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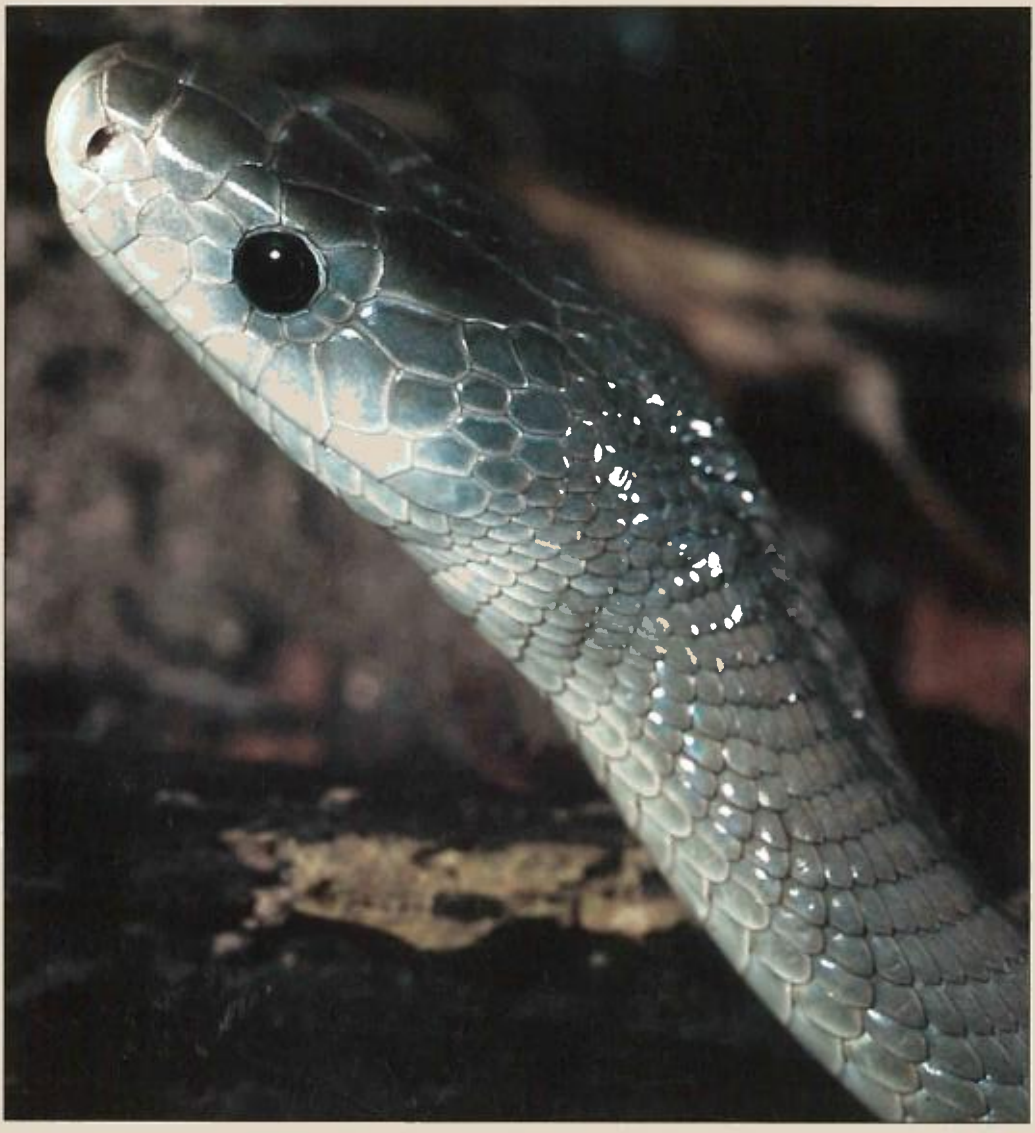

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THE HERPETOLOGICAL BULLETIN

The **Herpetological Bulletin** is produced quarterly and publishes, in English, a range of articles concerned with herpetology. These include full-length papers of mostly a semi-technical nature, book reviews, letters from readers, society news, and other items of general herpetological interest. Emphasis is placed on natural history, conservation, captive breeding and husbandry, veterinary and behavioural aspects. Articles reporting the results of experimental research, descriptions of new taxa, or taxonomic revisions should be submitted to The Herpetological Journal (see inside back cover for Editor's address).

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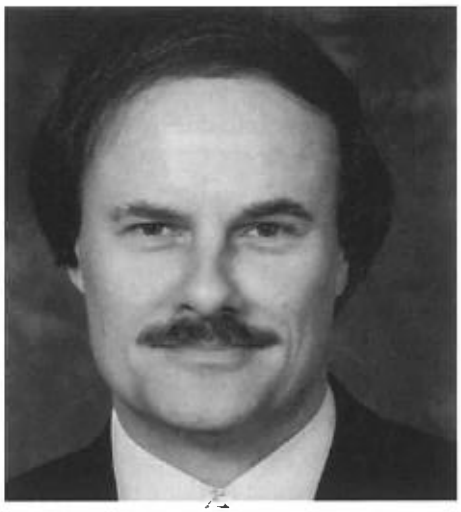
Front cover illustration
Black Mamba, *Dendroaspis polylepis*. Photograph by Tony Phelps. See article on page 7.

EDITORIAL

Meet the council....

Dr. Simon Townson, Chairman, BHS Captive Breeding Committee (CBC).



Simon Townson has had a life-long amateur interest in herpetology, from both a scientific and aesthetic point of view. He joined the BHS as an (underage) teenager in the late 1960s and has been an active member of the Society ever since, with interests extending to most areas of herpetology. However, his particular interests include captive breeding (focus on boid snakes and European newts and salamanders), fieldwork and conservation (UK and overseas, including the Caribbean Islands, Colombia, Guatemala, Costa Rica, West Africa, Australia, Europe and the USA). He has written/edited numerous articles on herpetology, covering subjects including the husbandry and breeding of boid and colubrid snakes, fieldwork on the West Indian Iguanas of the genus *Cyclura*, the politics of conservation and herpetological aspects of national and international legislation. As the co-founder/editor of the BHS Newsletter (1976-80), which evolved into the *British Herpetological Society Bulletin* (1980-2000), Dr. Townson has been involved as an editor for most of the 24 year period, helping to develop this publication to cover a broad and international interest in herpetology. In addition, more than 20 years ago he was the co-founder and first Chairman of the BHS Captive Breeding Committee (CBC) and initiated the rolling book programme. The CBC was formed to assist members and promote responsible animal keeping, to help co-ordinate breeding projects, to publish information sheets, scientific articles and a series of books on relevant subjects, and to advise government and other organizations on issues such as animal welfare, husbandry, trade and legislation. Some of these tasks have become increasingly complex and arduous, and together with dealing with inquiries etc. from members, outside bodies and the public, the Chairman's post can be very time consuming. Dr. Townson is now undertaking his third term or 'extended period' as Chairman of the CBC (re-elected from 1998), taking on the position really only in a 'caretaker' capacity, in the hope that a new Chairman will come forward (this Council position remained vacant for 2 years prior to 1998). Since this time the CBC has embarked on a major new initiative to collaborate with outside organizations and individuals to fund applied work/research on captive breeding and conservation projects. Funding for this initiative has come entirely from monies raised by the CBC from various activities, although mainly from the rolling book programme, which now has seven titles to its credit. Four projects have been funded to date, including a contribution to the Mallorcan Midwife Toad Recovery Programme at the Durrell Wildlife Conservation Trust (Jersey). In other recent activities, Dr. Townson has been closely involved with DEFRA and their agents, providing scientific advice with regard to the proposed review of the Dangerous Wild Animals Act (1976). In addition, this year he has appeared before the Companion Animal Welfare Council to give evidence pertinent to proposed new animal welfare legislation. Dr. Townson is a medical scientist by profession, and is currently the Director of the Tropical Parasitic Diseases Unit at Northwick Park Institute for Medical Research, London.

Leigh Gillett, Associate Editor, the Herpetological Journal.

Born in 1958, Leigh first became familiar with Britain's more common native amphibians and reptiles in the Sixties, keeping many in small outdoor vivaria or introducing them into the family's garden pond. By the early 1970s he had come across the BHS, but he was then too young to join and had to make do with receiving publications only. However, within a few years the decision was made to admit him to full membership. In the Eighties he started travelling up from Canterbury to the Society's London meetings, and the 1990s saw his first spell on Council.

Setting aside encounters in pet shops and on the Romney Marsh, Leigh's first exposure to exotic species occurred whilst working in New Zealand. Since then, he has been able to observe them in many other parts of the world, most notably Italy, Poland, France, Turkey and the United States. Fortunate enough to be studying in Oxford at the time of the first European Herpetological Symposium, held there in 1980, he was once again living in Canterbury in 1989 when the First World Congress of Herpetology took place in that city. It was at this event that he first made the acquaintance of Richard Griffiths and thus were the seeds sown for their later collaboration on the Herpetological Journal, on which he now serves as an Associate Editor.

ORIGINAL ARTICLES

Update on the status of the Green Lizard (*Lacerta viridis*) and Wall Lizard (*Podarcis muralis*) in Jersey

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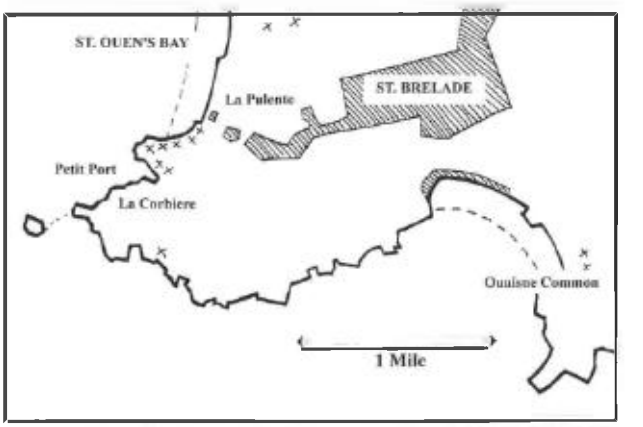
ON the 4th and 5th of May 1996 Jan Clemons and Michael Lambert headed a BHS Conservation Committee visit to Jersey and reported on both the various herpetofaunal captive breeding programmes being undertaken by the Jersey Wildlife Trust and Zoo and the status of the indigenous Jersey herpetofauna (Clemons et al., 1996). We saw neither the rare Agile Frog, *Rana dalmatina*, nor the island's collar-less morph of the Grass Snake, *Natrix natrix*, for the reasons stated in the report. We visited two Green Lizard sites, Ouaisne Common and the coast between La Corbiere and La Pulente, observing animals at the former. We also visited Mont Orgeil castle at Gorey, where the best population of Jersey's Wall Lizards are extant, seeing several. This year (2001) my wife and I visited Jersey between 20th and 25th September, managing to get accommodation

at Petit Port, which lies between La Corbiere and La Pulente, in the southwest of the island, on that part of the coast where we failed to see Green Lizards in 1996. We arrived in Jersey on the 20th at 13:30 hrs. It was sunny and warm with the temperature about 18°C. Between 14:30 and 17:00 hrs we saw five adult and two baby Green Lizards basking at the side of the coastal path between Petit Port and La Pulente, and a further two adults basking in islands of shrubs scattered about the heath that lies between the Quennevais Sand Dunes and St. Ouen's Bay. This heath runs from La Pulente right up to the northwestern-most corner of Jersey. Two male animals seen were very brightly coloured, their dark background hue being offset by spots of brilliant, luminous green. As mentioned in the 1996 report, the Jersey Green Lizards differ considerably in colour from those on the French mainland.



Map of southwestern Jersey showing location of Green Lizard sightings (denoted by crosses).

