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Observations of the Cape cobra, *Naja nivea* (Serpentes: Elapidae) in the DeHoop Nature Reserve, Western Cape Province, South Africa

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ABSTRACT – During September 2004 the author began research on the Southern adder, *Bitis armata*, and the Puff adder, *Bitis arietans*, at DeHoop, a National Nature Reserve and biodiversity ‘hotspot’, managed by the Western Cape Nature Conservation Board (now Cape Nature). It soon became apparent that the Cape cobra was a prominent species on the reserve, and presented an opportunity to extend the research programme to include this familiar but little studied venomous snake. The current study included general observations throughout the reserve, but also more detailed observations were undertaken of individual cobras at their respective refugia. Results so far have shown that the Cape cobra is essentially a diurnal species, and exhibits a pronounced degree of sedentary behaviour. Observations have also shown that this species is a feeding generalist; in addition to a diet of rodents, birds, snakes and other reptiles, observed feeding behaviour also included cannibalism of conspecifics, and scavenging road-killed snakes.

THE Cape cobra, *Naja nivea*, is a common monotypic elapid species in the Western Cape, and is responsible for most fatal incidents of snakebite in the province (Branch, 1998). The venom is also the most potent of all the South African cobras (Broadley, 1983). It is perhaps therefore surprising that virtually nothing is known about the ecology, habitats and behaviour of this widespread and potentially dangerous species.

Naja nivea is a habitat generalist, and can be found in a wide variety of biomes across southwestern Africa, including dune thicket, coastal and mountain fynbos, karroid sandveld, and semi desert. Unlike most other African cobras this species shows a wide range of colour variation; from yellow and golden brown to dark brown and black. In addition, individuals show a varying degree of black or pale stippling and blotches, and although it has been stated that colour and marking are geographically related, it is also possible to observe virtually all colour varieties at one location. For example, it is well known that the Kalahari specimens in Botswana are usually more consistently yellow than the more southerly populations (Spawls & Branch, 1995; Branch, 1998). However, at DeHoop, and other specific locations in the Western Cape, all colour variations have been recorded (pers. obs.). It is not

a particularly large cobra; average adult size is around 1.5 metres, and females are somewhat smaller than males. The largest specimen recorded at DeHoop was a male with a total length of 1.85 metres.

The Cape cobra is a timid snake, always seeking to escape when encountered, although when aroused it has been described as willing to bite readily (Spawls & Branch, 1995; Branch, 1998; Marais, 2004). It has also been stated that the Cape cobra is more aggressive during the mating period (Broadley, 1983; Spawls & Branch, 1995). However, passive observation of another notorious South African elapid, the Black mamba, *Dendroaspis polylepis*, has shown that in normal circumstances this species exhibits alert but calm behaviour (Phelps, 2000). Observations of the Cape cobra at refugia so far at DeHoop have indicated very similar behaviour.

The Cape cobra is a diurnal species and actively forages throughout the day. During very hot weather it may become crepuscular, but is rarely if ever observed during the hours of darkness (Pers obs.). There is no current information with regard to size of home range, population densities, or sex ratio. Detailed accounts of such as reproductive and feeding behaviour are also lacking, and past and current information has tended to be anecdotal, or repetitive in popular literature. For

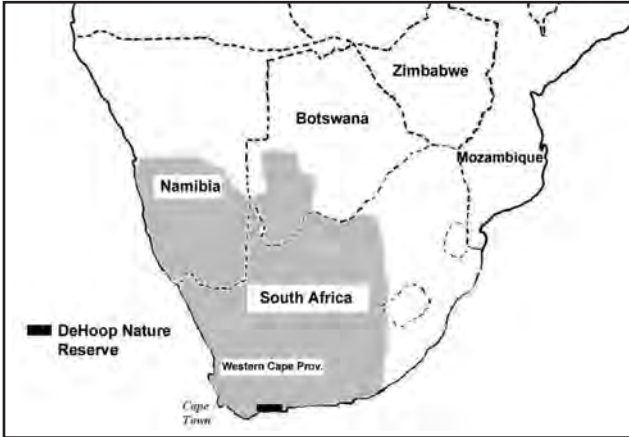


Figure 1. Distributional range of *Naja nivea*.

example, the accounts of the Cape cobra climbing and preying on sociable weaver (*Philetaurus socius*) in the Kalahari has been quoted many times (MacLean, 1973).

