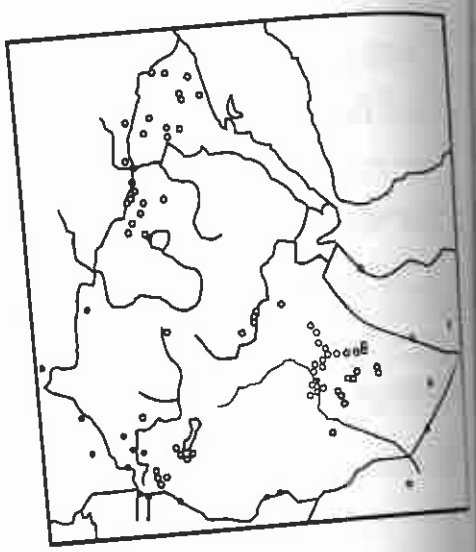
Rhinocerotidae Rhinoceroses

Diceros bicornis (Linnaeus, 1758). Black Rhinoceros, Awraris

The Black Rhinoceros was once common and widespread in Eritrea and Ethiopia, in the lowlands from 400-2300 m. It was especially well recorded in the NW and in the Ogaden, but also occurred in the Awash and Rift Valleys, and sparingly around the W and S borders. By 1909, it was extinct in the central Rift Valley, and had gone from the NW by about 1920.



It seems to have suffered a population crash (overhunting?) in the Oga den around 1910-2 but survived in small numbers to the 1930s, as it did in N Somalia, and disappear from the Awash valley about 1940. By the late 20th century, there may have been a fe animals remaining in the Omo N. Pk., and perhaps in the Dabus basin on the Sudan frontier (Largen & Yalden 1987). The last traces, foot prints, were observed in O area in 1983. The sharp decline, through poaching for its horns, in the rest of Af in the 1980s means that it is unlikely to be able to recover its status in S Ethiopia immigration. The Black Rhino is a browsing species, using its hooked upper lip to s leaves off twigs of *Acacia* and other shrubs. Invariably solitary, except that calves with their mothers for about 3½ years, they are never-the-less not territorial, but requi area of some 90 km^2 of thorn-bush, and require sources of water within their home r

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The Mammals of Ethiopia and Eritrea

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Contents

Preface, acknowledgements

The basis of this book is the Catalogue of the Mammals of Ethiopia, published in the Italian journal *Monitore Zoologico Italiano*. between 1974 and 1996 (Largen *et al.* 1974, Yalden *et al.* 1976, 1977, 1980, 1984, 1986, 1996). It also has a more immediate basis in a request from the Addis Ababa University Press to write it. The idea is to produce a relatively simple but up-to-date introduction to the mammals of both Ethiopia and Eritrea, since zoologically the two are barely distinguishable with the obvious exception that Eritrea can still boast some marine mammals and it would not make zoological sense to separate them. The boundaries might not show the actual demarcation. This book should serve to introduce the mammal fauna to Ethiopian and Eritrean students of Zoology, and also provide visitors to Ethiopia with an annotated list of the mammal fauna. It may play the same role for biologists from other biological and medical disciplines, as also those in tourism, conservation and legislative roles who need some basis for their own work. Ethiopia and Eritrea host a number of special species, the mammals that occur nowhere else in the world. These species, the en emics. are obviously of special conservation concern to anyone interested in mammals in Ethiopia, whether as ecologists studying them, tourists hoping to see them, or legislators trying to conserve them. We have given rather more attention to these species in our account. Popular accounts suggest there are only four or five of these, the large mammals. Our account introduces the many more, small species, that are also endemics, and moreover indicates that their number is growing as continuing research unravels the taxonomic wealth hidden in Ethiopia's small mammals. We do not claim that we have exhaustively covered the information especially on the distribution of species as further research will unveil more data. However, this is a kick start on the wealth of more than three decades of study on the subject by both of us and we hope that future talented Ethiopians will further reinforce and build on it.

We have done our best to provide an updated list of species, incorporating both new discoveries and genetic analyses. The maps from the Catalogue are updated as much as possible. There is much taxonomic turmoil in, especially, the small mammals, as targeted collecting and molecular phylogeny are applied and as new parks and reserves are studied. Continuing ecological studies within Ethiopia improve our knowledge of many species, and we have tried to include reference to this recent work, but we have not attempted a comprehensive review of studies elsewhere in Africa. For general information on these species, we have relied heavily on Kingdon (1997), and comments on African range, size, ecology and behaviour rely on his very useful field guide. Anyone wanting a more general introduction to the mammals of Africa is recommended to augment this book with Kingdon's field guide. As we write this book, a massive 6-volume handbook, *The Mammals of Africa*, is under preparation for publication (and to which we have contributed some of the Ethiopian species). That will provide more detailed keys, diagnoses and descriptions, as well as further ecological information (to diet, behaviour, reproduction, etc.) in due course. We could not hope to emulate this wealth of knowledge, but if we have offered a useful introduction to it, we shall be pleased.