The following morning we walked in a southwesterly direction round the La Corbiere lighthouse and to the coastal heaths beyond. We were disappointed to see extensive fire damage to vegetation near houses south of the lighthouse, which we assumed to be accidental. We saw our first and only Green Lizard of the day, a brightly coloured male which had recently shed its tail, near a disused railway line three quarters of a mile further round the coast. Next day we visited Mont Orgueil. Since the 1996 visit, very efficient conservation of south facing wall space and adjacent feeding grounds forming the Wall Lizards' habitat had been put in place, together with an information board about the lizards themselves. We saw many lizards, including two males with interesting dark green backs, very unlike those of the greyish Brittany animals or the lime green backs of males at Ventnor, Isle of Wight. This castle environment is stated as being the southern-most habitat of the Wall Lizard on Jersey (although an introduced colony is present on St Aubin's Castle in the south of the island) (Tonge, 1986). It was therefore with great interest that we noticed a female basking on the surround of a flower bed on Gorey promenade at least a third of a mile south of the castle. I made a video (my first!) of the lizards. It was very poor, with quite dreadful shake. Nevertheless I did manage to show a male responding to my whistling. On being assaulted by a squeaky version of *The Liverpool Strand* it slowly walked towards me, cocking its head to one side. Sunday 23rd September was a mixture of sunshine and showers. We found two baby Green Lizards on the coastal path right at Petit Port at 10:30 hrs, and in the afternoon went to Ouaisne Common. In May 1996 we saw several lizards. This time we saw only two babies at approximately 12:30 hrs. By then rain was threatening and the air seemed considerably cooler than during the last few days.

During this visit to Jersey, Green Lizards and Wall Lizards were the only reptile or amphibian species seen. Both seem to be thriving and we were impressed at the conservation measures put in place by the States of Jersey to protect these two lizards, particularly after the quite dense urbanisation of the countryside lying immediately behind the protected coastal heaths in the west and the large numbers of both British and French holiday makers visiting Mont Orgueil in the east. It was very pleasant indeed to be able to still see so many attractive reptiles in such a small, crowded island.

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Are Common Lizards increasing their range in Scotland?

FRANK D.BOWLES

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IN Gerald Leighton's 'British Lizards' published in 1903, Alex Rodger of Perth Museum is quoted as saying the following about the distribution of the Common Lizard, *Zootoca* (= *Lacerta*) *vivipara*, in Perthshire: 'It is widely distributed throughout the county, but nowhere, I think, very numerous, though one may sometimes see four or five in one day, while hunting the southern slopes of heather-covered hills in sunshine'. On 26th August 1998, monitoring a forest path in Cally Woods, Dunkeld, for Slow-worms, a walk that I had taken regularly since 1982, I saw Common Lizards for the first time. Between 14:00 and 15:00 hrs I counted 17; 10 adult females; 3 adult males and 4 juveniles. As these were the first lizards that I had seen in that area, I decided to survey the immediate vicinity, and on 11th September visited Birnham Glen, about two miles south of Cally Woods. I saw 28 lizards on the hill above the glen (7 hatchlings; 4 juveniles and 17 adults, and one isolated hatchling actually on the path at Birnham Station).

DISCUSSION

Although the habitats of Cally Woods and Birnham Hill are almost adjacent, they are different in many ways. The former is a south facing forestry estate on a steep hillside, with patches of felled woodland and gorse-covered heath bordering a path climbing due north. There the lizards are seen basking on discarded logs, dead Gorse bushes and patches of Couch Grass. When I was there the adult females were, for the most part, quite old and comparatively large. The males, on the other hand, were young and small with indistinct markings.

Birnham is quite different; the site where the highest concentration of lizards can be seen is adjacent to a path going in a westerly direction through old mature mixed woodland which faces south. On the north side of the path is a strip of heather and bilberry stands about 100 metres long which catches the sun due to the felling of the larger trees on the south side of the path. The lizards seek the areas with the most Bilberry and shun places covered in Bracken. Unlike those in Cally Woods, many of the male lizards are seasoned old warriors, large in size with proportionally big heads. I suspect the difference in the composition of the populations in the two sites is due to the fact that the one in Cally Woods has only been inhabited by lizards fairly recently. About five years ago the Common Lizard was deemed officially extinct in the county of Fife. In the spring of 2000, a young anthropologist from Dunfermline telephoned the Lothians Amphibian and Reptile Group to say that he had seen lizards only a mile away from Brankston Grange, a site where they were last seen in 1804. He had reported the sighting to a naturalist who told him that there were no longer any reptiles in Fife and that he had probably seen a Palmated Newt in its terrestrial mode. On 30th June I went along with him to the site, and we saw three lizards (and got a distant but clear snapshot of one basking gravid female). The site was a sandy wooded heath due to be open-cast mined for Silica sand the following spring. However, United Glass, the firm which owns it, have fortunately agreed to save the strip of heath inhabited by the lizards.

My own personal experience of lizards in Scotland is equally strange. I moved up to Renfrewshire from the south of England aged 13, in 1944, already an enthusiastic amateur herpetologist, having caught my first Common Lizards in 1940. Our new Scottish home was right in the middle of what looked like suitable reptile country, but I saw nothing and had to assuage my interest by transferring my attention to birds and small mammals which seemed at that time to be very abundant.

Apart from a male lizard seen on the beech at Troon in 1958 and a basking female seen near Dumbarton in the mid sixties, I saw no lizards in Scotland until hill-walking on Ben Lawers in the late seventies, when I found several individuals, torpid with the cold, at 600 metres altitude. Finding so many animals in such an inhospitable environment and at such an altitude re-kindled my interest in these elusive little creatures, and for the last quarter of a century I have devoted a considerable amount of time to recording their Scottish habitats. National Records show an increase of lizard sightings from one 10 kilometre square survey done in 1960 to another done in 1995. The accepted reason given for this apparent growth in lizard numbers is that Scotland is a poorly recorded country (Fig.1.) This may be partially the case, but I am inclined to think that for reasons not yet understood, lizard populations are increasing, fluctuating, or changing their distribution range. Do, for instance, the increasingly mild winters allow larger numbers of hatchlings to survive into the next year? Why did my four years domicile in rural Renfrewshire during the 1940s reveal no reptiles when the latest surveys of that area show lizards in every 10 km square? Why does a walk through the Perthshire hills demonstrate on average at least three times as many lizards today as it would have done 97 years ago?

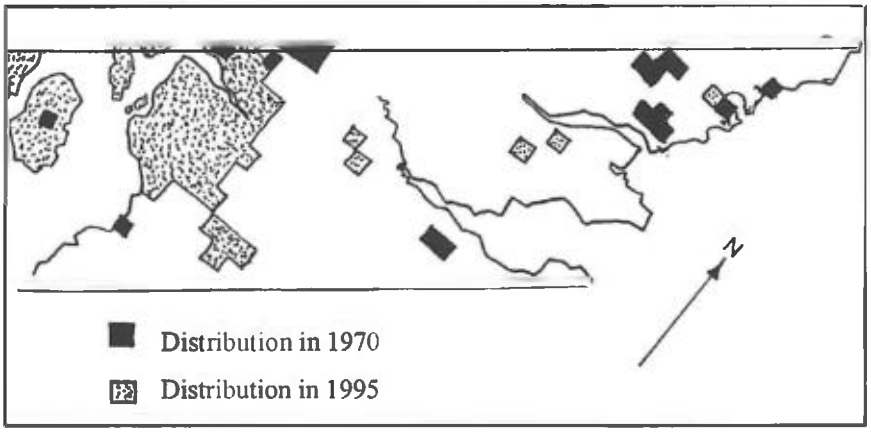

Figure 1. Increase of recorded distribution of *Lacerta* (= *Zootoca*) *vivipara* in the Central Lowlands of Scotland between 1970 and 1995.

During the last four years I have been visiting parts of Scotland where lizards have never been recorded. More often than not I am rewarded with a sighting. In July 1998 I saw 22 lizards basking along the roadside just outside New Abbey, in Dumfriesshire. In September 1999 I went to Dalwhinnie and Newtonmore, both in Invernesshire. The former demonstrated a large orange coloured male by the railway line at over 300 metres altitude, the latter a juvenile on a woodland bank. I also went to north Mull, just east of Dervaig, where no reptiles have ever been officially recorded. Within a couple of hours I saw five lizards, three Slow-worms and one baby Adder.

Lizard habitat; Sidlaw Hills near Dundee. Photograph by author.

A young female *Z. vivipara* with baby, near Tobermory, Mull. All photographs by author.

Female with youngster from Dunkeld.

An example of a heavily marked gravid female from Yorkshire (consuming grasshopper); her markings are quite different from those in the Scottish Highlands.

I first came to live in Dundee in 1974. Until quite recently the nearest place where I could find lizards was up in the Angus glens. In July 2000 I found them in two places in the Sidlaw Hills within seven miles of the city centre. In the same month a colleague of mine found an adult male under a piece of metal on waste ground next to Dundee's Swallow Hotel. On 4th August 2000, we found 4 adult and 12 baby lizards on a tiny heathery strip of ground at the foot of a road cutting through the Sidlaws between Dundee and Glamis. Last sightings of lizards here was in 1970. This year (2001), we had a polar spring in eastern Scotland, with fresh snow falling on 25th March, and temperatures earlier in the spring of -17 degrees centigrade. My confidence in the belief that Common Lizards were steadily increasing in numbers was considerably shaken. Normally male lizards are out by 1st March, but this year the first sighting was on 21st June at the road-cutting site, where I saw one baby where previously I had seen sixteen animals. A repeat visit to this site demonstrated the same one solitary youngster. Several visits to Dunkeld revealed nothing and my best site at Birnham was closed due to forestry work. The forestry folk promised me that they would avoid disturbing the lizards! Scottish lizard populations may or may not be increasing, but they certainly are fluctuating.

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A study of the Black Mamba (*Dendroaspis polylepis*) in KwaZulu-Natal, South Africa, with particular reference to long-term-refugia

TONY PHELPS

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THE Black Mamba, *Dendroaspis polylepis*, is probably the most infamous snake on the African continent. The snake's reputation has been borne as a mixture of fact and fiction, but mostly fiction. It is true that the Black Mamba is a potentially highly dangerous animal and an untreated bite would almost certainly be fatal, but most accounts of its aggressive nature, such as unprovoked attacks, are much exaggerated and can be discounted.

Research on Black Mambas, and other high profile venomous snakes, usually has a clinical bias, particularly in a country such as South Africa where snakebite is a very real problem. Although it may seem a tenuous connection snakebite statistics may offer clues as to the true nature of the Black Mamba. During the 1960s attempts were made to assess the incidence and epidemiology of snakebite in the Durban area (Chapman, 1967). Over a seven-year period more than a thousand cases were admitted, and although many of the species responsible were not identified, only seven were Black Mamba bites, all of which were fatal. Similar studies do show that the Black Mamba is the cause of a number of accidents; however, other species figure much more highly. In the Durban area these are: Night Adder (*Causus rhombeatus*), Bibron's Stiletto Snake (*Atractaspis bibroni*), Mocambique Spitting Cobra (*Naja mossambica*), and the Puff Adder (*Bitis arietans*). A more recent and detailed study in northern KwaZulu-Natal based on 164 cases over a sixteen-month period revealed that most bites were caused by the Mocambique Spitting Cobra and Stiletto Snake (Coetzer & Tilbury, 1982).

