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Notes on the Husbandry and Breeding of the Black Tree Monitor *Varanus (Euprepiosaurus) beccarii* (Doria, 1874)

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Abstract - Problems experienced with the incubation and hatching of a clutch of *Varanus beccarii* eggs are described. One egg ruptured during incubation, and two eggs contained fully-developed, dead embryos. One surviving offspring was artificially hatched. Potential causes for these results are discussed.

Introduction

The black tree monitor, *Varanus beccarii* was first described by the Italian naturalist Giacomo Doria in 1874 as *Monitor beccarii*; named after his friend and colleague Odoardo Beccari. Mertens (1942) classified it as a subspecies of its close relative *V. prasinus*, which inhabits New Guinea and some smaller islands located within the Torres Strait. Sprackland (1991) elevated it to species status based on its homogeneous black coloration and distinctively keeled neck scales. As several additional species belonging to the tree monitor, or *V. prasinus* species complex have been discovered (e.g. *V. macraei* [Böhme & Jacobs, 2001], *V. boehmei* [Jacobs, 2003] and *V. reisingeri* [Eidenmüller & Wicker, 2005]) and others whose taxonomy has been revised or discussed (e.g., *V. bogerti, V. keithhornei, V. telenesetes* [Sprackland, 1991], *V. kordensis* [Jacobs, 2002]), a complete taxonomic revision is needed to better understand the taxonomic relationships of this group.

Despite its presence and relevance within the international pet trade for several decades, very little is known about the ecology of *V. beccarii*. Like other representatives of the *V. prasinus* complex, *V. beccarii* is suspected of inhabiting forest canopies, but may also descend to the ground to search for prey. Irwin's (2004) report on the closely related *V. keithhornei* from north Queensland, Australia may offer some insight on the behaviour and ecology of *V. beccarii* and other members of the complex.

The distribution of *V. beccarii* is restricted to Aru, a group of 95 islands located 150 km southwest of West Papua, covering a total land area of about 8,500 km². Most of the archipelago is covered with tropical rainforest, while the coastline is distinguished by mangrove forests. Southern regions of the archipelago also support savannah habitats (Wallace, 1869). Precise climatic data from habitats inhabited by *V. beccarii* are lacking, but temperatures recorded in the archipelago's capital city of Dobo range from 25 °C at night (minimum of 22 °C) to 31 °C during the day (maximum of 34 °C). Total annual precipitation averages around 2000 mm (climate data acquired from http://www.meteoblue.com).

Indonesian traders export several hundred tree monitors each year to the European Union alone. Considering the limited distribution of most of these species and advancing habitat loss, these trade practices cannot be considered sustainable (Valoras, 1998; Nijman & Shepherd, 2009). For this reason, captive breeding is critical for reducing the demand and continued depletion of wild populations. However, despite the large numbers of specimens maintained in captivity, long-term success with keeping and breeding tree monitors is still rare. There have been relatively few published breeding reports for members of the *V. prasinus* complex which also highlight potential problems associated with their care and reproduction in captivity (*e.g.*, Dedlmar, 1994; Bosch, 1999; Ziegler *et al*., 2009). This article describes a successful breeding of *V. beccarii* and offers suggestions for improving husbandry in terms of enriching the captive environment and feeding methods, and discusses potential causes for failures experienced with egg incubation.

Husbandry of Adults

An adult male *V. beccarii* was acquired in early 2011 to compensate the loss of an eight year old captive-bred male that had been housed together with a female and died four months earlier from an atypical mycobacterial infection. The female was acquired as a "farm-bred" subadult in 2010. After four weeks of quarantine, the male was introduced to the female. At this time, the male measured 26 cm in snout to vent length (SVL) and 74 cm in total length (TL) with a mass of 210 g; the female had a SVL of 29 cm, a TL of 80 cm, and a mass of 214 g.

