# BIAWAK

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# On the Cover:
# *Varanus scalaris*

The dimminutive *Varanus scalaris* (to 253 mm in snout to vent length) is an arboreal member of the subgenus *Odatria* which inhabits a variety of wooded and forest environments across northern Australia from Western Australia to Queensland. Closely allied with *V. similis*, *V. scalaris* is believed to represent a species complex, with additional species likely to be identified in the future.

The *V. scalaris* depicted on the cover and inset of this issue was photographed in Arnhem Land, NT by **Stephen Zozaya** on 2 June 2012. The specimen was found resting on a tree in savanna woodland in the late afternoon. Following an initial photograph (right), the animal was captured for data collection and rephotographed for reference (below).

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*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 varanid lizards and the advancement of varanid research. Membership includes subscription to *Biawak*, an international research journal of varanid biology and husbandry, and is available online through the IVIG website.

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*Varanus salvator bivittatus* feeding on toad (*Duttaphrynus melanostictus*). Bali, Indonesia. Photograph by **Jan C. Deiman**.

# ORGANIZATIONAL NEWS

The International Varanid Interest Group continues to grow in terms of both its membership and the international breadth of its distribution. The period between June 2012 and May 2013 saw the addition of 125 new members, bringing IVIG membership to a total of 816 individuals from 51 countries. New member countries include the Russian Federation and Iran. Membership demographics are summarized in the figures below.

Now in its seventh year of publication, *Biawak* will continue to be published biannually, with new issues appearing in June and December of each year. This issue features a new installment which will highlight varanid illustrations from the past and present. Artists interested in having artwork displayed in future issues of *Biawak* should contact the editor in chief.

Although delayed since its announcement in the last issue of *Biawak*, an online radio podcast dedicated to discussions on varanid lizards is in development and should be available soon.

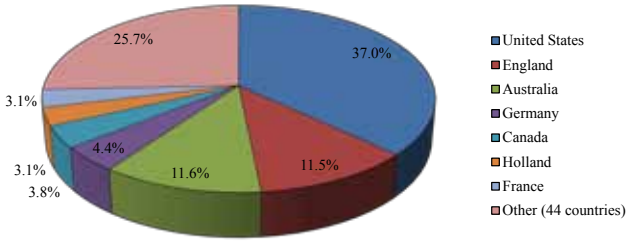


Fig. 1. Breakdown of IVIG membership by country.

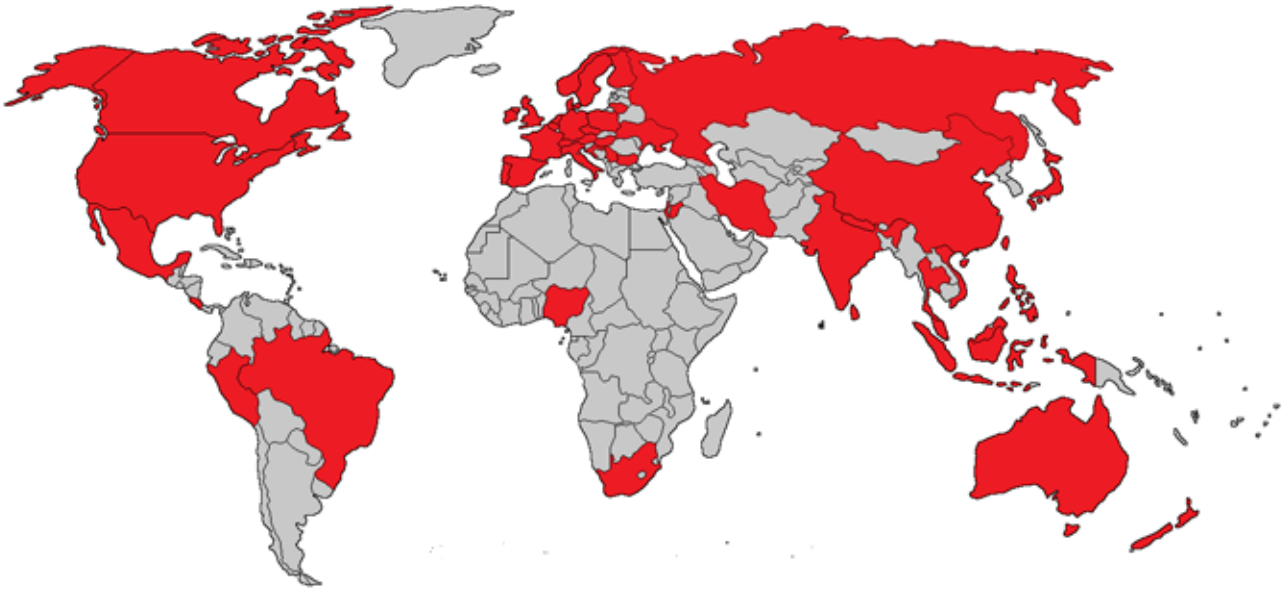

Fig. 2. Current global distribution of IVIG membership as of June 2013.

# NEWS NOTES

## Zoos Report Successful Hatching of Komodo Dragons

The Memphis Zoo announced the successful hatching of a clutch of sixteen Komodo dragon (*Varanus komodoensis*) eggs, the third successful reproduction of this species at the facility in the past year. Officials plan to display some of the hatchlings and send the rest to other unnamed facilities at a later date. The Surabaya Zoo has hatched seven Komodo dragons from a clutch produced in September and October; bring the current number of dragons maintained by the facility to sixty-three. As of press time, zoo officials were expecting another seven or eight hatchlings by the end of May.

*Sources: http://dailymail.co.uk, 18 January 2013; Bangkok Post, 20 March 2013*

## Multiple Komodo Dragon Attacks Reported

A tour guide was attacked by a Komodo dragon (*Varanus komodoensis*) while leading a group on the island of Rinca. The 25 year-old guide was bitten on his calf after reportedly passing between the two meter dragon and a shelter it was utilizing. The guide was taken to a hospital on Flores for treatment.

An eighty-three year-old woman, also on Rinca, was attacked by a two meter dragon as she was sitting on the ground outside of her house. The woman claimed she was unaware of the animal's presence until it bit her hand. She was able to kick the dragon and cause it to release its grip. She was taken to Labuan Bajo to receive stitches for her hand and wrist.

*Sources: http://news.com.au, 20 February 2013; http://afp.com, 11 April 2013*

## Indian Man Arrested for Poaching Monitor Lizards

Forestry officials arrested a 28 year old man for illegally poaching monitor lizards (species not identified, but likely *Varanus salvator*) near Boothapandi, Kanyakumari district, India. A total of five adult monitors, which were believed to have been poached for their meat, were seized from the man's house. Authorities are presently searching for a second suspect. Monitor lizards are protected in India under Schedule II of the Wildlife Protection Act.

*Source: http://timesofindia.indiatimes.com, 9 May 2013*

*Varanus salvator macromaculatus* and dogs. Laem Phak Bia, Thailand. Photograph by **Jerry R. Oldenettel**.

## Water Monitor Enters Parliament Building, Delays Legislation

Officials at the Parliament Building in Bangkok, Thailand were alerted to a large water monitor lizard (*Varanus salvator macromaculatus*) that had entered the duct work in the ceiling of the building. After unsuccessful attempts by security staff to coax the monitor to leave, workers from the Dusit Zoo and the Office of Disaster Prevention were called in to capture and remove the lizard from the building. It is not clear how the monitor entered the building, but water monitors are common in the area, including on the grounds of parliament and in the Dusit Zoo.

*Source: Bangkok Post, 23 May 2013*

## Monitor Lizard Skin Purses Seized at Los Angeles International Airport

On 6 May 2013, customs officers at Los Angeles International Airport, USA checked the bag of a man traveling from Nigeria, which contained a variety of handbags made from reptile skins, including monitor lizards (species not identified), African rock pythons, dwarf crocodiles, cobras, and puff adders. All of the items were seized and turned over to the United States Fish and Wildlife Service.

*Source: Los Angeles Times, 20 May 2013*

## Leg Brace for an Arthritic Komodo dragon

In an effort to treat a potential case of arthritis in a 10 year old male Komodo dragon (*Varanus komodoensis*), the Columbus Zoo (USA) partnered with a local orthotics company to mold and cast a leg brace for the dragon. The dragon, whose gait and movements were affected by the condition in its front left leg, was fitted with a plastic brace, which it wore for two months. The dragon's condition following the removal of the brace appears to have improved. If the condition returns, the brace will be put back on. This same technique was successfully used before on an arthritic Komodo dragon at the Phoenix Zoo.

*Source: The Columbus Dispatch, 4 June 2013*

## Report from the Fifth Annual Meeting of the "AG Warane und Krustenechsen"

The fifth annual meeting of the "AG Warane and Krustenechsen" (Monitor Lizard and *Heloderma* Working Group) of the Deutsche Gesellschaft für Herpetologie und Terrarienkunde (German Herpetological Society) took place on 11-12 May 2013 at the State Museum of Natural History in Karlsruhe, Germany. The first day featured a variety of talks given by well-known authorities including Bernd Eidenmüller, Uwe Krebs, Beat Akeret and Nikola Pantchev, as well as a tour through the museum's vivarium. On the following day, all attendees visited the Reptilium Zoo in Landau.

This year's meeting began with a welcoming from Thomas Hörenberg and André Koch of the group's advisory board, followed by an address made by DGHT president Peter Buchert on various topics and the activities of the society. In particular, he discussed the political situation in Germany concerning the imminent ban of exotic animals in captivity. He appealed to all attendees to publicize and publish their keeping and breeding successes with threatened and endangered herpetofauna, as there is strengthening political pressure

Invited talks were held during the first day of the annual meeting.

Participants of the fifth annumal meeting outside of the State Museum of Natural History in Karlsruhe.

from groups that propose a strict ban on all exotic animals in Germany. In this regard, increasing general knowledge about reptiles and amphibians and their responsible handling and care in captivity can play a crucial role in countering these efforts.

Next, a fascinating talk on the morphological variability of some well-known Australian monitor lizards was given by Bernd Eidenmüller (Frankfurt) based on animals that he's encountered during numerous trips to Australia. Besides photographs of habitats, he also showed slides of various *Varanus tristis*, *V. scalaris* and *V. acanthurus* populations, among others, that are widespread across Australia. It became obvious that different populations of each of these species vary considerably in morphology, size and coloration; especially when separated by hundreds or even thousands of kilometers. For some specimens, it seemed impossible to allocate them to a particular species, and the morphological boundaries between distinct subspecies and species are unclear. In sum, Mr. Eidenmüller claimed that detailed taxonomic investigations across species' entire distributions would probably shed more light on the true diversity of Australian monitors. Next, Uwe Krebs (Ansbach) reported on his longstanding experiences and observations of monitors with a talk entitled "Learning and intelligence of monitor lizards – behavioral research in the terrarium". Here, he discussed the intelligence and learning abilities of many monitor species, and encouraged attendees to conduct experiments of their own on the behaviors of captive monitor lizards, particularly foraging behavior.

Following a lunch break, the general assembly of the "AG Warane und Krustenechsen" took place in the museum's lecture hall. Thomas Hörenberg (Stuttgart) addressed attendees on the current number of AG members and discussed the location for next year's annual meeting, which will be held at the Leipzig Zoo in the Spring of 2014. The exact date and program will be announced at a later date. In addition, he reported on various governmental requests for information regarding monitor lizards and their care, and announced the forthcoming publication of a special issue of the German magazine *Draco*, which will focus on dwarf monitors of the subgenus *Odatria*. Several AG Warane und Krustenechsen members are involved with this project and have documented their experiences with the successful keeping and breeding of these species. Subsequently, André Koch (Bonn) talked briefly about recently published studies on monitor lizards as well as ongoing or recently completed research projects under his supervision or in collaboration with Thomas Ziegler (Cologne Zoo) and Wolfgang Böhme (Museum Alexander Koenig). Among the current projects is a taxonomic revision of the *V timorensis* group.

Next, Beat Akeret (Rümlang) from Switzerland gave a talk on the construction of terraria and the equipment used in caring for monitor lizards. Comprehensively, he explained how various materials can be used to replicate natural conditions within enclosures, and showed several excellent examples of large terraria he constructed in the basement of his house.

The final speaker of this year's meeting was Nikola Pantchev (Fellbach), who talked about various endoparasites found in monitor lizards. As a specialist of veterinary parasitology, he explained which parasites often affect imported wild-caught monitors, but also those hatched in captivity. Fortunately, in most cases these diseases are not transferrable to reptile keepers and

there is no risk of infection. Interestingly, the parasites of mice and insects fed to monitors as food items can be diagnosed in the lizards' feces. Although these pathogens usually just pass through the digestive tracts of monitors without infecting them, this must be taken into account when testing for parasites, as unnecessary medical treatments could have negative consequences for the monitor lizard. Following his talk, Mr. Pantchev answered many questions from the audience about diseases in varanids.

