser 1989). Mortality is high among imports, Stanfill (1995) reported 35% mortality of Asian forest monitors within the first 90 days of zoo acquisition. Once established monitors adjust well to captivity. Poor overall reproductive success and high mortality of imports are probably due to a variety of related husbandry problems, such as inadequate cage set up, lighting, diet, social grouping, heavy parasitic burdens and lack of environmental triggers for reproduction. These problems are further compounded

by failure to detect health problems and provide adequate veterinary care. None-the-less there is growing success, in terms sustained reproduction and better longevity, among zoos and private collectors. This paper will focus on typical husbandry and medical problems associated with varanids in captivity.

Husbandry

Housing - As with most reptiles an understanding of a species natural history (terrestrial, arboreal, semi-aquatic, etc.) is essential for successful

captive maintenance and cage design. Have an enclosure prepared and ready for the specimen to avoid potentially stressful and dangerous delays. As wild monitors are often nervous and flighty, the enclosure should have adequate hide areas, such as boxes, cork bark tubes or slabs, for security. The viewing windows may need to be temporarily covered with paper to provide more security. Screening along the sides is not recommended as monitors spend a lot of time climbing on it and can cut their toes and abrade their snouts. Because monitors have frequent, copious, loose stools set up the enclosure for easy cleaning with minimal disturbance.

Newspaper, sand, gravel, earth and bark mulch substrate can be used but should be spot cleaned and replaced as needed. Bare concrete can cause plantar and palmar calluses and abrasions on some individuals. Be sure any cage props, such as rocks or branches, are firmly held in place so as not to create a trap if moved by these powerful lizards. Monitors are particularly adept at forcing open doors, windows or screens and finding any other means of escape. Doors and lids should be able to close securely. Whenever possible house specimens individually.

As wild monitors are often nervous and flighty, the enclosure should have adequate hide boxes, cork bark tubes or slabs, for security.

Diet - Inadequate diet may contribute to failure of long term maintenance and reproduction. If monitors are provided with full spectrum lighting and fed a variety of whole prey items, problems with metabolic bone disease can be usually be avoided. Most monitors are opportunistic feeders, foraging on seasonally abundant prey. An understanding of a species' natural history is important in diet planning. For example, Grays monitor, *V. olivaceus*, is insectivorous as a juvenile then switches to fruits and tree snails as an adult (Auffenburg, 1995). Long term captive *V. olivaceus* in zoos fed largely a rodent diet often died from complications associated with visceral gout, which may have been linked to their captive diet. Invertebrates comprise a surprising amount of the diet even in some of the larger species. Keep in mind that insects have a low calcium to phosphorus ratio. Calcium supplementation through dusting and prey enrichment is advisable.

Environmental Temperatures - The following temperature regime works well for a variety of species. The ambient temperature range for tropical forest species should range from a low at night of 75 to 78° F and peak during the day at 86° F. A distinct thermocline should be present. A localized daytime basking site reaching 90 to 98° F allows behavioral thermoregulation. In desert species, night time temperatures should be 70 to 75° F with day time ambient temperatures of 85 to 90° F and a basking area between 95 to 100° F. Actual basking temperature can be even higher depending on the substrate heat absorption. Green and King (1993) note that core body temperatures over 105° F cause death in Australian monitors. In a comparison of 12 terrestrial and arboreal species they found body temperatures of active monitors to be from 89.6 to 104° F with an average of 96.8° F. In three aquatic species they found a lower active body temperature of 80.6 to 91° F. Seasonal variation in temperature may be important in triggering reproduction. A minimum/maximum thermometer will be valuable in checking temperatures. Inexpensive digital models, capable of storing highs and lows, are available from electronics stores. Indoor/outdoor varieties are useful to monitor temperatures in two areas of the cage. Although expensive, laser instant read thermometers (such as the Raytec Raynger ST Non-contact Temperature Measurement Gun) are useful for checking temperatures in large enclosures.

