Biawak. 2008. 2(3): 109-118

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

D.M.S. SURANJAN KARUNARATHNA [1], A.A. THASUN AMARASINGHE [2], and ASHA DE VOS [3]

[1] *The Young Zoologists' Association of Sri Lanka, Department of National Zoological Gardens, Anagarika Dharmapala Mawatha, Dehiwala, Sri Lanka*
dmsameera@gmail.com

[2] *Taprobanica Nature Conservation Society, No: 146, Kendalanda, Homagama, Sri Lanka*
aathasun@gmail.com

[3] *IUCN – International Union for Conservation of Nature, Sri Lanka Country office, No: 53, Horton place, Colombo 07, Sri Lanka*
adv@iucnsl.org

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.

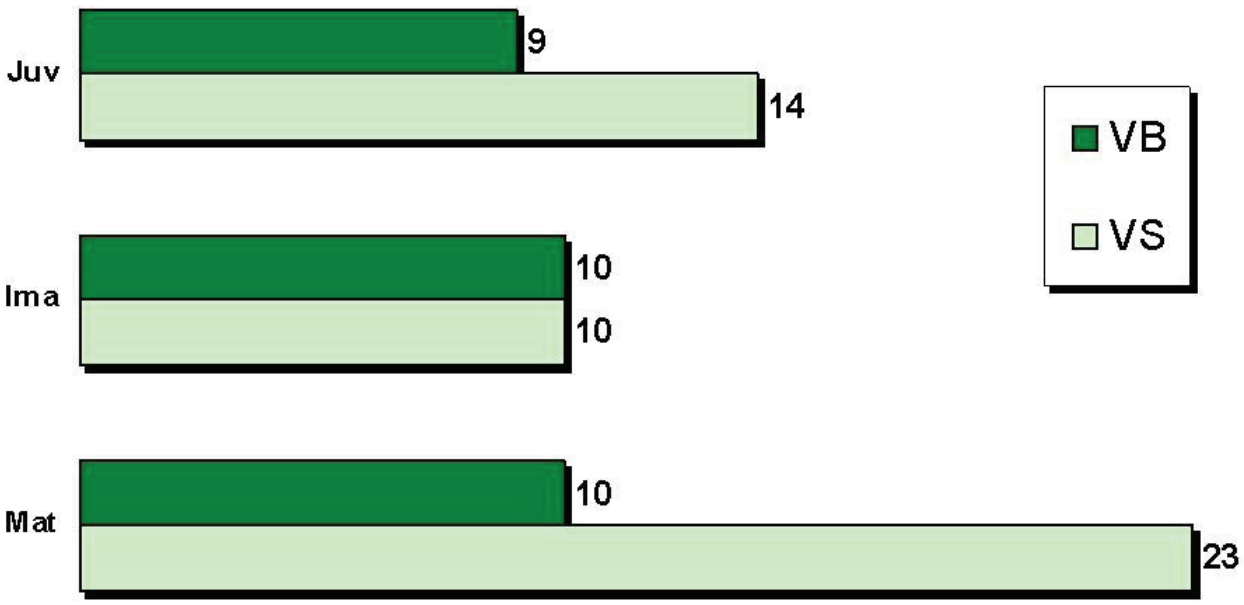

Figure 2. Total individual counts of the two monitor species observed in the NZG. Abbreviations: Juv = Juvenile, Ima = Immature, Mat = Mature, VB = *Varanus bengalensis,* VS = *Varanus salvator*

