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# HISTORICAL FACSIMILES

The following article by E.C. Stirling, originally published in 1912, represents the first published account on the natural history, ecology and behavior of *Varanus giganteus*. Likewise, it also represents one of the first truly detailed accounts on the ecology of varanid lizards, reporting field observations and notes made by several Australian naturalists including Francis James Gillen, the eponym of *V. gilleni*. This account also appears to document the first known living representatives of *V. giganteus* maintained in captivity. Thus, the following article is an important contribution to the biology of this species as well as to the history of varanid lizards in captivity.

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Stirling, E.C. 1912. Observations on the habits of the large Central Australian monitor (*Varanus giganteus*), with a note on the "fat bodies" of this species. Transactions and Proceedings of the Royal Society of South Australia 36: 26-33.

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## Observations on the Habits of the Large Central Australian Monitor (*Varanus giganteus*), with a Note on the "Fat Bodies" of this Species

By E. C. STIRLING M.D., Sc.D., F.R.S. [Read June 13, 1912]

As the opportunity of observing, at close quarters, the large Central Australian Monitor lizard, *Varanus giganteus* - and for that matter the same may be said of many other of our native fauna - does not often occur, I have thought that a few notes respecting some of their habits may not be without interest to members of the Society.

By the kindness of Mr. G.K. Grant Warren, of Balariung, William Creek, the National Museum received on February 9 of this year two living specimens of this species, both males, as was subsequently ascertained by dissection. Unfortunately by the misapplication of terms which is so common in Australia, the name "goanna" is commonly applied to this, as well as to some other species of Australian Varanidae, the word being generally understood to be a corruption of iguana, which properly belongs to quite a different group of lizards that is unrepresented in Australia. The origin of the name Monitor, which constitutes the vernacular designation of the Varanidae, is peculiar. The native

name of the Egyptian representative of this group is "ouaran," which is the Arabic term for lizards in general; this word written as 'waran' has been confused with the German "Warnen," to warn, hence these reptiles have been called Warn-eidechsen, or warning lizards, and it is this erroneously derived idea of warning, or admonition, which has found expression in the Latin term Monitor. (1)

The particular species, *Varanus giganteus*, is known locally in regions adjacent to Lake Eyre as "Perentie," or by its variants "Perinthie," or "Parenthie," which words I believe have originated from a native name, though I am not aware of the tribe to which it belongs. Further north, in the MacDonnell Ranges, it is called Echunpa, in the Arunta language, and it gives its names to one of the most important totem divisions of that tribe.

For some time we have been anxious to prepare for the Museum collection some properly-mounted specimens of this reptile, and, with that view, we were glad to have the opportunity of keeping them under

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(1) "Royal Natural History", R. Lydekker, Section ix., p. 150.

observation so that we might learn something of their habits and attitudes, of which very little appears to be known. With this view they were placed together in a large wire-netted cage, about 10 ft. long by 4 ft. wide by 3 ft. high, which gave them plenty of room to move about.

Though, from what can be gleaned from books, there appears to be a general similarity as to habits in all the members of this well-marked and widely-spread group, I could find but the scantiest references to this Australian species, and, supplementing our own observations by the results of inquiries made from those who know the animal in its wild state, I am able to offer a few notes of a little-known reptile that may not be without interest. Incidentally our observations have enabled us now to mount specimens in natural attitudes and so to correct various errors into which even the most careful taxidermist can scarcely avoid falling if he has never seen the animal he deals with alive.

In this connection one may express regret that so many reproductions of badly, or unnaturally, mounted specimens, or of inaccurately-drawn plates, have found their way into books of natural history purporting to give true representations of the animals in their natural state. These reproductions, repeated as they so often are from book to book, or serving as models for other mounted specimens, lead to the perpetuation of very erroneous ideas as to the real attitudes and true appearance of the animals in life. It is hoped that the illustrations accompanying this paper, which are reproductions from photographs of the living animals, will, so far as the species is concerned, at least serve as faithful models, either for the taxidermist or zoological artist, of an animal not often observed at close quarters. I think it will also be acknowledged that the Museum taxidermists have in their recently mounted specimens very accurately reproduced some of the unsuspected yet, as it appears, very characteristic attitudes of these reptiles.

