THE DANGEROUS SNAKES OF AFRICA

STEPHEN SPAWLS & BILL BRANCH

BLOOMSBURY

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This book is dedicated to
Royjan Taylor (1975–2019):
Kenyan, herpetologist
and friend.

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Namaqua Dwarf Adder, *Bitis schneideri* (Tyrone Ping).

PREFACE – Stephen Spawls

In 1995, Bill Branch and I published *The Dangerous Snakes of Africa*, a guide to Africa's dangerous snakes and the treatment of their bites. It was well received; many herpetologists and medical personnel remarked on how useful it was. Snakebite is a major problem in Africa. A Somali doctor wrote to us and said that, with our book, for the first time in his life he actually had in his hands concrete information about the deadly snakes of his country, where they lived, the risk they posed and how to take action against them.

Since 1995, the taxonomy of African snakes and the medical expertise around their bites has advanced. So when Johan Marais suggested to us in 2017 that our book was 'well overdue for a revision', Bill and I agreed. Our publishers showed interest, we signed a contract and we started the preliminary work. In late 2017, Bill cautiously wrote to me to tell me he was having mobility issues, and wasn't sure how this might affect our project. And in early 2018, to my shock, I heard from Bill that he had been diagnosed with motor neurone disease. But he remained full of optimism and said that he fully intended to do his bit, cheerfully pointing out that Stephen Hawking had lasted many years with the same affliction. Bill sorted out a superb set of digital pictures and started work on the snakebite and viper accounts.

But it was not to be. The disease quickly took hold. Bill could not move around and was confined to one floor of his house. He continued to work, but eventually he could no longer even hit the computer keys. Tragically, Bill died on 14 October 2018. His untimely death is a major loss to African herpetology; few herpetologists have reached both the public and their fellow scientists with as much verve and accuracy as Bill did.

So it has fallen to me to complete the book. With his wide-ranging and ever-precise knowledge of every aspect of African herpetology, Bill was one of my sternest critics. As I write, I find myself constantly asking, 'What would Bill think of this?' And so, on behalf of Bill and myself, I hope this book is going to be useful in putting into the public domain the information about Africa's dangerous snakes, where they live, and how to prevent and treat their bites. We hope it reduces the suffering of the people of Africa.

Puff Adder, *Bitis arietans*, Dodoma, Tanzania (Bill Branch).

ACKNOWLEDGEMENTS

A lot of people have helped with this book; we are profoundly grateful to them all, and we apologise if we have inadvertently missed anyone. We must start by expressing our gratitude to the herpetologists and snake handlers who risked life and limb helping us photograph dangerous snakes. Five institutions and their personnel stand out: Royjan Taylor, Sanda Ashe, Boniface Momanyi, Anthony Childs, Kyle Ray and Charles Wright at Bio-Ken Snake Farm, at Watamu on the Kenyan coast (sadly Royjan and Sanda are no longer with us); Joe Beraducci at MBT's Snake Farm and Reptile Centre at Arusha, Tanzania; Deon Naude and Lynn and Barry Bale at Meserani Snake Park, near Arusha in Tanzania; Paul Rowley, Edd Crittenden and Dr Rob Harrison at the Liverpool School of Tropical Medicine; and Patrick Malonza, Victor Wasonga, Beryl Bwong and Vincent Muchai at the Herpetology Section of the National Museum in Nairobi, Kenya. They have made a major difference. All have live collections and allowed us to freely photograph their often rare specimens. The Bio-Ken team also generously allowed access to their photographic database. In Arusha, Joe Beraducci frequently put aside his work in order to ferret out information for us. In the UK, we thank Mike Nolan and Ted Wade, who let us photograph the snakes in their private collections, and Patrick Campbell and David Gower, at the Natural History Museum in South Kensington, for their expertise and kind hospitality.

We thank also the medical professionals, those pioneering snakebite doctors, who allowed us to pick their brains. Professor David Warrell read much of the text, gently corrected the mistakes and generously allowed us to make extensive use of his major work on African snakebite. Dr Colin Tilbury wrote much of the original draft, and alerted us to (and kindly supplied) relevant literature. The mistakes that remain, of course, rest with us.

Several expert herpetologists also read our drafts. We have benefitted from the expertise of Wolfgang Wuster, who kindly sorted out the cobra accounts for us, and Tomáš Mazuch who greatly improved our treatment of the carpet vipers. Johan Marais kindly commented on the snakebite section and gave freely of his many years of expertise dealing with snakebite in southern Africa. Jean-François Trape also kindly allowed us to make use of his unpublished work on

Berg Adder, *Bitis atropos*, Storms River, South Africa (Bill Branch).

the snakes of Chad. Other friends who commented upon and improved the draft or gave willingly of their expert opinions include Zarek Cockar, Ton Steehouder, Jordan Benjamin, Bob Drewes, Aaron Bauer, Florian Finke, Werner Conradie, Luis Ceriaco, Jean-Philippe Chippaux, Harry Greene, Thomas Hakansson, Thea Litschka-Koen, Paula Kahumbu, Darrell Raw, Mark-Oliver Rödel, Barry Hughes, Bob Hansen, Kate Jackson, Mikey Mccartney, Petr Necas, Tyrone Ping, Norbert Rottcher, Washington Wachira, Sherif Baha El Din, Luca Luiselli, Laura Parker, Francois Theart, Vlada Trailin, Eli Greenbaum, Ted Wade, Ralph Braun and David Williams.

Next, the photographers. Over 60 herpetological photographers kindly allowed us to use their pictures, including top professionals who can command high fees for their pictures, yet generously allowed us to use their super images just for the reward of a copy of the book. In alphabetical order, they are: Jonas Arvidsson, Jordan Benjamin, Richard Boycott, Dayne Brayne, Don Broadley, Gary Brown, Evan Buechely, David Buttle, Juan Calvete, Luis Ceriaco, Alan Channing, Anthony Childs, Laurent Chirio, Tyler Davis, Max Dehling, Gerald Dunger, Dietmar Emmrich, Vincenzo Ferri, Florian Finke, Yannick Francioli, Paul Freed, Eli Greenbaum, Jelmer Groen, Václav Gvoždik, Harald Hinkel, Daniel Hollands, Barry Hughes, Kate Jackson, Tony Kamphorst, Chris Kelly, Luke Kemp, Sebastain Kirchof, Warren Klein, Johan Kloppers, Matthijs Kuijpers, Mark Largel, Dwight Lawson, Luke Mahler, Johan Marais, Jesse Mathews, Tomáš Mazuch, Mike McLaren, Konrad Mebert, Michele Menegon, Abubakr Mohammed, David Moyer, Deon Naude, Mark O'Shea, Laura Parker, Olivier Pauwels, Johannes Penner, Mike Perry, Tyrone Ping, Fabio Pupin, Gunther Rath, Darrell Raw, Eduardo Razzetti, Peter Riikula, Mark-Oliver Rödel, Paul Rowley, Steve Russell, Ignas Safari, Bill Roland Schroeder, Tim Spawls, Francois Theart, Colin Tilbury, Jean-François Trape, Sonya Varma, Luke Verburgt, Lorenzo Vinciguerra, Philipp Wagner, Alfred Wallner, Frank Willems, Elvira Wolfer, Wolfgang Wuster and Andre Zoersel.

Stephen would also like to thank his wife Laura for her endless unstinting support, and his old friend Jonathan Leakey, who kindly made available the field notebooks of C. J. P. Ionides, Tanzanian herpetologist; the natural history information here has proved invaluable. Thanks also to Julia Leakey and Dena Crain for getting the material to us. Stephen also thanks his many field companions, friends and those who gave hospitality and stimulating conversation, especially his sons Jonathan and Tim, Daniel Hollands, Glenn Mathews, Conrad and Linda Thorpe, Dave Morgan, Anthony and Emma Childs, Dave Brownlee, Jonathan Leakey and Dena Crain. Stephen is grateful to his fellow science lecturers at City College Norwich, Janet Cross and Ian Cummings, for stimulating daily discussion, and his principals at City College, Corienne Peasegood, Jerry White and Julia Buckland, who generously allowed him use of the college resources. At Bloomsbury, we thank Jim Martin for his enthusiastic championing of this book, Jenny Campbell, who has guided it to fruition, and the designer, Rod Teasdale. And finally, Stephen thanks James ('Jim') Ashe, who was not only responsible for Stephen's early herpetological education, but also a man who saved the lives of many Kenyans. He is remembered in the James Ashe Antivenom Trust (JAAT), whose work continues Jim's legacy.