The fact that the Black Mamba is not uncommon, even in urban areas of KwaZulu-Natal, strongly suggests that it is undeserving of such a bad reputation. Just how common Black Mambas can be was first made apparent during my time as Curator of the Fitzsimons Snake Park, Durban, in the early 1980s. The duties of the snake park staff included dealing with so-called problem snakes. Many of these call-outs involved harmless species but quite a large number included venomous species such as Puff Adder, Night Adder, Boomslang (*Dispholidus typus*), Green Mamba (*Dendroaspis angusticeps*), and Mocambique Spitting Cobra. In addition, about two or three calls each week were positive Black Mamba calls, and many were found in some unlikely places. Black Mambas were caught in the Durban Botanical Gardens and in the roof space of a house where one had been feeding on bats. Many were taken from overgrown gardens, and one was even rescued from a ladies toilet at a caravan park. One aspect that was quite consistent when attending Black Mamba calls was that the residents often stated that the snake had been there for some time, perhaps months or even longer. It was also the case that some people were not too concerned about having the snake on the property until the land needed improving or development was imminent. Others were shocked to find that they had been sharing their space with such a notorious species.

Examining the sites where Black Mambas were caught was quite revealing. Often the refuge, a hole, or a series of holes, and perhaps the stems at the base of a bush, would be highly polished, clearly showing that a snake had been there for some time. Such refugia sometimes also contained shed skin of varying ages. On closer examination some sites even had evidence of egg fragments, revealing further proof of a long-term occupation. Although it is widely accepted, and often stated,

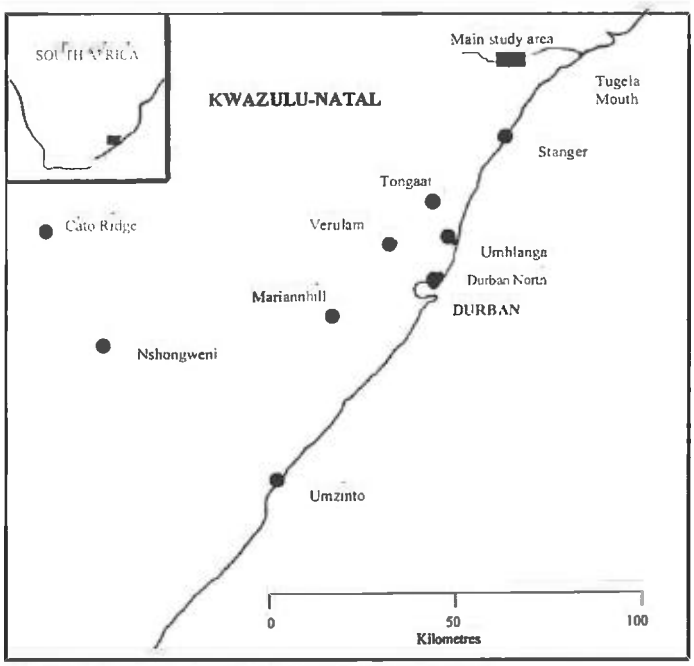

Figure1. Durban, showing location of study areas.

that the Black Mamba, and some other large elapids, appear to operate from a permanent refuge, (Pitman, 1974; Broadley, 1983), such statements appear to be a result of personal observation and anecdotes. However, such information that existed in popular treatise was enough to initiate a study of this aspect of behaviour. In addition, the study proved positive in recording other aspects of Black Mamba behaviour.

STUDY AREAS AND METHOD

Using a mixture of advice from colleagues, and as a result of my own experiences, nine study areas were established, all situated within a fifty kilometre radius from Durban centre. Although some of these areas were fairly remote, they all had one major disadvantage in that they all suffered from human disturbance in varying degrees. For this reason, another, and more remote, site was established as the main study area and was situated along the northern bank of the Tugela River some five km inland and 80 km north of Durban. This site was discovered while undertaking a general reptile survey along a two kilometre transect on this part of the Tugela River. This location is notable in that it represents the southernmost distribution for a number of reptile species, the most notable of these being the Nile Crocodile (*Crocodylus niloticus*). Other potential species to be found included the Snouted Night Adder (*Causus defilipii*), and possibly the Forest Cobra (*Naja melanoleuca*) and Egyptian Cobra (*Naja haje annulifera*). A checklist of the amphibian and reptile species recorded for this site is shown in Appendix I.

The habitat of the main study area consisted of dense riverine *Acacia* thicket with low rocky outcrops and occasional boulder-strewn open areas containing sparse grasses and thorn cushion. Although the acacia thicket was dense and virtually impenetrable, it only grew to a height of two metres or less. From the thicket the bank rose steeply to a low cliff face with hanging vegetation typified by aloes and euphorbias and various vines and climbing plants. A common factor for all the study locations was that all the actual refuges were situated in or very close to dense thicket or scrub. A short summary of the habitat types for the secondary study areas is given in Appendix II together with recorded sympatric snake species.

The actual refuge at the main study area consisted of a hole beneath two small boulders on the edge of a clearing, about two metres from thick cover (see page 11). The hole measured approximately fifty centimetres in width, by about thirty centimetres deep at its widest point. How far the hole extended beneath the ground was unknown. Black Mambas are shy and nervous, and usually very alert, and are difficult to approach to within thirty metres or so. However, observations at other sites, particularly around Durban, showed that the snakes that existed at long term refugia were fairly tolerant with regard to people habitually walking past. At one site, the refuge was just a few metres away from a well used track.

To establish fidelity of mambas at each respective refuge it was necessary to identify individuals. Scale clipping was not an option as past experience has shown that close disturbance, such as handling, can cause the snake to vacate the refuge (Phelps, 1981). Black Mambas obviously lack individual natural distinguishing features, such as body pattern, and it was initially thought that this may have presented a problem. The problem in fact solved itself when after a period of close observation, using both binoculars and telescope, it became obvious that nearly all the mambas identified bore the evidence of past trauma in the form of scarring, bits of the tail missing, and in one case an eye missing. Scarring was typified by patches of black where scales had been lost and the skin had healed. Some scars were quite large, others were more subtle, but size, shape, and location of scarring was carefully recorded and proved positive for identifying individual Black Mambas. The female Black Mamba at the main Tugela River study site was easy to identify as approximately ten centimetres of the tail was missing.

Site Name	No. snakes	No. of days visited	% days at refuge
Tugela River	1	85	90.58 (female)
Durban north	1	46	84.78 (female)
Umhlanga	1	52	92.30 (male)
Verulam	3	48	75.0 (females) 61.66 (male)
Tongaat	1	47	80.85 (female)
Mariannhill	2	54	92.59 (female) 77.77 (male)
Umzinto	1	41	80.48 (female)
Stanger	1	47	74.46 (female)
Cato Ridge	1	45	88.88 (male)
Nshongweni	2	62	91.93 (female) 80.64 (male)

Table 1. Black Mamba sites showing percentage of days at refugia. At the Tulega River site, snakes were visible for the period September 1982 to November 1984.

At the main study site a hide was set up on a low rock outcrop some thirty metres distance from the mamba refuge. The hide consisted of a two-metre wide canvas front extending to a roof some two metres in length and tied at the back to overhanging branches. Three apertures with flaps were made in the front of the hide and a screen of scrim was added for extra concealment. A telescope mounted on a tripod was set up for close detailed examination and binoculars used for general observation. The main study area was visited for a total of eighty-five days from 1982 to 1984 (Table 1). This included three sessions each consisting of five days continuous observation. During these extended periods of observation it was necessary to operate from a nearby base camp. As this was essentially a covert study it was desirable to be in place a little before dawn and depart just after dusk. This schedule was adhered to for both daily and extended periods of observation. All of the secondary study sites were visited at least twice a month and wherever possible the dawn till dusk timetable was employed. It will be appreciated that in some instances, for personal safety reasons, it was not possible to visit a minority of areas at certain times.

RESULTS

Social Structure — A total of fifteen individual Black Mambas were identified at twelve sites. Sexing individuals by sight alone was difficult but assumptions were made on shape of tail, (particularly during the breeding season), observations of courtship and mating, and positive proof of egg-laying. Accepting a small margin of error, of the fifteen Black Mambas identified, five were males and ten were females. All were adults estimated to be in excess of two metres, some notably much more.

During the study period no immature Black Mambas were observed. One probable reason for this is that Black Mambas can reach a length of almost two metres in the first year of growth (Broadley, 1983). It is also likely that shortly after hatching young mambas are more arboreal and remain secretive in thick bush. Quite early on

Black Mamba refuge, Mariannhill, KwaZulu-Natal, South Africa. Photograph by author.

during the study it became clear that Black Mambas do not occur in aggregations of any note throughout any given suitable habitat. The occurrence of more than one mamba at a refuge was unusual, and recorded for just for two sites. One refuge at Verulam consisted of a male and two females, while another at Tongaat had two females. These groups were observed to stay together during, and beyond the breeding season, although individuals were occasionally seen to be absent for several days or more. The fact that the Black Mamba is not uncommon would suggest that some individual refugia would be situated in reasonably close proximity to each other. However, due to the limitations of the study, mainly the requirement for minimal disturbance, this was not assessed in any detail. However, more than one refuge was identified at two sites: two refuges were seperated by 250 m at Mariannhill, and by 500 m at Nshongweni.

Although aggregations of Black Mambas were unusual, at four of the study sites, including the main Tugela site, the Mocambique Spitting Cobra was seen to share the refuge. This cobra is the most common elapid of the general area, as it is over much of central and southeastern parts of South Africa. During the study period the Mocambique Spitting Cobra was recorded in the general area at all but two of the sites.

At two sites, Umhlanga, and Umzinto, the Black Mambas existed in close proximity to the Green Mamba. The Green Mamba is highly arboreal and the two species were never observed to interact. Further up the coast, at the St. Lucia Estuary, Black and Green Mambas have been observed to occupy different areas; that is they are thought to be locally allopatric (T. Pooley, pers. comm.).

General behaviour — The Black Mamba is said to be the fastest snake in the world; discounting the more exaggerated stories, a maximum speed of around fifteen kilometres per hour is probably about right. But without doubt the most publicised aspect of the Black Mamba's behaviour is its supposed truculent nature and a so-called readiness to attack. This aggressive behaviour is said to be most apparent during the breeding season (Pienaar, 1978; Broadley, 1983), but others have stated that there is little hard evidence to support this (Spawls et al., 2002). However, the Black Mamba is a nervous excitable snake and meaningful defensive behaviour usually occurs in circumstances when the snake is either surprised or molested.

Observing Black Mambas from a place of concealment was a revelation. Although for most of the time individuals appeared to be alert, generally they were calm and were never seen to be aggressive. The daily cycle observed during the Spring (October) began with emergence at around 07:00 hrs. This time was seen to be constant throughout all the study sites, and for a seven day period during mid October all individuals showed a mean of 07:12 hrs (n = 12). Although the mamba's attachment to the refuge was seen to be constant throughout the year, lying-out, retreat, and movement, was variable and largely influenced by weather conditions. Pronounced sedentary behaviour was also observed when the

Refuge and egg-laying site of Black Mamba, *Dendroaspis polylepis* (hole between boulders in foreground). Tugela River, Kwazulu-Natal, South Africa. All photographs by author.

Female *D. polylepis*. Inquisitive hood-spreading. Tugela River, KwaZulu-Natal, South Africa.

Male and immature Boomslangs, *Dispholidus typus*. Tugela River, KwaZulu-Natal, South Africa.

Mocambique Spitting Cobra, *Naja mossambica*. Tugela Rive site.