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Photoperiod - Another important consideration is lighting. All varanids are diurnal. Since most live within tropical latitudes, seasonal variation in photoperiod is slight. An artificial photoperiod of 13 hours light and 11 dark empirically works well. In some collections windows or skylights are present providing dawn/dusk periods and seasonal changes in photoperiod. The importance of photoperiod in reproduction is not understood in monitors.

Lighting - As with other heliothermic saurians, the quality of the light seems to be important. Monitor lizards should have access to broad spectrum lighting, including an ultraviolet component. This is important for active normal behavior and proper growth. Broad spectrum lighting can be provided two feet or less from the lizards with a combination of full spectrum fluorescent bulbs such as Westinghouse Design 50 or Duro Test Vita Lite (a wide variety of other brands exist) and an ultraviolet bulb such as Sylvania BL Blacklight. If a suntanning fluorescent bulb, such as the Westinghouse FS 20, is used then a UV T Plexiglas should be between the lizard and the bulb to prevent sunburn. Other options for broad spectrum light include UV transmissible skylights (Lexan, General Electric) or the ultimate light source, the sun. Few of us have the luxury of being able to house reptiles outdoors year round. However, seasonal outdoor housing is recommended whenever possible.

Handling and Restraint - Monitors are surprisingly strong lizards. Temperament varies among species and individuals. Small species can deliver a painful nip and medium to large forms can deliver painful blood letting bites. When capturing a monitor, grasp the neck just behind the head, then grasp the base of the tail or around the pelvis. Many will try and roll, scratch, bite, thrash their tail and/or defecate immediately. Be prepared and do not let go. Aggressive individuals can be captured more easily if their head is first covered with a towel. Large monitors may take several people to safely restrain.

When restraint is necessary several anatomical features should be kept in mind. Do not grasp the monitor too tightly along the ventral aspect of the neck. The hyoid apparatus, composed of bone and cartilage, is present in this area and while flexible, should not be unduly stressed. Damage to this structure could result in impaired ability to swallow. Another potential injury from restraint is hip luxation. Hip dislocation is difficult

to repair in monitors because of their shallow acetabulum, broad femoral head and lack of the round ligament found in mammals between the femoral head and acetabulum (Barten, 1996).

Common Medical Problems

Wild Caught Specimens - Most monitors in the reptile pet trade are obtained from the wild. Monitors are collected by indigenous people, who generally collect lizards for a much larger skin trade, and for food. Once collected these lizards may pass through several hands/middlemen before ending up at large exporting facilities. From the time of capture to arrival at the final destination, several weeks or months may pass. During that time the lizards are usually kept under less than optimal conditions, which often enhance spread of pathogens, especially parasites. Lack of food, water, proper temperatures, overcrowding, trauma, parasites and stress exact a high mortality. Fresh imports often need immediate critical care to successfully acclimate to the captive environment.

Recent acquisitions, both wild-caught and long term captives, should be quarantined from other reptiles for a minimum of 6 to 8 weeks (Wright, 1993). As soon as possible have a veterinarian perform a full physical and fecal examination. The veterinarian should obtain an accurate body weight which is essential for calculation of drug dosages or fluid therapy and to track weight gain or loss. Further diagnostics, such as a complete blood count, chemistry panel, radiographs or stomach washes, and other tests, may also be indicated depending on findings from history and physical examination.

Dehydration is often present. Signs of dehydration include a light body weight, loose folds of skin with decreased turgor, and sunken eyes. If antibiotics are indicated nephrotoxic drugs, such as aminoglycosides, are not a good initial choice and should be avoided until after rehydration. Mild dehydration can be corrected with soaking, misting or raining. For soaking, provide a water container that is large enough for the lizard to submerge in with lukewarm clean water. Tropical rain forest species, such as the *V. prasinus* complex, *V. indicus* and *V. karlschmidti*, can arrive in a very dehydrated condition. These lizards often respond well to being rained or

Recent acquisitions, both wild-caught and long term captives, should be quarantined from other reptiles for a minimum of 6 to 8 weeks.