Following the talks, attendees were guided through the museum's vivarium by Johann Kirchhauser, the head of the department. He toured the group around the many aquariums and terrariums and discussed various topics pertaining to the vivarium's 70 year history. The heloderms and monitor lizards, including *V. macraei*, *V. glauerti* and *V. tristis* were of great interest to the group.

The following day was dedicated to visiting the Reptilium Zoo, a popular reptile and amphibian zoo located in Landau, about 40 km from Karlsruhe. Uwe Wünstel, the zoo's manager, guided visitors through the facility. In addition to displaying *V. macraei*, *V. salvator*, *V. reisingeri*, and *V. glauerti*, a new terrarium for *V. mertensi* was in preparation. The Reptilium Zoo also features a breeding facility where many species have successfully been bred over the past nine years. Among the eggs currently incubating was a recent clutch from *V. glauerti*. Towards the end of the tour, all participants met in the great desert hall where, among other reptiles, a group of tame *V. albigularis* was on display.

The advisory board of the "AG Warane und Krustenechsen" thanks all guest speakers, participants, the State Museum of Natural History in Karlsruhe, and the Reptilium in Landau for their support and hospitality. We hope to see you again next year at the Leipzig Zoo.

*-Submitted by Thomas Hörenberg & André Koch*

*Varanus salvator* observed swimming in the ocean off the coast of Tinjil Island, Indonesia in March 2013. This individual also happens to be the same animal whose nocturnal behavior is described in Uyeda *et al*. (this issue, p. 25). Photograph by **Linda Uyeda**.

# OBITUARIES

## Putra Sastrawan (1942 – 2013)

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Putu Putra Sastrawan was born in Bali, Indonesia on 25 May 1942, and spent more than 40 years of his life dedicated to the research and conservation of the Komodo dragon (*Varanus komodoensis*). Sastrawan's first involvement with Komodo dragon research began in 1969 when he assisted Walter Auffenberg in a monumental study on the behavior and ecology of the species on Komodo Island. For the past 40 years, Sastrawan continued his own research into the behavior and biology of *V. komodoensis*, and was the director of the Komodo International Research Center based at Udayana University, Indonesia, which involved many young Indonesian scientists in the discovery of various biological, ecological, and behavioral aspects of the species. In 1998 he worked with Joel Montgomery of the University of Texas to collect saliva and blood samples from free-ranging wild dragons and captive specimens to study the bacterial flora of the species and for DNA mapping (Montgomery *et al.*, 2002). In early 2000, he collaborated with Claudio Ciofi of Yale University (currently at the University of Florence, Italy) on studying the home range structure of wild *V. komodoensis* populations (Ciofi *et al*. 2007). Later on in 2002, Sastrawan worked with the Zoological Society of San Diego to develop an integrated approach to the research and conservation of *V. komodoensis* in Komodo National Park led by Tim Jessop (currently at Melbourne University, Australia).

Apart from his dedication to Komodo dragon research, Sastrawan was also a major contributor to the developing educational system and student movement in Bali, particularly when he served as the head of the Department of Biology, Dean of Mathematics and Sciences Faculty (1994-1998), and Vice Chancelor for Student Affairs (1998-2002) at Udayana University. Many of his former students are now researchers, lecturers, high school teachers, conservation workers, staff members of environmental affairs agencies, and wildlife photographers.

Although Sastrawan resigned from his position as lecturer in the Biology Department of Udayana University in 2007, his lifetime dedication to the Komodo dragon never ceased. Together with Claudio Ciofi and Tim Jessop, he pledged his full support in

Sastrawan preparing to handle and measure a captured Komodo dragon *Varanus komodoensis*.

Sastrawan taking blood samples from a *V. komodoensis*.

Sastrawan locating a nest site where a female *V. komodoensis* had laid its eggs.

establishing the Komodo Survival Program, a locally-based non-governmental organization dedicated to the research and conservation of *V. komodoensis*. In 2011, Sastrawan was awarded the "Young Hindu Award" by Mahendradata University for the category of "Intelectual of Bali" as a recognized expert on the Komodo dragon. Putra Sastrawan passed away on 10 February 2013 at the age of 71 due to illness, leaving behind his legacy as a founding contributor to Komodo dragon research and conservation.

**Publications**

Ciofi, C., J. Puswati, D. Winana, M.D. de Boer, G. Chelazzi & P. Sastrawan. 2007. Preliminary analysis of home range structure in the Komodo monitor, *Varanus komodoensis*. Copeia 2007(2): 462-470

Montgomery, J.M., D. Gillespie, P. Sastrawan, T.M. Fredeking & G.L. Stewart. 2002. Aerobic salivary bacteria in wild and captive Komodo dragons. Journal of Wildlife Disease 38(3): 545-551.

Sastrawan, P. & C. Ciofi. 2002. Population distribution and home range. Pp. 42-77. In Murphy, J.B., C. Ciofi, C. de La Panouse & T. Walsh (eds.), Komodo Dragons: Biology and Conservation. Smithsonian Institution Press, Washington D.C.

# ARTICLES

Biawak, 7(1), pp. 11-17
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# Impacts of Community Forestry on the Bengal Monitor, *Varanus bengalensis* (Daudin, 1802): An Empirical Study from Nepal

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**Abstract - Although the Bengal monitor lizard (*Varanus bengalensis*) is considered to be a species of least conservation concern, its populations are thought to be decreasing. In Nepal, community forestry was initiated around 33 years ago but its actual impact on faunal biodiversity has been poorly studied. This study was conducted in Jana Jagaran Community Forest of Parasan VDC, Kanchanpur to investigate the impacts of community forestry on *V. bengalensis* by studying the habitat preferences of monitors in habitats created by community forestry management activities. Fencing has had a positive impact, whereas plantations did not have a significant impact on *V. bengalensis*. Most lizards were observed on the ground, but the presence of both ground cover and large trees were equally important for the species. To date, community forestry has had a positive impact on *V. bengalensis* in the Jana Jagaran Community Forest, but further studies on the impact of plantations are recommended.**

## Introduction

The Bengal monitor lizard (*Varanus bengalensis*) is a wide-ranging species, occurring from Iran to South Asia and throughout Southeast Asia (Papenfuss *et al*., 2010). It is a generalist species inhabiting forests, agricultural lands and grasslands (Shah & Tiwari, 2004), and is categorized as a species of Least Concern in the IUCN Red Data List of Threatened Species (Papenfuss *et al.*, 2010), but listed in Appendix I of CITES (CITES, 2012).

Previously in Nepal, the rate of deforestation had been high (Shrestha *et al.*, 2010), threatening its biodiversity. In response to this, a community forestry program was started in Nepal around 33 years ago, which has helped slow the rate of deforestation (Kanel *et al*., 2005). Community forestry is considered as one of the most successful natural resource management programs of Nepal (Shrestha *et al.*, 2010); however, the exact role of community forestry in conserving biodiversity is unclear, as only a few research projects have studied its impacts (e.g. Pokhrel & Shah, 2008). Understanding the role of community forestry in faunal conservation is important, as community forests account for more than 21% of the total forests in Nepal (Gautam, 2011).

This study investigates the impacts of community

forestry on a population of *V. bengalensis* in Nepal. Although listed as a species of least concern, its populations are believed to be decreasing (Papenfuss *et al.*, 2010). In Nepal, various forestry management activities are carried out inside community forests that may affect wildlife, such as the construction of fencing and the creation of Teak and Eucalyptus plantations. The effects of these activities on *V. bengalensis* were assessed by studying its habitat preferences in areas created through forestry management activities. The null hypothesis is that fences and plantations do not have any effects on the habitat preferences of *V. bengalensis*. The behavior of *V. bengalensis* was also studied, which may be helpful in understanding the impacts of forestry management activities.

**Methods**

This study was conducted in Jana Jagaran Community Forest (28°36'04"N; 80°30'00"E), which lies in wards 4 and 5 of the Parasan Village Development Committee (VDC) of Kanchanpur District, Nepal. The location of the Parasan VDC is shown in Fig. 1. The Parasan VDC is bordered by Tribhuwan Basti VDC on its northern side, Duduwa National Park (India) on its eastern side, and by India on its remaining borders. The community forest is the only remnant natural forest of the Parasan VDC, and was declared a community forest in 2000. The climate of this area is dominated by tropical monsoons from June to September with a mean rainfall of 2100 mm, and temperatures ranging from 44 °C in summer to 2.5° C in winter (DHM, 2012). The Donda River flows through the northern side of the community forest. Sal (*Shorea robusta*) is the dominant tree species, whereas monkeys, squirrels, monitor lizards and jackals are the prominent faunal species found in the area. There are two extended parts of the community forest in the south (a narrow strip of forest along the southern slope) and northwest (entirely planted with Sissoo [*Dalbergia sissoo*]), which were excluded from this study. The total area of the community forest is about 200 hectares, of which 120 hectares comprised the study area.

Most of the community forest has been protected by barbed wire fencing since 2002, but some parts have been left unprotected for cattle grazing. In this study, the protected area inside the fence is referred to as the bounded area and the unprotected area left for grazing is referred to as the unbounded area; each was treated as separate habitat for *V. bengalensis*. Inside the bounded area, some parts have been planted with Eucalyptus (*Eucalyptus* sp.) and Teak (*Tectona grandis*) trees since 2003. Both species are planted in different areas within the bounded area, so these plantations occur as monocultures. Two different habitats were identified inside the bounded area: one with naturally occurring vegetation, and the other with a mix of planted and natural vegetation. These two habitats are identified in this study as the unplanted and planted areas,


Fig. 1. Location of the study area.

respectively.

The numbers of *V. bengalensis* sighted in different habitats were taken as indices of the habitat preferences to these habitats. Observations were conducted in July and August 2011. Time constraint visual survey (Campbell & Christman, 1982 cited in Cruze & Kumar, 2011; Corn & Bury, 1990 cited in Muths, undated; Crosswhite *et al*., 1999), with some modifications, was adopted for observing *V. bengalensis*. For observations, the community forest was divided into three equal parts with the help of a GPS device (Garmin Etrex H GPS; Garmin International Inc., Olathe, Kansas, USA). Daily observations of *V. bengalensis* were carried out over three periods; morning, afternoon and evening, and were conducted in an alternating manner. For example, if the first section of the community forest was observed during the morning of the first day, then the second sector was observed during the morning of the second day, and so on. Similar alternations were used for observations made in afternoons and evenings. This was done to minimize the bias caused by differences in observation times. Observation periods were 0700-1000 h (morning), 1200-1500 h (afternoon) and 1600-1900 h (evening) for six days in July, and 0730-1030 h (morning), 1200-1500 h (afternoon) and 1530-1830 h (evening) for six days in August.

During the survey, the researcher walked along a transect and recorded data if any monitor was seen within 20 m of either side of the transect. Monitors seen more than 20 m from the researcher were not considered. Habitat type, location, and the lizard's response to disturbance caused by the researcher's movements were also noted during observations. All observations were made by a single observer (principal author) on dry days (days receiving less than 30 minutes of rainfall). Altogether, two days were spent in the field prior to data collection and another twelve days were spent collecting data, totaling 108 hours of searching. Juvenile *V. bengalensis* were not considered in the study and only specimens greater than 50 cm in total length were considered for data collection.

The proportions of habitats in the study area were calculated using a non-mapping technique (Marcum & Loftsgaarden, 1980). A total of 150 random points were plotted, of which only 114 points fell inside the study area due to the irregular shape of the community forest. With the help of these random points in each habitat, the expected frequencies of *V. bengalensis* observations were calculated. Next, habitat preferences were calculated by using the chi squared goodness of fit test (Neu *et al*., 1974) with an adjustment for continuity (Emden, 2008). If there were significant differences in the use and availability of habitats by the monitors, then they were further clarified using confidence intervals (Byers *et al*., 1984). Observations of *V. bengalensis* in different situations and their responses to disturbance are presented in Table 3 and Figure 2.

## Results

### *Habitat Preferences*

Altogether, 64 observations of *V. bengalensis* were recorded during the study. The number of random points and the observed and expected frequencies of sightings in the bounded and unbounded areas are given in Table 1. The $\chi 2$ value calculated from Table 1 ($\chi 2$= 4.19, p= 0.041) indicates that *V. bengalensis* did not use bounded and unbounded areas according to their availability. The 5% confidence interval of the proportion of observations in the bounded area is 0.8562-0.9876, which is more than its expected proportion (0.8145). Therefore, *V. bengalensis* appears to be more abundant in the bounded area than the unbounded area.

The number of random points and observed and expected frequencies in the planted and unplanted areas are given in Table 2. The $\chi 2$ value calculated from Table 2 ($\chi 2$= 0.38, p= 0.538) implies that *V. bengalensis* was equally abundant in both planted areas and unplanted areas inside the bounded area of the community forest.