D. polylepis from Tulega River site (post-partum female; note especially thin body).

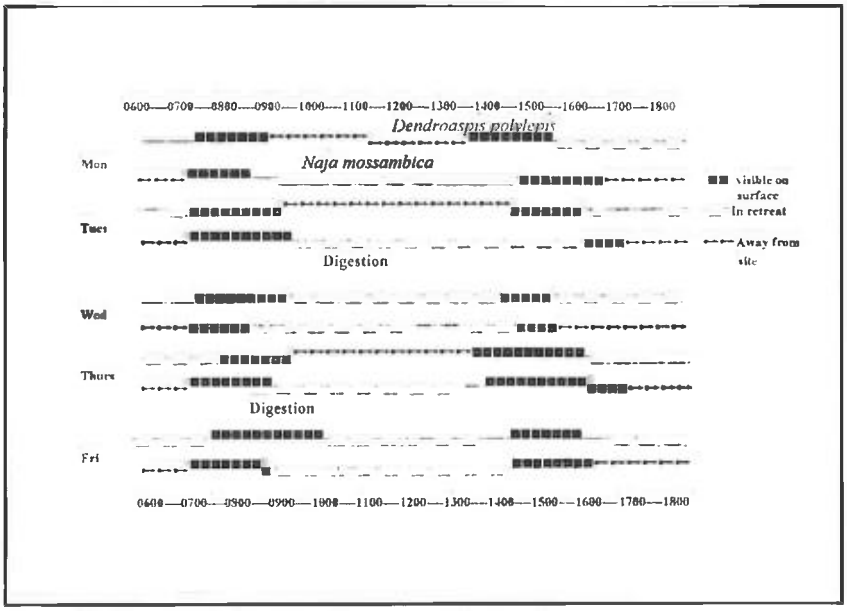

Figure 2. Diurnal activity of *Dendroaspis polylepis* and *Naja mossambica* observed over a five-day period at the Tugela River site, October 1983.

snake was in pre-moult condition and during parts of the winter period when a lower feeding regime was apparent. The daily cycle for two five-day periods in January and August is shown in Figs. 3 & 4.

Unlike snake refugia in temperate regions, hardly any of the Black Mamba sites were fully exposed to the early morning sun. The subtropical climate was typically humid and during the spring months night temperatures rarely dropped below twenty degrees Celsius. During the early part of emergence some individuals were seen to lie with just the forepart of the body out of the refuge. Others would emerge fully but stay immediately next to the refuge entrance. When fully emerged at ground level virtually all of the Black Mambas were observed to adopt a lying-out posture which can be described as an elongated ellipse with the head resting at the centre, and on top of the coils. During overcast weather, there were often extended periods of lying-out and this very often involved individuals climbing into low bush and stretching out in a loose posture.

At the sites that contained more than one individual at a refuge Black Mambas were seen to be extremely tolerant of each other, and during the early part of emergence would often lie entwined together. However, the interaction between the Black Mamba and the Mocambique Spitting Cobra, particularly at the main study site, was most notable. The spitting cobra at the main study area was a female of about a metre in length. Despite the size difference the two snakes would lie side by side most days, and on a number of occasions were seen to enter the refuge together. The Black Mamba is a diurnal snake and the Mocambique Spitting Cobra is largely nocturnal, and the fact that the lying-out times for both species were seen to noticeably overlap may appear unusual. However, at the main study site, the spitting cobra was observed to be at or near the refuge usually some time before the mamba and often looked well fed after a night of foraging. After a period of lying-out, alongside the female Black Mamba, the spitting cobra would retire into the hole around 09:00 hrs, and emerge again during the afternoon for another period of lying-out. The diurnal activity for the two snakes over a five-day period is shown in Fig. 2. The spitting cobra shared the mamba refuge continuously for eleven months and then disappeared, but reappeared two months later and stayed until the end of the study. The Black Mamba's tolerance toward other snake species was also made evident when an immature Rock Python, *Python natalensis*, took up residence in a mamba refuge at Nshongweni. The python stayed for just a week but during that time the resident Black Mamba showed no concern or react in any way other than to raise its head when the python moved close by.

The duration of lying-out periods in the spring at the refuge, consisted of around an hour and a

half in the morning with a similar period around mid afternoon, although at times the afternoon sessions were sometimes shorter. During the morning lying-out period at the main study site, the female Black Mamba would change position two or three times, including climbing into low bush if there was total cloud cover. lying-out periods usually ended with the snake moving slowly off into the surrounding thicket, but on occasions the female would move around the site following the edge of cover moving down toward the river. At such times the mamba would often pause and raise the forepart of the body and spread a hood as if surveying the way ahead. This behaviour was also observed with regard the spitting cobra but the snake only sometimes spread a hood.

Although the main study site was devoid of human activity the mamba was seen to be always alert to other possible threats. On one occasion, about an hour after emergence, the mamba suddenly raised its head and then rapidly entered the refuge hole. Some thirty seconds later a group of Banded Mongoose, *Mungos mungo*, appeared thirty metres away from the mamba, foraging along the edge of the river. It was almost forty minutes before the mamba emerged again from the refuge. On other occasions the proximity of other creatures drew little response. This was most apparent regarding a small troop of Vervet Monkeys, *Cercopithecus pygerythrus*. The monkeys were very much aware of the mamba's presence and its exact location, and would usually scold and bark from a tree some twenty metres away. These efforts solicited no response from the mamba, and the monkeys would give up and move off after a few minutes. On the occasions when the mamba climbed into low bush it would often be mobbed by birds, usually Bulbuls (*Andropadus* sp.), Weavers (*Ploceus* sp.), and Barbets (*Lybius* sp.). Even though these birds attacked boldly, almost touching the snake at times, it drew little response from the mamba, other than on one occasion when the mamba was seen to draw the head back and gape briefly. Birds proved to be useful allies as their alarm calls often signalled the mamba's return to the refuge during the afternoon some minutes before it actually appeared.

The female Black Mamba at the main study site did not always make daily excursions away from the refuge. Two reasons for remaining at the refuge were to allow the digestion of large meals and egg-laying. Another sedentary period was observed during the days when the snake was in the pre-moult condition. Normally, the colour of this mamba was ash grey with a dull white ventral surface. A few days before moulting the body colour changed very noticeably to a dark leaden grey, and in fact appeared as a completely different snake. During the period when the eyes became opaque the mamba became nervous and spent much of the time in, or at, the entrance of the refuge hole. When the eyes cleared, the snake moved away and moulted away from the refuge. Over a two-year period this mamba was observed to moult seven times.

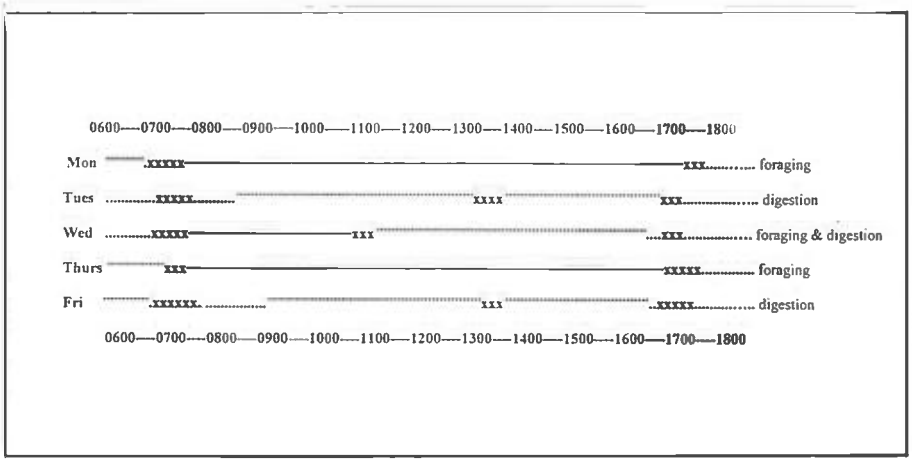

Figure 3. Activity of *D. polylepis* at the Tugela River site showing a high feeding regime over a five-day period during January 1984.

xxxxx visible on surface

******* in retreat

——— away from site

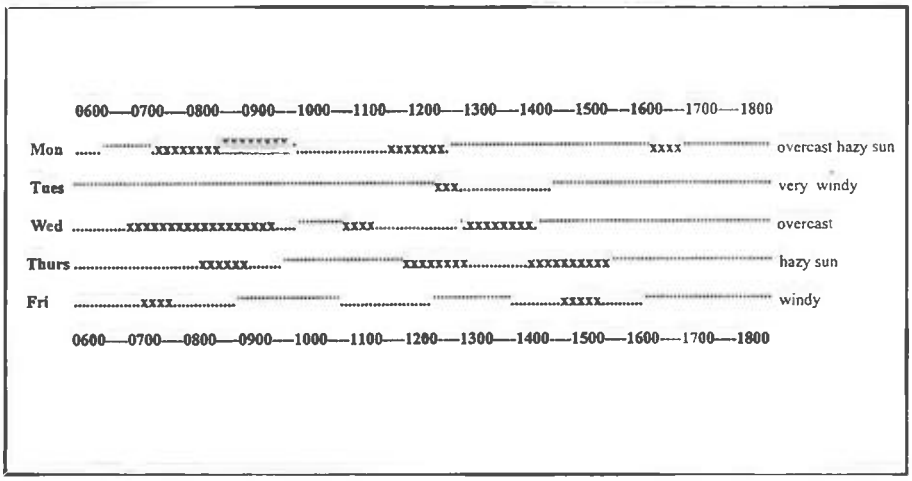

Figure 4. Activity of *D. polylepis* at the Tugela River site over a five-day period during August 1984, showing erratic lying-out periods and sedentary behaviour. The snake was in pre-moult condition

xxxxx visible on surface

******* in retreat

Foraging and Feeding — Although only one Black Mamba was actually observed ingesting prey, evidence of recent feeding was usually very obvious by a large bulge at mid body, which also showed that prey of some substantial size was taken. The one occasion when feeding was observed involved the female at Mariannhill. The mamba was seen some one hundred metres from the refuge and was identified by a long scar along the dorsals at mid body. The snake was half way up a small cliff face and had killed a young Rock Dassie, *Procavia capensis*, and was flicking the tongue over the body. The mamba was about two and a half metres in length and from the time that the snake engulfed the head of the prey until it was completely ingested engaged a duration of thirty-five minutes. The snake then retired into thick cover. Rock Dassies are said to be a favoured item of prey (Pienaar, 1978; Spawls & Branch, 1995). This is further confirmed by the fact that at least one tribal name for the Black Mamba in southern Africa, *muRovambira*, translates as 'dassie catcher' (Jacobsen, 1985). Rock Dassies were only present at three of the study sites, namely, Mariannhill, Nshongweni, and Cato Ridge. However, Black Mambas are known to take a wide range of warm-blooded prey and observations at the other study sites showed that there was no shortage of suitable food sources.

Evidence of Black Mambas feeding on bats was revealed during a rescue operation when a large female was taken from a roof space in a house at Westville near Durban. The snake regurgitated a freshly consumed bat, which was identified as the Free-tailed Bat, *Tadarida pumila*. The roof space also contained a number of other bat species including, the Cape Serotine, *Eptesicus capensis*, and an unidentified species of horseshoe bat, *Rhinolophus* sp. A moulted skin of a Black Mamba was also found in the roof space, which indicated that this could have been a permanent refuge. In fact, another Black Mamba was taken from the same roof space some three months later. On several occasions Black Mambas were seen in and around sugar cane plantations and one was identified as the male from the refuge at Verulam. The sugar plantations were also known to attract other snakes, including large Rock Pythons. The plantations contained large numbers of Cane Rats, *Thryonomys swinderianus*, although adults can reach a weight of five kilograms and Black Mambas would have only taken young animals. Potential prey at the main study site included Tree Squirrel (*Paraxerus cepapi*), Molerat (*Cryptomys hottentotus*), and Peter's Epauletted Fruit Bat (*Epomorphus crypturus*). The Cane Rat was also present in low numbers.

