

# BIAWAK

Volume 2 Number 2 - May 2008



ISSN: 1936-296X

## On the Cover: *Varanus panoptes panoptes*

The *Varanus p. panoptes* depicted on the cover and inset of this issue was photographed in Townsville, Queensland on March 2008 by **David Lynam** [lynam\\_fam@optusnet.com.au](mailto:lynam_fam@optusnet.com.au). The monitor was first seen around 0800 h on a sand ridge just above a swamp area, standing on its hind legs while looking into the lower branches of a tree. The monitor maintained a bipedal stance for ca. 2 minutes before it casually walked off. The temperature at the time of the observation was ca. 27 C.



---

# BIAWAK

*Quarterly Journal of Varanid Biology and Husbandry*

## **Editor**

ROBERT W. MENDYK  
*Center for Science Teaching and Learning  
1 Tanglewood Road  
Rockville Centre, NY 11570, US*  
[odatriad@yahoo.com](mailto:odatriad@yahoo.com)

## **Associate Editors**

HAROLD F. DELISLE  
*P.O. Box 1975  
Twentynine Palms, CA 92277, US*  
[varanus.edu@hotmail.com](mailto:varanus.edu@hotmail.com)

DANIEL BENNETT  
*School of Biology, Leeds University  
Leeds LS2 9JT, UK*  
[mampam@mampam.com](mailto:mampam@mampam.com)

## **Editorial Review**

BERND EIDENMÜLLER  
*Griesheimer Ufer 53  
65933 Frankfurt, DE*  
[bernd.eidenmueller@t-online.de](mailto:bernd.eidenmueller@t-online.de)

MICHAEL FOST  
*Learning Tutoring Center  
Georgia Perimeter College Clarkston Campus  
555 North Indian Creek Dr  
Clarkston, GA 30021, US*  
[mfost@post.com](mailto:mfost@post.com)

RUSTON W. HARTDEGEN  
*Department of Herpetology, Dallas Zoo  
650 South R.L. Thornton Freeway  
Dallas, Texas 75203, US*  
[ruston17@yahoo.com](mailto:ruston17@yahoo.com)

ROBERT G. SPRACKLAND  
*Virtual Museum of Natural History  
Unit #4 2635 Prosch Ave W  
Seattle, WA 98119, US*  
[robertsprackland@comcast.net](mailto:robertsprackland@comcast.net)

MICHAEL J. BALSAL  
*Department of Biology, Temple University  
Philadelphia, PA 19122, US*  
[Vze3vhpv@verizon.net](mailto:Vze3vhpv@verizon.net)

MICHAEL COTA  
*Thailand Natural History Museum, National Science Museum,  
Technopolis, Khlong 5, Khlong Luang,  
Pathum Thani 12120, TH*  
[herpetologe@gmail.com](mailto:herpetologe@gmail.com)

JEFFREY M. LEMM  
*Applied Animal Ecology Division  
Conservation and Research for Endangered Species (CRES)  
Zoological Society of San Diego  
15600 San Pasqual Valley Rd  
Escondido, CA 92027, US*  
[jlemm@sandiegozoo.org](mailto:jlemm@sandiegozoo.org)

---

## **INTERNATIONAL VARANID INTEREST GROUP**

**[www.varanidae.org](http://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.

## Local Names of Pan-African Varanids

.....	MARK K. BAYLESS	61
Remarks on Osteological Deformities in a Captive-bred Emerald Tree Monitor, <i>Varanus prasinus</i>	.....	
.....	ROBERT W. MENDYK	72
Observations on Three Species of <i>Varanus</i> in Ilfracombe, Queensland	.....	
.....	ROD SHANNON	80
A Case of Hermaphroditism in the Ridge Tailed Monitor ( <i>Varanus acanthurus</i> )	.....	
.....	DANNY BROWN	87
<b>EDITOR'S NOTE</b> .....	56	
<b>NEWS NOTES</b> .....	58	
<b>TRANSLATIONS</b> .....	89	
<b>HUSBANDRY NOTES</b> .....	95	
<b>NATURAL HISTORY NOTES</b> .....	97	
<b>RECENT PUBLICATIONS</b> .....	98	

© 2008 International Varanid Interest Group



*Varanus prasinus*. Lizards and Snakes Alive! exhibit, Houston Museum of Natural Sciences.  
Photograph by **Shau Lin Hon** [slyworksphotography@yahoo.com](mailto:slyworksphotography@yahoo.com)

---

# EDITOR'S NOTE

We would like to thank the numerous individuals who have responded with their thoughts and concerns over the controversial issues discussed in the *Editor's Note* of last issue concerning the potential regulation of private varanid keeping by local and national governments. From the responses we have received thus far, it seems as though there is a great disparity between hobbyists in favor of government-regulated permit systems for the legal and responsible keeping of varanids, and those against such systems. For those who are against a permit system, are there any alternatives which may help remedy the many shortcomings of the current hobby?

We would like to encourage our readers to continue to send in their thoughts and comments on this matter so that the IVIG can gain a broader understanding of how private hobbyists stand on the various factors which may affect the future of varanid keeping. Please send all comments and concerns via email to [submissions@varanidae.org](mailto:submissions@varanidae.org)

## Additional Varanid Literature Resources Offered by the IVIG

Perhaps one of the biggest problems limiting scientific literacy in society today is the large gap which exists between scientific research, discovery and publication, and the information available to the general public outside of science or academia. Scientific journals, which are the typical venue where the results of new scientific research and discoveries are published, are not usually accessible to individuals who are not affiliated with universities or other academic institutions, thus preventing these individuals from furthering their own knowledge and understanding of a particular scientific discipline.

Bridging this gap and promoting scientific literacy among varanid enthusiasts is one of the IVIG's



Juvenile *Varanus bengalensis* in termite mound. Ettimadai, Tamil Nadu, India.

Photograph by Shivapratap Gopakumar [shivapratap@gmail.com](mailto:shivapratap@gmail.com)

most fundamental goals. Therefore, the IVIG has created several supplemental varanid literature resources in addition to the journal *Biawak*, which are available through the website, <http://varanidae.org>. These literature resources, which are free and accessible to all visitors, will assist researchers, hobbyists, and enthusiasts in accessing published literature on monitor lizards, and furthering their understanding of varanid biology and husbandry.

**Online Research Articles-** An annotated bibliography of varanid research articles currently available online with direct links allows viewers to access articles published on external websites. Due to the dynamic nature of the internet, this section is regularly updated.

**Varanid Newsletter Facsimiles-** Complete issues of the out of print varanid newsletters *VaraNews*, *Dragon News*, *Varanids*, and the *Dutch Varanid Group Newsletter* are available for download. Articles cover a wide range of topics including, but not limited to the captive husbandry, veterinary medicine, and natural history of monitor lizards.

**Bibliotheca Varanoidea-** An online message board for the discussion of varanid literature allows participants to discuss new publications, critique information presented in varanid literature, as well as place requests for specific articles and papers amongst peers. Inquiries on scientific writing and documentation are also welcomed and encouraged.

## 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, fora, and message boards. For additional information on these positions, please contact the editor at [odatriad@yahoo.com](mailto:odatriad@yahoo.com).



Cat and juvenile *Varanus niloticus*. Mombasa, Kenya.  
Photograph by **Srinath Dasari**.  
[srinath.dasari@gmail.com](mailto:srinath.dasari@gmail.com)

---

# NEWS NOTES

## Oakland Zoo hatches *Varanus beccarii*

According to a recent AZA press release, the Oakland Zoo has successfully hatched a Black Tree monitor (*Varanus beccarii*). Three eggs were laid on 25 February 2007, however only one was viable. This egg hatched on 14 August 2007. It was not specified whether the zoo will keep the individual or transfer it to another zoological institution.

Source: *Connect Magazine*, February 2008: 35

## Large monitor lizard terrorizes village

A large lizard, originally purported to be a Komodo dragon (*Varanus komodoensis*), had been sighted in the bushes around Butibam village in Lae, Morobe Province, Papua New Guinea. Since the initial sighting, several other villagers came forth with additional sightings and claims of the lizard terrorizing the village, including eating dogs, leaving large footprints, and tearing down vegetation. When interviewed, several villagers said that they would not go into their gardens for fear of the giant lizard.

An expatriate residing in the area came forth claiming that his pet *V. komodoensis*, which he brought back to Papua New Guinea as an egg which hatched, had escaped, and offered a reward of 1000 Kina for the lizard to be killed. Later reports suggest that this claim was likely a hoax.

Intensive searches of the area by the army and Department of Environmental Conservation failed to find any such lizard, and it is suspected that the alleged lizard is not a *V. komodoensis*, and could be a Crocodile monitor (*V. salvadorii*), which attains a substantial size and is indigenous to Papua New Guinea, although no records of *V. salvadorii* currently exist for Morobe Province (see Horn et al., 2007. On the distribution of the Papuan monitor *Varanus salvadorii* [Peters & Doria, 1878] in New Guinea. *Mertensiella* 16: 25-43.). Search efforts were called off because there had been no new leads and the search was costing too much.

Sources: *The National*, 7 February 2008; *Associated Press*, 12 February 2008

## USDA seeks to poison rats and monitor lizards on Cocos Island

Recent plans have been proposed by the United States Department of Agriculture's Animal and Plant Inspection Service division, to use a combination of two poisons, diphacinone and brodifacoum, to diminish the predators of the endangered Ko'ko bird, or Guam Rail (*Gallirallus owstoni*) on Cocos Island, Marianas. The poisons will be used to cut down on the rat and monitor lizard (*Varanus indicus*) populations on Cocos, both of which pose a threat to the avifauna of the island, which is now a bird sanctuary. Eighty percent of the *V. indicus* population on Cocos is planned to be killed off

Opponents of the plan argue that the poisons will affect many other organisms on and around the island including aquatic animals, birds and mammals, including humans. Merizo residents stress that they do not want the local monitor lizard population to be harmed. Many feel that the island is perfect for them and a place of their own, being located away from roads and domestic chickens.

Source: *Marianas Variety*, 4 March 2008

## Komodo Dragons hatch at Surabaya Zoo

According to a recent news report, the Surabaya Zoo, located in East Java, Indonesia, has successfully hatched a clutch of 14 *Varanus komodoensis* eggs. The recent 14 hatchlings, in addition to an earlier clutch of 13, have brought the total number of *V. komodoensis* maintained by the zoo to 41.

*Source: Independent Television News Limited, 12 March 2008*



Male *Varanus komodoensis*. Miami Metrozoo. Photograph by **Steve Connors**

---

# ARTICLES

**Introductory Note** - The following article, submitted by the late Mark K. Bayless (1960-2006) prior to his death, cites numerous obscure and antiquarian book references. Unfortunately, the exact page numbers of these books, from which information was gathered, could not be obtained. Additionally, no efforts were made to update the names of countries which have changed since the cited reference's publication.

## Local Names of Pan-African Monitor Lizards (Varanidae: *Varanus*: *Polydaedalus*)

MARK K. BAYLESS

\**deceased*

African monitor lizards have a Pan-African distribution (Bayless, 2002). These lizards are known from generalized to specific habitats across Africa (Bayless, 1997). If studying zoology, herpetology, epidemiology, parasitology, or ethnography, it is helpful to know the local and regional names of these reptiles. To date, the most comprehensive listing of local names for *Varanus* has been written by Auerbach (1995:243-245). The following compilation includes the local names for each monitor lizard species listed by country, tribe, language, and source.

**Acknowledgements** - I thank Vivian de Buffrenil, and Hazel Chapman for clarifying and sharing some African *Varanus* names with me.

Table 1. Local names of *V. exanthematicus*.

Local Name	Country/Region	Tribe/Locale	Language	Reference
A-nak-a-nak	Kenya	Karamajong		Auerbach, 1995
A-nak-a-nak	Kenya	Tesa		Auerbach, 1995
Damo	Nigeria	Hausa		Bargery, 1934; Abraham, 1949; Dunger, 1967; Newman, 1990
Damu	Senegal			Roure, 1956
Eft	west Africa			Ogilby, 1670
Gueule-tapee	Cameroon			Morel and Mouchet, 1958
Gueule-tapee	Senegal			Roure, 1956; de Buffrenil, pers. comm.
Na-kwanga	Nigeria	Hausa		Bargery, 1934
Sao	Guinea			Tendiero, 1950
Anggogue	Ethiopia	Tigre		Lefebvre, 1845
Ardjano	Ethiopia	Amri		Lefebvre, 1845
Tatu'	Guinea			Bocage, 1893

Table 2. Local names of *Varanus ornatus*.

