X. APPENDICES – FAUNA and FLORA

Appendix Xb7. Bats of De Hoop (archival)

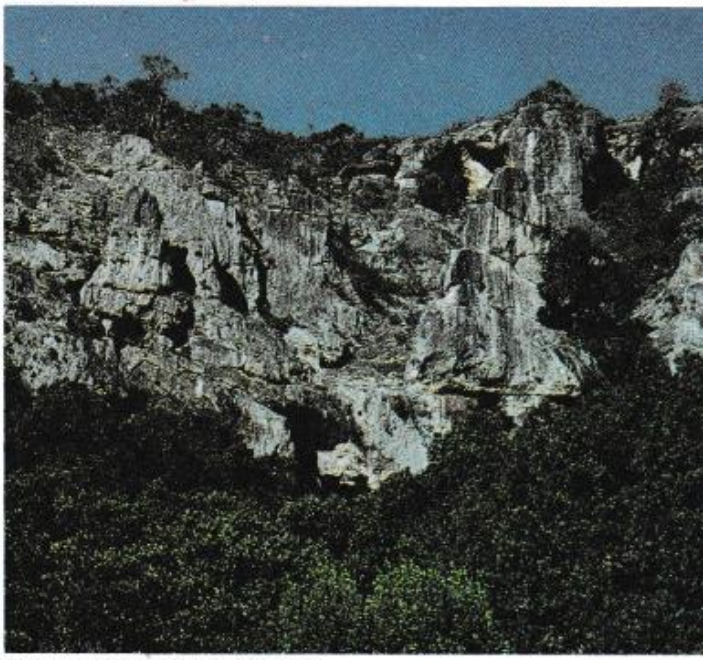
THE BATS OF DE HOOP NATURE RESERVE

by Pam Laycock

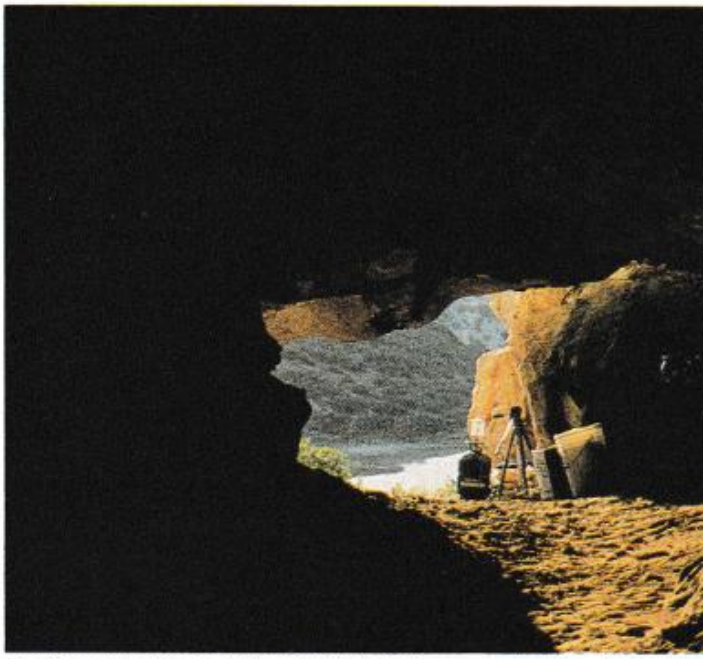
Pam Laycock is presently teaching biology at St. Cyprian's School in Cape Town. She obtained her M.Sc. (on insectivorous bats) from Natal University in 1977. This article is based on research she carried out on the ecology of the De Hoop Guano Cave in 1981 and 1982. Her work was carried out through the School of Environmental Studies at the University of Cape Town and was financed by the Southern African Nature Foundation.

NOT long ago, I submitted a report on my studies of the ecosystem of the De Hoop Guano Cave to the Southern African Nature Foundation (which had provided financial support for my work). In retrospect the concluding comments to my report now seem ironic: "The cave is situated in a *protected reserve* with a sufficient insect population to support large numbers of insectivorous bats throughout the year. Such a system should continue to be protected from excessive disturbance . . ." (my italics).