During the five-day observation periods at the main study site the female was seen to have taken very large items of prey. This was apparent when the mamba returned to the refuge around mid-afternoon with a hugely distended body. The snake

was obviously at a disadvantage at such times and moved clumsily, and stayed very close to the refuge hole. It has been stated that the Black Mamba can digest such large meals in as little as ten to twelve hours (Broadley, 1983), but the mamba at the main study site would stay at the refuge during the day after feeding. By the afternoon of that same day the snake was observed to have completely digested the meal making a total digestion period of closer to 24 hours.

When foraging, the mamba at the main study site was away for an average of four to five hours. Although there was no way of knowing how far the snake travelled the consistent and regular timetable indicated that movements were quite local. Observations show that, apart from moulting and breeding periods, the female mamba at the main study site fed two to three times each week and favoured large items of prey. Evidence that large items of prey were taken regularly was also recorded at Nshongweni, Mariannhill, Cato Ridge, and Verulam. Due to the notable paucity of immature mambas throughout the study areas it was not possible to investigate any ontogenetic shift in diet, although hatchling Black Mambas reared at the Durban Snake Park readily accepted skinks and other small lizards (pers. obs.). It is generally accepted that adult Black Mambas feed exclusively on warm-blooded prey (Branch et al., 1995). The Black Mamba has a wide spectrum of prey, and although this could not be confirmed during the study it is said to be willing to take relatively small items (Branch et al., 1995). The Black Mamba would appear to be an opportunist and this is made very apparent by the record of a two metre Black Mamba feeding on flying termite alates (Branch, 1991).

Breeding — Mating activity at the actual refuge was observed at only one of the study sites, Verulam, one of the refuges that contained more than one mamba. The resident male was seen to mate with one of the females on an overcast day during early October 1983, and then vacate the refuge but to return two weeks later. During late October through to the second week of November,

Sugar cane monoculutre. Feeding ground for *D. polylepis*. KwaZulu-Natal, South Africa. Photograph by author.

there were periods of up to five days when no mambas were seen at any of the refugia. The female at the main study site was absent from the refuge for two periods, each of two days, during early November. The absence from the refuge at this time involved both males and females and was obviously a part of the mating routine, and probably more specifically, mate-seeking.

During late October and early November an effort was made to observe Black Mambas away from the refuges. This part of study did not involve the main study area so as to maintain the discipline of minimal disturbance for this important site. In fact, searches away from the refuge were restricted to just two sites, Stanger and Nshongweni. Male rivalry was observed at Stanger involving two unknown males in the late afternoon of 4th November 1983. These males were in combat in full view on the edge of the sugar cane plantation and only approximately one hundred metres from the female refuge. Although not actually observed mating, the male and female from two of the respective refuges at Nshongweni were seen lying together in neutral territory during early November 1984.

Clear evidence of mating was obvious by the condition of females just prior to egg-laying in the summer. During December the female at the main study area was seen to be obviously gravid and in a premoult condition. The mamba had remained at the refuge for at least five days. One morning in

late January 1984 it was noted that fragments of moulted skin were scattered in and around the refuge hole. Later that day the female mamba emerged from the hole looking very thin and with fragments of old skin still adhering to parts of the body. The snake had obviously had a bad moult, but had definitely deposited eggs in the refuge hole. The female basked for about thirty minutes and then moved slowly down to the river and then returned some ten minutes later and retired down the refuge hole.

The opportunity of examining a gravid female was presented when a female close to the Umhlanga refuge killed a dog and a request was made for its removal. The female was duly caught and taken into captivity. Two weeks later this female laid twelve eggs. This mamba was notably large and details for this snake are given in Appendix III.

DISCUSSION

The study clearly shows that the individual Black Mambas have a definite and pronounced attachment to a permanent home base or refuge. The study sites were selected at random and although females outnumbered males by two to one overall with regard to individual sites it is most probable that long-term refugia are not biased toward either male or female. Twelve of the mambas were still in residence, including the female at the main study site, at the end of the study period. It is likely that unless disturbed Black Mambas may well remain at a particular refuge permanently. Correspondence with other herpetologists supports the statements in popular literature regarding a permanent refuge. In addition, a number of unofficial records were obtained including that of a Black Mamba in Kenya occupying the same refuge for seven years, (James Ashe, pers. comm.).

During the two-year period no Black Mamba exhibited any notable aggressive behaviour. The species is best described as alert, agile, and sociable toward their own kind and other snake species. During the breeding period some individual mambas became quite excitable, but such behaviour could not be described as aggressive.

The Black Mamba is not uncommon in KwaZulu-Natal and it is perhaps surprising that such a large snake could remain undiscovered in areas very close to human habitation for long periods of time. This aspect was most apparent at three of the study sites and probably says something about the true nature of the Black Mamba due to the lack of conflict between humans and snake.

We still know very little about the lives and habits of African snakes and there is a need for more ecological research, particularly with regard to the clinically important species contained in such genera as *Dendroaspis*, *Naja*, *Bitis*, *Echis*, and *Atractaspis*. Such knowledge can only serve as a better understanding of these so-called dangerous snakes and perhaps we may even learn how to minimise the age-old conflict between humans and snakes.

ACKNOWLEDGEMENTS

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Appendix I

Checklist of amphibians and reptiles recorded over a one kilometre transect at the Tugela River study area, Kwazulu-Natal.

AMPHIBIA

Bufonidae
Guttural Toad, *Bufo gutturalis*
Raucous Toad, *Bufo rangeri*
Red Toad, *Schismaderma carens*

Arthroleptidae
Bush Squeaker, *Arthroleptis wahlbergi*

Hyperoliidae
Painted Reed Frog, *Hyperolius marmoratus*
Yellow-striped Reed Frog, *Hyperolius semidiscus*
Greater Leaf-folding Frog, *Afrixalus fornasinii*
Bubbling Kassina, *Kassina senegalensis*
Forest Tree Frog, *Leptopelis natalensis*

Ranidae
Common Caco, *Cacosternum boettgeri*
Snoring Puddle Frog, *Phrynobatrachus natalensis*
Common River Frog, *Rana angolensis*

REPTILIA

Pythonidae
Rock Python, *Pyhon natalensis*

Colubridae
Brown Water Snake, *Lycodonomorphus rufulus*
Olive Grass Snake, *Psammophis phillipsii*
Green Water Snake, *Philothamnus hoplogaster*
Spotted Bush Snake, *Philothamnus semivariegatus*
Natal Green Snake, *Philothamnus natalensis*
Red-lipped Snake, *Crotophopeltis hotamboeia*
Boomslang, *Dispholidus typus*
Twig Snake, *Thelotornis capensis*
Brown Egg-eater, *Dasypeltis inornata*
Common Slug-eater, *Duberria lutrix*
Variegated Slug-eater, *Duberria variegata* (new record for area)
Bibrons Stiletto Snake, *Atractaspis bibroni*

Elapidae
Mocambique Spitting Cobra, *Naja mossambica*
Black Mamba, *Dendroapsis polylepis*

Viperidae
Rhombic Night Adder, *Causus rhombeatus*
Snouted Night Adder, *Causus defilippii*

Scincidae
Striped Skink, *Mabuya striata*

Gerrhosauridae
Yellow-throated Plated Lizard, *Gerrhosaurus flavigularis*

Varanidae
Nile Monitor Lizard, *Varanus niloticus*

Agamidae
Rock Agama, *Agama atra*

Chamaeleonidae
Flapneck Chameleon, *Chamaeleo dilepis*

Gekkonidae
Tropical House Gecko, *Hemidactylus mabouia*

Crocodylidae
*Nile Crocodile, *Crocodylus niloticus*

Pelomedusidae
Side-necked Turtle, *Pelomedusa subrufa*

Total no. amphibians - 12; Total no. reptiles - 25
*Most southerly distribution

Appendix II

Localities of individual Black Mamba refugia in the Durban area, South Africa, observed over a two year period (1982-1984).

	No. of sites	No. snakes /sex	Habitat	Recorded sympatric spp.
Durban North	1	1F	Thick bush at end of residential garden.	*Naja mossambica* *Dispholidus typus* *Lamprophis fuliginosus* *Crotophopeltis hotamboeia*
Umhlanga	1	1M	Coastal bush and cliffs	*Dendroaspis angusticeps* *Philothamnus semivariegatus* *Philothamnus natalensis* *Dasypeltis inornata* *Crotophpeltis hotamboeia*
Verulam	1	1M + 2F	Isolated *Acacia* scrub surrounded by monoculture (sugar cane).	*Python natalensis* *Philothamnus semivariegatus* *Thelotornis capensis*
Tongaat	1	2F	Riverine bush and low cliffs surrounded by monoculture (sugar cane).	*Python natalensis* *Naja mossambica* *Philothamnus natalensis* *Philothamnus hoplogaster* *Philothamnus semivariegatus* *Lycodonomorphus rufulus*
Mariannhill	2	1M + 1F	Well-vegetated cliff face along old pipeline, sites 250 m apart.	*Python natalensis* *Naja mossambica* *Bitis arietans* *Causus rhombeatus* *Dispholidus typus* *Thelotornis capenis* *Philothamnus hoplogaster* *Philothamnus semivariegatus* *Lycodonomorphus rufulus* *Lamprophis fuliginosus* *Apparallactus capensis* *Mehelya capensis*
Umzinto	1	1F	Coastal bush adjacent to large camp site.	*Dendroaspis angusticeps* *Naja mossambica* *Philothamnus semivariegatus* *Crotophopeltis hotamboeia* *Lamprophis fuliginosus*
Stanger	1	1F	Coastal bush close to residential area and sugar cane plantation	*Philothamnus hoplogaster* *Lamprophis fuliginosus* *Crotophopeltis hotamboeia*
Cato Ridge	1	1M	Rock outcrops with acacia thicket and small stream.	*Bitis arietans* *Naja mossambica*

				Elapsoidea sundevallii *Thelotornis capensis* *Atractaspis bibroni* *Philothamnus hoplogaster* *Philothamnus semivariegatus* *Crotophopeltis hotamboeia*
Nshongweni	2	1M + 1F	*Acacia* thorn scrub with steep cliffs and rock outcrops. Sites 500 m apart	*Bitis arietans* *Naja mossambica* *Causus rhombeatus* *Dispholidus typus* *Psammophylax rhombeatus* *Thelotornis capensis* *Philothamnus semivariegatus* *Philothamnus natalensis* *Mehelya capensis* *Lamprophis fuliginosus* *Lamprophis guttatus* *Apparallactus capensis* *Atractaspis bibroni* *Macrelaps microlepidotus* *Crotophopeltis hotamboeia* *Homoroselaps lacteus* *Python natalensis*

Appendix III

A note on maximum size for the Black Mamba, *Dendroaspis polylepis*, with reference to a large female taken at Umhlanga, KwaZulu-Natal, November 1983.

Accounts of Black Mambas reaching lengths in excess of five metres or more are well known. Some measurements have been taken from stretched skins; others are probably more likely the result of stretched imaginations. A stretched skin can add perhaps twenty percent to that of the actual live snake. One Black Mamba skin on display at a private game park in the Northern Transvaal measured 3990 mm. The living snake would have been more like 3220 mm, but still a very large snake. During the 1950s a Black Mamba said to measure 4.3 metres was shot by a man called Bennet in Natal. The account appeared in *African Wildlife* and the snake was referred to as the 'King of the Mambas'. Any mamba over 3 metres is a big snake; another Black Mamba caught in the Kerio Valley, Kenya, measured 3250 mm (Stephen Spawls, pers.comm.). The largest specimen in the Natural History Museum of Zimbawe is a 2990 mm female, although these largest specimens appear to be represented by heads only (Don Broadley, pers. comm.).

It has often been said amongst herpetologists who work in Africa that KwaZulu-Natal appears to have the largest Black Mambas. That is unofficial, but below are the measurements of the gravid female taken at Umhlanga. Surprisingly, this snake was living very close to a residential area and had been there for some time.