Local Name	Country/Region	Tribe/Locale	Language	Reference
Dgyou-Dgyou	eastern Nigeria			Angelici and Luiselli., 1999
Geedee	southern Nigeria	Ibo	Igbo (Kwa)	Page, 1908
Guana	Benin	Ibo		Deane, 1830
Ju-Ju	Nigeria	Ibo	Igbo (Kwa)	Adams, 1823; Cox, 1968; Bayless et al., 2003.
Ju-ju	Tanzania			Burton, 1972

Table 3. Local names of *V. albigularis*

Local Name	Country/Region	Tribes/Locale	Language	Reference
Agondwa	Malawi		Mang'anja	Scott, 1892
Ebanga	Malawi			Auerbach, 1995
Ebanga	Mozambique			Auerbach, 1995
Ekakala	Namibia	Oshikwanyama		Auerbach, 1995
Ekakala	Namibia	Oshiwambo		Jauch, 2002
Etatu	Angola	Ebanga		Monard, 1937
Godwa	Malawi		Chikunda	Scott, 1892
Gondoa	Malawi	Gorongosa		Auerbach, 1995
Gondoe	Malawi	Gorongosa		Auerbach, 1995
Gondwa	Malawi		Mang'anja	Scott, 1892; Loveridge, 1953; Auerbach, 1995
Gondwa	Congo	Nyangwe		Binneken, 1914
Gondwama-lemu	Malawi		Mang'anja	Scott, 1892
Gopane	Botswana		Setswana	Auerbach, 1985, 1995; Clauss and Clauss, 2002
Gwababa	Botswana	Ndebele	Setswana	Auerbach, 1985
Gwahli	Botswana	Shangaan		Auerbach, 1995
Gwavava	Malawi			Auerbach, 1995
Imbulu	Zululand	Xhosa		Auerbach, 1995
Imbulu	Zimbabwe	Shona		Chubb, 1909
Intaka	Botswana	Amandebele		Thomas, 1873
Ixamu	Zululand	Xhosa		Auerbach, 1995
Kakala	Angola	Mulondo		Monard, 1937
Kakandamuti	Angola	Mupa		Monard, 1937
Kama	Comoro Islands	Comoros		Auerbach, 1995
Kama	Kenya	Kigiryama		Auerbach, 1995
Kama	Kenya	Kikauma		Auerbach, 1995
Kama	Kenya	Kipokomo		Auerbach, 1995
Kama	Kenya	Kiswahili		Auerbach, 1995
Kgatwane	Botswana	Tsa Metsi	Setswana	Auerbach, 1985
Kgwate	Botswana	Tsa Metsi	Setswana	Auerbach, 1985
Kgwathe	Botswana		Setswana	Clauss and Clauss, 2002
Leguvan	Zambia		Afrikaans	Pitman, 1934
Ligondo	Malawi	Yoa		Loveridge, 1953
Liongondo	Tanzania	Kimakonde		Loveridge, 1942
Lubambi	Congo		Ki-yansi	Johnston, 1884
Mbambi	Congo	Bantu	Ki-teke', Kixi	Johnston, 1884; Bentley, 1887; Keirans, 1984
Mbambi	northern Angola			Keirans, 1984
Mbulu	Zambia		Nyanja	Broadley, 1971
Mfumba	Zambia			Boulenger, 1907
Mongagi	Kenya		Kitaita	Loveridge, 1936

Table 3. *continued*

Local Name	Country/Region	Tribe/Locale	Language	Reference
Mubulu	Zambia		Nyanja	Broadley, 1971
Mucelalesa	Zambia	Bemba	UwuLamba	Doke, 1963
Mukomeka	Zambia	Bemba	UwuLamba	Doke, 1963
Mussenvu	Angola	Lwena		Laurent, 1964
Ng'anzi	South Africa	Zulu	Bantu	Werner, 1933
Ngondo	Tanzania	Kimawiha		Loveridge, 1942
Tatu'	Angola			Bocage, 1895
Tchitatu	Angola	Tshokwe		Laurent, 1964
UmBulu	South Africa	Zulu		Cowles, 1936
Uru	Kenya		Kiamu	Loveridge, 1936
Uru	Kenya		Kipokomo	Loveridge, 1936
Uru	Kenya		Kiswahili	Loveridge, 1936
Veldlikkewaan	Namibia		Africaans	Grobler, 1981; Jauch, 2002
Witkeel	South Africa		Africaans	Auerbach, 1985

Table 4. Local names of *V. niloticus*.

Local Name	Country/Region	Tribe/Locale	Language	Reference
Anakana	Kenya	Karamojong		Loveridge, 1936
Anggogue	Ethiopia	Tigre		Lefebvre, 1845
Ardjano	Ethiopia	Amri		Lefebvre, 1845
Awonriwon	Nigeria	Yoruba		Dunger, 1967
Baranta	Egypt		Hamed	Flower, 1933
Cieng-Gangni	Sudan	Lak	Nuer	Evans-Pritchard, 1956
Dji-ma	South Africa	Thongas		Junod, 1962
Enswa-swa	Uganda	Kizima		Carpenter, 1925; Pitman, 1941
Gaang	Sudan	Karamojong	Nuer	Jackson, 1923
Gaang	Sudan	Riaq	Nuer	Jackson, 1923
Gaang	Sudan	Tchuak	Nuer	Jackson, 1923
Gedo	Kenya		Kipokomo	Loveridge, 1936
Guana	Guinea-Bissau			Beaver, 1805
Guana	Liberia			Johnston, 1906
Guana	Malawi			Scott, 1892
Guana	South Africa	Bechuana		Kirby, 1940; Kennedy, 1961
Guza	Nigeria	Hausa		Bargery, 1934; Abraham and Kano, 1949; Dunger, 1967; Newman, 1990; Awde, 1996
Hopani	Zambia		Lozi	Broadley, 1971
Imambe	Zambia	Bemba	UwuLamba	Doke, 1963
Imbulu	Kenya		Luragoli	Loveridge, 1936
Imbulu	Kenya		Lutereki	Loveridge, 1936

Table 4. *continued*

Local Name	Country/Region	Tribe/Locale	Language	Reference
Imbulu ya Manzi	Botswana	Amandebele		Thomas, 1873
Inga	Cameroon			Tornier, 1902
Insamba	Zambia	Bemba	UwuLamba	Doke, 1963
Ixame	Zululand	Zulu		Pooley, 1992
Kawawa	South Africa	Bantu	Tumbuka	Werner, 1933
Kenge	Tanzania		Kiswahili	Barbour and Loveridge, 1928; Huntingford, 1980; Pakenham, 1983
Kenge	South Africa	Bantu	Swahili	Werner, 1933
Kenge	Uganda		Swahili	Ansorge, 1899
Kwahle	South Africa	Thongas		Junod, 1962
Libekazansi	South Africa	Swaziland	Swazi	Marwick, 1940
Libulu	Tanzania	Chigogo	Wagogo	Loveridge, 1928
Likkewaan	South Africa			Butchart, 1987; Switak, 2000
Locengue	Angola			Bocage, 1893, 1895
Margoban	Chad	Kanuri		Nachtigal, 1881
Mbulu	Tanzania	Kisambara		Loveridge, 1942
Mburu	Zambia			Hughes, 1920
Ming'anzi	Malawi		Mang'anja	Scott, 1892
Mng'anzi	Malawi		Mang'anja	Scott, 1892
Mpenembe	Malawi		Chikunda	Scott, 1892
Mussenvu	Angola	Tshokwe		Laurent, 1952; 1964
Mwanzi	Malawi	Nyungwe		Loveridge, 1953
Ng'anzi	Malawi		Mang'anja	Scott, 1892
Ng'anzi	South Africa	Bantu	Nyanja	Werner, 1933
Ngombi	Cameroon			Tornier, 1902
Ngondo	Tanzania	Kimakonde		Loveridge, 1942
Nswaswa	Uganda	Bantu		Murphy, 1972
Nwakhwahle	South Africa	Thongas		Junod, 1962
Nxamu	Natal, S. Africa	Bantu		Werner, 1933
Qamu	Natal, S. Africa	Swaziland		Cowles, 1930
Penembe	Mozambique	Chisena		Cott, 1934
Polo	Botswana		Setswana	Clauss and Clauss, 2002
Polometse	Botswana		Setswana	Clauss and Clauss, 2002
Polometse	South Africa	Pedi		Quinn, 1959
Sakata	Malawi	Yao		Loveridge, 1953
Sangoe	Angola			Bocage, 1895
Tsari	Nigeria	Hausa		Bargery, 1934; Newman, 1990
Tyitatu	Angola	Ngangelases		Monard, 1937
Urwald	Cameroon			Tornier, 1902
Uxamu	South Africa	Bantu	Zulu	Werner, 1933

Table 4. *continued*

Local Name	Country/Region	Tribe/Locale	Language	Reference
Waraan	Egypt	Arab	Arabic	Attum, 2000
Waral	Sudan		Arabic	Hillelson, 1930
Waran	Liberia		Arabic	Johnston, 1906
Waran (male)	Egypt		Arabic	Bey, 1929
Warana (female)	Egypt		Arabic	Bey, 1929
Warana (female)	Sudan		Nuer	Flower, 1910; Jackson, 1923
Waran-el-bahr	Egypt	Arab	Arabic	Wilkinson, 1878
Wa-ya	Malawi		Mang'anja	Scott, 1892
Wurran-el-bahr	Egypt		Arabic	Rawlinson, 1860, 1880

Table 5. Local names of *Varanus sp.*

Local Name	Country/Region	Tribe/Locale	Language	Reference
Abagengen	Niger	Taureg		Nicolas, 1950
Amomol	Uganda			Driberg, 1923
Andzi	Congo	Nyangwe		Ginneken, 1914
Ayato	Niger	Taureg		Nicolas, 1950
Ayo	Nigeria	Ibo	Awka	Thomas, 1913
Bemba	Zambia			Lehmann, 1983
Ekakala	Namibia	Oshindonga		Viljoen, 1984
Embulu	Malawi	Kitosh	Nyanza	Hull, 1942
Embulu	Malawi	Samia	Nyanza	Hull, 1942
Ffubutusi	Uganda	Bantu		Murphy, 1972
Guanoes	Guinea			Smith, 1744
Imbulu	Malawi	Bunyore	Nyanza	Hull, 1942
Imbulu	Malawi	Hanga	Nyanza	Hull, 1942
Imbulu	Malawi	Kakamega	Nyanza	Hull, 1942
Imbulu	Malawi	Maragoli	Nyanza	Hull, 1942
Imbulu	Malawi	Teriki	Nyanza	Hull, 1942
Kada-garei	Niger	Taureg		Nicolas, 1950
Kasale	Malawi		Mang'anja	Scott, 1892
Kkonkome	Uganda	Bantu		Murphy, 1972
Kwa-awa	Congo	Nyangwe		Ginneken, 1914
Leguane	Guinea			Bosman, 1705
Lokekele	Congo	Lomongo		Ruskin, 1928
Martas	Malawi	Suk	Nyanza	Hull, 1942
Mbambi Ngombi	Congo	Bavili		Dennett, 1906
Mengubeit	Malawi	Kipsigis	Nyanza	Hull, 1942
Nabulwe	Zambia	Ba-ila	Ila	Smith, 1920
Ngaro	Namibia			Auerbach, 1995
Ng'ech	Malawi	Luo	Nyanza	Hull, 1942

Table 5. *continued*

Local Name	Country/Region	Tribe/Locale	Language	Reference
Ngwelawoli	Nigeria	Ibo	Onitsha	Thomas, 1913
Ngwere	Nigeria	Ibo		Nnaji, 1985
Nkaya	Gabon	Fang/Yesux		Trilles, 1912
Nsux	Gabon	Fang/Yesux		Trilles, 1912
Odwongmon	Uganda			Driberg, 1923
Omiaveze	Benin	Kwa	Bini	Melzian, 1937
Soro	Namibia			Auerbach, 1995
Tara	Nigeria	Hausa		Schon, 1888
Tari	Nigeria	Hausa		Schon, 1888
Tsxe	Namibia			Auerbach, 1995

### Literature Cited

- Abraham, R.C. and M.M. Kano. 1949. Dictionary of the Hausa Language. Crown Agents for the Colonies Government of Nigeria. 992p.
- Adams, Captain John. 1823. Cape Palmas to the River Congo. G. & W.B. Whittaker, London. 265p.
- Angelici, F. and L. Luiselli. 1999. Aspects of the ecology of *Varanus niloticus* (Reptilia, Varanidae) in southeastern Nigeria, and their contribution to the knowledge of evolutionary history of *Varanus niloticus* species complex. *Revue Ecologie* 54: 29-42.
- Ansorge, W.J. 1899. Under The African Sun. Longmans, Green, and Company, New York. 355p.
- Attum, O. 2000. Searching for the Nile monitor in the land of the Pharaohs. *Reptiles* 8(9): 10-12, 14, 16.
- Auerbach, R.D. 1985. The Reptiles of Gaborone. Botswana Book Centre, Gaborone. 47p.
- \_\_\_\_\_. 1995. Segwagwanyana. Edition Chimaira bei Bucher-Kreth, Frankfurt am Main. 248p.
- Awde, N. 1996. Hausa – English, English – Hausa Dictionary. Hippocrene Books, New York. 454p.
- Bargery, G.P. 1934. A Hausa – English Dictionary and English – Hausa Vocabulary. Ahmadu Bello University Press Limited, Zaria. 1280p.
- Bayless, M.K., G.C. Akani and L. Luiselli. 2003. Daudin's Monitor (*Varanus ornatus*, Daudin 1803) and its association with Ubani (Bonny Island), Southern Nigeria. *Herpetological Bulletin* 83: 2-6.
- Beaver, P. 1805. African Memoranda: relative to an attempt to establish A British Settlement on the Island of Bulama, on the Western Coast of Africa, in the year 1792. C. & R. Baldwin, London. 500p.
- Bentley, W.H. 1887. Dictionary and Grammar of the Kongo Language. Baptist Missionary Society and Turner & Company, London. 718p.

