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On the Cover: *Varanus salvator macromaculatus*

The *Varanus salvator macromaculatus* depicted on the cover and inset of this issue was photographed off Pulau Tiga, south of Kota Kinabalu on the northwest coast of Borneo by **Matt Oldfield** www.scubazoo.com in May 2006. Water monitors are common on Tiga, and are often observed swimming and foraging around the resort jetty, particularly around dusk and dawn during high tides. One individual was seen emerging from the surf with a flapping fish in its mouth, suggesting that the monitors are hunting out in the saltwater. *Varanus s. macromaculatus* are also frequently encountered swimming out in the bay off Tiga, which is where this specimen was photographed. Monitors encountered swimming in open water are normally skittish and timid, but will often approach people in the water to rest on their head, shoulder, or camera gear. Whether or not this occurrence is common elsewhere throughout the range of *V. salvator* remains to be seen.

BIAWAK

Quarterly Journal of Varanid Biology and Husbandry

INTERNATIONAL VARANID INTEREST GROUP
www.varanidae.org

The International Varanid Interest Group is a volunteer-based organization established to advance varanid research, conservation, and husbandry, and to promote scientific literacy among varanid enthusiasts. Membership to the IVIG is free, and open to anyone with an interest in monitor lizards and the advancement of varanid research. Membership includes subscription to *Biawak*, a quarterly journal of varanid biology and husbandry, and is available online through the IVIG website.

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Varanus marmoratus. Sabang, Palawan, Philippines
Photograph by **Pierre Le Leannec** http://flickr.com/kerolic

EDITOR'S NOTE

The Value of Translations

Translations play an integral part in the dissemination of knowledge. Without translations, awareness of important scientific research and discoveries would be restricted by linguistic barriers, creating great chasms in humanity's understanding of the natural world. To the researcher or enthusiast, translations of previously published scientific literature can be just as valuable as new research and discoveries.

Over the past three centuries there have been numerous, significant contributions to the study of varanid lizards, published in many different languages. Many works of varanid literature written in languages other than English have since been translated into English, yet hundreds still await translation.

The IVIG welcomes bilingual individuals interested in translating original works of varanid literature into English for future publication in *Biawak*. For those who wish to contribute to the biology or husbandry of varanid lizards, but lack noteworthy data or observations, translations may provide an excellent opportunity to help further their study. The editorial board is available for assistance with suggesting and furnishing original texts, and translational assistance is also available to those who inquire. For additional information about contributing translated material, please contact submissions@varanidae.org

Varanus bengalensis nebulosus. Perlis, Peninsular Malaysia.
Photograph by **Chan Kin Onn** kin_onn@yahoo.com

New Editorial Reviewer

The IVIG welcomes André Koch to the editorial board of *Biawak*. Presently a PhD. student at the Zoologisches Forschungsmuseum Alexander Koenig (ZFMK) in Bonn, Germany, his dissertation research focuses on the herpetofauna of Sulawesi, with special consideration of the phylogeographic relations of *Varanus* to adjacent islands. He is also currently investigating the biogeography, systematics and taxonomy of the *V. indicus* species group.

Biawak Editorial Board Positions Available

In a coordinated effort to reach a broader global audience, and to help advance the study of monitor lizards through publishing novel information and data, the IVIG is presently seeking several individuals from Europe and Australia to join the editorial board of *Biawak* as regional liaisons to assist with gathering article submissions from private varanid hobbyists, enthusiasts, and zoos from their respected regions, as well as to help promote *Biawak* on various online herpetological communities and message boards. For additional information pertaining to this position, please contact the editor at odatriad@yahoo.com

Varanus salvator macromaculatus. Sungei Buloh Wetland Reserve, Singapore.
Photograph by **Chim Chee Kong** chimck@yahoo.com

NEWS NOTES

Nile monitor found dead on Sanibel Island, Florida

Indigenous to Africa, the Nile monitor (*Varanus niloticus*) has been introduced to southwestern Florida, US through the release and escape of pet monitor lizards, and an established breeding population now exists in the city of Cape Coral. On 5 July, 2008, a dead adult male *V. niloticus* (ca. 2 m total length; 6.7 kg), was found floating in an inland lake of Sanibel Island, off the coast of Cape Coral. This recent sighting represents the third official sighting of *V. niloticus* on Sanibel, and reconfirms the presence of an established population on the island.

A necropsy of the monitor was inconclusive as to the cause of death. The only prey item found within its stomach was the eggshell of a freshwater turtle. The body was later sent to Todd Campbell at the University of Tampa for further analysis.

Source: Island Reporter, 18 June; 2 July 2008

Monitor lizards delay flights

More than 100 flights were delayed at Indira Gandhi International Airport in New Delhi, India on 16 June 2008 after several monitor lizards were spotted on the runways and taxiways of the airport. The monitor lizards' activities disturbed birds, thereby increasing their movement above the airport, resulting in the closing of runway 27 between 0930 and 1000 h. Five monitor lizards (presumably *Varanus bengalensis*) were recovered from the runway and taxiway, bordered by long grass and drainage ditches, and are planned to be released elsewhere, possibly in Asola Bhatti sanctuary.

Source: Express India, 17 June 2008

Monitor lizard meat seized in wildlife processing factory raid

Malaysian Wildlife and National Parks Department officials raided one of Malaysia's largest facilities used to process, preserve and store exotic meat in Segamat, after receiving a tip-off that the facility was processing protected species. In addition to recovering 800 kg of what is believed to be python meat, 1700 kg of water monitor (*Varanus salvator*) meat was also recovered.

Source: New Straits Times, 15 June 2008

Rosenberg's monitors found at Shoalhaven, NSW

A recent study has discovered that Rosenberg's monitor, *Varanus rosenbergi* occurs at Shoalhaven, New South Wales. Although *V. rosenbergi* is common in Western Australia and South Australia, reports of its occurrence in New South Wales are scarce.

Calls from local residents of monitor sightings often misidentified the Lace monitor (*V. varius*) as *V. rosenbergi*, and only three confirmed *V. rosenbergi* were spotted in Shoalhaven during the one year study. Results and details of the study are to be presented at an upcoming community workshop held before the Shoalhaven city council.