Total length — 3800 mm
Snout-vent — 3015 mm
Mid-body girth — 295 mm

An overview of the Cuban Turtle, *Trachemys decussata*, in Cuba

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TURTLES of the West Indies belong to the slider genus *Trachemys*. The endemic Cuban Turtle, called locally the Jicotea, *Trachemys decussata*, is divided into two subspecies: *T. d. decussata* and *T. d. angusta* (Seidel, 1988). *Trachemys d. decussata* is found in the Central and eastern Provinces of Cuba, whereas *T. d. angusta* is known to occupy western Cuba including Isla de Juventud or 'Island of the Youth' (formally known as Isla de Pinos or Isle of Pines).

Description

Trachemys decussata appears to be the largest West Indian *Trachemys* species (Seidel, 1988). During my visit in January 2002, the largest individuals I observed reached 266 mm for a female and 242 mm for a male from Santiago de Cuba Province, which is still below the maximum size of 388 mm for females and 268 mm for males reported by Seidel (1988). Melanism in adult males is common. The adult carapace is brown or olive and the plastron is usually yellow and unmarked. A complete diagnosis is provided by Seidel (1988): the inguinal scutes are posteriorly aligned and projected laterally to form an angle, the gular scute is short, the cranium is shallow with the maxilla flared laterally, and the squamosal is tapered posterodorsally.

Distribution

In Cuba, wetlands cover 5,345 square kilometers (Diaz-Briquets & Pérz-López, 2000). The Cauta River is the longest river (370 km) and flows from the mountains of eastern Cuba to the southern coast. Cauto tributaries are among the largest Cuban rivers. The two next longest rivers are the Sagua Grande and the Tara (Figure 1). Many other rivers run from the central spine of Cuba. After the revolution, numerous man-made reservoir were built in various parts of the country and about 200 large dams and 800 'mini-dams' are now part of the landscape (Diaz-Briquets & Pérz-López, 2000). The first herpetological reports from Cuba were vague about the distribution of *T. decussata* (Barbour & Ramsden, 1919; Buide, 1967). The species was found everywhere in Cuba where suitable habitat was present (e.g. rivers, ponds, marshes and reservoirs). The only detail mentioned by Barbour & Ramsden (1919) was that the Cauta River and other major large rivers harboured large populations, and they specifically noted that turtles were heavily captured for food.

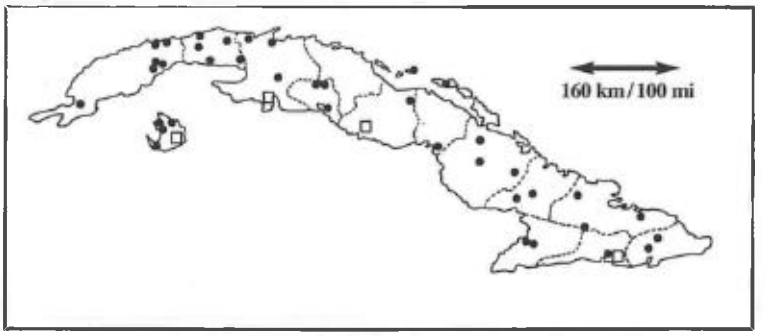
Due to my short excursion in Cuba, I could not evaluate the abundance of Cuban Turtles in the Cauta River. However, an ex-fisherman from the area (Manolo Benítez Corella, pers. comm. 2002) informed me that *T. decussata* is not as abundant as it used to be. The first Cuban Turtle distribution map shows that *T. decussata* is widespread (Seidel, 1988). I have added new localities to this map especially in the Zapata swamps (Matanzas Province) where abundant populations still exist (Figure 1). These localities are based on observations and interviews with fishermen in the field. The Cuban Turtle may also inhabit many man-made reservoirs, but further investigation is needed to determine its current extent in Cuba and its adaptation to man-made habitats.

Natural History

According to Pritchard (1979) *T. decussata* is carnivorous. However, I would characterise the Cuban Turtle as opportunistic and a dietary generalist, eating several groups of animals and plants. For instance, local people captured them using fruit as bait. Their diet may vary seasonally, locally, and also according to their different life stages. Food items are swallowed in the water. The Cuban Turtle is less active during the dry season (November to May) and some individuals are believed to aestivate. At this time of the year, fewer turtles are observed basking.

The reproductive ecology of *T. decussata* has been poorly studied. Females may deposit two

clutches or more in a single year (Sampedro & Montañez, 1989). Oviposition usually starts in May with egg-laying taking place after sunset and not later than midnight. The incubation time averages 87 days in the Zapata swamps (Sampedro & Montañez 1989). Egg sizes average 40.5˜25.5 mm (Petzold, 1968). Larger females appear to nest earlier in the season than smaller ones. Among the 36 nests studied by Sampedro & Montañez (1989), 45 percent were predated by feral dogs and mungus. Nests were excavated between 2-3 meters from the water's edge, with one instance up to 200 meters. Turtle density is unknown in their natural habitat; however, Builde (1963) noted that they live in colonies of hundred of individuals. Their home range and overland movements are still a mystery.



Distribution of *Trachemys decussata* in Cuba. Squares represent new locality records (2002), circles denote records from Siedel (1988). Scale bar = 160 km/100 miles.

Economic and Cultural Importance

In Cuba, many animals including reptiles are believed to cure human diseases. These beliefs originate from the indigenous Taino Indians, long before the invasion of the Spaniards. Most of these beliefs have been transformed or even disappeared since. The Cuban turtle is thought to help 5 diseases. The Cuban Boa *Epicrates angulifer* is held to be useful for 41 disorders! (Silva Lee, 1997). The believed medicinal properties of the turtles and other reptiles do not appear to be used any more. The Cuban turtle is also captured as a food source. At the beginning of the 1900s, turtles were sold in markets and probably widely consumed. Barbour and Ramsden (1919) were alarmed by their potential decline in the future due to over consumption. Until 1959, the year of the revolution, their consumption was probably important. The lack of ownership and private market imposed by the new centralized socialist government has probably decreased the *T. decussta* capture rate in the wild. The economic crisis of the 1990s, which continues nowadays, has revitalized the black market, creating a potential 'push' in turtle consumption. Cuban Turtles are eaten on an irregular basis. People also capture them to keep them as a 'pet' to provide good fortune. As such, they are sometimes kept in cruel conditions.

Vulnerability and Conservation

Numerous anthropogenic factors could have reduced or exterminated Cuban Turtle populations. Some major impacts to populations and their habitats are likely associated with a regime change in rivers and creeks due to extensive damming and lowering underground water tables (e.g. southern plain of Pinar del Rio Province), water pollution (industrial, agricultural and urban), and habitat loss. Non-native species could also affect *T. decussata*. For instance, the introduction of Bullfrogs, *Rana catesbeiana*, could be a potential predator of hatchlings. Builde (1967) was the first to mention the Bullfrog presence in Cuba but their introduction occurred before the late 1960s. The Cuban Turtle is not protected under Cuban laws. A small reproduction

Trachemys d. decussata; male, Zapata swamps area. Photograph by author.

Trachemys d. decussata from eastern Cuba; female on left, male on right. Photograph by author.

Trachemys d. decussata; head pattern of male from eastern Cuba. Photograph by author.

Cuban Turtle habitat near Santiago de Cuba. Photograph by author.

program (dozens of turtles) exits near the Zapata swamps as part of a larger, endemic fish reintroduction program. Due to the lack of financial resources however, the turtle reproduction program appears inefficient, especially after the recent damage inflicted by Hurricane Michelle (2001).

A study on the current distribution and abundance of *T. decussata* is urgently needed to assess its status in Cuba. This study should be part of a larger Cuban herpetofauna research program leading to conservation efforts.

ACKNOWLEDGEMENTS

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Herpetofaunal observations in agricultural drainage dykes, Naoussa, northwestern Greece

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GREECE is well known for its rich and diverse herpetofauna (see Werner, 1938; Ondrias, 1968; Chondropoulous, 1986, 1989; and Corbett, 1989). A wealth of information is available, with distribution records for many of the islands; however, in mainland areas there may be missing pockets in our overall knowledge of species distribution (Pérez Mellado et al., 1999). Naoussa is located east of Thessaloniki just north of Veroia in the Imathia division. The slopes of the Mount Vermion region surrounding Naoussa are known for their healthy agriculture and successful production of red wine. The hydroelectric town of Naoussa trades mainly in rug/skin processing and fruit production. The surrounding area remains tranquil throughout the year, the main tourist calendar event being a historical parade and carnival in February.

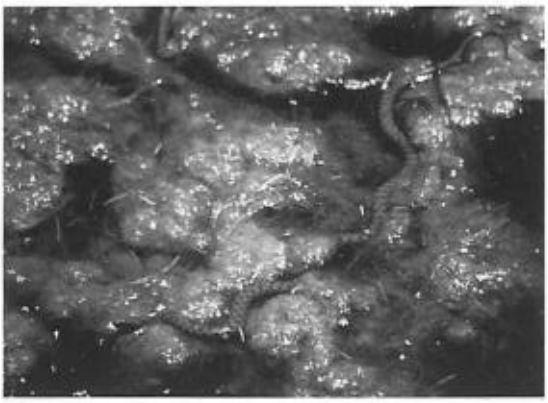
This short report comments on the few herpetofaunal species found in agricultural drainage dykes in the Naoussa region, northwestern mainland Greece, during four visits between April-June 1999. The area investigated was situated a few miles outside of the town. Lowland farmland areas in this region are characterised by a patchwork of peach, apricot, and silk farms at elevations of <500 m.

Observations of herpetofauna frequenting field margin drainage dykes at an agricultural research site (operated in conjunction with The Aristotelio University of Thessaloniki) were conducted on three occasions. The time allocated was short due to the primary study time focusing on retrieval and monitoring of botanical samples. Each survey lasted for 60 minutes and covered four 150 m-long dykes. There was a network of dykes, but the four chosen were the only ones containing water. All animals were identified and released at the site of capture.

HERPETOFAUNA

Bombina variegata, Yellow-bellied Toad (L). Comments: Largely diurnal, frequents most forms of temporary pool. Sociable, calls both diurnally and nocturnally. Small (<5 cm), flat, warty body. Bright yellow underside with blue grey/blackish markings, yellow markings on finger tips, grey brown to olive back, no vocal sac (for additional identification features see Arnold et. al., 1980 and Lang, 1988). Over 20 specimens were found in a running stream close to an actively used path. Most of the individuals congregated under a 2 m piece of corrugated iron in the stream (presumably for protection). Seven of the same individuals were found on all three occasions under the tin (identified by their distinctive belly pattern). When disturbed, individuals would exhibit the familiar *Unkenreflex* (see Hinsche, 1928; Duellman & Trueb, 1994). Interestingly, all *B. variegata* found had very few of the grey-blue blotches on their undersides and some younger individuals had just a few flecks. Specimens were also found buried under fist-sized rocks in the main babbling flow.

Rana ridibunda, Marsh Frog/Lake Frog (Pallas). Comments: Gregarious, diurnal, highly aquatic, warty, pointed snout, grey vocal sacs, olive green to brown back, <15 cm, closely set eyes, basks in sun (see Arnold et al., 1980). The specimens encountered were extremely agile and avoided capture. Those captured for identification were retrieved from deep grassy pockets beside the ditches and under a confluent pipe. Four to five individuals existed in each 100-250 m length of field margin dyke. The individuals captured from the pipe frequented thick soupy water that was rich in algae, other aquatic plants and detritus. Locating individuals was made easier by their persistent croaking chorus.



Natrix tessellata foraging in drainage dyke, Greece (Corfu). Photograph by P. Stafford.