West African Night Adder, *Causus maculatus*, DR Congo (Konrad Mebert).

INTRODUCTION

Snakebite is best treated by use of the correct antivenom for the correct snake, given at the correct time.
James Ashe, founder of Bio-Ken Snake Farm, Watamu, Kenya

This book is intended to meet a real need in Africa. Dangerous snakes occur virtually throughout Africa and are often common, and snakebite is an ever-present deadly hazard. The risk is exacerbated because it is disproportionately faced by the poorest members of society, who are constantly exposed to venomous snakes all of their lives and who often lack the means to protect themselves and reduce the risk of being bitten. In addition, snakebite treatment can be hideously expensive. Pharmaceutical companies can expect little profit from developing effective antivenom, since those who are bitten largely cannot afford the treatment. In addition, medical authorities in Africa have often been reluctant to take the problem seriously and devote resources to combating snakebite, although this is now improving. We have expanded on this in the section on snakebite (pp. 279–308).

The estimated number of victims of snakebite varies, due to problems gathering data in remote areas. But the figures are large. Worldwide, it is confidently believed that snakebite affects the lives of 4.5 million people yearly, seriously injuring 2.7 million people and claiming 125,000 lives. In Africa, a study of snakebite in 2008 estimated there were between 80,000 and 420,000 bites per year, and between 3,500 and 30,000 deaths per year. Whatever the true figure, this is an awful medical problem that needs attention.

And thus the major purpose of this book: comprehensive descriptions, with diagnostic photographs and maps, of all the 136 species of dangerous snakes of Africa. We have also provided photographs and descriptions of the 'look-alikes' – innocuous snakes that are likely to be confused with dangerous forms. This is followed by a section on snakebite in Africa, how to prevent it, some

practical considerations, and the medical aspects of snakebite, including first aid and hospital treatment. The Appendix (pp. 309–24) lists useful resources. It is our intention that this book can be used, anywhere in Africa, to work out: (a) what dangerous snakes occur here and how they may be identified, (b) the risks involved from the bite of a local snake, (c) the means to prevent or lessen the risk of snakebite and (d) guidelines on how to treat bite victims. We hope it serves its purpose.

A brief word on semantics is necessary. We use the word 'dangerous' to describe snakes that represent a danger to humans, and that is why we have included the large pythons. We use the term 'venomous' to describe snake species that have a venom delivery system; that is, modified teeth (fangs) and toxic mouth secretions. In the past, the term 'poisonous' was often used for venomous snakes; a classic 1968 work was called *Poisonous Snakes of the World*. However, scientists working on venomous creatures nowadays use the word 'poisonous' to mean organisms that are toxic to eat, and 'venomous' to mean those that inject toxins, by biting or stabbing.

AFRICA'S SNAKES: WHICH ONES ARE DANGEROUS?

Snake classification is a formal business, based on a mixture of morphology and molecules, and we shall shortly expand upon it. However, an informal but most handy way of classifying Africa's dangerous snakes was coined by Professor David Warrell, a medical doctor with a pioneering interest in snakebite. Warrell's classification is based on medical significance: really dangerous snakes that bite a lot of people, really dangerous snakes that hardly ever bite anyone, not very dangerous species that bite a lot of people and not very dangerous species that hardly bite anyone. This is a useful division and we refer to it from time to time. For the people of Africa, it is the first group that are really bad news: the deadly animals that bite a lot of people. It is impossible (at present) to accurately put them in order of medical importance as we don't have the data, but those snakes are: the four widespread species of carpet viper (*Echis*), the Puff Adder (*Bitis arietans*) and the seven spitting cobras (*Naja nigricollis, N. ashei, N. nigricincta, N. mossambica, N. katiensis, N. pallida* and *N. nubiae*). They are followed by snakes of the Egyptian cobra (*Naja haje*) and forest cobra (*Naja melanoleuca*) complexes, and the Black Mamba (*Dendroaspis polylepis*). If you are rural dweller in Africa, those are the snakes you really want to avoid.

Worldwide, there are over 3,700 species of snake. Around 600 species are known from Africa, in nine families, as follows: Pythonidae (pythons), Boidae (boas), Colubridae (colubrid or 'ordinary' snakes), Lamprophiidae (African snakes), Natricidae (water snakes), Elapidae (cobras, mambas and allies), Viperidae (vipers), Typhlopidae (blind snakes) and Leptotyphlopidae (worm or thread snakes). Africa's really dangerous snakes are the so-called 'front-fanged snakes', those with tubular fangs at the front of the upper jaw, a system that ensures venom can be injected, under pressure, below the skin on every bite. There are about 120 species of front-fanged snakes in Africa. There are around 55 African vipers, in the family Viperidae; all have long fangs that can fold flat, enabling a large fang to fit in a small mouth. Just over 40 species are placed in the Elapidae (the family of cobras, mambas, African garter snakes and allies); they have relatively short, rigid fangs at the front of the upper jaw. The 20 or so species of burrowing asps (also called stiletto snakes, mole vipers or side-stabbing snakes; genus *Atractaspis*) are in the

subfamily Atractaspidinae, within the family Lamprophiidae. Like the vipers, they have long, folding fangs, which led to them being classified as vipers in the past.

In addition, there are at least 10 or 15 so-called 'rear-fanged' snakes that are known to have toxic venom, and several of these have killed people, although the danger they pose to the ordinary rural dweller is almost negligible. These rear-fanged snakes are in two families, Colubridae and Lamprophiidae, and have grooved (not tubular) fangs set back in the upper jaw, often below the eye; when they bite, the venom trickles down the fangs. Africa also has a handful of fangless snakes, often with long but unspecialised teeth, which have been shown to have fairly toxic oral secretions. These toxins were largely identified after the snakes bit and chewed snake handlers, who were reluctant to quickly remove the snake in case they damaged its mouth. We have described those known to have toxic saliva. There will probably turn out be more of these. However, they are not medically significant to the average person in Africa, who does not allow snakes to chew on them. There are also two large pythons in Africa, which are large enough to be able to cause physical injury or even death by constriction and have killed a few people. The remaining 450-odd species of African snake are essentially harmless to humans.

The taxonomy (classification) of Africa's snakes has changed a lot over the years, and it continues to change. It is an exciting and often controversial field, and the uncertain status of some taxa – whether they are separate species, subspecies, or just varieties within a species – is why our numbers are sometimes imprecise. For example, it was long believed there were only four species of true cobra, *Naja*, in Africa: the Egyptian (*Naja haje*), Cape (*N. nivea*), Forest (*N. melanoleuca*) and Spitting (*N. nigricollis*) Cobras. In 1995, in the original edition of this book, we described seven species of African cobra. In this book, the number of cobra species has increased to 21. The additions are not totally new forms, freshly discovered, but are nearly all due to the taxonomic splitting of the original species, using advanced tools to elucidate diverging lineages. In addition, molecular studies show that the water cobras originally placed in the genus *Boulengerina* are nested with the true cobras, *Naja*, and more than two species of water cobras may exist (see Figure 1). The small vipers of the many-horned adder (*Bitis cornuta*) complex are now split into five species. The 'original' Forest Cobra, *Naja melanoleuca*, has been split into five separate species, some of which are hard to tell apart. Further splits may be on the cards.

Fig 1: Three water cobras; the status of the bottom one is unknown (Václav Gvoždik).