Source: South Coast Register, 23 July 2008

Varanus albigularis. Kruger National Park, South Africa
Photograph by **Arno Meintjes** arnom@lantic.net

ARTICLES

Biawak. 2008. 2(3): 106-108

A Case of Predation of the Water Monitor *Varanus salvator* on the Western Snail-eating Turtle *Malayemys macrocephala* (Reptilia: Varanidae & Bataguridae) in Bangkok

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The Water monitor, *Varanus salvator* (Laurenti, 1768), is well known as a scavenger and predator, consuming a wide variety of prey, invertebrates as well as vertebrates (see a.o. Karunarathna et al., 2008; and the compilations on this species' diet made by Gaulke, 1991; Losos and Greene, 1988; Shine et al., 1998; Traeholt, 1994a,b). However, specific documented data on its diet are scarce. We report hereafter for the first time on a predation by the Water monitor on *Malayemys macrocephala* (Gray, 1859) (Testudines: Bataguridae).

Two of us (TB and SS) made a herpetological survey of Lumpini Park, central Bangkok city, in 2006. This park, offered to the Thai population in 1925 by H. E. King Rama VI, is the first public park of Bangkok. Its surface is approximately 58 ha and it includes many man-made ponds, housing aquatic fauna such as *M. macrocephala*. This latter species is very common in central Thailand (see Brophy, 2004), and is the most commonly released turtle species in Thailand. This turtle is widely available in local markets; although it is protected according to Thai laws, it is purchased by people to be later released for religious purposes. Lumpini Park is often chosen by Buddhist people to release those turtles, where they are hence

abundant. Snails, the main food of *M. macrocephala*, are readily available in the park's ponds and allow the turtles to survive. *Varanus salvator* is another commonly observed aquatic animal in the park.

On 29 October 2006, TB and SS observed, at 0725 h, an adult *V. salvator* (ca. 75 cm SVL) swimming in an artificial pond. The observed individual left the water to search for food at the base of a bridge with dense vegetation. It was using its head to forage among the plants where it seized a young *M. macrocephala* (straight carapace length ca. 10 cm). It turned the turtle from its transverse position to a position parallel to the head, widely opened its mouth, and swallowed the whole turtle without biting nor masticating (Figure 1). Immediately after this, it continued to search for more food and found a second, larger, *M. macrocephala* (straight carapace length ca. 20 cm) at direct proximity. In spite of efforts to correctly orientate the turtle's body to swallow it (Figure 2), it was unable to do so and released it, probably due to its too large size. Just following this, it rested and basked at the same place for about ten minutes before going back to swim in the water. The observers did not disturb the monitor during the observations. For the next 15 min, TB and SS surveyed 100 m along the water reservoir and encountered four additional water monitors (SVL from 60 to 75 cm), resting on the bank or swimming. Another visit by TB and SS on 5 November 2006 starting at 0850 h on the same transect allowed the observation of eight individuals of *V. salvator*, whose SVL were from 45 to 80 cm. The abundancy of both *V. salvator* and *M. macrocephala* in Lumpini Park suggests that this predator-prey relationship is locally common, and that monitors might play an important role in locally regulating turtle populations.

Acknowledgements - We are grateful to Maren Gaulke, Henrik Bringsøe and Indraneil Das for providing useful literature and information.

Figure 1. Adult *Varanus salvator* swallowing a young *Malayemys macrocephala* in Lumpini Park, Bangkok

Figure 2. Adult *V. salvator* unsuccessfully trying to swallow an adult *M. macrocephala* in Lumpini Park, Bangkok

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Preliminary Notes on the Monitor Lizards (Family: Varanidae) within the National Zoological Gardens (NZG) Dehiwala, Colombo District, Sri Lanka

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Introduction

The monitor lizards, family Varanidae, are the largest of the extant lizards and show a uniformity of structure not seen in the other groups (Daniel, 2002; De Silva, 1998). The genus *Varanus* holds all 70 described species (De Lisle, *pers. comm*.; Halliday and Adler, 2002; Reptile Database, 2008). Monitors are distinguished by their long and flattened body, long tail, long neck and extremely elongated, slender, forked tongue similar to that of snakes (Pough et al., 2004). They have well developed eyelids and most have recurved teeth. Their head is covered with small scales, body covered with small round or oval scales and ventral scales arranged in regular rows (De Silva, 1996). Monitor lizards also have well developed limbs and their digits are armed with strong claws (Deraniyagala, 1953). They can be found in both aquatic and terrestrial habitats such as swamps, ditches, home gardens, streams, reservoirs, ponds, arboreal areas and mangroves (Gaulke and De Silva, 1997; Karunarathna et al., 2008a).

The monitor lizard diversity of Sri Lanka is limited to two species, namely the water monitor (*V. salvator*) and the land monitor (*V. bengalensis*), with neither being endemic to the island (Das, 2001; Das and De Silva, 2005; Deraniyagala, 1953; De Silva, 2006). They are widely distributed and found up to elevations of 1000 m. Monitor lizards are some of the most famous and easily observed inhabitants of most aquatic habitats within Sri Lanka (Gaulke and De Silva, 1997). They are useful animals for humans (pest control and scavengers) and categorized as scavengers which mainly feed on animal carcasses (Daniel, 2002; De Silva, 1998). Hence, the research committee of the Young Zoologists' Association (YZA) decided to conduct a survey on the monitor lizard population and diversity within the National Zoological Gardens (NZG). The main objective of this survey was to document the vanishing urban biodiversity sustained by the NZG, in order to raise conservation awareness and promote relevant actions to conserve this urban biodiversity refuge (Karunarathna et al., 2008b).

Figure - 1. Aerial map of the study area in the National Zoological Gardens (NZG), Dehiwala and its vicinity, yellow spot locating the Gal Wala area and light green dots showing the NZG boundary (Source: http://maps.google.com)

Study Area

The National Zoological Gardens (NZG) is approximately 9.3ha (23 acres) in extent (Karunarathna et al., 2008b; National Zoological Gardens, 2004). It is situated at a mean elevation of 25 m above sea level (Figure 1) and belongs to the lowland wet zone of Sri Lanka. The NZG area lies at the intersection of 6^0 51` 21.48`` - $6^0$ 51` 30.30`` N ; 79^0 52` 20.08`` - $79^0$ 52` 33.99`` E, approximately 2 km from the town of Dehiwala and 11 km away from Colombo (Weinman, 1957). The NZG receives >2000 mm of mean annual rainfall, with mean annual temperatures ranging from approximately 27.1 ^{0}C to 29.4 ^{0}C (Somasekaran, 1988). The NZG consist of several habitat types which can be categorized as man made small grasslands, scrublands, several small ponds, home gardens and large shade trees (e.g., *Ficus* spp., *Diospyros* spp., *Pterocarpus* spp., *Samanea* spp. and *Tabubbia* spp.).

