

## Notes on Breeding *Varanus albigularis* in Captivity

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This account describes two successful captive breeding attempts for *Varanus albigularis*; the first occurring in 2000, and the second in 2006. Different lizards were involved in each event.

The two *V. albigularis* involved in the first breeding attempt (2000) were a 7 year old male and a 4 year old female, both of which were originally wild-caught and unrelated. The monitors were maintained in an apartment where they were free to roam the different rooms. Their primary room offered a shallow layer (ca. 1 cm deep) of substrate consisting of a sand and soil mixture atop a concrete floor. Furnishings consisted of large stones and several thick tree branches. Heat and light were provided by six 150 watt reflector bulbs and four full spectrum bulbs (*Zoo Med Laboratories, Inc. San Luis Obispo, CA, USA*). This room's daytime ambient temperature was ca. 24-26 °C, and basking temperatures ranged between 35 and 40 °C. Night-time ambient temperature varied between 19 and 21 °C, depending on the season. The monitors were fed five times a week on a diet of mice, day-old chicks, rats, locusts, and occasionally hard-boiled eggs. This diet has proven to be successful after several years, and none of the monitors have ever become obese or lethargic. It is felt that feeding quantity and quality are crucial in the reproduction of monitors. Vitamin supplementation was added to the food twice weekly, and water was provided daily.

In the first week of May 2000, the male showed typical varanid courtship behavior, consisting of spasmodic head movements when approaching the female, and tongue-flicking around the female's body, especially on the neck and head. This courtship behavior lasted for a week. Intense copulation began on 12 May, and ended 15 May. Copulation did not occur in the primary room, but instead took place in the adjacent rooms where temperatures were lower, around 20 °C (Figures 1 & 2). On average, mating occurred four times a day, with short breaks in between where both lizards rested close to each other. After this three day period, both monitors were observed sheltering together in the same hide spot, and showed no further mating activity. Both used this area as their primary shelter during this period, but also spent



Figures 1 & 2. Copulation of *Varanus albigularis*

nights together in various other locations such as beneath slabs of tree bark positioned in various rooms of the apartment, and in closets. One week later, a large wooden nesting box measuring 180 x 90 x 40 cm, was placed in the primary room. The box was filled with a sand and soil mixture to a depth of ca. 35 cm, and was left open for easy viewing. A 100 watt heat lamp suspended from the ceiling to a height of ca. 30 cm above the nest box was directed down onto the nesting substrate, and the substrate moisture levels were monitored daily. Approximately 4 weeks after the last observed copulation, the female showed a special interest in the nest box by repeatedly digging in it. This behavior lasted for several days, as she searched for a suitable place to lay. During this time, her appetite decreased, and she refused to feed four days prior to oviposition.

Overnight, between 17 and 18 June 2000, the female deposited a clutch of 21 eggs atop the sand and soil substrate covering the concrete floor, ignoring the nest box provided (possibly not deep enough). During oviposition, the female positioned herself inside a hollow tree trunk with only her hind limbs and tail exposed, allowing for perfect viewing of the laying process. The female laid her first egg on 17 June at 2400 h, and her 21st egg on 18 June at 0900 h. An additional 3 eggs were laid between 19 June and 20 June atop the substrate covering the cement floor. By using her rear limbs, she carefully pushed each egg into a pile between her hind limbs. Eggs averaged 7 cm in length and 4 cm in width. No nest guarding behavior or aggression was observed in the female towards the male.

All eggs were removed from their site of deposition, and set up for incubation in two separate incubators in order to accommodate the entire clutch. Eleven eggs were incubated in a Brinsea Hatchmaster (*Brinsea Products Ltd. North Somerset, England, UK*), maintained at 30 °C with a humidity of ca. 70-80%. The other 13 eggs were placed in a plastic container inside an aquarium partially filled with water and heated with a 40 watt heat lamp connected to a thermostat. The temperatures within the aquarium incubator ranged between 28-31 °C, and the humidity ranged between 70-95 % . All eggs were partially buried in a water and vermiculite mixture prepared at a ratio of 1:1 by weight (Figure 3).

