

BIAWAK

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On the Cover: *Varanus komodoensis*

The *Varanus komodoensis*, depicted on the cover and inset of this issue were photographed by **Michael L. Peck** and **Dolores R. Fernandez** <http://www.wildlife-pix.com> in mid-morning on 5 February 1997 near Loh Liang, Komodo Island. First, a subadult dragon approached a Timor deer (*Cervus timorensis*) carcass, nosed around it for a while, then tore off some strips of flesh from the ribs. After scavenging for ca. 20 min, the subadult left the carcass. Soon after, an adult *V. komodoensis* approached the carcass and made a brief, unsuccessful attempt to swallow the lumbar spine of the deer. Total observation time for the adult individual was ca. 10 to 20 min.



BIAWAK

Quarterly Journal of Varanid Biology and Husbandry

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INTERNATIONAL VARANID INTEREST GROUP

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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.

Volume 2 Number 4 - November 2008

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Juvenile *Varanus indicus*. Fai Fai Beach, Guam.

Photograph by **Evan Miller** h.evan.miller@gmail.com

EDITOR'S NOTE

As the second volume of *Biawak* is completed, the IVIG wishes to thank the countless individuals and organizations who have supported *Biawak* through their readership, promotion, indexing, feedback, and written and photographic contributions. The global response to *Biawak* has been overwhelming and encouraging, with IVIG memberships currently numbering 533 individuals from 27 countries. Although at the time of its inception it was unclear as to whether or not there was enough of a demand for such a specialized publication, it has become evident that the journal has filled a unique niche within the field of herpetology, and the IVIG hopes to continue publishing *Biawak* for many years to come.

A Call for Papers

To date, *Biawak* has received article submissions from a myriad of individuals including university and museum faculty, field researchers, veterinarians, students, amateur varanid enthusiasts and private keepers. Missing have been contributions from zoos, aquariums and related facilities. This is surprising, given the growing number of varanids successfully maintained and bred in zoological institutions each year, as well as the broad scope of scientific research carried out on varanid lizards by zoos in recent decades. As valuable sources of data and information pertinent to the biology of varanid lizards, *Biawak* welcomes manuscripts from zoos and related facilities which discuss biological research, behavioral



Martial Eagle (*Polemaetus bellicosus*) predating on *Varanus albigularis* near Mopani Bush Camp, Kruger National Park, South Africa. Photograph by **Bill Davies** billda25@yahoo.com

observations, captive breeding, veterinary treatment, training and enrichment of varanids maintained in their collections.

New Editorial Reviewer

The IVIG welcomes Tim S. Jessop to the editorial board of *Biawak*. Currently a research ecologist with the Department of Wildlife Conservation Sciences, Zoos Victoria, he maintains active involvement in varanid research both in Indonesia studying *Varanus komodoensis* ecology and conservation, and in southeastern Australia investigating the impacts of introduced predators on numerical and functional responses in *V. varius*.

Logo Needed for the IVIG

The IVIG is currently seeking an official insignia to represent the group online, at events, in publications and on organizational documents. Entries should be submitted electronically in jpeg format and be no smaller than 2400 x 2400 pixels. The only strict requirement for the design is that it must include the IVIG's unabbreviated name, "International Varanid Interest Group". The winning design shall be announced and unveiled in a future issue of *Biawak*. Design entries should be submitted to: submissions@varanidae.org. The deadline for submissions is 15 May 2009.



Varanus albigularis albigularis. Western Kalahari, Namibia.
Photograph by **Miha Krofel** miha.krofel@gmail.com

NEWS NOTES

Cologne Zoo Hatches *Varanus macraei*; Monitor Stolen



The Cologne Zoo has become the second zoo in the world to successfully reproduce *Varanus macraei* in captivity. Five live offspring resulted, produced by a pair of adults confiscated and given to the zoo in January 2007.

One of the *V. macraei* offspring (depicted below) was recently stolen from the Cologne Zoo. Any information pertaining to the theft or whereabouts of the specimen can be directed to:



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Photographs by **Thomas Ziegler**

Source: Net-Tribune, 7 August 2008; Thomas Ziegler

Monitor Lizards Confiscated

Four monitor lizards, presumably *Varanus bengalensis*, were confiscated in Kaggalipura village, India by state police officials on 17 August 2008. According to officials, the accused individuals, belonging to the Hakki Pikki tribe, were planning to sell the lizards, possibly to roadside hotels as delicacies. Monitor lizards are protected under the Wildlife Protection Act, and the confiscated lizards will be sent to the Bannerghatta Biological Park for veterinary analysis.

Source: The Hindu, 18 August 2008

Six Fined for False Trade Description in Hong Kong

Six Hong Kong businessmen have been fined for selling water monitor lizard meat falsely labeled as that of a crocodile. One of the businessmen was convicted on 1 September, 2008 in Eastern Magistracy. Customs officers disguised as customers purchased the alleged crocodile meat, which was later determined to be water monitor (*Varanus salvator*) lizard meat, from a shop on Ko Shing Street, Sheung Wan, in September 2007. Customs officers fined the businessmen for trading water monitor lizard meat under a false description.

Source: *News.gov.hk* 3 September 2008

Monitor Lizards Rescued

A total of 1,261 monitor lizards (of unspecified species) and 11 pythons destined for the black market trade were intercepted by officials in Bukit Astana, Indera Mahkota, Malaysia on 20 October 2008. The animals were discovered in an uninhabited house when raided by officials. It is suspected that a syndicate was planning to smuggle the animals overseas however no suspects were apprehended. The seized reptiles will be given to the Wildlife Protection and National Parks Department for further action.

Source: *The Star Online*, 25 October 2008

Thousands of Live *Varanus bengalensis nebulosus* Seized

In two separate raids carried out by the Malaysian Department of Wildlife and National Parks in Muar and Segamat, Johor, officials have seized more than 7,000 live Clouded monitors (*Varanus bengalensis nebulosus*) in addition to hundreds of carcasses of protected wildlife species. The first raid in Muar on 4 November 2008 led to the confiscation of 51 live *V. bengalensis nebulosus* and hundreds of frozen bird, mammal, and snake carcasses. The second raid, conducted on a shop in Segamat on 7 November, resulted in the seizure of 7,093 live *V. bengalensis nebulosus* believed to be destined for restaurants and traditional medicine dealers. A man in his 50s was arrested in the first seizure and has pled not guilty at the Tangkak Magistrate's Court. The confiscated monitor lizards are scheduled to be released back into the wild.

Source: *New Straits Times*, 12 November 2008

“AG Warane” of the German Society of Herpetology and Herpetoculture (DGHT) Re-established

On 8 November 2008, around 30 monitor lizard enthusiasts met in Kahl am Main (near Frankfurt) to re-establish the “AG Warane”, the monitor lizard working group of the Deutsche Gesellschaft für Herpetologie und Terrarienkunde (DGHT). This working group existed until some years ago under the name “AG Warane und Krustenechsen” (monitor lizards and beaded lizards).

Aims of the AG Warane:

- Organize and connect interested and dedicated keepers of monitor lizards
- Increase the transfer of knowledge
- Publication of experiences and observations in a specialized newsletter
- Connect scientific and hobbyist communities
- Strengthen the international cooperation with other working groups
- Support beginner monitor lizard keepers and new comer scientists
- Assist in problems with authorities
- Preparation of breeding statistics and placement of captive bred specimens

Leadership of the working group:

Kay Uwe Dittmar (working group leader)

André Koch (scientific leader)

Henning Schwier (editor)

Christina Rüggeberg (treasurer)

At the meeting three talks on monitor lizards were presented. First, Steven Arth talked about the keeping and breeding of the spiny-tailed monitor lizard, *Varanus acanthurus*. André Koch reported on the project “Wallacea & Warane“, which investigates the phylogeography and systematics of Sulawesi water monitor lizards (*V. salvator*). Finally, Robert Richter reported on observations of wild monitor lizards near Darwin, Australia.

Monitor lizard enthusiasts are invited to join the AG Warane. Additional information can be found on the working group home page: <http://www.dght.de/ag/warane/warane.htm>.

Monitor Lizard Interest Community (IGW) Founded

The monitor lizard interest community, Interessengemeinschaft Warane (IGW) was founded on 1 November 2008 by Frank Mohr, Esther Böck and Thilo Böck as a volunteer-based, non-registered interest group. The principal reason for creation of this interest group was the lack of an organized network of monitor keepers, enthusiasts and breeders in German-speaking countries. The main goal of the IGW is to advance the captive husbandry of monitor lizards through cooperation between private keepers and zoological associations and institutions.