The two monitors, received in a perfectly sound and healthy condition, and in process of shedding their skin in patches, were kept under observation in their cage for over three months. From what I had heard of their great voracity and comprehensive tastes in their wild state I anticipated that there would be no difficulty in feeding them, but though eggs, dead and live mice and sparrows, live guinea pigs, and a live rabbit were at different times placed in the cage, they voluntarily ate nothing, and, with the exception to be mentioned directly, they did not attempt to interfere with any of these animals, nor did the latter show any fear of their formidable companions.

Thinking the reptiles might at length be feeling the effects of starvation, and it was evident that they were becoming emaciated and less active, they were on two occasions taken out of their cage and forcibly fed with strips of raw meat—a matter of some little difficulty in the case of the larger specimen on account of his size and strength. It was after the second of these feedings, when possibly excited by the handling or by the taste of meat, that the larger reptile seized the live rabbit, then in the cage, by the loins, holding on to it with a bulldog grip that was never changed or relaxed until the victim died. But it made no attempt to eat the rabbit, though this was left dead in the cage for two days. The guinea pigs used to run over the reptiles, sometimes even perching on their heads in the most confiding way.

The result of this abstinence from food was a progressive emaciation and dwindling vigour, though on being excited they showed themselves still capable of powerful and active movements. Even at the end of the starvation period of three months the larger specimen still retained, as was shown by dissection, two solid masses of fat weighing a pound each. These will be subsequently described.

In their wild state, Mr. Warren informs me, the Perentie is practically omnivorous as regards flesh foods, its diet mainly consisting of other lizards, snakes, birds, eggs, the smaller animals, and, of late years, the rabbit, the only animal of small size that is immune to its attacks being the echidna. The late Mr. Gillen told me he saw one catch and kill a one-third grown kangaroo, and then, placing his forefeet on the body, it tore out pieces of flesh like a dog.

Everyone that has seen these reptiles in their wild state testifies to the extraordinary pace with which they can travel over the ground, and that agility was still manifest in our specimens under the limitations of their cage. In this, when moving quickly, their gait was distinctly quadrupedal, the body, head, and tail being raised some inches above the ground, but, I am informed by Mr. P. Barbe Ayliffe, that when travelling at their topmost speed the forelimbs are raised from the ground, so that their gait then becomes bipedal. We had, however, no opportunity of observing this under the restricted space in which our specimens were confined. I have myself seen this mode of progression, which recalls that attributed to some of the extinct dinosaurs, to take place in the Frilled Lizard (*Chlamydosa, urus kingii*), and it has also been noticed by Mr. J. Rau, one of our taxidermists, in the case of *Amphibolurus cristatus* under extreme speed. It is probable, I think, that closer observation would show a similar mode of progression

for other of the more swiftly moving lizards.

One feature of the Perentie became immediately apparent, *viz.*, the habitual use of the long and muscular tail as a weapon of offence. Whenever the animals became excited either by the suspicious movements of one another, or by being touched by a rod, or even by the too close presence of spectators, most vigorous blows that resounded against the sides of the cage were struck with this organ. The striking of the blow could generally be anticipated by the preparatory attitude in which the tail was held, that is to say, it was flexed well to one side in a curved position, the muscles being manifestly tense. To prevent any obstruction to the blow the thick proximal part and the end of the tail were held clear of the ground so that it touched only by a limited length of its middle portion. Mr. Gillen, who was well acquainted with these animals, informed me that he once saw a large Perentie knock down a native woman in this way by a blow on the legs, and Mr. Warren writes that he had known both forelegs of a dog to be broken in a similar manner. No one who has seen the force of these blows could have any difficulty in accepting such statements.