- Bey, S.S. 1929. An English Arabic Vocabulary of the modern and colloquial Arabic of Egypt. Third Edition. Ellias; Modern Press, Cairo. 325p.
- Bocage, J.V.B. du 1893. Zoologia 1. Lista dos reptis das possessoes Portuguezas d'Africa occidental que existem no Museu de Lisboa. Jornal of Sciencias Mathematicas, Physicas e Naturaes, Series 2, 1(4): 37-56.
- \_\_\_\_\_. 1895. II. Reptis da Guinea' Portugueza. Jornal de Sciencias Academia Real das Sciencias Lisboa 4(8): 65-102.
- Bosman, W. 1705. A New and Accurate Description of the Coast of Guinea. Divided into the Gold, the Slave and the Ivory Coasts. Ballantyne and Company, Ltd., London . 506p
- Boulenger, G.A. 1907. On a collection of fishes, Batrachians, and Reptiles, made by Mr. S.A. Neave in Rhodesia, north of the Zambesi, with field notes by the collector. Memoirs and Proceedings of the Manchester Literary & Philosophical Society 51(12): 1-12.
- Broadly, D.G. 1971. The Reptiles and Amphibians of Zambia. The Puku 6: 1-143.
- Burton, J. 1972. Animals of the African Year the Ecology of East Africa. Holt, Rinehartand Winston, New York. 173p.
- Butchart, D. 1987. Arende & Boere/Eagles & Farmers. Endangered Wildlife Trust and the Southern African Ornithological Society Johannesburg. 29p.
- Carpenter, D.G.H. 1925. A Naturalist in East Africa. Clarendon House, Oxford. 187p.
- Chubb, E.C. 1909. The Batrachians and Reptiles of Matabeleland. Proceedings of the Zoological Society London: 590-597.
- Clauss, B. and R. Clauss. 2002. Common Amphibians and Reptiles of Botswana. More than just Creepy-crawlies. Gameberg Macmillan Publishers, Windhoek. 444p.
- Cott, H.B. 1934. The Zoological Society's Expedition to the Zambesi, 1927: No. 5. On a collection of lizards, mainly from Portuguese East Africa, with descriptions of new species of *Zonurus*, *Monopeltis*, and *Chirindia*. Proceedings of the Zoological Society London 1: 145-173.
- Cowles, R.B. 1930. The Life History of *Varanus niloticus* as observed in Natal South Africa. Journal of Entomology and Zoology 22: 1-31.
- \_\_\_\_\_. 1936. Casual notes of the Poikilothermic vertebrates of the Umzumbe Valley, Natal, South Africa. Copeia 1: 4-8.
- Cox, J.G. 1968. Cox and the Juju Coast. A journal kept aboard HMS "Fly" 1868/69. Ellison and Company, St. Helier. 88p + foldout maps.

- Deane, J.B. 1830. Worship of the Serpent traced throughout the World and Its Traditions referred to the Events of Paradise. Boston and Palmer, London. 391p
- Dennett, R.E. 1906. At the Back of the Black Man's Mind or Notes on the Kingly Office of West Africa. MacMillan and Company, Ltd., New York. 288p.
- Doke, C.M. 1963. English – Lamba Vocabulary. Witwatersrand University Press, Johannesburg. 179p.
- Driberg, J.H. 1923. The Lango. A Nilotic Tribe of Uganda. T. Fisher Unwin, Ltd., London. 468p.
- Dunger, G.T. 1967. The lizards and snakes of Nigeria. The Nigerian Field 32(4): 170-178.
- Evans-Pritchard, E.E. 1956. Nuer Religion. Oxford University Press, New York. 336p.
- Flower, S.S. 1910. List of Animals. Zoological Gardens, 2nd Edition. Special Report 5: 1-372.
- \_\_\_\_\_. 1933. Notes on the recent reptiles and Amphibians of Egypt, with a list of the species recorded from that Kingdom. Proceedings of the Zoological Society London: 735-851.
- Ginneken, J.V. and J. Torrend. 1914. Les classes nominales des langues Bantoues. Anthropos (Wien), Janner-April, 9(1-2): 781-800.
- Grobler, J.H. and P.J. Bronkhorst. 1981. A Preliminary checklist of Reptiles and Amphibians in the Mountain Zebra National Park. Koedoe 24: 193-197.
- Hillelson, S. 1930. Sudan Arabic English-Arabic Vocabulary. Sudan Government. McCorquodale and Company, Ltd., London. 351p.
- Hughes, J.E. 1920. Eighteen Years on Lake Bangweulu. The Field House, London. 376p.
- Hull, R.L. 1942. The Names of some Birds and Reptiles in Several Nyanza Languages. The Journal of East Africa and Uganda Natural History Society 16(2-3): 125-126.
- Huntingford, G.W.B. 1980. The Periplus of the Erythraean Sea. The Hakluyt Society, London. 225p.
- Jackson, H.C. 1923. The Nuer of the Upper Nile Province, Part C. Sudan Notes and Records 6(2): 123-189.
- Jauch, H. 2002. Southern Africa's Monitor, *Varanus albigularis*. Reptilia 22(3): 3-48.
- Johnston, H.H. 1884. The River Congo; from its mouth to Bolobo. Sampson Low, Marston, Searle and Rivington, London. 470p.
- \_\_\_\_\_. 1906. Liberia. Volume II. Hutchinson and Company, London. 1183p.
- \_\_\_\_\_. 1888. The Niger Delta. Proceedings of the Royal Geographical Society and Monthly Record of

- Junod, H.A. 1962. The Life of A South African Tribe. Volume II. University Books, New York. 660p.
- Kearton, C. 1929. In the Land of the Lion. Robert M. McBride and Company, New York. 298p.
- Keirans, J.E. 1984. George Henry Falkiner Nuttall and the Nuttall Tick Catalogue. U.S. Department of Agriculture, U.S. Government Printing Office, Washington, D.C.1438: 1-1785.
- Kennedy, R.F. 1961. Journal of Residence in Africa by Thomas Baines 1842-1853. Volume I. Van Riebeeck Society, Cape Town. 252p.
- Kirby, P.R. 1940. The Diary of Dr. Andrew Smith. Volume II. The Van Riebeeck Society, Cape Town. 342p.
- Laurent, R.F. 1952. Reptiles et Batraciens de la region de Dundo (Angola du Nord-Est). Companhia de Diamantes de Angola Museu de Dundo (Diamang) 6: 127-136.
- \_\_\_\_\_. 1964. Reptiles et Amphibiens de l'Angola. Publications Culturais Companhia de Diamantes de Angola, Lisboa 67: 1-165.
- Lefebvre, T. 1845. Voyage en Abyssinie. Execute pendant les annees 1839, 1840, 1841, 1842, 1843. Volume 6: 196-198. Arthus Bertrand, Paris. 398p.
- Lehmann, D. 1983. Folktales from Zambia. Reiner Publishers, Berlin. 120p.
- Loveridge, A. 1928. Field notes on vertebrates collected by the Smithsonian-Chrysler East African Expedition of 1926. Proceedings of the United States National Museum 73(7): 1-69.
- \_\_\_\_\_. 1936. Scientific results of an expedition to rain forest regions in Eastern Africa V. Reptiles. Bulletin of the Museum of Comparative Zoology 79(5): 209-337.
- \_\_\_\_\_. 1942a. Scientific Results of a fourth expedition to forested areas in east and central Africa. IV. Reptiles. Bulletin of the Museum of Comparative Zoology 91: 237-332.
- \_\_\_\_\_. 1942b. Comments on the Reptiles and Amphibians of Lindi. Tanganyika Notes and Records 14: 38-51.
- \_\_\_\_\_. 1953. Zoological results of a fifth expedition to East Africa III Reptiles from Nyasaland and Tete. Bulletin of the Museum of Comparative Zoology 110(3): 141-322.
- Marwick, B.A. 1940. The Swazi. Cambridge University, Cambridge. 320p.
- Melzian, H. 1937. A Concise Dictionary of the Bini Language of Southern Nigeria. Kegan Paul, Trench, Trubner and Company, Ltd., London. 233p.
- Monard, A. 1937. Contribution a l'Herpetologie d'Angola. Arquivos do Museo Bocage 8: 1-154.

- Morel, P.-C. and J. Mouchet. 1958. Les Tiques du Cameroun (Ixodidae et Argasidae). *Annales de Parasitologie Humaine et Comparee* 33(1-2): 69-111.
- Murphy, J.D. 1972. *Luganda – English Dictionary*. Consortium Press (The Catholic University of America Press), Washington, D.C. 651p.
- Nachtigal, G. 1881a. *Sahara and Sudan. Volume I*. Weidmannsche Buchlandlung, Berlin. 460p.
- \_\_\_\_\_. 1881b. *Sahara and Sudan. Volume II*. Weidmannsche Buchlandlung, Berlin. 540p.
- Newman, R.M. 1990. *An English – Hausa Dictionary*. Yale University Press, New Haven. 327p.
- Nicolas, F. 1950. *Tamesna. Les Ioullemmeden de L'est ou Touareg "Kel Dinnik"*. Imprimerie Nationale, Paris. 279p.
- Nnaji, H.I. 1985. *Modern English – Igbo Dictionary*. Kucene Damien Nigeria, Ltd., Akwa. 345p.
- Ogilby, J. 1670. *Africa*. Tho. Johnson, House of White Fryers, London. 767p.
- Page, J. 1908. *The Black Bishop*. Samuel Adjai Crowther. Hodder and Stoughton, London. 440p.
- Pakenham, R.H.W. 1983. The Reptiles and Amphibians of Zanzibar and Pemba Islands. *Journal of the East African Natural History Society and National Museums* 177: 1-40.
- Pitman, C.R.S. 1934. A report on a faunal survey of northern Rhodesia with special reference to game, Elephant Control and National Parks. Government of Northern Rhodesia. 500p.
- \_\_\_\_\_. 1941. About Crocodiles. *The Uganda Journal* 9(1): 89-114.
- Pooley, A.C. 1992. *Mashesha*. Southern Book Publishing, Pty., Halway House. 240p.
- Quin, P.J. 1959. *Foods and Feeding Habits of the Pedi*. Witwatersrand University Press, Johannesburg. 278p.
- Rawlinson, G. 1860. *The History of Herodotus. Volume III*. D. Appleton and Company, New York. 463p.
- \_\_\_\_\_. 1880. *History of Ancient Egypt. Volume I*. Dodd, Mead and Company, New York. 570p.
- Roure, G. 1956. *Faune et Chasse en Afrique Occidentale Francaise*. Editions G.I.A., Dakar. 412p.
- Ruskin, E.A. and L. Ruskin. 1928. *Dictionary of the Lomongo Language*. Christian Literature Society and Regions Beyond Missionary Union, London. 651p.
- Schon, J.F. 1888. *Appendix to the Dictionary of the Hausa Language (Published 1876)*. Church Missionary House, London. 206p.

- Scott, D.C. 1892. A Cyclopaedic Dictionary of the Mang'anja Language spoken in British Central Africa. Foreign Mission Committee of the Church of Scotland, Edinburgh. Gregg International Publishers, Ltd., Farnborough. 737p.
- Smith, E.W. 1920. The Ila-Speaking Peoples of Northern Rhodesia. Volume I. Macmillan and Company, Ltd., London. 423p.
- Smith, W. 1744. A New Voyage to Guinea: Describing The Customs, Manners, Soil, Climate, Habits, Buildings, Education, Manual Arts, Agriculture, Trade, Employments, Languages, Ranks of Distinction, Habitations, Deviations, Marriages, and whatever else is memorable among the inhabitants. John Nourse, London. 276p.
- Switak, K.H. 2000. The Might Nile Monitor. *Reptiles* 8(9): 82-95.
- Thomas, T.M. 1873. Eleven Years in Central Africa: A journey into the interior-sketch of recently discovered diamond and gold fields - Umzilikazi, His Country and people – A brief history of the Zambesi Missions. John Snow and Company. 418p.
- Thomas, N.W. 1913. Anthropological Report on the Ibo-Speaking Peoples of Nigeria. Part II. English-Ibo and Ibo-English Dictionary. Harrison and Sons, London. 360p.
- Tornier, G. 1902. Herpetologisch Neues aus Deutsch-Ost-Afrikas. *Zoologische Jahrbucher* 15: 578-590.
- Trilles, R.P.H. 1912. Le Totemisme Chez Les Fan. *Anthropos Bibliothek* 1(4): 1-653.
- Viljoen, J.J., P. Amakali, and M. Namuandi. 1984. Oshindonga/English English/Oshindonga Embwiitya Dictionary. Gamsberg Macmillan Publishers, Windhoek. 109p.
- Werner, A. 1933. Myths & Legends of the Bantu. George G. Harrap and Company, Ltd., London. 335p.
- Wilkinson, J.G. 1878. The Manners and Customs of The Ancient Egyptians. Volume III. John Murray, London. 528p.