Table 1. Observed and expected frequencies of *V. bengalensis* observations in bounded and unbounded areas of the community forest.

| Habitat type | Random points | Observed frequency of observations | Expected frequency of observations |
|---|---|---|---|
| Bounded area | 86 | 59 | 52.13 |
| Unbounded area | 28 | 5 | 11.87 |

Table 2. Observed and expected frequencies of *V. bengalensis* observations in planted and unplanted areas inside the bounded area of the community forest.

| Habitat type | Random points | Observed frequency of observations | Expected frequency of observations |
|---|---|---|---|
| Planted area | 14 | 6 | 8.14 |
| Unplanted area | 72 | 53 | 50.86 |

Table 3. Observations of *V. bengalensis* in different situations within the community forest.

| Substrate type | Number of observations | % of total observation |
|---|---|---|
| Tree | 14 | 21.88 |
| Ground | 50 | 78.12 |

*Behavior*

More *V. bengalensis* were observed on the ground than in trees. Observations of monitors in different situations are summarized in Table 3. Fifty nine lizards (92% of total sighting) responded to disturbance. Among these, 39% used living trees, 8% used dead trees and 53% used bushes in response to disturbance (Fig. 2).

**Discussion**

Habitat preference is an important factor for the conservation of any species. In this study, *V. bengalensis* preferred the bounded area over the unbounded area, suggesting a positive impact on the abundance of monitor lizards from fence construction. More than 90% of *V. bengalensis* observed in this study responded to disturbance, indicating their wariness of people. Since there are more disturbances from humans and cattle outside the fence than inside, this may partly explain their preferences for areas within the bounded area. Due to grazing, trampling, and human activities, unbounded areas have substantially less ground cover than bounded areas (compare Figs. 4 & 6). Reptiles generally favor areas with ground cover and woody debris (Crosswhite *et al.,* 2004). Since more than 50% of *V. bengalensis* used

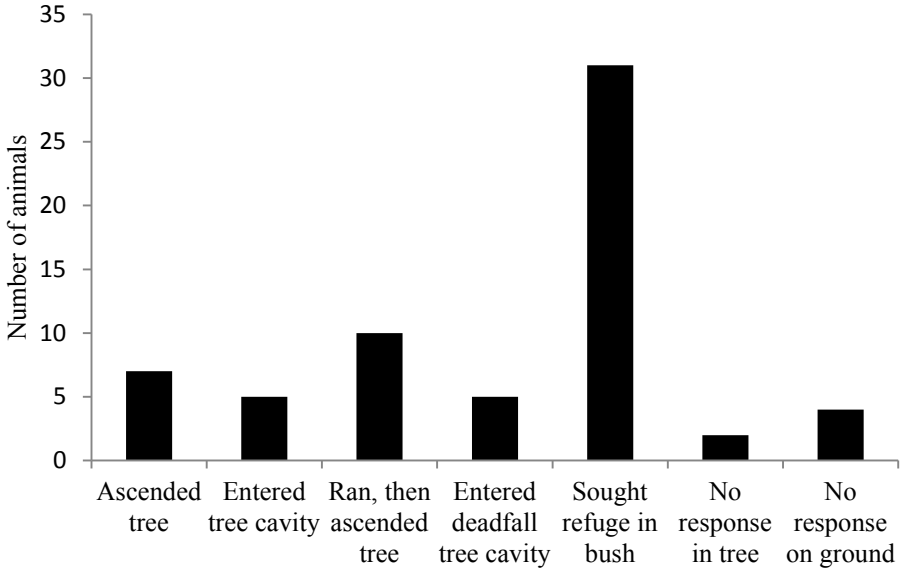


Fig. 2. Responses of *V. bengalensis* to disturbance.

Fig. 3. *V. bengalensis* in a Sal tree.

bushes for retreat (Fig. 2), the presence of ground cover could also explain why bounded areas were preferred by monitors.

Monoculture is a common practice in community forests of Nepal (Shrestha *et al*., 2010), and plantations have been established as a way of increasing the supply of wood used for fuel. Some reptiles can be affected by silvicultural operations (Crosswhite *et al*., 2004). In the present study, plantations do not appear to have had an impact on the habitat preferences of *V. bengalensis*, but single species plantations can have other effects on the species. For example, Eucalyptus is an alien species in Nepal, and both Eucalyptus and Teak have smooth trunks. As no *V. bengalensis* were seen using either of these tree species, it is possible that the monitors avoid these trees due to their difficulty to climb. Monoculture can also affect the availability of tree cavities, which serve as important refuge sites for *V. bengalensis* (Pattanavibool & Edge, 1996; Fig. 2), as both Eucalyptus and Teak trees usually lack hollows or cavities. Eucalyptus trees can also decrease the abundance of insects (Majer & Recher, 1999), the major food source of *V. bengalensis* (Auffenberg, 1994). Ground cover, which is also important for *V. bengalensis*, was less common in planted areas than in unplanted areas (compare Figs. 5 & 6).

Since *V. bengalensis* have large home ranges of 40 to 300 hectares in size (Auffenberg *et al*., 1991), plantations in the community forest, which are less than 25 m wide, may have a negligible effect on the habitat preference of the species. However, if the size of plantations were greater, *V. bengalensis* may not have exhibited the same preferences seen in this study.

Beetles are the major dietary component of *V.*

Fig. 4. Unbounded area of the community forest.

Fig. 5. Area planted with Teak trees inside the bounded area of the community forest.

Fig. 6. Unplanted (natural) area inside the bounded area of the community forest.

*bengalensis*, and their abundance and availability to monitors is often particularly high in the presence of cattle dung, in which the beetles live and feed (Auffenberg, 1994). Therefore, the presence of grazing cattle in the unbounded area might be expected to increase the abundance of *V. bengalensis* in this area of the community forest. However, there were fewer observations of monitors in this area than the bounded area, suggesting there are fewer individuals utilizing this habitat. Most human inhabitants of the area are farmers, and local people, especially herders, collect the dung for its use as organic fertilizer. Hence, cattle dung does not remain in the wild long enough to allow for beetles to utilize it, which will limit the ability of *V. bengalensis* to utilize them as a source of food.

As seen in Table 3 and Fig. 2, both trees and ground cover are important for *V. bengalensis*. Most *V. bengalensis* forage on the ground, which may be the reason why more individuals were seen on the ground than in trees. However, when fleeing from danger, ground cover and trees are equally as important to the species. Fewer than 10% of *V. bengalensis* used deadfall trees, but this may be due to the limited number of fallen trees when compared to living ones.

While there have been some negative impacts on biodiversity from current community forest management programs (Shrestha *et al.,* 2010), there have been some positive impacts as well (Pokhrel & Shah, 2008). From the results of this study, it seems that the construction of fences helped to conserve *V. bengalensis* in the protected area of the community forest. If the fence had not been constructed, all of the forest might have been disturbed by human activities and cattle grazing to the same extent as the unbounded area. The unbounded area can serve as a reference for the impacts of community forestry because the condition of the forest before its declaration as a community forest was virtually the same as the unbounded area today. Protective efforts began following its declaration as a community forest and handover to a managing group. The construction of fences has offered the forest more protection than before by excluding humans and cattle, thereby initiating the forest's regeneration. Therefore, community forestry appears to be beneficial to the conservation of *V. bengalensis* through the creation of fences and/or plantations, but further studies on the impacts of planting alien species on *V. bengalensis* and other wildlife are needed.

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# Field Observations on *Varanus macraei*

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**Abstract – Field observations on the occurrence and natural history of *Varanus macraei* near Mandui village, Batanta are reported. Over-collection for the live reptile trade is reported to have nearly extirpated a population of *V. macraei* on a small island off the coast of Mandui.**

## Introduction

Although frequently collected for the live reptile trade, very little is known about the natural history of the blue tree monitor *Varanus macraei*. Described from the island of Batanta in Papua, Indonesia (Böhme & Jacobs, 2001), details on its occurrence in the wild are lacking. Here, I describe field observations on *V. macraei* made during a brief trip to Batanta in June 2007.

## Study Site

Mandui, a small village located on the north shore of Batanta (Fig. 1) was reached by boat from Sorong on 13 June 2007 and used as a base camp for the next four days. With the exception of illegal logging vehicles, motor vehicles were absent from Mandui. A local villager who was once a collector for the live reptile trade was hired as a guide. Three days were spent searching for *V. macraei* in forests outside of Mandui, and one day was spent searching on a small island (ca. 2 km in length) located just off the coast of Mandui (Fig. 2), on which, according to local animal collectors, *V. macraei* was also reported to occur.

Fig. 1. View of Batanta from Mandui Bay.

Traveling around Mandui proved to be very difficult. Like many other islands within the Raja Ampat archipelago, Batanta is steeply sloped in many areas (Fig. 3), which, in combination with a wet ground, is easy to lose one's footing and slide several meters down the slope. Global positioning system (GPS) navigation was ineffective due to the dense forest canopy (Fig. 4). The lowest nighttime temperature recorded at Mandui over the four day period was 22º C. At sunrise (ca. 0600 h), ambient temperatures averaged 24º C, and by 1100

Fig. 2. A small island off the coast of Mandui which allegedly supported a population of *Varanus macraei*.

Fig. 3. View of forested hills on Batanta.

Fig. 4. Dense tropical forest near Mandui.

Fig. 5. Forested area where *V. macraei* was observed by the author.

h, temperatures reached 35º C. The highest daytime temperature recorded in the shade at an elevation of 124 m was 37º C.

In addition to field searches, approximately 30-40 villagers from Mandui and some small islands visited along the way between Sorong and Batanta were interviewed about the occurrence and natural history of *V. macraei*.

**Observations and Results**

In three days of searching in areas around Mandui, only a single *V. macraei* was observed. It was seen at around 1100 h climbing through the forest canopy in a steeply-sloped section of dense forest (Fig. 5) at an elevation of 124 m above sea level, ca. 4 km east of Mandui. Upon its detection, the monitor fled from tree to tree through the canopy until it finally disappeared from sight**.** My accompanying guide noted that when alarmed or panicked, *V. macraei* occasionally jump or fall to the forest floor, where they are easier to capture.

*Varanus macraei* could not be located on the small island situated off the coast of Mandui. My guide reported that the species had been heavily collected from this island for the pet trade, and that its population there has nearly been extirpated.

A female *V. macraei* with a snout to vent length of 28 cm and a total length of 85 cm was captured by locals one morning (Fig. 6). It was collected in a densely forested area outside of Mandui in late morning using a noose atop a long bamboo cane. Palpation of the animal's abdomen revealed the presence of eggs and confirmed the collectors' suspicions that it was a gravid female.

Known locally as "Soa soa", the same name used for other arboreal monitor lizards in the region, *V. macraei* was reported by villagers in Mandui to become active around 0900 to 1000 h, and retire by 1300 h when temperatures reach their daytime highs. This was corroborated by my guide, who claimed that

Fig. 6. Gravid female *V. macraei* collected by local villagers near Mandui, Batanta.

*V. macraei* was difficult to find in the afternoon. He also noted that *V. macraei* is rarely found at elevations below 50 m along the coast, and that it feeds primarily upon grasshoppers (Orthoptera), which were frequently observed and abundant in forestes around Mandui. *Varanus macraei* is not eaten by villagers in Mandui.

Two *V. jobiensis* were also observed during searches in forested areas; one was seen at sea level and the other at an elevation of 50 m (Fig. 7).

Fig. 7. Forested site where *V. jobiensis* was observed.

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# Feral Monitor Lizards (*Varanus spp.*) in Catalonia, Spain: An Increasing Phenomenon

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**Abstract - Between 2001 and 2011, a total of 14 feral monitor lizards representing four species were captured in the Catalonia region of Spain, suggesting that these animals either escaped or were intentionally released by pet owners. In addition to documenting these cases, this article also discusses the potential implications of feral monitor lizards on the conservation of threatened and endangered wildlife in Catalonia.**

The Catalonia region of north-eastern Spain encompasses a total land area of 32,114 km$^2$ and is dominated by forests as well as open areas and coastal habitats. The region experiences a Mediterranean climate; in 2011, the lowest annual temperatures recorded in its coastal zone, from Le Perthus at the French border to Ebro Delta Natural Park in the south, ranged from 5-10° C (Servei Meteorologic de Catalunya, 2011).

Most of Catalonia's cities and towns occur near the coastline, and Barcelona, the region's capital, is home to approximately three million residents. Large-scale animal importers, pet shops, and the exotic pet trade are concentrated in this densely populated zone. Reptiles comprise an important part of the exotic pet trade, and among them, monitor lizards (*Varanus spp*.) are one of the biggest groups imported (Pernetta, 2009).

The number of feral, free-ranging monitor lizards observed in Catalonia has conspicuously increased over the past several years, most likely due to the deliberate release or escape of captive specimens. Between 2001 and 2011, the Catalonian Reptile and Amphibian Rehabilitation Center (CRARC) received and accommodated 14 monitor lizards that were captured within the region (Table 1). However, this number probably represents a small fraction of the total number of feral monitors in Catalonia, and raises the questions of how many monitors are living in the region, and can any survive the winter or reproduce in Spain?

