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NOTES ON THE BIOLOGY OF *VARANUS EREMIUS*

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Varanus eremius, the Desert Goanna, is one of the most widespread of the Australian "pygmy" goannas, but also one of the least known. This handsome lizard (Figure 1) was described in 1895 by Lucas and Frost and later accurately figured in colour by the same authors (Lucas and Frost, 1896). These workers noted that Baldwin Spencer found the type specimen on the ground under logs and debris. Except for Loveridge (1934), who states that his collector (W. E. Schevill) reported that a Hermannsburg specimen had eaten a mouse, nothing new has since been published

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about this species. The present paper is based upon 43 specimens lodged in the Australian state museums, plus 53 specimens in my own collection. Most of my observations were made in the Western Australian sector of the Great Victoria Desert; a few were made in the Great Sandy and the Tanami Deserts.

Figure 2 is a spot map showing known localities. Closed circles represent records based upon specimens I have examined, open ones those which I have not seen. The stippled area indicates the probable limits of distribution. Exact localities are listed below, using the following abbreviations: AM (Australian Museum), NMV (National Museum of Victoria), NTM (Northern Territory Museum), SAM (South Australian Museum), WAM (Western Australian Museum), and ERP (personal collection). Specimens reported in the literature but not known to be in the above collections are listed along with the appropriate reference.

NORTHERN TERRITORY: NMV D159, D160 (Alice Springs); NMV D1418, D2071, D3557 (Central Australia); NMV D527, SAM R532 (Charlotte Waters); AM R11903, R11904 (Coniston Station); AM R10854-6, SAM R76-79 (Hermannsburg); NMV D478 (Illamurta, James Range); NMV D9136, WAM R11353 (Idracowra); NTM R2148 (Lander River Floodout; 20° 04½', 131° 37'); NTM R2147 (Refuge Basin, Tanami Sanctuary; 20° 32', 130° 56½' and 20° 08½', 130° 29½'); NMV D2947, SAM R6090 (Tennant Creek); ERP 11554, 11572, 11589 (21 miles E. Sandy Blight Junction); ERP 11626 (10 miles NNW. of Chilla Well); ERP 11636, 11654, 11668 (7 miles SE. of The Granites); Finke River (Loveridge, 1934); Hermannsburg (Loveridge, 1934).

SOUTH AUSTRALIA: AM R7635 (407 miles, E-W. Line); Immarna (Kinghorn, 1924); NMV D99 (Oodnadatta).

WESTERN AUSTRALIA: WAM R28015 (Boologooroo); WAM R14916 (Mileura); WAM R11353 (Mullewa); WAM R28023 (10 miles N. of Mt. Davis); WAM R17081 (3 miles E. Roebourne); WAM R20082-4, SAM R4487-9 (Tambrey); WAM R14658, R22020

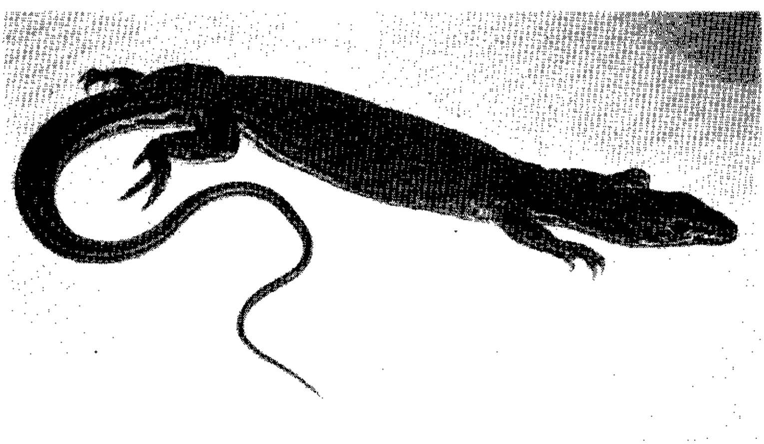

Figure 1—An adult female *Varanus eremius* from the Great Victoria Desert. The dorsum is reddish-brown flecked with spots of cream and black, the tail longitudinally striped with cream and dark brown. Ventral surfaces are white except for the diagnostic grey patterning on the throat.

(Warburton Range); WAM R22001 (presumably Warburton Range); WAM R27230 (Wanjarri Station, Kathleen Valley); NMV D1772, D1787 (Middalya); NMV D9140-1 (280-300 miles NW. of Mt. Doreen, N.T.; ERP 12742 (62 mi. SW. Wiluna); ERP 13655 (15 mi. SW. Youanmi); ERP 13368 (9 mi. N. Millrose HS); ERP 11082 (8 mi. W. Neale Junction); ERP 10351, 11124, 13013 (16 mi. S. Neale Junction); ERP 11046, 12052, 12830 (24 mi. ENE. Laverton); ERP-10 specimens (21 mi. W. Lorna Glen HS); ERP-12 specimens (16 mi. S. Atley HS); ERP-14 specimens (6 mi. NE. Dunges Table Hill); Labbi Labbi Rockhole, 50 mi. N. Lake Mackay (Thomson and Hosmer, 1963).

