# A comparative study of the diet of the wedge-snouted sand lizard, *Meroles cuneirostris* (Strauch), and the sand diving lizard, *Aporosaura achietae* (Bocage), (Lacertidae), in the Namib Desert

Gareth W. Murray*
Zoology Department, University of the Witwatersrand and Desert Ecological Research Unit, Gobabeb,
P.O. Box 1592, Swakopmund 9000

Diana Schramm
Desert Ecological Research Unit, Gobabeb
P.O. Box 1592, Swakopmund 9000

*Present adress:
St Stithians College, Private Bag 2, Randburg 2125.

ABSTRACT

The diets of two sympatric lizards, *Metroles cuneirostris* and *Aporosaura anchietae*, collected in the same areas at the same time, were compared by analysis of the stomach contents. Observations of the feeding behaviour of *M. cuneirostris* were also made.

*A. achietae* has an omnivorous diet, with seeds constituting the major portion of the items consumed. *M. cuneirostris* consumes largely arthropods. Although rainfall appeared to influence the relative proportions of the different prey items, prey volumes in the stomachs did not increase significantly after heavy rains.

*M. cuneirostris* has an active bimodal foraging pattern during the day. However *M. cuneirostris* also employs "sit and wait" tactics, often robbing *Camponotus detritus* ants of food and waiting at newly formed termite mounds. Although there is some evidence of opportunistic feeding, *M. cuneirostris* generally appears to be selective in the type of food taken.

CONTENTS



## 1 INTRODUCTION

The Namib wedge-snouted sand lizard (*Meroles cuneirostris*) and the Namib sand-diving lizard (*Aporosaura anchietae*), are two common lacertids from the Namib Desert of coastal south-western Africa (Fitzsimons 1943, Holm and Scholz 1980). These two lizards are of a similar size and are found in narrow sympatry in the parallel dune-system south of the Kuiseb River in the central Namib. *M. cuneirostris* (5-9 g) is found mainly on the lightly vegetated dune base but is also occasionally found in the sandy interdune areas. *A. anchietae* (3-6 g) occurs mainly on the dune slipfaces but is also occasionally found on the dune base or sandy interdune areas. The micro-habitats of these two species thus overlap slightly in the dune environment.

The diets of these two lizards have been previously examined (Louw and Holm 1972, Robinson and Cunningham 1978, Stuart unpublished) but never in the same area at the same time. The object of this study was to compare the diets of these two sympatric lacertids using material collected in the same area at the same time and to observe the feeding behaviour of *M. cuneirostris,* the less well studied of the two species.

## 2 MATERIALS AND METHODS

*M. cuneirostris* and *A. anchietae* were collected from the dunes more than 10 km south of Gobabeb (23° 33'S, 15° 05'E). Lizards were sampled monthly from June 1978 till May 1979. A total of 101 *M. cuneirostris* and 95 *A. anchietae* stomachs were collected and analysed. Between 6 and 12 individuals were captured each month. Stomachs from an additional *M. cuneirostris* were obtained from the same areas during December 1980 and January 1981.

Analysis of the stomach contents was as follows: Number of prey items or segments thereof were counted. Prey items were identified with the aid of a dissecting microscope and a reference collection. The volume (in ul i.e. $mm^3$ ) of prey in each stomach was estimated by spreading the stomach contents uniformly out on a piece of graph paper in a petri dish and estimating the relative areas covered by each prey item, and visually estimating each item's height.

TABLE 1: Monthly stomach analyses of *Meroles cuneirostris.* – Numbers refer to: no. of items and vol. (mm³) respectively (ad = adults; l = larvae).

