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SHORT NOTE

Notes on the adaptive ecology and behaviour of four species of *Rhoptropus* (Gekkonidae) from the Namib Desert with special reference to a thermoregulatory mechanism employed by *Rhoptropus afer*

by

Francois J. Odendaal*

Zoology Department,
University of the Witwatersrand,
Johannesburg

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Four of the members of the gecko genus *Rhoptropus* found in the Namib Desert are *R. afer*, *R. bradfieldi*, *R. barnardi* and *R. boultoni*. They occur in several combinations of sympatry and allopatry. The genus is diurnal, an attribute which may be related to the demand for nocturnal niches in the desert. Spot observations of individuals in the open after sunset were infrequent, and amounted to less than 0,5 % of the total number of summer observations. In winter no lizards were observed in the open after sunset. The observations in summer of lizards in the open after sunset could presumably be explained in terms of individuals absorbing heat off the rocks after dark, or at the end of a hot day possibly cooling off in the cool evening breeze. The possibility of individuals simply omitting to seek cover for the night cannot be excluded.

The genus has a more or less sedentary habit of obtaining food. The lizards sit motionless in wait, often at strategic places that increase the field of view like on a rock overlooking flat rocky surfaces. A small amount of active foraging does take place, however less so in *R. afer* than in the other species. The larger foraging coefficients (time spent foraging/total time of activity) of species other than *R. afer* may be explained in terms of habitat diversity. *R. bradfieldi*, *R. boultoni* and *R. barnardi* generally live in rocky hills or ridges where a great number of cracks and crevices occur, often containing gnats and nocturnal moths. To some extent these species go after prey in these crevices, but by far most of their time is spent employing the sit-and-wait strategy. *R. afer*, living on flat flaky granite surfaces, inhabits a far less diverse habitat with respect to temperature microclimates and microhabitats in general. It is more restricted to desert conditions in its distribution and this may also relate to it being the most sedentary of the four forms occurring in the Central Namib. A number of fairly active lacertid and scincid foragers inhabit the sites in which the former three species were studied including *Mabuya hoeschi*, *M. sulcata*, *Agama spp.*, and *Eremias undata*. The *R. afer* sites, on the other hand, hardly contained any active foragers. Werner (1977) mentions that he has only once seen a lizard other than *R. afer* in the day-time in that kind of habitat around Gobabeb. The present author has seen both *Mabuya longiloba* and *M. occidentalis* in *R. afer* biotope in the Gobabeb area but has found them to occur in extremely low densities so that on some days none were spotted, whereas several hundreds of specimens of *R. afer* can be seen daily on many of the granite substratum sites around Gobabeb.

The genus is morphologically adapted for a rock-living existence by the presence of lamellae under the toes, the other species more so than *R. afer* (Table 1) which can be regarded as an inhabitant of the gravel plains while the other three species generally inhabit koppies or ridges.

* Present address: School of Biological Sciences, The Flinders University of South Australia, Bedford Park 5042, South Australia.

Rhoptropus afer

This species differs significantly from the others in three important behavioural characteristics, namely in nesting behaviour, locomotion and by employing a particular thermoregulatory mechanism.

Fitzsimons (1943) states that the eggs are deposited under stones or large flakes. The present author found that the eggs are laid in sand (but are usually not completely covered by sand) and they are very often not stuck to rocky surfaces as appears to be always the case in all the other forms of the genus. The fifteen laying sites examined by the author were all under the rocky flakes which are an important physical character of all nineteen *R. afer* study sites examined. The laying sites contained one to four clutches of two eggs each which were always partially covered in the sand under the rocky flakes, very often without touching the rock surface. Occasionally eggs were stuck to horizontal granite substrates which were covered by a layer of sand.

R. afer moves in a way characteristic of many terrestrial species. It runs somewhat erratically in spurts, often covering distances of fifty yards or more before stopping suddenly. When stopping it cryptically blends with the environment. This habit of locomotion may be related to the flat flaky habitat in which the lizard cannot simply escape some predators by moving out of reach on a vertical surface. It often has to run some

PLATE 1: Hatched eggs of *Rhoptropus afer* found at Gobabeb.

distance before reaching a shelter. It often happens that the first crack reached is not suitable, either because it is too shallow or because it is already occupied, so that the lizard has to run for shelter again. Its habitat is not normally shared by any other members of the genus, a habitat which is rather more suitable for fast-moving lizards than for a climbing gecko.