At the time of writing the report, I was



De Hoop Guano Cave entrance.



Looking out of the cave towards the vlei. photo: Cape Dept. of Natu

At the time of writing the report, I was totally unaware of the plans of Armscor and the Ministry of Defence for the De Hoop Nature Reserve and surrounding areas. I merely wanted the authorities to ensure that groups of casual visitors should be discouraged from entering the bat cave as bats are very sensitive to disturbance.

When people become aroused over the conservation of particular areas or habitats, it is usually the fish, bird and large mammal faunas which excite their concern. Seldom do the small nocturnal mammals such as bats receive much attention, although they are just as important to the ecosystems of which they are a part. This is perhaps because the average person seldom consciously notices or recognises bats. He may even misidentify bats fluttering through the twilight as late-flying swallows.

From 1976 to 1979, Jan Herselman and his colleagues in the Cape Department of Nature and Environmental Conservation

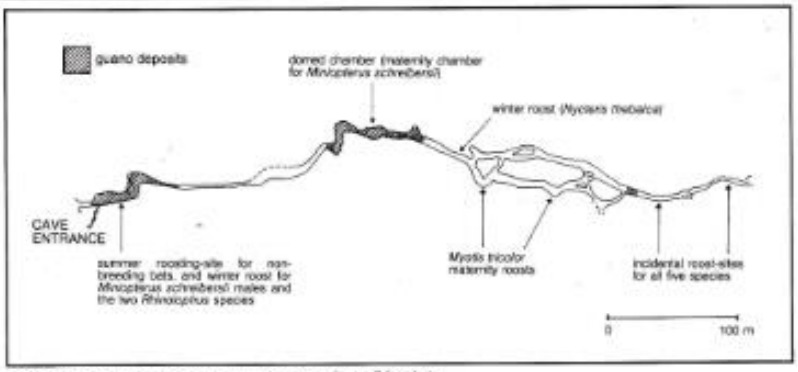
Looking out of the cave towards the vlei. photo: Cape Dept. of Nature and Enviro

Cape Province (see *African Wildlife* Vol. 32 No. 4, 1978). Their preliminary manuscript listed 28 species in the province. Of all these species, the most abundant is Schreiber's long-fingered bat *Miniopterus schreibersii*, a bat which is widespread and common throughout sub-Saharan Africa and through Europe, Asia, Malaysia and Australasia. The subspecies found in southern Africa is *M. schreibersii natalensis*. Only six breeding caves for this species are so far known in the Cape Province, and by far the most important of these is the De Hoop Guano Cave, which, incidentally, is also the only important breeding cave for this species in the south-western Cape Province.

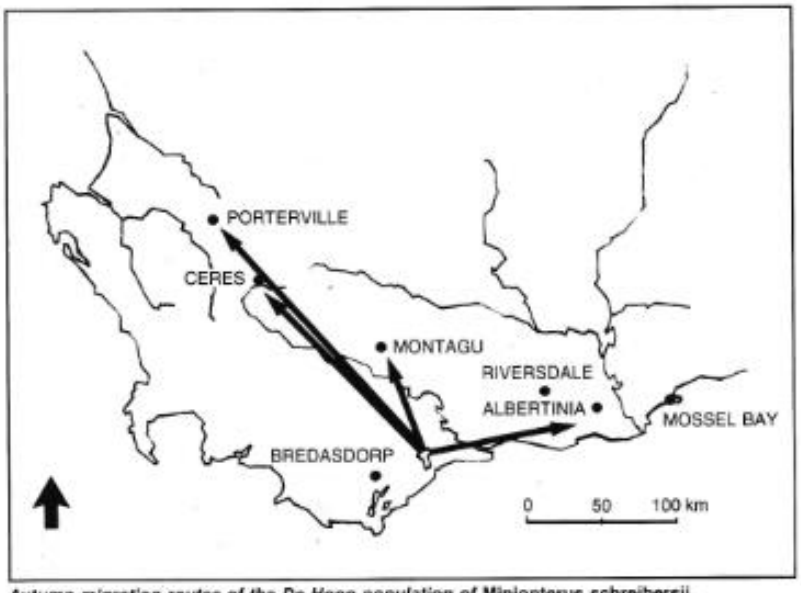
As well as supporting a huge population of *M. schreibersii* in summer — well over 100 000 — De Hoop Cave serves as a roost for four other insectivorous bat species, viz. the horseshoe bats *Rhinolophus clivosus* and *R. capensis* (respectively known as Geoffroy's horseshoe bat and the Cape horseshoe bat), the mouse-eared bat *Myotis tricolor*, and the common slit-faced bat *Nycteris thebaica*. The total summer population of all five species at De Hoop is believed to be around 150 000.