We gratefully acknowledge the various colleagues who have helped us in the field on our own collecting trips, and those who have kept us aware of their own work by sending us reprints. Dr Pat Morris invited DWY to join the Great Abbai expedition of 1968, starting his interest in the mammals of the country, and organised 3 more expeditions involving both himself and DWY. Dr Malcolm Largen was already on the staff at Addis Ababa University, joined enthusiastically in all four trips, and also played a large role in writing the mammal catalogue while developing also his own expertise on the reptiles and amphibians of the country. He also introduced the two of us, having taught Afework Bekele at Addis Ababa, and recommended him as a research student to Derek Yalden at Manchester University. Most importantly, for this book, he and DWY co-authored an account of the history on mammalogy in Ethiopia which was never published: it forms the basis of Ch. 2. Since getting established on the staff of Addis Ababa university, AB has had the good fortune to cooperate with many international colleagues, including Dr Leonid Lavrenchenko and his Russian colleagues, Dr Marco Corti from Italy, Dr Herwig Leirs from Belgium and Dr Duane Schlitter from the USA.

Dr Chris Hillman also played an important part in the studies that led to this book. He organised, and invited us both to join, the expedition to the Harenna Forest, Bale, in 1986, and gave us both much assistance and support in other studies. He also inspired much conservation work, which he started and others have carried forward, in Bale and elsewhere, especially on the iconic but threatened endemic species.

We cannot mention all the others whose work has contributed, but hope we have remembered to cite their work in the bibliography. Drawing that work to the attention of students who might need to know it is one of our more important roles. We do single out for thanks those who read some or all of, this book, allowing us to avoid various mistakes, in addition to those allowing us their photos: Dr Meri Happold, Dr Leonid Lavrenchenko, Dr Malcolm Largen, Anagaw Atickem, Addisu Mekonnen, Fanuel Kebede, Dessalegn Ejigu, Pat Morris, Yilma Dellelegn, Mengistu Wondafrash and others. In particular, Dr Happold remarked on the bat chapter, in advance of the publication of the relevant volume of *The Mammals of Africa* (which she has edited), and Dr Lavrenchenko similarly commented on the rodent chapter for us. However, there are two people whose help behind the scenes has been crucial to all we have done. Both of our wives have been "zoological widows" for most of our careers, but their support and help has been tremendous, and we certainly could not have reached this point without them. We acknowledge and thank Zaf Gebretsadik and Pat Yalden for "holding the fort" while we were mentally, and sometimes physically, elsewhere.

Chapter 1

Introducing Ethiopia, Eritrea and their mammals

Lying between 3° 30' and 15° 00' N. Ethiopia is entirely tropical but with a climate much modified by topography. Surrounded by much lower ground in neighbouring Somalia, Kenya and Sudan, lower ground which is also much drier, the Ethiopian plateau creates an isolated moister and cooler climate which fosters a distinctive fauna and flora. It has been estimated that 50% of all the highlands above 2000 m in sub-Saharan Africa are in Ethiopia, and 80% of those above 3000 m (Yalden 1983). Moreover, Ethiopia is a large country: at around 1,100,000 km^2 it is about the fifth or sixth largest in Africa, certainly smaller than Sudan, Algeria and Zaire, but comparable with several other countries (Mali, Mauritania, Chad, Niger, South Africa) in area. However, in population, it is much more densely occupied than any of these and exceeded only by Nigeria. As elsewhere, its population is also increasing rapidly, at 2% p.a or more. Mesfin Wolde-Mariam (1972) estimated 26 million in 1968 and the census in 1984 gave a population of 42 million (Ethiopian Mapping Authority 1988) (both figures included Eritrea). At that time, only 4.7 million (11%) lived in towns. The population of Ethiopia (s.s.) at present exceeds 85 million.

Eritrea is a much smaller country, divided between a high plateau continuous with that of Ethiopia and a coastal lowland, along the Red Sea, that is continuous with those of Sudan and Djibouti. Lying between 12°30′ and 18°00′ N, with an area of 117,400 km^2 and a population of 5 million, even the plateau is dry, compared to Ethiopian highlands further south, so that woodlands and agriculture are much less extensive. Asmara, the capital, which is on the plateau, has an annual rainfall of only 515 mm, compared to 1330 mm in Addis Ababa.