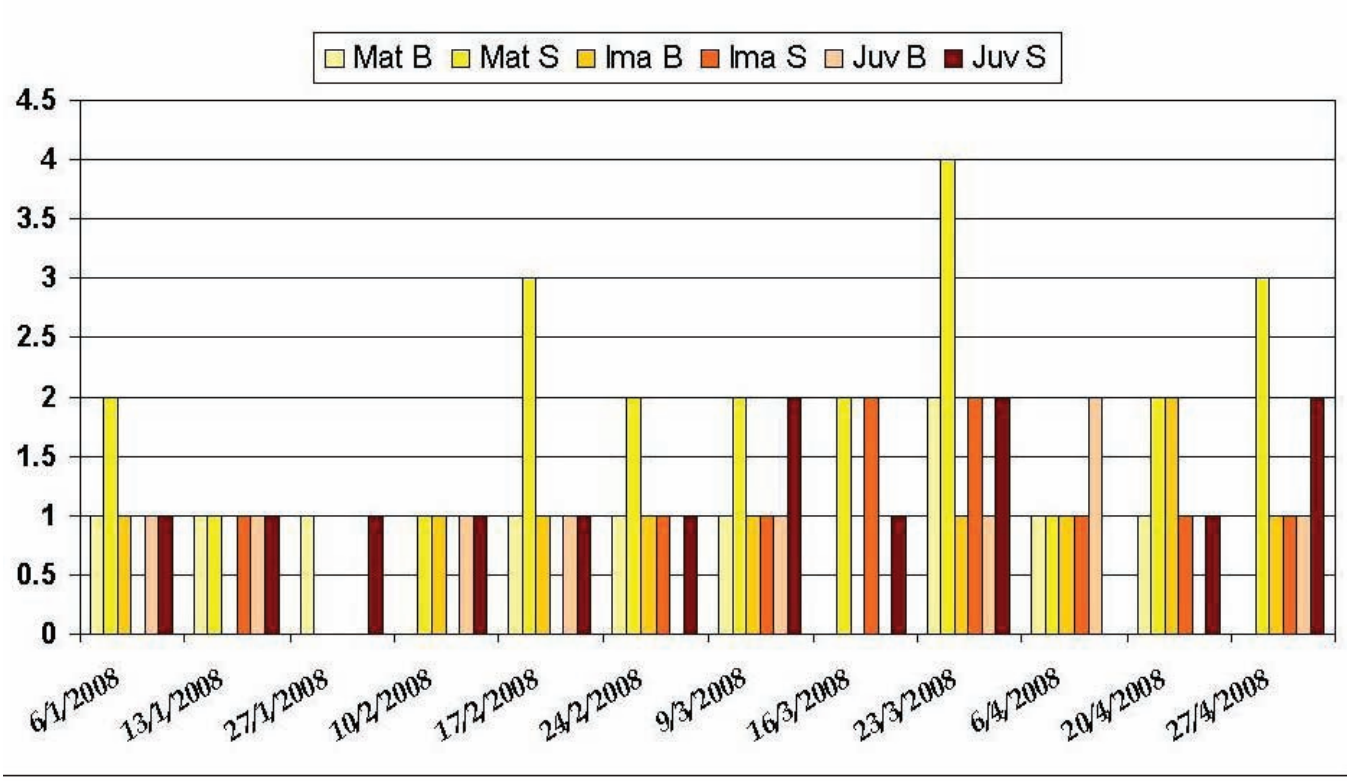

Figure 3. Number of monitor lizards observed by date. Abbreviations: Mat B = Mature *Varanus bengalensis*, Ima B = Immature *V. bengalensis*, Juv B = Juvenile *V. bengalensis*, Mat S = Mature *V. salvator*, Ima S = Immature *V. salvator*, Juv S = Juvenile *V. salvator*

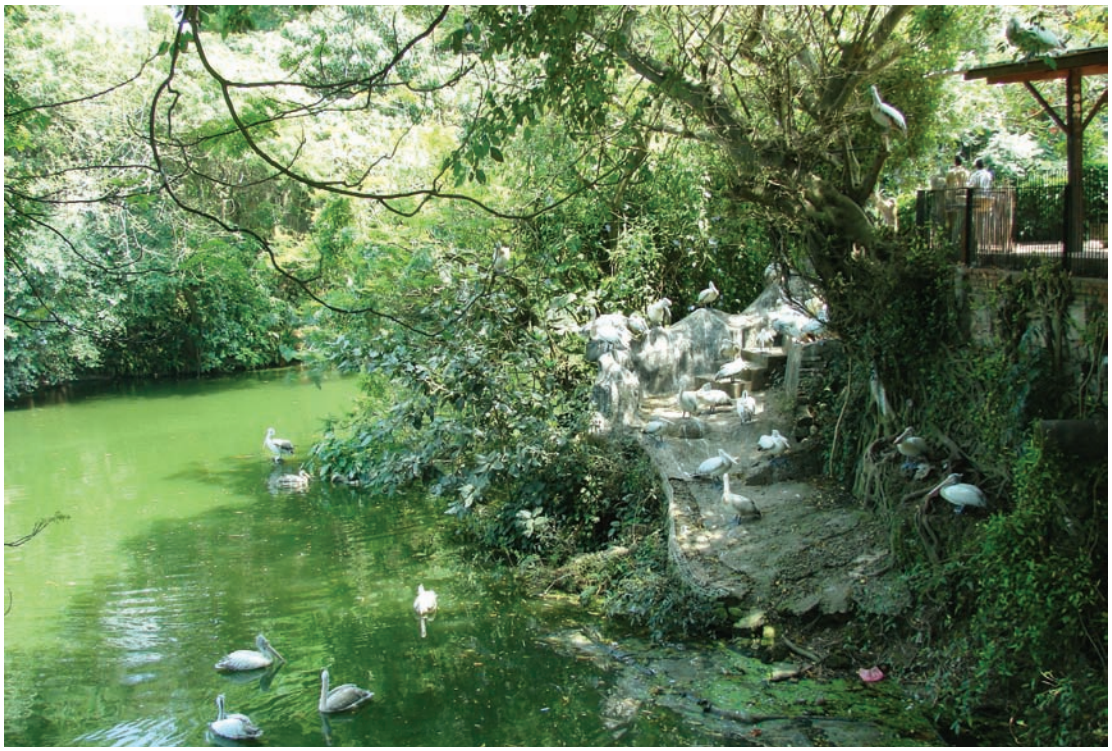

Figure 4. Habitat type of the Gal Wala = Pond area inhabited by several birds

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.