Methods

The findings presented here are based on field investigations carried out over 24 days between May 2007 and April 2008. We have also included opportunistic sightings collected between 2004 and 2006. Visual Encounter Surveys (VES) were used to gather data and general area surveys were carried out in

different aquatic and land habitat types within the NZG using binoculars (8 x 30). All morphological measurements were taken using Tricle brand ® (Shanghai, China) dial vernier calipers, calibrated to the nearest 0.01 mm, and 1 m measuring tapes. After recording the necessary measurements the lizards were released into their original habitat. Each of the representative habitats were surveyed by foot for a total of five hours per day between 0900 and 1200 h and again between 1600 and 1800h. Photographs of individuals were taken using a Sony DSC–H50 camera. The varanid lizards were identified and verified using the following field guides: Das and De Silva (2005); Deraniyagala (1953); Daniel (2002) and Reptile Database (2007).

Results

The present study represents the first varanid survey within the NZG. Both species of monitor lizard (*V. bengalensis* and *V. salvator*) were recorded in the one year period, with 76 individual counts, 29 of which were of *V. bengalensis* (juveniles n = 9; immature subadults n = 10; mature adults n = 10) and 47 of which were of *V. salvator* (juveniles n = 14; immature subadults n = 10; mature adults n = 23) (Figure 2). The greatest number of monitor lizards observed in a single day (n = 12) was recorded on 23 March 2008 and the lowest number (n = 2) on 27 January 2008. The greatest number of *V. bengalensis* observed in a single day (n = 4) was recorded on 23 March and 6 April 2008 and lowest number (n = 0) on 16 March 2008; the greatest number of *V. salvator* observed in a single day (n = 8) was recorded on 23 March 2008 and lowest numbers (n = 1) on 27 January 2008 (Figure 3). We estimated the *V. bengalensis* population within the NZG to be n = 11 (juveniles n = 3 / immature subadults n = 4 / mature adults n = 4) and *V. salvator* population to be n = 15 (juveniles n = 4 / immature subadults n = 4 / mature adults n = 7). "Gal Wala" (= Rocky pond; Figure 4), the manicured lawn (Figure 5), and other wet areas (Figure 6) and their vicinity appear to be important breeding, feeding and resting habitats for both species.

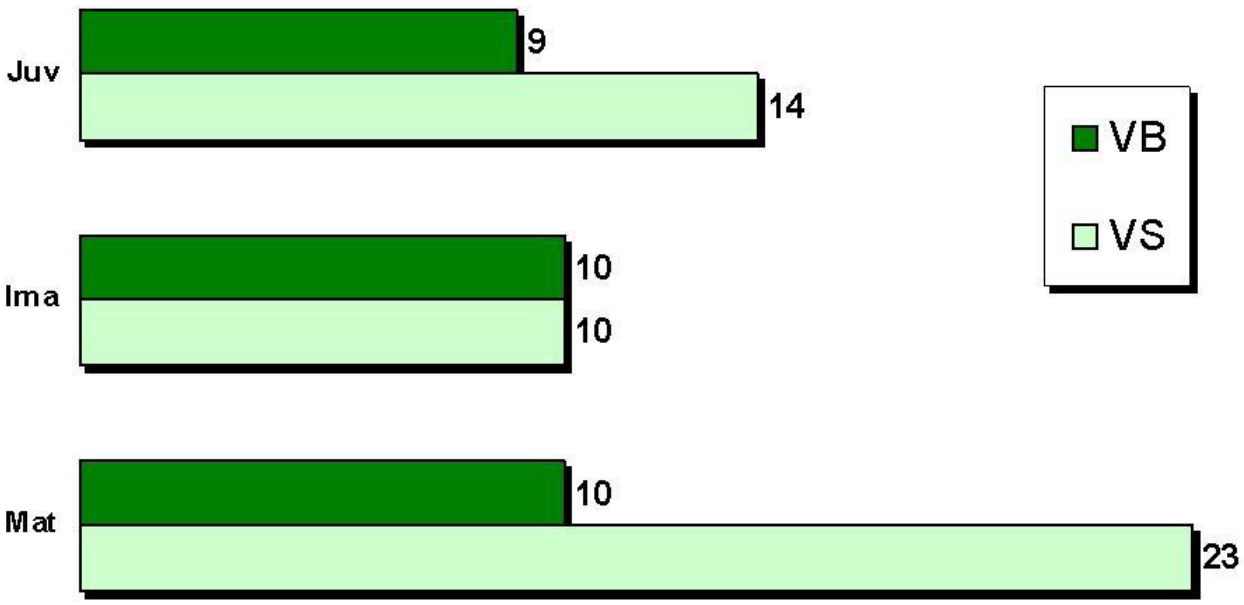

Figure 2. Total individual counts of the two monitor species observed in the NZG. Abbreviations: Juv = Juvenile, Ima = Immature, Mat = Mature, VB = *Varanus bengalensis,* VS = *Varanus salvator*