Of the 24 eggs incubated, 7 successfully hatched; 4 in the aquarium incubator after 150 days of incubation, and 3 in the commercial incubator after 180 days of incubation. The 17 eggs which did not hatch began to look bad towards the end of incubation, and were dissected. One egg contained a dead embryo, and, the others appeared to be infertile; each containing a gelatinous, reddish-colored mass. All seven surviving hatchlings emerged from their eggs on their own without any assistance over the course



Figure 3. (Partial) Clutch of eggs.



Figure 4. Hatchling emerging from egg

of several days, mostly during the night or in the early morning (Figures 4 & 5). Upon emerging, two hatchlings had residual yolk sacs and umbilical stalks attached, which soon fell off after rubbing their abdomens on the substrate.

All seven hatchlings (Figure 6) were set up in a plexiglass enclosure which offered a floor space area of 100 x 40 cm. At night, hatchlings sheltered clustered together under a slab of tree bark. Hatchlings began feeding on crickets after 48 h.

The next successful breeding began in May 2006. Two unrelated lizards were involved in this breeding; a 6 year old captive-bred female originating from the 2000 successful breeding, and an 8 year old male of wild-caught origin. Both lizards were kept together with eight other adult monitor lizards (7 *V. albigularis*: 4 females and 3 males; and one female *V. salvator*) in a spacious cellar measuring ca. 18.5 m<sup>2</sup>, which was furnished specifically for the lizards. Shelters, branches, and stones to climb on were provided, as well as a water container large enough to allow the monitors to fully submerge their bodies when needed. As in the previous breeding, lighting and heating were provided by five 150 watt reflector bulbs and one 160 watt full-spectrum Power Sun reflector lamp (*Zoo Med Laboratories, Inc. San Luis Obispo, CA, USA*). The room's temperatures were comparable to those offered in the 2000 breeding. All copulation occurred in this cellar. Courtship was similar to the 2000 breeding, and lasted for two weeks.

Deposition of 16 eggs occurred at night on 2 June 2006, after a gestation period of 30 days from the last observed copulation. As in the previous breeding, the eggs were laid atop the sand substrate, however no nesting box was provided for this event, based upon the previous female's taking to laying atop the substrate. All 16 eggs were incubated in the same Brinsea incubator, maintained at 30 °C and 90 % humidity. This increase in humidity from that used in the 2000 breeding was not intentional.

The first egg hatched on the night of 19 November 2006, after 180 days of incubation, and by morning, the hatchling had fully emerged from its egg. By 3 December 2006, six more hatchlings had emerged from their eggs. The remaining nine eggs failed to hatch, and dissection once again revealed that these eggs were infertile, containing no developing embryos.

Although involving different individuals, both breeding events were very similar with respect to observed reproductive behavior and hatching results. Seven monitors hatched from clutches of 24 and 16 eggs, respectively. A clutch of 25 eggs, laid on 24 May 2007, resulting from the same pair involved in the 2006 breeding, is currently incubating in both incubators used in the 2000 breeding. As with previous



Figure 5. Emerging hatchling in hand



Figure 6. Captive-bred offspring

clutches, oviposition occurred at night, and once again the female made use of a hollow tree trunk as cover while she deposited the eggs atop the substrate.

Despite receiving healthy hatchlings from each breeding, the cause for the poor egg viability and hatch rates experienced in both clutches remains unknown. In the wild, it would be expected that female monitors deposit their eggs in safe, secure areas protected from extreme climatic conditions and potential predators. Therefore, depositing eggs on the surface of the substrate is unlikely normal nesting behavior, and suggests that the nesting options provided may be insufficient. Further testing of different nesting media, depths of media, temperature ranges, and moisture content may help resolve this issue, and provide further insight into the nesting preferences of captive *V. albigularis*.