Aims of the IGW:

- Document captive breeding statistics and establish a registry of monitor lizards kept by IGW members

- Limit inbreeding by creating breeder communities which allow for the exchange individuals between breeders.
- Improve general knowledge of monitor lizards through documentation of observations on captive and wild individuals.
- Educate beginner monitor keepers
- Improve the current state of the trade in wild-caught monitor lizards
- Raise awareness of technological advancements which can help improve captive husbandry
- Publish a biannual magazine entitled 'Varanus' (in German) on the captive husbandry and veterinary treatment of monitor lizards
- Produce an annual calendar with high quality photographs of members' monitor lizards
- Hold an annual convention which will include lectures, workshops, talk-shops and reports on activities and achievements of the IGW

Although most members of the IGW are from Germany and German-speaking countries such as Switzerland and Austria, anyone with an expressed interest in monitor lizards is welcome to join. Additional information on the IGW can be found on its website: <http://www.ig-warane.de> (German), or on its international website (English): <http://www.ig-varanidae.org>



Varanus varius with tick attached to eyelid. Cooloolo National Park, Rainbow Beach, Qld.
Photograph by Troy Bell tjb@bellsmobileservices.com.au

ARTICLES

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Geographical Distribution, Instinctive Feeding Behavior and Report of Nocturnal Activity of *Varanus dumerilii* in Thailand

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Introduction

Varanus dumerilii was first described by Hermann Schlegel in 1839; however, it would not be found in Thailand until over one hundred years later. Geographic distribution maps are often made in error in species with significant ranges and confusion concerning names and locations, especially in Thailand, where there are rarely exact transliterations. The documented range of *Varanus dumerilii* in Thailand is herein recorded to aid in greater accuracy of future publications.

Varanus dumerilii has always been a rather elusive monitor. Due to its cryptic habits and perhaps being the most sedentary of the monitors in the Asia-Pacific region, not much has been written about it, observations in the wild are infrequent, and little is known about its natural history. Earlier in 2008, *V. dumerilii* was observed in Singapore at night (Yong et al., 2008) and we suggest that this species may occasionally be nocturnal. This might also partially explain why it is seen so rarely throughout its geographical distribution, even though its presence in the pet trade gives the appearance of a species that is more common. Part of the reason for nocturnal behavior may be its prey of choice, crabs, which are much more active nocturnally. Specific behavior for crab-feeding from even the youngest of hatchlings along with a wide skull adaptation suggest a long evolutionary history of specializing in crabs, resulting in this specific feeding behavior becoming instinctive.

Geographical Distribution

Based on locality records (Taylor 1963; Nabhitabhata et al., 2000; Lauprasert and Thirakupt, 2001; Nabhitabhata and Chan-ard, 2005; this paper), the geographical distribution of *V. dumerilii* in Thailand extends northward up the length of peninsular Thailand and along the Thai-Burmese border to a point in northern Kanchanaburi province. The northern known limit of its range in the Tenasserim region of Myanmar is reported as Tavoy (Mertens, 1942). The range is by no means continuous and is dependent upon suitable habitat.

Varanus dumerilii is often associated with mangrove forest habitats (Boulenger, 1912; Smith, 1935; Nutphand, 1989; Eidenmüller, 2007), but this record shows them in an inland evergreen forest away from the shore. Bennett (1998, 2004), Bennett and Liat (1995) and Cox et al. (1998) each comment that they are to be found in inland evergreen forests as well as in mangrove forests. Their presence in inland evergreen

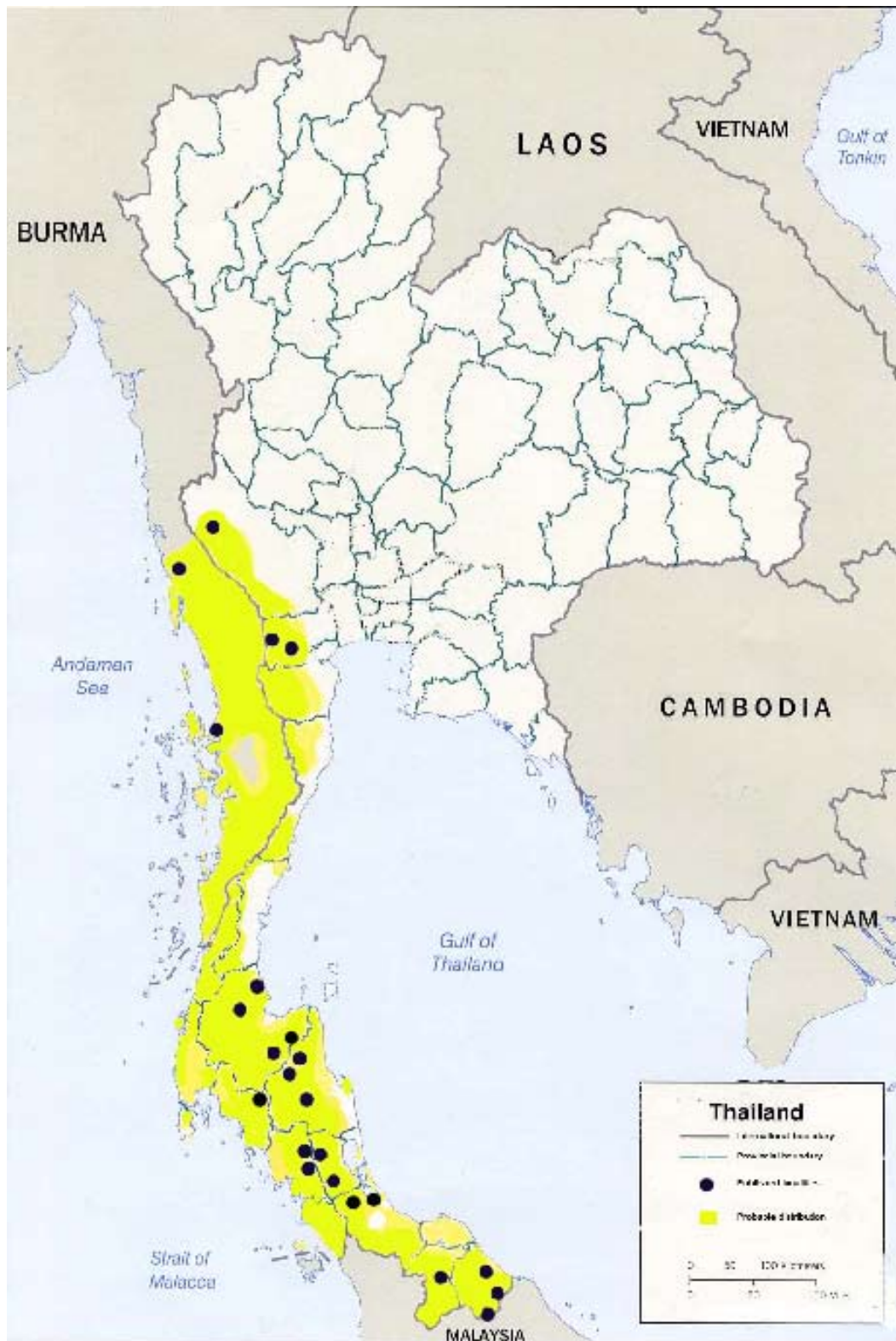


Figure 1. Distribution map of *Varanus dumerilii* in Thailand and neighboring Myanmar, by recorded locality data. Locality information based on Nabhitabhata et al. (2000), Lauprasert & Thirakupt (2001), Nabhitabhata & Chan-ard (2005), Mertens (1942), and Taylor (1963), Smith (1935), Boulenger (1912) and specimen recorded in this paper are recorded with black dots, probable distribution is represented in yellow.

forests is further confirmed by numerous published localities inside mainland/non-peninsular Thailand along the border with Myanmar (Nabhitabhata et al., 2000; Nabhitabhata and Chan-ard, 2005). *Varanus dumerilii* is also occasionally found in secondary forests. Lauprasert and Thirakupt (2001) reported finding *V. dumerilii* in rubber and coffee plantations within tropical rainforests in southern Thailand. No matter what habitat *V. dumerilii* is found in, it never appears far from water.