The pair is housed together in a 160 x 120 x 185 cm (L x W x H) enclosure constructed from phenolic resin-coated plywood. The side and back walls are covered with baked cork plates, and the enclosure is further furnished with oak bark, branches, and vines. Some of the branches are freely suspended to encourage the animals' coordination while moving amongst the artificial canopy. Other branches contain multiple drilled holes of varying diameters, some of which pass through the branch completely. These serve as enrichment (e.g., see Mendyk, 2012) when they are filled with very small pieces of cooked egg, fish, chicken bits or live cockroaches from time to time. A heated (27 °C) 110 L water basin (157 x 50 x 15 cm) helps maintain a relative humidity of 70-95%. The enclosure is automatically misted six times a day at one minute intervals. Ambient temperatures range from 22-25 °C at night to 24-34 °C during the day. Illumination and basking sites are provided by two 75 Watt HQI spots (5600 K), one 150 Watt HQI spot (6500 K) and two 75 Watt halogen PAR spots (2900 K) (*Osram GmbH, München, Germany*). Surface temperatures beneath basking spots exceed 45 °C. Three leaf litter-filled nesting boxes constructed from phenolic resin-coated plywood (two of which measure 25 x 15 x 15 cm; the other 20 x 20 x 35 cm) provide opportunities for sleeping and egg deposition. A sliding door down the middle of the enclosure allows for separation of the pair. The enclosure is further furnished with several live plants (*Monstera, Ficus, Billbergia, Platycerium, Phalaenopsis, Zamia, Dracaena, Asplenium, Rhoeo* and *Epipremnum*) and a 5-15 cm thick layer of forest soil and withered oak leaf litter serves as substrate (Fig. 1). Ventilation is provided by two barred cuttings (ca. 8 x 40 cm) diagonally placed in the lower front and upper back of the enclosure.

Fig. 1. Adult *Varanus beccarii* enclosure with live plants, natural substrate and dividing wall. Photographed by **Claudia Ewerhardy**.

More than 90% of the diet, by mass is comprised of insects (*Blaptica dubia, Pachnoda marginata, Zophobas morio* and others). Occasionally the animals are fed fish (*Osmerus sp.*), egg (chicken and snake; including shells), and day old chicks or beef (including bones and marrow). All live prey items are bred on site and gut loaded. Food is frequently supplemented with Herpetal Complete T (*Keweloh Tierernährung GmbH & Co., Osnabrück Germany*) and calcium citrate. Usual provisions are 10 to 20 g of food per animal per week. Animals are fed once or twice a week. Whenever possible, food is not offered from tongs but is instead either set free into the enclosure or placed into the prepared branches to encourage hunting and other foraging behaviors. A lively population of cockroaches, woodlouses and other arthropods populating rotten wood and leaf litter inside the enclosure offers additional opportunities to forage for small prey items.

Courtship, Copulation and Nesting

Shortly after their introduction, the male began to pursue the female, usually approaching her with an increased frequency of tongue-flicking. In most cases the female retreated from the male, which often escalated into a fast chase through the enclosure that ended only when the female was able to distance herself from the male via a visual barrier. This enabled the female to

reach a hideout before the male could spot her again.

Copulation was first observed on 25 December 2011, lasting for approximately two hours. Copulation occurred while the pair clung to the back wall of the enclosure; little movement was observed. Two additional instances of copulation were observed up until 1 January 2012. From this point onward, food was offered to the female every other day (ca. 7.5 to 9 g per feeding).

On 7 January, the pair was separated due to the male's continued attempts to initiate copulation. The female showed increased activity, but no digging was observed, and her abdominal girth and tail base area did not show any indications of gravidity. The female briefly refused insects and other food items for three days, but then reluctantly accepted two small cockroaches on 11 January and gorged on four cockroaches on 13 January. Since searching for eggs within the enclosure was unsuccessful, and the female showed normalized behavior, it was assumed that the she was not gravid. The male was reintroduced later that day and immediately began to chase the female. Despite this aggressive courtship behavior, the pair was not separated.

Rather unusual, the female was the first to awake the following morning, appearing fairly exhausted but lacking any physical signs of oviposition. Nevertheless, the nesting boxes were searched for eggs. A clutch of three eggs was found buried in the moist substrate beside the water basin. While excavating the area, the ground was dug up carelessly and two of the eggs were scattered about the enclosure before they were found. All three eggs were white in coloration, but showed large indentations. Each egg was marked with a pencil, measured, weighed, and then placed inside a digitally controlled incubator (*Jäger & Pfrommer. Wächtersbach, Germany*).