A biomechanical examination of body relations may indicate that *R. afer* is a better runner than the other three species which are better climbers (Odendaal, in

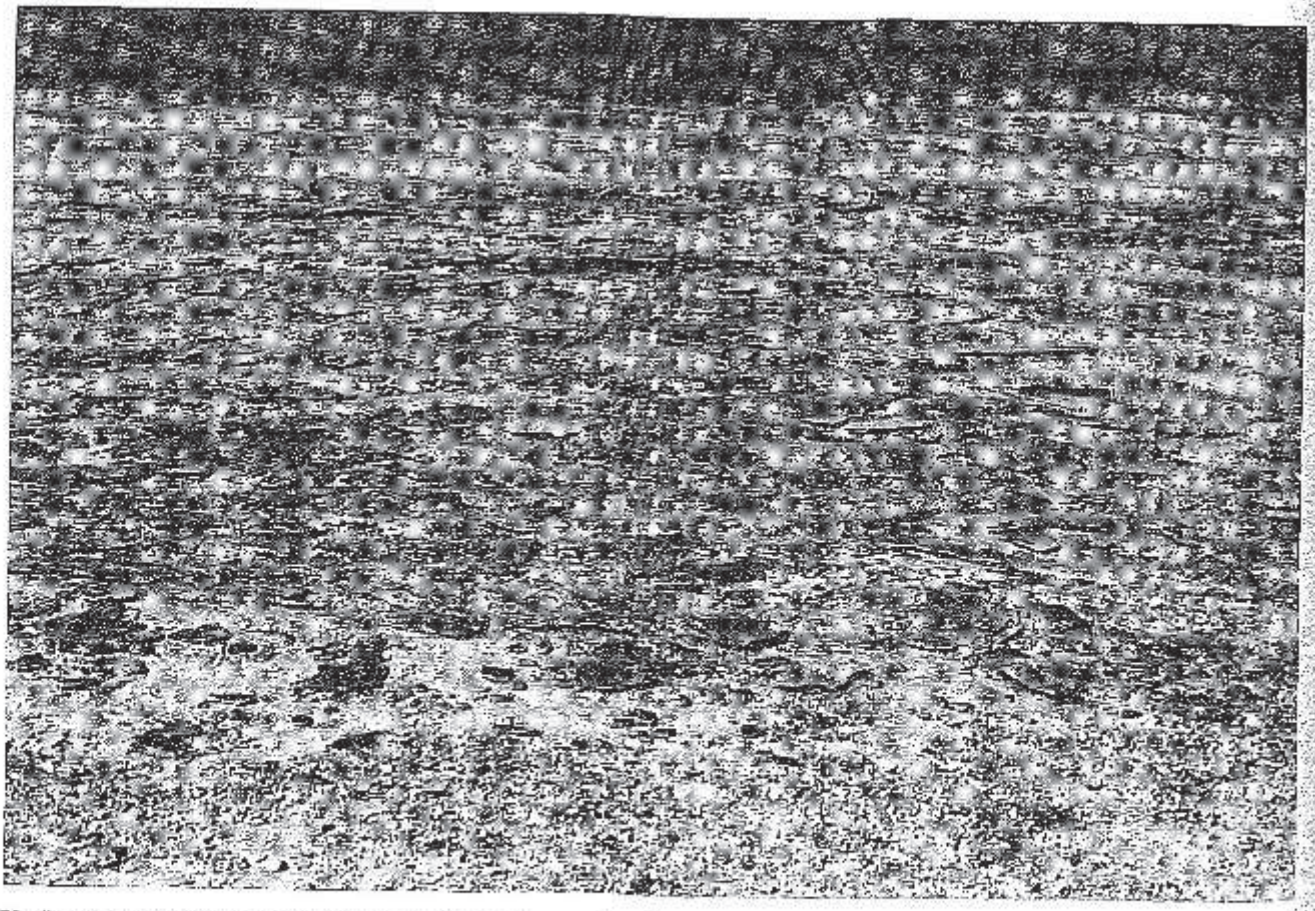

PLATE 2: Habitat of *Rhoptropus afer* in the first interdune valley 4 km SE of Gobabeb.

prep.). A variety of climbing manoeuvres in all angles are performed with apparent ease by *R. bradfieldi*, *R. boultoni* and *R. barnardi*. Using the number of the lamellae under the toes as a parameter, *R. afer* is less well-suited to a climbing existence than the other species of the genus (Table 1). In two sites *R. afer* and *R. bradfieldi* occur sympatrically, but in a situation which approximates ecological allopatry because of spatial niche differentiation. *R. afer* almost exclusively occupied the horizontal aspect of the site while *R. bradfieldi* almost exclusively occupied the vertical surfaces of the boulder.