In the past, snakes were largely classified by a mixture of general morphology or shape, scale details, colour and teeth, characters that have proved useful for over 250 years of herpetological taxonomy. Recently, a new set of tools has become available to laboratory-based taxonomists: the techniques that enable the isolation of standardised bits of DNA from both the cell nucleus and the mitochondria, and the computing power that allows the statistical analysis of that DNA. With these tools, new forms can be defined. New evolutionary lineages and relationships can be unearthed and old ones modified, through the identification and alignment of, and observed differences in, matching sections of DNA. Although traditional reptile taxonomy is still useful, especially with new forms that clearly differ from other members of the genus, the analysis of DNA has enabled researchers to fine-tune their identification and often split what seemed in the past to be a single species into several species that have evolved separately. Even the approximate date at which the two forms began to diverge and to accumulate differences can be ascertained. This is a very useful development, although it has occasionally led to new species being identifiable only in terms of their DNA and to controversy over what constitutes a separate species; the veteran molecular taxonomist David Hillis has suggested that many proposed species in reality simply represent arbitrary slices of continuous geographic clines.

WHERE ARE THE DANGEROUS SNAKES IN AFRICA?

Dangerous snakes occur almost throughout mainland Africa, apart from areas above the snowline and in some of the higher-altitude forests. However, the number of species and individual numbers of dangerous snakes vary considerably throughout the continent. In general, the number of snake species (including dangerous forms) at any place increases with (a) nearness to the equator, (b) decreasing altitude and (c) increasing rainfall. Thus, a low-altitude town with high rainfall in Central Africa will have many snake species; a high-altitude town with low rainfall in North Africa will have few. In most places in tropical Africa, there will be between 25 and 40 species of snake, and five to eight of these will be dangerous.

Although our knowledge is imperfect, at present Watamu on the Kenyan coast seems to be the snake capital of Africa, with some 48 species of snake, 10 of which are dangerous. However, on the moorlands of the Aberdare Mountains in Kenya, at altitudes of over 2,800m, only two species of snake occur, one of which is dangerous. There are a few places in Africa where there are no dangerous species. Addis Ababa, in Ethiopia, is the only African capital with no dangerous snakes; the six species known from that city are all harmless. The capital of Lesotho, Maseru, has only three species of dangerous snake. But at Wajir, in dry north-east Kenya, one dangerous species, the North-east African Carpet Viper (*Echis pyramidum*), is the most common and abundant species.

The number of species is not the same as the actual number of dangerous snakes, however. This varies a lot, not only from place to place, but also with the seasons, the weather, the time of day and the habitat. Small habitat changes may make a considerable difference. At a town in northern Ghana, not a single snake in a collection of over 400 was a West African Brown Spitting Cobra (*Naja katiensis*), yet at a town 160km north, two out of five snakes collected in a short expedition were of that species. In a survey of snakes near Lake Turkana in northern Kenya, out of 70 snakes collected, 51 were carpet vipers, four were

Red Spitting Cobras (*N. pallida*), three were Puff Adders and only 12 were innocuous species. At Moille Hill, in northern Kenya, a commercial collecting team found 4,000 North-east African Carpet Vipers (*Echis pyramidum*) in four months, and yet only two examples of this species were found in 25 years by a zoologist collecting around Cairo.

Certain dangerous species can be very abundant, even if there are few species of dangerous snake in the area. On the other hand, some areas may have several species of dangerous snake but the common species all turn out to be harmless. And, even if a dangerous species turns out to be common, it may not represent any danger to humans. The Tanzania-based herpetologist C. J. P. Ionides collected over 4,500 Eastern Green Mambas (*Dendroaspis angusticeps*) in a four-year period in south-eastern Tanzania. This is a front-fanged snake with a deadly venom, yet the only person Ionides knew of who had been bitten by an Eastern Green Mamba at that time was himself; he picked up a juvenile thinking it was a harmless species. There are few quantitative studies of dangerous snakes, but certain species, in particular the carpet vipers, Horned Adder (*Bitis caudalis*), Eastern Green Mamba, Eastern Gaboon Viper (*Bitis gabonica*) and Forest Vine Snake (*Thelotornis kirtlandii*) have been found to be abundant in parts of their ranges.

To understand the distribution of dangerous snakes in Africa, it is helpful to have some understanding of the vegetation, as many species are associated with one (or more) vegetation types, which themselves are associated with climate and altitude. Africa can be split simply into three main vegetation types: forest, savanna and desert. Two other 'transition' zones may be usefully defined: the zone where the savanna becomes heavily wooded but the tree canopy is mostly at a single level, for which we have used the term 'woodland'; and the zone where the savanna becomes very dry and sparsely vegetated, with few trees, for which we have used the term 'semi-desert'. We have also used the term 'forest–savanna mosaic' to describe areas where forest is interspersed with savanna. These are broad terms in respect of Africa's complex botanical regions, but they are useful in describing where snakes live. Snakes tend to occur in one of the major vegetation types (forest, savanna or desert) and often in one or both of the transition zones, but relatively few species occur in two of the zones, and no snake occurs in all three. The West African Night Adder (*Causus maculatus*), a versatile snake, is found in forest, woodland, savanna and semi-desert, but this is very unusual. A number of widespread dangerous snakes occur in woodland, savanna and semi-desert, including the Black Mamba, Boomslang (*Dispholidus typus*) and Puff Adder.

Some other vegetation zones that should be mentioned are the Mediterranean regions of Africa north of the Sahara, the ancient forested hills and mountains of eastern and south-eastern Africa (the Eastern Arc), and the temperate regions, hills and small deserts of southern Africa. In these regions there occur some dangerous snakes with very limited distributions. Most of these snakes are small; some occur in one country alone or in one very limited habitat and are called endemics. There is also a small group of dangerous snakes of the Middle East that just reach eastern Egypt but penetrate no further into Africa. Interestingly, the limited information that we have at present indicates that human–snake encounters take place most commonly in savanna or semi-desert and not, as one might suspect, in the great forests. We return to this point in the final section, Snakebite in Africa (pp. 279–308). Figures 2–10 (p. 14) show some of these vegetation types.

Fig 2: African desert habitat (Stephen Spawls).

Fig 3: East African savanna (Stephen Spawls).

Fig 4: African forest habitat (Stephen Spawls).

Fig 5: Grassland habitat (Stephen Spawls).

Fig 6: Montane moorland habitat (Stephen Spawls).

Fig 7: Rocky desert habitat (Stephen Spawls).

Fig 8: Semi-desert habitat (Stephen Spawls).

Fig 9: West African savanna habitat (Stephen Spawls).

Fig 10: Woodland habitat (Stephen Spawls).

USING THE MAPS IN THIS BOOK

Where a species is widespread, there are many locality records and/or there is a fairly clear pattern of distribution, we have shown the overall distribution in solid colour. For species with a poorly understood distribution, or species with relatively few records, coloured dots show the actual locality records. For such species, pay particular attention to the notes on distribution and habitat. In some cases, both solid areas and dots appear on the map, indicating that the distribution pattern is clear in parts of the snake's range but not in others; the dots represent records beyond the present known continuous range of the species. A question mark indicates possible but unproven occurrence. We have also provided three maps showing African countries, vegetation and altitude (Figures 11–13, pp. 15–17), to assist with orientation.

Generally, the distribution of African snakes is poorly documented, and much work remains to be done. Species may well occur outside their known ranges. If you think you have positively identified a snake but find that the map shows it is outside its known range, take careful note of the habitat – a suspected Gaboon viper (*Bitis gabonica* or *B. rhinoceros*) will not be in desert. If you have positively identified the snake and think your specimen represents a range extension,

Fig 11: Political map of Africa.