Incubation and Egg Development

All three eggs were stored separately in transparent plastic boxes with small ventilation holes. Vermiculite, initially moistened with distilled water at a 1:2 ratio by weight, served as an incubation substrate. The incubator's temperature was set to 30.5 °C, and the humidity level inside the incubator was 85%. Inside the egg boxes, the temperature recorded on top of the substrate was 30 °C and relative humidity was approximately 95%.

Weights and morphometrics of the eggs were recorded (Table 1). Candling the eggs with a common LED flashlight did not reveal blastodiscs or any other indication of fertility. By 16 January, all indentations in the eggs' shells had filled out, and each egg's weight had increased by an average of 0.8 g. Further developments in egg weights are documented in Fig. 2.

Table 1. Egg measurements.

Egg No.	Weight (g)	Length (mm)	Width (mm)
1	11.7	46	21
2	11.3	45	20
3	11.3	46	23

One month after deposition, the eggs still lacked any visible signs of fertility when candled with a 40 watt bulb, but continued to grow steadily. After three months, candling showed diffuse shadows, which, in one case exhibited movement. On 23 April 2012, the candling method was improved by switching to a cardboard tube and a 15 Watt energy saver bulb, which resulted in an impressive view of the embryo (Fig. 3). Remarkably, all three embryos were positioned towards the bottom of the egg, beneath the yolk. Further candling showed that the embryos maintained this position throughout incubation, which is quite different from the usual position described in the literature (Köhler, 2004).

On day 136, egg #3 was removed from its box for measurement; its mass had increased to 265% of its original weight (see Fig. 2). Inspection of the egg revealed a rupture on its underside created by a 10 mm long fissure in the shell. A large gelatinous clot of what appeared to be allantois and vermiculite clung to the egg. As there was no visual indication of infection or smell of decay, the egg was turned over and immidiatly repaired. Because the egg continued to spill out more allantois as the fissure was cleaned, it was neccessary to stop the leak with cellulose pulp before the fissure was sealed with hot wax (Fig. 4). Three days later, the egg still smelled fine and candling revealed movement.

Since egg #2's weight had decreased for one week and did not show any signs of movement during daily candling, it was manually opened on day 159, revealing a fully developed, dead embryo (Fig. 5). The reason for its death remains uncertain, as no signs of infection were visible. The embryo weighed 9.64 g and had an attached yolk sac that weighed 1.1 g. Based on the egg's weight development over the last several days (see Fig. 2), the pale coloration of the yolk sac, missing blood vessels, and the cloudiness of the allantois, it was estimated to have died around one week earlier.

Around 1630 h on 22 June 2012, after 161 days of incubation, egg #3 began to sweat heavily. Unlike the day before, candling showed no blood vessels on the