Broadley (1983) states that the Cape cobra uses rodent burrows and other animal holes as a more or less permanent retreat, but other information regarding sedentary behaviour or the occupation of permanent refugia also appear to be anecdotal.

STUDY AREA AND METHODS

DeHoop Nature Reserve is situated on the south coast of the Western Cape Province, South Africa, at 34°S 20°E, and represents part of the most southerly distribution for the Cape cobra in southern Africa, the most southerly distribution being found at Cape Agulhas some 70 km south

west from DeHoop. The reserve covers an area of 50 km of coastline, (not including the Marine reserve), and extends inland for distances ranging from 10 to 20 km. The habitat consists of a mosaic of dune thicket, sand and limestone fynbos, and restioveld at altitudes from sea level to 300 metres.

The climate is temperate with rainfall occurring mainly during the winter months which are typified by cold nights and sunny, but cool days. Summer temperatures can reach as high as 35°C with night time temperatures between 18°C and 22°C. Daytime temperatures during the spring

period can reach 30°C, but average between 24°C and 28°C.

Study period – The study is ongoing, but the initial period has so far covered 68 days from October 2004 until March 2006. No study was undertaken during the winter months (May-August).

Method – The present study was prompted by the discovery and subsequent observation of a male and female Cape cobra at one particular refuge during October 2004 at DieMond, which is situated in the south-western corner of the reserve. The refuge consisted of two connecting burrows, and was situated at the edge of a gravel road. The animals were observed from a vehicle at a distance of just three metres; four other refugia were also monitored in a similar manner at distances of five to fifteen metres. The cobras at refugia were

passively observed, often with the aid of binoculars, and not physically handled or disturbed. A number of cobras, which were opportunistic sightings, were captured and sampled. Other cobras were observed from a distance with binoculars to record foraging behaviour. It was also necessary to remove a number of cobras from potential dangerous situations, and move them locally to a place of safety.

Captured cobras were measured and sampled for DNA by ventral scale clipping, and in some cases caudal vein



Figure 2. Map of DeHoop Nature Reserve.



Figure 3. Adult male *Naja nivea* in fynbos habitat, Oudtshoorn, Little Karoo. All photographs © T. Phelps.



Figure 4. Adult male *Naja nivea* DN01 basking next to refugia burrow. DeHoop Nature Reserve, Western Cape.



Figure 5. Adult male *Naja nivea* DN01 emerging from refugia burrow. DeHoop Nature Reserve, Western Cape.



Figure 6. Immature *Naja nivea* DOR killed while eating *Duberria lutrix*. DeHoop Nature Reserve, Western Cape.



Figure 7. Juvenile *Naja nivea* in *Protea* bush, Gansbaai, Western Cape.

Species	Qty	Source
Rodents		
<i>Rattus rattus</i>	3	Obs+SC
<i>Rhabdomys pumulio</i>	3	SC
Birds		
<i>Francolinus capensis</i>	1	Obs
<i>Ploceus capensis</i>	1	SC
Snakes (inc carrion)		
<i>Duberria lutrix</i>	1	SC
<i>Psammophylax rhombeatus</i>	3	Obs+SC
<i>Psammophis notisticus</i>	2	SC
<i>Bitis arietans</i> (immature?)	1	SC
Lizards		
<i>Agama atra</i>	1	SC
<i>Trachylepis capensis</i>	1	SC
Conspecifics		
80 cm ?	1	SC
95 cm ?	1	SC

Table 1. Recorded prey species of *Naja nivea* at DeHoop Nature Reserve. Obs = Observation. SC = Stomach contents.

puncture. The scale clips were also used for identifying individual snakes. As additional aids to identification snakes were photographed, and colour, markings, permanent injuries and scars were noted, and each snake allocated a field number. Snakes were always handled in a gentle and safe manner, and restrained in tubes of appropriate size for close examination and sampling.