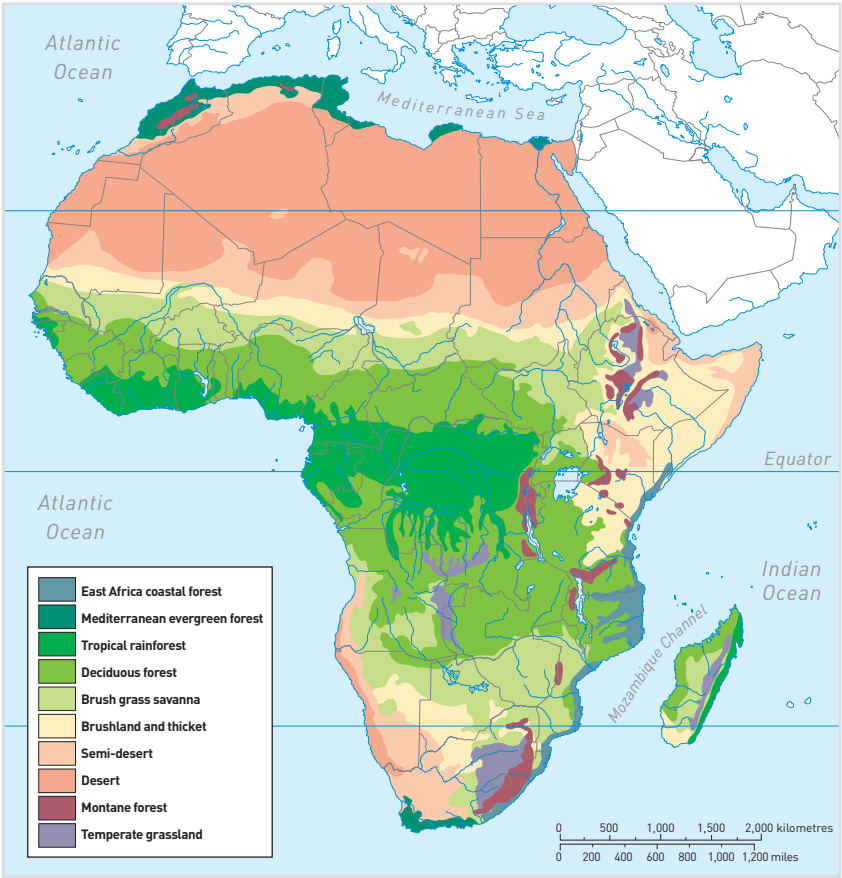

Fig 12: Vegetation map of Africa.

and it is dead, then preserve it and send it to the nearest museum or institute dealing with reptiles, noting in particular: (a) the geographical locality where it was found, including nearest town, and latitude and longitude if possible; (b) the date, time and microlocality (under a rock, in a tree, etc.) if possible; and (c) the collector's name and address. Alternatively, send a good photograph. You may well have a medically and biologically important discovery. Several forums exist for the publication of range extensions for African snakes (see the Appendix, pp. 309–24).

A NOTE ON CONSERVATION

Snakes have benefits. Their venoms contain a range of compounds that are being increasingly utilised by the pharmaceutical industry, to make useful drugs. And snakes, even dangerous ones, are important members of Africa's fauna and have a significant place in food webs, helping to maintain the balance of nature. At the same time, the species described here can be dangerous to humans and may have to be removed from places where they pose a threat. If no competent snake handler is available to relocate the snake safely, it may need to be driven away or killed. A large cobra within a school, or sliding around a village, must obviously

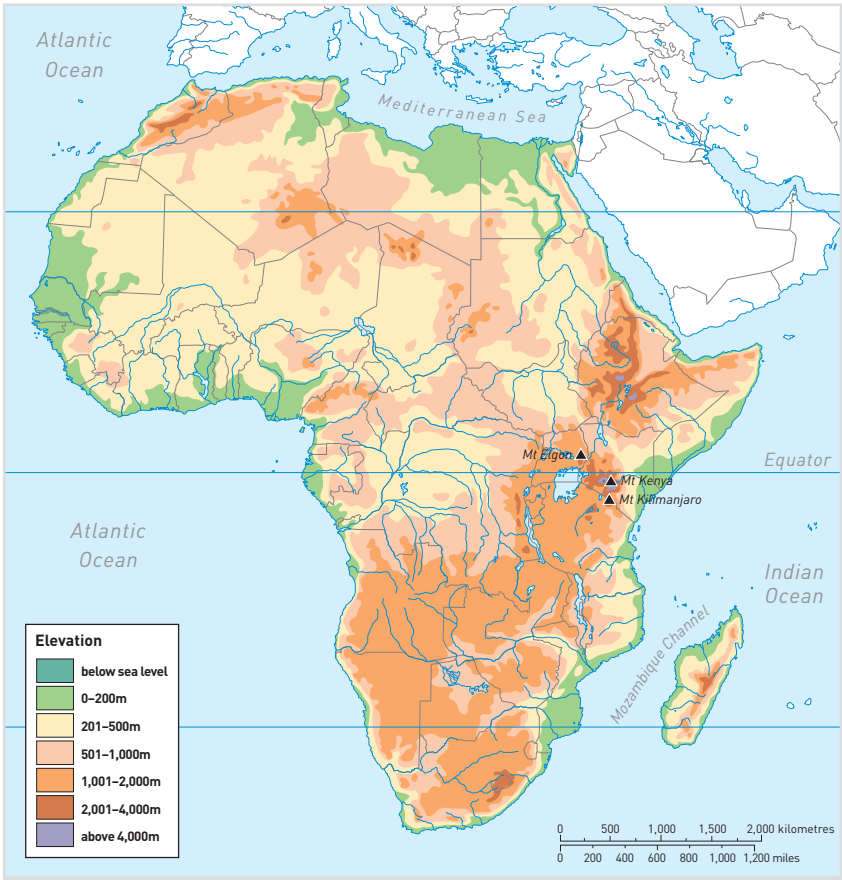

Fig 13: Topographic map of Africa.

be made safe, one way or another. However, a cobra crossing a road in a national park can be watched and appreciated without being molested. Our request, where snakes are concerned, is to use your judgement. Try to find out if the animal you are dealing with is dangerous or not. Use this book. And remember that killing, or trying to kill or catch, a dangerous snake (particularly a large one like a mamba or a cobra) is a risky undertaking. Take great care. If the snake is not near habitation and poses no threat to life, leave it alone.

A brief word on ethics may also be important here. Humanity's attitudes towards snakes, especially dangerous ones, vary considerably, depending on education, culture and to some extent how affluent we are. However, much of it is driven by fear of a deadly hazard. It has been said that we are instinctively afraid of snakes (a point explored in some elegant works by the anthropologist Lynne A. Isbell). To the reasonably well-off, viewing a wild snake in a wild place, or even in the garden, can be an exciting and possibly pleasant experience. To the poor rural dweller, however, snakes are an ever-present deadly menace that can kill, or cripple and potentially financially ruin them.

Most people are unable to distinguish between a harmless snake that may be beneficial, for example by eating rats, and a deadly snake. Some species are

notoriously hard to tell apart (see Figure 14). The instincts of many people (and not just in Africa, but worldwide, even in prosperous countries like Australia and the United States) is to immediately kill the snake and neutralise the potential danger. Researchers in California who placed a realistic rubber snake on a road observed a disturbingly large number of drivers try to deliberately run the snake over, even at considerable risk to themselves and other road users. In Africa, if you spot a snake in a residential area and are seen to leave it alone, you are asking for trouble. If it bites someone, you may get the blame or, worse, be accused of being involved with witchcraft and loving snakes. In parts of Africa, being suspected of being a witch or wizard can be a death sentence. And yet there is often a surprising amount of intolerance towards those who kill snakes, directed largely, it must be said, by the affluent towards the poor, and this shows a worrying inability to put oneself in the shoes of others. People who post pictures of dead snakes on the internet, even innocently seeking identification, may be subject to a torrent of abuse. A recent social media post exemplified this: the writer had seen two Kenya Wildlife Service (KWS) rangers kill a small spitting cobra that was approaching a ticket office. The post attracted a storm of abuse towards the rangers and, by association, KWS. Nobody seemed to notice that (a) if the snake had got into the office and spat at or bitten a visitor, there would have been considerable bad publicity, and (b) shepherding away or catching a dangerous snake, especially one that spits venom, is a very difficult thing to do and requires expertise. It is important to see things from both sides.