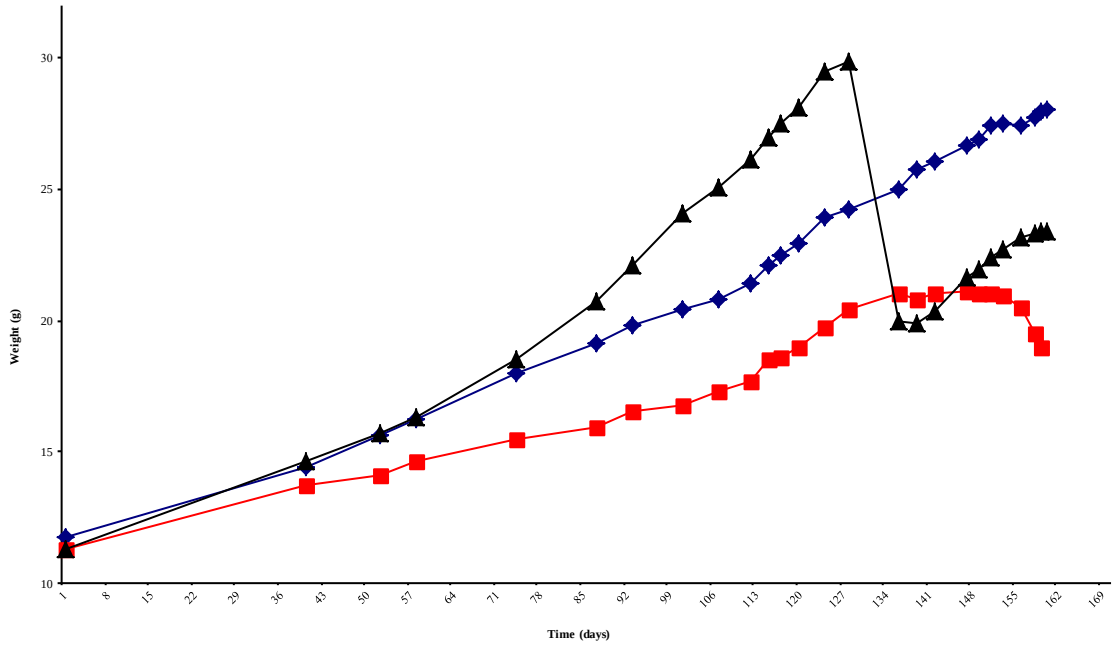

Fig. 2. Clutch development during incubation. Blue diamonds = egg #1; Red squares = egg #2; Black triangles = egg # 3

upper inside of the egg. Although the box was opened for better ventilation, the egg continued to visibly sweat until at least 0530 h the following morning. By 1030 h on 23 June, there was no sign of hatching. The egg was then manually opened, also revealing a fully developed, dead embryo. Based on the egg's continued sweating until the early morning, the vivid coloration of the yolk sac and it's blood vessels, and the clear opacity of the allantois, the time of death was estimated to have been just a few hours earlier. Further investigation of the repaired fissure and the wax seal did not reveal any cause for the embryo's death. In fact, the wax and cellulose pulp were still in perfect condition and did not show any signs of infection or decomposition (Figs. 6 & 7).

Due to the loss of both well-developed eggs, it was decided to open the remaining egg right away. The usual procedure would be to cut a window in the egg's shell and manipulate the embryo's head out, in order to encourage it to breath and complete the hatching process on its own (Köhler, 1989, 2004). Since the head's location could not be determined with candling or by opening the egg with a small incision, the shell was opened along its length to expose the embryo. The live offspring was immediately transferred to a box with moist paper towel and stored in the incubator (Figs. 8 & 9). Shortly after

Fig. 3. Candling revealed the position and body features of the embryo in egg #1 on day 100 of incubation. Photographed by **Claudia Ewerhardy**.

Fig. 4. Wax seal on egg #3, one month after repair. Photographed by **Claudia Ewerhardy**.

Fig. 5. Dead, fully-developed embryo from egg #2, showing no signs of decomposition besides the faint color of the yolk sac. Photographed by **Claudia Ewerhardy**.

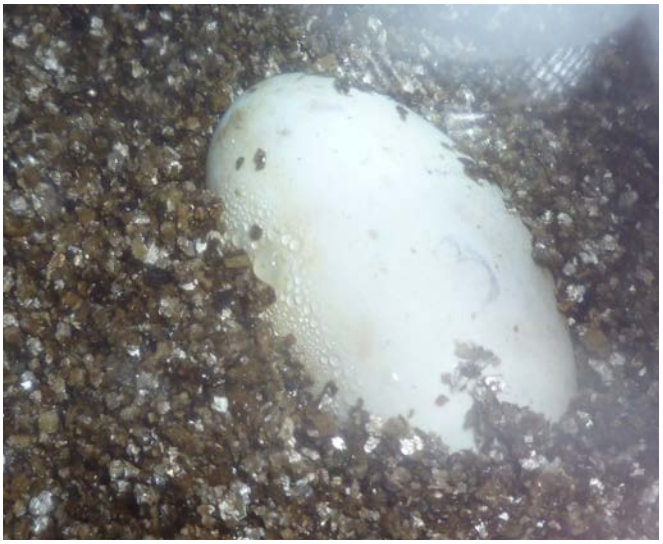

Fig. 6. Egg #3, sweating. Photographed by **Claudia Ewerhardy**.