A particular thermoregulatory mechanism is employed by *R. afer* which involves the utilization of a breeze. The use of this mechanism is a function of the habitat in which the only shade from about 9 h 30 to about 15 h 30 is found in the horizontally situated flaky shelters. In this kind of habitat the lizards will be forced to take cover from the sun for a great part of the day in these cracks and under loose-lying flakes. However, when a breeze is present during these hours, and especially if it is a cool one from the ocean, the lizards do not seek cover, but position themselves in the following position on the rock: the body is lifted as high as possible off the surface of the rock, and sometimes part of the tail as well. The lizard selects the highest physical site in its immediate vicinity. If it is chased off its perch it will resume this original position as soon as permitted. When "breezing" the lizard is most reluctant to leave its perch and go into the rocky shelters. An ambient temperature difference of up to 5°C (but usually 1 – 3°C) between the cooler perch in the breeze and the sheltered air under the rock explains this reluctance in view of the fact that ambient temperatures may be as high as 43°C on a hot summer day. The position of breezing is very distinct from the ordinary basking position. In the early morning the lizard lies flat on the rocky surface. As it becomes hotter, it will lift its head off the surface before eventually taking cover or taking up the breezing position. Individuals were often observed during the hotter hours to be orientated to the sun with an angle minimizing irradiation, and often they were orientated so as to maximize the cooling effect of the breeze, namely by assuming a position ± perpendicular to the wind direction. The importance of wind direction and velocity with respect to the position of a lizard in exchanging energy by convection with the surrounding air has been illustrated by using a metal (silver) lizard model (Bartlett and Gates, 1967).

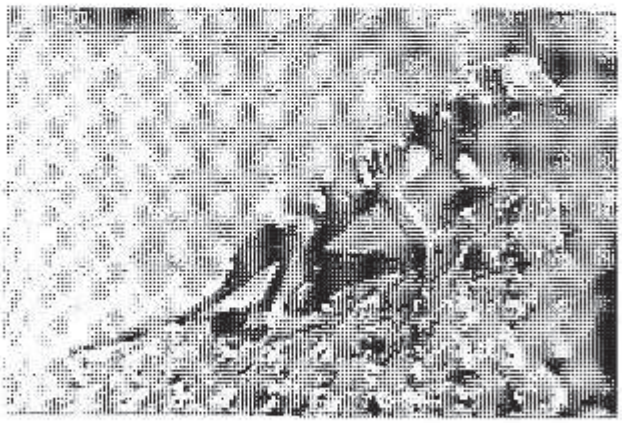

PLATE 3: *Rhoptropus afer* in the "breezing" position.

"It is known that many active lizards maintain their body temperatures within fairly narrow limits which are characteristic of the species and in order to maintain a regular temperature, lizards orientate themselves in their environment so that the establishment of an equilibrium between the heat budget gained and energy lost is resulted. This will result in a body temperature which is characteristic of the species" (Bogert 1959). On hot summer days the "breezing" thermoregulatory mechanism of *Rhoptropus afer* probably plays a major role in maintaining a suitable body temperature. The possibility of the "breezing" position playing a role in territoriality, because it makes a lizard in that position more conspicuous to other lizards was suggested. This possibility can be dismissed since no "breezing" positions were observed at all in winter or on windless summer days.

Rhoptropus bradfieldi

R. Bradfieldi sticks its eggs to rocky surfaces in all planes. The eggs are laid in cracks in clutches of two eggs and the laying sites may be used by one or numerous individuals. Werner (1977) makes mention of two egg-laying sites uncovered behind vertical slabs of exfoliating sandstone surmised to belong to *Rhoptropus bradfieldi*.