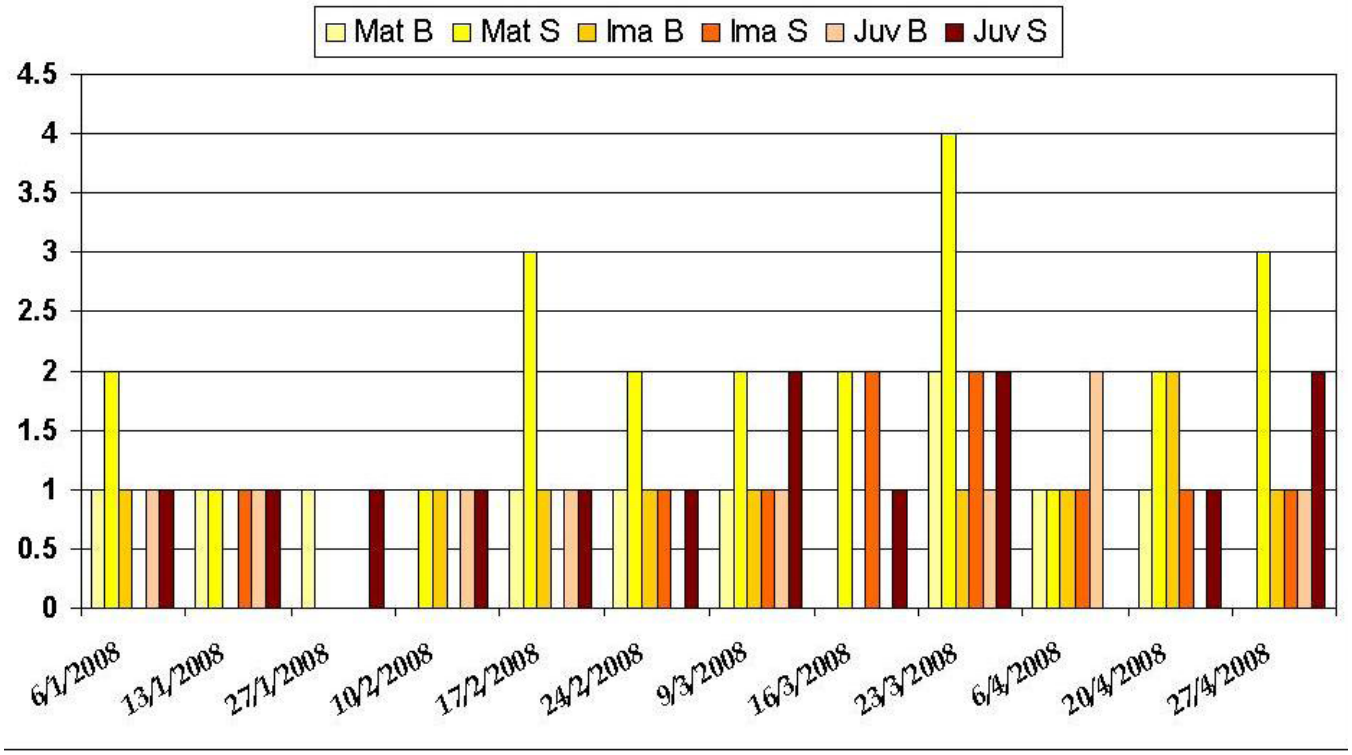

Figure 3. Number of monitor lizards observed by date. Abbreviations: Mat B = Mature *Varanus bengalensis*, Ima B = Immature *V. bengalensis*, Juv B = Juvenile *V. bengalensis*, Mat S = Mature *V. salvator*, Ima S = Immature *V. salvator*, Juv S = Juvenile *V. salvator*

Figure 4. Habitat type of the Gal Wala = Pond area inhabited by several birds

Figure 5. Detail of the manicured lawn of the restaurant area in the NZG

Figure 6. Aquatic habitat of Ali wala = Elephant arena in the NZG

Discussion

This study was conducted to assess the population size of non-captive varanid species inhabiting the national zoological gardens. As such a photo catalog of each individual was made by taking photographs of their heads, bodies and tails from various angles and noting down special characteristics. The largest population was recorded from the Gal-wala area which is inhabited by a host of wild aquatic birds. The water in this pond is murky and foul-smelling because of the accumulation of bird feces and urine as well as trash and other debris. There were nine *V. salvator* and four *V. bengalensis* inhabiting this area. This area provides various habitats and enough resources for the survival of these individuals. Wild aquatic birds nest and breed in this area and a considerable number of young fall into the water, which are often consumed by *V. salvator*. In addition, this species feeds on fish such as the suckermouth catfish (*Hypostomus plecostomus*), Mozambique tilapia (*Oreochromis mossambicus*), Nile tilapia (*Oreochromis niloticus*) and giant gourami (*Osphronemus goramy*), which are supplied by the zoo for consumption by the aquatic birds.

Observations of *V. salvator* feeding on juvenile *V. bengalensis* were rare, but it appears that competition between the two species for food and space is lacking. Juvenile and subadult *V. bengalensis* generally live in trees where juvenile *V. salvator* were rarely observed (Figures 7). Around the zoo both of these species feed on juveniles of captive birds, mammals, fish and the Black turtle (*Melanochelys triguga*). In addition, they were also observed feeding on wild common rat snakes (*Ptys mucosus*). The preferred foods of *V. bengalensis* are rodents such as the common rat (*Rattus ratus*), mole rat (*Bandicoota bengalensis*) and Malabar bandicoot (*B. indica*). During rainy days, both monitor species remain inactive. Their natural predators are the Brahminy Kite (*Haliastur indus*), Shikra (*Accipiter badius*) and Serpent Eagle (*Spilornis cheela*), however most are unable to capture juvenile varanids because they are shy ground-dwelling animals.

Several reproductive events were observed during this study, some of which were monitored until hatching. The *V. salvator* hatchlings live on trees during their first month. In the third month they lead semi-terrestrial lives. During this period they tended to feed on bird-eggs, nestlings, geckos, agamid lizards, rats, squirrels and insects as well as garbage from the zoo. *Varanus bengalensis* was generally found up to 15 m high in trees (Figures 9) and *V. salvator* was observed less than 5 m high in trees while thermoregulating (Figure 8). *Varanus salvator* was generally active from 1000 to 1400 h. The largest individual *V. salvator* measured ca. 3 m in total length. During August, most *V. bengalensis* are shedding skin. Additionally, many keepers confirmed that this species sheds its skin during the month of August (*pers. comm*.). *Varanus salvator* are usually seen in groups (when resting) consisting of 3-6 individuals. The majority of *V. salvator* individuals observed appeared to be mature females, while a small number of

Figure 7. Juvenile water monitor (*V. salvator*) in a tree hollow in the NZG

Figure 8. Water monitor (*V. salvator*) resting in a tree in the NZG

Figure 9. Juvenile land monitor (*V. bengalensis*) on a tree in the NZG

Figure 10. Mature land monitor (*V. bengalensis*) in a burrow in the NZG

mature males and immature animals were also recorded.

The largest mature male *V. bengalensis* measured approximately 1.2 m in total length. Both males and females are generally active between 1100 and 1600 h, when they can been observed searching for insects and other food amongst rocks, logs, and on roofs. Normally they live alone and are rarely found in pairs. During September through November, females lay 4 -10 eggs measuring from 48.2 x 37. 8 mm to 55.8 x 44.5 mm. The dorsal yellow spots are very distinct in hatchlings, becoming indistinct in adults. Many instances of ritualized combat between mature males were observed. These rituals lasted for 20 min, but according to Daniel (2002), observed combat behavior has lasted for 1.5 h with occasional breaks. The home range of *V. salvator* is 50 – 70 m^2 while the home range of *V. bengalensis* is 100 – 130 m^2 area.