Fig. 7. Dead, fully developed embryo from egg #3. Note the difference in yolk sac color compared to embryo #2 (Fig. 5). Photographed by **Claudia Ewerhardy**.

Fig. 8. Exposing the live embryo from egg #1. Photographed by **Claudia Ewerhardy**.

Fig. 9. Surviving neonate *V. beccarii* inside incubator after its forced hatching. Photographed by **Claudia Ewerhardy**.

its emergence, it showed signs of heavy breathing in the throat and thorax. Very little movement was observed and its eyes remained closed for the remainder of the day. By the following day, the hatchling had begun to perk up, supporting itself with the forelimbs. At this time it was decided that the remaining yolk sac no longer had a functional connection to the hatchling and was removed with heated scissors by cutting the umbilical cord. Nourishment with water and raw egg was attempted, but failed. Later that day the hatchling began to move around slowly. Its behavior appeared calm, but vigilant.

Husbandry of Offspring

On 25 June, the hatchling was transferred to a quarantine enclosure measuring 40 x 30 x 25 cm and furnished with moist paper towel, thin oak branches, and a small *Ficus benjamina* for coverage. Several food items of suitable size were offered daily (insects, beef, egg, fish), but refused. Direct misting of the juvenile encouraged it to drink. Hatchling members of the *V. prasinus* complex often refuse to take any food for up to two weeks (Pelgen, 2011), and sometimes even longer (F. Mohr, pers. comm.). Nevertheless, force-feeding was initiated after a week due to a planned absence for 12 days and the suspected compromised physical condition of the offspring given its inability to absorb its yolk sac. Supplemented pieces of beef and day-old chicks were used for daily force-feeding. After one week, force-feeding was stopped, and the temporary caretaker offered food items daily. During the second week of absence, the temporary caretaker initiated force-feeding again on a two day cycle because weight measurements showed a decrease in body mass; food items were still offered daily. This cycle was maintained until the offspring began accepting food on its own on 25 July, one month after hatching.

No other live food items besides flies (*Musca sp., Sacrophaga sp.* and *Lucilia sp.*) were accepted. To ensure a more controllable, supplemented diet, an omelett was developed. The recipe contained one part (by weight) egg, 1.5 to two parts mixed insects (ca. 70% *Blaptica dubia*, 20% *Pachnoda* larvae and beetles, 10% *Zophobas* larvae), 0.5 to one part banana or spinach, one teaspoon of calcium citrate and one scoop (0.9 g) of *Herpetal Complete T*. Banana and spinach were added to supplement the mixture with carbohydrates and fibers which are naturally low in a carnivorous diet. While Greene (1986) did not list any plant matter in his study of stomach contents of several tree monitor species, some authors suggest the occasional feeding of fruits (Rogner, 1994; Sprackland, 1999). This is backed by several observations of tree monitors occasionally feeding on live plants in captivity (e.g., *V. prasinus* [Simon, 2011], *V. beccarii* and *V. macraei* [Mohr, 2011]). The insects were mixed with the egg, vegetables and supplements, pureed, and then baked in a microwave oven. This offered the juvenile a well-apportioned fiber-rich diet based on its natural, primarily insectivorous diet (Greene, 1986).

Due to its high activity levels, the offspring was moved to an 80 x 60 x 110 cm enclosure on 24 July 2012. The terrarium is fully furnished with baked cork plates lining the walls, oak branches, live plants, and a 40 L water basin that is heated to 30 °C to help maintain a minimum temperature of 24 °C at night and a high relative humidity. Illumination and heat is provided by two 23 Watt Dulux Superstar energy saver bulbs and a 75 Watt halogen PAR spot (*Osram GmbH, München, Germany*).