| No. of stomachs | JUL 78 12 | | AUG 78 11 | | SEP 78 11 | | OCT 78 11 | | NOV 78 6 | | DEC 78 10 | | JAN 79 12 | | FEB 79 9 | | MAR 79 6 | | APR 79 7 | | MAY 79 6 | | DEC 80 6 | | JAN 81 4 | | TOTAL 111 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ORDER SQUAMATA | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Fam. *Lacertidae (Meroles juv.)* | | | | | | | | | | | | | | | | | | | 1 | 450 | | | | | | | 1 | 450 |
| ORDER ARANEAE | 1 | 24 | 15 | 42 | 6 | 16 | 7 | 30 | 2 | 44 | 4 | 195 | – | 24 | – | 6 | 3 | 36 | 2 | 12 | 2 | 2 | 2 | 4 | 7 | 7 | 44 | 435 |
| ORDER SOLIFUGAE | | | | | 1 | 30 | | | | | – | 9 | | | 1 | 6 | | | | | | | | | 1 | 104 | 3 | 149 |
| ORDER ISOPTERA | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Fam. *Termitidae* | 54 | 166 | 2 | 1 | 67 | 1652 | 20 | 1500 | | | | | | | | | | | | | 34 | 40 | | | 17 | 234 | 194 | 3593 |
| ORDER MANTODEA | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Fam. *Mantidae* | 1 | 1 | | | | | | | | | | | | | | | | | | | | | | | | | 1 | 1 |
| ORDER ORTHOPTERA | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Fam. *Acrididae* | | | | | 1 | 105 | | | | | | | | | | | | | | | | | | | | | 1 | 105 |
| Fam. Undetermined | | | | | | | 2 | 2 | 1 | 5 | | | 6 | 450 | | | | | | | 12 | 29 | | | | | 21 | 486 |
| ORDER HEMIPTERA | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Sub-order *Heteroptera* | | | 21 | 85 | 18 | 70 | | | | | 10 | 40 | 4 | 256 | | | | | 1 | 40 | | | | | | | 54 | 431 |
| Sub-order Undetermined | 1 | 10 | 8 | 10 | 7 | 14 | 30 | 197 | 1 | 2 | 2 | 18 | | | – | 12 | 3 | 8 | – | 24 | | | | | | | 52 | 293 |
| ORDER NEUROPTERA | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Superfamily *Myrmeleontoidea* (l) | | | 1 | 21 | | | 1 | 60 | | | | | 4 | 59 | | | | | | | – | 6 | | | | | 6 | 146 |
| ORDER COLEOPTERA | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Fam. *Carabidae* | 2 | 4 | | | | | | | | | | | | | | | | | | | | | | | | | 2 | 4 |
| Fam. *Tenebrionidae* (ad) | | | 18 | 870 | 11 | 81 | 7 | 60 | | | 33 | 1160 | 30 | 128 | 43 | 830 | 22 | 600 | | | | | | | 12 | 720 | 181 | 4449 |
| (l) | 1 | 25 | 4 | 180 | | | 1 | 90 | | | 4 | 130 | | | | | 1 | 40 | 3 | 80 | | | | | | | 14 | 545 |
| Fam. *Staphylinidae* (l) | | | | | 1 | 2 | | | | | | | | | | | | | 3 | 3 | | | | | | | 4 | 5 |
| Fam. Undetermined (ad) | 62 | 60 | 37 | 174 | 52 | 375 | 30 | 115 | 24 | 334 | 7 | 122 | 21 | 102 | 66 | 777 | 16 | 210 | 7 | 14 | 23 | 273 | 2 | 4 | 19 | 174 | 366 | 2734 |
| (l) | | | | | | | 1 | 240 | 2 | 10 | | | | | | | | | | | 4 | 18 | | | | | 7 | 269 |
| Superfamily *Curculionoidea* | | | | | 1 | 126 | | | | | 29 | 288 | 5 | 50 | | | | | | | | | | | | | 35 | 464 |
| ORDER DIPTERA | 2 | 2 | 5 | 4 | | | 1 | 4 | | | 7 | 192 | | | 1 | 16 | | | 6 | 40 | | | | | | | 22 | 258 |
| ORDER LEPIDOPTERA | 1 | 1 | | | | | | | | | | | | | | | | | | | | | | | | | 1 | 1 |
| ORDER HYMENOPTERA | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Superfamily *Formicoidea* | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Fam. *Formicidae* | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Sub-fam. *Formicinae* | | | | | | | 1 | 6 | 44 | 150 | | | | | | | | | 18 | 70 | 5 | 140 | | | 3 | 4 | 71 | 370 |
| Sub-fam. *Myrmicinae* | 19 | 10 | | | | | | | 229 | 343 | 36 | 42 | | | | | | | | | | | 8 | 4 | 1 | 2 | 293 | 401 |
| Sub-fam. Undetermined | | | | | 13 | 35 | | | 2 | 2 | | | | | | | | | | | | | | | | | 15 | 37 |
| Superfamily *Apoidea* | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Fam. *Apidae* | | | | | 5 | 4 | | | | | | | | | | | | | | | | | | | | | 5 | 4 |
| Fam. Undetermined | | | | | 8 | 14 | 1 | 45 | | | | | | | | | | | | | | | | | | | 9 | 59 |
| Superfamily *Ichneumonoidea* | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Fam. *Braconidae* | | | | | | | | | | | | | | | | | 9 | 15 | | | | | | | | | 9 | 15 |
| Superfamily *Chrysidoidea* | 1 | 6 | | | | | | | | | | | | | | | | | | | | | | | | | 1 | 6 |
| Superfamily Undetermined | 29 | 14 | | | 2 | 6 | 46 | 312 | 40 | 103 | 21 | 29 | | | 1 | 40 | 2 | 2 | 68 | 134 | 4 | 2 | | | 1 | 80 | 214 | 722 |
| UNDETERMINED INSECTS (ad) | 12 | 9 | 13 | 28 | 23 | 66 | 3 | 48 | | | | | 24 | 33 | 1 | 32 | – | 24 | 10 | 78 | 10 | 255 | 3 | 12 | | | 99 | 533 |
| (l) | | | 8 | 65 | 1 | 3 | | | | | 3 | 13 | 8 | 94 | 5 | 90 | | | 3 | 9 | 1 | 6 | | | | | 29 | 280 |
| PLANT MATERIAL | 2 | 5 | 6 | 5 | 1 | 2 | 2 | 10 | 1 | 2 | | | | | | | | | | | 4 | 38 | 1 | 4 | | | 17 | 66 |
| UNDETERMINED MATERIAL | | | – | 54 | | | | | | | 1 | 81 | | | – | 9 | | | | | – | 20 | 1 | 8 | – | 45 | 2 | 217 |
| TOTAL | 188 | 337 | 138 | 1539 | 218 | 2601 | 153 | 2719 | 346 | 995 | 1157 | 2317 | 102 | 1196 | 118 | 1818 | 56 | 935 | 122 | 952 | 99 | 829 | 17 | 36 | 54 | 1363 | 1773 | 17637 |
| RAINFALL (mm) | 0 | | 0 | | 0 | | 0 | | 0 | | 0 | | 0 | | 2.75 | | 0.1 | | appr. 4.0 | | 1.6 | | 0 | | 0 | | 8.45 | |