This offensive use of the tail is described (2) in the case of *Varanus salvator*; apparently the largest member of this group, which inhabits Ceylon, the Malay Peninsula, and the islands of the Malay Archipelago, and extends, according to the British Museum Catalogue of Lizards (1885), to the Cape York Peninsula of Queensland, but I have not seen the habit noticed in the case of *Varanus giganteus*. It is, however, not unlikely a common feature of the larger members of the group. When alarmed the Perenties have a habit of running up tree in their efforts to escape, which they do with extraordinary swiftness; they have been known, also, to run up a man or a horse, probably, in their alarm, mistaking these vertical objects for trees. On one occasion, at Alice Springs, Mr. Gillen treated the lacerated breasts of a lubra who had been attacked by one, and, according to this informant, the blacks, who have a fear of these animals, state that such attacks were not uncommon. It may be, however, that the attacks are not deliberate, but that in their alarm and desire to escape they run up the first vertical object that presents itself, under which circumstances wounds would not unlikely result from the very sharp and strong claws or even from the teeth.

Notwithstanding the fear of the natives for these

reptiles their flesh is esteemed a great delicacy, and it is no doubt in consequence of the appreciation of it by the adults that it is one of the foods (which, it may be observed, are generally of some gastronomic merit) that are forbidden to uninitiated boys of the tribe. (3) I have also heard white men speak approvingly of the flesh of the tail of the Perentie, though in the case of one man who had often tried he stated that it always induced vomiting.

The aspect of the head and neck is very snakelike, and it was noticed that in moving amongst the branches of a dead limb placed in the cage in imitation of a small tree that the Perentie was able, while holding on by the grasp of its hind limbs only and by utilizing the tail as a lever, to project the rest of the unsupported body into space while seeking for a hold for the fore paws.

When excited or provoked they utter a sound which may be described as a combination of a hiss and of a continuous blowing sound like that of a blacksmith's bellows, and under these circumstances of provocation the throat is inflated into a large and conspicuous pouch, often to a more considerable degree than is shown in pl. iv., figs. 1 and 2; the long-forked tongue is also protruded and withdrawn with lightning-like rapidity.

They are stated to be capable of being readily tamed, and I have been told of one that used to appear regularly at stated times to be fed and to follow its adopted master about.

In their native habitat they usually live in holes in the ground, and, according to Mr. Warren, they prefer a hole that enters under a rock to one in the open ground. In these holes they hibernate from May to August, living sometimes singly and sometimes male and female together.

**Distribution.**-As is so often the case with many of our Australian animals, we have very little information as to the exact distribution of this species. Many, indeed, of our animals have already become extinct without our having been able to answer this question, and it will probably be the same with many others. Mr. Gillen told me that they occur in Central Australia from about Strangways Springs, in the south, to Hann's Range, about 80 miles north of the MacDonnell Ranges, but as to its range east and west of this tract I have no information. Its favourite habitat being rough, stony country, its distribution is no doubt largely determined by these conditions. The late

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(2) "Reptiles of the World", R.L. Ditmars.

(3) Spencer and Gillen, "Native Tribes of Central Australia", p. 471.

Mr. John Bagot used to speak of them as common and of large size on what was, then, his Peake Station, which comprised the country around Warrina, and Mr. Warren writes that they are only found on certain limited parts of the rough country on Anna Creek Station.

So far these limits constitute *Varanus giganteus* a Central Australian species, but in the British Museum Catalogue of Lizards (1885) one, the type of the species, is stated as having come from the "North Coast of Australia," which seems to indicate that the species may have a more extended range than is indicated by its Central Australian distribution.

**Size.**-In this respect, as might be anticipated of such relatively large lizards, one hears most exaggerated statements. The late Mr. John Bagot, however, assured me that he had seen specimens 7 ft. 6 in. in length, and I have it from Mr. Gillen that one killed by himself measured 7 ft. 2 in. The total length of the largest of the few stuffed specimens recorded in the British Museum Catalogue of Lizards (1885) is given as 206 cm, or 6 ft. 9 in., but it is not stated whether this measurement referred to the actual animal, to the skin, or to the mounted specimen. A detailed statement of the dimensions of our

own specimens will appear directly, but in the meantime it may be said that the total length of the larger of the two was 5 ft. 10 in., and of the smaller 5 ft. 4 in. and that their weights, at the close of what was practically a starvation period of more than three months, during which they manifestly lost bulk, were respectively 17 lb. and 9 lb. It will thus be seen that though not differing greatly in length there was a very marked difference in the weight of these two specimens. Not long ago we received the skin of a specimen from William Creek, the length of which, when mounted, is identical with that of the larger of our two living specimens, but this skin may have been somewhat stretched in its removal, which is very liable to happen under the hands of an unskilled operator, who was in this case an aboriginal. Relatively large amongst other lizards as are these land reptiles, they are, nevertheless, the dwarfed descendants of much larger lacertilian forms, for we have in the Museum a few vertebrae of an extinct Monitor (*Varanus priscus*, Owen) obtained at the Warburton River which, if the size may be reckoned by crocodilian comparisons, must have been 20 ft. in length, or possibly even larger.