Natrix tessellata, Dice Snake, Tessellated (Water) Snake (Laurenti).

Comments: Highly aquatic, adults 100 cm+ (usually <75 cm), narrow pointed head, round pupil, keeled dorsal scales, variable colour and markings, grey brown to yellow green, dark blotches on body, sometimes with yellowish spot, yellowish chequered underside (see Arnold et al., 1980). One live and one dead individual were found. The dead individual was an adult found at the edge of a peach plantation field. The cause of death was most probably a lawn mower (the animal was found shredded shortly after a cut). The live specimen was juvenile (<20 cm) and found under a slab of concrete near a confluence of three dykes. It may be assumed that *Natrix* sp. frequented the area due to the availability of suitable habitat and food resources (Hailey et. al., 1982). The juvenile specimen did not musk upon capture.

DISCUSSION

Corbett (1989) describes a range of threats to herpetofauna within Greece including collection, persecution and speculation for land development. Regarding Naoussa, collection may not be a large threat due to the isolation of the town and limited tourist interest (compared with Greece's many islands). However, vast open tracts of land may not necessarily be patrolled routinely by farmers. Persecution could also be a threat if animals were to venture onto paths/tracts through crops although the chances of this are arguably low. Encounters with amphibians and reptiles are few without actually searching for the animals.

Naoussa's main potential threat to herpetofauna is from agricultural intensification of its lowland habitats. Amphibians are known to inhabit agricultural areas (Beebee, 1981) but this can depend upon the physiological characteristics of the pond and tolerance of its inhabiting species (Beebee, 1983). Most intensive agricultural areas make poor habitats regardless of chemical pollution (Beebee & Griffiths, 2000). The reduction in diversity caused by monocultures and removal of corridors such as hedges and dykes inhibits the life cycle of migratory species and could lead to an isolated population. It is uncertain without further study whether the individual species encountered were resident, migratory or relic populations. Their isolation amongst such vast agricultural plantations may indicate a use of the dykes as corridors to other habitats.

The agricultural testing plots that were studied are mostly used for bio-control experimentation. Amphibians found in the dykes appeared healthy with no visible signs of physiological damage from agrochemical leaching, despite the dykes showing signs of eutrophication. Eutrophication is usually associated with excess phosphate and nitrate run-off and is common in crop margin dykes (Hill, 1991; NRA, 1992). However, it would be debatable in this instance whether nitrates (although known to be toxic to larval and adult amphibians — Secher, 2000; Oldham et. al., 1997; Watt & Oldham, 1995) are a potential factor limiting the distribution and presence of herpetofauna in this area. The higher summer temperatures (which coincide with applications) encourage maximum rates of growth and therefore optimum uptake by the fruit trees. Bare soils leach easier than those in Naoussa planted with fruit trees and the scorching summer sun can increase evapotranspiration of water-soluble nitrate from the soil (Hill, 1991). Other factors, such as type of soil, groundwater level and drainage, crop strains, type and frequency of nitrogen applied, can also influence levels of leaching (Hill, 1991; Soffe, 1995).

Numbers of amphibians found were greater in the two dykes surrounding a peach plantation. Peach plantations are generally sprayed very lightly to avoid damage to the plant (NAC, 1994). These testing plots in particular were also being used for Integrated Pest Management experimentation. Perhaps the increase in amphibian numbers is correlated with the implementation of biocontrol methods. In-situ studies into the effects of locally used agrochemicals and tolerance levels of these populations could reveal this. Further reports of species, their habitat preferences and distribution would also enable monitoring of the herpetofauna inhabiting this unusual, artificial habitat.

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Keeping and breeding Leopard Tortoises (*Geochelone pardalis*). Part 1. Egg-laying, incubation, and care of hatchlings

ROBERT BUSTARD

THIS captive-breeding/husbandry article on a very beautiful — indeed magnificent-looking — tortoise, resulted from a discussion at Council in October 2001 on the inadequate number of practical articles on keeping the various species of reptiles and amphibians being submitted to *The Herpetological Bulletin*. I at once had a 'whip round' getting everyone present to undertake to write an article on some topic of their competence. I then asked Council what they wanted me to write. I think it was Barry Pomfret who actually 'roped me in' for this topic as he said there were a lot of people keeping 'leopards' these days. Partly I was to blame, as I had said that they were 'boring', and didn't do much and — insult of insults — that one would be as good with some garden gnome leopards as with the real thing! That, of course, only made Barry keener that I should write about keeping leopards. My comments were more than a little unfair to the leopards as will hopefully become clear below.

In this first article (of a two-part series) I deal specifically with reproduction and the care/rearing of hatchlings — this has been intentionally provided first as it will appear at a time in the UK when leopards will be breeding and hatchlings will start becoming available. Information on husbandry will follow in the second part.

Leopard tortoises, well looked after (see Part 2), will breed naturally each year once they are of breeding size/age. In the (unfortunate) case of imports, because of their treatment prior to reaching you (Part 2), together with adjustment to our seasons for southern hemisphere races, this may take a year or more. As is the case with all/most reptiles studied, size not age is the key factor in sexual maturity. Reptiles do not commence breeding until they have reached a certain minimum size irrespective of their age. Male leopards are sexually active at a flat shell length of about 15cm (6"). At this time they will court females assiduously. Females are considerably larger, however, before they commence breeding with the result that these newly sexually mature males have trouble in mounting them successfully. Although female leopards take on average a couple of years longer than males to reach sexual maturity, size/weight is always a much more reliable guide than age in reptiles and females can be expected to commence breeding around a weight of 8kg.

Because of the leopards' highly-domed carapace males need to be sufficiently large to be able to successfully mount any given female. Enthusiasm is not enough! As is common in tortoises, optimistic males will usually select the largest female on offer. Although there are good evolutionary reasons for this (larger females lay more eggs so more surviving progeny can be expected) mating for leopards with too disproportionate a size difference is physically impossible. A colleague in the southwest, who regularly breeds leopards, told me that he found he was able to overcome this problem of size discrepancy by wedging a piece of brick below the rear of the plastron of females to raise them up and so allow mating to take place. This story, which I believe to be true, although I have never tried it personally, provides an excellent illustration of the passiveness of leopards. Leopards will happily dig in grass unlike many tortoise species which seek out clear areas of soil. Furthermore, they will regularly nest in the open whereas many other species are attracted to secluded areas. I have recorded nesting in the middle of my 8m square pen. This must reflect their nesting habits in the wild. The greatly elongated claws on the club-like feet of female leopards are an invaluable aid not only in acting like a fork to break through the grass roots but also in digging the nest; indeed it would

seem impossible for them to succeed without them due to the club-like hind feet of adults. As the nest construction proceeds, the piles of soil on both sides grow larger and the female raises herself up on her front legs in order to reach further down with each hind limb in turn. Chelonians dig the egg chamber as deep as they can reach, the reach obviously becoming greater as the tortoise grows which automatically provides more space for the increasing egg clutch.

Plate 1. A large adult leopard egg-laying in the middle of the paddock. Note the large amount of soil excavated and its spread — it is well placed to each side to prevent it falling back into the egg chamber. Photograph by author.

I collect the eggs as soon as I am sure that egg-laying has finished. To be quite certain I wait until the first covering-in movements commence then I lift the female forward, collect the eggs as described below, and then return the female to her former position over the egg chamber. Moving the female in no way interrupts her covering in behaviour which is entirely automatic. The eggs, marked so that they are not rotated, are removed to a rigid container (so that the eggs do not come together when it is lifted), containing slightly moistened vermiculite for incubation and the female left to cover up the nest site. Covering and disguising the nest site is an immensely more difficult task in grass compared to a nest dug in soil. However, by the end of the process you can see from Plate 1 that they make a very good effort. As with other chelonians the females move forwards as covering up progresses so that the actual site of the nest is disguised. The time taken from the start of digging to the completion of covering up and disguising the nest-site varying widely depending on the type of ground in which they are digging, the size of the female, and the number of eggs laid. There are also marked differences in the time that different females spend disguising the site. Some seem to go on forever. 'Average' timespans for the whole procedure, based on my own observations of females digging in established grass would be between one and a half and two hours.

Many people breed tortoises — of various species — without ever realising that they have done so, and others only realise when they come across eggs in the autumn whilst turning over the ground. By that time, of course, the eggs will not hatch as they have not been warm enough. If you breed tortoises, it is vital to know when egg laying has taken place so that you can remove the eggs to a suitable incubating environment as soon as possible. People use various techniques to know when a tortoise has laid. These work much better, however, with tortoises which lay in open areas of soil as precise nesting sites with all the preferred attributes — including a warm area with open southerly exposure — can be prepared. This is much more difficult with species which will nest in the middle of an area of grass rather than in a prepared nesting site. With leopards, unless you think

Plate 2. Hatchling emerging from the egg. Note the highly-domed carapace and strongly contrasting coloration even at this age. Photograph by author.

Plate 3. Emerging hatchling with a substantial yolk sac still to be absorbed (see text). Photograph by author.

nesting has occurred and search very carefully for tell-tale signs, the nesting may easily be overlooked in a sizeable outdoor pen. If you are at home during the day it is a good idea with breeding tortoises to check them very regularly. A watch alarm set to go off hourly and switched on each morning and off in the afternoon is a foolproof method. Tortoises will normally be outside in the sun for some time in the morning before commencing to nest and are also unlikely to nest late in the day. For, most species the vast majority of nests will be made during the heat of the day say between 11am and 3pm. If you cannot check during the day you will have to rely on other cues. One is differences in the female's behaviour. Pre-nesting females frequently wander more and appear restless in the days preceding egg-laying. Secondly, very careful checks of the outdoor pen will need to be carried out daily for the least sign of disturbance to the ground.

If you are present at the egg-laying then the tortoise can be moved a short distance off the nest immediately egg-laying is complete. The best technique is to wait until the very first signs of filling in just in case there are one or more 'late' eggs. This movement will not disturb her and the eggs can be carefully removed into a container set up with vermiculite. As each egg is lifted a small mark is made on the top so that the egg is not subsequently rotated. This is crucial with reptile eggs. The egg clutch in its container is then placed without delay in the (prepared) incubator.

Clutch sizes increase with the size of the tortoise and females breeding for the first time may lay only a few eggs; with leopards clutches of about 6-10 eggs are average. Leopard eggs are fairly circular and of a good size averaging about 42-43 mm in diameter with weights of about 45g. There is a good possibility of multiple clutches (two or even more) being laid each year where the females are kept under ideal conditions with plenty of warmth, sunshine and a good varied diet. Since each clutch is not onerous for the female in biomass terms (that is the weight of the clutch as a proportion of the female's weight) it seems probable that in nature several clutches are laid each season. Ideal conditions should replicate this in captivity.

Prior to anticipated egg-laying the incubator should always have been tested to ensure that it is in working order and that the thermostat is correctly set. There are many forms of 'incubator' with some DIY ones doing excellently and varying from those in which the temperature is provided by an aquarium heater in a tank partly filled with water, through polystyrene fish boxes with small thermostatically-controlled heaters to professional incubators of which the 'Brinsea' range are

probably the best known. I use exclusively Brinsea incubators, but whatever you use the key thing is to have a reliable incubator.

I do not think the substrate is important as tortoise eggs will hatch in a wide range of mediums. I use vermiculite which is convenient and sterile. It is kept slightly dampened throughout the entire incubation period as the humidity is beneficial. Vermiculite does not 'compact down' like some soils and some sands. This can be important as it could trap the hatching tortoise if the eggs are completely buried. I do not completely bury the eggs but leave just the tops projecting so that I can readily check hatching through the glass window of the 'Brinsea' incubator.