With 4,500 living specimens exported from Ghana, Benin and Togo to Spain between 2001 and 2011 (CITES Trade Database, 2012), *V. exanthematicus* is one of the most popular lizard species encountered in

Fig. 1. *Varanus exanthematicus* observed in the Cadi-Moixero Natural Park (El Grasolet). Photograph by **Ariadna Cabeza**.

Fig. 2. Two *V. salvator* at CRARC that were captured at the localities of Reus and Sabadell, respectively. Photograph by **Joaquim Soler**.

Table 1. Free-ranging monitor lizards observed or captured in Catalonia.

| Species | Age class | Date | Locality |
|---|---|---|---|
| *exanthematicus* | adult | 24-Oct-2011 | Natural Park Cadí-Moixero |
| | | | (El Grasolet) * (Fig. 1) |
| | | | 31T CG97 |
| | juvenile | 18-Aug-2011 | Natural Park Garraf |
| | | | 31T DF06 |
| | adult | 25-Sep-2010 | Natural Park Sant Llorenç del Munt i l'Obac (Matadepera) |
| | | | 31T DG10 |
| | adult | 3-Sep-2009 | Granollers |
| | | | 31T DG40 |
| | adult | 3-Oct-2007 | Roda de Barà |
| | | | 31T CF76 |
| | adult | 17-Sep-2007 | Vilafranca (near Garraf Park) |
| | | | 31T CF97 |
| | adult | 15-May-2006 | Castelldefels (near Garraf Park) |
| | | | 31T DF16 |
| | adult | 20-Oct-2004 | Viladecans (near Garraf Park) |
| | | | 31T DF17 |
| | adult | 12-Jul-2004 | Mataró |
| | | | 31T DF59 |
| | adult | 19-Jan-2002 | Cambrils |
| | | | 31T CF34 |
| | adult | 11-Jul-2002 | Vigues i Riells |
| | | | 31T DG31 |
| *niloticus* | adult | 7-Aug-2001 | Barcelona |
| | | | 31T DF38 |
| *salvator* | subadult | 6-Jul-2008 | Reus (Fig. 2) |
| | | | 31T CF45 |
| | juvenile | 15-Jun-2011 | Sabadell (Fig. 2) |
| | | | 31T DG20 |
| *juxtindicus* | adult | 1-Aug-2011 | Llagostera (Fig. 4) |
| | | | 31T DG93 |

* This specimen could not be caught, and was identified from a photograph (see Fig. 1).

the pet trade. From the data collected at CRARC, we see that *V. exanthematicus* has been the most frequently encountered feral monitor lizard in Catalonia, with most observed animals being adults. It is a robust species that can probably survive for some time in natural areas of the coastal zone, where it can be detrimental to native wildlife and create conservation problems for protected and endangered species.

Introduced monitors can pose serious threats to the indigenous wildlife of a region (Enge *et al*., 2004; Krysko *et al*., 2011). For example, in southern Florida, USA, a region with a climate similar to that of

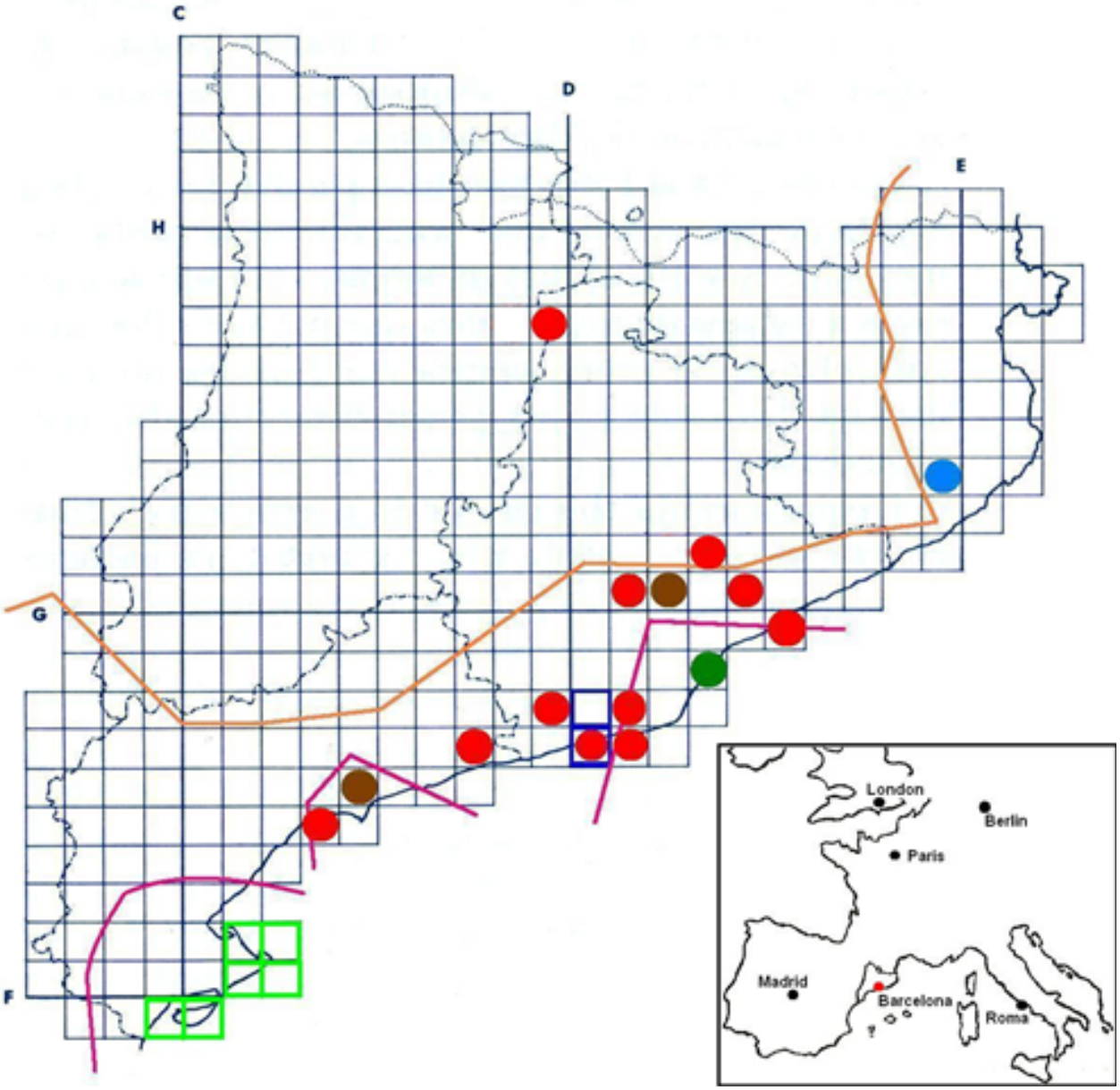


Fig. 3. Localities of free-ranging *Varanus exanthematicus* (red dots), *V. salvator* (brown dots), *V. niloticus* (green dot), and *V. juxtindicus* (blue dot) in Catalonia, Spain. Areas beneath the orange line experience an average annual temperature range of 14-16° C, and areas beneath the purple lines experience average temperatures of 16-18° C. Green squares represent Ebro Delta Natural Park; Blue squares represent Garraf Natural Park.

Catalonia, at least one species of monitor (*V. niloticus*) has become established through the escape or deliberate release of captive specimens, where it poses a threat to several native species (Enge *et al*., 2004). While large monitor species may be unable to survive harsh winters in Catalonia, they can probably find enough food and suitable climatic conditions to survive from spring to autumn. Even if they are only capable of surviving for short periods of time, their temporary presence in natural habitats may affect endangered wildlife in Catalonia. With rising global temperatures, there is also some risk that monitors could eventually adapt to a warmer Mediterranean climate and become established within the region.

The discovery of several *V. exanthematicus* in the vicinity of Garraf Natural Park in 2011 raises concerns that feral monitors could prey on an existing population of the Mediterranean tortoise *Testudo hermanni hermanni*,

Fig. 4. *Varanus juxtindicus* captured at Llagostera, now in the quarantine room at CRARC. Photograph by **Joaquim Soler**.

a species which is threatened with extinction on the Iberian Peninsula and has been reintroduced to the park since 1992 (Soler *et al*., 2001). *Varanus exanthematicus* is known to prey on tortoise hatchlings (Owens *et al*., 2005), and may threaten this population if additional monitors are present or arrive in the future. Due to its close proximity to residential areas with reptile keepers, Ebro Delta Natural Park is another setting in Catalonia where free-ranging monitors could threaten the survival of rare indigenous species. Potentially vulnerable wildlife in this park include one of the last remaining European colonies of Audouin's Gull (*Larus audouinii*) (Martínez-Vilalta, 1994) as well as an additional reintroduced, and well-established population of *T. h*. *hermanni* (Bertolero, 1991). While these scenarios remain speculative for now, the fact that several large monitor species have been able to survive in Catalonia under the Mediterranean climate and natural conditions of its coastal zone where they may prey on threatened indigenous species, demonstrates a risk which will need to be evaluated.

**Acknowledgments -** We thank Ariadna Cabeza for providing us with a photograph of the *V.exanthematicus* in Cadi-Moixeró Nature Park, and André Koch for his help with the identification of the *V. juxtindicus* found at Llagostera and for his help with the preparation and publication of this note. We also thank Beate Pfau for her bibliographic contributions, advice and assistance.

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# Nocturnal Activity of *Varanus salvator* on Tinjil Island, Indonesia

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**Abstract - Nocturnal activity has rarely been reported in *Varanus salvator*. This report documents observations of nocturnal activity in *Varanus salvator* on Tinjil Island, Indonesia, where such behavior may provide a competitive advantage over conspecifics in foraging for human food leftovers. Pre-dawn scavenging of a *V. salvator* carcass by a conspecific is also noted.**

## Introduction

The water monitor lizard, *Varanus salvator,* is generally considered to be diurnal (Gaulke & Horn, 2004), though nocturnal activity has been observed on occasion. For example, Biswas & Kar (1981) noted nocturnal nesting behavior in *V. salvator*, and Gaulke (pers comm.; 1989) documented nocturnal feeding behavior by two *V. salvator marmoratus* (now *V. palawanensis*) on the carcass of a wild pig. Here, 16 observations of nocturnal activity by a single *V. salvator* on Tinjil Island, Indonesia are reported. An observation of a second *V. salvator* attempting to scavenge on the carcass of a conspecific in the early morning (prior to daylight) is also noted.

## Methods

*Varanus salvator* were observed from 5 July 2012 to 11 August 2012 on Tinjil Island, Indonesia as part of an ongoing study of the island's population and their behavior, range, and resource use. Tinjil Island, located approximately 16 km off the south coast of Java, Indonesia, is about 600 ha in size and consists primarily of lowland tropical rainforest and coastal/beach vegetation. Since 1987 the island has been designated as a natural habitat breeding facility for long-tailed macaques (*Macaca fascicularis*) (Kyes *et al*., 1997). Although there are officially no permanent residents on Tinjil Island, a continuous human presence of staff and researchers (about 5-8 people at any given time) reside in a small base camp area. Food preparation is carried out primarily in a main base camp building, and food scraps (*e.g*., egg shells, fish skeletons) are regularly discarded in a clearing anywhere from 1 to 5 m from the east side of the main base camp building. Food scraps and other garbage are also routinely disposed of in a large, ca. 1.5 x 2 x 1 m cement garbage box, located approximately 3 m south of the main base camp building. The garbage box has large openings in the side and top, through which *V. salvator* commonly enter to forage (Uyeda, pers. obs.). *Varanus salvator* living in the base camp area are

habituated to people and seem unconcerned about the presence of humans when walking and foraging around base camp (Uyeda, pers. obs.)

In addition to the base camp, there are also three small fishermen camps spaced along the north side of the island. The fishermen utilizing these camps are not permanent residents, but stay on Tinjil Island regularly when fishing in nearby waters. The fishermen camps are small (3-5 fishermen per camp), equipped with basic huts and no modern facilities. Cooking and fish cleaning also occur at the fishermen camps.

Throughout the study period, behavioral observations were carried out using a combination of ad libitum sampling (behaviors of one or more animals were recorded) and focal individual follows (behaviors of a single focal animal were recorded). Focal individuals were followed for two-hour time blocks between 0600 and 1800 h. During these daytime ad libitum and focal sampling periods, recorded behaviors included sleeping, walking, foraging, etc.

Although initial observations were carried out between 0600 and 1800 h, sampling periods were extended to begin at 0500 h on 9 July 2012 after pre-dawn activity was observed on 8 July 2012. Sampling periods were further extended on 30 July 2012 to include the hours between 0300 h and 0500 h following observations of nocturnal activity on 28 and 30 July 2012. These early morning observations were carried out daily from 30 July 2012 to 11 August 2012, with the exceptions of 5 August 2012, 7 August 2012, and 10 August 2012 (Table 1).