Table showing dimensions of two specimens of *Varanus giganteus*:

	Male A. cm.	Male B. cm.	Longest Specimen in British Mus. Cat. Of Lizards (1885)
Total length	179.5	163	206
Head (maxm.)	13.6	12	14 (5)
Neck	18	15	22
Body	47.8	42.5	53
Tail	100	93.5	117
Fore limb	25.2	21	27
Hind limb	32.1	29	35
Weight, in lbs. (after 100 days' starvation period)	17	9	-

(4) This is the type specimen

(5) It is not stated whether this refers to the maximum length of the head or to that taken in the median line, which falls short of the former. In our own specimens the maximum length is given.

In the description of the conspicuous colour-markings of this species the British Museum Catalogue, while correctly stating the neck and throat to be marked with large blackish reticulations on a white ground, adds that the belly is immaculate. In the larger of the two above-mentioned Museum specimens the chest was marked by four well-marked single, irregularly zig-zagging, but on the whole, transverse black bands, and the belly by six double bands of similar disposition, the reticular pattern appearing on the sides. A very little fore-and-aft approximation, however, of the ventral bands would have formed a reticular pattern by the meeting of the angles of the zig-zag lines. In the smaller specimen the belly was marked with a reticular pattern similar to that on the sides of the neck, only much fainter in colour.

***Fat-bodies (Corpora adiposa).***-A median longitudinal incision through the front of the abdominal walls exposed on either side a large lobulated, dorsoventrally compressed mass of firm, bright-yellow fat, which, but for its slender vascular attachments at the posterior end, lay free in an apparently closed extra-peritoneal cavity. The inner or median wall of this cavity was formed by a smooth, tough membrane, which apparently constituted the parietal peritoneum of the abdomen, while on the outer side the fat mass lay in close contact with the glistening inner surface of the lower ribs and abdominal walls.

The constituent lobules composing these fat masses were, for the most part, irregularly, transversely arranged, the length of the lobules being generally coincident with the width of the adipose mass, though some fell short of this, and, in consequence of their close and accurate coaptation, the body as a whole appeared as a more or less superficially lobulated, but otherwise compact, mass. The compactness was, however, only apparent, for the constituent lobules were very easily and naturally separable from one another, being held together only by a superficial connective tissue capsule