The foraging behaviour of *M. cuneirostris* was observed for 10 days in December 1980 and for 4 days in April 1981 on a 600 m² study area located on the dunes 8 km south of the Kuiseb. Lizard movement and foraging behaviour within this site was recorded by 3 to 7 observers using binoculars. In December the first 3 days were spent observing numerous lizards. From the third day a charcteristic female (2 tailed) was observed and her feeding behaviour recorded. A total of 33,2 lizard observation hours were accumulated during this study period. During April, 23 hours of observations were obtained.

Sand surface temperatures were recorded during observation periods using a mercury thermometer. Readings were taken at half hour intervals.

During December, an estimate of total insect activity was obtained by "fixing" the binoculars on a spot on the sand surface about 10 m distant and counting the number of insects passing through the field of vision in 5 minutes.

Samples of the most common ant species were collected, 160 of the common, unidentified myrmicine ant and 1075 *Camponotus detritus* of various sizes. These were weighed and individual ants measured to obtain an indication of their potential energy yields.

## 3 RESULTS

Analysis of the stomach contents of 111 *M. cuneirostris* (Table 1) indicated that coleopterans were by far the most important food for this lizard species on a volumetric basis. Isoptera and Hymenoptera also figured promimently. In contrast, analysis of 95 stomach contents of *A. anchietae* (Table 2) indicated that seeds were the most common food item both on a numerical and volumetric basis.

When foraging, individuals of *M. cuneirostris* were often observed ascending small tussocks on which they would remain for long periods. From here they apparently preyed upon small myrmicine ants, which constituted the most commonly observed prey consumed by *M. cuneirostris* (Table 3). Termites were the second most common prey type, 68% of which were taken as they moved upward through the sand toward the surface. Whilst the myrmicine ant foraging pattern is indicative of a 'sit and wait' foraging tactic, that of the termites appears to follow an active foraging search.

Sixteen per cent of the total feeding observations involved items robbed from other animals, mainly termites taken from the jaws of *C. detritus*. On more than one occasion, a lizard was observed to lie motionless in the shade of a bush and allow all the solitary *C. detritus* ants to pass. However those ants carrying objects in their jaws were almost always robbed by the lizard. On a few occasions the lizard did not eat the

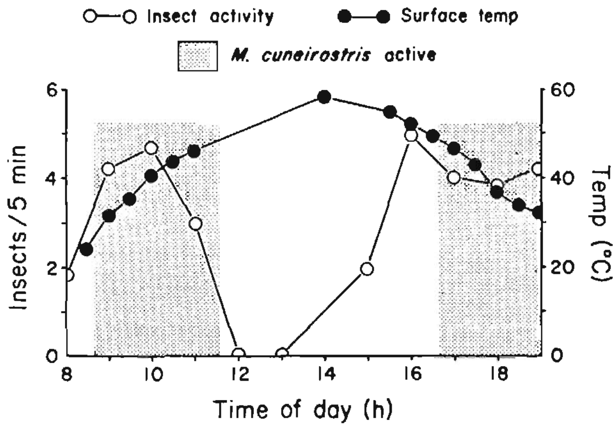


Figure 1: Graph of insect activity and temperatures versus time of day

stolen item which was in each case found to be an inanimate object such as dry faeces.

*C. detritus* was the most common insect observed in the study area although not often consumed by *M. cuneirostris*. It is much larger than the myrmicine ants commonly preyed upon (*C. detritus* — weight: 41,0 mg, n= 1075, length: 12,7 ± 1,7 mm, n = 150; myrmicine ants — weight: 1,5 mg, n = 160, length: 4,2 ± 0,3 mm n = 142).

Insect activity and lizard activitiy, derived from total counts of individuals, were found to be distinctly bimodal with lowest activity during the hottest part of the day and peak activity occurring during the cooler periods of mid-morning and late afternoon, (Fig. 1).

## 4 DISCUSSION

Our observations on the dietary preferences of *M. cuneirostris* and *A. anchietae*, collected from a dune area south of Gobabeb, suggest that *M. cuneirostris* prefers a more insectivorous diet whilst *A. anchietae* a more omnivorous one. Stomach analyses (Tables 1 and 2) indicate that both these lacertid lizards eat a wide variety of arthropod species, consisting mainly of insects. Although *A. anchietae* forages on insects belonging to orders which are amongst those foraged upon by *M. cuneirostris*, monocotyledonous seeds appear to constitute the largest proportion of the diet of *A. anchietae*.