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misted on for 24 to 48 hours. To do this place a hose with a sprinkler head or fog nozzle, turned on low, above the cage. Water temperature should be 78 to 80° F. The enclosure must have sufficient drainage to prevent flooding or drowning and allow for behavioral thermoregulation. For severe dehydration gastric, subcutaneous, intracoelomic, or intraosseous fluids (or a combination thereof) should be considered. Each has its advantages and disadvantages but in general the more critical the patient the more aggressive one must be with treatment. Several days of hospitalization are often needed to rehydrate and stabilize these patients. This often puts the veterinarian at odds with the experienced owner who, understandably, wants to stress the monitor as little as possible. None-the-less severe dehydration is life threatening and must be corrected.

Prophylactic administration of 100 mg/kg metronidazole into the esophagus (repeat in 2 to 3 weeks) has been advocated for Asiatic monitors (Wright, 1993) and should be expanded to include all rehydrated recent imports. Clinical discretion determines whether or not to include prophylactic administration of 50 mg/kg fenbendazole (Panacur Suspension 10 mg/ml, Hoechst-Roussel Agri-Vet Co., Somerville, NJ) orally. Repeat fenbendazole every 2 weeks for 2 to 3 more treatments or until ova are not

present in fecals. As these two anthelmintics will not eliminate all parasites, fecal examination is still indicated. Wright (1993) recommends at least three consecutive negative fecal exams before releasing monitors from quarantine.

Begin offering food 24 to 48 hours after rehydration is complete, if the lizard seems alert and active. This will allow the lizard time to settle into the new surroundings. Some specimens will refuse food for several days. Be patient and disturb the lizard as little as possible. From natural history information, or advice from others experienced with monitor husbandry, select the appropriate food items. Start with small meals daily and gradually increase meal size. If the lizard is not strong enough to feed once rehydrated, or not eating enough to maintain body weight, stomach tube with macerated pinkies or small skinned mice, or use enteral

formulas suggested by Donoghue and Langenburg (1995). Further diagnostics may be indicated.

Fecal examination - Imported monitors tend to be heavily parasitised by protozoans, nematodes, trematodes, cestodes and even pentastomids (Klingenburg, 1993, Card, 1995). Detecting all these parasites can be tricky. On a direct smear of a colonic wash and or a freshly voided fecal sample, it is important to look for protozoans and other parasites. Protozoans encyst and become more difficult to find if the fecal sample sits for more than half an hour or is refrigerated. Fecal flotation, especially with centrifugation, concentrate nematode, cestode and trematode ova, making them easier to detect. Trematode ova are often so dense they sink in flotation solutions, but can be found in the sediment. Follow up fecals are indicated to assess efficacy 6 weeks after the last treatment. Strimple (1996) recommends regular fecal examinations for monitors every 6 to 12 months.

Skin trauma - Lacerations and abrasions are one of the more common problems. Monitors have a propensity for finding sharp objects within their enclosures. Try to eliminate exposed wires and sharp edges. Many species are crevice dwellers and like to wedge tightly between objects. This can result in abrasions along the dorsum of the head and trunk. Watch the lizard and try to determine the source and eliminate it. Minor lacerations and abrasions should be cleaned with dilute tamed iodine or chlorhexidine and treated topically. Watch for signs of infection such as redness, swelling, pain or foul odor. Seek veterinary attention for more serious wounds.

Although monitors are commonly thought of as rodent eaters some species have little experience with them. Sprackland (1989) noted green tree monitors can be severely bitten and scratched by mice until they learn to seize rodents by the nape. Larger monitors rarely give rodents a chance to retaliate, but injuries can occur, and live adult rodent prey should not be left in the enclosure without observation. With the exception of providing live prey as an enrichment activity there is little reason to provide live rodents as monitors quickly learn to consume dead prey. Insect prey can attack the eyes, tail or digits of neonatal monitors if present in the enclosure in sufficient numbers. Don't overload cages with insects. Insects can also be contained in bowls or plastic tubs. Intraspecific and interspecific aggression can have devastating results. Monitors should only be housed with