The study population consisted of seven *V. salvator* that had been fitted with LPR-3800 radio-telemetric harnesses (Wildlife Materials, Murphysboro, IL, USA) and marked with crayon as part of a broader study on Tinjil Island's population. Although these study animals were outfitted with telemetry equipment, it was extremely difficult to track animals through the forest in the dark without creating a noisy disturbance and without the excessive use of artificial light. For this reason, nocturnal observations were carried out in the immediate base camp area (a cleared perimeter surrounding the main camp building approximately 10 m in width), where they could be accomplished quietly and with minimal effect on the monitors' behavior. No *V. salvator* were observed sleeping in the cleared perimeter surrounding the base camp building during the early morning sampling periods and only active behaviors such as walking and foraging were recorded during these times. As *V. salvator* activity (*e.g.*, walking, foraging) could be easily heard from inside the main base camp building (Uyeda, pers. obs.), it was also possible for researchers to become aware of nocturnal behavior without actively observing the area. Additional instances of nocturnal behavior were opportunistically recorded as they were discovered.

On 5 July 2012 an adult *V. salvator* was captured, fitted with an LPR-3800 radio-telemetric harness (Wildlife Materials, Murphysboro, IL, USA), and marked with crayon. The animal was assigned the identifier "04" and was released at the point of capture. Monitor 04 was a suspected male based on size (17 kg, 217 cm in total length–minus tail tip) and numerous observed agonistic interactions with other individuals.

**Repeated nocturnal activity and foraging behavior in a solitary individual**

On 8 July 2012, monitor 04 was observed walking in the dark at 0525 h in the immediate base camp area. At 0530 h on 12 July 2012, monitor 04 was again observed walking in the dark in the base camp area. No other *V. salvator* were observed engaging in nocturnal behavior until 28 July 2012, when monitor 04 was again seen active in the base camp area.

21 July 2012 marked the first day of the month-long religious fasting associated with the observance of Ramadan. All researchers and staff present on Tinjil Island at that time began observing the fast, and meal times were adjusted to include the traditional pre-dawn meal (that occurs during the fasting period) at approximately 0300 h each morning. Cooking for the pre-dawn meal generally began around 0200 h, and perimeter lights for the main base camp building were turned on for approximately an hour between 0230 h and 0330 h. An additional early morning dumping of food scraps (around 0330 h) also occurred on most days during this fasting period.

At 0341 h on 28 July 2012 monitor 04 was seen walking around the main base camp building. Although it was dark outside, perimeter lights to the building had been turned on, illuminating the immediate base camp area. Monitor 04 was seen again at 0343 h on 30 July 2012 walking around the main base camp area. Following the 30 July 2012 sighting of monitor 04, sampling periods were extended to include additional hours corresponding to the pre-dawn meal associated with the Ramadan fast. In total, monitor 04 was observed engaging in nocturnal activity in the base camp area on 14 occasions from 28 July 2012 – 11 August 2012 (Table 1). Among these 14 nocturnal observations, activity was recorded as early as 0128 h (1 August 2012) with the

Table 1. Nocturnal observations of *V. salvator*, monitor 04, at Tinjil Island base camp

| Date (2012) | Time observed | Lights | < 1 h after food discarded | Observed consuming food? |
|---|---|---|---|---|
| 8-Jul | 0525 h | Off | ? | Yes |
| 12-Jul | 0530 h | Off | ? | No |
| 28-Jul | 0341 h | On | ? | No |
| 29-Jul | No data | -- | -- | -- |
| 30-Jul | 0343 h | On | ? | No |
| 31-Jul | 0259 h | On | ? | No |
| 31-Jul | 0317 h | On | Yes | No |
| 1-Aug | 0128 h | Off | No | No |
| 1-Aug | 0413 h | Off | Yes | Yes |
| 2-Aug | 0505 h | Off | ? | Yes |
| 3-Aug | 0252 h | On | ? | No |
| 4-Aug | 0330 h | On | ? | Yes |
| 5-Aug | No data | -- | -- | -- |
| 6-Aug | 0527 h | Off | No | Yes |
| 7-Aug | * | * | -- | -- |
| 7-Aug | 0514 h | Off | No | No |
| 8-Aug | 0455 h | Off | No | Yes |
| 9-Aug | 0450 h | Off | No | Yes |
| 10-Aug | * | * | -- | -- |
| 11-Aug | 0334 h | On | No | Yes |

* Staff members reported seeing monitor 04 at approximately 0300 h (lights on), but animal was not formally observed

majority of activity observed between the hours of 0300 and 0530 h (Table 1). On seven occasions, monitor 04 was seen active while the perimeter lights were on, but on seven occasions monitor 04 was active in the absence of artificial light (Table 1). Of the seven dates monitor 04 was observed without supplemental perimeter lights, three (1 August 2012 and 2 August 2012) occurred when the moon was near full/full, and the other four (6 August 2012 – 9 August 2012) occurred as the moon approached its third quarter.

Each of the 14 occurrences of nocturnal activity involved monitor 04 alone as it was engaged in foraging/eating and/or walking to one or both base camp garbage dumping areas (approximately 15 m apart). On three occasions monitor 04 was observed actively foraging/eating for longer than 1 hr; foraging was carried out across both base camp garbage scrap dumping areas, and monitor 04 was observed consuming food scraps (fish and crab remains, bits of chicken, etc.) Although monitor 04 often slept along the forest edge, very close to base camp (as confirmed visually and by radio-telemetry), the nocturnal activity did not seem to closely correspond to any obvious cues such as the commencement of cooking, turning on of the perimeter lights, or the dumping of food scraps. On only two occasions did monitor 04 arrive at the base camp clearing within one hour of food scraps having been discarded (Table 1). Monitor 04 was also observed on occasion walking to each of the garbage areas in the dark and leaving the area presumably after finding that no new food had been dumped. On 31 July 2012 and 1 August 2012 monitor 04 was observed returning to camp a second time after food scraps were dumped (Table 1). However, an observer might wait more than two hours after food scraps were dumped before witnessing the emergence of monitor 04 from the forest edge. When active in the base camp clearing, monitor 04 was observed rummaging through newly discarded food scraps whenever available.

Fig. 1. Monitor 04 foraging in the dark on Tinjil Island, Indonesia at 0420 h, 1 August 2012. Photograph by **Linda Uyeda**.

Fig 2. Monitor 04 foraging in the dark at Tinjil Island base camp at 0425 h, 1 August 2012. Photograph by **Linda Uyeda**.

Fig. 3. Monitor 04 foraging in a bucket outside the Tinjil Island base camp kitchen in the dark, 0515 h, 2 August 2012. Photograph by **Linda Uyeda**.

Discarded food did not always include meat, consisting of rice, vegetables, fruit rinds, etc., and was not always consumed.

Based on information obtained via radio-telemetry, monitor 04 was likely not active in the forest prior to the observed nocturnal activity around base camp; at the beginning of each observation period monitor 04 was often tracked to just inside the forest edge, with the position confirmed multiple times and the animal inactive up until emergence from the forest to forage at base camp.

**Early morning nocturnal activity: Attempting to eat a carcass**

On 30 July 2012 an unknown adult *V. salvator* was encountered at 0520 h while engaged in foraging in the dark at the forest edge ca. 3 m from the base camp clearing. The individual's behavior was characterized by lateral head movements and frequent tongue flicks focused on a particular area on the ground. After approximately 3 min of this behavior, the monitor scraped at the leaf litter with its forefeet, unearthing an old, desiccated *V. salvator* carcass. The monitor then dragged the carcass approximately 2 m and propped it against a fallen branch. The monitor used its forefeet to hold the carcass down while maneuvering around to tear at the carcass with its mouth. The carcass appeared quite tough and devoid of flesh.

The monitor attempted to rip at the carcass with its mouth from numerous angles but seemed to be unsuccessful. After about 5 min of this behavior, the monitor left the carcass and walked directly towards the observer while tongue flicking, approaching within 0.5 m. The monitor then retreated farther into the forest, at which time the observation was concluded. This observation was carried out in the dark; however, a headlamp and flash photography were utilized sparingly by a single observer, ca. 3 m away from the monitor. The monitor did not appear to have been disturbed noticeably by the presence of the observer or the accompanying light sources.

**Discussion**

Throughout the course of the study period, only two individuals were seen engaging in nocturnal behavior. Other than the unknown monitor attempting to feed on a *V. salvator* carcass in the early morning, all occurrences of nocturnal behavior were observed in a single individual, monitor 04. On numerous nighttime occasions, monitor

Fig. 4. *Varanus salvator* addressing the carcass of a conspecific near Tinjil Island base camp, pre-dawn (ca. 0523 h), 30 July 2012. Photograph by **Linda Uyeda**.

Fig. 5. *Varanus salvator* attempting to feed on the carcass of a conspecific near Tinjil Island base camp, pre-dawn (ca. 0525 h), 30 July 2012. Photograph by **Linda Uyeda.**

Fig. 6. *Varanus salvator* pulling on the arm of a *V. salvator* carcass near Tinjil Island base camp, pre-dawn (ca. 0525 h), 30 July 2012. Photograph by **Linda Uyeda**.

04 was seen foraging on recently discarded food scraps alone and free from any competition. During daylight hours, monitor 04 was frequently observed "patrolling" the base camp area, walking back and forth between garbage dumping areas and chasing smaller and even similarly sized monitor lizards away. In all agonistic interactions observed in the base camp area between monitor 04 and other individuals, monitor 04 was the clear "winner", with the exception of those encounters between monitor 04 and the largest individual recorded in the area, monitor 07 (22 kg, 221.5 cm in total length–minus tail tip). As monitor 07 was an infrequent presence in the base camp area, monitor 04 was generally able to access all dumped garbage at will despite the presence of other monitors, though with some effort. Thus, it can be concluded that monitor 04 did not engage in nocturnal foraging out of necessity, but perhaps as a strategy to increase food consumption without having to expend additional energy on the defense of food resources. Previous research has documented associations between nocturnal activity in varanids and feeding: in addition to Gaulke's (1989) observation of nocturnal feeding activity in two *V. salvator marmoratus* (now *V. palawanensis*), Yong *et al*. (2008) documented nocturnal foraging in *V. dumerilii*, Trembath (2000) noted nocturnal foraging in *V. gouldii*, and Cota *et al*. (2008) documented nocturnal activity in *V. dumerilii* in an area where crabs, a favorite prey item, were abundant.

High nighttime temperatures have also been suggested as a partial explanation for unusual occurrences of nocturnal behavior in *V. panoptes* (Shannon, 2008) and *V. dumerilii* (Cota *et al*., 2008). *Varanus salvator*, however, is generally active at body temperatures of 30-32° C (Traeholt, 1995) and has demonstrated an apparent tolerance for ambient temperature fluctuations. For example, Traeholt (1995) noted that *V. salvator* in a Malaysian study population were easily able to raise their body temperatures above the ambient temperature even during the cooler rainy season. Nocturnal behavior in Tinjil Island's population occurred at ambient temperatures as low as 24.6° C, suggesting that nocturnal activity in *V. salvator* is not restricted to high nighttime temperatures.

Though monitor 04 was observed engaging in early morning nocturnal activity before the start of Ramadan, fourteen of the sixteen recorded occurrences fell within the month of religious fasting. Monitor 04's behavior may represent a shift in foraging activity in response to a change in human activity associated with the fast. A logical test of this hypothesis would be to compare the incidence of monitor 04's nocturnal activity between

periods including the month of Ramadan, to those typifying times when Tinjil Island's inhabitants are not participating in a nightly 0300 h meal. Interestingly, throughout the study period monitor 04 was not observed engaging in regular nocturnal activity between 1800 h and 0100 h despite the fact that food scraps were often dumped after an evening meal around 1800 h. As research on Tinjil Island's *V. salvator* population is ongoing, future observations of monitor 04 in subsequent field seasons will serve as opportunities to shed further light on this individual's nocturnal behavior. Additional observations in the Tinjil Island study area may also reveal new instances of individuals engaged in nocturnal activity. Further systematic study of nocturnal activity in varanids is needed to explore the prevalence and potential fitness benefits of such behavior.

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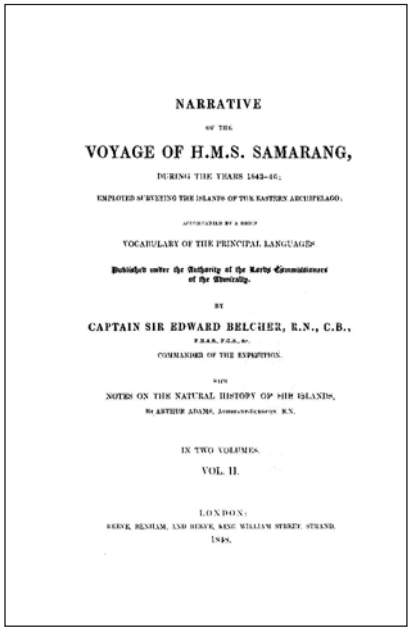
# 19th Century Accounts on the Natural History of Monitor Lizards from the Malay Peninsula, Philippines, and Indonesia

Following the end of the First Opium War between China and England in 1842, Sir Edward Belcher, Royal Navy commander of the H.M.S. Samarang, was assigned the task of surveying the coasts, ports, and rivers of off-lying islands and archipelagos of the Chinese empire situated between the 50° N and 10° S parallels. These surveys would provide new information on navigation routes, as well as details on the culture and natural history of the region, and culminated in a two volume work entitled, *Narrative of the Voyage of H.M.S. Samarang, During the Years 1843-1846.*



NARRATIVE

OF THE

VOYAGE OF H.M.S. SAMARANG,

DURING THE YEARS 1843-46;

EMPLOYED SURVEYING THE ISLANDS OF THE EASTERN ARCHIPELAGO;

ACCOMPANIED BY A BRIEF

VOCABULARY OF THE PRINCIPAL LANGUAGES

Published under the Authority of the Lords Commissioners of the Admiralty.