Instinctive Behavior

Uwe Krebs (1979) suggested that the broad skull in adult and juvenile *V. dumerilii* is well adapted to feeding on crabs. A specialized feeding behavior also described involved removal of the pincers and often the legs of larger crabs, especially those that could cause damage with their pincers. Through experimentation with hatchlings, crabs (*Uca* sp.) elicited the most aggressive feeding response over all other prey items, which included insects, shrimp, lizards, rodents, eggs, and frogs. Even the hatchlings violently shake their prey and break off the pincers of their crab prey before continuing to consume them (pers. obs.), which indicates a long lineage of this specialization resulting in an instinctive behavior. This along with the broad skull shape suggests that it has evolved both instinctual behavior and morphological adaptations to more efficiently handle their specialized prey.

The practice of dismembering crabs starting with the pincers becomes more refined and efficient with practice as *V. dumerilii* ages (pers. obs.). Large crabs are quickly dispatched by first violently shaking the prey then systematically breaking off the claws, followed by breaking off the legs, and finally crushing the carapace into pieces so it can be swallowed. The claws are broken off just as Krebs (1979) describes, by violently levering them, using the ground as a base. Although many other prey items are opportunistically accepted by adults, crabs (*Somanniathelphusa* spp. and other crab genera) remain the favorite prey item in captivity, eliciting the strongest feeding response.

Varanus rudicollis is also known to eat crabs (Losos & Greene, 1988 and pers. ob.); however, they will not take crabs as large, proportionately, as will *V. dumerilii*. Experimentation with captive *V. rudicollis* (Cota, unpubl. obs.) showed that they will take crabs as prey items only if they can easily be swallowed whole. *Varanus salvator* and *V. bengalensis* will also eat crabs; however, of all the *Varanus* spp. in Thailand observed in captivity and in the case of *V. salvator* in captivity and the field, only *V. dumerilii* dismembers and crushes the carapace of larger crabs that cannot be swallowed whole (Cota, unpubl. obs.).

Nocturnal Observation

In October 2006, a survey of the herpetofauna of Khao Nan National Park, Nakhon Si Thammarat Province, Thailand, was conducted by the Thailand Natural History Museum, National Science Museum. During this survey, a remote location was chosen in a limestone valley within the National Park, which consisted of cliffs to the sides of the valley. The valley floor consisted of numerous streams broken up by higher jagged limestone formations. Canopy was at ca. 80% coverage. During the survey, a great number of crabs were seen crawling about, especially near the water. On 23 October 2006 at ca. 19:30 h. a 97 cm male *V. dumerilii* was captured. This animal was at the edge of the water on an unusually smooth and flat rocky surface. It was startled by the presence of the survey team and quickly moved in front of us, perpendicular to the direction of the survey team's movement. Restrained by the anterior 1/3 of the tail, the monitor immediately started to thrash about violently. When restrained by holding the neck and pelvic region, it became calm, nearly to the point of feigning death.

This is the second nocturnal activity record of *V. dumerilii* in the field, the other record being Yong et al. (2008). In the short time the specimen from Nakhon Si Thammarat was in captivity, most of its activity was within the first few hours of darkness, even though the specimen was not disturbed during the day.



Figure 2. Limestone canyon where *V. dumerilii* was found at night. Photograph by **Michael Cota**.



Figure 3. *V. dumerilii* was found on the canyon floor covered in primary forest, jagged limestone outcrops and streams flowing through the low areas. Photograph by **Michael Cota**.



Figure 4. Male *V. dumerilii* captured while active during the night.
Photograph by **Tanya Chan-ard**.

Nocturnal activity, if it does occur commonly, might partially explain why this species is not seen often in its natural habitat. Shyness may also explain why it may be seldom seen in its natural habitat (Bennett and Liat, 1995). Barbour (1921) wrote about the Dyaks in Sarawak reporting *V. heteropholis* (synonym of *V. dumerilii*) living in the trees and never coming down, possibly taking refuge in holes high up in the trees. Barbour (1921) also described *V. heteropholis* (*V. dumerilii*) as a very rare species. It was so rarely seen in the past within Thailand that Boulenger (1912) does not mention its presence in Siam (Thailand) and Smith (1935) stated it was yet to be found in Siam (Thailand), even though both had recorded it in the adjacent Tenasserim region of Burma (Myanmar), showing a disjointed geographical distribution. However, the frequency of this species in the American and Japanese pet trades suggests that it might be more common throughout its geographical distribution than the few wild observations suggest.

Although there are now two published accounts for *V. dumerilii*, nocturnal behavior should not occur in any *Varanus* sp. The visual cells of the retina have poor visual acuity in low light, because they are made up of cone receptors (Röll & Horn, 1999) that only are capable of good day vision, which is typical in diurnal lizards. The only diurnal lizard currently known to have both rods, receptor cells for low light conditions, and cones, cell receptors for daytime conditions, is *Tiliqua rugosa* (Braekevelt, 1989, cited in Röhl & Horn, 1999). The only platynotans that are nocturnally active are the *Heloderma* spp. The eyes of *Heloderma* spp. show a modification of the cone which allows them to see better in nocturnal conditions and shows a transition of receptor cells from cones to rods (Walls, 1934, cited by Röhl & Horn, 1999). In *Varanus*, the existence of rod receptor cells or even modified cone receptors as in *Heloderma* spp. are unknown, so when *V. dumerilii* is nocturnally active, it is suspected that it does so nearly or completely blind. One reason why *V. dumerilii* would be nocturnally active would be in search of its favorite prey item, crabs, which are more active nocturnally in tropical Asia because of the intense day time heat and higher night time relative humidity. This observation showed nocturnal activity in an area rich with crabs and the observation from Yong et al., 2008 reported a specimen actively foraging.

Literature Cited

- Barbour, T. 1921. Aquatic Skins and Arboreal Monitors. *Copeia* 97: 42-44.
- Bayless, M. K. & B. Aller. 2004. Dumeril's Monitor Lizard (*Varanus dumerilii*) A look at an uncommon monitor lizard. *Reptiles* 12(3): 42-47.
- Bennett, D. 1998. Monitor Lizards Natural history, biology & husbandry. Edition Chimaira, Frankfurt. 352pp.
- Bennett, D. 2004. *Varanus dumerilii*. In E.R. Pianka and D.R. King, Varanoid Lizards of the World, 172-175. Indiana Univ. Press, Bloomington, Indiana.
- Bennett, D. & L.B. Liat. 1995. A Note on the Distribution of *Varanus dumerilii* and *V. rudicollis* in Peninsular Malaysia. *Malaysian Nature Journal* 49: 113-116.
- Boulenger, G.A. 1912. A Vertebrate Fauna of the Malay Peninsula from Isthmus of Kra to Singapore Including Adjacent Islands. Reptilia and Batrachia. Taylor and Francis, London. 294pp.
- Braekvelt, C.R. 1989. Photoreceptor fine structures in the bobtailed goanna. *Histol. Hisopath.* 4: 281-286.
- Cox, M.J., Dijk, P.P. van, Nabhitabhata, J. & K. Thirakupt. 1998. A Photographic Guide to Snakes and Other Reptiles of Thailand and Southeast Asia. Asia Books, Co. Ltd., Bangkok. 144pp.
- Eidenmüller, B. 2007. Monitor Lizards Natural History, Captive Care & Breeding. Edition Chimaira, Frankfurt. 176pp.
- Horn, H.-G., & B. Schulz. 1977. *Varanus dumerilii*, wie ihn nicht jeder kennt. *Das Aquarium* 91(11): 37-38.
- Krebs, U. 1979. Der Dumeril-Waran (*Varanus dumerilii*), ein spezialister Krabbenfresser? *Salamandra* 15(3): 146-157.
- Lauprastert, K. & K. Thirakhupt. 2001. Species Diversity, Distribution and Proposed Status of Monitor Lizards (Family Varanidae) in Southern Thailand. *Natural History Journal of Chulalongkorn University* 1(1): 39-46.
- Losos, J.B. & H.W. Greene. 1988. Ecological and evolutionary implications of diet in monitor lizards. *Biological Journal of the Linnaean Society* 35: 379-407.
- Mertens, R. 1942. Die Familie der Warane (Varanidae). Dritter Teil: Taxonomie. *Abhandlungen der senckenbergischen naturforschenden Gesellschaft* 466: 235-391.
- Nabhitabhata, J., Chan-ard, T. & Y. Chuaynkern. 2000. Checklist of Amphibians and Reptiles in Thailand. Office of Environmental Policy and Planning, Bangkok. 152pp.