In conservation terms, however, Africa's snakes are not really threatened by direct killing for safety's sake, or by commercial collection, and relatively few people eat snakes in Africa (although there are a few that do; see Figure 15). Snakes tend to avoid humans, often making strenuous efforts to escape detection. The most serious threat at present to Africa's herpetofauna is from large-scale habitat destruction (although the potential effects of climate change may also prove to be significant). Many of the snakes described here live in small forest patches, often on hills and mountains, and these refuges are threatened by large-scale farming and logging. Others are large, and/or sluggish, and are simply incompatible with any sort of human presence. If Africa's unique fauna is to survive, it needs not just protection in reasonable-sized reserves (which by itself can be counterproductive), but also for the people of the region to feel that the survival of the wilderness and its inhabitants is of benefit to them, either in a practical or aesthetic way. The best way for this to be achieved is for the wilderness to provide those who live nearby with a living, and with material benefits. The more direct those benefits are, the more the people will respect our wild places.

IDENTIFYING A SNAKE

This book should help you identify Africa's dangerous snakes, primarily by using the photographs, maps and text together. We have also provided dichotomous keys (see our comments on these on page 28). But note well: while it is often useful to know what you are dealing with, it should be remembered that successful treatment for snakebite is not dependent upon the actual snake being identified. Although such identification may be useful, snakebite can be treated without positive identification. There are also some useful techniques and rules to assist with snake identification in Africa, and we detail them here. Use them with care.

Fig 14: Rhombic Night Adder, *Causus rhombeatus* (dangerous, on left), and Common Egg-eater, *Dasypeltis scabra* (harmless, on right) (Stephen Spawls).

Fig 15: Central African Rock Python, *Python sebae*, on the menu, Ethiopia (Dietmar Emmrich).

You don't want to make a mistake. Read also our notes at the beginning of the section on look-alikes and common species (p. 252).

There are nearly 600 types of snake in Africa; this book covers about a third of them. If you can't find the snake you want, it may not have been recorded as dangerous. Have a look at the pictures of non-dangerous snakes in the Look-alikes and common species section (pp. 252–78). It is worth browsing through this book, possibly in connection with a regional guide to all the snakes of your area (a list of these is included in the Appendix, pp. 309–24), and possibly combining this with a visit to your local reptile or snake park, before you can make a certain identification. Practice makes perfect. Get used to what the animals look like. Also make use of the internet; this is an excellent source of data (but always bear in mind that it is unregulated and misidentifications occur). There are some useful websites and online forums, also mentioned in the Appendix (pp. 309–24).

Figures 16–22 show details of the head, body and scales of snakes that may be used in identification. In this book we have given details of the midbody scale count, and the ventral and subcaudal scale counts. It goes without saying that scale counts should never be attempted on a living snake. The dorsal scale rows are counted at midbody, roughly halfway between the head and the tail. Starting at one side of a belly scale, count diagonally forwards to the middle of the back, and then diagonally backwards to the other side of the belly scale. Figure 21 shows how this is done, and shows a snake with a midbody scale count of 19. To count the ventral

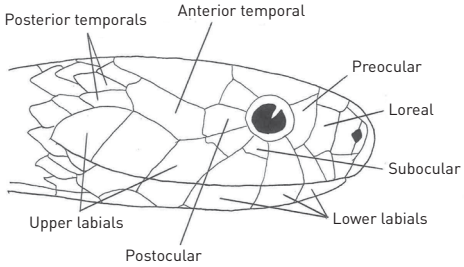

Fig 16: Head scales of snake, side view.

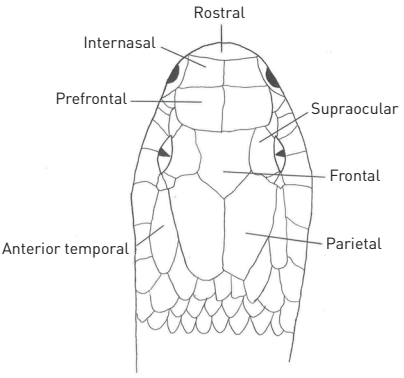

Fig 17: Head scales of a snake, from above.

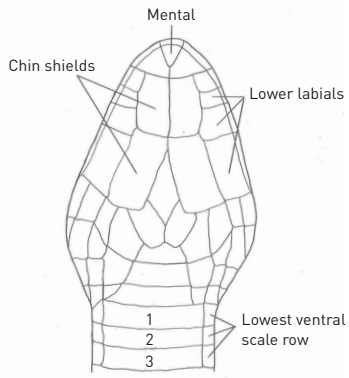

Fig 18: Head scales of a snake, from below.

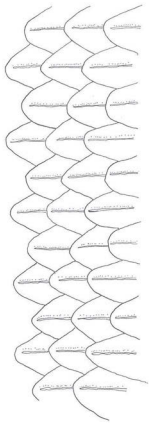

Fig 19: Keeled dorsal scales.

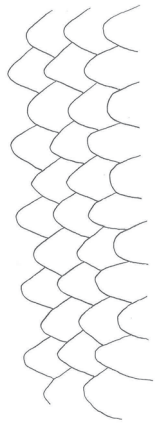

Fig 20: Unkeeled dorsal scales.

scales (the broad belly scales; see Figure 18); start your count with the first ventral scale (marked '1') that touches the lowest dorsal scale row, and count towards the tail; the count finishes on the scale in front of the cloacal scale.

Careful observation of a potentially dangerous snake is a must. But remember, the sighting of a snake is often an emotional situation. It may be difficult to recall exactly what you saw. Try to remain calm, take no risks, and look as carefully and objectively as possible. Photograph the snake if it is safe to do so; use flash if the light is low, take several pictures

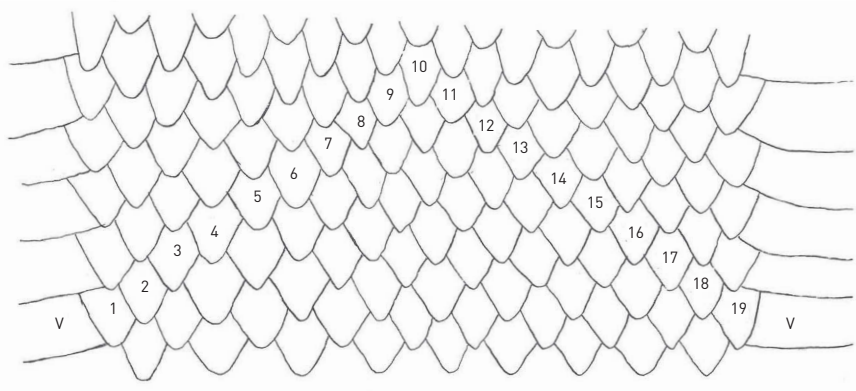

Fig 21: How to count the dorsal scale rows of a snake. V = ventral scale.

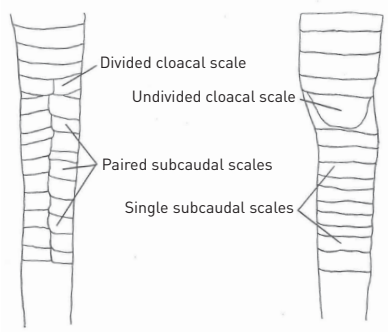

Fig 22: Snake tail cloacal and subcaudal scales.

and keep the camera steady. Make sure the head is visible and in sharp focus. Activate the GPS function if you have one. Compare the pictures to the ones in this book. There are several internet forums where snakes can be identified, and you can send your pictures to them (details in the Appendix, pp. 309–24); apps are also available that aid identification. If you can't photograph the snake, write down what you saw as soon as possible.