The Cave (see diagrammatic map above, and article on p. 16) is situated on the eastern shore of De Hoop Vlei, within the De Hoop Provincial Nature Reserve. Its entrance lies about 35 m above sea level and about 15 m above vlei level, and opens into the riverine bush along the base of the cliffs above the vlei. The cave extends horizontally into the limestone cliffs for 470 m.

Forty metres from the entrance is a sharp bend, which, together with the single functional entrance, serves to reduce air flow within the system to a minimum. Two hundred and five metres into the cave there is a large domed chamber which



Plan of De Hoop Guano Cave, Bredasdorp District.
after Crombie, Cloven and Snook, 1978, the South African Speleological Association



***Autumn migration routes of the De Hoop population of* Miniopterus schreibersii.**
adapted from African Wildlife Vol. 32 No. 4

The enormous numbers of *M. schreibersii* which congregate in this part of the cave in summer help cause the temperature to rise to over 30°C. These high temperatures, taken together with the minimal air movement, lead to supersaturation of the atmosphere within the domed chamber. This situation is most unpleasant for the human observer but is ideal for *Miniopterus schreibersii* maternity colonies.

Beyond the domed chamber the temperatures are lower and the atmosphere less humid. This situation meets the requirements of the mouse-eared bat *Myotis tricolor* for its maternity roosts. On the other hand, the less extreme conditions with slight daily variations which are found in the cave passage on the side of the domed chamber nearest to the entrance, are preferred by the two horseshoe bat species for giving birth to their young, and for nursing.

The outer passage and chambers of the system nearest to the cave entrance, being cooler, and unoccupied by pregnant or nursing females, are available as roost sites for males. The cave is therefore to some extent "partitioned" between the

Miniopterus schreibersii is numerically the most important species in the cave. Why is the cave so favoured by this bat? As far as we know, all major breeding colonies of *M. schreibersii* throughout its entire range are characterised by high humidities and relatively high temperature. This consistent coincidence of high temperature with major maternity roosts implies that adequate heat is essential to at least some stages in the breeding cycle. Newly born bats are tiny creatures and their weight approaches the minimum weight at which a warm-blooded animal can theoretically regulate body temperature; it is probable, therefore, that the function of the high temperatures in the nursery chamber is to create incubator-like conditions for the early stages of development of the young bat.

Another reason could be that the heat in the cave helps the adult bats to save energy. Adult bats without young to look after, living in the cooler parts of cave systems, usually enter a state of daily torpor during the day, or at least a state of decreased metabolic activity which is accompanied by a lowering of body temperature. For the bat this is an important

striking longevity of bats (up to 24 years for some insectivorous species). In the hot, humid conditions of a large bat nursery, however, the female bats could perhaps allow their body temperatures to follow the high cave temperature, thus allowing them to remain active during the day without having to use up their own supplies of energy.

In other words, high cave temperatures would not only be of benefit to the naked infants but also to their mothers, as a means of saving energy whilst permitting the females to nurse their young actively throughout the day; at night of course the mothers have to hunt for food and abandon their young temporarily.