- Nabhitabhata, J. & T. Chan-ard. 2005. Thailand Red Data: Mammals, Reptiles and Amphibians. Office of Natural Resources and Environmental Policy and Planning, Bangkok. 234pp.
- Nutphand, W. 1989. The Monitor Lizards of Thailand. Mitphadung Publishing Office, Bangkok. 33pp. [in Thai]
- Röll, B. & H.-G. Horn. 1999. The Structure of the Eye of the Monitor Lizard *Varanus griseus capsius* (Reptilia: Varanidae). pp. 291-306. In H.-G. Horn & W. Böhme (eds.), Advances in Monitor Research II, Mertensiella 11, Rheinbach.
- Smith, M.A. 1935. The Fauna of British India Including Ceylon and Burma, Reptilia and Amphibia. Vol. II.- Sauria. Taylor and Francis, London. 440pp.
- Taylor, E.H. 1963. The Lizards of Thailand. University of Kansas Science Bulletin 44(14): 687-1077.
- Walls, G.L. 1934. The Reptilian Retina. I. A new concept in visual cell evolution. American Journal of Ophthalmology 17: 892-915.
- Yong, D.L., Fam, S.D. and J.J. Ng. 2008. Rediscovery of Dumeril's Monitor, *Varanus dumerilii* (Varanidae) in Singapore. Nature in Singapore 1: 21-22.

Observation of *Varanus salvator* from Koh Tao Island in the Gulf of Thailand

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At 1430 h on 28 July 2008, a juvenile Water Monitor *Varanus salvator* (total length ca. 45 cm; Figure 1.) was observed as it was standing on the edge of shallow water beside a road (ca. 10° 05' 05" N ; 99° 50' 59" E and ca. 300 m from seashore) in Koh Tao Island (Surat Thani Province, southern Thailand; Figure 2.). It slowly walked and later stopped on a dead log for few minutes. Then it started walking and regularly flicking its tongue to the dense vegetation.

Distribution of *Varanus salvator* in Thailand is previously known from the mainland and adjacent islands (i.e. Taylor, 1963; Luxmoore and Groombridge, 1990; Cox et al., 1998; Nabhitabhata et al., 2000; Lauprasert and Thirakhupt, 2001; Nabhitabhata and Chan-ard, 2005). This observation is the first for Koh



Figure 1. A young *Varanus salvator* from Koh Tao island.

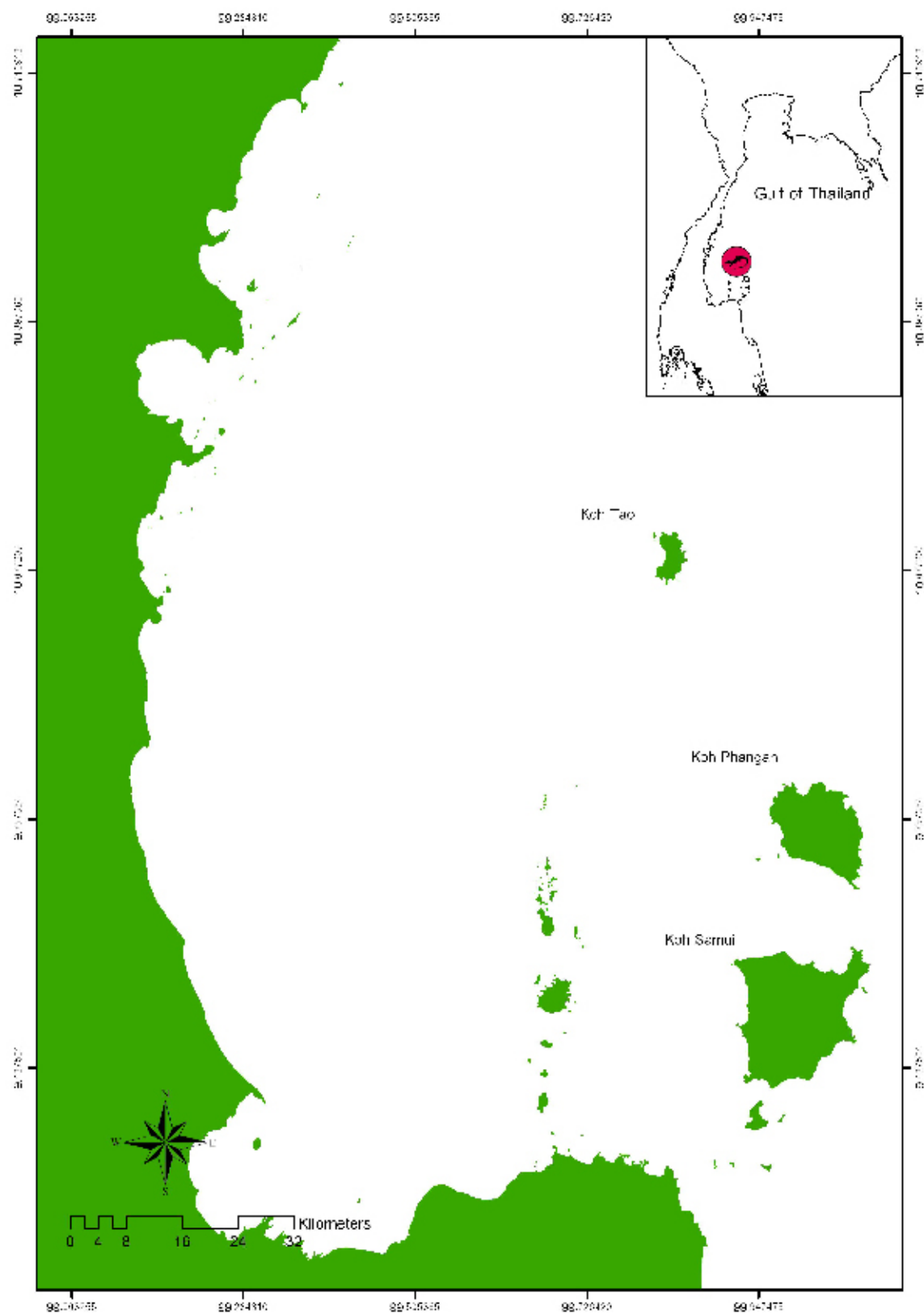


Figure 2. Map of Koh Tao and adjacent islands

Tao Island (ca. 21 km² in area, ca. 70 km out from the mainland) of the Gulf of Thailand, and expands the previously known distribution of this species. Borden (2007) observed this species swimming between two small islands (ca. 2.4 km out from the coast of Railay, Krabi Province) in the Andaman Sea. This observation indicated that the Water Monitor is a very strong swimmer and the individual observed was probably traveling to an island, rather than swimming out in the open water for some other purpose.

Similar to three congeneric species (*V. bengalensis*, *V. dumerilii* and *V. rudicollis*), *V. salvator* is protected under the Wild Animal Reservation and Protection Act of 1992. However, illegal hunting of this species for various purposes such as for meat or the skin trade still occurs throughout the country (Luxmoore and Groombridge, 1990; Lauprasert and Thirakhupt, 2001) and directly threatens the species' populations in their natural habitats (Nutphan, 1982). Further conservation efforts including research and law enforcement are needed.

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Literature Cited

- Borden, R. 2007. *Varanus salvator* (Asian Water Monitor) migration. Biawak 1(2): 84.
- Cox, M. J., P. P. Dijk, J. Nabhitabhata and K. Thirakhupt. 1998. A Photographic Guide to Snakes and Other Reptiles of Thailand and Southeast Asia. Asia Books Co., Ltd. Bangkok. 144pp.
- Lauprasert, K. and K. Thirakhupt. 2001. Species diversity, distribution and proposed status of monitor lizards (Family Varanidae) in Southern Thailand. Nat. Hist. J. Chulalongkorn Univ. 1(1): 39-46.
- Luxmoore, and B. Groombridge. 1990. Asian Monitor Lizards. A review of distribution, status, exploitation and trade in four selected species. World Conservation Monitoring Centre. 219 (c). Cambridge. 194pp.
- Nabhitabhata, J. and T. Chan-ard. 2005. Thai Red Data: Mammals, Reptiles and Amphibians. Office of Natural Resources and Environmental Policy and Planning, Bangkok. 234pp.
- Nabhitabhata, J., T. Chan-ard and Y. Chuaynkern. "2000" 2004. Checklist of Amphibians and Reptiles in Thailand. Office of Environmental Policy and Planning, Bangkok. 152pp.
- Nutphan, W. 1982. Reptiles and amphibians that might be extinct. J. Wildlife Thailand 3: 62-69 [in Thai].
- Taylor, E. H. 1963. The lizards of Thailand. Univ. Kansas Science Bulletin 45(14): 914-928.