This species is an excellent climber and active throughout the entire day, since there is always shade available on the site. They are able to perform a variety of manoeuvres exploiting all angles of the rock face. Its ability to climb in part is manifested by the great number of lamellae under its toes. (Table 1). Two lizards were marked and it was found that they maintained more or less the same locality on a boulder for several days. They display the same behaviour as *R. afer* when a lizard moves into a crack already occupied by another lizard although several individuals may take refuge in a large crevice.

Vocalisation in the form of high-pitched squeaks has been observed when lizards approach one another, indicating a possible role in territory maintenance or other forms of intra-specific interaction. The possibility that it functions in part as a warning system may not be ruled out since several lizards emitted these sounds on occasion in a very short space of time when approached by the author. The tip of the tail is furthermore employed in a flicking movement. This again mostly happens when lizards approach one another, indicating a possible intra-specific communicative function. Occasionally the tailtip appears to be wagged spontaneously since the observer was unable to detect another gecko in the vicinity.

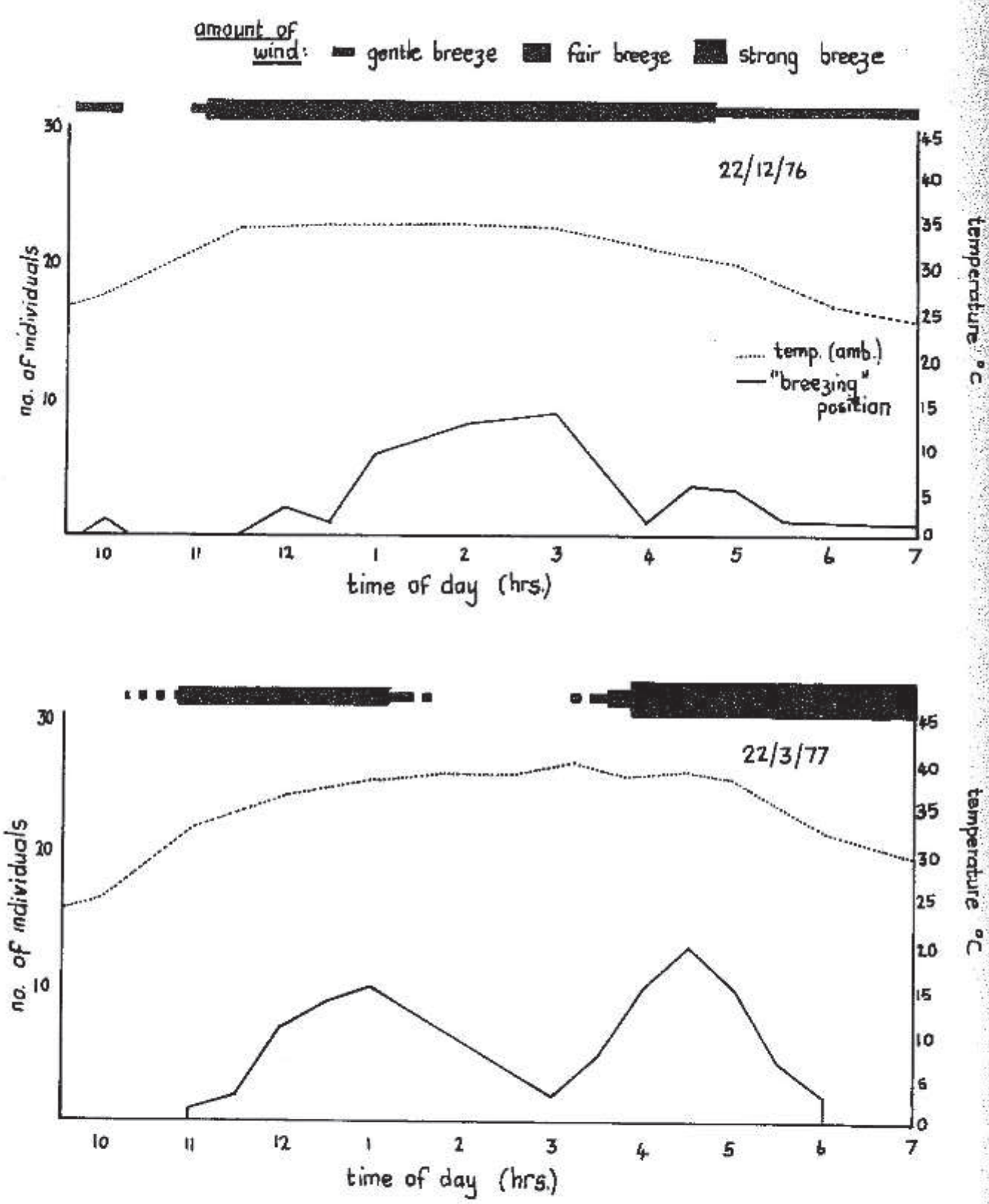

FIGURE 1: Illustrating amount of "breezing" (in no. of individuals) in *Rhagtropus afer* in relation to temperature (ambient) and amount of wind during two days at a flaky granite surface in the first interdune valley, 4 km SE of Gobabeb. Note the correlation between the amount of "breezing" and amount of wind. The graph of no. of individuals was obtained by walking random transects at an even pace across the site for the duration of the whole activity period.