In Sri Lanka, large numbers of *V. bengalensis* are killed for their flesh while that of *V. salvator* is considered to be highly poisonous (De Silva, 1996). Observations of this species outside the zoo were limited as the zoo is located in a suburb of the city. In addition to the zoo, these species can be observed at Attidiya Sanctuary, Wellawatta channel and Bolgoda Lake, located 3, 4 and 10 km away from the zoo, respectively (Karunarathna et al., 2008a). The wild varanid populations inhabiting the zoo are very important in order to maintain biodiversity in the crowded city in which the zoo is located. During the first decade after the opening of the NZG in late 1936, there were no records of observations on wild varanids. However post-1990s, their numbers began to increase after the establishment of well-shaded tree-covered areas and artificial bodies of water. These species help to balance the native fauna and the entire ecosystem, with little attention of the authorities and the visitors of the zoo.

Conservation

The family Varanidae is represented by only two species in Sri Lanka, both of which are recorded in Colombo as well as the NZG. In addition to these, 22 non-captive reptile species are recorded in the zoo. Of these 22 species, 5 are endemic and 4 are threatened (Karunarathna et al., 2008b). Varanids are protected in Sri Lanka. It is interesting to note that *V. salvator* was the first reptile in Sri Lanka to receive legal protection in 1937 (as well as in the 1992 CITES appendix II list), while *V. bengalensis* has been placed in CITES appendix I (De Silva, 1996). During the survey period several threats to the biodiversity within the NZG were observed, such as water pollution and the excessive use of chemicals. This preliminary investigation of the fauna of the NZG clearly shows that NZG is an important location in terms of biodiversity. It is also evident that NZG acts as an important suburban refuge for threatened faunas in the wet zone of Sri Lanka (Karunarathna, 2008b). Therefore, many awareness programs should be conducted for visitors and keepers as well as the community residing in Colombo and its suburbs to conserve these valuable species.

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Two Observations of Captured Green Tree Monitors (*Varanus prasinus*) in the Western Province of Papua New Guinea

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In April 2002, a Green Tree Monitor (*Varanus prasinus*) was locally captured, observed in hand, and subsequently released beside a small jungle airstrip near the small village of Hukim (ca. 300 inhabitants). This is a remote area of the Ningerum tribe (also spelled Ninggerum) in Western Province, Papua New Guinea (5° 33' 23.17" S ; 141° 1' 49.89" E). The airstrip sits ca. 320 m above sea level and is located ca. 4.8 km west and slightly north of Hukim village, and 3.2 km east of the Indonesian border. The area lies in the foothills of the Star Mountains, a component of the Central Mountain Range which runs roughly east to west through the center of New Guinea. The area originally consisted of moss rainforest, however today only one-third remains untouched. The other two-thirds has been cleared over the past 30 years by local subsistence farmers for gardens, but only ca. 10% of this land is actively cultivated. The remainder has re-grown into secondary forest with varying amounts of undergrowth depending on how long ago it was abandoned.

The area receives an average annual rainfall of just over 850 cm. The monsoon season occurs from May to August, although rains typically occur year-round. During the drier summer months from October to May, the vast majority of rainfall occurs at night. Winter temperatures range from nighttime lows of 18 °C to daytime highs up to 28 °C, whereas summer temperatures range from ca. 24 °C at night to 31 °C during the day. The relative humidity, although unmeasured, remains consistently high (ca. 70 - 100%). The adult *V. prasinus* was captured just as the dry season was coming to an end.

Approximately mid-day, a group of youths were seen carrying a large *V. prasinus* along the airstrip; one boy was holding the body while the other kept a firm grasp of the animal's neck just behind the head. The lizard was not measured, but is estimated to have been over one meter in total length. The *V. prasinus* was bright green in coloration and had several dark transverse bands across its dorsum (Figure 1).

When trees are cut down, whether to clear for a garden or obtain timbers for building, the locals search the canopies of fallen trees for animals or nests. The *V. prasinus* was presumably captured in this manner since the only known traps used in the area are employed for fishing. Aside from birds, there are relatively few large animals in the area, and except for the occasional domesticated or wild boar, *V. prasinus* would be one of the largest animals encountered in the area. Thus for humans, protein-rich foods are at a premium, and finds such as eggs and snakes are quickly taken to be cooked. However, unlike many other animals captured by locals, the *V. prasinus* was not consumed. When asked why, the locals stated that it was not good for food. When asked what was wrong with this particular species, the same answer was given, "It is not good to eat". After photos were taken, the lizard was placed at the edge of an area comprised of long

grass with secondary growth 30 meters beyond. After stopping twice to look back, it quickly disappeared into the foliage.

A few months later, a juvenile *V. prasinus* was captured in the same area, again by local youths. It was brought by in mid-afternoon, shortly after its capture (presumably in the same manner as the previous adult). This specimen was ca. 50 cm in total length and darker in coloration than the previously captured adult specimen, but possessed similar dark, transverse dorsal banding. Since it was a young specimen, an attempt was made to keep the monitor captive. However, it escaped from its enclosure less than one week later.

Both of these observations were casual in nature, but should provide additional data on both the distribution of *V. prasinus* and the environments in which it occurs.

Figure 1. Adult *Varanus prasinus* captured near Hukim village, Western Province, Papua New Guinea

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Incidence of Fish Hook Ingestion by Komodo dragons

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The Komodo dragon *(Varanus komodoensis)*, a large robust monitor lizard, persists on the 5 islands in Eastern Indonesia (Ciofi and de Boer 2004). The waters surrounding these islands are intensively utilized for marine resources and in particular line and net fishing are prolific. For other reptiles, particularly freshwater and marine turtles, incidental injury and mortality through ingestion of fishing hooks during routine foraging activities are not uncommon (Polovina et al. 2000). However, similar incidents of reptile by-catch in terrestrial species is poorly documented, even though many large lizards such as monitors are semi-aquatic, or cohabit and forage within coastal areas in which intense fishing activities persist. Here we report two incidents of ingestion of fishing hooks by Komodo dragons during routine monitoring of island populations between 2002 and 2006.