An extensive study of bat caves in America by Tuttle and Stevenson (1977) led them to conclude that it is rare for any one cave in temperate regions to provide sufficient thermal complexity for year-round occupation by insectivorous bats. De Hoop Guano Cave is one such roost.

This is not to say that De Hoop plays host to both sexes of all five species throughout the year. The situation is much more complex than that, and provides yet another illustration of the

unravel the details of these requirements, otherwise we cannot hope to conserve our wildlife resources properly.

In summer, the De Hoop Guano Cave serves as a major maternity roost for a large population of *Miniopterus schreibersii*, and for smaller numbers of *Myotis tricolor* and the two *Rhinolophus* species. It is also a summer roost for male *M. schreibersii* and *Rhinolophus*, and a pre-wintering cave for *Myotis tricolor* males. Both sexes of *Nycteris thebaica* and the two *Rhinolophus* species, and also male *M. schreibersii*, overwinter in the cave. What happens to the females of *M. schreibersii* in winter?

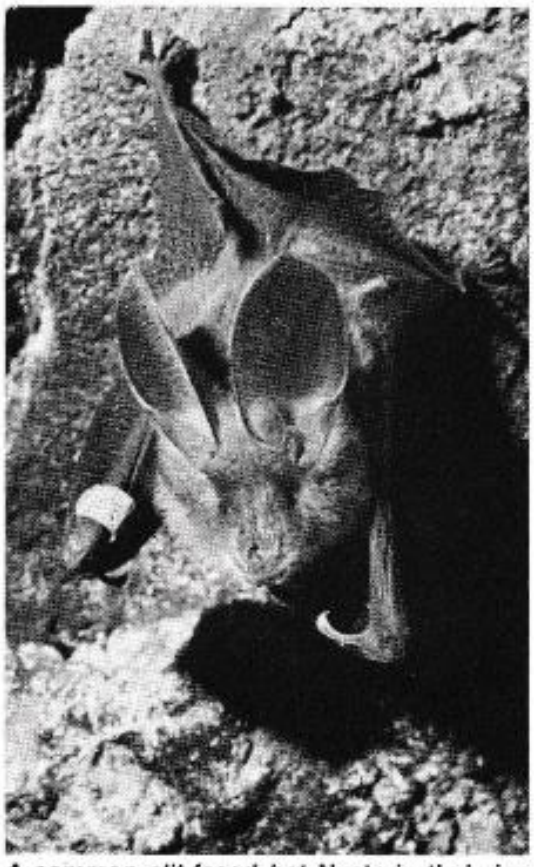
In winter in temperate regions, insectivorous animals face the problem of a decline in insect numbers, and thus of food availability. An insectivore may cope with this problem either by hibernating, or by migrating to an area with a sufficient food supply. As the latter option would often involve migrations over hundreds of kilometres, hibernation is the more common solution.

The ambient (surrounding) temperature in the De Hoop Guano Cave does not drop low enough in winter to allow periods of extended hibernation, and the females of both *Miniopterus schreibersii* and *Myotis tricolor* are absent during this period. They in fact migrate to cooler areas to hibernate (see map), for example to Porterville.

Why the females? Why do the males not need to hibernate? Most insectivorous bats mate in autumn in temperate latitudes, as at De Hoop, when the males are in peak condition. As gestation would be very demanding on energy reserves over winter — a period of diminished food supply — the females have to resort either to delayed fertilisation or to delayed embryonic development. Hibernation appears to be a prerequisite for this.

average mass of one of these bats as 12,5 g, then with each bat potentially consuming approximately one-third of its body mass each evening, the entire *Miniopterus* population of the cave would be consuming 100 000 x 4,1 grams, or 410 kg of small moths, mosquitoes and midges every night. And we have not added in the contribution of the thousands of bats of the other four species.