RESULTS

From October 2004 to March 2006 a total of twenty eight Cape cobras were recorded, plus eight dead specimens found on roads (DORs). Of the living cobras, fourteen were males and fourteen females. All were in excess of one metre in length, and as such were deemed to be adults. The dead specimens consisted of two juveniles, two adult females, and four adult males.

Eight snakes were observed at five separate refugia; the DieMond site contained a male and female, another site was occupied by two males and one female, the remaining three were occupied by single individuals (two males, and a female). The DieMond refugia consisted of two burrows one metre apart situated in sand fynbos. The

remainder also consisted of two or more burrows, three were situated in well vegetated limestone fynbos; the other on more open ground, and also in limestone fynbos.

Daily activity – From mid October 2004 the DieMond refuge was observed from dawn until dusk for twelve consecutive days, and the times of emergence and retreat for the male DN01 were recorded (Figure 9). On cloudless sunny days the air temperature reached between 22°C and 25°C by 09:30 h. Clear sunny days were apparent for eight days for the twelve day observation period. One morning was overcast after overnight rain, and temperatures within the above range were not recorded until 11:15 h. Emergence was recorded when the air temp was between 26°C and 28°C, with a mean of 27.2°C for the twelve day period. The corresponding surface temperature at times of emergence for the period was between 28°C and 33°C, with a mean of 29.5°C.

Emergence was a slow process. Firstly, the tip of the snout and flicking tongue would be apparent at the lip of the burrow. The cobra would then slowly move up with hood spread, fully alert (Figure 5), and then turn the head a full 180°. The cobra usually remained at the mouth of the burrow for a full five minutes or so before moving off to bask a metre or so away, (Figure 4). The male DN01 was easily identified due to a truncated tail. The duration of basking varied little on clear sunny days with a minimum of twenty minutes, and a maximum of twenty eight minutes. On overcast days the basking period extended to a maximum of forty two minutes. Regardless of weather conditions the basking posture never varied; the cobra extended the body for its entire length exposing maximum surface to both ground and available sun. Following the morning basking sessions the cobra would move off slowly into the surrounding vegetation, but return a short while later after a period of between thirty and sixty minutes. On returning to the site the cobra would either engage in a brief lying out session, or retreat into the burrow using either of the two entrances. This behaviour was consistent for the twelve day period.

The female cobra, DN02, was never observed engaged in early morning basking sessions at the site, although basking was observed at other times of the day around the burrow entrance. Although it was obvious that the burrow was occupied by both snakes at times during the day, they were never observed basking together. During the observation period it became apparent that this site was probably not the female cobra's permanent home, and that the activity pattern strongly suggested that it was visiting the site.

During the hottest part of the day both cobras remained together in retreat within the burrow for a period ranging from two to three hours. At mid-afternoon, always between 15:00 and 15:45 h, the female cobra would emerge from the right side burrow and move off immediately into the surrounding vegetation. Between ten and fifteen minutes later the male would emerge, and after a very short period of lying out would move off. On its return, never later than 17:00 h, the male went into retreat immediately. For the entire twelve day period this represented the last sightings of the day for both male and female.

Although not as intense, observations were made at the four other refugia. This included monitoring morning basking, and checking for presence during the mid-afternoon. Three of the refugia contained single cobras, two males and one female. The fourth was unusual in that three cobras were seen to be consistently in residence; two males and one female. The cobras at this refuge exhibited passive behaviour toward each other, and it was the only occasion where communal basking was observed.

The periods and timing of morning emergence and basking was similar to the first refuge. However, although return was observed during late afternoon, occasional observations strongly suggested that the cobras at these refugia were away for much longer. A total of five cobras, were positively identified at significant distances away from their respective refugia from late morning until mid-afternoon.