Although at present there are no records from Queensland, it is probable that further collecting will turn up *eremius* in the Birdsville area.

Varanus eremius is predominantly a lizard of sandy, spinifex-dominated country. But, at Boologooroo, Mullewa, and Roebourne in Western Australia, it probably occurs on somewhat harder soils.

Whereas larger goannas such as *V. gouldi* become completely inactive during the winter months (at least in the Great Victoria desert), *V. eremius* is active all year long. In fact, there is some indication that this species may be more active in the winter than in the summer (Figure 3). On cold winter days it emerges late and does most of its foraging during the midday, while on hot midsummer days individuals are active as early as 0800 hours and appear to spend the heat of the day underground.

The frequency of its unique and conspicuous tracks suggests that *V. eremius* is common in sandy deserts. However, it is extremely wary and hence seldom seen. In spite of this a great

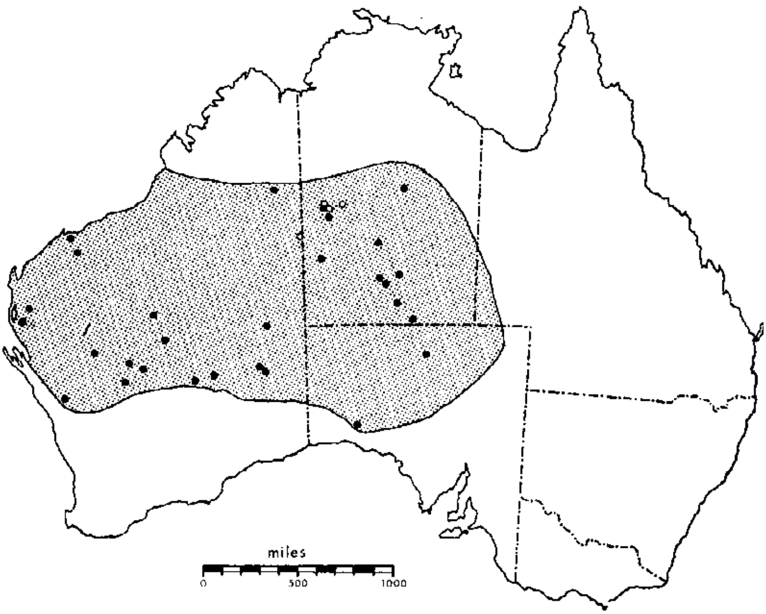

Figure 2 Known localities of collection of *Varanus eremius*. The open circles represent localities based upon specimens the author was unable to examine.

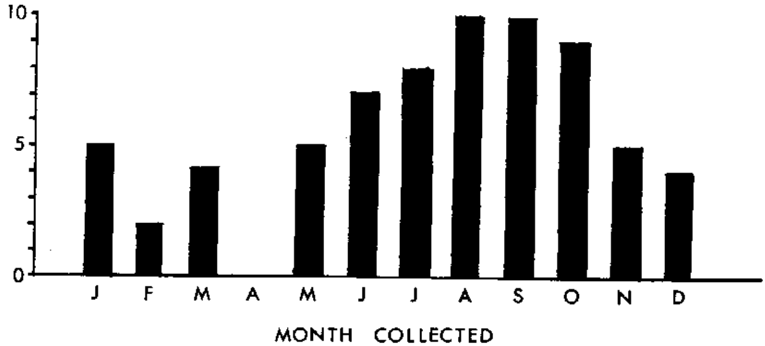

Figure 3—Histogram showing the number of specimens collected during different months, suggesting greater activity during the late winter and early spring months.

deal about its activities and habits can be deduced from its track; many of the statements to follow are based upon impressions gained while following *eremius* tracks. Individuals usually cover great distances when foraging, and I have often followed a fresh track for distances up to half a mile. Tracks indicate little tendency to stay within a delimited area; if there is a "home range," it must be an extremely large one. These small goannas are attracted to fresh holes and diggings of any sort, and almost invariably will visit any man-made digging within a day or two after it is made. In contrast to *V. gouldi*, *V. eremius* apparently never do any digging for their prey, but rather rely largely upon catching it above ground. In a typical foraging run, an individual often visits and goes down into several burrows belonging to other lizard species (especially the complex burrows of *Egernia striata* where these occur). It is uncertain whether this is in search of food, related to thermoregulatory activities, or involved with escape responses. In any case, an *eremius* apparently remembers the exact positions of the burrows visited, since, in case of emergency, it will usually run directly to the closest one.