## Remarks on Osteological Deformities in a Captive-bred Emerald Tree Monitor, *Varanus prasinus*

ROBERT W. MENDYK

*Center for Science Teaching and Learning*

*1 Tanglewood Road*

*Rockville Centre, NY 11570, US*

[odatriad@yahoo.com](mailto:odatriad@yahoo.com)

**Abstract** - The successful captive reproduction and osteological deformities of a *Varanus prasinus* are reported. Incubation took 170 days at a temperature of 30 °C. Osteological deformities were present at hatching and progressively intensified over the next six months. Causation of the skeletal deformities remains unknown.

### Introduction

Reports of skeletal abnormalities and other developmental aberrations in varanid lizards are not uncommon. Lang and Böhme (1991) report an abnormality of the hyobranchial skeleton of a wild-caught *Varanus bengalensis nebulosus*, where extended epibranchials embedded within the epidermis proper give the appearance of protruding spines from the gular region. Similar hyoid deformities have also been reported in captive-bred specimens of *V. acanthurus* (Lipfert and Dickoff, 2004) *V. primordius* (Husband, 2001), and *V. dumerilii* (M. Fost, *pers. comm.*), and photographic evidence of the same condition in a captive-bred *V. gouldii* has appeared on the internet in recent years as well. Additionally, eggs of *V. acanthurus*, a species naturally possessing dorsal ocelli, incubated at temperatures higher than normally accepted values have yielded full-term embryos exhibiting aberrant longitudinal dorsal striping (A. Owen, *pers. comm.*).

Here, I report on osteological deformities in a *V. prasinus* bred and hatched in captivity. Since thermal and hydric incubation environments (e.g., Phillips and Packard, 1994; Chao-Hua, 2001 ) as well as maternal health and physical condition (e.g., Sinervo, 1990; Warner, 2001; Bell et al., 2006) have been shown to influence the phenotypes of hatchling reptiles, the captive husbandry and reproduction of the parents, and incubation are also described.

### Methods

*Husbandry of adults*- A pair of long-term captive adult *V. prasinus* (male 26.7 cm snout to vent length [SVL]; female 24.1 cm SVL) originally of wild-caught origin was acquired on 1 April 2005. Prior to their acquisition, the pair was fed crickets about three times weekly, misted daily, and had not bred in captivity. Upon arrival, the pair was housed in an enclosure measuring ca. 90 x 76 x 180 (l x w x h) which offered numerous tree limbs of various diameters and cork hollows mounted to the cork tile-lined walls. Ambient temperatures were maintained around 28.3 °C and a basking temperature of ca. 54.4 °C was provided by a single 100 watt halogen flood lamp. No supplemental or ultraviolet lighting was provided. Humidity was maintained in excess of 70% through twice-daily sprayings by an automatic misting system. Although a

poultry-based diet (cf. Lemm et al., 2004) was infrequently offered to both adults, frozen-thawed weaned mice made up ca. 98% of the adults' diet. Both monitors were offered food daily.

*Preparation of specimen-* Upon its death the specimen was frozen, then later fixed in 70% ethanol and sent to Samuel S. Sweet at the University of California, Santa Barbara for clearing and staining and osteological analysis. The *V. prasinus* was cleared and stained following methodology of Dingerkus and Uhler (1977), and compared to a full-term dead-in-egg (referred to hereon as DIE) *V. macraei* prepared in the same way.

## Results

### *Copulation, Oviposition and Incubation*

Copulation began on 15 June 2005 and occurred intermittently each day for seven days. Courtship and copulation was consistent with previously published reports on captive reproduction in *V. prasinus* (Barker, 1984; Dedlmar, 1994; Polleck, 2004; Baldwin, 2006). A nest box measuring 20 x 20 x 61 cm (l x w x h) filled with coconut fiber and sphagnum moss was mounted to the terrarium side wall immediately after the first copulation. Temperatures within the nest box ranged from 26 °C at the bottom to 29.5 °C towards the top. Over the next three weeks, the female showed increasing interest in the nest box by visiting it regularly, and approximately one week prior to oviposition, began test-digging. On 16 July 2005, the female deposited two eggs on top of the nest box, ignoring the medium inside. Later that day the female deposited a non-viable egg (clearly misshapen) in the water basin at the bottom of the enclosure. The first two eggs were set up for incubation in a 6.6 L plastic container half-filled with dampened vermiculite mixed at a ratio of 1:1 with water by weight. Glad-wrap™ (*Glad Products Co., Oakland, CA, USA*), a breathable polyurethane food wrap was tightly secured as the cover to the incubation box. Incubation



Figures 1 & 2. Copulation of *Varanus prasinus*



Figure 3. *Varanus prasinus* eggs laid on top of nest box.



Figure 4. Resulting live hatchling *V. prasinus*

temperature was maintained at 30 °C (+/- .5 °C) throughout the course of incubation.

On 29 December 2005, after 168 days of incubation, both eggs had become discolored and were dented. One egg was dissected to reveal a fully-developed, turquoise-colored, DIE embryo (7.6 cm SVL; 18.4 cm TL). The dead embryo had very little residual yolk remaining, and appeared ready to hatch. A small incision made in the second egg revealed a live embryo. This egg was left in the incubator, and allowed to hatch on its own. The hatchling finally emerged on 31 December 2005, measuring 7.7 cm SVL (18.5 cm TL) and weighing 5.7 g. Very little residual yolk was present in the live hatchling, and it appeared as though much of it had been internalized prior to hatching.

The hatchling was left inside the incubator for 48 h, and was then transferred to a glass terrarium measuring 61 x 31 x 76 cm (l x w x h). The walls of the terrarium were covered with cork sheeting and several branches of various diameters were provided for additional climbing and basking. Temperatures and humidity levels were consistent with those offered to the adults. A 50 watt halogen flood lamp provided a basking area and ambient lighting. No supplemental UV lighting was provided.

#### *Physical Deformities at Hatching*

As with the full-term dead sibling, the surviving *V. prasinus* was also turquoise in coloration. When compared to its non-deformed sibling, the live hatchling showed several noticeable signs of physical malformations. Its head was shorter and taller than the DIE sibling, and its dentaries were broader and slightly bowed outwards, creating a slight under-bite. The dentaries also appeared flexible or 'rubbery', uncharacteristic of ossified lower jaws in healthy individuals. All digits appeared swollen and disproportionate when compared to the sibling. There was also a noticeable kink in the spine around



Figure 5. Hatchling *V. prasinus*. Note irregularly shaped cranium and dentary

the first to second sacral vertebrae. Internalized yolk remained a hardened mass within the hatchling's abdomen for ca. 2 weeks.

#### *Behavior*

After several unsuccessful attempts at feeding, it was noticed that the tongue of the *V. prasinus* was non-functional, not being used in normal varanid scent detection. The hatchling finally accepted food

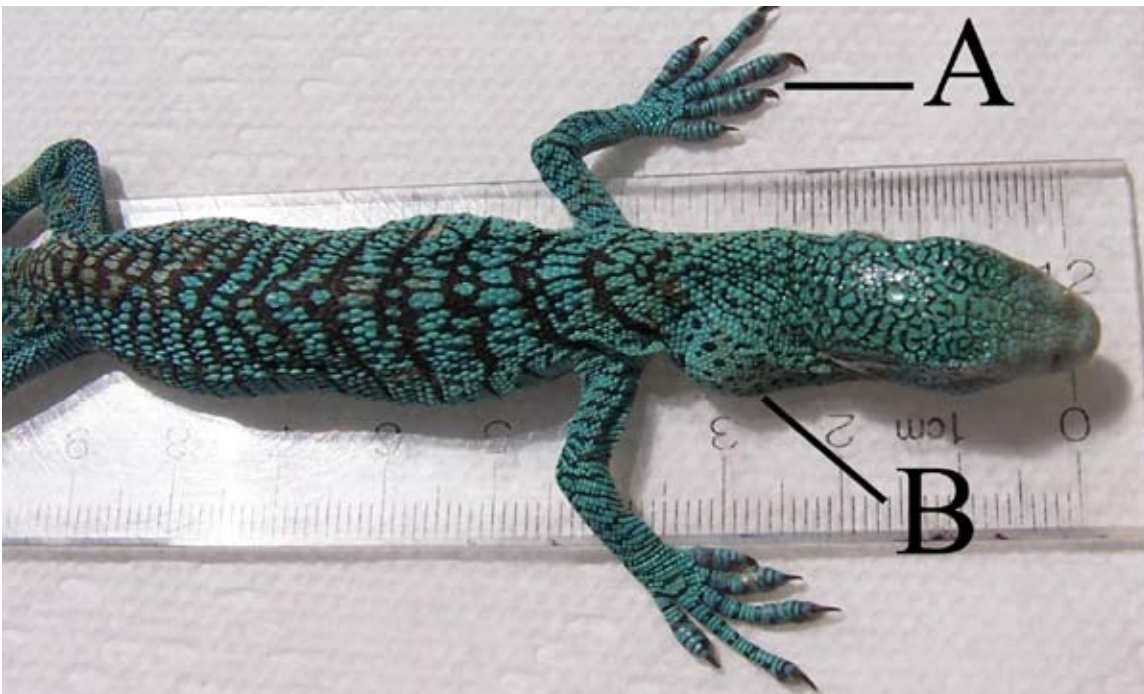


Figure 6. *Varanus prasinus* at time of death; dorsal view. Note swollen digits (A) and large mass in neck musculature (B)

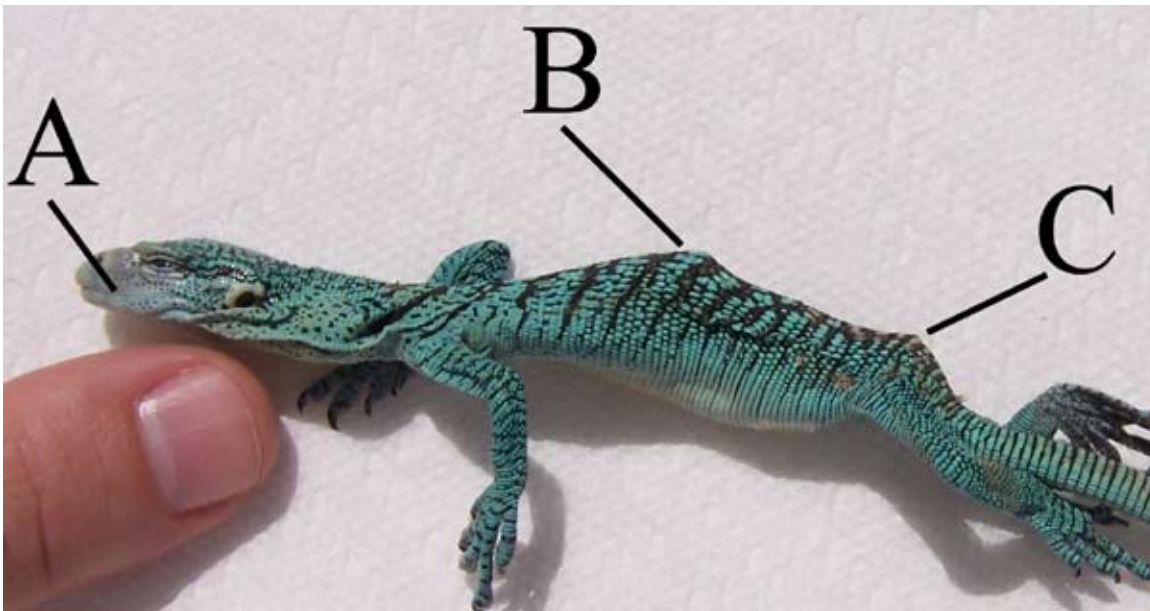


Figure 7. *Varanus prasinus* at time of death; lateral view. Note deformed dentary (A), spinal injury (B), and deformed sacral vertebrae (C).

after three to four weeks, but would only feed on thawed ground turkey. Likely a result of a deformed lower jaw, ingesting food proved to be difficult, and meals which would normally take a healthy hatchling seconds to swallow often took the *V. prasinus* several minutes.

Movement in the *V. prasinus* was noticeably compromised. Although climbing did not seem to be affected, movement on the ground or on horizontal branches appeared to be obstructed by the kink in the lower spine. The monitor also appeared to have problems with maintaining balance while walking, with its head swaying back and forth seemingly uncontrollably.