Field Observations on *Varanus spinulosus*

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Since its original description by Mertens in 1941, *Varanus spinulosus* has remained one of the most poorly known varanids. It is known only from two museum specimens with precise locality data, the type specimen from San Jorge (Solomon Islands) NMW 23387, and another from Cape Torokina, Bougainville (PNG) USNM 120886. An additional five specimens with imprecise locality data from Isabel Island (SI) were imported to the United States in the early 1990s (Sprackland, 1993) bringing the total number up to seven known specimens. A published photograph credited to a Malaysian animal dealer (Bennett, 1995) and personal communications with reptile dealers in Indonesia (J Gorman, pers. comm.) suggest that there may be more specimens in captivity.

Recent observations on the hemipeneal morphology of *V. spinulosus* have demonstrated that it is not a member of the *V. indicus* complex, as previously thought and its taxonomic standing is not currently understood (Böhme and Ziegler, 2007). The distribution of *V. spinulosus* is also poorly understood. At the time of writing, it has only been formally documented from Bougainville, Isabel and San Jorge. The range map in Eidenmüller and Philippen (2007) which includes the Louisiade Archipelago is an error according to the author (Eidenmüller, pers. comm.) and a photo of a live animal taken at the Charapoana Resort on Charapoana Island (Danielova and Daniel, 2001) is not considered a valid record either (Böhme and Ziegler, 2007). During the Pleistocene, Bougainville, Choiseul, Isabel and Nggela (= Florida Islands) were all connected (Mayr and Diamond, 2001), so the presence of *V. spinulosus* on Choiseul would not be surprising. Their occurrence in Nggela is less likely because these islands are much less remote and have been extensively collected by reptile traders. (A. Fafale, pers. comm.)

Due to the fact that exports of *Corucia zebrata*, once the staple of the SI reptile trade, have been banned, and the worldwide trade in live birds is coming to a close as well, the wildlife trade in the Solomon Islands has waned considerably in recent years and it seems unlikely that animal traders will turn up more specimens of *V. spinulosus* accidentally.

In August of 2008, my wife Monica Perez, and I traveled to San Jorge and Isabel Island to search for and observe *V. spinulosus* in the wild. Due to logistical constraints, we were only able to explore the northwest and northeast coastline and interior of San Jorge Island. No specimens were observed despite extensive searching in different habitats such as mangroves, inland rainforest and cultivated areas. We did see monitor tracks on the northeastern beach of San Jorge along the Ortega Channel opposite Isabel. However, funnel traps which were set baited with fish did not turn up any lizards. When shown photos of both *V. indicus* and *V. spinulosus*, local people on San Jorge identified *V. spinulosus* as the monitor with which they were familiar. They refer to the monitors as “Saba.”

We observed the introduced toad *Rhinella marina*, (formerly *Bufo marinus*) to be very common on San Jorge and feared that *V. spinulosus* populations might have been negatively affected by the toad’s presence. Populations of *V. indicus* have been documented to be in serious decline in other areas where *R. marina* has been introduced such as Guam (Dryden, 1965) and Guadalcanal (McCoy, 2006).

We had much better luck observing *V. spinulosus* on the southwestern coast of Isabel Island where we saw six individuals in two days (ca. 10 field hours total). All of the lizards observed were in a coconut grove

which, according to the locals, had been planted along the coast after a tsunami in the 1950s (Figure 1). The grove stretched along the beach from the outskirts of Kaevanga to Kapito River (the river delta area known as “Bottom River”), then inland to another village. On the other side of the river the terrain consisted of rainforest with wild betel nut palms and sago palms. The coconut palm plantation was approximately 200 m wide and 4 km long, bordered on the inland side by dense rainforest at sea level for 600 m before the elevation began to gradually increase. A fairly well-traveled (by foot) dirt road bisected the grove (Figures 1 & 2). The grove was maintained and did not have high ground cover. A number of the palms had arboreal termite nests which are possibly used by the monitors as egg-laying sites. Other reptiles observed in this grove were *Emoia nigra*, *E. atrocostata* and *Lamprolepis smaragdina*, the latter only along the rainforest edge.



Figure 1. *Varanus spinulosus* habitat near Kaevanga, Isabel Island.



Figures 2 & 3. *Varanus spinulosus* habitat near Kaevanga, Isabel Island.

Five of the six *V. spinulosus* observed were on the ground when first encountered and fled up the coconut palms upon being disturbed. Flight distance for two of the three adult lizards observed was approximately 15 m. Both adult lizards and the subadult paused after climbing 1-2 m, tongue-flicked and continued casually up into the crowns, edging around in an effort to keep the trunks between themselves and the observers. A juvenile (ca. 20 cm) and the third adult shot up into the crowns without a pause. A tractor that had just passed coming from the opposite direction a minute before us most likely startled one adult lizard that was already halfway up a palm before we saw it. The individual we captured ran about one and a half meters up a palm and focused its attention on Monica, who held the camera and was walking towards the palm to snap a photograph (Figure 4). The animal inched around the back of the palm, keeping a wary eye on Monica and did not see the author coming up behind to grab it. Upon capture, the lizard struggled, hissed, then quickly calmed down. It did not defecate or try to bite.

We also observed numerous sets of monitor tracks along Vale Beach in the intertidal zone parallel to the Kaevanga road, but saw no evidence of digging for crabs. Indeed, we did not see any crabs other than hermit crabs along this stretch of beach bordering the grove. One set of tracks appeared to have been from a lizard that was substantially larger than any of the *V. spinulosus* we subsequently saw, all of which were less than one meter in total length (TL). The adult male that was captured the following day and the observed subadult (ca. 60 cm TL) were both within 30 m of where the small juvenile had been seen the day before. All of the lizards were observed between 1000 and 1600 h in full sun, some quite close to human habitation and some within a few meters of the high tide line.

We did not see any *V. indicus* in this habitat which is interesting because coconut plantations in the Solomons are reported as *V. indicus* habitat (McCoy, 2005; Woods, 2007). *Rhinella marina* was abundant in this area as well, and this might account for the lack of *V. indicus*. McCoy (2006) reports *V. spinulosus* as inhabiting mangroves, which are also well documented as *V. indicus* habitat (Philipp, 1999). How these two species avoid competition is not clear if they are indeed sympatric as previously reported (Sprackland, 1993; Böhme and Ziegler, 2007). We are pleased to report that *V. spinulosus* appears capable of co-existing with *R. marina* in disturbed habitat and in close proximity to humans. The chief of Fanavi, a village approximately 20 km south of Kaevanga, informed us that they are common in Sago palm plantations as well. The monitors appear to not be molested by the local people, who seem indifferent to them. We did not see any domestic dogs or cats in either of the villages on Isabel. It is not clear if *V. spinulosus* feeds on *R. marina* and is unaffected by the skin toxin or whether they take no interest in the toads. Members of the *V. salvator* complex are known to feed on *R. marina* without ill effects (Gaulke, 1991). *Varanus salvator* and *V. spinulosus* may be related (Böhme and Ziegler, 2007).

Observations on Diet

According to San Jorge islanders, *V. spinulosus* feeds on megapode eggs and on fish, often emerging from the bush to scavenge the entrails of fish after they have been cleaned. One chicken farmer told us that his coops had been raided by the same large lizard on several occasions; “a mightywon” is how he put it. The adult male we captured on Isabel defecated the remains of a bird, possibly a lorikeet, which we often saw nesting in holes on the same palms where the lizards were observed.

The only published data available on the wild diet of *V. spinulosus* is the stomach contents of an adult male (USNM 120886) from Bougainville which contained five species of arthropods (Böhme and Ziegler, 2007). Sprackland (1993) reported that one of the three captives mentioned above fed only on fish, whereas the other two fed on rodents and insects as well. One of the lizards imported in the 1990s which ended up at the Baltimore Zoo fed only on cockroaches and small mice that had been dipped in egg (Baltimore Zoo staff, pers. comm.). Sprackland’s observations on diet were dismissed by Böhme and Ziegler (2007) as being irrelevant. Nevertheless, in our experience, recently collected animals will often



Figure 4. *V. spinulosus*, Kaevanga, Isabel Island.

only accept familiar foods at first. Therefore, we believe that due to information supplied by islanders and the tracks observed in the intertidal zone at low tide that it is quite possible that *V. spinulosus* actively search for dead fish.