The diet of *M. cuneirostris* has previously been examined by Robinson and Cunningham (1978), in the Kuiseb River floodplain (near Rooibank 23° 9'S 14° 35'E), and by Stuart (unpubl.) in the low vegetaged eastern Namib Dunes (Kamberg Dunes, approx 23° 40'S 15° 40'E). Observed diets in these studies differed considerably from each other and from the current study.

Robinson and Cunningham (1978) found, on a numerical basis, that Lepidopteran larvae, followed by ants (Formicidae), other hymenopterans, tenebrionid lar-

TABLE 2: Monthly stomach analyses of *Aporosaura anchietae*. – Figures in each column refer to no. and vol. (mm³) respectively (ad = adults; l = larvae).

| | JUNE 78 | | JULY 78 | | AUG 78 | | SEP 78 | | OCT 78 | | NOV 78 | | DEC 78 | | JAN 79 | | FEB 79 | | MAR 79 | | APR 79 | | TOTAL | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NO. OF STOMACHS | 6 | | 6 | | 12 | | 11 | | 12 | | 6 | | 12 | | 12 | | 6 | | 6 | | 6 | | 95 | |
| CLASS MONOCOTYLEDONAE | | | | | | | | | | | | | | | | | | | | | | | | |
| Fam. *Gramineae* (seeds) | 17 | 45 | 192 | 360 | 165 | 270 | 14 | 20 | 184 | 400 | 60 | 100 | 50 | 80 | 180 | 300 | 222 | 750 | 102 | 340 | 239 | 540 | 1425 | 3205 |
| CLASS DICOTYLEDONAE (seeds) | 12 | 14 | | | 106 | 160 | | | 112 | 200 | 46 | 40 | 43 | 30 | 186 | 260 | | | 78 | 100 | 57 | 20 | 640 | 824 |
| CLASS ARACHNIDA | | | | | | | | | | | | | | | | | | | | | | | | |
| ORDER ARANEAE | | | 1 | 1 | 1 | 2 | | | 1 | 20 | | | – | 30 | | | | | 1 | 125 | | | 4 | 178 |
| CLASS INSECTA | | | | | | | | | | | | | | | | | | | | | | | | |
| ORDER THYSANURA | | | | | | | | | | | | | | | | | | | | | | | | |
| Fam. *Lepismatidae* | | | | | | | | | | | | | | | | | | | | | 1 | 3 | 1 | 3 |
| ORDER ISOPTERA | | | | | | | | | | | | | | | | | | | | | | | | |
| Fam. *Termitidae* | 2 | 4 | 2 | 1 | | | 1 | 2 | | | | | | | | | | | | | | | 5 | 7 |
| ORDER ORTHOPTERA | | | | | | | | | | | | | | | | | | | | | | | | |
| Fam. *Pyrgomorphidae* | | | | | | | 1 | 300 | | | | | | | | | | | | | | | 1 | 300 |
| Fam. undetermined | | | | | | | | | | | 1 | 32 | | | 1 | 50 | | | | | | | 2 | 82 |
| ORDER HEMIPTERA | | | | | | | | | | | | | | | | | | | | | | | | |
| Sub-order *Heteroptera* | | | | | | | | | | | | | | | | | | | | | | | | |
| Fam. *Tingidae* | | | | | | | 2 | 60 | | | | | | | | | | | | | | | 2 | 60 |
| Sub-order undetermined | | | | | | | | | – | 20 | | | | | | | | | 3 | 9 | | | 3 | 29 |
| ORDER COLEOPTERA | | | | | | | | | | | | | | | | | | | | | | | | |
| Fam. *Tenebrionidae* (ad) | | | | | 6 | 25 | | | | | | | | | | | 2 | 56 | | | | | 8 | 81 |
| (l) | | | | | | | 36 | 1152 | 7 | 350 | | | | | 2 | 100 | | | | | | | 45 | 1602 |
| Fam. *Curculionidae* | 1 | 400 | | | | | | | | | | | | | | | | | | | | | 1 | 400 |
| Fam. *Staphylinidae* (l) | | | | | | | | | | | 4 | 6 | | | | | | | | | 2 | 1 | 6 | 7 |
| Fam. *Meloidae* (l) | | | | | 1 | 81 | | | | | | | | | | | | | | | | | 1 | 81 |
| Fam. undetermined (ad) | | | | | | | 33 | 200 | 6 | 48 | – | 150 | 1 | 24 | | | | | | | | | 40 | 422 |
| (l) | | | | | | | | | | | | | 4 | 24 | | | | | | | | | 4 | 24 |
| ORDER DIPTERA (l) | | | | | 3 | 15 | | | | | | | | | | | | | | | 1 | 1 | 4 | 16 |
| ORDER HYMENOPTERA | | | | | | | | | | | | | | | | | | | | | | | | |
| Fam. *Formicidae* | | | | | | | | | | | 5 | 5 | | | | | | | | | | | 5 | 5 |
| Fam. *Chalcidae* | | | | | | | | | 6 | 8 | | | | | | | | | | | 1 | 1 | 7 | 9 |
| Fam. undetermined | 1 | 1 | | | 2 | 1 | | | | | | | | | | | | | | | | | 3 | 2 |
| UNDETERMINED INSECTS (ad) | | | | | 13 | 30 | | | 20 | 105 | – | 20 | | | | | 2 | 4 | – | 50 | | | 35 | 209 |
| (l) | | | | | 10 | 50 | | | 2 | 6 | | | | | | | – | 9 | | | | | 12 | 65 |
| (pupae) | | | | | | | | | | | | | | | 6 | 240 | | | | | | | 6 | 240 |
| UNDETERMINED MATERIAL | | | – | 49 | | | | | | | | | – | 110 | – | 200 | | | | | | | – | 359 |
| TOTAL | 33 | 464 | 195 | 411 | 307 | 634 | 87 | 1734 | 332 | 1109 | 122 | 251 | 97 | 424 | 376 | 1174 | 226 | 819 | 184 | 624 | 301 | 566 | 2260 | 8210 |
| RAINFALL (mm) | 0 | | 0 | | 0 | | 0 | | 0 | | 0 | | 0 | | 0 | | 2.75 | | 0.1 | | appr. 4.0 | | 6.76 | |