Despite daily offerings of this diet, the juvenile did not significantly increase in weight or begin to grow for several weeks. Measurements taken on 9 September 2012 eventually showed a vital growth in length and weight that continues to this day (Table 2). Five months after its forced hatching, the juvenile accepted live *B. dubia* for the first time, and only a few days later accepted *Pachnoda* larvae. The young monitor shows an astonishing activity level and becomes less nervous and timid each day.

Discussion

Tree monitors, or members of the *V. prasinus* complex, have frequently been imported to Europe and North America for several decades. While the average physical condition of imported specimens has greatly improved over the last several years, consistent, repeatable breedings are still scarce. A problem experienced by many keepers is the death of fully developed embryos shortly before or during the hatching process. Some suspected causes include an excessively high level of substrate moisture during the last third of incubation resulting in extensive pressure build-up inside the egg, excessively thick egg shells caused by a prolonged gestation period, and insufficient maternal nutrition where females lack an appropriate supply of essential vitamins and minerals needed for egg production (Köhler, 2004).

While published breeding records for tree monitors do not mention offering an extra supply of vitamins and minerals to gravid females in addition to the usual supplementation recommended (Dedlmar,

Table 2. Hatchling measurements. DIE= dead in the egg .

Hatchling No.	Date of Measurement	SVL (cm)	TL (cm)	Hatchling Mass (g)	Mass of Yolk Sac (g)
1	hatching	8.5	18.5	7.9	0.7
	6 weeks	10	22.5	10.2	-
	15 weeks	10.5	24.5	11.9	-
	21 weeks	11.5	27	13.8	-
2	DIE	8	18.8	9.6	1.1
3	DIE	7.5	17.5	10.4*	n/a

** hatchling and yolk sack weights combined*

1994; Eidenmüller, 2003), deficiencies can result in a poor physical condition of the female. Köhler (2004) and many private breeders in Europe have identified nutritional deficiencies as the most important underlying cause for incubation failures resulting in dead, fully developed embryos. However, signs of vitamin and mineral deficiency could not be confirmed for the dead embryos in this report. Kiehlmann (2012) recommended pressing the heads of the embryos as an indicator of insufficient skeletal mineralization. This was performed on both dead embryos, but their heads and skeletons seemed as stable as one would expect for a lizard of that size.

It remains uncertain if a prolonged gestation period due to the abscence of suitable egg depostion sites resulted in excessive calcium accumulations within the egg shells (Köhler, 2004). Comparative vernier calliper measurements (to the nearest 1/20 mm) off egg shells from the failed *V. beccarii* eggs and from successfully hatched *V. macraei* eggs showed no significant differences in thickness.

Lizard embryos are known to use both an egg tooth and their claws to shear apart their egg shells (Köhler, 2004). However, the embryos in this study did not appear to have reached the point of the hatching process where they would attempt to slit their egg shells. While egg teeth were present and well developed in all three embryos (Fig. 10), an inspection of the shells showed no signs of perforation on the inner side of the shell or membrane. Moreover, the embryos' claws were still covered by the neonychium, a temporary tissue which covers the claw tips during their development and is then shed around hatching (Alibardi, 2009). This tissue may prevent the embryo from lacerating vital structures inside the egg during development.

While eggs of some varanid species successfully hatch when incubated under different substrate moisture levels, from "dry" to "wet" (Phillips & Packard, 1994; Walsh *et al*., 2002), others, such as tree monitors, may not be as tolerant. Many breeders successfully use vermiculite as an incubation medium, but a moist substrate may be a suboptimal choice for incubating tree monitor eggs. If wild representatives of the *V. prasinus* complex do in fact deposit their eggs in arboreal termite nests as suggested by Greene (1986), a substrate-less, suspended incubation method may yield better results. Surfaces inside a termite nest would conceivably be dry, but relative humidity would be extremely high. However, private keepers have also reported hatching failures in *V. prasinus* when using suspension-based incubation techniques (Anonymous, 2012). Although Engle (2004) reported sweating prior to the successful hatching of *V. keithhornei*, Wesiak (2010) identifies it as a sign of suboptimal conditions. While sweating was not specifically reported, monitor lizard eggs have been shown to lose weight before hatching (e.g. *V. albigularis*;

Fig. 10. Egg tooth on embryo #2. Photographed by **Claudia Ewerhardy.**

Phillips & Packard, 1994); this phenomenon has been observed in other lizards species as well, including *Tupinambis* (Köhler, 1989).