TABLE 1.—SUMMARY OF STOMACH CONTENT DATA (N=67). 24 stomachs were empty. Volumes measured in cubic centimetres.

Food Item	Number	Volume	% of Total Number	% of Total Volume	Frequency
Centipedes	1	0.5	1.6	0.8	2
Scorpions	1	0.1	1.6	0.2	2
Grasshoppers	26	16.0	40.0	23.9	38.2
Roaches	2	1.0	3.2	1.3	4
Caterpillars	1	0.1	1.6	0.2	2
unidentified insects	3	0.9	4.8	1.3	5
Lizards	24	47.5	35.1	70.9	30
unidentified partially digested material	8	0.75	12.0	1.1	11
Totals	66	67.0	99.9	99.8	

Table 1 summarizes the results of examination of 67 stomachs, listing food items by both number and volume and giving the frequency of occurrence (i.e., the percentage of stomachs containing that prey item) of the various food types. It is readily apparent that *V. eremius* feed mainly upon large insects (especially grasshoppers) and other lizards. Although as many grasshoppers are eaten as lizards, their volume and energetic importance is considerably less than that of lizard food. Lizard prey species identified in the stomachs examined include: *Ablepharus butleri, Ablepharus greyi, Ctenotus calurus, Ctenotus grandis, Ctenotus lesueurii, Ctenotus pantherinus ocellifer, Ctenotus quattuordecimlineatus, Delma fraseri, Amphibolurus isolepis gularis, Amphibolurus inermis*, and *Physignathus longirostris*. It is therefore clear that *V. eremius* depend upon fairly large prey items and that they will probably eat nearly any lizard they can overpower. I have often noted an *eremius* track intercept the track of another lizard with evidence of an ensuing tussle. In only one case was an *eremius* actually observed to attack another lizard. On this occasion, a large *V. eremius* leapt out of a loose *Triodea* tussock when a small *Ctenotus calurus* came within a few inches of the edge of the tussock.

Such dependence upon large food items (especially other lizards) is intimately related to the widely-foraging mode of hunting, both being readily understandable in terms of the other. It is a basic ecological principle that secondary and tertiary carnivores must usually be more mobile than either the herbivores or primary carnivores upon which they feed. During the course of foraging, an individual *eremius* may be expected to encounter a certain number of grasshoppers and other large insects. Because of the uncertainty of finding and capturing a lizard on that particular foray, an *eremius* can not afford to pass by such food items. However, there must be some lower size limit to acceptable prey because small insects are not taken. Hence there is some evidence that the capture of prey items smaller than large grasshoppers requires more energy than such food items return to a large and active lizard like *V. eremius*. It might also be that the time an *eremius* would spend upon small prey can be better spent searching for larger foods.

Testes volumes varied considerably in the 38 males dissected, but were generally small during the winter months and largest during the months of September, October and November. Since testes size is a good indicator of breeding activity, it is likely that mating also occurs during these months. Only 6 of the 22 adult females examined were in reproductive condition. Three females collected during the month of October had very large ovarian eggs (from 5 to 10 mm. diameter), one collected during January also had enlarged ovarian eggs (6 mm. dia.), while two other January specimens had large elongated eggs (23-30 mm.)

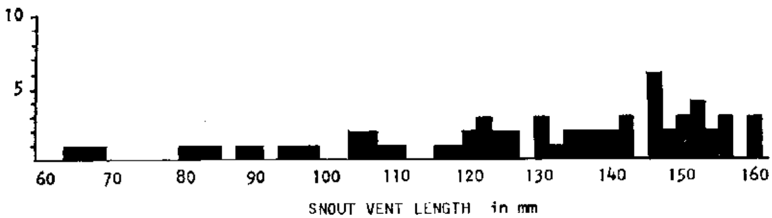

Figure 4—The snout-vent length frequency distribution for the 66 *Varanus eremius* measured. At least six distinct size groups are present.

in their oviducts. Therefore, the eggs are probably deposited in late January or February. The clutch size was either 3 or 4 in the six gravid females examined. In my sample, 64-68 mm. snout-vent length hatchlings first appear in March, but one 66 mm. juvenile was collected in the Tanami desert in June. The smallest specimen collected during July through February measures 80 mm. snout-vent, suggesting fairly rapid early growth of the hatchlings. Polymodal analysis of the snout-vent length frequency distribution (Figure 4) by the method outlined by Cassie (1950, 1954), shows six size groups, which could well represent year classes.

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