Annual mark-recapture studies were conducted at 10 sites across 4 islands within Komodo National Park between 2002 and 2006 and resulted in 827 individual dragons captures. From this sample, 2 cases of fishhook ingestion were reported. The first case, comprised a small monitor (Animal ID: 00063A9978, 69.35 cm SVL, 7 kg) captured at Loh Buaya (8° 39’ 21.7” S; 119° 43’ 06.2” E) on Rinca Island and appeared to have occurred recently as the line protruding from its mouth was still relatively long and the nylon in good condition (Figure 1). Based on the line weight it is suspected that the hook ingested by this lizard was relatively small. This lizard was recaptured in 2005, without any evidence of the protruding fishing line (however if the hook was remaining is unknown). The individual appeared to be in good condition as it had grown 8.75 cm in SVL and increased its mass by 1.45 kg since it previous capture. The second lizard, an adult male (Animal ID: 000643A7EC, 127.75 cm SVL, 41.8 kg) was captured on 19 June 2004 also from Rinca Island at Loh Tongker (8° 45’ 31.1” S; 119° 42’ 57.3” E) a small coastal valley on the southeast coast. In this incident the hook ingested was considerably larger and typical of those used for capturing large pelagic species on long line. This hook was shackled with 2 strands of heavy trace wire (Figure 2). It appeared that the hook was ingested several weeks to months earlier as indicated by the lesion induced by abrasion from the trace wire. In 2005, this adult male was recaptured, there was no evidence of the protruding trace but it was unknown if the hook still resided within the animal. The weight of this male had decreased by 8.8 kg from 2004 and 20 kg from its first capture in 2003 despite growing relatively little in length (4 cm in SVL).

Consumptions of fishing hooks by Komodo dragons, albeit rare, is a likely consequence of these

lizards' prodigious scavenging capacity coinciding with discarded fishing gear that finds it way into the intertidal areas exposed on the low tide. As yet we do not know what effects hook ingestion might incur for the specific individuals dragons, however, given that mortality occurs readily in other reptiles, it is possible that at least in the case of the second animal there may be negative consequences.

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Figure 1. An immature Komodo dragon with ingested fishing tackle with protruding monofilament nylon line captured at Loh Buaya on Rinca Island

Figure 2. An incident of fish hook ingestion by an adult male Komodo dragon. This dragon has ingested a large hook connected to wire trace that has abraded to the lower jaw resulting in a small lesion.

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Husbandry and Reproduction of the Peach-throated Monitor *Varanus jobiensis* in Captivity

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Abstract - The captive husbandry and reproduction of *Varanus jobiensis* is reported. A wild-caught adult pair of *V. jobiensis* maintained together year-round copulated in August 2007, resulting in a clutch of 5 eggs. Three live hatchlings emerged after 179-181 days at a temperature of 28.9 to 32.2 ºC.

Introduction

The Peach-throated monitor, *Varanus jobiensis*, has been kept in captivity in both European and North American collections for several decades (earlier referred to as *V. karlschmidti*). Despite being widely kept by both zoos and private hobbyists, little has been published on its husbandry (Horn, 1977; Bayless and Dwyer, 1997; Sprackland, 2007; Eidenmüller, 2007) and reproduction in captivity (Horn and Visser, 1997; Dwyer and Bayless, 2001; Engelmann and Horn, 2003). Here, the husbandry and successful breeding of *V. jobiensis* in captivity are reported.

Acquisition and Husbandry of Adults

A wild caught sexual pair (1.1) of adult *V. jobiensis* was acquired in mid-2006 from separate sources. These animals were housed together year-round in a custom-built enclosure measuring 243 x 91 x 243

Figure 1. Adult *Varanus jobiensis* enclosure

Figure 2. Observable differences in the shape of the tailbase were used to distinguish between male (A) and female (B) *V. jobiensis*

cm (l x w x h), constructed from landscape timbers and an aluminum cattle trough (Figure 1). A 46 cm deep substrate comprised of 75% sand, 20% top soil and 5% fine cypress mulch was provided throughout the enclosure. Ambient temperatures within the enclosure ranged between 26.1 and 29.4 °C, and multiple basking locations ranging from 35 to 54.4 °C were provided using outdoor flood lamps (65 to 90 watts). A 14:10 light:dark photoperiod was maintained year-round. The enclosure was heavily misted with a garden hose for several minutes each day.

The adults were primarily fed weaned mice, although roaches (*Blaptica dubia*) were also occasionally offered. Both adults were fed daily. Due to a strong feeding response in the male, care was taken that food was presented to the female from tongs, to ensure that the male did not steal and consume her food. To prevent the male from becoming obese, he was encouraged to chase after his food, offered from tongs, given his gluttony.

Sexes were determined based on differences in appearance of the tailbase area. The male possesses a prominent hemipenal bulge, whereas the female does not (Figure 2). The male also possesses a high keel towards the middle of the tail, whereas the female does not.

No aggression has been observed between the adult pair. The female usually acts indifferently to the male, whereas the male often pursues the female throughout the enclosure, flicking his tongue while rhythmically shaking its head from side to side. The pair is often seen basking together.

Courtship, Copulation and Nesting

Courtship behavior was first observed on 4 August 2007. The male would approach the female while rapidly tongue-flicking on her head and rear legs, with his head twitching and swaying side to side as he walked. The male would relentlessly pursue the female around the enclosure until she would submit to copulation. Copulation occurred several times a day throughout the enclosure for 12 days, with each event lasting between 10 min and 1 h in duration (Figure 3). No alternation of hemipenes was observed during copulation.

Figure 3. Copulation of *V. jobiensis*

Figures 4 & 5. Oviposition

By 16 August, the male no longer showed interest in the female. Over the next several days the female began to increase in diameter and appeared noticeably gravid. During this time, the female was seen seeking hotter basking temperatures than normal and resting in peculiar positions, such as lifting her abdomen up off of basking spots or suspending her abdomen from objects in the enclosure rather than resting directly on them. These behavioral changes have remained consistent over four clutches laid by the female to date, and in addition to a sudden increase in girth, have become reliable indicators for determining whether or not the female is gravid.

On 1 September 2007, two eggs which had been eaten and digested, as evidenced by their collapsed appearance, were found in the water basin. Test digging throughout the enclosure was observed two days prior to oviposition. The female would dig several shallow pits then insert her snout into the bottoms of these pits to presumably test the humidity and or temperatures.