Description of Specimens Observed

All of the lizards observed near Kaevanga were similar in color and pattern to the individual in Figure 4, with the exception of the juvenile which seemed to be darker. The sandpaper-like skin texture, unique among varanids, described by Böhme and Ziegler (2007) who published on a preserved individual, is very apparent when handling a live animal and is not the result of improper preservation. Also notable is the unusually baggy skin of the healthy, wild individuals. In a previously published photograph of three *V. spinulosus*, two clearly visible (Bennett, 1995), the bagginess of their skin is not apparent. However these lizards appear to have flattened themselves out to maximize surface area during basking. The claws of *V. spinulosus* are not as sharp as some other varanids, e.g., those of *V. indicus*. This suggests that *V.*



Figure 5. Male *V. spinulosus*; partial eversion of hemipenes.

spinulosus might lead a more terrestrial lifestyle. We were surprised to see that the undersides of the front feet on the male captured on Isabel were orange.

We applied for and received permits to export 10 live *V. spinulosus* from the Solomon Islands to our facility in Costa Rica and plan to follow up this paper with a subsequent report on captive husbandry and reproduction.

Literature Cited

- Böhme, W. and T. Ziegler. 2007. Notes on the distribution, diet, hemipenis, morphology and systematics of *Varanus spinulosus* Mertens, 1941. pp. 100-108 in Horn, H.-G., W. Böhme and U. Krebs (eds.), *Advances in Monitor Research III*. Mertensiella 16, Rheinbach.
- Bennett, D. 1995. *A Little Book of Monitor Lizards*. Viperpress, Aberdeen. 207 pp.
- Danielova, M. and R. Daniel. 2001. Solomon Islands Wildlife Conservation Project. <http://www.charapoana.com/html-en/projekt.phtml>, 3pp. Last accessed 27.09.2005.
- Dryden, G. L. 1965. The food and feeding habits of *Varanus indicus* on Guam. *Micronesica* 2(1): 73-76.
- Eidenmüller, B. and H.-D. Philippen. 2007. *Terralog Vol. 6: Varanoid Lizards of the World*. Edition Chimaira, Frankfurt. 148 pp.
- Gaulke, M. 1991. Systematic relationship of the Philippine water monitors as compared with *Varanus s. salvator*, with a discussion of dispersal routes. pp. 154-167 in Böhme, W. and H.-G. Horn (eds.), *Advances in Monitor Research II*. Mertensiella 11, Rheinbach.
- Mayr, E. and J.M. Diamond. 2001. *The Birds of Northern Melanesia*. Oxford Univ. Press, New York.
- McCoy, M. 2006. *Reptiles of the Solomon Islands*. Pensoft, Sofia-Moscow. 212 pp.
- Philipp, K. M. 1999. Niche partitioning of *Varanus doreanus*, *V. indicus* and *V. jobiensis* in Irian Jaya: preliminary results. pp. 307-316 in Böhme, W. and H.-G. Horn (eds.), *Advances in Monitor Research II*. Mertensiella 11, Rheinbach.
- Woods, I. G. 2007. *Varanus indicus* (Mangrove Monitor) Liapari Island. *Biawak* 1(2): 90.
- Sprackland, R.G. 1993. Rediscovery of a Solomon Islands monitor lizard (*Varanus indicus spinulosus*) Mertens, 1941. *Vivarium* 4(5): 25-27.
- _____. 1994. Rediscovery and taxonomic review of *Varanus indicus spinulosus* Mertens, 1941. *Herpetofauna* 24(2): 33-39.

NATURAL HISTORY NOTES

VARANUS RUDICOLLIS (Rough-necked monitor) OCCURRENCE

Little is known about the natural history and geographic distribution of *Varanus rudicollis*. Here, I report on observations of *V. rudicollis* made while traveling in southwestern Borneo.

On 17 November 2006, while traveling in a 10 m long wooden boat known locally as a klotok on a small tributary of the Sungai Sekonyer River in Tunjung Putting National Park, outside of Pangkalanbun, Central Kalimantan (ca. -2.757087° S ; 111.946825° E), several *V. rudicollis* were seen swimming along the banks (Figure 1). The immediate area, a swamp forest, was densely vegetated, and the river was lined with dense foliage and smaller trees (Figure 2).

Around 12 independent observations of *V. rudicollis* were made over the course of two four-hour trips. All sightings occurred during mid-morning to early afternoon. There was significant cloud cover the entire trip. All individuals were seen swimming, noticeable by the V-shaped wake created by their movements as they swam towards vegetation lining the banks. The monitors were taking shelter in the heavy vegetation along the banks of the river, but only deep enough to where they were out of reach and difficult to see as we passed. Several sightings involved more than one individual. Sometimes groups of two to three individuals were seen within 5 m of one another, swimming across the river in front of our boat, however most sightings were of single individuals. *Varanus rudicollis* was only seen in areas where vegetation was dense along the river. There is considerable boat traffic on the river, so the monitors may be somewhat accustomed to river traffic.



Figure 1. Juvenile *Varanus rudicollis* swimming.



Figure 2. Riverbank vegetation used by *V. rudicollis*.

Observed individuals appeared to have been between 45 and 75 cm in total length. Each individual was light gray in background coloration with yellowish crossbands. Although *V. salvator* occurs in aquatic habitats throughout Borneo, every monitor seen within sufficient viewing distance (first noticeable from ca. 30 m, clearly visible from 10 m, and as close as 2 m) appeared to have the same body coloration and markings as the individual photographed, leading me to believe that they were all the same species. No large monitors over 75 cm, such as *V. salvator*, were seen along the river.

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***VARANUS RUDICOLLIS* (Rough-necked monitor)**

OCCURRENCE

At 0615 h on 4 May 2008, an adult *Varanus rudicollis* (ca. 1.2-1.5 m in total length) was observed resting in a tree (Figure 1) along a forest edge between an oil palm plantation and a forest reserve (Figure 2) in Tawau, Sabah, Borneo (4°17'53"N ; 117°52'59"E). The *V. rudicollis* was seen resting vertically on the trunk of a tree at a height of ca. 6 m. The monitor was observed for 10-15 min from a distance of ca. 100 m, and did not seem to react to the author's presence. No other varanid lizards were seen in the area.



Figure 1. Adult *Varanus rudicollis* resting in tree.



Figure 2. Habitat of *V. rudicollis*.

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HUSBANDRY NOTES

VARANUS PANOPTES HORNI (Argus monitor) SEXUAL MATURITY

The ages at which varanid lizards reach sexual maturity in captivity remain poorly documented. Here, I report on sexual maturation in a young pair of *Varanus panoptes horni* born and raised in captivity.

A group of four (1.3) *V. panoptes horni* hatched in captivity between 6 and 22 January 2008 (Paden, 2008) were raised together in an enclosure measuring 244 x 122 x 213 cm (l x w x h). A 76 cm deep sand substrate was offered for burrowing, and driftwood and sculpted rockwork provided climbing space. Two separate basking areas were provided, each consisting of two 45 watt halogen outdoor flood lights. Three of the lights were maintained on a 12:12 photoperiod, whereas the fourth was kept on permanently. From the time of hatching, the group was primarily fed mice daily, with the “San Diego Zoo diet” (Lemm et al., 2004) and insects making up less than 5% of their diet. The group coexisted with few territorial disputes. All three females have demonstrated similar growth rates and are comparable in size; the male is considerably larger than the females and has demonstrated a noticeably faster growth rate.

Copulation was first observed between the male and one of the females on 25 July 2008. Both individuals were between 186 and 202 days old at this time. After a gestation period of ca. 20-23 days, a clutch of six eggs was laid on 21 July 2008 near the base of a buried log at a depth of ca. 45 cm and at a temperature of 29.3 °C. Egg measurements were not recorded. At the time of oviposition, the female measured just 29.8 cm in snout to vent length (SVL) whereas the male measured ca. 5-8 cm longer in SVL. All eggs appeared to be fertile, however one egg was discarded after two weeks of incubation. At the time of this writing, the eggs have been incubating for three months.



Figure 1. Adult male (left) and female (right) *Varanus panoptes horni*.



Figure 2. *Varanus panoptes horni* eggs.

Literature Cited

- 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.
- Paden, L. 2008. *Varanus panoptes horni* (Argus monitor) Reproduction. *Biawak* 2(2): 95-96.

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TRANSLATIONS

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Mertens, R. 1962. *Papusaurus*, eine neue Untergattung von *Varanus*. Senckenbergiana Biologica 43(5): 331-333.