All physical deformities intensified over the next several months. Around 4 June 2006, the monitor sustained a fall from the top of the terrarium which resulted in a spinal injury (Figure 7). Shortly thereafter, the monitor showed limited movement in its rear legs and overall activity diminished. The monitor was euthanized on 10 June 2006.

#### *Post-Mortem Osteological Comments by Samuel S. Sweet*

The *V. prasinus* displays severe ossification deficiencies throughout the skull and appendicular skeleton, with lesser ossification effects in the vertebral column; however, the vertebrae are irregularly segmented and partially fused in the lumbar and sacral regions, and postzygapophyses are deformed throughout the trunk region.

Ossification in the skull is limited to endochondral components; all dermal elements are partially ossified or not visibly ossified. Only the middle portions of the dentaries were bony, and Meckel's cartilage is exposed near the symphysis. Teeth are strongly calcified but are not ankylosed to the jaw elements. The skull contracted to an hourglass form during dehydration owing to absence of supporting bone in the frontals and parietals (this is thus an artifact of specimen preparation).

The hyobranchial cartilages are of normal form and proportions. There is an irregularly rounded non-staining mass within the neck musculature immediately posterior to the left quadrate.

Trunk vertebrae 19-25 and sacral vertebra 1 are irregularly deformed and partially fused; TV25 and S1 form an amorphous mass. The sacral processes are not in contact with the ilium of the pelvis. All ribs

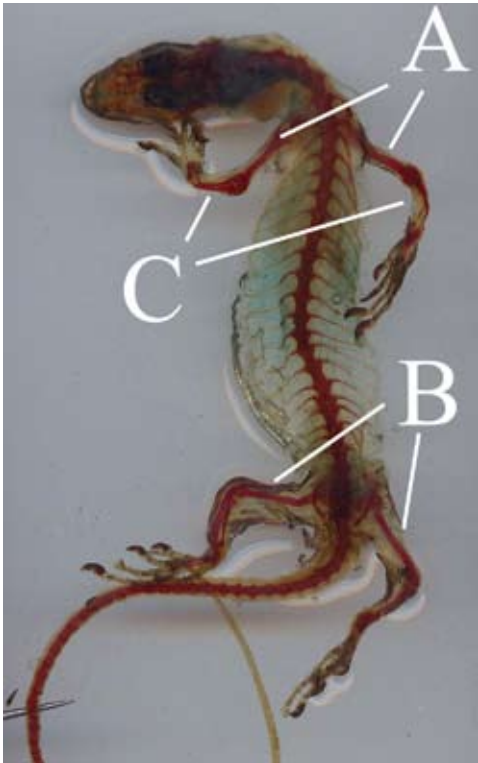


Figure 8. Cleared and stained *V. prasinus*. Note malformed humeri (A), irregular femurs (B), and partially ossified and contorted radius and ulna in both front limbs (C).

are very lightly ossified and many are deformed distally. The caudal vertebrae are well-segmented, but ossified only in the proximal half of the tail.

The pectoral and pelvic girdles are moderately ossified and of normal proportions, but the limbs are moderately deformed and display significant ossification deficiencies. The humeri are irregular, the right element displaying a strong bend; likewise both femurs are irregular, and the left is strongly deflected near the pelvis. In both limbs the radius and ulna are twisted and unossified distally, as are both tibia and fibula in the rear limbs. All of the metapodial elements are well-ossified, but only the central metacarpals and metatarsals are partially ossified. There is no ossification evident in the phalanges.

The DIE *V. macraei* is younger, yet all elements are well-ossified, and took up alizarin stain much more strongly than did any element in the *V. prasinus*. In general the *V. prasinus* did not accept Alcian Blue cartilage stain except in the hyobranchial cartilage, suggesting that cartilage resorption had already occurred but replacement with bone generally failed.

## Discussion

Since the present case represents just a single, isolated occurrence, it is near-impossible to determine the causation of the skeletal aberrations seen in the hatchling *V. prasinus*.

Although the incubation environment of varanid eggs has been shown to affect the phenotypes of hatchlings (Phillips and Packard, 1994), given that the DIE sibling showed no visible deformities when exposed to the exact same incubation environment, it is improbable that the resulting deformities are the result of improper incubation conditions such as extreme temperatures or humidity levels. Furthermore, the temperature and substrate moisture levels maintained throughout incubation were not outside the accepted values for successful egg incubation in the *V. prasinus* complex (e.g. Dedlmar, 1994; Bosch, 1999; Polleck, 2004; Baldwin, 2006; Mendyk, 2006).

Death of the sibling *V. prasinus* embryo is suspected to have been caused by unfavorable environmental conditions of the incubation medium towards the very end of incubation. Both eggs had become desiccated,

indicating that the vermiculite had become too dry, with one embryo perishing. Since both embryos incubated for the entire term, using up virtually all of the nutrients and reserves provided by the female within each egg, it is also unlikely that maternal health or investment had anything to do with the cause of the deformities in the live hatchling.

Physical deformities in the *V. prasinus* were evident upon hatching, however they progressively intensified with age. Although there have been few studies which assess the need for UV light by varanids (Gillespie et al., 2001), given the importance of UV exposure in many other diurnal lizard groups, and the prevalence of bone deficiencies in specimens of these taxa maintained in the absence of supplemental UV light (e.g., Mader, 1996), it is possible that a lack of UV exposure by the juvenile *V. prasinus* in the present case intensified its osteological deformities.

Aside from the skeletal aberrations seen in the *V. prasinus*, of particular interest was the difference in body coloration between both adults and their offspring (Figures 1 & 4, respectively). Both the live hatchling and DIE embryo were turquoise in coloration, whereas both adults were emerald green and classical representatives of *V. prasinus*. Turquoise offspring resulting from captive breedings of *V. prasinus* have previously been reported (e.g., see images in Polleck, 2004), and long-term captives originating from the wild have been known to lose yellow pigmentation over time in captivity, resulting in turquoise body coloration (*pers. obs.*). The true cause of this loss of pigmentation remains to be seen, however a deficient diet and or lack of adequate UV exposure may be suspect. This green to turquoise color transformation appears to be common in several green-colored reptile and amphibian species such as *Morelia viridis*, *Physignathus cocincus*, *Basiliscus plumifrons*, *Abronia graminea*, and *Litoria caerulea* (*pers. obs.*), but has received very little attention in the herpetological or herpetocultural literature (Switak, 2006). Future investigations are needed to determine the cause of this color loss in captive herpetological collections and whether or not the same agent is responsible across all groups in which it occurs, and if such a deficiency may have any lasting physiological effects on captive specimens.

**Acknowledgements** – I would like to thank Samuel S. Sweet for preparing the *V. prasinus* and for analyzing its osteology.

## Literature Cited

- Baldwin, B. 2006. Successful care and reproduction of Green Tree monitors (*Varanus prasinus*) at the San Diego Zoo. *Iguana* 13(4): 283-287.
- Barker, D.G. 1984. Maintenance and reproduction of Green Tree monitors at the Dallas Zoo. *Proceedings of the 8th International Herpetological Symposium on Captive Propagation and Husbandry* 8: 91-92.
- Bell, B., J.R. Spotila and J. Congdon. 2006. High incidence of deformity in aquatic turtles in the John Heinz National Wildlife Refuge. *Environmental Pollution* 142(3): 457-465.
- Bosch, H. 1999. Successful breeding of the Emerald monitor (*Varanus p. prasinus*) in the Löbbecke Museum + Aquazoo, Düsseldorf (Germany). *Mertensiella* 11: 225-226.
- Chao-Hua, J.I.X.Z. 2001. Effects of thermal and hydric environments on incubating eggs, hatching success, and hatchling traits in the Chinese skink (*Eumeces chinensis*). *Acta Zoologica* 47(3): 256-265.

- Dedlmar, A. 1994. Haltung und Nachzucht des Smaragdwarans (*Varanus [Odatria] prasinus*). Salamandra 30(4): 234-240.
- Dingerkus, G. and L.D. Uhler. 1977. Enzyme clearing of alcian blue stained whole small vertebrates for demonstration of cartilage. Stain Technology 52: 229-232.
- Gillespie, D, F.L. Frye, S.L. Stockham and T. Fredeking. 2001. Blood values in wild and captive Komodod dragons (*Varanus komodoensis*). Zoo Biology 19(6): 495-509.
- Husband, G. 2001. Natural history and captive maintenance of the Northern Bluntspined monitor *Varanus primordius*. Herpetofauna 31(2): 126-131.
- Lang, M. and W. Böhme. 1991. Remarks on a hyoid abnormality in *Varanus bengalensis nebulosus* Gray, 1931. Mertensiella 2: 233-239.
- Lemm, J.M., M.S. Edwards, T.D. Grant and A.C. Alberts. 2004. Comparison of growth and nutritional status of juvenile Komodo monitors (*Varanus komodoensis*) maintained on rodent or poultry-based diets. Zoo Biology 23: 239-252.
- Lifert, J. and A. Dickhoff. 2004. Der Stachelschwanzwaran *Varanus acanthurus*. Natur und Tier, Münster.
- Mader, D.R. 1996. Reptile Medicine and Surgery. W.B. Saunders Company, Philadelphia.
- Mendyk, R.W. 2006. The Green Tree monitor: a herpetological gem. Reptiles 4(8): 44-53.
- Phillips, J.A. and G.C. Packard. 1994. Influence of temperature and moisture on eggs and embryos of the White-throated Savannah monitor *Varanus albigularis*: implications for conservation. Biological Conservation 69: 131-136.
- Polleck, R. 2004. Haltung und Nachzucht von *Varanus prasinus prasinus* (Schlegel, 1839). Sauria 26(2): 43-45.
- Sinervo, B. 1990. The evolution of maternal investment in lizards: an experimental and comparative analysis of egg size and its effects on offspring performance. Evolution 44: 279-294.
- Switak, K.-H. 2006. Adventures in Green Python Country. Natur und Tier, Münster.
- Warner, D.A. 2001. Phenotypes and survival of hatchling lizards. Unpublished Thesis, Virginia Polytechnic Institute and State University.

## Observations on Three Species of *Varanus* in Ilfracombe, Queensland

ROD SHANNON

*Rodney Downs*

*Ilfracombe, Queensland. 4727 Australia*

[Rodney\\_downs@bigpond.com](mailto:Rodney_downs@bigpond.com)

### Introduction

Here, I report on observations of three varanid species at Rodney Downs station, in Ilfracombe, Queensland, Australia. Rodney Downs is a 75,000 acre sheep and cattle property. The main homestead, Rodney Downs (23°11'10.7"S, 144°51'3.4"E, datum: WGS84), is located ca. 53 km north of Ilfracombe by road, and the Dauntton homestead (S 23 15 56.2, E 144 49 04.7, datum: WGS84) is ca. 43 km north of Ilfracombe. Both stations are located within the Mitchell Grass Downs country of inland Australia.

The property consists predominantly of black soil ca. 1-4 m deep, over sandstone shale with some areas of red sandy loam and sandstone outcrops. The Rodney Downs homestead is located ca. 350 m from the edge of a series of creek channels which run the length of the eastern side of the property. The creeks remain dry for all but 3 to 4 weeks each year during the wet season, usually around February to March. The property ranges from very open rolling downs country in the western part with loose, high-clay black soil (Figure 2), to tighter and more timbered black soil country along the creek system in the eastern part. Vegetation is dominated by Mitchell grass (*Astrebla* sp.), although creeks are lined with assorted *Eucalyptus* trees. Several species of *Acacia* including Gidyea (*A. cambagei*) and Boree (*A. tephрина*) are also common along the creek systems. The area around the main homestead is lightly timbered with *Eucalyptus* (mostly *E. coolabah* and *E. terminalis*), *Acacia* (mostly *A. cambagei* and *A. sutherlandii*), and

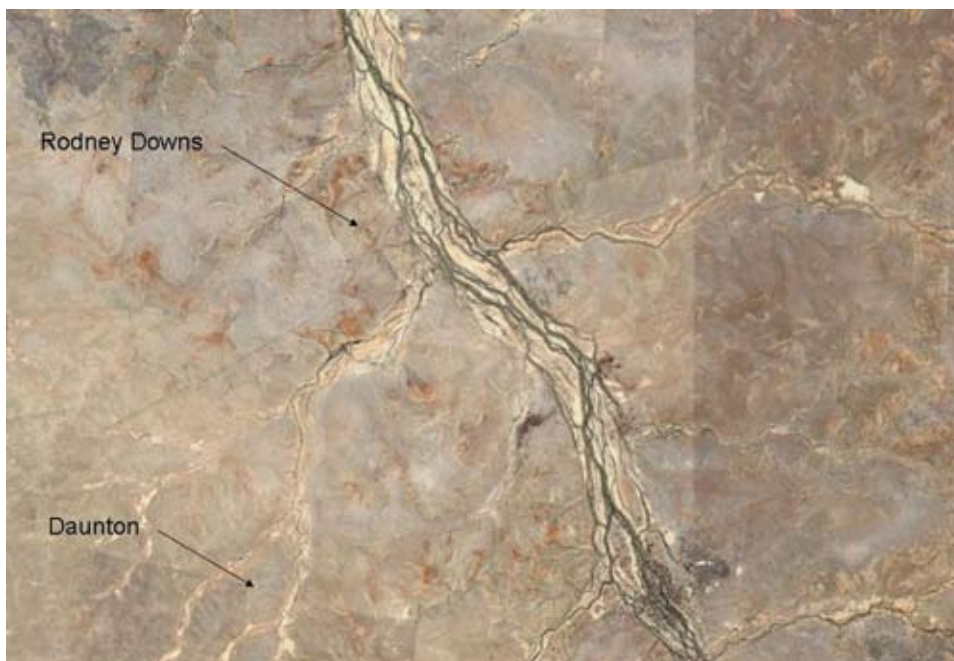


Figure 1. Map of study area



Figure 2. Typical landscape where *Varanus tristis* is sighted. Tree in foreground is a Bloodwood (*Eucalyptus terminalis*), and background shows a creek lined with mostly Coolabah (*Eucalyptus coolabah*). These trees are frequented by nest-ing birds, and often have hollow limbs, which makes for great opportunities for *V. tristis*.