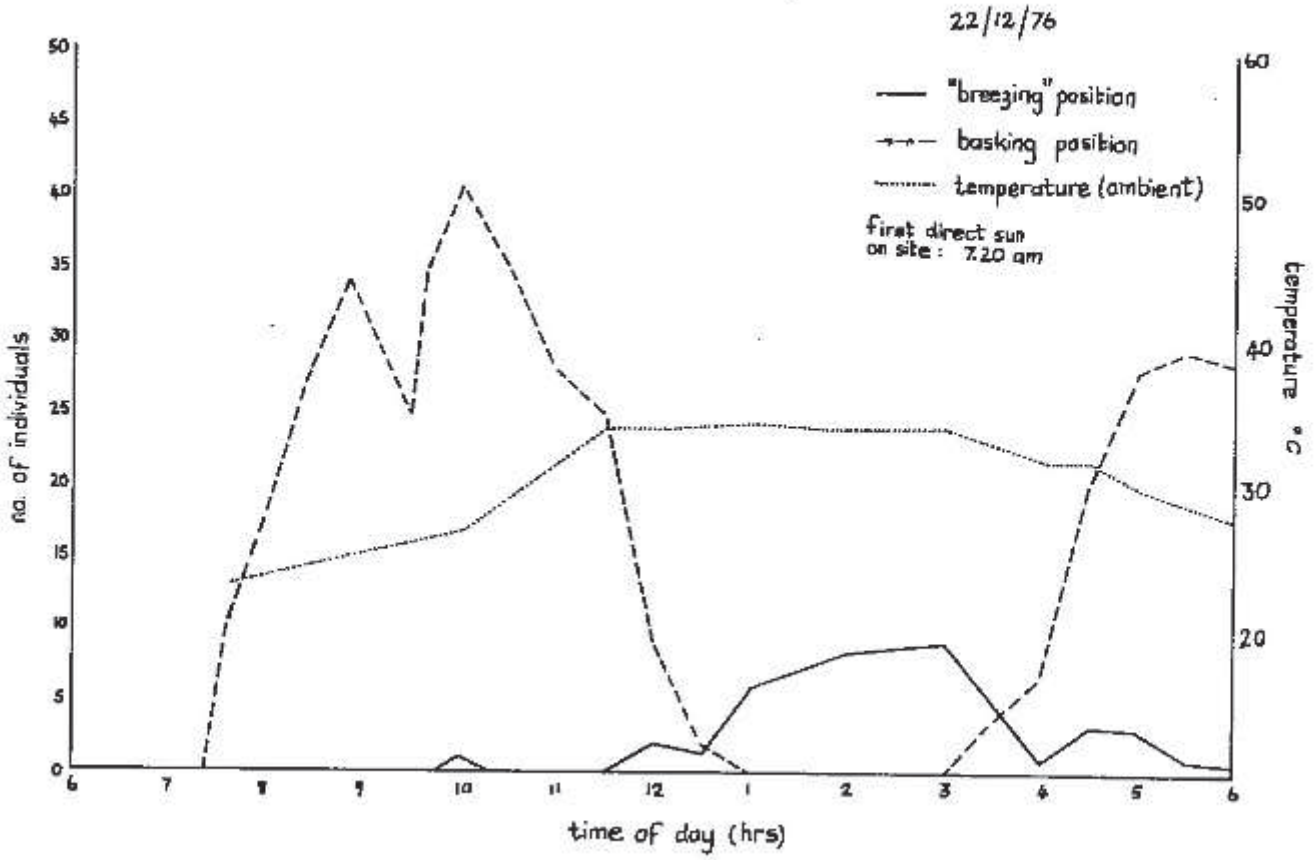

FIGURE 2: Illustrating amount of "breezing" (in no. of individuals) in *Rhoptropus afer* in relation to amount of basking (in no. of individuals) during peak activity period on a fairly windy summer day at a flaky granite surface in the first interdune valley, 4 km SE of Gobabeb. Both graphs obtained by walking random transects at an even pace across the site for the duration of the whole activity period.

TABLE 1: No. of rows of lamellae in three species of *Rhoptropus*.

	digits						
R. afer	I	II	III	IV	V	Total	
foot	6	6–7	7	7	7	33,5	sample size: 30
hand	5–6	6	6–7	6–7	6	31,5	
R. barnardi	I	II	III	IV	V	Total	
foot	7–8	7–8	8–9	8–9	8–9	40,5	sample size: 14
hand	7	7–8	8	8–9	8–9	39,5	
R. bradfieldi	I	II	III	IV	V	Total	
foot	8	8–9	9	10	10	45,5	sample size: 30
hand	8	8–9	9	9–10	9	44,5	
R. boultoni (from V. F. FitzSimons, 1943)	I	II	III	IV	V	Total	
foot	6	7	12	10	8	43,0	
hand	5	7	9	9–10	8	38,5	

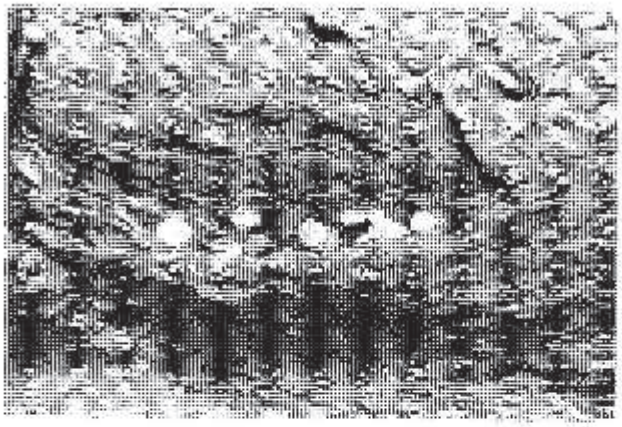