The Ethiopian plateau is bisected by the Rift Valley, with its important chain of lakes, and further dissected by deep river valleys. These all provide important habitats for mammals, probably provided corridors by which lowland mammals spread into Ethiopia in the past, and by separating sections of high ground, encouraged further

diversification of the fauna. So the mammal fauna of Ethiopia includes lowground species which occur in neighbouring lowlands, moreover different species to the west, shared with Sudan, to the south, shared with Kenya, and especially to the east, shared with Somalia, but also highground specialists, some of which also occur on high ground elsewhere but a substantial number which occur nowhere else in the world. It is this latter category, the 30 or more endemics, which are so special, and give the fauna of Ethiopia its major scientific interest, but also its major conservation responsibility (Yalden & Largen 1992). The best known are the Walia Ibex, Gelada Baboon, Mountain Nyala and Ethiopian Wolf, but there are also numerous endemic small mammals. A few of the "endemics" in this region are actually shared with Eritrea (so strictly not endemic to modern Ethiopia), but zoogeographically it is hard to treat these close neighbours separately; this is also true historically, because many of the early collectors entered through the ports of Massawa or Zula in order to explore the fauna and flora of Ethiopia. Most of the lowland species have a wide distribution across the savannas of Africa, but a strong selection of those that are shared with Somalia have restricted distributions in NE Africa, either confined to E Ethiopia and Somalia, or extending marginally into N Kenya or E Sudan. These species, termed the Somali-arid endemics (like Grevy's Zebra, Gerenuk, Soemmering's Gazelle and the dik-diks), are another important element in the fauna of Ethiopia.

The mammal fauna of Ethiopia is under active study, and it is uncertain just how many species should be recognised. Particularly among the smaller mammals (bats, shrews and rodents), the identification of species remains uncertain. This might seem surprising. Surely with all the work that has been done on the mammals of the World, we know which occur in Ethiopia? Well, no: there are several problems. Firstly, there are still places that have not been properly explored. As an example, recent trapping near the NW frontier in the Alatish National Park (Tadesse Habamu & Afework Bekele 2008) found at least 3 rodents and a shrew which seem to be quite new, both to the fauna of Ethiopia and to science. The forests of the south-west have been explored over the last decade or two by several joint Ethio-Russian expeditions, but before that were very poorly known and might well yield yet more surprises. Secondly, there are taxonomic problems to be solved. Some of these are matters for international research, perhaps to be undertaken in museums

around the world, settling whether mammals that occur in Ethiopia are the same as those found elsewhere, perhaps in Kenya or Sudan but possibly far off in west or south Africa. In other cases, the problems will have to be resolved within Ethiopia - are small mammals found in Kaffa, say, the same species that are also found in the forests of Bale or Sidama, on the other side of the Rift Valley? In the past, such research was mostly a matter of museum study, comparing skins and skulls collected in one region with those from another. Comparison of local specimens with the first of that species to be described, the type specimen, perhaps in some foreign museum far away, was, and still is, an important part of such research. Increasingly however, such research extends into examining chromosomes and looking at the genetic variations (especially in mtDNA) between samples of the species from different localities within its range, to ascertain whether indeed it is the same species throughout, or whether so-called cryptic species, difficult to recognise in the field but genetically quite distinct, might be hidden within what had hitherto been considered all one species. The Harsh-furred Rat *Lophuromys flavopunctatus* exemplifies this problem. It was originally described from Ankober, and the type specimen, collected there around 1841 but not described until 1888, is in the Natural History Museum, London. Clearly, then, this must, by definition, be a species that occurs in Ethiopia. Very similar rodents occur in Kenya. Are they the same species, or different? More importantly, there are striking genetic differences and more subtle morphological ones as well, between the *Lophuromys* east and west of the Rift Valley, and at lower and higher altitudes within some of the forests where it occurs. Once these were thought to be clines - gradual changes in, for instance, tail length with altitude - within one species (Yalden *et al.* 1976). Now there is evidence that there are at least four or five species, with subtly different skull shapes, fur colour, chromosome numbers and genetic characters (Lavrenchenko *et al.* 2004b). Unpublished recent work on mtDNA variation in *Tachyoryctes* specimens from different localities similarly suggests more species than the one recognised here.