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other monitors of the same species and relative size. Big monitors can and do eat smaller ones, even of the same species. When introducing specimens into the same enclosure observe them and intervene if fighting escalates to dangerous levels. Visual barriers provided by props and adequate flight distance are important. Males of some monitor species are known to engage in ritualized combat. Allowing this combat to occur maybe beneficial in stimulating reproduction. Some biting and scratching may occur. The subordinate animal will often retreat if sufficient flight space is available. However if the enclosure is too small or there are not enough retreat areas, combat can turn into a flesh ripping extravaganza or even death. Aggression between sexes can also occur. In some species females can exhibit post breeding aggression and nest guarding that can result in serious injury. Minor lacerations and punctures should be cleaned and disinfected and left open. Larger lacerations require veterinary attention for thorough cleaning and suturing under anesthesia. If the lizard is bleeding light pressure for 5 minutes will stop most bleeding. If not apply a light wrap or pressure to stop hemorrhage and see your veterinarian. Do not use tourniquets.

Ticks - Ticks are common on newly imported monitors, especially in or around the eyes, ears, nares, vent, and the base of limbs. Ticks potentially harbor serious zoonotic diseases such as Q-fever (Wright, 1993) and a boatload of other unknown diseases. It is best to remove them with forceps or hemostats, kill them and dispose of them safely. Avoid contact with the bodily fluids of ticks (Wright, 1993).

Toe problems - Nails can be torn from climbing on screens, digging, or from pulling a monitor off something it has firmly gripped. Digital dysecdysis, bacterial or fungal infections can also predispose monitors to nail sloughing. Digital dysecdysis can occur in smaller specimens because of low humidity in captivity. Stuck sheds can be difficult to visualize. As they build up they gradually restrict circulation to the digits. This leads to avascular necrosis and eventually the nail and part or all the digit dries up and falls off or it may become swollen and infected. Mild stuck sheds on the toes often come off after three to five days of antibiotic ointment, vaseline or aloe vera gel. Don't try and remove them immediately or the toe may be needlessly traumatized. For severely infected or devitalised toes, amputation with local anesthesia is indicated. Toes should be

amputated flush with the foot and sutured. The differential diagnoses for swollen toes includes digital or joint infection, fracture, dislocation and articular or periarticular gout or pseudogout. Dental or regular radiographs are useful to ascertain etiology. Dislocated digits can be splinted successfully and corrected if treated soon after occurrence. Long standing cases often can not be corrected.

Cryptosporidiosis - Gastrointestinal (GI) infection with *Cryptosporidium* spp. is not uncommon in monitors but has not been well characterized. *Cryptosporidia* are single celled protozoans related to coccidia that attach to the GI lining and interfere with absorption. Clinical signs include chronic regurgitation, dehydration, weight loss, lethargy, with or without pain on coelomic palpation and hemorrhagic watery or mucoid diarrhea. These are non-specific signs that can be caused by a variety of diseases. Diagnosis can be difficult, as *Cryptosporidium* translates as "hidden sporocyst". Special acid-fast stains are usually needed to detect *Cryptosporidia* although if large numbers are being shed they may be directly observable under the microscope. Klingenburg (1996) reported a case in a Savanna monitor that was not shedding *Cryptosporidia* in feces but did have a trichomonad overgrowth which potentially could obscure diagnosis. Multiple direct fecal smears, fecal flotations, surface smears of recently regurgitated prey, stomach washes, survey and contrast radiographs, endoscopy, exploratory surgery, blood work and/or multiple stomach biopsies may be needed for diagnosis (Cranfield and Graczyk, 1996). Monoclonal antibody tests may enhance detection and offer much promise for the future (Cranfield and Graczyk, 1996, Klingenburg, 1996). Unfortunately cryptosporidiosis in monitors is often a post-mortem diagnosis but as veterinarians become more aware of it this should change. *Cryptosporidia* should be considered highly contagious to other reptiles and careful disinfection is indicated. Thick walled *Cryptosporidia* oocysts are highly resistant to environmental disinfection. Thorough cleaning followed by disinfection with 5% ammonia then drying for 3 days has been recommended (Cranfield and Graczyk, 1996). Currently there is no recognized effective treatment, but new treatments are under investigation (Cranfield and Graczyk, 1996). Euthanasia should be considered.