Figure 3. Ilfracombe-Aramac Road; Typical landscape where *V. spenceri* is sighted. The high-expansion black soil develops wide cracks in dry times, and provides havens for many ground-dwelling animals.

Whitewood (*Atalaya hemiglauca*). Except for some occasional Mimosa bushes (*A. farnesiana*), there are few shrubs or bushes around the homestead.

My interest in the local wildlife and ecology of the region began back in 1973, after a 6 week visit by Geoff Witten, then a graduate student from the University of Armidale who was collecting and identifying fauna from the region. Witten primarily focused on reptiles and amphibians, but was also interested in all other fauna of the region. Witten awakened a deep appreciation of the wildlife present on the property, and our family has been carefully observing the local wildlife ever since.

Numerous reptile and amphibian species occur at Rodney Downs. The restrooms of the station are regularly inhabited by Green tree frogs (*Litoria caerulea*) and Desert tree frogs (*L. rubella*) seeking cool refuge during the day, and rainy nights are deafening with the calls of Rough frogs (*Cyclorana verrucosa*), Broad-palmed frogs (*L. latopalmata*), Spotted Grass frogs (*Limnodynastes tasmaniensis*) and Desert toadlets (*Crinia deserticola*). King Brown snakes (*Pseudechis australis*) are common on the property and occasionally find their way into the homestead, and Carpet pythons (*Morelia spilotes mcdowelli*) have taken residence in the storeroom of the homestead for several years. Three dragons, *Lophognathus gilberti*, *Tympanocryptis tetraporophora* and *Pogona barbata* are common, and extremely active during the warmer months. Three species of goanna are present on the property: the Black-headed goanna (*Varanus tristis tristis*), Yellow-spotted goanna (*V. panoptes panoptes*), and Spencer's goanna (*V. spenceri*).

### ***Varanus tristis***

Several *Varanus tristis* reside around the main homestead. *Varanus tristis* seem to be predominantly tree-based, and are frequently seen investigating birds' nests in many of the trees surrounding the homestead. *Varanus tristis* are more often noticed by the commotion caused by agitated birds rather than the lizards themselves. They are notorious nest-raiders and have caused a family of sparrows to move out from the



Figures 4 & 5. *Varanus tristis* inhabiting the Rodney Downs homestead roof



Figure 6. Dorsal patterning of local *Varanus tristis*

rafters of the homestead when one took up residence in the roof.

The homestead roof seems to be a much-preferred venue for *V. tristis* (Figures 4 & 5), offering many of the same features as a tree, using the roof gutters to move about while remaining unseen. Neighbors confirm that *V. tristis* commonly inhabits other roofs in the region. At the homestead, several individuals have worked out the benefits of leaf-guards on the roof gutters which allow them highway access around the perimeter of the homestead roof, where they can often be heard traveling through the piping. There are several large down-pipes which meet at a single junction, which the *V. tristis* use to scope out potential meals around the roof. Goannas often encounter *L. caerulea* in these down-pipes, resulting in loud screams from the frogs. The *V. tristis* are more than likely too small to eat a grown frog, however *L. caerulea* are often found injured by goannas, suggesting possible predation attempts.

Excluding the colder months (June through September), *V. tristis* are usually very active and can be seen from sunrise to near-dusk. Adult *V. tristis* at Rodney Downs reach a maximum total length of ca. 60 cm. Although adults are common around the homestead, juveniles are rarely seen. One juvenile, measuring ca. 10 cm SVL, was discovered in August 2006 living beneath a rain-gauge atop a 1.5 m tall post located away from any buildings and trees (Figure 7). The juvenile was hiding in a 5 cm gap under the base of the rain gauge. This was the first juvenile *V. tristis* ever seen on the property, and was also the first time anything other than a gecko or frog was found living under the rain-gauge. Recently-hatched neonates, presumably only a few days old, have been found in the outdoor lavatory of the station on two



Figure 7. Juvenile *V. tristis* found beneath a rain-gauge.

separate occasions, 27 January 2007 and 18 March 2008.

The *V. tristis* population appears to have grown considerably since eradication efforts of the feral fox & cat populations were enacted at the station in 2001. Best estimates suggest that there are about five adult *V. tristis* living within a 500 m radius of the homestead. Foxes on the property have become a rarity, although cats have proven to be more difficult to eradicate. Efforts are still underway to further reduce the feral cat population.

### *Varanus panoptes*

*Varanus panoptes* is extremely common at Rodney Downs and can be encountered throughout much of the property, with several individuals visiting the homestead on a daily basis. Although *V. panoptes* are usually a common sight whenever driving around the property, it is difficult to estimate the total number of individuals residing on the property.

During the hottest summer months (November through March), *V. panoptes* have been known to seek out and submerge in bore-drains and dams scattered throughout the property. Interestingly, *V. panoptes* have also been seen diving for freshwater mussels on several occasions at one of the same dams.

*Varanus panoptes* are serious scavengers, and are often seen feeding on road-kill. The local *V. panoptes* are also known to rummage through the food scraps from the homestead. One individual learned how to open the lid of the rubbish bin, and now repeatedly gets into what was once thought to be a secure bin. Another individual, the largest resident *V. panoptes* around the homestead at present, was seen sampling expired yogurt left out for the chickens (Figure 10). Chicken eggs are relished, and many *V. panoptes* have raided homestead chicken runs over the years. On one occasion, a large *V. panoptes* was encountered inside the chicken-run, where it had caught two small Bar-Shouldered doves (*Geopelia humeralis*). The goanna kept one dove pinned down with one of its front claws while it devoured the first bird whole, then proceeded to consume the second dove. *Varanus panoptes* have been observed digging up lizard eggs, primarily those of *L. gilberti*, and have also been seen chasing younger *V. panoptes*.



Figure 8. Profile of local *V. panoptes*



Figure 9. Dorsal coloration and patterning of local *V. panoptes*



Figure 10. *Varanus panoptes* after sampling expired yogurt



Figures 11 & 12. A *V. panoptes* feeds on a Bar-shouldered dove (*Geopelia humeralis*) it captured inside a chicken-run

An adult *V. panoptes* was seen active alongside a road at night in December 2005. The weather was quite warm during the day (daytime high was ca. 41 °C), and warmer nighttime temperatures (ca. 34 °C) may explain this unusual nocturnal behavior.

### *Varanus spenceri*

*Varanus spenceri* is the least-encountered goanna on the property, and is usually seen in areas where there are few or no trees. The soil in these areas is comprised of very high-expansion clays, where cracks form during dry periods. This high expansion makes it difficult for trees to grow in this soil type. *Varanus spenceri* has only been seen out in the open Mitchell grass Downs country on the western side of the property. During his visit, Geoff Witten reported that *V. spenceri* was quite common in this area of the property, having seen several individuals during the 6 weeks he was here collecting specimens (*pers. comm.*). A neighbor has also reported seeing this species regularly on their property, which is identical in soil-type to the areas in which it has been seen at Rodney Downs. Although the *V. spenceri* encountered



Figure 13. Detail of *V. spenceri*



Figure 14. Death-feigning behavior in *V. spenceri*

on the property have appeared to have been out foraging for food, given their reclusive nature, we have yet to observe any feeding behavior or prey items taken by this species.

*Varanus spenceri* is markedly different than the other goanna species which occur on the property in its primary defense technique. While *V. panoptes* will either flee or take up a defensive position if approached too closely, *V. spenceri* feigns death, a behavior which appears to be common for this species in the area (G. Witten, *pers. comm.*). Usually when approached from within 10 to 13 m, *V. spenceri* will flatten its body against the ground, extend one hind limb while keeping all other limbs close to the body, and curve its tail into a series of S-bends (Figure 14). The head is kept up to keep an eye on the threat. Unless the animal is nudged several times, it will stay in this position until the threat has left the area. When passing a goanna on the road by car, this behavior is usually reliable for distinguishing *V. spenceri* from *V. panoptes* before having the chance to sight it properly.

## Discussion

Depending on seasonal weather conditions and prey availability, all three goanna species are seen throughout the year at Rodney Downs station, although they become less active between the months of May and August. While *V. tristis* and *V. panoptes* seem to tolerate human presence and activity well and occur in and around the main homestead, *V. spenceri* appears to be much more timid and occurs only in open areas away from the homestead.

## **A Case of Hermaphroditism in the Ridge Tailed Monitor (*Varanus acanthurus*)**

DANNY BROWN

92 Bulic Ct.

Glasshouse Mountains, Queensland, Australia, 4518

[geckodan@bigpond.com](mailto:geckodan@bigpond.com)

Hermaphroditism is generally considered rare amongst higher vertebrates. Herein I describe a case of hermaphroditism in a monitor lizard, *Varanus acanthurus*.

The individual lizard was part of my own private collection. It was an estimated 3 years of age and was obtained by legal wild collection from the Port Hedland area of the Pilbara in Western Australia.

It was one of 5 specimens kept in two groups (1.2 and 1.1) in large plastic tubs with a sand substrate, stacked hollow bricks for shelter and a heat lamp providing a temperature gradient of 70 °C at the basking site to 28 °C at the cool end of the enclosure. The enclosures are heated for 14 hours per day in summer and 4 hours per day in winter. This particular animal had been in my care for 5 months but had recently been placed with a new larger male (as the previous male was at least 50% smaller than her).

In appearance, this individual was considered quite large (26 cm snout to vent length [SVL], 54 cm total length [TL]) and was somewhat masculine in physical robustness. It had however, very small, blunt post cloacal spurs. Radiography was utilized in order to confirm gender and the lack of hemipenial ossifications (hemibacula) in an animal of this size suggested a female gender.

As the ambient weather conditions started to warm up, reproductive activity was observed in my 1.2 pairing so introduction of this male and female was considered appropriate. Within this 1.1 pairing, the male began to show interest in mating within hours of introduction and he was seen mounting the female on numerous occasions, but hemipenial penetration was never observed. The female appeared to submit to courtship advances and mating attempts. At that time, I had assumed that the lack of copulations may have been due to a size disparity between the two as the male was still considerably smaller (21 cm SVL, 44 cm TL) than the female and I had presumed that the male may have had difficulty grasping the neck and positioning the cloaca in such a large female. Oddly, on at least 5 occasions I noticed that the ‘female’ mounted the male, and I considered that this may have been due to dominance interactions.

Towards the second week of November, the male was continuing to show mating behavior but unusually was also showing considerable aggression towards the female in the form of biting, particularly about the face and forelimbs. The male was separated from the female for 1 week after a particularly aggressive attack that left the female with bleeding wounds to her forelimb. After the female’s wounds had healed sufficiently, the male was returned to the enclosure and showed little immediate aggression but several attempted matings were recorded over the next 48 hours. Unfortunately, soon after, the female was found dead in the enclosure with a large wound on the back of the neck that had partially severed the dorsal aspect of the neck resulting in severe bleeding and death.

Owing to the fact that many matings had occurred, a post-mortem was performed in order to determine if there was any evidence of current or prior ovulation. This post-mortem revealed the presence of an active testicle on the right side of the body and an inactive ovary, oviduct and uterine tissue on the left (Figure 2). It was difficult to ascertain the caudal insertion of the uterine tissue as it was obscured by perirenal fat. Otherwise the gross post-mortem revealed no further abnormalities in body organs. The area in the expected vicinity of the hemipenes was dissected and revealed two normal sized hemipenes. The

hemipenal support structures (hemibacula) were present but were not ossified and firm, instead having the consistency of soft rubber (such as inner tube rubber).

It was presumed that the hermaphrodite possessed enough recognisable female characteristics (from a male monitor's perspective) to induce vigorous mating but also enough male characteristics to induce aggressive behaviour. The "female" behaved as such for most of the time but, on occasions, showed typically male behaviour such as mounting which ultimately lead to its demise.