PLATE 4: Eggs of *Rhoptropus bradfieldi* at Bloedkoppie.

Rhoptropus barnardi

Rhoptropus barnardi has similar laying sites to *R. bradfieldi*. They have a tendency to be more communal in laying site choice with laying sites sometimes containing up to more than 200 eggs. The laying sites are also situated in cracks or between boulders. *R. barnardi* is also a good climber and the most generalized in its preference of habitat. It is also found on a greater range of rock types than the other two species. (Odendaal, in prep.).

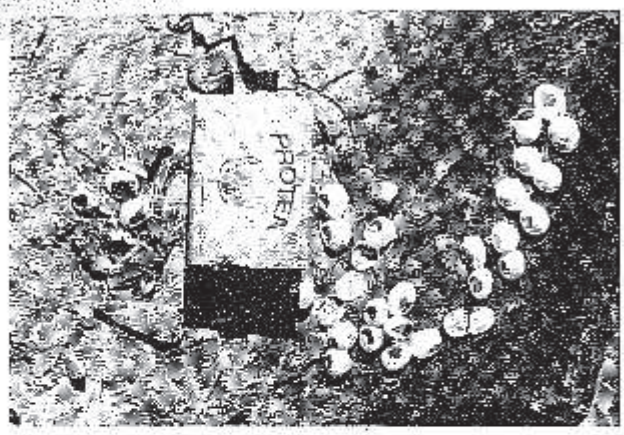

PLATE 5: Eggs of *Rhoptropus barnardi* at Bloedkoppie.

Rhoptropus boultoni

Rhoptropus boultoni was observed casually at various localities in the northern Namib. It was not studied intensively like the other three species but the morphology and behaviour appear to be very similar to that of *R. bradfieldi*.

ACKNOWLEDGEMENTS

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