It should be emphasized that repeated regurgitation (more appropriately vomiting) should be cause for alarm in monitors but is a symptom of disease and not a

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disease itself (Funk, 1996). It can be caused by a variety of other problems such as stress, too large a meal, feeding partially autolysed prey, handling too soon after feeding, low environmental temperature, organ system failure, foreign bodies, masses impinging on the GI tract, intussusceptions, torsions, volvuli of the GI tract or a variety of parasites, bacteria, fungi or viruses (Funk, 1996).

Tail necrosis - Acute liquefactive necrosis of the tail has been seen sporadically in monitors. The entire tail may be lost rapidly over a few days. A small number of cases have yielded clostridial organisms. Tail necrosis may also represent a loss of vascular supply. Aerobic and anaerobic bacterial culture with antibiotic sensitivities are indicated. Tail amputation between vertebrae, well proximal to infected tissue, systemic antibiotics and supportive care are indicated. The skin should be sutured and sutures removed in 6 weeks. Monitor tails are not autotomous nor do they regenerate.

Respiratory tract infections - Respiratory tract infections are not as common as in boids, but are occasionally seen, especially in young monitors if environmental temperatures are too cool. Clinical signs include lethargy, anorexia, gurgling respiratory sounds (best detected with the open bell of a stethoscope), difficult or rapid breathing, excessive pharyngeal mucous, and sometimes nasal or ocular discharge and not opening its eyes. As symptoms progress the monitor may hold its head elevated and bubbly mucous may exude from the nares and mouth (Balsai, 1993). If the nares are clogged the lizard may need to open its mouth to breathe. Elevated ambient temperature may cure very mild cases but most require antibiotics for a minimum of three weeks. Consider hematology, tracheal or lung bacterial culture with antibiotic sensitivities and cytology to better characterize the problem and look for bacterial types, fungi or nematodes.

Thermal Burns - Incandescent bulbs provide a good heat source for basking but care must be taken to avoid burns. All monitors are very good climbers and have no difficulty climbing upside down on wire mesh, such as on an enclosure top. Be sure that all bulbs are suspended a safe distance from anywhere the lizard can climb to or under or enclose them within a safe distance from the lizard. The minimum distance between light and lizard for 100 watt or lower incandescents is 6 inches and 18 inches for 250 watt incandescents and all infrared lights, including ceramics. Anything you can't

rest your hand under for 5 minutes or more could eventually burn the lizard. Superficial burns cause wrinkling of the scales, pain, redness, and discoloration (Barten, 1996). Partial thickness burns cause a loss of scales, blisters and eventually plasma oozes out and dries to form crusts (Barten, 1996). Full thickness burns ventrally can penetrate the coelom. Veterinary evaluation of burns is advisable. Treatment consists of good supportive care, cleaning the burn, wet to dry bandages, water soluble antibacterial ointments or creams (such as Silvadene cream, Marion Laboratories, or Betadine ointment, Purdue Frederick), and antibiotics if the wound is infected (Barten, 1996). Burns take weeks to months to heal depending on size and severity. Partial to full thickness burns eventually fill in with whitish scar tissue. Difficulty shedding around burns and dramatic improvement with each shed is to be expected.

Obesity - Obesity is a common problem in many long term captives as a result of decreased activity and a richer diet (rodents vs. invertebrates). Monitors seem healthiest a little on the lean side. Obese specimens are not very active. Monitors should be weighed and measured periodically to assess weight trends.