Over a period of some 25 years, starting in 1972, Malcolm Largen (then at Addis Ababa University, later at Liverpool Museum), Dieter Kock (at the Senckenberg Museum, Frankfurt) and Derek Yalden (at the University of Manchester) collated what was known about the mammal fauna of Ethiopia from the international literature, the museums in London and Frankfurt, and some extra field collecting. The results

were published in a series of 7 parts, constituting a Catalogue of the Mammals of Ethiopia, in the Italian journal *Monitore Zoologico Italiano*, later renamed *Tropical Zoology*, between 1974 and 1996 (Largen *et al.* 1974, Yalden *et al.* 1976, 1977, 1980, 1984, 1986, 1996). This was an attempt to collate all the locality records, and produce maps from them, for all the species known from Ethiopia (necessarily including records from Eritrea within those accounts). These lists include 277 terrestrial species, as well as 11 marine mammals. All the localities were identified, and included in a gazetteer, to facilitate mapping; this often necessitated reference to original expedition maps. This Catalogue forms the basis for the accounts of mammals in this book, and in particular for the distribution maps. However, the Catalogue is not readily available to students, and we hope that, by producing this book, we can make its main contents more accessible, especially in Ethiopia where it should be most useful. We also have the opportunity to update the list, drawing attention to the important new work that has been done in the last decade. Increasingly, this is work carried out within Ethiopia by Ethiopian postgraduate students, as it should be. It is ridiculous that one of us should have been flying 6700 km to study Ethiopian mammals! We can also refer to the increasing amount of very good work coming out of Addis Ababa and other universities, some of it not yet published but written up in student reports and theses. We are aware that further work in the future will enrich the distribution pattern of mammals: different areas that are unexplored but zoologically important, especially the Somale region, will yield new records, perhaps even new species, and we hope our imperfect maps will encourage others to fill the gaps.

A brief history of Ethiopia and Eritrea

An underlying theme in the history of mammalogy in Ethiopia has been the series of changes during the last 200 years in Ethiopia itself. Initially, what was invariably called Abyssinia (hence *abyssinicus* as a specific name for various birds and mammals) was a northern entity, with capitals initially in Axum in the 1st-7th C, and much later, from 1636, in Gondar. Massawa was the only port of entry to this northern kingdom. The Emperor Tewodros II (Theodore) moved the capital to Magdala in 1865, but after the British attack on his fortress there in 1868, and his suicide, the capital reverted to Gondar under the governance of Kassa, who became Emperor

Yohannes IV. One of his most important vassals and (sometimes) allies was King Menelik of Shoa, who moved his capital from Ankober to Holeta (in 1878), Entoto (in 1882) and finally Addis Ababa (in 1886). Menelik conquered Wollo in 1866-1876, and Gojjam in 1882, but this expansion northwards was thwarted by Yohannes, who encouraged him to look southwards. Menelik invaded and annexed Kaffa (1882-97), Arsi (1882-86), Wollega (1886) and Harar (1887) (Kofi Darkwah 1972, Bahru Zewde 2002). When Yohannes was killed while defeating the Sudanese at Metemma in 1889, Menelik succeeded him as Emperor, and Addis Ababa became the capital of Ethiopia: Menelik's expansionist policies to the southwest and southeast continued into Illubabor, Sidamo, the Ogaden and Bale. Thus the modern boundaries of Ethiopia, and Addis Ababa as its capital, were consolidated by and followed his succession. Most of these boundaries are marked by relatively obvious changes of altitude. That with the Sudan was successfully defended by the Battle of Metemma, and settled by a boundary treaty with the British in 1902. Similarly, the boundary with Kenya was settled by treaty, after a boundary survey, in 1907. The boundaries to the east, however, in the Ogaden, are not so obviously demarcated geographically, and the straight lines mapped during the 1890s were followed by treaties fixing the boundaries with French (1897), British (1897) and Italian (1908) Somaliland (French Somaliland now being Djibouti, while the former British and Italian Somalilands now constitute Somalia). The boundary commissions that mapped these borders included naturalists who added interesting records of mammals from these little-explored areas. Prior to their activities, the loose term "Somaliland" was applied to much of this area, and quite a number of early records of mammals in this part of Ethiopia are therefore, confusingly, assigned to Somali-land. To the north, Eritrea had a less sure historical continuity. Although Ethiopian emperors controlled the port of Massawa, and the passage of foreigners from there to the Ethiopian highlands, up to the 18th century, the coastal strip became firstly an Arab sultanate, then an Egyptian colony, and when the Egyptians left in 1888, an Italian colony. The Italians also tried to obtain political control over Ethiopia in the 1890s, and pushed at the boundaries of Ethiopia. However, the boundary with Eritrea was fixed by treaty in 1900 following the decisive defeat of the Italian armies at Adowa in 1896, abrogated when the Italians tried to conquer Ethiopia in 1935-41, reinstated by the United Nations after 1945, removed again by union with Ethiopia in 1952, but reinstated yet again when Eritrea took its independence in 1993. Zoologically,