Based on the available information, the incubation failures experienced in this study are suspected to have been related to excessive substrate moisture levels, especially during the critical, final third of incubation. For future egg incubation, an overall drier substrate (1:1 vermiculite to water ratio instead of 1:2) will be used and the clutch will once again be closely observed by frequent weight measurements. Unfortunately, due to a lack of available data, comparisons between developments in egg weights in this study (Fig. 2) and those from successfully hatched clutches could not be made. The reasons for egg #3's immense growth remain unclear. While frequent measurements and candling could have affected the eggs due to temporary temperature changes, internal pressure changes caused by handling, or light stimuli, measurements were conducted as cautiously as possible and were considered necessary to increase understanding of egg development in tree monitors.

Artificially hatching embryos is a critical procedure. Often enough, such hatchlings do not survive the first few days, especially since the state of development at the time of the forced hatching is not precisely known (Köhler, 1989, 2004; Kroneis, 2012). The surviving offspring in this study proved quite vital, however. In retrospect, force-feeding would most likely not have been necessary at all, as the offspring's body weight varied greatly even after it had begun to accept food on its own and fed daily with gusto. Frequent measurements were conducted as non-invasively as possible, but did require capture and restraint. This contributed to the wariness of the offspring towards the keeper which kept it from becoming tame until recently. Still, no serious effects from handling were observed, and now that the offspring has begun to to grow (Fig. 11), measurements will be taken less frequently. Its futher development will be closely observed and recorded.

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Fig. 11. Molting juvenile *V. beccarii* at 15 weeks. Photographed by **Claudia Ewerhardy**.

References

Alibardi, L. 2009. Development, comparative morphology and cornification of reptilian claws in relation to claws evolution in tetrapods. Contributions to Zoology 78(1): 25-42.

Anonymous. 2012. http://www.forum.waranwelt.de/index.php?page=Thread&threadID=7325&pageNo=1 (Accessed 18.11.2012).

Böhme, W. & H.J. Jacobs. 2001. *Varanus macraei* sp. n., eine neue Waranart der *V. prasinus*-Gruppe aus West Irian, Indonesien. Herpetofauana 23(133): 5-10.

Bosch, H. 1999. Successful breeding of the emerald monitor (*Varanus p. prasinus*) in the Löbbecke Museum + Aquazoo, Düsseldorf (Germany). Pp. 225-226. In Horn, H.-G. & W. Böhme (eds.), Advances in Monitor Research II, Mertensiella 11. Deutsche Gesellschaft für Herpetologie und Terrarienkunde e.V., Rheinbach.

Dedlmar, A. 1994. Haltung und Nachzucht des Smaragdwarans (*Varanus* (*Odatria*) *prasinus*). Salamandra 30(4): 234-240.

Eidenmüller, B. 2003. Warane – Lebensweise, Pflege, Zucht. Herpeton Verlag, Offenbach. 174 p.

Eidenmüller, B. & R. Wicker. 2005. Eine weitere neue Waranart aus dem *Varanus prasinus*-Komplex von der Insel Misol, Indonesien. Sauria 27(1): 3-8.

Engle, K. 2004. Breeding behavior of the canopy goanna (*Varanus keithhornei*). Australia Zoo online publication. http://www.australiazoo.com.au/conservation/publications/breeding%20behaviour%20of%20the%20canopy%20goanna.pdf (Accessed 18.11.2012)

Greene, H. 1986. Diet and arboreality in the emerald monitor, *Varanus prasinus*, with comments on the study of adaptation. Fieldiana (Zoology) 31: 1-12.

Irwin, S. 2004. *Varanus keithhornei*. Pp. 401-405. In Pianka, E.R., D. King & R.A. King (eds.). Varanoid Lizards of the World. Indiana University Press, Bloomington.