In nature, leopard eggs, because of the wide distributional and altitudinal range of the species, may hatch over very variable, and often lengthy, periods. There are genetic factors involved so that even at the same temperature there may be widely different incubation timespans for eggs from different populations of the same species as I discovered long ago in Australian geckos (Bustard, 1969).

Leopard eggs incubate well at 30°C or just below this, and incubation at this temperature averages about 150 days. It is important to appreciate that not all eggs may hatch together so late-hatching eggs should not be discarded. They may well hatch a week or two later.

Neo-natal care — As with many reptiles the baby tortoises do not emerge immediately after slitting the shell. Slitting the shell provides them direct access to air for breathing but often considerable amounts of yolk are still present at this time. This yolk should be absorbed prior to emergence. Furthermore, the baby tortoise, which is curved round in the egg, has to 'straighten out'. This process, depending on the amount of yolk still present externally when the shell is slit, may take only a matter of hours or may take a day or more. If the incubator environment is too dry, there is danger of egg residues, such as mucus, which can dry in sheets like 'clingfilm' adhering to the baby with possible risk of suffocation. This would not be a problem in nature as at this stage the hatchling is still underground and consequently at higher humidity levels. The solution to this problem is to remove hatching tortoises to another container at the same temperature but with damp kitchen towel on the bottom thus increasing humidity and preventing problems. Tortoises which emerge from the egg with the egg-sac still protruding should be given the same treatment. It is not safe to allow them to walk around on a rough, dry substrate in such a state. In all but extreme conditions, where a little longer may be required, the eggsac will be fully absorbed after 24 hours. At hatching baby leopards average about 42mm in flat shell length and weigh 25-35g.

Rearing the young — Baby leopards are not difficult to rear. Like all babies they should initially be kept at higher temperatures than the adults. I recommend a background day temperature of 26°C (80°F) with a hot spot area reaching 32°C (90°F) falling to 20°C (68°F) at night when the hot spot lamp is switched off. An under-tank heat mat should be used to achieve these temperatures. The babies should only be outside on warm sunny days when shade must always be available. For baby tortoises a sun/shade mosaic is ideal, failing which there should be readily available 'tufty' vegetation into which they can burrow. The purpose of these arrangements is to ensure that the baby tortoises can always readily find shade and avoid overheating. The heating and cooling curves of hatchling tortoises are totally different from adults in that due to their tiny weights and comparatively huge surface areas they can heat up to lethal temperatures dangerously fast. Cooling under adverse conditions is also rapid.

Baby leopards tend to be very active. This is perfectly normal and is no cause for concern. As with all baby tortoises when newly hatched/very small the food should be cut up very finely so that they can ingest it readily. As with adults there should be good variety in the food provided. Nutrobal should be given regularly (initially every other day; after 3-4 months twice weekly). This is on the basis that the baby tortoises have access to

growing food and sunshine. It should be increased if this is not the case. Water should always be available. For baby tortoises I use jam jar lids as they are easy to access and due to their shallow nature even the smallest baby cannot drown in them and can readily move out. These factors are important as tortoises often drink from 'puddles' in nature and will actually enter the puddle to drink. The babies may actually climb into the jam jar lid to drink. Where water is often at a premium tortoises will drink dew, scooping it off the grass in the mornings. After a couple of years or so you will have superb juvenile tortoises, and if you obtained captive-bred youngsters in the first place, you will have come full circle.

I urge you NOT to sell newly hatched 'leopards' or newly hatched tortoises of any species. These are delicate and need what to ordinary people amounts to special care. I agree entirely with the Tortoise Trust view that captive-bred European tortoises should ideally be obtained/sold at about two years old and I grow my captive-bred European tortoises on to this age before letting them go. Leopards should similarly be grown on. This need not be for so long due to their rapid growth rate and the fact that they remain active throughout the year as opposed to undergoing hibernation. Young of the year can safely be passed on in the spring of the following year.

To aid procurement of captive-bred youngsters I intended giving a list of leopard tortoise breeders either within or known to the Society at the end of this article and holding contact telephone numbers for those who did not wish their details published. Unfortunately not a single breeder of this tortoise has responded to my recent request in the *Natterjack* that they provide me with their details despite confidentiality being assured if required. In order to obtain captive-bred youngsters I suggest you place a 'wanted' advertisement in the *Natterjack* or the IHS Newsletter.

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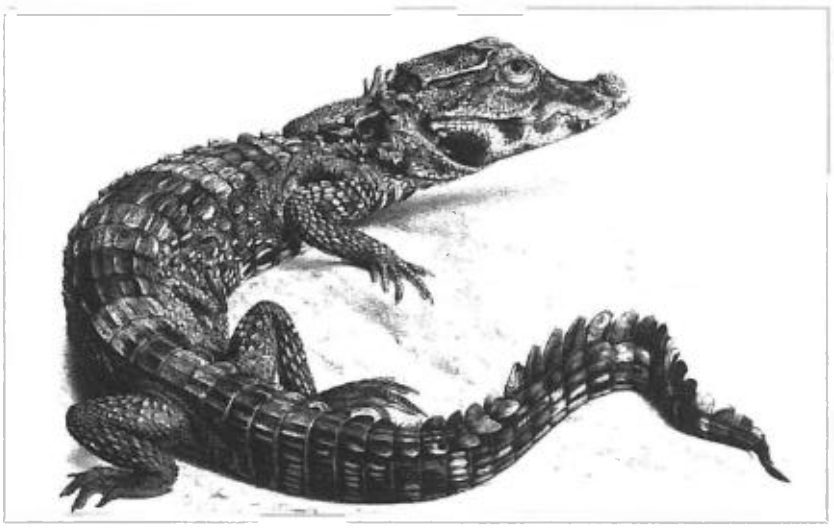

Crocodylus frontatus (*Osteolaemus tetraspis*). From *Proceedings of the Zoological Society of London*, 1862. Reproduction courtesy of the Zoological Society of London.

Natural History Notes features short articles documenting original observations made of amphibians and reptiles mostly in the field. With few exceptions, an individual 'Note' should concern only one species, and authors are requested to choose a keyword or short phrase which best describes the nature of their observation (e.g. Diet, Reproduction). Format details and other guidelines are available in *Herpetological Bulletin* No. 78, Winter 2001.

***NATRIX NATRIX* (Grass Snake): INTRASPECIFIC PREDATION**. Grass Snakes are known to feed mainly on amphibians and fish. Occasionally a (nestling) rodent, bird or lizard may be taken (Kabisch, 1999). To our knowledge there are no published records of cannibalism, let alone ophiophagy, for *N. natrix* under natural circumstances. In this note we report for the first time a case of cannibalism for the Grass Snake from the field. From July 1997 to October 1997 Grass Snakes were caught at a site near Amsterdam, The Netherlands, and translocated several kilometres away from the capture site. This action was a mitigation measure since the capture site had previously been a dumping ground for chemical waste and needed to be sanitised. On the 24th of July a female of 83 cm total length was caught in this area (52° 21' 0" N, 4° 59' 37" E) underneath a wooden board. She was kept in an empty cloth bag while the search for other Grass Snakes continued. The next time the cloth bag was checked it was found to contain a second, dead Grass Snake, which the original female had apparently regurgitated. The front part of the dead snake's body was missing. It could not be deduced whether this was still inside the female, digested or not, or was already missing when swallowed. The remains of the body, including tail, measured about 46 cm. The absence of hemipenes proved it to be a female. The specimen has been deposited in the Zoological Museum of Amsterdam (ZMA 12839).

Among reptiles, conspecifics form a consistent but small part of the diet of opportunistic generalist predators (Polis & Myers, 1985). In these cases of cannibalism the prey consists nearly always of young conspecifics. Grass Snakes in the study area feed almost exclusively on locally abundant amphibians (pers. ob.) indicating a rather narrow prey spectrum. Considering the large size of the incomplete body it can be inferred that the prey was not an immature animal. It is therefore likely not be a case of opportunistic catching and eating a smaller conspecific. Another explanation could be opportunistic feeding on carrion (Capula et al., 1997). However, no eggs or larvae of flesh-flies could be found on the regurgitated snake. The most plausible explanation for this case of intraspecific predation is that a conspecific was accidentally ingested. Accidental predation of conspecifics has been observed in captivity for another *Natrix* species, namely the Viperine Snake *N. maura* (Hailey, 1981). When two snakes get hold of the same prey item at the same time, one snake might ingest not only the prey but also the other snake. The presence of frog or toad remains in the cloth bag would have given further evidence to support this hypothesis, yet no amphibian remains were found.

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BOOK REVIEW

A Field Guide to the Reptiles of East Africa

Stephen Spawls, Kim Howell, Robert C. Drewes, James Ashe.

543 pp. Academic Press, Hardback. £29.95
ISBN: 0126564701

Field guides these days are no longer the slim volumes that used to fit neatly into pocket or back pack. This book runs to five hundred and forty three pages and contains descriptions of all known species in the five countries, Kenya,Tanzania, Uganda, Rwanda, and Burundi.

The four authors are all well known in the field of African herpetology, and in addition two other prominent names, Alex Duff-MacKay, and Harald Hinkel, are listed as consultants. The first thirty-two pages consist of what are described as introductory essays. In fact, some of these essays provide valuable information on such aspects as, zoogeography, observing and collecting, conservation, and photography.

The book is written in an easy style and the treatment is both modest and honest. For example, it is admitted that some of the species have not been seen since they were first described, perhaps fifty years ago. Such a book is a massive undertaking and the fact that the authors relied much on the work of others is duly acknowledged. Popular myths such as the 9 metre python, and the 4.5. metre Black Mamba have been avoided due to the lack of any real evidence.

There are some very useful hints on photographing reptiles, and one part made me smile, and I part quote, 'Unless you are photographing a dangerous snake, you should get as close to the subject as you can. The snake that looks huge in your viewfinder returns from the developers looking like a discarded fan belt seen from a distance!' I guess we have all taken photographs like that at some time.

The bulk of the book deals with the four hundred and twenty species in the five groups, chelonians, lizards, worm lizards, crocodiles, and snakes. Most of the species are accompanied by one or more photographs of excellent quality the majority of which were taken by Stephen Spawls.

Each group and genus is preceded by an excellent key devised by, or else adapted from the work of Donald Broadley. Individual species description is divided into three parts, identification, habitat and distribution, natural history, and in the case of venomous species a description of the venom. The distribution maps that accompany each species description are small but adequate.

I must admit that quite a few of the species were new to me, the section on dwarf geckos, *Lygodactylus* spp., for example, was somewhat of a revelation. Just how localised many of these are, and some both endemic and endangered, such as the amazing looking Turquoise Dwarf Gecko, *L. williamsi*, found only in the Kimboza Forest, Tanzania. Rarity and restricted range is a feature for quite a number of species in the book and our current knowledge of these is made quite clear from such comments as, 'little is known, nothing known, virtually nothing known'. But that is not a failing of the book merely a confirmation of the current state of affairs with regard to our knowledge. The authors in fact make the point that there is still much to be done and urge others to get out in the field.

There are a number of typographical errors, and one particular one that caused me some confusion with regard to the Carpet or Saw-scale Viper, *Echis pyramidum*. The photographs on pages 483 and 484 are captioned, *E. carinatus aliaborri*, and *E.c. leakyi*, respectively. This genus has proved problematical for some time and I contacted Don Broadley for some clarification. His response stated, Schaetti (in Golay et al., 1993) treated *E. varia* as a synonym of *E. pyramidum*, with *aliaborri* and *leakeyi* as races. So the picture captions are incorrect.

But this is a fine book and is destined to become a classic, and I have no hesitation in recommending it to even those with just a passing interest in African reptiles. At a hefty 1.4 kg be prepared for some excess baggage, but it will be worth it.

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