A bat population of this size naturally results in a considerable input of guano into the roost-site. This guano forms the basis of a complex food web of fungi and tiny invertebrate creatures. Forty-seven



A common slit-faced bat* Nycteris thebaica *after being ringed at De Hoop Cave. photo: Cape Department of Nature and Environmental Conservation

Why do female *Rhinolophus* bats not migrate away from De Hoop in winter? These horseshoe bats have the habit of enfolding their bodies with their wings and so exposing the maximum area of naked skin (the wings themselves); this causes the body temperature to drop to a level low enough to trigger off hibernation.

Most of the male *Rhinolophus* (and also the male *Miniopterus schreibersii*) enter deep daily torpor at De Hoop in winter, but become active in the evening and leave the cave for brief foraging flights.

The common slit-faced bats (*Nycteris thebaica*) are gleaners and apparently eat any arthropods they can find, from insects to scorpions. Consequently they do not appear to need to hibernate to overcome food shortage. No inactive slit-faced bats have been seen at De Hoop.

Analysis of the stomach contents of *Miniopterus schreibersii* showed their summer diet to be predominantly Lepidoptera (moths) *c.* 60%, and Diptera (mosquitoes and midges) *c.* 40%. In winter their diet was almost completely composed of Lepidoptera. It is interesting to speculate on how many insects must be consumed every summer's night by the *Miniopterus* bats alone in the De Hoop

species of invertebrates (46 of which are arthropods) and 52 species of fungi have so far been identified in the cave. Of the invertebrates found here, at least one species of pseudoscorpion is completely new to science; it is presently being described by Dr. V. Mahnert of the Natural History Museum in Geneva.

I have found that there is a dramatic decline in invertebrate numbers in the cave in winter, which appears to coincide with the decline in the size and activity of the bat population. This reflects the dependence of cave floor life on a continuous supply of fresh nutrients in the form of guano. Some people may ask if these "insignificant" invertebrates are worthy of attention; this leads to the ethical issue of "why conserve anything anyway?" Does a dominant, thinking, destructive species such as Man have a moral responsibility for the welfare of other species?

THE IMPORTANCE OF DE HOOP GUANO CAVE

Through an accident of geography and geology, the De Hoop Guano Cave provides the ideal conditions for numerous insectivorous bat needs throughout the year. No other comparable cave is known

Province is more than five times larger than England, or 22 times larger than the Netherlands). Of six bat roosts in the Cape documented as being of especial importance, De Hoop tops the list. With 150 000 bats of five species, it "beats" the second contender, Kogelbeen Cave in the northern Cape, by a wide margin; Kogelbeen has only 60 000 bats of two species.

The De Hoop Cave lies on the shores of an extensive vlei which is surrounded by natural bush and farm-lands. This environment supports an enormous population of nocturnal insects. The form of the cave itself is unusually suitable for various bat species at different periods of their life cycles. We cannot afford to let it be harmed.

THE CONSERVATION OF THE CAVE

What harm can come to the bats of the De Hoop Guano Cave if Armscor and the military authorities move in to the area? Firstly, there may be disturbance — the physical disturbance caused by thoughtless people invading the sanctity of the cave, panicking pregnant or lactating female bats, causing babies to fall from the ceiling, upsetting hibernating or torpid bats. Secondly, there may be disturbance caused by vehicular activity over the cave, in the vlei and in the air; the bats must not be harassed into abandoning the cave. Thirdly, if supersonic jet aircraft and rockets are to be for De Hoop a feature of the future, what effect will supersonic (ultrasonic?) noise have on the bat population? These bats are *all* insectivorous species of the suborder Microchiroptera, and rely on ultrasonic sound for communication and hunting. Can we afford to risk ultrasonic environmental pollution? Can the bats withstand it? Would sonic booms cause cave collapse?

Misguided missiles will, we are assured, be no real threat, but *any* modification of the environment, for example, deliberate or accidental veld-burning, *will* affect insect life, and ultimately the bats of De Hoop.

The De Hoop Guano Cave is a little-known and vastly important natural resource of the Cape Province and South Africa. It must be handled with care.

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SUGGESTED FURTHER READING:

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