If you are looking at a living snake that may disappear, do the following:

1. Make a careful estimate of its size, shape and appearance, without getting too close. Take a photo or write your observations down immediately, if possible while still watching the snake. Be objective and careful. People who have had a quick look at a snake often remember it as being much larger than it really was. If the snake is (or was) lying on a branch, or on the ground, try to note where its head and tail are, and measure this distance later.
2. Take careful note of its colour (this may be difficult to judge at dusk, or if the snake is seen by torchlight or artificial light). Compare the colour, if possible, to nearby vegetation or soil/rock colours. Look carefully to see if the snake has any markings or patterns.
3. Look at its thickness. Is it as thick as, for example, a pencil, a broomstick, your forearm, or a car inner tube? Would you say it was fat, medium or thin? Try to see its head. Are its eyes obvious? Are they large or small, or any obvious colour? Do they have round or vertical pupils? Does it have large or small scales on top of the head? Does the snake have an obvious neck? Is the head broader than the neck? Are its scales dull, glossy or keeled?
4. Note its position and behaviour; these are often useful aids to identification. Was it in a tree, or on the ground? Did it move slowly, quickly or not at all? Did it hiss or strike, and did it move with its head raised? Was it moving by day (hence probably a diurnal snake), or was it under cover during the day or moving by night (probably a nocturnal snake)? Did it try to climb or burrow? What did it do when approached – did it flee, move off slowly, spread a hood, freeze, open its mouth, rub its coils together, strike, lunge forward or spit? All these forms of behaviour may give vital clues towards identification.

If the snake is dead, or captive, identification may be easier and you may be able to get a good photograph, but you must be totally sure that the snake is dead before you try to approach or handle it. Some snakes pretend to be dead (feigning or shamming death), and a fatally injured and thoroughly bashed snake, on the point of death, can still bite; even if it is essentially dead, its jaws may still open and close. Severed snake heads have been known to bite more than an hour after they were cut off. To find out if a snake is dead, one or more of the following tests may be tried. In all cases, use a stick or a broom to move the snake, not your bare hands. Be particularly careful if the snake is large, or might be a cobra or mamba.

1. Turn the snake totally onto its back and watch it. If it tries to turn over, it is not dead. If rhythmic waves or 'shivers' are seen along the body and the tail coils and uncoils, the snake is probably fatally injured, but it is not safe to handle yet.
2. Drop the body into a bucket of water and push the head under. If the head makes no move to come up for 20 minutes or so, it is dead.
3. Lay the body out in sunlight, on a hot surface, and watch for movement.
4. If you're still not certain that the snake is dead, use a spade or a long-bladed knife to chop the head off. Don't touch the head for at least an hour afterwards.

Note well: it is no good poking the eye of a snake to see if it is dead. Snakes have no eyelids and their eyes never shut.

If you are totally satisfied that the snake is dead, then do the following:

1. Lay the snake out and measure its length. If you have no measuring tool, the following dimensions may be useful: the long stride of an adult man is just under a metre, and that of an adult female is about 80cm; a soft drink bottle is about 25cm long; the average table is about 75cm high.
2. Compare the appearance, colour and pattern against the pictures in this book. Remember to look at and photograph the underside, which may provide valuable clues, especially for identifying cobras and vipers. Remember that after death, cobras' hoods may disappear, and snakes that have inflated necks when threatened (such as the Boomslang and vine snakes, *Thelotornis*) will have thin necks after death.
3. Look at the head; take close-up pictures of the head and neck, above and below if feasible. Check (a) width, (b) position and size of the eye, (c) type of pupil, (d) type of scales on top (many small scales usually means the snake is a viper) and (e) neck – is it thinner than the head, or the same thickness? Look at the scales. Are they dull or shiny, and do they have keels or are they smooth (see Figures 19 and 20)?
4. An expert may be able to check if the snake has obvious fangs. To do this (with great care), grip the snake by the neck and use a strong, thin twig, piece of wire or thin-bladed screwdriver to open the mouth. Push the wire to the back of the mouth, as shown in Figure 23. Taking great care not to catch a hand or a finger on the teeth, push the wire up against the upper jaw. Slide it forward and see if it catches on any enlarged teeth (Figure 24). This method is not an infallible way of detecting a dangerous snake. The snake's fangs may be broken or folded well back, so that they don't show, and some dangerous snakes (for example, the night adders, *Causus*) have small fangs that may be hard to see. The fangs may also be hidden in a fleshy sheath. In addition, some harmless snakes have very long teeth, which can be confusing. However, if your wire catches up on some long teeth roughly below the eye, the snake is probably rear-fanged. If there are enlarged immoveable teeth at the front of the upper jaw, the snake is probably an elapid (Figure 25, p. 24). If there are some very long, curved teeth at the front of the upper jaw, the snake is probably a viper (Figure 26, p. 24). Note also the colour of the inside of the mouth. The

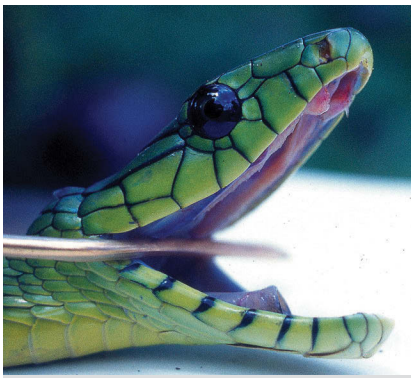

Fig 23: Jameson's Mamba, *Dendroaspis jamesoni* (Gerald Dunger).

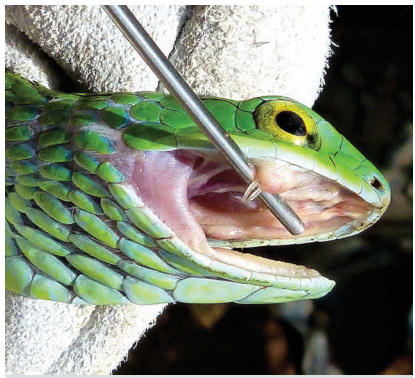

Fig 24: Boomslang, *Dispholidus typus* (Harald Hinkel).

Black Mamba has a black mouth lining, as does the Western Green Snake (*Philothamnus irregularis*), the Common Egg-eater (*Dasypeltis scabra*) and the Hook-nosed Snake (*Scaphiophis albopunctatus*). Most other snakes have a white mouth.

5. If you have a tentative identification, check the distribution and habitat, to see if they match your specimen.
6. If there is a possibility of taking the snake to an expert or an institution for identification but it may take a while, you will need to preserve the snake – just the head will do if the snake is large. A small snake or a severed head can be simply dropped into preservative. Suitable liquids are 10% formaldehyde solution (formalin), methylated spirit, very strong brine (salt solution), petrol or alcohol (spirits such as gin or whisky will do). If you have no preservative or suitable container, then make some long cuts along the body, ensuring you slit the gut, and hang it in a tree in the sun to dry. Watch out for predators trying to take it away. Alternatively, send your photographs. Don't forget to include details of exactly where you found the snake.

Fig 25: Black Mamba, *Dendroaspis polylepis* (Stephen Spawls).

Fig 26: Gaboon Viper, *Bitis gabonica* (Gerald Dunger).

It is important to know that, in Africa, there is no single way in which a dangerous snake can be told from a harmless one – you have to know all the species. However, there are certain general rules that may be used to identify African snakes, and we list them below. You should use them **with caution**. Be aware that there are also some extremely dangerous myths about how to identify venomous and non-venomous snakes. These frequently circulate on the internet, often with misleading endorsements of their benefits. A common myth – totally incorrect – is that dangerous snakes have vertical pupils and harmless snakes have round ones. Look at Figures 27–30 (pp. 25–26), showing an innocuous Speckled Green Snake (*Philothamnus punctatus*) and dangerous Red Spitting Cobra, both with round pupils, and an innocuous Large-eyed Snake (*Telescopus dhara*) and dangerous Puff Adder, both with vertical pupils. Other incorrect myths are that harmless snakes have smooth scales and dangerous ones keeled scales; that dangerous snakes have broad heads and harmless ones narrow heads; and that dangerous snakes have single subcaudal scales and harmless ones have double ones. Bear in mind the apposite saying: the internet exposes us to the stupidity of others even more efficiently.

Fig 27: Speckled Green Snake, *Philothamnus punctatus* (Bill Branch).