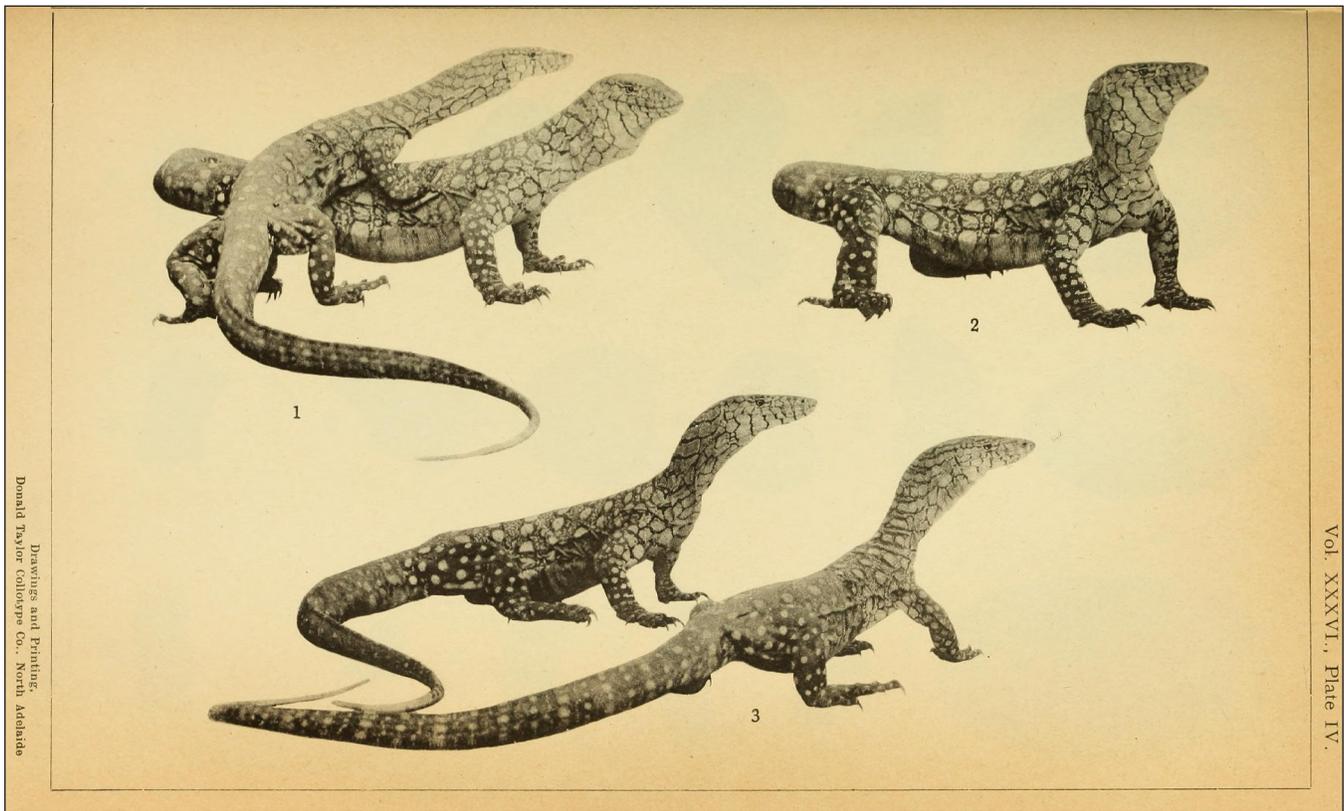
of extreme tenuity and slight vascularity on the front and back of the organ, but of rather firmer texture at the ends of the lobules, where these together formed the lateral margins of the body. Thus, when the removed fat mass was held up by one end, the weight of the dependent lobules was sufficient to rupture to a great extent the connective tissue attachments of the lobules on the front and back, so that these fell away from one another for the greater part of their length) remaining joined chiefly at their ends, that is to say, at the lateral edges of the body, where the inter-lobular attachments were strongest. The appearance under these circumstances was that of a thick pad or cushion of fat perforated by transversely disposed fenestrae, these apertures being widest at points corresponding to the centres of the lobules and becoming narrower and more slitlike towards their ends, where they still remained attached.

The combined weight of the two masses in the largest specimen at the close of a three and a half months' starvation period was 2 lb.

Concerning the full significance of these fat bodies our knowledge is still incomplete, but according to C. K. Hoffmann (6) they correspond to the *corpora adiposa* of Amphibians and have some relation to the sexual activities, a view which is supported by their periodic increase and decrease of size. They reach, says this writer, their maximum of development in Spring. From the composition of these bodies it is also reasonable to suppose that they may serve as reservoirs of fat to be utilized for nutritional purposes during the hibernation period, but if so it is remarkable that they should still have been so large (constituting 12 per cent. of the total body weight) at the close of the long fast, when all other obvious adipose tissue had disappeared from the body. As, however, the animals when killed had evidently shrunk in bulk, particularly in respect to the region of the trunk, it is very probable that some amount of reduction in the fat masses had taken place.

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(6) Bronn's Thierleben Abt 3, Reptilien (Eidechsen und Wasserechsen, p. 994).



**DESCRIPTION OF PLATE IV.**

*Varanus giganteus.*

The three figures, taken from life, represent the animals in characteristic attitudes. In figs. 1 and 2 the larger specimen shows the gular pouch inflated to a moderate degree; the latter figure also shows the body completely raised from the ground, and the tail, here concealed behind the body, was also similarly raised, as well as strongly flexed. The great length of the tail is shown in figs. 1 and 3, and the snake-like appearance of the head is seen in the case of the smaller animal in both these figures.