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A Third Captive Generation of Komodo Dragons (*Varanus komodoensis*) at Rotterdam Zoo, The Netherlands

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Abstract - At Rotterdam Zoo, *Varanus komodoensis* has been bred to the third generation. Four offspring hatched in the enclosure of the parents. Total length and weights of the hatchlings are tabulated. A short discussion on imbreeding of this species in zoos is presented.

Introduction

In 1992, the first hatching of the Komodo dragon, *Varanus komodoensis*, outside of Indonesia occurred at the Smithsonian National Zoological Park in Washington D.C., USA, where 13 young dragons were born from wild-caught parents (Walsh et al., 1993). In 1995, in a great gesture of international cooperation, the management of the zoo in Washington D.C. sent several of these overseas to Komodo dragon keeping institutions, among them the zoos of Berlin and Rotterdam. Together with the few *V. komodoensis* that were already in European zoos, this became the nucleus of a new population.

Breeding Program

After an international zoo meeting in 1998 at the Zoo of Thoiry in France, it was decided to start a European Studbook for the *V. komodoensis* in the European zoo community, under the umbrella of the European Association of Zoos and Aquariums (EAZA). An international studbook as well as an American studbook, were already in place at the time. Two years later this European Studbook evolved into a so called "EAZA EEP", a standardized breeding program for endangered species.

The program was and still is, coordinated by the Rotterdam Zoological and Botanical Gardens (Rotterdam Zoo, The Netherlands). The senior author of this paper became the species coordinator for Europe. In 2000, the population consisted of 17 animals in eight institutions (Visser and Belterman, 2000).

The First European Births

In 1999, Rotterdam Zoo was one of the zoos to receive three (1.2) young dragons from Washington. Four years later, it was decided to send one of those females to Reptilandia reptile park on Gran Canaria, Canary Islands, Spain for reasons of available space and most of all, for the climatic benefits; on the Canary Islands, *V. komodoensis* can remain outside under almost natural conditions for most of the year.

In 2001, Reptilandia managed to obtain a pair of captive born, F1 *V. komodoensis* from Gembira Loka Zoo, Yogyakarta, Indonesia, and so an unrelated potential F1 breeding pair was established. This resulted in a clutch of 32 eggs in February 2004 and, in September of the same year, the first hatching of F2 *V. komodoensis* in Europe, and within the EEP. A total of 17 young hatched successfully (Pether and Visser, 2007).

Further Births in Europe

Following Reptilandia's breeding, several births occurred in Europe. At the Zoological Society of London's London Zoo in Great Britain, one sexually-conceived F2 hatchling was born in August 2006. However, the event that had rocked the international reptile community prior to this hatching, was the birth of 4 parthenogenetic dragons in March 2006 (Watts et al., 2006; Sunter, 2008). In 2007, a further eight parthenogenetic *V. komodoensis* hatched at Chester Zoo (Great Britain).

Meanwhile, Prague Zoo (Czech Republic) had received an adult F1 pair from Indonesia (born in Taman Safari, Indonesia), which later produced three hatchlings in April 2007 (Velensky, 2007).

The Rotterdam Situation

In order to get the best possible results, animals within the EEP are placed in the most potentially favorable circumstances, which implies that in several cases adult *V. komodoensis* were moved around to different European zoos and replaced by subadults or even hatchlings that were born elsewhere within the EEP. This is done to make up for the "loss" of a nice adult specimen and with it the attraction value such an animal has for the public of the zoo in question. In that respect, the cooperation between zoos in this EEP is exemplary.

For Rotterdam, it meant that we had to send our large, and then solitary male to Great Britain, to be paired up with females at Chester Zoo. In return, Rotterdam Zoo received a young sibling pair from Gran Canaria (born September 2004) for exhibition purposes.

In July 2008, matings were seen, but since it is generally accepted that *V. komodoensis* reach sexual maturity at five or six years of age, these events were regarded as a form of "play" behavior, and no results were expected. The female was 3.5 years of age at the time. As it is rather easy to over-feed these animals, they were kept on a strict diet and therefore the animals grow

Fig. 1. The sibling pair of *V. komodensis* on exhibit at Rotterdam Zoo just after their arrival in 2007. Photograph by **Gerard Visser / Archives Zoo Rotterdam**

slowly. Hence, the pair is small compared to what was customary in the past. This rather smallish female indeed showed no signs of being gravid at all.

F3 Generation

We were of course greatly surprised to first find two, and then another young *V. komodoensis* in the 120m², fully-planted Komodo dragon exhibit on 10 and 11 March 2009. As we had noticed the "copulations" in July, the eggs may have been laid in August 2008. When we found the young dragons, the yolk sack had been fully absorbed, so we believe the young may have been a day or two old. The eggs had been buried in the exhibit's substrate, which was comprised of hard, loamy soil approximately one meter deep., in which the parents have dug several burrows and tunnels. Thus, in this soil, the eggs must have been incubating for ca. eight months.

After the young were found, we searched for the nest, further eggs, or egg shells, but nothing was found. To find the nest would have meant a total demolishing of the entire exhibit, which was, and still is not feasible.

Two months later, on May 10, we found another hatchling, adding up to a total of four youngsters. This is an indication of a prolonged hatching process. Since these hatchlings were born to an F2 sibling pair, they represent the first captive F3 generation of *V. komdoensis* ever produced.

The measurements and weights of these hatchlings (Table 1.) fall into the low end of the range of weights and lengths known from other captive born hatchlings that were artificially incubated. The animals show no birth defects. Additionally, the estimated incubation period seems to be rather normal. This would imply that the conditions in the soil of the exhibit were well suited for the incubation of monitor eggs, even during the rather cold winter of 2008-2009 when the ambient

Fig. 2. An F3 hatchling, two weeks after birth, feeding on a locust.
Photograph by **Marten van Dijl / Archives Zoo Rotterdam**

temperatures dropped to as low as 25ºC on cold days.

Inbreeding Allowed?

Although captive breedings involving sibling pairs is not recommended within the EEP-breeding programs, these animals can still play a significant role in the population. They may serve as "exhibit only" animals for zoos that just wish to keep *V. komodoensis* without further breeding goals, or as replacement animals for adults sent out to be grouped with others to form breeding pairs, and, in case of an emergency, they could still be used for breeding purposes in the future. The aim of the EEP is to keep genetic variability at a maximum level, so hopefully inbreeding will be a last resort. Our goal remains that the European *V. komodoensis* population will develop without further inbreeding. For that purpose, the EEP has sought and found cooperation with the zoos of Pretoria (South Africa) and Singapore. At the moment, several pairs are in position to breed and three institutions have received eggs in 2009. At the moment there are 19 participating zoos (in comparison to 8 in 2000), with a few more on the waiting list. The number of *V. komodoensis* in European collections has risen to 42 specimens, from just 17 in 2000. Hence, the future of the European *V. komodoensis* population may not be as gloomy as it seemed to be just a few years ago.

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Appendix

Table 1. Hatchling morphometrics.

No.	Snout-vent Length (cm)	Total Length (cm)	Weight (g)
1	17.5	41.1	85
2	18.0	40.3	85
3	17.5	42.5	90
4	14.5	39.0	70

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