Oviposition occurred at night on 6 September 2007 (Figures 4 & 5). Despite the presence of an external nest box, the female deposited 3 eggs in the substrate of the enclosure at a depth of ca. 9 cm and at a temperature of ca. 30 °C. Clutch measurements are presented in Table 1. Following oviposition, the female traveled to the water basin to drink then retreated to an external hide box towards the top of the enclosure**.**

Incubation and Hatching

The eggs were retrieved and set up for incubation in a sealed 2.8 L plastic container. Glitter-grade vermiculite mixed with water by soaking and then rung-out by hand, was used as incubation medium. The incubator, a modified mini-refrigerator with a 3 gallon water reservoir at the bottom, maintained

Table 1. Egg measurements
** devoured/digested eggs not included*

No.	Length (cm)	Width (cm)	Mass (g)
1	5.7	2.5	24.4
2	6.0	2.5	24.8
3	6.4	2.5	24.5

Table 2. Hatchling measurements

No.	SVL (cm)	Total Length (cm)
1	7.9	19.1
2	12.1	24.8
3	10.8	26.7

Figure 6. Hatching *V. jobiensis*

Figure 7. Captive-bred *V. jobiensis*

Figure 8. Detail of ventral coloration and pattern

temperatures between 28.9 to 32.2 ℃. The egg container was vented periodically for gas exchange.

The first egg hatched on 3 March 2008 after 179 days of incubation. The remaining two eggs hatched out on 4 and 5 March. Hatchling measurements are provided in Table 2. The hatchlings measured 7.9 cm snout to vent length (SVL), 19.1 cm total length (TL); 12.1 cm SVL, 24.8 cm TL; 10.8 cm SVL, 26.7 cm TL, respectively.

Husbandry of Offspring

After remaining in the incubator for two days, all three hatchlings were housed individually in 38 L (10 gallon) aquaria. Sphagnum moss was provided as substrate and the rear walls were covered with tree bark. A basking branch and some tree bark scattered on the ground completed the furnishings of each setup. A pyrex bowl for water with a piece of silk foliage in the bowl was provided for each terrarium. Screen aquarium tops were completely covered with plastic sheeting to help retain humidity levels. Three 6 mm holes were made in the plastic sheeting to allow for adequate ventilation. Basking sites of 32.2 ℃ were provided by 50 watt incandescent bulbs.

The offspring accepted food after 2 days. Roach nymphs (*Blaptica dubia*) and chopped pinkie mice were offered daily. The raising of the offspring has been without difficulties, and all three offspring continue to grow rapidly.

Acknowledgements - I would like to thank everyone for their support, and I would especially like to thank the late Mark K. Bayless for his friendship and collaboration on varanids over the years.

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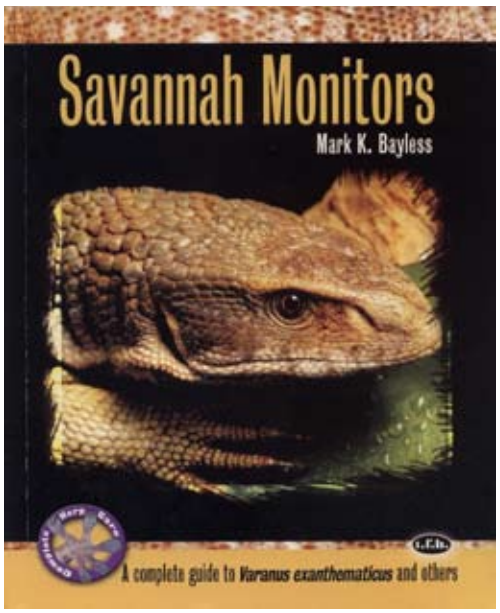
BOOK REVIEWS

Biawak. 2008. 2(3): 131-134

Savannah Monitors: a Complete Guide to *Varanus exanthematicus* and Others

MARK K. BAYLESS
TFH Publications, Neptune NJ. 2006.
128 pp. Softcover. ISBN: 9780793828869



There have been several books written over the past two decades on the captive husbandry of *Varanus exanthematicus* and its allies (Balsai, 1992; Coborn, 1994; Sprackland, 2001; Bennett and Thakoordyal, 2003). Some of these books contain husbandry advice which is now considered to be outdated by modern varanid husbandry standards, yet are still frequently sold in pet shops across North America and abroad. Given the popularity and prevalence of *V. exanthematicus* within the pet trade, as well as the general lack of appropriate literature on their care, there is a great demand for accurate and up to date husbandry information on this species among pet monitor lizard keepers, particularly the clientele of pet shops. Furthermore, with many reptile hobbyists unaware of herpetological and herpetocultural journals, magazines, newsletters, and online message boards, pet shop books, if well written, can help educate these hobbyists about the environmental and physiological demands of their captives, through a medium familiar to them.

When I first learned of Bayless' then new book on savannah monitors in 2006, I did not know what to expect. Published by TFH Publications, a publisher of "pet shop" reptile care books known throughout the herpetocultural community for their poor editing and organization, recycled photographs (among other TFH herp books), and outdated husbandry advice, there was a great chance that it would live up to the poor reputations of many of their other titles. However, given Bayless' devotion and significant contributions to the study of varanid lizards (see Mendyk and Aller, 2007), particularly African varanids (e.g., Bayless, 1994, 1997, 2002, 2007, 2008; Attum, et al., 2000), there still remained the possibility that his book would stand out from other books written on the same subject.

The book starts out with a chapter on natural history, which covers distribution, habitat, temperature, humidity, hibernation and aestivation, predators, taxonomy, and descriptions of each of the three species discussed in the book (*V. exanthematicus, V. albigularis and V. ocellatus*). Next is a chapter which pertains exclusively to behavior, with sections on intelligence, thermoregulation, swimming, aggression and combat, sociality, senses, and defensive behavior. The following chapter covers purchasing, quarantine, and establishment. The next two chapters cover housing and handling, and feeding, nutrition and growth, and is followed by a chapter on breeding, which summarizes data and observations reported by other authors on the captive reproduction of savannah monitors. The final chapter on health care discusses various health afflictions commonly seen in captive varanids, and includes a detailed synopsis of parasites known to savannah monitors in captivity. A literature cited, resource section, and index completes the

book.

In many ways, this book is not unlike previous titles from TFH, having careless editing mistakes including missing text and awkward grammar. A notable example of careless editing occurs halfway through the description of *V. ocellatus* in the first chapter, where the text is cut off after page 23, and immediately skips to the next chapter. A noticeable inconsistency occurs in the third chapter, on purchasing a monitor. With the exception of the first section of the chapter entitled "Monitor Addiction", all successive parts to this chapter are inconsistent with Bayless' writing style, and appear to have been written by someone else. This is not surprising, given that the vagueness, styling and formatting of this chapter could theoretically be used for other taxa; an interchangable "cookie-cutter" insert usable in multiple reptile hobbyist books. In fact, the writing style of this chapter is reminiscent of the typical formatting used in many other poor reptile keeping books of the past.