Mating behaviour – During the study period so far, no actual physical mating has been observed. The initial observation period at the DieMond site was within the known mating period for the species.

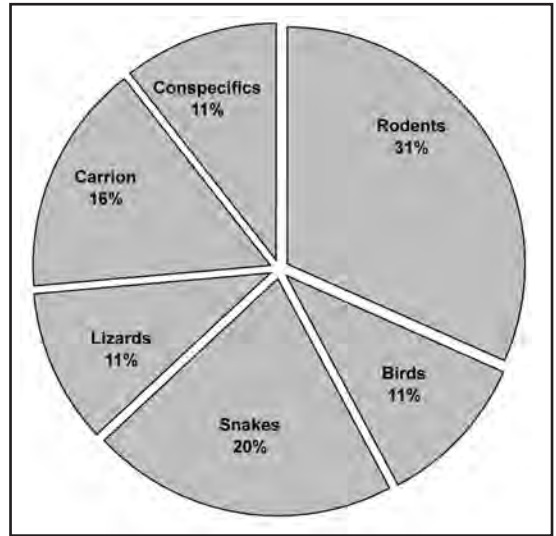


Figure 8. Recorded prey items for *Naja nivea* at DeHoop from October 2004 to March 2006.

The long periods spent together in retreat suggested that mating may have been taking place. There were several other clues to suggest mating activity. On one occasion another cobra, assumed to be a male, entered the left side of the burrow only to exit rapidly with the resident male in pursuit. The resident male returned quickly and re-entered the same burrow. Another clue was when on one morning the female emerged with a small bead of blood showing on the rear of the hood approximately four centimetres behind the head. However, it has not yet been shown that fang penetration is a factor of mating behaviour for this species.

Although a good number of male cobras were observed moving around in general during the mating period, it was difficult to distinguish between potential behavioural aspects. Unless actually witnessed feeding, it was assumed that mate-searching could have been an equally likely alternative.

Foraging & feeding – Nineteen prey items were recorded and identified, either by first hand observation, or the examination of stomach contents of road-killed individuals (Table 1; Figure 6). The sample was thought large enough to indicate that the Cape cobra is a feeding generalist; the percentage of prey types is shown in Figure 8.

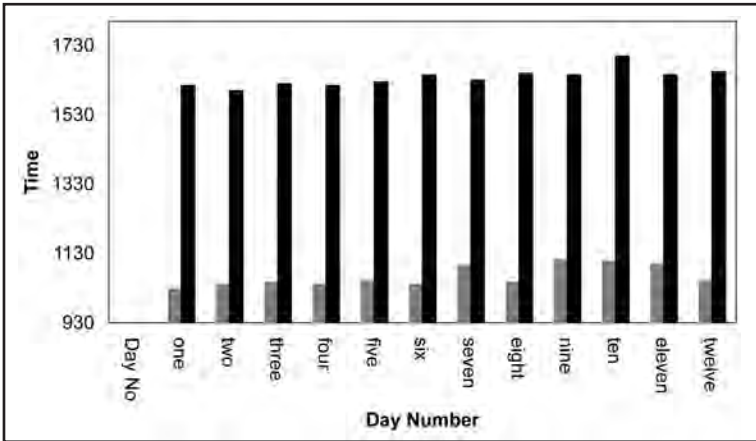


Figure 9. Emergence and retreat times of male *Naja nivea* (DN01), October 2004.

One interesting feeding observation occurred when a cobra was seen to emerge from a burrow in open ground amid a covey of Cape francolin, *Francolinus capensis*, which included a number of very small young. The cobra, still only partly emerged from the burrow, snatched the nearest young bird and withdrew back into the burrow. Another cobra was encountered with an adult Skaapstecker, *Psammophylax rhombeatus*, partly ingested. Interestingly, although the snake was not disturbed, it was moving slowly with head raised during the swallowing process. On two occasions cobras were observed near staff quarters consuming rats, *Rattus rattus*. These cobras were eventually removed to another location some one kilometre distant.