Figure 1. The "female" *Varanus acanthurus*

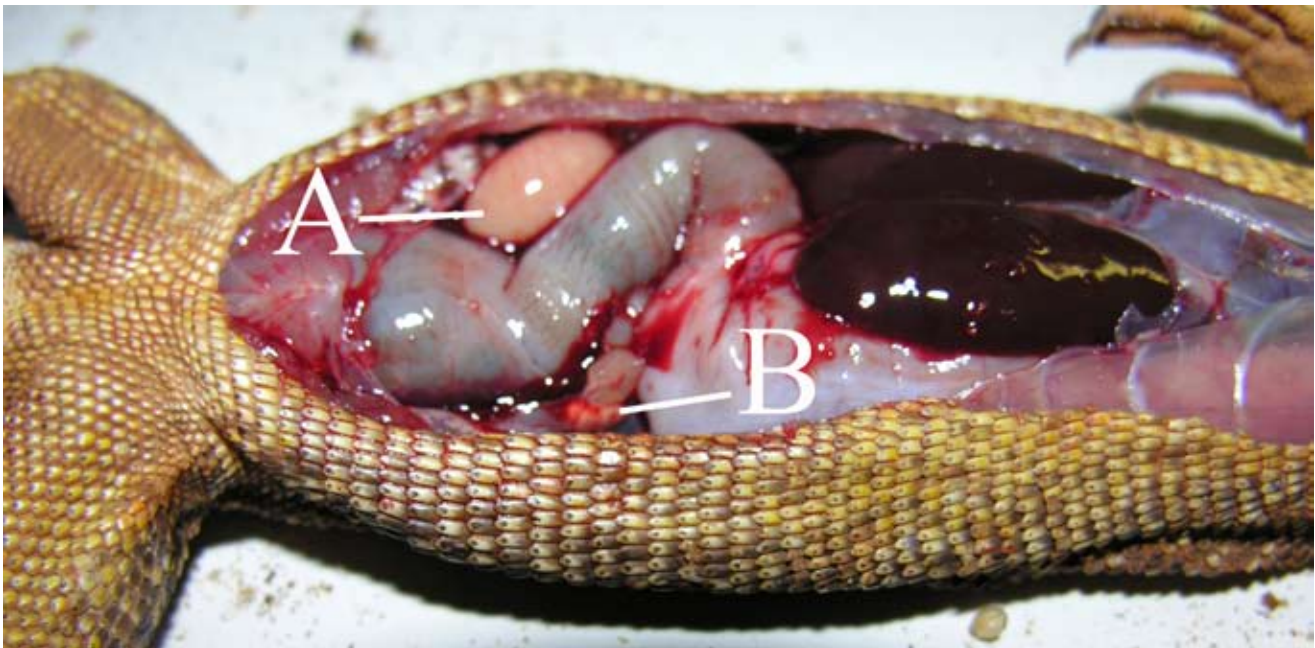


Figure 2. Post-mortem findings. Note the large pale oval testicle (A) and small pink ovary (B) with the oviduct and uterine structures trailing caudally.

---

# TRANSLATIONS

Biawak. 2008. 2(2): 89-94

© 2008 by International Varanid Interest Group

Moldovan, D. 2007. Haltung und Zucht von *Varanus (Odatria) similis* Mertens, 1958. Sauria 29(3): 21-26.

## Husbandry and Captive Reproduction of *Varanus (Odatria) similis*, Mertens, 1958

DANIEL MOLDOVAN  
Martin-Boyken-Ring 9  
D-31141 Hildesheim, Germany  
[webmaster@baumwarane.de](mailto:webmaster@baumwarane.de)  
<http://www.baumwarane.de>

**Abstract** - Following a brief general overview of the *Varanus timorensis* complex, the husbandry conditions, behavior, diet, breeding and the raising of juveniles of *V. similis* are described in detail.

**Key words:** Reptilia: Squamata: Varanidae: *Varanus similis* Mertens 1958: captive care, behavior, breeding, rearing

### Introduction

*Varanus similis* with its related species *V. scalaris*, *V. auffenbergi* and *V. timorensis* presently forms the so-called *timorensis*-complex within the subgenus *Odatria*. Different analyses conducted by several authors trying to emphasize the relationships between the species have not led to a clear, distinct difference. Mertens (1958) first described *V. similis* as a subspecies of *V. timorensis*. Due to a different morphology of the hemipenes, Branch (1982), Böhme (1988) and also Ziegler and Böhme (1997) concluded that *V. similis* cannot be accepted as a synonym of *V. timorensis*. Nevertheless, the demarcation between *V. similis* and *V. scalaris* (Mertens 1941) is still not clear (Böhme 2003). Mertens (1958) doubted that there were enough reasons to justify two (sub-) species names because the two species only differ in a few ways. Storr (1980) considered *V. similis* to be a synonym of *V. scalaris*. Following this reasoning, Wilson and Knowles (1988) did not accept the taxon *V. similis* either and considered at least all Australian populations to be variations of *V. scalaris*. In 1999, Sprackland described *V. auffenbergi* and thereby revived new discussions about the diversity of this species complex. For example, the magnificent “leopard-*timorensis*” from the island of Kisar (NE of Timor) still waits to be explored and described.

Actually, the species complex is still far away from taxonomic clarity. It can only be hoped, that future herpetological investigations on the Indo-Australian archipelago will benefit scientific examination of the relationships and will hopefully result in a complete revision of the entire *timorensis*-complex.

### Acquisition, Size, Sexual dimorphism

The author's pair of *V. similis* was purchased in 2004, aged 2 years. The animals are German captive

born specimens and presently have a total length of 50 cm (male) and 45 cm (female). Male and female could only be distinguished between by the larger size of the male and its wider skull and stronger neck. Post-cloacal spurs are missing; differences in color, pattern, nor prominent hemipenial bulges can be used to distinguish the sex.

## Housing

The pair of *V. similis* was housed in a tall terrarium measuring 1 x 1 x 2 m (l x w x h). Though this enclosure may be a little bit oversized, dimensions of 80 x 80 x 130 cm (l x w x h) should be regarded as minimum. The terrarium was furnished with some hollow cork tubes as shelters, which the animals preferred to stay in, and the rear walls were covered with pieces of natural cork, which they could use for climbing. Ground substrate was a 5 cm layer of pine bark, mixed with potting soil. The enclosure was planted with a large *Yucca* and several *Philodendron* in pots, and some plastic plants. It was illuminated with one 150 Watt HQI floodlight type daylight (5000° Kelvin), and a hotspot with a 150 Watt halogen spotlight, which was directed at a branch. An additional ReptiGlo 8.0 UVB ® (HAGEN GmbH u. Co KG, Holm, Germany) fluorescent tube mounted 30 cm above a favorite resting spot provided a permanent supply of UV light, complemented by a fixed-installation UV floodlight OSRAM Ultravitalux ® (OSRAM GmbH, Munich, Germany) of 300 Watts, which was switched on manually every day for ca. 20 min. An under-floor heating cable (20 Watt) was used to increase humidity by heating the ground substrate moderately. The temperatures varied from 30° C in the upper stories to 25° C on the ground. The hotspot provided a local temperature of 40° C for basking. A wooden nest box, usually used for nesting lovebirds, was filled with half potting soil and half sand, and fixed to the rear wall in the upper story of the terrarium. This was a proper nesting place which was used by the female each breeding season without any problems. In general, only successful experiences have resulted from using appropriately dimensioned wooden nest boxes for all my tree dwelling monitors. Nevertheless, equivalent boxes placed on the ground might fulfill the same purpose of course, if a temperature of at least 27° C can be provided. It is good advice to provide at least several nest boxes at different locations from which the female can choose from, though *V. similis* does not seem to be very particular about nest sites, as also described by Berghof (2001). A daily misting in the evening provided a relative humidity level of 60-80%. During the dry season, between November and January, misting was decreased. A water bowl with fresh water completed the furnishings.

## Behavior

It is a great concern of mine that people do away with the preconception many adhere to that this species complex is extraordinarily shy. Generally, shyness is an attribute of all wild-caught monitor lizards. To understand their initial shyness in captivity, you need to observe their biology in the wild. All species of the *timorensis*-complex are medium-sized tree dwellers, preferring hollow tree trunks and niches to live in, and they are ambush hunters, not active foragers as is the case with *V. tristis*. Because of this fact, wild-caught specimens are not extraordinarily shy when first housed in captivity; they are just behaving naturally. Additionally, they react to a threat (humans) in their natural manner - they flee or hide until the presumed predator has passed.

This natural behavior is wrongly characterized as 'shyness' and wrongly compared to supposed 'tame' *Odatia* such as *V. tristis*, but in fact it's not that easy because most *V. tristis* are captive born and are therefore used to captivity (i.e. tameness in monitors to me means that a monitor lizard does not constantly try to flee when observed, and even takes food from forceps). In my opinion, their shyness and flightiness would be same as in *V. timorensis* or *V. auffenbergi*, the only *Odatia* species which can presently be purchased as wild-caughts. Even *V. timorensis* can almost be as 'tame', visible, and active as

other monitor lizards, and furthermore, captive-born specimens were as confiding as any other captive born *Odatria* specimen (Hutter, 2007, *pers. report*).

If you are a beginner, it is strongly advised to obtain captive-born specimens. Wild-caught animals will disappoint your expectations of a usually visible monitor lizard which can proudly be shown to visitors. Do not prevent their natural behavior by removing their hiding places. If you do, keeping reptiles might be absolutely wrong for you.

My pair of *V. similis* leave their hiding places every morning to bask, showing absolutely no shyness. They have even become quite aggressive when fed, jumping towards the forceps to get to the feeder insect right away!

## Diet

The animals accept all common types of feeder insects and are not dainty with food, taking nearly everything offered. They were mainly fed roaches (*Blaptica dubia*, *Blaberus atropus*) of adequate size, which are bred by me. Locusts were a welcomed variation of prey, and desert locusts (*Schistocerca gregaria*) were more popular than migrating locusts (*Locusta migratoria*) and were pursued with greediness and pertinacity. In particular, when the locusts flapped their wings, this would trigger an extraordinary feeding response. To provoke this wing-flapping, the locust had to be held with forceps by its abdomen, and it would more or less instantly begin to flap its wings. Adult male roaches of *B. dubia* with fully developed wings had the same effect on feeding response.

Occasional feedings with pinky mice, smelt, and mussel meat complemented the diet and were especially fed to the gravid female. Any offered food was dusted with a multi-vitamin, multi-mineral supplement called Korvimin ZVT+Reptil ® (WDT eG, Garbsen, Germany). Once a week each specimen got a single feeder insect or pinky mouse which was prepared with one drop of a liquid vitamin supplement called Multi-Bio-Weyxin ® (Veyx Pharma GmbH, Schwarzenborn, Germany). Therefore, the animals were considered to have been provided with sufficient vitamins and minerals. Neither the male nor the female showed any signs of deficiencies.

Because *V. similis* is an opportunistic feeder, it is absolutely necessary to observe and regulate the individual food intake to avoid obesity.

*Varanus similis* is not an active forager like *V. tristis*; most of the time, it lies in wait for a feeder insect. Short breaks in feeding and subsequently given locusts were a great allure to the monitors, who couldn't wait to pursue them head over heels!

Gravid females should be fed more protein and sufficient vitamins and minerals to produce well-supplied eggs for the long incubation period. Nevertheless, it is important to keep the vitamin and mineral supplement application rates documented. An easy way to supplement calcium is to prepare pinky mice with little pieces of *Sepia* valve. My female *V. similis* appreciated this high quality diet with two record clutch sizes of 15 fertile eggs in 2005 and 18 fertile eggs in 2006; this confirmed that the male was in good health. A 100% hatch rate with strong and perfect hatchlings also indicated that the diet was adequate.

## Mating, Gravidity, Oviposition

The animals mated each year in the same season. During the dry season, from November through January, the animals were less active and highly secretive. Though the photoperiod and temperature were unchanged, the average temperatures (summer 30-35°C, winter 25-28°C) correlated with indoor temperatures in the occasionally heated room where the enclosure was placed. In February, when the subsequent rainy season was initiated, the misting was intensified and the animals were fed more and began to become more active through the day. After 4-5 weeks, in around mid-March, mostly in the

evenings, the male was observed continuously pursuing the female through the terrarium, intensively checking the female with its tongue and scratching on the female's back to stimulate her to lift her tail. Mating was suspected to have taken place in the cork tubes, because it was not yet observed. Nevertheless, a successful mating can easily be determined by an increasing appetite and growing girth of the female. Depending on clutch size, oviposition took place after 4-6 weeks, mainly at night in the prepared rear wall nest box. Shortly before oviposition, the hip bones could be seen through the skin, which is in my opinion, a good indicator not only that the egg development phase is finished, but also of the short amount of time before oviposition. The eggs were buried deep in the substrate, with the nest covered with great care. After oviposition, the female needed to be fed the same quality and quantity diet as during gravidity to recover. The male was left in the terrarium during the entire time of gravidity, oviposition, as well as after oviposition, and no agonistic behavior by the female could be observed.