BY

CAPTAIN SIR EDWARD BELCHER, R.N., C.B.,

F.R.A.S., F.G.S., &c.

COMMANDER OF THE EXPEDITION.

WITH

NOTES ON THE NATURAL HISTORY OF SIR ISLANDS,

By ARTHUR ADAMS, Assistant-Surgeon R.N.

IN TWO VOLUMES.

VOL. II.

LONDON:

REEVE, BENHAM, AND REEVE, KING WILLIAM STREET, STRAND.

1848.

The H.M.S. Samarang's voyage spanned 1843 to 1846, visiting many islands within the region including, but not limited to Borneo, Singapore, Luzon, Mindanao, Mindoro, Celebes (now Sulawesi), and Ternate. Arthur Adams, the ship's on-board surgeon, recorded notes on the natural history of the region, including detailed accounts of its plants and animals which were later published in the second volume of the voyage's narrative.

Included among Adams' accounts on the fauna of the region were those pertaining to monitor lizards, particularly members of the *Varanus salvator* complex. The selected exerpt presented below provides some of the earliest published accounts on the natural history of water monitors in what is today the Philippines, Malaysia, and Indonesia, including information on the behavior and occurrence of *V. cumingi*.

This account also reflects some of the confusion surrounding the taxonomy of monitor lizards during the 19th century. For example, four genera are identified for monitor lizards: *Monitor*, *Hydrosaurus*, *Regenia*, and *Uranus*. *Varanus salvator* and its kin (e.g., *V. cumingi*, *V. marmoratus*) are also misidentified as the "lace lizard", the common name assigned to the Australian lace monitor, *V. varius*, and *Hydrosaurus giganteus* - a junior synonym of the Australian perentie, *V. giganteus*. Despite flaws in the taxonomic conventions used by Adams, the following account should be of interest to admirers of early natural history and exploration, as well as historical accounts on the biology of monitor lizards.

*-RWM*

Arthur, A. 1848. Pp. 273-277. In Belcher, E., Narrative of the Voyage of H.M.S. Samarang, During the Years 1843-1846. Volume II. Reeve, Benham and Reeve, London.

# Narrative of the Voyage of H.M.S. Samarang, During the years 1843-1846

On another occasion, a reptile, described as a gigantic Iguana, having been seen in the neighborhood of our dwelling at Sarawak, I was anxious to procure it, as I conceived it must be a large species of *Hydrosaurus*, or Lace-lizard. For this purpose, I watched two days by the side of a spring, which I fancied the reptile would select as his head-quarters during his stay in our neighborhood, this being a peculiarity of these creatures, and on the third day, sure enough, he came, trotting leisurely along, and stretched himself at full length on the brink:

"Nunc etiam in gelida sede lacerta latet".

Throwing myself on him, I wounded him with a clasping knife in the tail, but he managed to elude my grasp, and made for the woods. I succeeded, however, in tracking his retreating form, on hands and knees, through a low, covered labrynth, in the dense undergrowth, until I saw him extended on a log, when leaving the jungle, I called my servant, a Marine, who was shooting specimens for me, and, pointing out the couchant animal, desired him to shoot him in the neck, as I did not wish the head to be injured, which he accordingly did. Entering the jungle, I then closed with the wounded Saurian, and, seizing him by the throat, bore him in triumph to our quarters. Here he soon recovered, and hoping to preserve him alive, to study his habits, I placed him in a Malay wicker hen-coop. As we were sitting , however, at dinner, the black cook, with great alarm depicted in his features, reported that "Alligata get out his cage". Seizing the carving knife, I rushed down, and was just in time to cut off his retreat into the adjoining swamp. Turning sharply round, he made a snap at my leg, and received in return a "Rowland for his Oliver", in the shape of an inch or so of cold steel. After wrestling on the ground, and struggling through the deserted fire of our sable cook, I at length secured the runaway, tied him up to a post, and to prevent further mischief, ended his career by dividing the jugular. The length of this Lizard, from actural measurement, was five feet ten inches and a half.

These gigantic Lizards (*Hydrosaurus giganteus*) are rather shy and reserved in their habits, and not very agile in their movements. They affect a swampy habitat, frequenting the low river banks, or the margins of springs, and although I have seen them basking on rocks, or on the dead trunk of some prostrate tree, in the heat of the sun, yet they appear more partial to the damp weeds and undergrowth in the vicinity of water. Many, indeed, are pre-eminently aquatic, as I have noticed in the rivers of Celebes and Mindanao. Their gait has somewhat more of the awkward lateral motion of the Crocodile, than of the lively action of the smaller Saurians. When attacked, they lash violently with their tail, swaying it side-ways with great force, like the Cayman. These modern types of the *Mososaurus* and *Iguanodon* have a graceful habit of extending the neck and raising the head to look about them, and as you follow them leisurely over the rocks or through the jungle, they frequently stop, turn their heads round, and take a deliberate survey of the intruder. They are by no means vicious, though they bite with severity when provoked, acting, however, always on the defensive. On examining their stomachs, Crabs, Locusts, Beetles, and the remains of the *Periophthalmus*, or Jumping-Fish, the scales of Snakes, and bones of Frogs and other small animals were discovered. Like that of the Iguanae of the New World, the flesh of these Saurians is delicate eating; I can compare it to nothing better than that of a very young suckling-pig.

At the island of Mayo we landed amid the surf, upon a group of high, bare rocks covered with *Chitons*, *Littorinae* and *Nerites*, with large painted *Grapsi* running about in all directions. As I climbed the rugged acclivity, a huge Monitor Lizard, upwards of five feet in length, disturbed in his noonday siesta, made off to a swampy ravine on the other side, climbing the perpendicular ascent with awkward activity, and stopping now and then to look around and examine his pursuer. The romantic chine in which he finally disappeared was abundantly supplied with trickling rivulets, that came tumbling down among enormous boulders, from their sources in green clumps of tall *Pandanus* trees, springing from the height above. The specimen of *Hydrosaurus giganteus*, from the north coast of New Holland, in the British Museum, is seventy-eight inches in length. Many African species, as, for example, the white-throated *Regenia* (*R. albogularis*) and the Nilotic *Monitor* (*M. Niloticus*), also attain a great size. How admirably adapted are these semi-aquatic, dingy-hued Saurians to the hot, moist swamps and shallow log-laden lagoons that fringe the rivers of this densely-wooded island! The imagination is carried back, while contemplating the dark forms of these *Hydosauri* plunging and wallowing in the water, or trotting along deliberately over the soft and slimy mud, to that "Age of Reptiles" in the world's infancy, when the vast muddy shores of the primeval ocean were peopled by those lazy lizard-like monsters, and slow-moving giant Efts, the *Mososaurus*, which must have been between the *Monitor* and *Iguana*, twenty-five feet long with a laterally compressed tail; the *Saurodon* with its lizard-like teeth; and the *Dinosauria* and *Megalosaurus*, large carnivorous Crocodile-Lizards. Along the banks of the fresh-water rivulets of Mindanao, numbers of these giant water-loving Lizards are seen, plunging and diving into the dark, still streams, basking on the banks, trotting among the foliage, or lying flat on their bellies upon the trees thrown across the rivers and stagnant ponds. Among these I think I recognized the two-streaked Lace-Lizard (*Hydrosaurus Salvator*) and another small species, entirely of a dull brown. In the stream that runs through the village of Anjer, in Java, I noticed also numerous Saurians of this group, of somewhat more

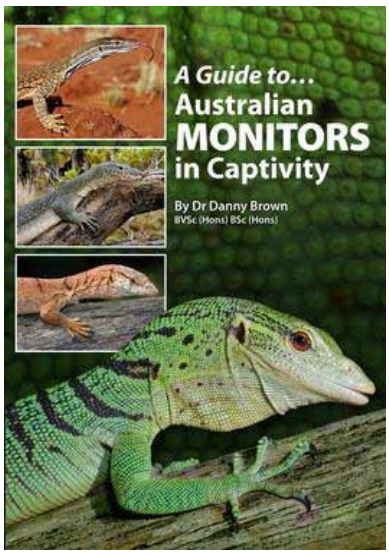
sluggish movements, most probably *Uranus heraldicus*, and other species closely allied. When wounded, these large Lizards bite very severely, but unless provoked are perfectly harmless. They are easily shot, but it is not without some difficulty they are caught alive.

*Varanus niloticus*. Musoma, Tanzania Photograph by **Jim McLean**.

*Varanus baritji.* Fenton Airbase, NT. Photograph by **Bernd Eidenmüller**.

# BOOK REVIEWS

## Monitor Husbandry from an Australian Keeping Perspective




**A Guide to Australian Monitors in Captivity**
DANNY BROWN
ABK Reptile Publications, Burleigh. 2012.
Paperback, 263 p.

Reviewed by ROBERT W. MENDYK
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Beginning with Jiři Rotter's *Die Warane* in 1963, there have been many books published to date which focus on the husbandry of monitor lizards in captivity (Balsai, 1992, 1997; Bartlett, 1996, 2006; Bayless, 2006; Bennett, 1998; Bennett & Thakoordyal, 2003; Berghof, 2009; Coborn, 1997; Eidenmüller, 1997, 2003, 2007, 2009; Faust, 2001; Husband & Bonnett, 2009; Kirschner *et al*., 1996; Lipfert & Dickoff, 2004; Sprackland, 1992, 2000, 2009; Suzuki, 2006). Considering that monitor husbandry has experienced many advancements and paradigm shifts over its history, particularly in the past two decades, recommendations on their care and breeding presented in some of these earlier works are now antiquated by today's keeping standards; surpassed by keeping methodologies supported by a firmer understanding of monitor biology and their tolerances and requirements in captivity. With each new book on the subject of monitor husbandry come greater expectations and a responsibility to improve on previous works by presenting current and biologically-appropriate information.

For many years, books on monitor husbandry were authored by European and North American keepers and enthusiasts (e.g., Balsai, 1992, 1997; Bartlett & Bartlett, 1996; Bennett, 1998; Eidenmüller, 1997, Kirschner *et al*., 1996; Rotter, 1963; Sprackland, 1992). It is important to note that although Australia now has a booming reptile and amphibian hobby, many Australian monitors were first kept and bred in European and North American collections decades before they were legally available to and widely-kept by Australian herpetoculturists. Due largely to prohibitions on the keeping of native reptiles by several Australian states, it wasn't until around the mid to late 1990s that monitor keeping in Australia began to catch up with other parts of the world, with captive breeding success becoming more commonplace in private collections. Around this time, Vincent & Wilson (1999) authored the book, *Australian Goannas*, which offered a uniquely Australian perspective on the keeping and breeding of monitor lizards. This approach was later adopted by Husband & Bonnett (2008) in their chapter on monitors appearing in Swan's (2008), *Keeping and Breeding Australian Lizards*, and is continued once again with Danny Brown's new book entitled, *A Guide to Australian Monitors in Captivity*. As there are more than 20 monitor lizard species currently kept and bred in Australian collections, it only seems right that Australian keepers continue this tradition of advancing knowledge about the husbandry of species found right in their own backyards.

*A Guide to Australian Monitors in Captivity* focuses solely on the captive management and breeding of monitor lizards indigenous to Australia. The cover to this 263 page paperback book features vivid photographs of *V. gouldii*, *V. indicus*, *V. gilleni,* and *V. prasinus*. Inside, the book's pages are of a quality glossy finish, and feature 397 crisp color photographs. Fourteen tables provide additional data and information which supplement the text.

Following a brief introduction, the book is divided

into several chapters which discuss various aspects of captive husbandry: general management, housing, feeding methods and nutrition, breeding, and common diseases and disorders. Following these chapters are species accounts. Listings of Australian herpetological societies and useful informational websites are provided towards the end of the book, which are followed by a brief bibliography of selected works for further reading and a glossary of terms appearing in the text.

The chapter on general management covers a broad spectrum of topics including specimen acquisition and transportation, keeping legalities, general safety and security, and quarantine procedures. The following chapter on housing discusses the logistics and suitability of indoor and outdoor enclosures, as well as substrates, refuge sites, environmental enrichment, heating and lighting, and humidity relations. Under feeding methods and nutrition, the author discusses various vertebrate and invertebrate prey items, including their nutritional compositions and instructions for culturing several species, as well as dietary supplementation and feeding difficulties. The chapter on breeding covers sex identification, sexual maturity, courtship and copulation, reproductive biology, nesting, egg incubation and neonatal care, and offers strategies for enhancing reproductive success. The following chapter on diseases discusses nutritional, parasitic, physiological, and reproductive disorders commonly seen in captives and provides information on their prevention, identification, and treatment.