Cobras were seen scavenging and feeding on carrion on two occasions (Phelps, 2006). Both were road-killed snakes, the first, an adult *P. rhombeatus*, the second an adult Karoo whip snake, *Psammophis notostictus*.

Cobras were seen foraging at virtually anytime from mid-morning onwards, even during the hottest part of the day. However, much of the foraging behaviour involved moving in and out of burrow systems. Although hypothetical, it was thought that this partly subterranean behaviour offered scope for optimum thermoregulation. Six of the cobras observed foraging were identified as originating from their respective refugia. The furthest straight line recorded distance travelled from refugia was for a female (DN05), at 2 km.

Other cobras were recorded at distances of between two hundred metres and one kilometre from the respective refugia.

Research at DeHoop on other snakes, namely the Puff adder, *Bitis arietans*, and Southern adder, *B. armata*, involved searches at dusk until two to three hours after nightfall throughout spring and summer. During this time no cobra activity was observed.

Site fidelity – All the cobras observed exhibited a pronounced attachment to their respective refugia. Even though some were seen to be highly vagile, and move long distances, all returned to the home base. There was some variation; the female at the DieMond site disappeared after two weeks, leaving the male in sole occupation. Another roadside refugia containing one male was damaged during road grading operations, and the cobra was not seen again. During March 2006 five of the Cape cobras were still in residence at their respective refugia.

Additional observations – Since January 2006 Cape cobras have been observed and monitored around the author’s home at Oudtshoorn in the Little Karoo. Here the Cape cobra is extremely abundant, and can be frequently encountered within the town limits. Many records were typically ‘problem’ cobras taken from gardens and work places. Four neonate Cape cobras were taken in three days from the Police Training College (Figure 7). On one day during March five cobras were taken from a variety of situations, including gardens and cars, all within the town limits.

Future work in the Little Karoo will include identifying individual refugia in nearby karroid sandveld, and to observe and record the cobras in a similar manner to DeHoop.

DISCUSSION

Nocturnal activity of the Cape cobra is poorly documented (Spawls & Branch, 1995) and although there appears to be some consensus with

regard to it being a diurnal species, some literature still states that the Cape cobra is largely active by night (Trutnau, 2004). This study strongly suggests that the Cape cobra is totally diurnal, even during very hot weather when it appears to maintain an optimum temperature because of the partly subterranean habit during any one day.

The lack of data regarding mating and courtship was disappointing; it was thought as the study has so far encompassed two mating seasons then more would have been revealed. It could be that mating is a secretive affair, and may take place beneath ground; the observations at the one site suggest this. The recorded blood on a female also suggests that fang penetration may be a component part of mating; other cobras are known to exhibit this behaviour (Phelps, 1989). However, observing more than one cobra at refugia indicates some gregarious behaviour, and that the Cape cobra is not necessarily a solitary species.

Results show very clearly that the Cape cobra is a feeding generalist. There are records of other cobras scavenging and feeding on road-kill snakes (Loehr, 2005). Except for scavenging of an injured Mole Snake in the Kalahari recorded by Clauss & Clauss (2002) the observations for this study represent the first record of scavenging on actual dead snakes for the Cape cobras as far as is known.

This study showed that the Cape cobra exhibits pronounced site fidelity but also shows a high degree of vagility, moving long distances during a day. Further study will gain more detail with regard to the actual home range of individual cobras.

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Appendix

Syntopic snake species and numbers recorded at DeHoop Nature Reserve.

Typhlopidae

Rhinotyphlops lalandei 7

Colubridae

Lamprophis capensis 2

Lamprophis inornata 1

Pseudaspis cana 4

Duberria lutrix 12

Prosyma sundevalli 2

Psammophis notostictus 15

Psammophis crucifer 24

Psammophylax rhombeatus 35

Dispholidus typus 23

Atractaspididae

Homoroselaps lacteus 2

Viperidae

Bitis arietans 28

Bitis armata 15