TABLE 3: Observed feeding responses of *Meroles cuneirostris* during the December 1980 and April 1981 study periods. Active, robbed and dead refers to prey individuals that were active at the time of their capture; individuals that were robbed from other organisms and dead individuals respectively

| Prey type | Active | Robbed | Dead | Total |
|---|---|---|---|---|
| Myrmicine ants | 51 | – | – | 51 |
| C. detritus | – | 1 | 3 | 4 |
| termites | 19 | 9 | - | 28 |
| dipterans | 1 | – | - | 1 |
| unidentified | – | 4 | – | 4 |
| | | | | 88 |

vae and weevils (Curculionidae), were the preferred dietary items of *M. cuneirostris*. Orthopterans, mantids, and wasps were reported to have been eaten seasonally, but tenebrionid adults and larvae, other Coleoptera, ants, undetermined Hymenoptera and lepidopterans were taken nearly every month.

Stuart's (unpubl.) analyses (Table 4) indicated that isopterans, adult and larval coleopterans and ants were significant prey items, with a high percentage occurence each months.

The present study revealed that an unidentifiable form of adult coleopteran, other hymenopterans, tenebrionid adults and termites contributed substantially to the diet of *M. cuneirostris.*

Apparent differences (Table 5) in the prey preferences could be related to the faunal and ecological differences between the three habitat types, although the data necessary to confirm this are currently not available.

The study by Robinson and Cunningham (1978) near Gobabeb on the diet of *A. anchietae,* is comparable to the present study. Both studies suggested that this lizard has an omnivorous diet. In both studies, insects were the largest animal component. On a numerical basis grass seeds, followed by *Trianthema hereroensis* seeds, unidentified bugs (Hemiptera) and thysanurans dominated the diet of the *A. anchietae* examined by Robinson and Cunningham (1978). Grass seeds, dicotyledonous seeds, adult tenebrionids, undetermined adult coleopterans and undetermined adults insects were numerically dominant prey items in the present study. Both studies thus indicate graminous seeds to be important in the diet of *A. anchietae.* According to Robinson and Cunningham (1978) seeds of several species of grass (*Stipagrostis gonatoschys, S. ciliata, S. sabulicola* and *S.* cf. *namaquensis*), are available at all times of the year and constitute an important energy resource for *A. anchietae.*

Availability of some of the prey items noted by the 3 studies may reflect responses to climatic factors. The rainfall that was recorded during Robinson and Cunningham's (1978) study (87mm) was much higher than that recorded for the Kamberg or Gobabeb studies (although 107,5 mm of rain had fallen prior to the commencement of the 1980 study.) Heavy rain may produce an expansion of the niches occupied by certain animals and plants to the extent that overlap occurs in specific instances (Seely and Louw, 1980).

Differences in foraging behaviour, i.e. active foraging versus a 'sit and wait' type foraging tactic, has been suggested by Huey et al (1984) to reflect differences in locomotor capacity or even differences in potential activity levels. However, both the physiology and morphology must be expected to affect the locomotor abilities of lizards. *M. cuneirostris* and *A. anchietae* seem well adapted to living in narrow sympatry in the Namib Desert. They are morphologically similar and have a very similar diurnal activity pattern, but they differ markedly in their diet, reproductive activity and habitat (Goldberg and Robinson 1979). Differences in

TABLE 4: Monthly stomach analyses of *Meroles cuneirostris* from the kamberg dunes during 1974. (C. Stuart unpubl.). Numbers refer to % occurence – calculated using number of prey items. (ad = adults; l = larvae).

| | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC | TOTAL | MONTHLY |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. of Stomachs analyzed | 11 | 0 | 13 | 15 | 13 | 16 | 12 | 16 | 8 | 21 | 15 | 10 | 151 | 13,73 |
| Order Scorpiones | | | 8 | | | | | | | | 7 | | 15 | 1,36 |
| Order Solifugae | | | | 7 | 8 | | | 6 | | 5 | | | 26 | 2,36 |
| Order Isoptera | 9 | | 85 | 73 | 23 | 37 | 67 | 62 | | 9 | 13 | 10 | 388 | 35,27 |
| Order Orthoptera | | | | | 8 | 6 | | | 11 | 5 | | | 30 | 2,73 |
| Order Hemiptera | 9 | | | | 8 | | | | 22 | | 7 | | 46 | 4,18 |
| Order Neuroptera | | | | | | | | | 33 | | | | 50 | 4,55 |
| Order Coleoptera (ad) | 9 | | 8 | 27 | 23 | 25 | 8 | 37 | 33 | 38 | 33 | 70 | 373 | 33,91 |
| (l) | 27 | | | | 23 | 12 | | | 44 | 43 | 13 | | 162 | 14,73 |
| Order Diptera | | | | 13 | | 6 | | | | | 20 | | 39 | 3,55 |
| Order Lepidoptera | | | | 7 | 8 | | | | | 5 | 7 | | 27 | 2,45 |
| Order Hymenoptera | | | | | | | | | | | | | | |
| Fam. Formicidae | 18 | | 15 | 60 | | 44 | 8 | 6 | 22 | 29 | 20 | 20 | 242 | 22 |
| Undetermined | 9 | | | | 23 | 6 | 16 | 6 | | 5 | | | 65 | 5,91 |
| Rainfall | | | | – – – – 14,0 – – – – | | | | | | – – – – 10,5 – – – – | | | | |

TABLE 5: Percentage of prey items consumed on a monthly basis by *Meroles cuneirostris*. Observations from the Kamberg Dune study (Stuart unpubl.); Rooibank study (Robinson and Cunningham 1978) and the present study site. Monthly values are standardized to the total samples using: –

$$\frac{\text{no of stomachs analyzed in a month}}{\text{total no of stomachs analyzed}} \times \%\ \text{occurence of the prey items}$$

(ad = adults; l = larvae)