Papusaurus*, a New Subgenus of *Varanus

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The Papua-monitor, *Varanus salvadorii* (Peters and Doria 1878) was previously placed in the subgenus *Varanus* Merrem 1820. However, on the basis of body form, scalation, and cranial characters, it seems that this splendid monitor, restricted to New Guinea, actually is not closely related to other monitors and occupies a special position (Mertens, 1950: 566). This special position is revealed most of all by the peculiar tail of this animal, which has a relative length of from 2.3 to 2.6 times as long as the head and body taken together. This relative length surpasses that of any other species of monitor. In addition, the shape of the tail is remarkable.

Peters and Doria noted in the original description (1878: 337) that the tail is not laterally compressed like a rudder, but is rounded at the base and even appears somewhat flattened so that it appears triangular in cross-section. On the other hand, Boulenger (1885: 314) noted: "tail rounded at the base, feebly compressed and keeled above in the rest of its length". Originally in my studies of the monitors I had access only to a single specimen, a young specimen at the Zoological Museum in Berlin (ZMB 24220). Unfortunately *Varanus salvadorii* is one of the great rarities at the Senckenberg Museum- there are only two mandibular rami (SMF 57877, 57878)- so it was a sensation for herpetologists when the first live Papua-monitor arrived in Germany in the summer of 1960. Thanks to the initiative of the director, Albert Schochle, *Varanus salvadorii* could then be exhibited at the "Wilhelma" Zoo in Stuttgart (Mertens 1960).

As I observed the animal, which was over 2 meters long and in flawless condition, it occurred to me that the tail could in no way be considered laterally compressed. Instead, it is very low or depressed and appears at first rounded in cross-section, but then somewhat triangular, and a low double keel runs along the dorsal surface. As previously mentioned, its unusual length is noteworthy. The scalation is unusual, since the scales beyond the base of the tail are not arranged in diagonal rows, and the scales of the underside of the tail are larger than those along the side of the tail. A row of subcaudal scales therefore corresponds to two or three of the lateral rows. This last observation does not seem to be as important as is the divergent tail form in recognizing that *V. salvadorii* may no longer be placed in the subgenus *Varanus*. This situation was known to Peters and Doria, the describers of *V. salvadorii*, when they wrote: "Questa forma assai rimarchevole e quasi un passaggio tra i sotto generi *Hydrosaurus* (= *Varanus*) ed *Odatria* perche non ha la coda remiforme dei primi, ne grandemente verticillata della seconde" (Translator's note: 'This very remarkable form is almost like an intermediate between the subgenera *Hydrosaurus* and *Odatria* because it does not have the oar-like tail of the first, nor the multi-whorled tail of the second'). Here is an early

indication that it is unfeasible to include *V. salvadorii* in either subgenus, *Varanus* or *Odatria*. *Varanus salvadorii* does not agree with the characters of the subgenus *Odatria*, as follows. In *Odatria* the caudal scales are regular, arranged in uniform rings to the end of the tail, in contrast to *V. salvadorii*. The skull characters are known to differ in *V. salvadorii* (for example the reduction of the parietal lamina in old individuals). The teeth in *V. salvadorii* are remarkably long and straight, becoming curved only at the tip, and then are only weakly curved. Finally, the total length of *V. salvadorii* distinguishes it from *Odatria*, some members of which are among the smallest monitors, not exceeding one meter in length, and most of the others are small, while *V. salvadorii* belongs among the giants of the genus, those species reaching at least 2.5 meters. Although the author is no advocate of monotypic genera or subgenera, in this case the only alternative is to erect such a new subgenus.

Papusaurus n. subgen.

Diagnosis – A subgenus of *Varanus* Merrem 1820. Very large, over 2 meters long. Head long, flat with long muzzle; nostril an elongated oval shape, situated along the side of the snout; tail very long, about 2.5 times as long as the head and body, very flat, not laterally compressed or rudder-shaped, rounded at base in cross-section, becoming triangular posteriorly, bearing a double keel dorsally; supraoculars not differentiated; caudal scales not arranged in whorls; skull with strongly vaulted nasal region when seen in lateral view; maxillae of the “hypsiprosopisch” (Translator’s note: “hysiprosopisch” = the excavation of the maxilla does not extend beyond the posterior border of the septomaxilla, and the prefrontal process of the maxilla, which is rather long, rises gradually See Mertens, 1942, Part 2: 129); nasals paired or unpaired; parietal lamina well-developed in adult only anteriorly, reduced posteriorly; maxillary and mandibular teeth very long, pointed, almost straight, curved backwards only at the distal end and then only slightly; 10 maxillary and 10 mandibular teeth on either side and 8-9 premaxillary teeth.

Type species – *Monitor salvadorii* Peters and Doria 1878
= *Varanus salvadorii* (Peters and Doria 1878)

Papusaurus is the tenth subgenus of *Varanus*, and includes only the single species described here. The ancestors of *Varanus* (*Papusaurus*) *salvadorii* may be searched for among the members of the subgenus *Varanus*. The shape of the tail suggests that the Papua-monitor is not amphibious, but rather is arboreal. The live specimen in the “Wilhelma” Zoo appears to confirm this..

The Papua-monitor at Stuttgart unfortunately died on 27 August 1962 and may now be found in the collection of the Senckenberg Museum (SMF 58064). The total length of this male animal measured 244 cm.

Mertens, R. 1971. Über eine Waransammlung aus dem östlichen Neu Guinea. Senckenbergiana Biologica 52: 1-5.

A Collection of Monitors from Eastern New Guinea

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Among the monitors collected by Dr. Thomas Schultze-Westrum during his trips in 1959 and 1966 to New Guinea are specimens of all the forms of that family known until now to occur in New Guinea except for *Varanus timorensis similis*. This material, which except for a few specimens in the Senckenberg Museum is housed in the Zoologischen Staatssammlung in Munich, is especially valuable for two rarities: *Varanus salvadorii* and *V. karlschmidti*. Until now, the latter species was known only from four specimens in the Museums of Chicago, Frankfurt, and Basel. Both animals in Schultze-Westrum's collection improve not only the diagnosis for the species (the color in life) but also increase our knowledge of its distribution. The collection also serves as an important enrichment to our rather meager knowledge of the varanid fauna of southeast New Guinea- I have earlier noted the debate on the subspecies problem in *V. indicus*.

Varanus (Odatria) prasinus prasinus (Schlegel)

Nos. 23, 318 (Now SMF 65963): 2 adults, Aird Hill, Gulf of Papua; October 1959.
Unnumbered specimens: 1 adult, 1 juvenile. Aird Hill, Gulf of Papua; March 1960.

In addition to these four specimens I also have available another two males, from the same locality, which I have received from Reverend Cribb on 24 September 1960. One of these animals is still alive, after more than 10 years.

Varanus (Papusaurus) salvadorii (Peters and Doria)

No. 71: 1 juvenile. Kopi Village near Kikori, Gulf of Papua: March 1966.
Unnumbered: 1 adult (tanned skin with skull), Kikoni River, Gulf of Papua, August 1960.
Unnumbered: 1 adult skull, Aird Hill, Gulf of Papua

The young specimen of this impressive arboreal monitor has a better marked color pattern than the older animal. These have a very long tail, as does no other *Varanus* species: in an animal of 242 mm SVL, the tail is 521 mm or more than twice as long as the SVL. The skull in the tanned hide in this collection has a gnathion-occipital condyle length of 134.8 mm, but this is smaller than the skull of the famous "Wilhelma" Zoo specimen (141.7 mm, SMF 58064). In Dr. Schultze-Westrum's opinion *Varanus salvadorii* is not the most massive monitor but is the longest, and may considerably exceed 3 meters.

Varanus (Varanus) gouldii gouldii (Gray)

No. 319: 1 subadult, Port Moresby; 5 November 1959

This Gould's monitor of 268 SVL + 415 mm tail came from the savannah and shows no differences between the nominate form from west, north and east Australia.

Varanus (Varanus) indicus indicus (Daudin)

No. 15 (now SMF 66915): 1 subadult, Aird Hill, Gulf of Papua; 12 Jan. 1966.

Nos. 43, 49, 195, 221-225, 288, 289 (now SMF 66916), 290, 295, 315: 13 adult and subadults, Aird Hill, Gulf of Papua; Oct. 1959 and Jan.-Feb. 1966.

No. 77: 1 adult, Pairupeni, edge (or rim) of hills on the Gulf delta; March 1966.

No. 78: 1 adult, Aird Hill, Gulf of Papua, March 1966.

No. 113: 1 subadult, Maeaera Plantation, St. Joseph River, Central District; 17 June 1966.

