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Varanus Komodoensis: Thermoregulation in Captivity

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THERMOREGULATION IN Varanus komodoensis (Komodo monitor) IN CAPTIVITY -- A PRELIMINARY REPORT

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INTRODUCTION

The "Komodo dragon" elicits the same type of response among the general public that giant snakes, highly venomous snakes and giant crocodilians bring forth -- intense curiosity tempered with fear. As is often the case, this is the result of a lack of authentic information concerning the biology of the species. Tales of Komodo monitor lizards attaining lengths of 8 meters arose from publications of the traveling naturalists of the early Twentieth Century. In fact one scientist, De Rooij (1915), allowed herself to fall prey to rumor and list the probable maximum length at 7 meters.

Only in the past 6 years have we begun to accumulate some of the basic facts concerning this fascinating reptile. It is now documented that the maximum length is closer to 3.5 meters. The Komodo monitor is unique in that it is the World's largest living lizard species occurring in one of the smallest known geographic ranges. Walter Auffenberg of the Florida State Museum has begun to publish facts on the highly complex predator-scavenger feeding behavior of the species which paint a picture of an extremely complex and intelligent animal which has evolved to deal quite readily with mammalian prey of considerably greater size than itself. In fact it is true that the Komodo monitor has killed humans and killed and eaten water buffalo.

Such an animal is of great educational and entertainment value to the public. And yet Jones (1965) can only document 55 individuals in zoological gardens outside of Indonesia during the period 1926-1964. [Perhaps ten more have been displayed since the publication of Jones' (ibid.) study.] Jones (ibid.) records the total longevity of 40 of the 55 specimens. Perhaps one of the reasons that Komodo monitors are not more common in zoos is that they do not do well at all. The average longevity for the 40 specimens in his study was 3.65 years. This is not a particularly good record for a species that Auffenberg feels may live 50 to 60 years in nature. Furthermore the species has never successfully bred outside Indonesia.

THE PROBLEM

Shortly after I accepted the position as curator of reptiles and

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amphibians at the San Diego Zoo, it became apparent that one of my most pressing problems involved the housing of our two Komodo monitors. These animals had arrived in July of 1968 and had been housed in the heated reptile house during most of the period until 1974. An outdoor enclosure was built to house them year round. The enclosure included heated burrows which could be closed. Several ancillary problems forced the zoo to remove the animals during the colder months and keep them in totally inadequate quarters indoors.

While comparing climatic data taken at the San Diego Zoo over a period of 10 years (1958-1967) with preferred body temperatures recorded in nature by Auffenberg (personal communication) it became apparent that the outdoor enclosure simply could not meet the thermal needs of the Komodo monitor. Fewer than 5 (average = 4.4) days per month in San Diego were warmer than 23.3°C (74°F) between November and June inclusive. Auffenberg (personal communication) has recorded an average cloacal temperature of 35.6°C (96.8°F) in 27 active monitors on the island of Komodo. McNab and Auffenberg (in press) have noted cloacal temperatures in the monitors of 36°C to 40°C (96.8°F to 104.0°F) between 1000 hours and 1700 hours in the wild.

The animals were finally removed from the old enclosure in October of 1975 when one apparently fell one meter from a basking site and suffered a spiral fracture of the right humerus which required surgery and a stainless steel plate.

THE SOLUTION

During the fall and winter of 1975-76 a new enclosure was designed and is presently being built. Dr. Auffenberg consulted on burrow structure, dietary and thermal problems. He also positively identified the sexes of our two animals. They are both female.

Construction of the new indoor-outdoor enclosure was begun in April of 1976 and is due to be completed in June of 1976.

The indoor portion is enclosed in glass and includes heated burrows and a pool as well as keeper facilities and enclosed viewing for the public. Heat to supplement the solar heat coming through the glass roof will be supplied by individually thermostatically controlled radiant gas heaters. The exact locations of these heaters will be determined empirically. I wish to establish a thermal gradient within the enclosure whenever it is artificially heated to allow the animals to thermoregulate as normally as possible.

Our department lost two Komodo monitors in 1964-65 almost certainly due to low temperature. At necropsy, both had suffered from severe gastroenteritis. However, as Peaker (1969) and others have pointed out, high temperatures are just as deleterious as low temperatures to the proper management of ectothermal animals in captivity. Therefore, I feel wherever possible ectotherms should be allowed to thermoregulate within a variable thermal environment.

THE STUDY

In order to determine the response of our monitors to their new environment, it was decided that one of our summer Curatorial Fellowships would be devoted to an analysis of the thermoregulatory behavior of the animals in the enclosure. The study will commence in June of 1976 and observations will continue until June of 1977.

It would be a very short-lived project if we were to attempt to take cloacal temperatures with a thermometer. It was decided to use biomedical telemetry techniques to avoid such hazards. Small transmitters will be custom made for this project (some types of transmitters are commercially available) and fed to our animals. The signals will be picked up by the antenna of an FM receiver and converted to pulses by a Heathkit Counter (IM-4100). The pulses will be permanently recorded on paper by a Heathkit Strip Chart Recorder (IR-18M).

Two types of data will be transmitted. We will be able to study not only deep body temperature but the rate of peristalsis as well. The study will be carried out under conditions of both natural and artificial heating. While functioning in the artificial mode, we will experiment with various thermal gradients. The various ambient temperatures and gradients will also be recorded.

These data should allow us to compare the patterns of thermal regulation of our captive animals with those documented for wild animals by McNab and Auffenberg (in press). The latter feel that the thermal inertia imposed on these monitors by their mass (up to 100 kilograms) is one of the species important adaptations while at the same time providing the animals with one of its most complex problems. Large animals (monitors included) heat up quickly and cool down slowly. The average preferred body temperature is only 7°C below the lethal temperature [42.7°C (109°F)]. Thermal stress is noted only 5°C above the preferred body temperature. An animal that cools slowly and heats rapidly must thermoregulate carefully to avoid thermal difficulties.

Hopefully our data will allow us to make these comparisons and perhaps thereby construct an adequate thermal environment for these animals. When this hurdle has been cleared, we can move to the next challenge which presents itself along the road to a successful husbandry program.

LITERATURE CITED

De Rooij, N. 1915 The Reptiles of the Indo-Australian Archipelago. I. Lacertilia, Chelonia, Emydosauria. Leiden 382 pp. 132 figs.

Jones, M.L. 1965. The Komodo Dragon, International Zoo News 12(3): 92-93.

McNab, B.K. and W. Auffenberg (In Press) The effect of large body size on the temperature regulation of the Komodo dragon, Varanus komodoensis, and other reptiles.

Peaker, M. 1969. Some aspects of the thermal requirements of reptiles in captivity. International Zoo Yearbook 9: 3-8.