Savanna or Bosc's monitors, *V. exanthematicus exanthematicus*, are particularly prone to gross obesity. Considering that little is known about this species natural history it behooves us to consider a closely related, better known, species, the white-throated savanna monitor, *V. exanthematicus albigularis*, to help us understand why. Both occur in sub-Saharan Africa, a harsh, arid, savanna environment which has three distinct seasons. The hot wet period is from January to April, the cool dry period is from May until August and the hot dry period from September to December (Phillips, 1995). Both species are primarily invertebrate feeders. Invertebrates are seasonally abundant during the hot wet season when plant growth increases. During this time home ranges for male and female white-throats were just over 7 and 2 square miles respectively (Phillips, 1995). Both sexes also gained weight dramatically during this time, and lost it subsequently as the two dry periods wore on. Adult lizards weighed an average of 42% more during the wet season than the dry seasons (Phillips, 1995). During the dry seasons both sexes were relatively sedentary except for males during the breeding season when they often traveled 2 to 4 km. per day (Phillips, 1995)! Thus white-throats are active and gain weight when food is abundant but relatively

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inactive (except for breeding) and loose weight when food is less abundant. In captivity, with a constant supply of rodents, hot dry conditions year round, and thus relatively little activity, it should come as little surprise obesity is common.

The Rotterdam Zoo increases activity in their white-throats by occasionally feeding live rodents or alternatively increasing the feeding interval to 14 days (Visser, 1980). Obesity in captive savanna monitors can be decreased by increased exercise (perhaps stimulated by an artificial rainy season), feeding a wider variety of invertebrates, less rodents, and periodically drastically reducing their food intake. Enrichment activities that stimulate greater activity should be considered. Huff (1991) mentioned large chunks of wax moth culture and giant land snails as being very stimulating to monitors, even to the point of inducing male-male combat or breeding.

Dystocia - Egg retention or dystocia can be caused by a variety of factors. Probably the most common cause in reptiles is a lack of an adequate oviposition site. Female monitors may take several hours to excavate a nesting site. Several species, including *V. albigularis*, *V. bengalensis*, *V. giganteus*, *V. gouldii*, *V. niloticus*, *V. rosenbergi* and *V. varius*, are known to lay their eggs in termitaria (Green and King 1993). The termites repair the lizard damage resulting in eggs that are not only well protected but also incubated at a fairly constant temperature! Some species will seek areas with warmer than ambient temperatures to nest. This can be provided with incandescent spot heat or suspended radiant heaters in larger enclosures. In creating a nest area keep in mind that the female will need sufficient room to excavate a tunnel and nest chamber. A mixture of sand and soil or peat moss, slightly moistened, works well for nest medium. A variety of nest containers have been used. Plastic trash cans packed with nest medium work well for medium sized species. If feasible the nest area can be incorporated into the enclosure floor by mounding up a sand and soil mixture in one corner or along a wall. During the post mating period the female may become aggressive towards the male particularly as oviposition time draws near. Remove the male from the enclosure and eliminate this distraction. Keep gravid females well fed and hydrated. Provide a secure basking retreat, allow behavioral thermoregulation and disturb females as little as possible. False nesting or exploratory digging is not uncommon a week or more prior to laying.

If the female continues to dig for several weeks but fails to lay and becomes weaker veterinary evaluation is indicated. Consider diagnostics such as radiographs, a complete blood count and plasma chemistry panel. In iguanas (we assume monitors are similar) females either have pre-ovulatory follicles (much more common) or shelled eggs in the oviduct. The difference is important because follicles may be rarely resorbed, whereas it is unlikely that shelled eggs can be resorbed and the female is likely to die from anorexia or egg-related coelomitis if the eggs are retained. In contrast to birds and chelonians, lizards have soft-shelled eggs. Therefore radiographs delineate egg or follicle peripheries but rarely are distinct eggshells visible. Follicles tend to heavily overlap and flatten out in contact with one another (Barten, 1995). Oviductal eggs tend to be more dispersed with some distinct round or oval shapes visible (Barten, 1995). It can be difficult to distinguish one from the other radiographically.