The book's species accounts are broken down into several groups based on size and ecological similarities: large terrestrial and arboreal species (*V. giganteus*, *V. gouldii*, *V. panoptes*, *V. rosenbergi*, *V. spenceri*, *V. varius*), rock dwelling species (*V. glauerti*, *V. glebopalma*, *V. kingorum*, *V. pilbarensis*), small terrestrial species (*V. acanthurus*, *V. baritji*, *V. storri*, *V. primordius*, *V. brevicauda*, *V. eremius*), small to medium arboreal species (*V. gilleni*, *V. bushi, V. caudolineatus*, *V. tristis, V. scalaris*), and semi-aquatic species (*V. mertensi*, *V. mitchelli*, *V. semiremex*, *V. indicus*). Accounts include physical descriptions of each species including variation between genders and localities, as well as information on the natural history, housing, feeding, breeding, and sex identification of species within the group.

*A Guide to Australian Monitors in Captivity* is an easy read which should be useful to monitor keepers of all backgrounds and experience levels, especially beginning hobbyists that may be intimidated by heavy text. In several sections, the book reads like an instruction manual or care-sheet, which may be a familiar format for novice keepers as they establish baseline husbandry for which to build upon as they gain more knowledge and experience. Equally as useful, the author simplifies and explains several complex metabolic processes which are often misunderstood or misinterpreted by reptile keepers, such as UV utilization and Vitamin D3 metabolism (p. 57).

Generally speaking, the husbandry information presented in this book is current and up to date. One of the most important aspects of captive management touched upon in this book in sufficient detail is thermal husbandry. The appropriate ranges of temperatures required by monitor lizards to thermoregulate properly and reach preferred body temperatures in captivity are often misunderstood or overlooked by private keepers and zoos, which can lead to thermally compromised individuals and a host of associated health issues (e.g., Mendyk *et al*., 2013). Attitudes towards the basking temperatures offered to monitors in captivity have markedly changed over the last two decades (Anonymous, 1997; Good, 1999; Retes & Bennett, 2001; Husband & Vincent, 2009), with many successful keepers and breeders now providing surface basking temperatures which exceed 45° C. It is pleasing to see that this book promotes elevated basking temperatures ranging from 55-70° C, as these are more likely to enable captives to reach their optimal body temperatures and maintain healthy physiologies.

One of the most impressive features of this book is the chapter on sex identification. Reliably sexing monitor lizards has presented major challenges for those attempting to keep and breed them in captivity (e.g., Horn & Visser, 1997). The descriptive detail and accompanying photographic references presented in this book on sex determination are unmatched by any other work on the subject. While an entire chapter is dedicated to discussions on sex determination in the genus, the topic is also revisited again in each species account. Comparative photographs depicting gender-related morphological differences including head size and shape, jawline morphology, and tail base morphology are provided for most species covered in the book and should prove to be very useful to zoos and private keepers. Many of these sexing techniques may be used as alternatives to other semi-reliable sexing methods such as ultrasonography and radiography which are largely inaccessible to private keepers, or used in conjunction with other sexing techniques to improve accuracy.

Another useful feature of this book is that it highlights many different housing arrangements and styles of enclosures that are suitable for monitor lizards,

including both indoor and outdoor setups. Numerous photographs depicting a variety of enclosure designs can help keepers learn which elements of their design are critical, as they design and construct their own customized enclosures and approaches to husbandry.

The section on diseases and their prevention provides useful information on the identification and treatment of common maladies that will be useful for all monitor keepers. Some discussion of gout and its potential causes (i.e., inadequate temperatures, chronic dehydration, etc.) would have been useful, especially considering its frequency of occurrence in captive monitor lizards (Hartdegen, 2002; Garner, 2008; Mendyk *et al*., 2013).

The chapter on diet and nutrition offers useful information on the nutritional components of many commonly offered vertebrate and invertebrate prey items, and also offers instructions for culturing crickets, locusts, cockroaches and isopods in captivity. Although the chapter focuses primarily on whole prey items, which are ideal for monitor lizards, I do consider some of the book's dietary recommendations to be biologically inappropriate and reminiscent of antiquated husbandry practices that favored keeper convenience over suitability for the animal, such as canned cat food (p. 78). Most surprising was the recommendation of offering grated cheese as an "occasional treat" to captives (p. 78).

Another useful discussion explains the genetics of the "Bell's" color phase in *V. varius*. Although this naturally-occurring color phase is common in Australian collections and animals with this condition have been bred to multiple generations in captivity, its genetics are often misunderstood.

Barring the few husbandry recommendations discussed above, I have only two criticisms of this book. My main criticism deals with several sections in this book which appear to be very general in their information, where they could even be inserted into similar works on other lizard taxa. Some of this vague and sometimes confusing information conflicts with monitor lizard biology. For instance, since all monitor lizards are represented by the single genus *Varanus*, statements such as "*Each genus or unique species has been dealt with individually*...." (p. 16), and "*This book covers all Australian genera that are currently maintained in captivity*..." (p 16) suggest that these sections of text were written for some other broader work on Australian lizards. Additional statements such as "...*hatchlings of diurnal species*..." (p. 123), "...*particularly for diurnal species that require a heat lamp*..." (p. 123), and "*Even species that lay soft-shelled eggs*..." (p. 108), are equally as confusing, as there are no nocturnal monitor species, nor do they lay any other type of egg besides soft-shelled eggs. In another example, the statement, "*Generally, following courtship, the male grips the female by the skin of her neck or shoulders with his mouth*." (p. 102) typifies agamid reproduction rather than that of monitor lizards, as biting is not a part of the behavioral repertoire of monitors during courtship or copulation.

The author has recently produced three additional books in the same series on Australian gekkonids and pygopods (Brown, 2012c), skinks (Brown, 2012b), and agamids (Brown, 2012d), as well as a forthcoming all-inclusive work entitled, "*A Guide to Australian Lizards in Captivity*". While I have yet to view these additional works, based on the statements highlighted above, it is possible that they were intended for use in some of these other titles, or have been reused in multiple works.

My other criticism deals with the book's general lack of bibliographic references. Numerous reproductive data are presented throughout the book without citing from whom or which publications they originated. While a brief bibliography of suggested readings does appear towards the back of the book, it is incomplete in its coverage of works on the keeping and breeding of Australian monitors. The formatting for these references is also inconsistent, with page numbers provided for some references but not for others, which can complicate sourcing and acquiring some of these publications.

Typographical errors were minimal and hardly noticeable; the only mistake worth noting was the use of Merten's rather than Mertens' water monitor as the common name for *V. mertensi* (named after German herpetologist Robert Mertens).

In sum, *A Guide to Australian Monitors in Captivity* is an important contribution to the husbandry and breeding of monitor lizards. The author's personal experience and knowledge of this genus in captivity shines through with this work, offering many sensible husbandry recommendations that are consistent with monitor lizard biology and follow current keeping methodologies. Keepers of all backgrounds and experience levels should find this book useful, especially for modifying and customizing their own enclosures and husbandry practices. Although the book focuses solely on Australian species, much of the information should be applicable to African and Asian taxa as well. Accordingly, it should be read and kept on hand by private keepers, zoos and veterinarians working with these animals in captivity.

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Road-killed *Varanus varius*. Lake Wivehoe, Queensland. Photograph by **Tony Jewell.**

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*Varanus albigularis*. Cheringoma, Mozambique. Photograph by **Bart Wursten**.

# RESEARCH REQUESTS

## Temperature Data Sought from Zoos and Private Monitor Lizard Keepers

As part of a larger ongoing study on the thermal husbandry of monitor lizards, temperature data are sought from zoos and private keepers for all species currently maintained in captivity. A brief 10 question online survey has been created to facilitate the anonymous exchange of this information. Thermal data sought include surface basking temperatures and the lowest temperatures available to captives within their enclosures.

Compiled data will be used to approximate the average basking temperatures and thermal gradients currently offered to monitor lizards in captivity. To participate in this online survey, please contact **Megan Baumer** at megancbaumer@gmail.com.

MEGAN BAUMER
ROBERT W. MENDYK
LAUREN AUGUSTINE

*Varanus griseus caspius*. Central Uzbekistan. Photograph by **Tom Martin**.

# ILLUSTRATIONS

## PAUL KMIOTEK

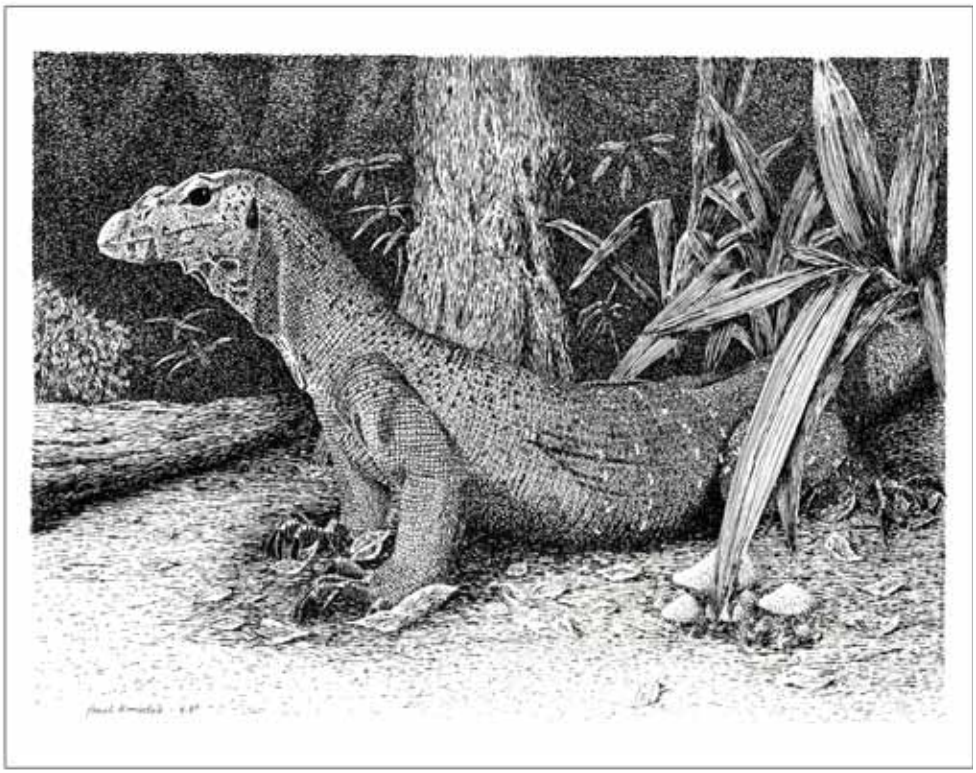
*Kmiotek Art Works*
http://sites.google.com/site/kmiotekartworks
E-mail: pekmiotek@yahoo.com

Paul Kmiotek is an award winning American artist whose work has been displayed at the Ridgewood Art Institute, the Hiram Blauvelt Art Museum, the Belle Levine Art Center, and the Lake Carmel Arts Center. His talents have been commissioned by the Wildlife Conservation Society, the Komodo dragon Species Survival Plan, and the Wildlife Care Center of Belize.