| Animal Material | JAN | | | FEB | | MAR | | | APR | | | MAY | | | JUNE | | JULY | | AUG | | | SEP | | | OCT | | | NOV | | | DEC | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Site* | | | Site | | Site | | | Site* | | | Site | | | Site | | Site* | | Site | | | Site | | | Site* | | | Site | | | Site | | |
| | K | R | G | R | G | K | R | G | K | R | G | K | R | G | K | R | K | G | K | R | G | K | R | G | K | R | G | K | R | G | K | R | G |
| | (11) | (15) | (12) | (15) | (9) | (13) | (15) | (6) | (15) | (15) | (7) | (13) | (15) | (6) | (16) | (15) | (12) | (12) | (16) | (15) | (11) | (9) | (15) | (11) | (21) | (15) | (11) | (15) | (15) | (6) | (10) | (15) | (10) |
| Order Scorpionida | | | | | | 0,69 | | | | | | | 0,58 | | | | | | | | | | | | | | | 0,70 | | | | | |
| Order Aranea | | 0,58 | 0,96 | 1,66 | 0,99 | | | 1,98 | | 0,58 | 0,98 | | 0,58 | 1,02 | | 0,58 | | 0,96 | | 0,58 | 2,97 | | 0,58 | 0,99 | | | 1,98 | | 1,08 | 1,98 | | 0,58 | 2 |
| Order Solifugae | | | | | 0,99 | | | | 0,70 | | | 0,69 | | | | | | | 0,64 | | | | | 0,99 | 0,70 | | | | | | | | 1 |
| Order Thysanura | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Fam. Lepismatidae | | 0,58 | | | | | | | | 0,58 | | | | | | | | | | | | | 3,32 | | | | | | 0,58 | 1 | | | |
| Order Orthoptera | | | | | | | | | | | | 0,69 | | | 0,64 | | | | | | | 0,66 | | | 0,70 | | | | | | | | |
| Fam. Acrididae | | | | | | | | | | | | | 1,66 | | | 0,58 | | | | 0,58 | | | | 0,99 | | | | | | | | | |
| Fam. Tettigoniidae | | | | | | | 0,58 | | | | | | 1,08 | | | | | | | | | | | | | | | | | | | | |
| Fam. Undetermined | | | 0,96 | | | | | | | | | | | 1,98 | | | | | | | | | | | | | 0,99 | | | 1,02 | | | |
| Order Isoptera | 0,66 | | | | | 7,32 | | | 7,25 | | | 1,98 | | | 3,92 | | 5,32 | | 6,60 | | | | | | 1,25 | | | 1,29 | | | 0,66 | | |
| Fam. Termitidae | | | | | | | 2,24 | | | | | | | 1,02 | | | | 3 | | | 0,99 | | | 2,97 | | | 0,99 | | | | | | |
| Order Dictyoptera | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Fam. Mantidae | | | | 1,08 | | | 0,58 | | | 0,58 | | | 0,58 | | | | | 0,96 | | | | | | | | | | | | | | 0,58 | |
| Fam. Blattidae | | | | | | | | | | 0,58 | | | | | | | | | | | | | | | | | | | | | | | |
| Order Thysanoptera | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Fam. Thripidae | | | | 0,58 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Order Hemiptera | 0,66 | | | | | | | | | | | 0,69 | | | | | | | | | | 1,31 | | | | | | 0,70 | | | | | |
| Sub-order Heteroptera | | | 3,96 | | | | | | | | 0,98 | | | | | | | | | | 2,97 | | | 1,98 | | | | | | | | | 2 |
| Fam. Pentatomidae | | | | | | | 1,66 | | | | | | 0,58 | | | | | | | | | | 0,58 | | | | | | | | | 0,58 | |
| Sub-order, Undetermined | | 0,58 | | 0,58 | 0,99 | | 1,08 | 1,02 | | | 0,98 | | 0,58 | | | 0,58 | | 0,96 | | | 0,99 | | 0,58 | 1,98 | | | 6,05 | | 1,08 | 1,02 | | | 2 |
| Order Neuroptera | 0,66 | | | | | 0,69 | | | | | | | | | | | | | | | | 1,97 | | | | | | | | | | | |
| Fam. Myrmeleontidae | | 0,58 | 2,04 | | | | | | | 1,08 | | | | 1,02 | | | | | | 0,58 | 0,99 | | 0,58 | | | 0,58 | 0,99 | | | | | | |
| Fam. Chrysopidae | | | | | | | | | | 0,58 | | | | | | | | | | | | | 0,58 | | | | | | | | | | |
| Order Coleoptera | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Fam. Carabidae | | | | 0,58 | | | | | | | | | | | | | | 0,96 | | | | | | | | 1,66 | | | | | | | |
| Fam. Cicindelidae | | | | | | | 2,74 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Fam. Curculionidae | | | 0,96 | | | | | | | 0,58 | | | 0,58 | | | 3,32 | | | | 2,74 | | | 1,66 | 0,99 | | 3,32 | | | 2,24 | | | 1,66 | 1 |
| Fam. Tenebrionidae (l) | 1,97 | 1,66 | | 1,08 | | | | 1,02 | | 2,24 | 2,03 | 1,98 | 1,66 | | 1,27 | 4,98 | | 0,96 | | 2,24 | 0,99 | 2,62 | 2,74 | | 5,98 | 2,24 | 0,99 | 1,29 | 2,24 | | | 1,66 | 1 |
| (ad) | 4,66 | 3,90 | 0,96 | 0,58 | 1,98 | 1,29 | 1,08 | 1,02 | 2,68 | 1,66 | | 1,98 | 0,58 | | 2,65 | | 0,64 | | 3,92 | 1,66 | 1,98 | 1,97 | | 0,99 | 5,28 | 1,08 | 0,99 | 3,28 | 0,58 | | 4,64 | 2,24 | 2 |
| Fam. Staphylinidae | | 0,58 | | | | | | | | | 2,03 | | | | | | | | | | | | | 0,99 | | | | | | | | | |
| Fam. Undetermined (l) | | | | | | | 0,58 | | | | | | 0,58 | 1,02 | | | | | | 1,08 | | | 0,58 | | | | 0,99 | | | 1,98 | | | |
| (ad) | | | | 2,74 | | | 1,66 | | | | 2,03 | | 1,66 | 3 | | 1,66 | | 6 | | 1,08 | 6,05 | | 0,58 | 6,05 | | 1,08 | 4,95 | | 2,24 | 4,02 | | | 2 |
| Order Lepidoptera | | | | | | | | | 0,70 | | | 0,69 | | | | | | 0,96 | | | | | | | 0,70 | | | 0,70 | | | | | |
| Fam. Undetermined (l) | | 0,58 | | 1,08 | | | 2,74 | | | 4,40 | | | 1,66 | | | 2,24 | | | | 0,58 | | | | | | | | | 2,24 | | | 0,58 | |
| (ad) | | | 3,96 | | 6,03 | | | 1,02 | | 0,58 | | | 1,08 | | | | | | | 0,58 | | | | | | 0,58 | | | 1,66 | | | | |
| Order Diptera | | | | | 0,99 | | | | 1,29 | | 0,98 | | | | 0,64 | | | 2,04 | | | 0,99 | | | | | | 0,99 | 1,99 | | | | | 1 |
| Fam. Asilidae | | | | | | | 0,58 | | | | | | | | | | | | | | | | | | | | | | | | | 0,58 | |
| Fam. Undetermined (l) | | | | | | | | | | | | | | | | | | | | | | | 0,58 | | | | | | | | | | |
| (ad) | | | | | | | 0,58 | | | | | | 1,08 | | | | | | | | | | 0,58 | | | 1,66 | | | 0,58 | | | 1,66 | |
| Order Hymenoptera | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Fam. Formicidae | 1,31 | 2,24 | | 2,24 | | 1,29 | 1,08 | | 5,96 | 1,08 | | | 2,74 | | 4,66 | | 0,64 | | 0,64 | 1,08 | | 1,31 | 1,66 | | 4,03 | 0,85 | | 1,99 | 0,85 | | 1,32 | 1,08 | |
| Sub-family Formicinae | | | | | | | | | | | 0,98 | | | 1,02 | | | | | | | | | | | | | | | | 1,98 | | | |
| Sub-family Myrmicinae | | | | | | | | | | | | | | | | | | 2,04 | | | | | | | | | 0,99 | | | 4,02 | | | 2 |
| Sub-family Undetermined | | | | | | | | | | | | | | | | | | | | | | | | 0,99 | | | | | | 1,02 | | | |
| Superfamily Apoidea | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Fam. Apidae | | | | | | | | | | | | | | | | | | | | | | | | 0,99 | | | | | | | | | |
| Fam. Undetermined | | 4,98 | | | | | | | | | | | | | | | | | | | | | | 0,99 | | | 0,99 | | | | | | |
| Superfamily Ichneumonoidea | | | | 0,58 | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1,08 | |
| Fam. Braconidae | | | | | | | | 1,02 | | | | | | | | 1,08 | | | | | | | | | | | | | | | | | |
| Superfamily Chrysoidea | | | | | | | | | | | | | | | | | | 0,96 | | | | | | | | | | | | | | | |
| Fam. Pompilidae | | | | | | | | | | | | | 1,08 | | | | | | | | | | | | | | | | | | | | |
| Fam. Vespidae | | | | | | | | | | | | | 1,08 | | | | | | | | | | | | | | | | | | | 0,58 | |
| Fam. Undetermined | | | | 1,08 | 0,99 | | 1,66 | 1,02 | | 2,74 | 3,01 | | 1,08 | 1,02 | | 1,08 | | 5,04 | | 1,66 | | | 2,24 | 0,99 | | 1,08 | 3,96 | | 4,40 | 3,96 | | 1,66 | 2 |
| Order Squamata | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Fam. Lacertidae | | | | | | | | | | | 0,98 | | | | | | | | | | | | | | | | | | | | | | |
| Fam. Scincidia | | | | | | | | | | | | | | | | | | | | | | | 0,58 | | | | | | | | | | |
| Order Undetermined (l) | | | 3,96 | | 2,97 | | | | | | 0,98 | | | 1,02 | | | | | | | 3,96 | | | 0,99 | | | | | | | | | 2 |
| (ad) | | | 2,04 | | 1,98 | | | 1,98 | | | 4,97 | | | 4,98 | | | | 3 | | | 2,97 | | | 4,95 | | | 1,98 | | | | | | |
| Plant Material | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Fam. Gramineae | | | | | | | | | | | | | 0,58 | | | | | | | | | | 0,58 | | | | | | | | | | |
| Fam. Undetermined | | | | | | | 0,58 | | | | | | | ·1,98 | | 0,58 | | 2,04 | | | 1,98 | | | 0,99 | | | 0,99 | | | 1,02 | | | 2 |
| Undetermined Material | 0,66 | 0,58 | | | 0,99 | | 0,58 | | | 0,58 | | 1,98 | | 1,02 | 0,64 | | 1,27 | | 0,64 | 0,58 | 1,98 | | | | 0,70 | | | | | | | | |