In iguanas oxytocin has been unrewarding in the junior author's experience, but calcium injections (0.5 to 1.0 ml/kg Calphosan IM), followed by 1 to 10 IU oxytocin/kg body weight can be tried. Oxytocin is obviously of no benefit for pre-ovulatory follicles. Prostaglandins followed by β -adrenergic blockers, such as propranolol, then oxytocin or vasotocin, offer much promise for dystocia in reptiles. If oviposition can not be induced then surgical intervention maybe needed.

Metabolic Bone Disease - Young monitors grow very rapidly and without adequate dietary calcium their bones may not grow fast enough to support them. In fact their growth is so rapid one would suppose they need much more calcium than adults. Metabolic bone disease (MBD) is common in juvenile monitors fed insects without calcium supplementation. A frequent error is to provide multivitamins as a calcium supplement. Multivitamins do not contain enough calcium to prevent metabolic bone disease in insectivores regardless of what the label claims. Providing a more balanced diet including chopped whole mice, pinkies, fuzzies and whole fish, as well as dusted and fortified insects, is important for long term prevention. Nine out of thirteen hatchling Komodo dragons, *V. komodoensis*, fed small mice and housed without UV lights developed spontaneous long bone fractures, suggestive of MBD, at two months of age.

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Vitamin D metabolites were low until a month after provision of artificial UV lights (Allen *et al.*, 1994). This would suggest growing monitors require UV light and that artificial UV lights provide enough UV B to assist vitamin D synthesis.

Most lizards with MBD don't survive once clinical signs are evident without intensive treatment. Clinical signs include anorexia, docile disposition, lack of weight gain or growth, a soft pliable skull, mandible or maxillae, long bone fractures and difficulty lifting the body up off the ground while walking. Dietary history, physical examination, radiographs and a plasma chemistry panel are useful to assess severity, undetected disease as well as formulating a treatment plan. Treatment consists of oral Neo-calglucon (calcium glibionate syrup, Sandoz Pharmaceuticals) twice daily for 1 to 3 months. If normocalcemic the lizard can be given calcitonin which is believed to inhibit further calcium uptake from bone, relieve bone pain and suppress excess parathyroid hormone production. Depending on previous multivitamin supplementation a vitamin D-3 injection may also be indicated. Fracture stabilization and correcting husbandry deficiencies, such as UV light are also important. Most cases respond well to aggressive treatment.

Conclusion

This has been a brief review of husbandry and diseases of monitors. Herpetoculturists with an interest in monitors often are more keen to the needs of reptiles than your typical pet owner. As such they may be reluctant to seek veterinary care as they sometimes know much more about their animal than the typical veterinarian. This may be true. The goal of this paper has been to identify diseases in monitors but we purposively omitted more advanced treatments. We enthusiastically admit a bias towards veterinary treatment. Veterinarians have the medical background to deal with disease even if they are not experts on husbandry. Seek a veterinarian with an interest in exotic animal medicine, preferably enthusiastic about reptiles, and learn with them. There is little medical information on monitors, yet captive monitors will survive and breed better if veterinarians and herpetoculturists can work together. We urge you to go even further. Share your experiences with other herpetoculturists and veterinarians so that we can all learn from small successes or large failures.

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Notes on the Natural History and Husbandry of the Black Tree Monitor, *Varanus beccari*.

By: Ruston Hartdegen, Dept. of Herpetology, Dallas Zoo.

Introduction

Currently there are two recognized species of black tree monitors, *Varanus beccari* and *Varanus bogerti*. *Varanus beccari* has only been recorded from the Aru Islands off the south-western coast of Irian Jaya, while *V. bogerti* is found on a series of small islands (Fergusson, Normanby Islands, and the Louisiade Archipelago) off the eastern coast of Papua New Guinea. Both species are entirely black in coloration as adults with keeled neck scales. *Varanus beccari* can be identified by the presence of 70-79 ventral scale rows and 81-86 midbody scale rows, while in *V. bogerti* ventrals range from 87-90, and midbody scale rows from 95-99 (Bennett, 1995).