Clutch sizes cited in literature lie between 3-6 eggs (Eidenmüller and Wicker, 1991), 11 eggs (Lambertz, 1994) and 12 eggs (Berghof, 2001). The clutch sizes of 15 and 18 eggs reported in this article may be an exception and are considerably larger than the ones achieved by specimens living in the wild.

## Incubation

After oviposition, the entire nest box was removed from the terrarium to recover the eggs. This is regarded as very useful, as the eggs can be removed without any disturbance and without having to work in small areas or confines, half inside and half outside the terrarium. The clutch was moved into a prepared Bruja FB 300 Rep® (*Janeschitz GmbH, Hammelburg, Germany*) reptile incubator at temperatures between 28-29° C. The incubator should already be tested a few days before estimated oviposition. The eggs were placed in groups of 3-4 in plastic freezer boxes, only half-buried in moist Perlite® to improve controlling possible variation in conditions. To provide the best humidity, the boxes were sealed after being prepared with ventilation holes. These little boxes maintained a stable microclimate. Even if the incubator was opened to examine the eggs from time to time for a few minutes, the temperature and humidity would not decrease as fast as if the eggs were incubated in open boxes.

The reason for only half-burying the eggs was to make signs of egg infertility visible, which can't be ascertained if the egg is completely buried. Eggs react to over-moistening (sweating) and to a substrate running dry (denting egg shell); therefore, the keeper at least has a chance to improve incubation parameters more quickly than in the worst case, only seeing the results (rotten egg) if something went wrong. An egg completely buried in an over-moistened substrate will even rupture due to an abnormal intake of water, and the embryo may even drown. The keeper has no chance to react or even recognize this; on the other hand, an egg only half-buried will begin to sweat and may even be recognized by its unusual growth, so the keeper has at least some chance of preventing the death of the embryo. The time leading up to an egg drying out is longer. An egg placed in too dry a substrate at an adequate depth will also show signs of drying out by developing recesses or dents in the shell.

In my opinion, monitor lizard eggs are more sensitive to excessive moisture than to a temporary relative dryness. Accidental damage to eggs exposed to an over-moistened substrate is irreversible in most cases; on the other hand, most eggs which suffer from a dry substrate should be able to be rescued. However, both extremes should be avoided if possible.

After 2-3 weeks, the substrate in the freezer boxes was remoistened moderately by dripping water into the furthest corners of the boxes. It is absolutely important to avoid direct contact with the eggs. On the other hand, it is not even necessary to get the water as close as possible to the egg, because capillary action and the evaporation within the box will do this much better than the keeper could.

The little monitor lizards emerged from their eggs after an incubation period of 120-136 days. Initially, only the noses stuck out of the eggs, but all animals hatched within 24 h of slitting their egg shells, without

any yolk sacs remaining. Hatchlings should be removed from the incubation container as soon as possible, sooner if eggs are incubated in groups, because it is possible that the hatchlings could disturb their unhatched siblings or even shift the remaining eggs out of their correct position, which may result in late term death of a viable egg, e.g., if the egg is turned upside down. For this reason, it is advisable to mark the tops of the eggs with a cross or something similar to be able to determine their original position. Therefore, the best choice would be to incubate each egg individually, though this may cause spatial problems in conventional incubators.

## Raising

The hatchlings were raised in a separate glass terrarium measuring 60 x 30 x 30 cm (l x w x h) for the first 6 months. It was furnished with some cork tubes, a shallow water bowl, heated by a 40 Watt halogen spotlight, and additionally illuminated by a 18 Watt ReptiGlo 5.0 UVB ® (HAGEN GmbH u. Co. KG, Holm, Germany) UV fluorescent tube, which was placed in the terrarium for UV. Initially, the terrarium floor was only covered with paper towels until the umbilicus was healed to prevent infections.

By day 4, the little monitors had already fed on small crickets, roaches and little pieces of smelt and pinky mice from forceps. They quickly developed the same greediness for food as their parents. It was quite a challenge to control 15-18 greedy babies. Therefore it became necessary to split the group to help control individual feeding. Their food was also dusted with Korvimin ZVT+Reptil ®.

The further raising of the F1 generation *V. similis* proceeded without any problems. If fed properly, the small monitor lizards may reach sexual maturity at 2 years of age.

## Results

*Varanus similis* is an undemanding, appreciative species of moderate size, which can be kept and bred quite easily. Therefore, in my opinion, it is an alternative tree-dwelling equivalent to the popular ground dweller *V. acanthurus*.

## Literature Cited

- Böhme, W. 1988. Zur Genitalmorphologie der Sauria: Funktionelle und stammesgeschichtliche Aspekte. Bonner Zoologische Monographien 27: 1-176.
- Böhme, W. 2003. Checklist of the living monitor lizards of the world (family Varanidae). Zoologische Verhandelingen, Leiden 341: 3-43.
- Branch, W.R. 1982. Hemipeneal Morphology of Platynotan Lizards. Journal of Herpetology 16(1): 16-38.
- Berghof, H.-P. 2001. Die Pflege und Vermehrung des kleinen neuguineischen Baumwarans *Varanus (Odatria) similis* Mertens 1958. Herpetofauna, Weinstadt 23(135): 5-13.
- Eidenmüller, B. and R. Wicker 1991. Einige Beobachtungen bei der Pflege und Nachzucht von *Varanus (Odatria) timorensis similis* Mertens 1958. Salamandra 27(3): 187-193.
- Lambertz, K. 1994. Haltung und Zucht von *Varanus similis*. Elaphe 2(2): 16-17.

- Mertens, R. 1941. Zwei neue Warane des australischen Faunengebietes. *Senckenbergiana Biologica* 23(4/6): 266-272.
- Mertens, R. 1958. Bemerkungen über die Warane Australiens. *Senckenbergiana Biologica* 47: 229-293.
- Sprackland, R.G. 1999. A new species of monitor (Squamata: Varanidae) from Indonesia. *Reptile Hobbyist* 4(6): 20-27.
- Storr, G.M. 1980. The monitor lizards of Western Australia. *Records of the Western Australian Museum* 8(2): 237-293.
- Wilson, S.K. and D.G. Knowles. 1988. *Australia's Reptiles*. William Collins Pty., Sydney.
- Ziegler, T. and W. Böhme. 1997. Genitalstrukturen und Paarungsbiologie bei squamaten Reptilien, speziell den Platynota, mit Bemerkungen zur Systematik. *Mertensiella* 8: 1-210.

#### **Captions for figures in original article**

- Fig. 1: Breeding pair of *Varanus similis*
- Fig. 2: Male *Varanus similis*
- Fig. 3: Terrarium for the breeding pair of *Varanus similis*
- Fig. 4: Juvenile upon emerging from its egg
- Fig. 5: Juveniles of a few weeks old in the raise-up terrarium
- Fig. 6: Juveniles basking in the terrarium

---

# HUSBANDRY NOTES

## *VARANUS PANOPTES HORNI* (Argus Monitor) REPRODUCTION

An adult pair of *Varanus panoptes horni* (male acquired as a hatchling in August 2006 and female acquired in 2007 as a 3 year old adult) has been maintained in a 366 x 122 x 244 cm custom enclosure since 5 April 2007. The enclosure offers multiple basking areas and a substrate depth of 60 cm comprised of a topsoil and sand mixture. Prior to being introduced to the male, the female laid two clutches of infertile eggs. For most of the year, a partition across the center of the enclosure was used to separate the pair to prevent fighting. The divider was removed every two weeks for three to four day intervals. The adults were offered a daily diet consisting primarily of mice, although bait fish (“bull minnows”) ca. 12–15 cm long were occasionally offered.

Prior to copulation, the male became very restless and repeatedly attempted to access the female through the partition. During this time, the female was offered as many mice as she would eat, usually 6-8 small adult mice per day.

Copulation was first observed on 3 June 2007, and continued intermittently each day for four days. At the time of copulation, the male measured ca. 107 cm in total length and the female was approximately 10 cm longer, and also heavier and larger in build. Several days after copulation ended, the female’s abdomen appeared noticeably distended, and she spent time resting in irregular positions, presumably to relieve abdominal pressure while gravid. The pair was separated one week prior to the estimated time of nesting, ca. 10 days after the last observed copulation.

Nesting occurred at night on 26 June 2007. A total of 12 eggs were deposited in the substrate of the enclosure at a depth of ca. 41-46 cm and at a temperature of 28.9 °C. The eggs were retrieved and set up for incubation inside a sealed 5.7 L plastic container, partially buried in a 1:1 mixture of water and perlite by weight. The egg box was placed on a shelf in the same room as the adults’ enclosure, where ambient temperatures averaged around 29-30 °C during the day, with temperatures dropping ca. 3-4 °C at night, with the lowest recorded temperature being 18.3 °C. The egg box was vented weekly.

Nine eggs hatched between 6 and 22 January 2008. Three eggs failed to hatch and contained dead full-term embryos. All three full-term embryos still had a considerable amount of yolk left, and the cause of their deaths remains unknown. Live hatchling measurements are presented in Table 1. No difficulties were experienced with the rearing of the hatchlings, and all offspring continue to grow rapidly.

Table 1. Hatchling measurements.

Hatching No.	Mass (g)	SVL (cm)	Tail Length (cm)	Total Length (cm)
1	36	12.0	14.0	26.0
2	43	12.5	15.5	28.0
3	35	11.0	16.0	27.0
4	38	11.5	14.0	25.5
5	41	11.5	14.5	26.0
6	35	12.0	14.5	26.5
7	43	12.5	16.5	29.0
8	32	12.0	14.0	26.0
9	40	12.0	15.0	27.0



Figure 1. Hatchling *V. panoptes horni* emerging from egg.



Figure 2. Recently-emerged hatchling



Figure 3. Resulting offspring

LANCE PADEN  
8203 Jessup Court  
Greensboro, NC 27455  
[rpaden@triad.rr.com](mailto:rpaden@triad.rr.com)

---

# NATURAL HISTORY NOTES

## *VARANUS BENGALENSIS* (Bengal Monitor) NESTING

While driving through King's Sanctuary in Nagarhole National Park, India late one morning on 8 December 2006, a Bengal monitor, *Varanus bengalensis* (estimated to be ca. 70-80 cm in total length) was sighted on the side of the lightly-traveled road. It was first presumed that the lizard was dead given its lack of movement. Upon closer inspection, the lizard was positioned with its hind legs down inside a burrow located ca. 15-30 cm from the edge of the road. When poked with a stick by a park ranger to see if it was alive, the monitor failed to flinch or move and remained extremely rigid. By gently moving it aside slightly with a stick, several eggs were revealed within the burrow, although the total number of eggs could not be determined.

The surrounding area consisted of scrubby undergrowth interspersed with large trees, partially cleared for about 20 m from the road. No rainfall was encountered that day however the ground appeared as though it had rained relatively recently. December falls within the wet season of the region, and vegetation in the area was lush and green. Only one other *V. bengalensis* was observed in Nagarhole National Park, emerging and fleeing from a burrow.

PHOEBE WESTON

[phoebe.weston@gmail.com](mailto:phoebe.weston@gmail.com)



Figure 1. *Varanus bengalensis* nesting. Photograph by Meriel Weston

---

# RECENT PUBLICATIONS

- \_\_\_\_\_ 2008. Black monitors born at Oakland Zoo. AZA Connect Magazine, February 2008: 35.
- \_\_\_\_\_ 2008. Rare Quince monitors hatch at Bronx Zoo. AZA Connect Magazine, March 2008: 39-40.
- Avadhani, R. 2008. *Varanus salvator*, the Water monitor: India's largest lizard. Reptilia 57: 43-47.
- Imansyah, M.J., T.S. Jessop and Z. Akbar. 2008. Ontogenetic differences in the spatial ecology of immature Komodo dragons. Journal of Zoology 274(2): 107-115.
- Jacobs, H.J. 2008. Zucht von *Varanus reisingeri* Eidenmüller & Wicker, 2005 mit Vergleich der Jugendkleider der *V. prasinus* Gruppe und Bemerkungen zu deren Taxonomie. Sauria 30(1): 5-12.
- Jessop, T., A. Sahu and D. Opat. 2008. *Varanus komodoensis* (Komodo Dragon) Occurrence. Herpetological Review 39(1): 95-96.
- Jessop, T. and M.J. Imansyah. 2008. *Varanus komodoensis* (Komodo Dragon) Parasites. Herpetological Review 39(1): 96-97.
- Manrod, J.D., R. Hartdegen and G.M. Burghardt. 2008. Rapid solving of a problem by juvenile black-throated monitor lizards (*Varanus albigularis albigularis*). Animal Cognition 11(2): 267-273.
- Sunter, G. 2008. Management and reproduction of the Komodo dragon *Varanus komodoensis* Ouwens 1912 at ZSL London Zoo. International Zoo Yearbook 42: 1-11.
- Wesiak, K. 2008. Unterbringung, Pflege und Nachzucht von *Varanus (Odatia) auffenbergi* Sprackland, 1999. Elaphe 16(1): 37-47.