Acknowledgements - The authors wish to thank Mr. Mendis Wickramasinghe (SLHS - Sri Lanka Herpetological Society) and Mr. Kelum Manamendra-Arachchi (WHT – Wildlife Heritage Trust of Sri Lanka) for various comments and relevant literatures. We also thank the 2007 - research committee members of the Young Zoologists' Association (YZA) and Mr. Saminda Fernando, Mr. Gayan Wijethunga, Mr. Asanka Udayakumara, Mr. Sacheendra Deepankara, Mr. Gayan Edirisinghe, Mr. Thilina Pathum and Mr. Praneeh Jayamadu for their kind help during the field visit and other activities in the National Zoological Gardens. We wish to extend our heartfelt gratitude to the directors, Mrs. Renuka Bandaranayeke, Mrs. Dammika Malsinghe and other supporting field staff of the National Zoological Gardens, Dehiwala, Sri Lanka. Finally, we thank Robert Mendyk, Harold De Lisle and anonymous reviewers for useful comments.

Literature Cited

Das, I. 2001. Biodiversity and Biogeography of the herpetofauna of Southern Asia. Pp. 1-38. In C.N.B. Bambaradeniya and V.N. Samarasekara, An overview of the threatened Herpetofauna of South Asia. IUCN Sri Lanka and Asia Regional Biodiversity Programme, Colombo, Sri Lanka.

Das, I. and A. De Silva. 2005. Snakes and other Reptiles of Sri Lanka. New Holland Publishers. UK. London.

Daniel, J.C. 2002. The Book of Indian Reptiles and Amphibians. Bombay Natural History Society and Oxford University Press, Oxford.

Deraniyagala, P.E.P. 1953. A Colored Atlas Of Some Vertebrates From Ceylon Volume 2: Tetrapod reptilia. The Ceylon Government Press, Colombo.

De Silva, A. 1996. The Herpetofauna of Sri Lanka: a brief review. Graphic Land, Kandy, Sri Lanka.

De Silva, A. 1998. Sauria (Lizards and Varanids) of Sri Lanka : A checklist and annotated bibliography. Graphic Land, Kandy, Sri Lanka.

De Silva, A. 2006. Current status of the Reptiles of Sri Lanka. In C.N.B. Bambaradeniya, Fauna of Sri Lanka: Status of Taxonomy, Research and Conservation, pp. 134-163. The World Conservation Union, Colombo, Sri Lanka and Government of Sri Lanka.

Gaulke, M. and A. De Silva. 1997. Monitor lizards of Sri Lanka: preliminary investigation on their population structure. Lyriocephalus 3(1): 1-5.

Halliday, T. and K. Adler. 2002. The new encyclopedia of Reptiles and Amphibians, Oxford University Press, Oxford.

Karunarathna, D.M.S.S., A.A.T. Amarasinghe and E.M.K.B. Ekanayake. 2008a. Observed predation on a Suckermouth Catfish (*Hypostomus plecostomus*) by a water monitor (*Varanus salvator*) in Bellanwila-Attidiya Sanctuary. Biawak 2(1): 37-39.

Karunarathna, D.M.S.S., D.A.M.M. Athukorale, W.A.A.D.G. Pradeep, J.K.P.P.D. Jayawardena, K.P.A. Rashintha, W.W.D.H.P. Perera, W.A.D.S.P. Wijesinghe and M.H.S.A. Jayasekara. 2008b. Some observations on the non-captive faunal diversity in the National Zoological Gardens Dehiwala and its Environs in Sri Lanka. Tigerpaper 35(1): 13-21.

Malsinghe, D., N. Senarath, S. Premalal, L.P. Jayantha and R.A. Rathnasiri. 2004. The Butterfly Park of the National Zoological Garden, Dehiwala, Sri Lanka. Zoos' Print Magazine 19(5): 5-7.

National Zoological Gardens. 2004. The Visitor guide of the National Zoological Gardens of Sri Lanka. Department of National Zoological Gardens, Sri Lanka.

Pough, F.H., R.M. Andrews, J.E. Cadle, M.L. Crump, A.H. Savitzky and K.D. Wells. 2004. Herpetology, Third edition. Pearson Prentice Hall, USA.

Reptile Database. 2007/2008.http://www.tigr.org/reptiles/search.php?taxon=&genus=Varanidae&species.

Somasekaran, T. 1988. The National Atlas of Sri Lanka. Surveys Department, Sri Lanka.

Weinman, A.N. 1957. A zoological guide to the Zoological Gardens of Ceylon. Government press of Ceylon.