Natural History

Little is known about the black tree monitors' natural history. They are highly adapted for arboreal existence, possessing a prehensile tail and long slender hindlimb digits with sharp claws (Green, 1986). They are able to move swiftly through the forest canopy. Few observations of wild specimens have been made and in captivity these animals are extremely nervous making observations difficult. Little information exists on their natural diet. They are most likely opportunists. Gut content analysis shows that arthropods make up the majority of their diet (Green, 1986).

Husbandry

The Dallas Zoo's Department of Herpetology currently house 3.2 specimens (3 male, 2 females). Three glass front fiberglass enclosures measuring 45 x 32 x 45.4 in. (115 x 81 x 117 cm) hold two pairs and a single sub-adult male. A two bulb florescent fixture fitted with one Philips white light (Cr50) bulb and one Slyvanna blacklight (350 bl) bulb provide proper illumination and ultraviolet radiation. A 75 watt incandescent bulb provides a basking site temperature of approximately 86F (32C). Ambient temperature is held at 80F (26C), with a relative

humidity of 70%. Humidity levels are important to this species. Low levels cause rapid dehydration, which can lead to kidney problems. However, extremely high levels of humidity can lead to chronic infectious lesions. This problem is addressed by "raining" on the enclosure, three to four times a week, for short periods. A drainage hole covered with wire screen prevents standing pools of water. They are also given large water bowls. All specimens have access to cover provided by plastic foliage and cork bark tree hollows, as well as a secure nesting chamber. The nest chamber consists of a small plywood box, measuring approximately 9 x 9 x 12 in. (22.5 x 22.5 x 30 cm), filled half way with moist sphagnum moss. It is placed near the top of the enclosure, with nearby branches providing access.

Varanus beccari are nervous captives, which can make feeding problematic. The Dallas Zoo specimens are offered neonatal mice individually once a week from forceps. Usually they will take the prey items from the forceps but will not consume them until the enclosure door is shut. Care must be taken when feeding animals kept in the same enclosure due to extremely strong feeding responses of some individuals. I have observed these lizards steal food items from the mouths of others. Also, adult crickets are broadcast throughout their enclosures four times a week. After feeding, these lizards should not be handled since they commonly will regurgitate if stressed. In general *V. beccari* should be handled only when absolutely necessary. Not only can excessive handling cause extreme stress on the animals but their long, sharp claws and teeth can inflict painful wounds.

Reproduction

Animals at the Dallas Zoo are exposed to the natural photoperiod of the Dallas/Fort Worth area by the use of sky lights. Specimens are housed in pairs all year round. Past experience housing multiple

animals together all year round. Past experiences housing multiple animals together has proven very risky. Males kept in this type of situation have severely injured each other in combat. Females have also shown extremely aggressive behaviors toward both males and other females. Long term, healthy, established pairs seem to be the key to our success with these animals.

After successful copulation a gravid female will usually frequent her nest chamber. Special attention must be given to potentially gravid females as they have been observed displaying aggressive nest-guarding behavior, both pre and post-oviposition, toward cagemates and keepers (Garrett and Peterson, 1991). Clutch size ranges from two to six eggs (Bennett, 1995). Incubation takes approximately 190 days at 82.5F. Hatchlings rarely survive past the first six months, probably due to dehydration (Card, 1995). Hatchling animals should be setup in separate enclosures, each provided with ultraviolet radiation and a low wattage basking lamp. Water is critical to their survival, and easily provided via "raining" on their enclosures several times a week. A varied diet of insects should be available, due to their high level energy demands. In the past prey items had to be crushed, exposing body fluids, to elicit feeding responses in some hatchlings. Plenty of cover must be provided to reduce stress.

Further Comments

Currently monitors are receiving an increased amount of attention (Card, 1995). The dissemination of information between individuals, successes and failures, will help to establish sound husbandry techniques for *V. beccari*, paving the way for continued successful reproduction of this species. Research with captive specimens could lead to valuable information concerning their ecology and behavior as it has with other varanids, thus providing a glimpse into the natural history of *V. beccari*.

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