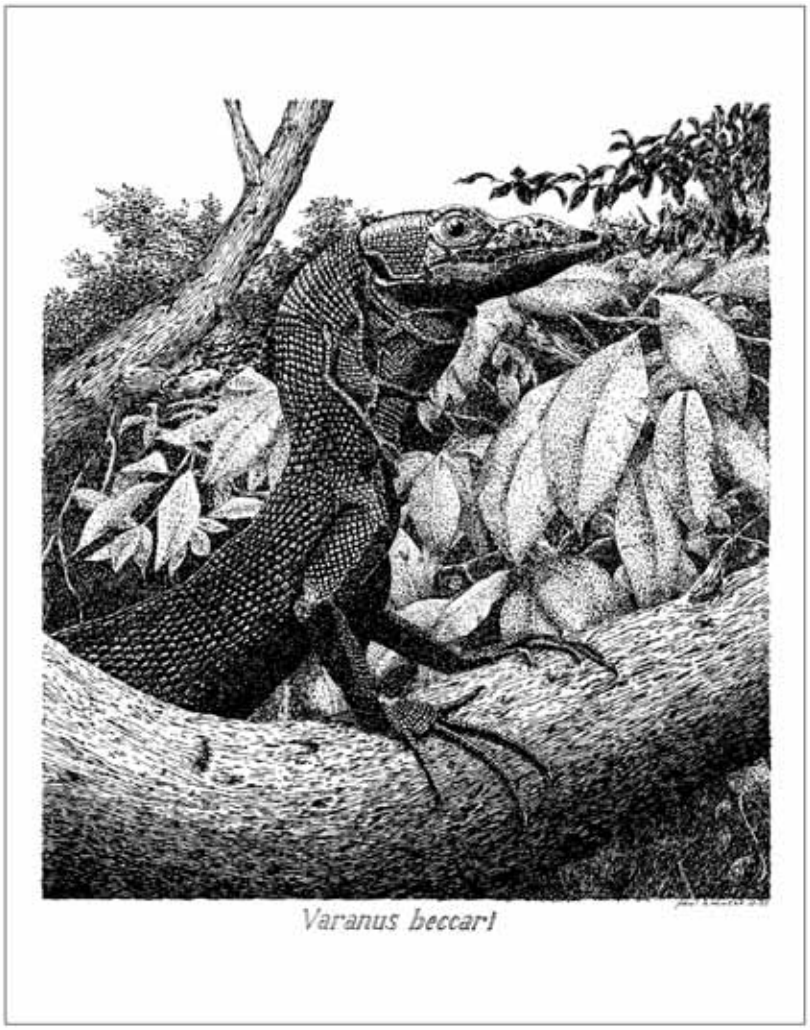
Associated with the Bronx Zoo's Department of Herpetology for 17 years, first as a volunteer and most recently as the department's Senior Keeper, Paul has been active in herpetological husbandry and field research in the greater New York/New Jersey area. Highlights include monitoring North American wood turtle (*Glyptemys insculpta*) populations, testing for pollutants in common snapping turtles (*Chelydra serpentina*), and surveying populations of the eastern hognose snake (*Heterodon platirhinos*). At the Bronx Zoo, he was involved with husbandry-based research on the diet and nutrition of Galapagos tortoises (*Chelonoidis nigra*) and the captive breeding of the yellow-headed box turtle, *Cuora aurocapitata*.

Monitor lizards have been a favorite subject in Paul's artwork. A series of six pen and ink illustrations featuring *Varanus acanthurus*, *V. beccarii*, *V. bengalensis*, and *V. salvator* were released between 1996 and 1998; two of which were featured on the covers of the first and second issues of Varanids Newsletter (published by the Varanid Society) in 1997. A black ink and colored pencil illustration of *V. komodoensis* was commissioned by the Komodo dragon Species Survival Plan in 2004.

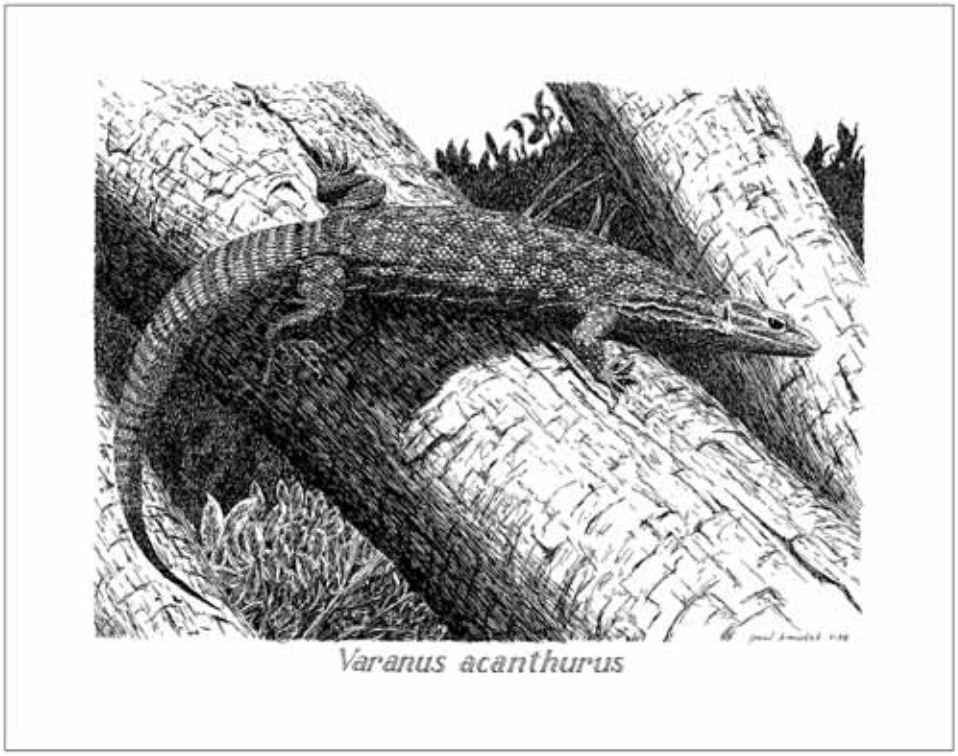
He currently resides in the Hudson Valley of New York with his wife and two children.



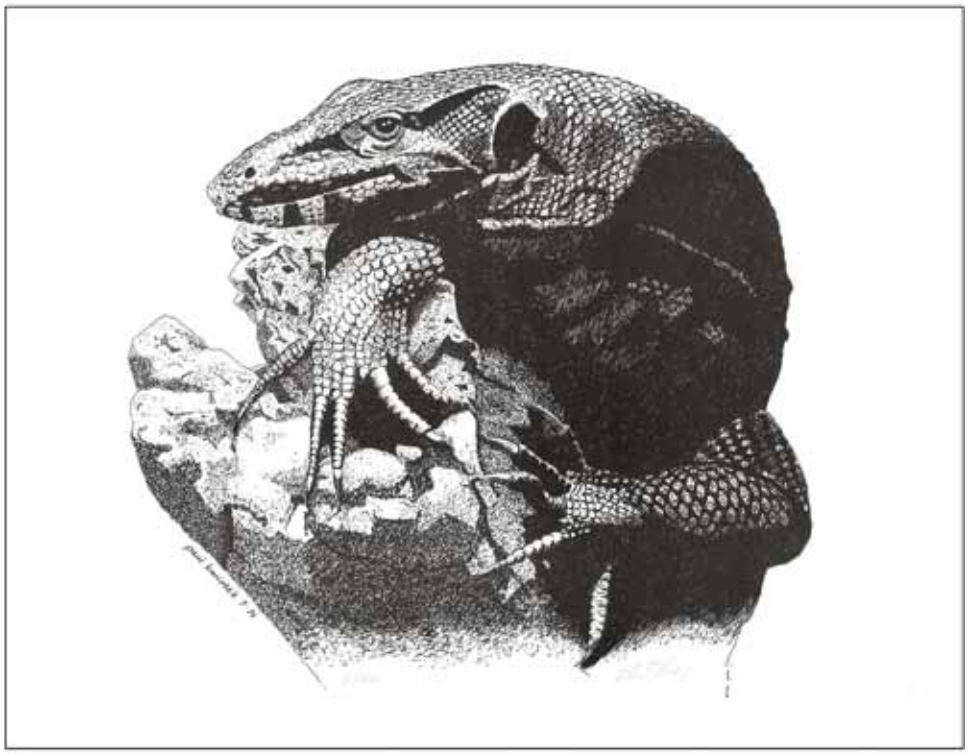
Bengal monitor *Varanus bengalensis*. April 1997. Pen and ink. 35.6 x 28 cm (14 x 11").




Black tree monitor *Varanus beccarii*. October 1997. Pen and ink. 28 x 35.6 cm (11 x 14”).

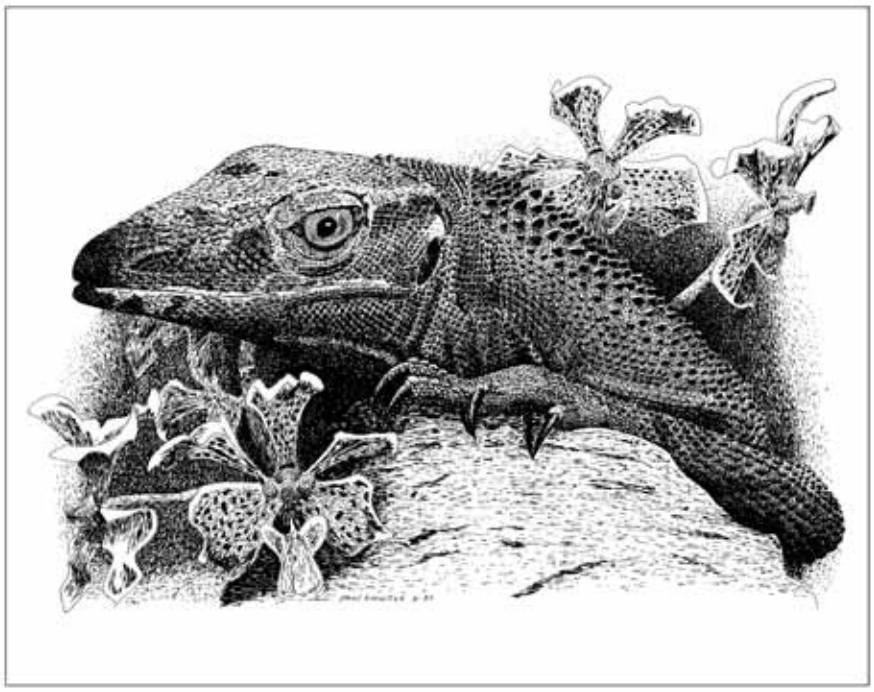



Spiny-tailed monitor *Varanus acanthurus*. January 1998. Pen and ink. 35.6 x 28 cm (14 x 11”).

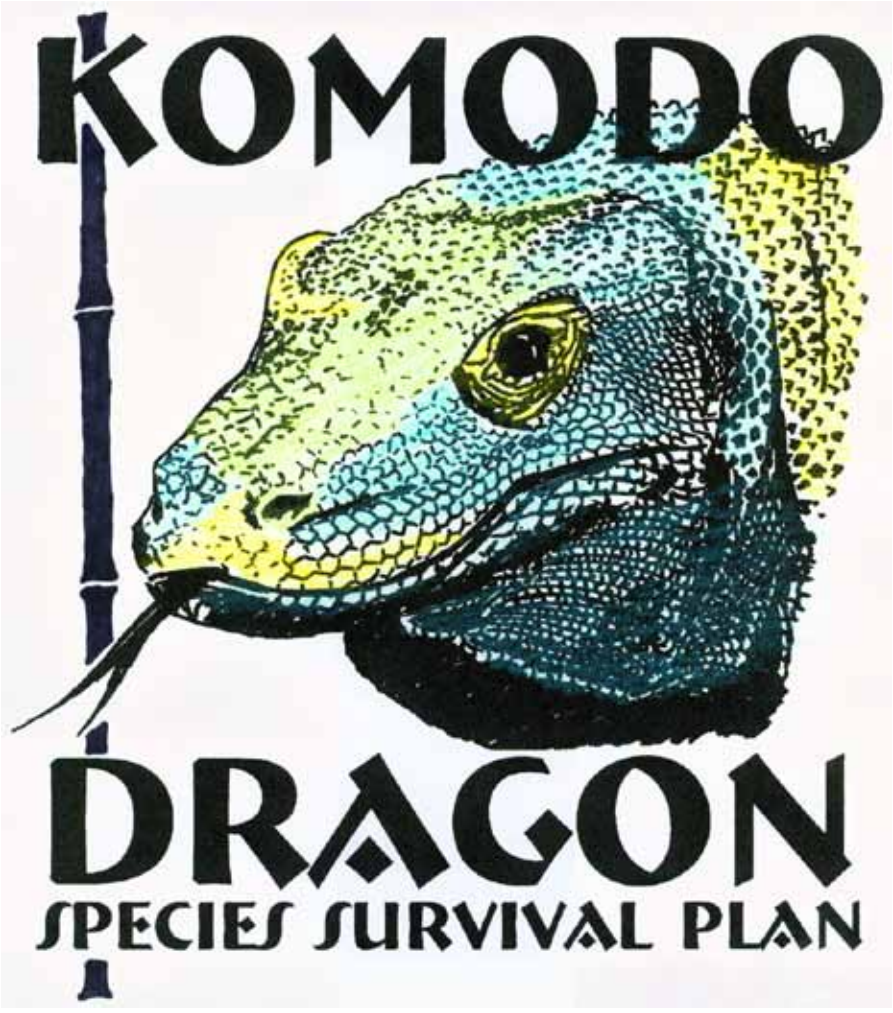


Black water monitor *Varanus salvator macromaculatus*. September 1996. Pen and ink. Original: 35.6 x 28 cm (14 x 11”); Prints: 28 x 21.6 cm (11 x 8.5”).

Water monitor *Varanus salvator*. December 1996. Pen and ink. 28 x 35.6 cm (11 x 14”).



Rough-necked monitor *Varanus rudicollis*. March 1997. Pen and ink. 35.6 x 28 cm (14 x 11”).




Komodo dragon *Varanus komodoensis*. 2004. Black ink and colored pencil. Commissioned by the Komodo dragon SSP.

*Varanus bengalensis nebulosu*s. Bukit Cemetary, Singapore. Photograph by **Lisa Ridings**.

*Varanus nuchalis*. Caticlan, Boracay Island, Philippines. Photograph by **Tess Alunan**.