Editorial blunders aside, there were a few sections which were disagreeable, or questionable in their inclusion within the book. The section on taxonomy, which includes a table listing morphometric measurements and scale counts for each species, may be confusing or too complicated for the average pet hobbyist to fully comprehend or even care about, especially when no comparative photographs of each species are provided to accompany the section. To further add to this confusion, Bayless goes through the trouble of arguing the validity of *V. ocellatus*, a species long-synonymized with *V. exanthematicus* (Mertens, 1942), as well as its subtle differences from *V. exanthematicus*. Yet, not a single photo of *V. ocellatus* is provided in the book. Lastly, after a seemingly long-winded discussion about *V. ocellatus* and its taxonomic validity, the reader isn't even given the opportunity to completely review the evidence provided by Bayless for its alleged validity, because that portion of the text was left out by careless editing!

A few anecdotal reports of sociality, varanid senses, and "looping behavior" add little or nothing to this book, but were perhaps included to catch or maintain the interest of readers. I felt that the section on claw trimming was inappropriate and potentially misleading especially to beginner hobbyists, considering that varanid lizards do not require nail trimmings if their environmental needs are met. Encouraging hobbyists to do so may just further reinforce the anthropomorphic mindset already prevalent among many keepers which often hinders progressive and critical thinking towards the improvement of their reptile husbandry. Lastly, my final criticism pertains to the chapter on health care. Lacking were descriptions of appropriate treatments for the ailments described. However, I suppose one can argue that given the target audience of this book, it is probably best that beginner hobbyists do not attempt to perform veterinary procedures and treatments on their own.

Despite the many shortcomings of this book, there were a few positive aspects which stood out over several other published books on savannah monitors. It was encouraging to see a section devoted to defensive behavior rather than "aggressiveness", as it is so commonly misrepresented to describe captive varanid behavior. Bayless discusses the fear and vulnerability which hatchling and recently-imported individuals experience in captivity, something which many beginner monitor keepers seldom understand. Addressing these issues may help reduce the amount of stress exerted on newly acquired monitor lizards by unsuspecting, beginner keepers. Bayless also stresses the importance of variation in diet, advising keepers to offer an assortment of prey items, while stressing the importance of avoiding improper diets perpetuated by the pet trade, such as dog food and canned monitor lizard diet. Improper diet is a major contributor to poor health and premature death in captive varanids. Addressing these important issues in his book may help improve the current state of varanid husbandry among beginner hobbyists.

Unlike many other pet reptile books I've come across over the years, Bayless actually cites primary literature within the text; something which I fear will go unnoticed and unutilized by the book's target beginner audience. It was quite surprising to see references cited throughout this book, as it would seem that for such a non-technical book, a literature cited section would be a considerable waste of valuable

page space, especially since all titles within TFH's "Complete Herp Care" series are restricted by page length (128 pp). It was a relief to see new photographs used for this book, given the publisher's previous tendency to reuse photos from other titles, and there were no noticeable errors in image captions.

Compared to most other savannah monitor books, Bayless does offer some sound, progressive advice to their captive husbandry, especially in regards to variation in diet, housing and substrate, which will hopefully be employed by those who read this book. Given the poor quality of most other books presently available on the captive husbandry of *V. exanthematicus* and related species, I suppose I would recommend this book to beginner hobbyists. However, I would not consider it to be an acceptable alternative to networking and speaking with other keepers and breeders, as one can likely receive more appropriate and useful husbandry advice and information from fellow hobbyists. Considering the book retails for only about $10 US (and substantially cheaper if purchased used), it would make an inexpensive addition to any varanid enthusiast's library, even if just for the photographs.

My overall impression of this publication is that Bayless sought to produce an informative, semi-technical book, which turned out to be inappropriate for the publisher's target audience. This is evidenced by the choppy and often inconsistent flow of the text, where some chapters appear to have been oversimplified, yet some remain semi-technical and likely confusing to a beginner hobbyist. Given his extensive dedication to, and knowledge of both wild and captive African varanids, I feel that Bayless' efforts would have been better applied towards writing a book aimed at a more informed audience. Given this, I personally see this book as an unfortunate waste of his time, knowledge, ability and resources.

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RESEARCH REQUESTS

Photographs requested for systematic research in Asian and Indo-Australian monitor lizards:

For ongoing studies on biogeography, systematics and taxonomy of the *Varanus salvator* complex (Asian water monitors) and the *V. indicus* species group (Pacific monitors), I am searching for photographs of any species and populations of both groups. Due to the vast distribution of both of these monitor lizard groups, comprising Southeast Asia (*V. salvator*) as well as the Indo-Australian region and many Pacific islands (*V. indicus* group), the documentation of geographic variation in color pattern represents an enormous challenge. The rising number of species involved in both groups, and in some species, ontogenetic changes in color and pattern (i.e., from juveniles to adult specimens) may complicate the identification and taxonomic allocation of individuals and populations. In addition, specific features of the color pattern may fade during preservation. Therefore, photographs of live monitor lizard specimens may help to compare and interpret the patterns of examined voucher specimens of natural history collections. Provided the consent of the author, submitted photographs may be used in future publications. Please send any photographs, either digital or print outs, to:

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For additional information about myself and my research projects, visit my homepage http://www.zfmk.de/web/ZFMK_Mitarbeiter/KochAndr/index.en.html. Thank you for your support, and many thanks to everyone who has already sent me monitor lizard photographs in the past.

Deceased Specimens of the *Varanus prasinus* complex for morphometric analyses

Formalin or alcohol-fixed and frozen specimens of adult male and female *Varanus beccarii*, *V. boehmei*, *V. bogerti*, *V. kordensis*, *V. macraei*, *V. prasinus*, and *V. reisingeri* are sought on temporary or permanent loan for use in non-destructive morphometric analyses. Locality data are not required, therefore deceased pet trade animals and those from zoological collections are preferred. Unfortunately due to CITES limitations, only specimens presently within the United States are eligible.

Shipping costs will be paid, as well as costs incurred for any preservation materials required. If able to furnish specimens, or would like additional information or instructions on how to preserve recently-deceased specimens, please contact:

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RECENT PUBLICATIONS

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Varanus varius tracks. Ben Boyd National Park, NSW.
Photograph by **Jason Taylor**