Jacobs, H.J. 2002. Zur morphologischen Variabilität der nominellen Smaragdwaran-Taxa *Varanus prasinus* (H. Schlegel, 1839) und *V. kordensis* (A.B. Meyer, 1874), mit Bemerkungen zur Erstzucht des letzteren. Herpetofauna (Weinstadt) 24(137): 21-34.

Jacobs, H.J. 2003. A further new emerald tree monitor lizard of the *Varanus prasinus* species group from Waigeo, West Irian (Squamata: Sauria: Varanidae). Salamandra 39(2): 65-74.

Kiehlmann, D. 2012. http://www.forum.waranwelt.de/index.php?page=Thread&threadID=7325&pageNo=1 (Accessed 18.11.2012).

Köhler, G. 1989. Lebensweise, Haltung und Nachzucht von *Tupinambis teguixin* (Linnaeus 1758). Salamandra 25(1): 25-38..

Köhler, G. 2004. Inkubation von Reptilieneiem. Herpeton Verlag, Offenbach. 254 p.

Kroneis, M. 2012. Der Grüne Baumpython: Vom mysteriösen Absterben schlupfreifer Jungtiere. Terraria 36: 33-43.

Mendyk, R.W. 2012. Reaching out for enrichment in arboreal monitor lizards. Animal Keepers‘ Forum 39(1): 33-36.

Mertens, R. 1942. Die Familie der Warane (Varanidae). Erster bis dritter Teil. Abhandlungen der Senckenbergischen Naturforschenden Gesellschaft 462, 465, 466: 1-391.

Meteoblue.com. 2012. http://www.meteoblue.com/de_DE/wetter/vorhersage/woche/dobo_id_17482 (Accessed 18.11.2012).

Mohr, F. 2011. http://www.forum.waranwelt.de/index.php?page=Thread&threadID=6439 (Accessed 18.11.2012).

Nijman, V. & C.R. Shepherd. 2009. Wildlife Trade from ASEAN to the EU: Issues with the Trade in Captive-bred Reptiles from Indonesia. Traffic Europe, Brussels. 23 p.

Pelgen, J. 2011. http://www.waranwelt.de/index.php?option=com_content&view=article&id=199 (Accessed 18.11.2012).

Phillips, J.A. & G.C. Packard. 1994. Influence of temperature and moisture on eggs and embryos of the white-throated savannah monitor *Varanus albigularis*: Implications for conservation. Biological Conservation 69: 131-136.

Rogner, M. 1994. Echsen 2: Warane, Skinke und andere Echsen sowei Brückenechsen und Krokodile. Verlag Eugen Ulmer, Stutgart. 270 p.

Simon, F. 2011. http://www.forum.waranwelt.de/index.php?page=Thread&threadID=6439 (Accessed 18.11.2012).

Sprackland, R.G. 1991. Taxonomic review of the *Varanus prasinus* group with descriptions of two new species. Memoirs of the Queensland Museum 30(3): 561-576.

Sprackland, R.G. 1999. The emerald monitor. Reptile & Amphibian Hobbyist 4(11): 8-16.

Valoras, G. 1998. Monitoring the wildlife trade in the European Union: Assessing the Effectiveness of EU CITES Import Policies. Traffic Europe, Brussels. 50 p.

Wallace, A.R. 1869. The Malay Archipelago. Periplus Editions, Hong Kong. 488 p.

Walsh, T., D. Chiszar, G.F. Birchard & K.A. Tirtodinngrat. 2002. Captive management and growth. Pp. 178-195. In Murphy, J.B., C. Ciofi, C. De la Panouse & T. Walsh (eds.), Komodo Dragons: Biology and Conservation. Smithsonian Institution Press, Washington.

Wesiak, K. 2010. http://www.forum.waranwelt.de/index.php?page=Thread&threadID=5740&pageNo=2 (Accessed 18.11.2012).

Ziegler, T., M. Strauch, T. Pes, J. Konas, T. Jirasek, N. Rütz, J. Oberreuter & S. Holst. 2009. First captive breeding of the blue tree monitor *Varanus macraei* Böhme & Jacobs, 2001 at the Plzen and Cologne Zoos. Biawak 3(4): 122-133.

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