Fig 28: Red Spitting Cobra, *Naja pallida* (Tim Spawls).

Fig 29: Large-eyed Snake, *Telescopus dhara* (Bill Branch).

Fig 30: Puff Adder, *Bitis arietans* (Florian Finke).

Thus some functional rules for African snakes (only); cross-check these against our pictures:

- Most slim snakes with conspicuous stripes running along the body are probably not dangerous (see the sand snakes and relatives in the look-alikes section, pp. 252–78).
- Any snake over 2m long is probably dangerous.
- Any grey, green or greenish tree snake over 1.2m long is almost certainly dangerous; it will be an elapid or rear-fanged snake. If it inflates the front half of the body when threatened, it will probably be a Boomslang or a vine snake (although the harmless tree snakes of the genus *Thrasops* also inflate themselves, as do the smaller harmless green snakes, *Philothamnus*).
- Any snake that spreads a hood, flattens the neck or raises the forepart of the body off the ground when threatened is almost certainly dangerous; it will probably be an elapid (but it might be a night adder or a beaked snake, *Rhamphiophis*).
- Any snake with conspicuous bars, cross-bands, rings or chevrons (V-shapes), especially on the neck, the front half of the body, on the back or on the belly, is probably dangerous.
- Any snake with dark cross-bars or blotches on the underside of the body, especially the front half of the body or the neck, is almost certainly dangerous; it is probably a cobra.
- Any fat-bodied snake, especially one that lies quietly when approached, or any snake with a triangular or subtriangular head, is almost certainly dangerous; it is probably a viper.
- Small black or grey snakes with very tiny eyes, no obvious neck and a short, fat tail that ends in a spike are probably burrowing asps, and are dangerous.
- Small, mostly green and/or yellow and black snakes with broad heads and thin necks, in trees or bushes, are probably bush vipers and are dangerous.
- Any small snake with conspicuous pale bands all along a dark body will be a juvenile garter snake (*Elapsoidea*), and is dangerous.
- Any snake with rectangular, subrectangular or triangular markings on the back or sides, or rows of semicircular or circular markings along the flanks, is probably a viper (dangerous).
- A snake that forms C-shaped coils and rubs them together, making a noise like water falling on a hot plate, will either be a carpet viper (*Echis*, dangerous), North African desert viper (*Cerastes*; northern half of Africa, dangerous), bush viper (*Atheris*; forests of tropical Africa, dangerous), egg-eater (*Dasypeltis*; anywhere in Africa, harmless) or Floodplain Viper (*Proatheris superciliaris*; south-eastern Africa, dangerous).
- Any small snake with a blunt, rounded head, a blunt, rounded tail, eyes that are either invisible or visible as small black dots beneath the skin, and tiny scales that are the same size all the way around the body will be either a blind snake (*Afrotyphlops* species, fairly stout) or a worm snake (*Leptotyphlops* species, thin like a bootlace); both are harmless.

On a slightly more technical note:

- All African vipers (apart from the night adders) have many small scales on top of the head – this is a good positive identification of a viper, as the only other African snakes with tiny scales of the same size all over the top of the head are the sand boas (*Eryx* species). Sand boas are harmless, are found in

the northern half of Africa, in dry areas, and their heads are more or less the same thickness as their necks (vipers have broad heads and thin necks). Vipers (apart from the night adders) also usually have keeled scales, as do Boomslangs, but note that harmless egg-eaters and a few other innocuous species also have keeled scales.

- Most elapids (cobras, mambas, garter snakes, and tree and water cobras) do not have a loreal scale. The loreal is a scale between the eye and the nostril, but does not touch either (see Figure 16), nor does it touch the lip scales or extend onto the top of the head. If a snake has a loreal, it will not be an elapid (but remember, some dangerous snakes do have loreals, including the Boomslang, vine snakes and night adders).
- All the vipers (except the night adders) have fairly long fangs, as do burrowing asps; all the elapids and the night adders have fairly short fangs.

And, importantly, there are no venomous lizards in Africa.

Some final thoughts. The first is that it can sometimes be extremely difficult to identify a snake with certainty. Recently we sent a clear picture of a cobra, photographed in Kenya, to a cobra expert. He made a provisional identification. We then sent two more pictures, and he changed his mind. You may need to be flexible. And, as previously mentioned, successful medical treatment of a snakebite is not necessarily dependent upon the snake being identified.

Secondly, on our photographs. In a field guide, a secondary consideration beside the illustrative merits of a picture is usually its aesthetic quality; for example, is the animal alive, is it posed naturally, does it have any blemishes, is the background natural and uncluttered, can you see all of it? However, in this book we intend that users can identify, with as great a certainty as possible, Africa's dangerous snakes. So in some cases we have used pictures that are not aesthetically pleasing, but which we feel aid identification; for example, dead snakes, damaged snakes, snakes in cages, snakes upside down, and snakes held by hand or in grab sticks. We offer no apology for this; if such photographs aid medical personnel to make an identification with certainty, then our pictures will have served their purpose.

Finally, dichotomous keys are usually used to identify museum specimens. The keys in this book do not cover every snake in Africa, only the ones perceived to be dangerous, and thus some couplets end with 'not a dangerous snake'. We have tried to make the keys user-friendly, and thus we have included some visual characteristics. In the final analysis, however, if you want to identify some animals to species level with certainty (for example, burrowing asps), you will probably need a binocular microscope, you may need to have some idea of where the snake originated, and you may have to find fangs and count scales (never try this on a living snake). We hope these keys may be useful not only for indentifying snakes in the field, but also to those maintaining snakes, particularly for antivenom production, for a very important reason. There have been cases where commercially sourced venom has come from misidentified snakes, meaning of course that it is then ineffective, or even useless, for the treatment of a bite from the correctly identified snake. Antivenom manufacturers must be confident that the venom they use has come from snakes that have been unerringly identified.

Dangerous front-fanged snakes

Mt Mabu Bush Viper, *Atheris mabuensis*, Mozambique (Bill Branch).

In this and the next section on dangerous rear-fanged and fangless snakes, we describe the 130-plus species of dangerous snakes known from Africa. Each subsection starts with a brief overview of the family, a key where relevant, the subfamily (where relevant) and a generic introduction, including a synopsis of the venom and its effects. Each species is described under the following headings: Identification, Habitat and Distribution, Natural History and Medical Significance, and Taxonomic Notes where relevant. All species are accompanied by a map and photographs, where available.

Recent taxonomic work, using both fossil evidence and DNA, has created some stimulating debate over the order of appearance of the various groups of reptiles, snakes included. However, in this book we have not followed the taxonomic order of appearance of the various groups, but have started with the most medically significant. Thus our running order is: vipers, elapids, burrowing asps, and finally dangerous rear-fanged and fangless snakes. The following section, the 'look-alikes' (pp. 252–78), is similarly not in taxonomic order.

The two keys on p. 30 should enable the technical identification of any African snake to (a) its superfamily and (b) the smaller taxonomic groups. These are then further broken down at the beginning of the relevant sections. These keys are slightly convoluted, but should enable both the separation of dangerous and harmless snake taxa, and the individual identification of the dangerous species. As we have repeated in later pages, the keys are technical; the snake will need to be dead (do not start trying to key out a living snake), and you will probably need a binocular microscope and some familiarity with snake scalation (see Figures 16–22, pp. 20–21).