No. 129: 1 juvenile, Libano River, Mt. Bosavi region; August 1966.

No. 140: (now SMF 66917): 1 subadult, Moinamu village, Gulf of Papua; 8 October 1959.

No. 177 (now SMF 66918), 323, 328: 3 subadults, Kikori, Gulf of Papua; 14 October 1959.

No. 317: 1 subadult, Bulolo, Eastern Highlands District, Territory of New Guinea; October 1959.

No. 331: 1 adult, Didessa, around Mt. Bosavi, Southern Highlands District; 7 September 1966.

This series of 24 monitors gives a strong impression of uniformity, with a single exception (No. 317). These all have a grayish-black base color, dorsally sprinkled with yellow, the yellow spots have very little tendency to form rosettes. Therefore these are typical "*indicus*"- some individual variation in color, such as that of the tail or the intensity of the throat color, would only be recognized in living animals. More variable than the dorsal pattern is that of the venter: which from nearly patternless specimens goes through a complete range to sprinkled and even flecked patterns. As for the dorsal pattern, only No. 317, a half-grown specimen from Bulolo (SVL 228 mm), has no light spots, but only larger yellow flecks; except for one *V. karlschmidti*, no other small specimens are at hand from that locality. In life, these would appear as bright yellow on the black ground color (dorsally) and as green-yellow flecks on the nape of the neck. The tail was bluish green laterally, the throat was rosy-yellow on the side, the underside yellow, flecked with black. The tips of the tongue are yellow.

Earlier I stated that it is not possible at present to recognize these and other pattern variations of *Varanus indicus* as being distinct taxa. In many parts of the extensive geographic distribution of *V. indicus*, for example the Aru and Kei Islands, such variations seem to be geographically isolated, but elsewhere they are not.

The largest specimen in the collection, No. 77 from Pairupeni, has a total length of about 130 (50+80) cm. This is only slightly smaller than the size record for this species.

Varanus (Varanus) karlschmidti Mertens

No. 316: 1 subadult (now SMF 66919) Bulolo, Eastern Highlands District; October 1959.

No. 330: 1 adult, around Mt. Bosavi, Southern Highlands District, 7 September 1959.

This monitor was immediately recognized as a different taxon from *V. indicus* by the field collector on the basis of the color in life. It is distinguished from the species, which usually has a yellow throat, by its throat coloration which ranges from a rosy color to a bright flesh (reddish or pink) color, this is

documented in color photographs. It may also be noted that *V. karlschmidti* may be separated from *V. indicus* in life by the coloration of the tongue: which in *V. indicus* is yellow, in *V. karlschmidti* it is reddish with two small black tips.

Although both new specimens of *V. karlschmidti* agree in scalation pattern with the previously known four specimens, they are different in head coloration, which is not unimportant. I have already emphasized (1951: 468) as a distinctive character, the pronounced tendency towards a light yellow head and neck coloration in the types and both paratypes. But examination of the fourth specimen revealed (1959: 234) that the light coloration was not present on the dorsum of the head, and was only evident as a light brownish coloration on the sides of the head. In this regard, it is not generally recognized that both of the Schultze-Westrum's specimens have dark pigment dorsally and laterally on the head, and as mentioned previously only the underside are they a very noteworthy light red color. It is noteworthy that the first four specimens are from northern New Guinea (previously Kaiser Wilhelm's Land) but the new specimens are from the south part of the island (Bosavi) and the east part (Bulolo). It is not impossible that *V. karlschmidti* shows geographic variation in head coloration.

No. 316. SVL 290 mm. Tail 445 mm. Left 6, right 5 supraoculars, whose rows are separated from each other by seven scales. The number of scales from one corner of the mouth to the other is 61; there are 190 scales around the body; 106 transversely across the venter. Dorsally, the color in alcohol is blackish gray, some whitish scales, some are grouped and arranged in rosettes. Dorsally the head is a single color, dark gray, as is the side of the head. The underside of the head is patternless, light; belly is yellowish with small black flecks; dorsally the tail is dark with (a) yellow marbled design, in contrast the distal half is indistinctly banded, alternately light/dark. As to the color in life, it is noted: "Tongue reddish with two small black tips. Dorsum of head blackish gray. Throat with bright yellow on underside becoming bright fleshy-red anteriorly. Dorsum black with vivid greenish-yellow spots. This specimen resembles closely the one from Bosavi with rosy-colored throat (No. 330).

No. 330. SVL about 355 mm, tail about 500 mm. Left 8, right 9 supraoculars, whose rows are separated from each other by 9 scales. 59 scales from one corner of the mouth to the other. 197 scales around the body and 97 transverse scale rows ventrally. Coloration in alcohol: dorsally blackish gray with very sporadic light spots, which do not form rosettes. Dorsum of the head similar, light flecks scarcely noticeable; side of head is similar. Underside of head bright, patternless except for a few black flecks at the edge of the jaws; belly dark, clearly distinct from the bright underside of the head, dirty yellow with many small, black flecks. Dorsum of tail dark with light flecks, the second half (distal half of the tail) is darker and with bright transverse bands.

Varanus karlschmidti is extremely close (closely-related) to *V. indicus*. They agree in general body form, although the anterior part of the head is sometimes narrower in *V. karlschmidti* (Fig. 1). In addition, *V. karlschmidti*, whose total length exceeds 1 meter, does not have the same body mass (bulk) as does *V. indicus*.

As for the scalation, it appears that both species have the same type of enlarged scales, forming a ridge, on the basal portion of the fourth toe. In spite of this, it seems beyond doubt that *V. karlschmidti*, often living sympatrically with *V. indicus*, represents a valid species.

A very important distinguishing character between the two forms can be noted, that in *V. karlschmidti* the much smaller (and therefore more numerous) scales on the head and trunk are apparent without magnification (Figs. 1, 2). The scales on the neck are especially noteworthy, which are not only smaller but also more oblong and more strongly protruding. The scales are also finer in the temporal region, as shown by comparison of the number of scales from one corner of the mouth to the other (56-61 vs. 35-50). As for the color pattern, it is less distinct dorsally in *V. karlschmidti* than in *V. indicus*. On the contrary, the yellow color of the dorsum of the head and neck, emphasized in the original description, up to now has

only been known in specimens from the Sepik region of northeast New Guinea.

Summary

Five species of *Varanus* occur in east and southeastern New Guinea: *V. prasinus*, *V. salvadorii*, *V. gouldii*, *V. indicus*, and *V. karlschmidtii*. The last species was previously known only from northeast New Guinea; its diagnosis is significantly expanded on the basis of coloration in life; in this regard a geographic gradient in variability does not seem unlikely.

Figure Caption

Figure 1. *Varanus karlschmidtii* No. 316, Bulolo. The fine scalation is readily apparent, in contrast to that of the *V. indicus* in Fig. 2.

RECENT PUBLICATIONS

- Amer, S.A.M. and Y. Kumazawa. 2008. Timing of a mtDNA gene rearrangement and intercontinental dispersal of varanid lizards. *Genes and Genetic Systems* 83: 275-280.
- de Buffrenil, V., A. Houssaye and W. Bohme. 2008. Bone vascular supply in monitor lizards (Squamata : Varanidae): Influence of size, growth, and phylogeny. *Journal of Morphology* 269(5): 533-543.
- Gaulke, M. 2008. International terrarium exhibits- the Ailon Montalban Zoological Park, Philippines. *Reptilia* 59: 55-59.
- Gaulke, M. and A.D. Demegillo. 2008. The Mabitang: large fruit-eating monitor of the Philippines. *Reptilia* 59: 39-46.
- Smith, J.G., K. Christian and B. Green. 2008. Physiological ecology of the mangrove-dwelling varanid *Varanus indicus*. *Physiological and Biochemical Zoology* 81(5): 561-569.
- Smith, K.T., B.A.S. Bhullar and P.A. Holroyd. 2008. Earliest African record of the *Varanus* stem-clade (Squamata: Varanidae) from the early Oligocene of Egypt. *Journal of Vertebrate Paleontology* 28(3): 909-913.
- Valverde, J. 2008. Book review: Taxonomy, Life History, and Conservation of Giant Reptiles in West Kalimantan. *Reptilia* 58: 76-77.
- Winchell, S. 2008. Book review: Varanoid Lizards. *Reptilia* 59: 68-69.
- Yong, D.L., S.D. Fam and J.J. Ng. 2008. Rediscovery of Dumeril's Monitor, *Varanus dumerilii* (Varanidae) in Singapore. *Nature in Singapore* 1: 21-22.