* K = Kamberg 1974 R = Rooibank 1976; January 1977 G = Gobabeb January – June 1979; July – December 1978

diet may therefore be a reflection of the relative abundance and preferred dietary alternatives present within each habitat type.


## 5 ACKNOWLEDGEMENTS

I wish to thank: Dr. M.K. Seely and her research assistants for providing the lizards from the Gobabeb area. Mr. C. Stuart for letting me make use of his unpublished stomach analyses of *M. cuneirostris* from the Kamberg area. Dr. D.N. Johnson for organising my first trip to Gobabeb, and for his assistance with the writing up of the project. Messrs. M. Picker and M. Keeping for helping with some of the insect identification. Mr. D. Morgan and the seven students from St. Stithians College, for helping with field work during April 1981. Alan Marsh, R.D. Pietruszka and M.K. Seely for assistance in the writing up of the paper. The financial support of the CSIR was much appreciated. The Department of Agriculture and Nature Conservation provided facilities and permission to work in the Namib Naukluft Park.


## 6 REFERENCES


FITZSIMONS, V.F.M.
1943: *The lizards of South Africa. Tvl. Museum Memoir* no. 1 Pretoria, South Africa, 528 p + 24 plts.

GOLDBERG, S.R. and ROBINSON, M.D.
1979: Reproduction in two Namib desert lacertid lizards, *Aporosaura anchietae* and *Meroles cuneirostris. Herpetologica 35* (2): 169—1975

HOLM, E. and SCHOLTZ, C.H.
1980: Structure and pattern of the Namib Desert dune ecosystem at Gobabeb. *Madoqua 12* (1): 3—39

HUEY, R.B., BENNETT, A.F., JOHN-ALDER, H. and NAGY, K.A.
1984 Locomotor capacity and foraging behaviour of Kalahari lacertid lizards. *Animal Behaviour* 32: 41—50

LOUW, G.N., and HOLM, E.
1972: Physiological, morphological and Behavioural Adaptations of the ultrapsammophilus, Namib Desert Lizard, *Aporosaura anchietae* (Bocage). *Madoqua* 1: 67—85

ROBINSON, M.D. and CUNNINGHAM, A.B.
1978: Comparative diet of two Namib Desert sand lizards (Lacertidae). *Madoqua* 11: 41—53

SEELY, M.K. and LOUW, G.N.
1980: First approximation of the effects of rainfall on the ecology and energetics of a Namib Desert dune ecosystem. *Journal of Arid Environments* 3: 25—54.