Key to the African snake superfamilies

1a Body worm-like; head round and blunt; tail blunt; eyes visible only as minute dark dots under the head skin; body scales all the same size……Typhlopoidea, blind and worm snakes; all harmless; see pictures in the section on look-alikes (pp. 252–78)

1b Body not worm-like; head not round; tail not blunt; eyes well developed; enlarged belly scales present……2

2a Ventral plates as broad or almost as broad as the body; no vestigial limbs; midbody scale rows fewer than 50……Colubroidea, typical snakes (pp. 226–41)

2b Ventral plates broader than the body scales but much narrower than the body; vestiges of hind limbs present as short claws on either side of the vent; midbody scale rows more than 70……3

3a Small, adults less than 1.2m; subcaudal scales single; no obvious neck……Booidea, boas; all harmless (p. 254)

3b Large, adults over 1.2m; subcaudal scales paired; obvious neck……Pythonoidea, pythons; non-venomous, but some may be dangerous due to their size (pp. 222–25)

Key to the African families, relevant subfamilies and relevant genera of the Colubroidea

1a One or more pairs of enlarged caniculate or tubular poison fangs present in the front of the upper jaw……2

1b No enlarged caniculate or tubular poison fangs present in the front of the upper jaw; fangs when present usually grooved and set below the eye……5

2a Poison fangs relatively small and immobile, not folded back when not in use……3

2b Poison fangs large, moveable, folded back in a sheath when not in use……4

3a Confined to South Africa; black with a red or yellow vertebral stripe; adults always less than 65cm……Subfamily Atractaspidinae, genus *Homoroselaps*, harlequin snakes; slightly dangerous (pp. 218–20)

3b Not confined to South Africa; not black with a red or yellow vertebral stripe; adults often larger than 65cm……Family Elapidae, cobras, mambas and allies; all dangerous (pp. 119–93)

4a Eye very small; pupil round; body usually uniformly dark (a few with white head or tail-tip markings); no loreal scale……Subfamily Atractaspidinae, genus *Atractaspis*, burrowing asps; all dangerous (pp. 194–217)

4b Eye relatively large; pupil usually vertically elliptic (but round in *Causus*, night adders); loreal scale present……Family Viperidae, vipers; all dangerous (pp. 31–118)

5a No loreal scale present; grooved rear fangs nearly always present……Subfamily Aparallactinae, African burrowing snakes (pp. 249–50); largely not dangerous (except Kwazulu-Natal Black Snake, *Macrelaps microlepidotus*, which is possibly dangerous; see account, p. 249)

5b Loreal scale present; grooved rear fangs present or absent……Families Colubridae/Lamprophiidae/Natricidae, colubrids/African snakes/house snakes/water snakes (excluding the Aparallactinae and Atractaspidinae); a few dangerous species pp. 226–41, pp. 242–51 and pp. 272–77)

Family Viperidae Vipers

A family of dangerous snakes with long, perfectly tubular, folding venom fangs, and of international medical significance. The vipers or adders (the names are interchangeable, although it is suggested that the name adder be restricted to those that give birth to live young) are split into three subfamilies: the Viperinae (Old World vipers), Crotalinae (pit vipers of America and Asia) and Azemiopinae (two species in one genus, curious slim Asian vipers).

Subfamily Viperinae Old World vipers

A subfamily of 13 genera and just over 100 species, found in Asia, Europe and Africa; five genera are confined to Africa and six are in both Africa and Asia. At present, some 56 species occur in Africa. The various genera, and most of the species, can be readily identified in the field using a combination of appearance, size, locality and behaviour, but we have provided technical keys below. Viper venoms tend to cause shock and have local cytotoxic or systemic haemorrhagic effects, although the venoms of some of the small southern African *Bitis* (and in particular the Berg Adder, *Bitis atropos*) are neurotoxic.

Key to the African viper genera

Note one exception to this key: a single African population of Puff Adders (*Bitis arietans*) is known from north of the Sahara, in Morocco and Western Sahara.

1a Pupil round; nine large scales on top of the head.....*Causus*, night adders (pp. 101–11)
1b Pupil vertical; many small scales on top of the head.....2

2a Subcaudal scales single.....3
2b Subcaudal scales paired.....4

3a Head pear-shaped; usually on the ground in dry country and semi-desert of the northern half of Africa; usually shades of brown or grey.....*Echis*, carpet or saw-scaled vipers (pp. 83–95)
3b Head not pear-shaped; usually in trees and bushes, in forest and woodland of tropical Africa; usually some combination of green, yellow and black.....*Atheris*, bush vipers (pp. 32–51)

4a On the high-altitude moorlands of central Kenya (Aberdares/Mount Kenya); slim; brown or grey with black markings.....*Montatheris hindii*, Kenya Montane Viper (p. 52)
4b Not on the high-altitude moorlands of central Kenya; not slim; not brown or grey with black markings.....5

5a A large single supraocular shield present; south-eastern Africa only.....*Proatheris superciliaris*, Floodplain Viper (p. 53)
5b No large single supraocular shield; not only in south-eastern Africa.....6

6a In sub-Saharan Africa, and all small species in Kenya or further south.....*Bitis*, African vipers (pp. 55–82)
6b In the Sahel or North Africa, and all small species north of 10°N.....7

7a Upper dorsals with knobbed (lumpy) keels; usually in or near the Sahara.....*Cerastes*, North African desert vipers (pp. 96–100)
7b Upper dorsals with narrow keels; usually north of the Sahara.....8

8a In the Sinai; has horns.....*Pseudocerastes fieldi*, Western False Horned Viper (p. 112)
8b Not in the Sinai; without horns.....9

9a Snout tip turned upwards; adults less than 60cm.....*Vipera latastei*, Lataste's Viper (p. 117)
9b Snout tip blunt; adults larger than 60cm.....10

10a Midbody scale count 26–27.....*Daboia mauritanica*, Moorish Viper (p. 113)
10b Midbody scale count 25.....*Macrovipera lebetina transmediterranea*, North African Blunt-nosed Viper (p. 115)

Bush vipers *Atheris*

A tropical African genus of attractive, largely green, broad-headed vipers. Most are arboreal and inhabit forest and dense woodland. They are small, never longer than 80cm. They are usually regarded as medically insignificant and appear to cause very few documented snakebites in Africa. This is for a number of reasons: they are secretive and live largely in trees, often in inhospitable areas (although they may be relatively common), and they are rarely on the ground near habitation at night or moving through farmland (although, being in a tree, if confronted they are more likely to deliver a bite to the upper body, a risk noted with arboreal pit vipers in South America).

No antivenom is produced against their bite, although African carpet viper (*Echis*) antivenoms seem to provide paraspecific neutralisation of their venoms. However, two species have large ranges, namely the Green Bush Viper (*Atheris squamigera*) and Western Bush Viper (*Atheris chlorechis*). The Green Bush Viper has caused some fatalities (although none with any thorough clinical details), and some alarming symptoms have been experienced following bites by the Western Bush Viper and Great Lakes Bush Viper (*Atheris nitschei*). So perhaps they are more dangerous than they are given credit for; a viper that feeds on mammals may well have venom that is very toxic to humans. Several bites to herpetologists and snake keepers are documented. The venom appears to be locally cytotoxic, and bites result in pain (often intense), swelling, shock, incoagulable blood and necrosis. Any doctor dealing with a bush viper bite should consider pain relief, testing for clotting abnormalities, and the possible necessity of blood transfusions. As mentioned, the use of antivenom prepared for carpet vipers can be considered.

At present, at least 15 species of bush viper are known; nine were known when the original edition of this book was published, although there is debate about the status of some forms. Their evolutionary scenario is interesting; probably one or more ancestral forms occurred through the great Central African forest, and the subsequent shrinking of the forest left populations isolated in hilltop and other relict forest patches; these populations then accumulated changes. Several forms can be instantly identified to species by their locality. These small snakes show a remarkable similarity in colour and body form to the arboreal pit vipers of Asia and Central and northern South America – an example of convergent evolution.

Key to the genus *Atheris*, bush vipers

1a Subcaudals fewer than 22.....*Atheris barbouri*, Barbour's Short-headed Viper (p. 34)
1b Subcaudals more than 22.....2

2a Predominantly brown with very prickly head scales; found west of Ghana..... *Atheris hirsuta*, Hairy Bush Viper (p. 40)
2b Does not have the above combination of characters.....3

3a Ventral scales fewer than 138; south of 15°S, in Mozambique.....*Atheris mabuensis*, Mount Mabu Bush Viper (p. 44)
3b Ventral scales usually more than 138; north of 15°S.....4

4a Lateral scales serrated.....5
4b Lateral scales not, or only feebly and irregularly, serrated.....10