the border is as hazy to the animals which live there as are the boundaries around the Ogaden to the Somali-arid species. With colonial administrations established in neighbouring countries, routes for zoologists to enter Ethiopia on zoological expeditions multiplied, and with trade encouraged through these outlets, consuls were established in, for instance, Dangila, Mega, Harar and Gore. A.W. Hodson, consul in Mega, and especially R.E. Cheesman, consul in Dangila during the 1920s, made significant contributions to our knowledge of mammals in those regions.

For much of its recent history, Ethiopia has been organised administratively into 13 regions (or provinces) (Tigray, Gondar, Gojam, Wello, Shoa, Arsi, Bale, Hararge, Wellega, Kaffa, Ilubabor, Gamo-Gofa, Sidamo), and those names appear frequently in the historical literature, including the localities where mammals were collected. Currently, Ethiopia is instead organised into many Regions (Tigray, Afar, Somale, Amhara, Southern Nations, Oromia, Gambela, Benshangul) which reflect the ethnic groupings of the republic; these names have less value for identifying the classic mammal collecting localities, but are relevant to the current management of protected areas (see Ch. 14).

The ecological history of Ethiopia

When the volcanic dome that became the Ethiopian plateau started to emerge about 30 Ma (million years ago), it pushed into a forested landscape. A peat core from Chilga, about 100 km NW of Lake Tana, provides important evidence (Kedamawit Yemane *et al.* 1985). Dated back to 8 Ma, and now at 1900-2000 m altitude, it shows a wet forest flora with pollen of *Afrocrania*, *Brachystegia*, *cf. Isoberlina*, *cf. Iodes*, *cf. Holoptelea*, *cf. Oligoconodon* and *Rauvolfia* type. These are mostly species that occur in wet forests further south, in Tanzania or Congo, though *Afrocrania* does occur in Ethiopia. Spores of a variety of ferns are also present. Conversely, there is little grass, no *Juniperus* or *Podocarpus*, pollen types that would now occur in this area and altitude in Ethiopia. Collectively, these suggest that Chilga was then at about 1000 m above sea level, and has been pushed up at about 0.1 mm per year ever since. At around 6.5.Ma, the climate in and around the Mediterranean became much drier, and it is suspected that a combination of continuing uplift since the Chilga flora was

deposited and this climatic event isolated the Ethiopian plateau from forested areas further south in East Africa. Drier forests, typified by Tid *Juniperus procera*, would probably occur widely over much of the main plateau, had human activity not since removed most of it over the last 300 years. Remnants remain on, for instance, Managasha, near Bale Goba, and as isolated trees in many church environs (Hall 1984). In the wetter southwestern forests, as also in the Harenna Forest on the S side of Bale, broadleaved forests with such species as *Schefflera*, *Aningeria* and *Croton*, as well as the conifer *Podocarpus*, form a band from a lower tree-line at 1800 m to about 3000 m. Towards the upper limit, Kosso *Hagenia* and *Hypericum* are typically present. Above them, to about 3300 m, is a zone of giant heath *Erica arborea*, with *Helichrysum* and other hardy species. The Ethiopian forests have a poor mammal fauna, apparently lacking at least 50 species that occur in the equivalent forests in S Sudan, Uganda, or the forested mountains of Kenya and Tanzania (Yalden *et al.* 1996). The Ethiopian forests are also considered to have an impoverished bird fauna, with only 2 endemic species and a third forest species shared with Kenya (Diamond & Hamilton 1980). It is likely that cold, dry periods in the Pleistocene reduced forests to small remnants. Certainly, large glaciers in Bale produced extensive moraines down to 3200 m, and pollen analyses suggest that forest was pushed below 2200 m; in drier Simien, less ice formed, and the smaller glaciers extended down to 3800 m. Low levels are recorded for many of the lakes during the maximum of the last glacial period, 20.5-14.5 ka and again in the Younger Dry as 12.9-12.0 ka, emphasizing that these were both cold and dry periods. At Garba Guracha, Bale, the pollen record begins with a cold, arid adapted flora of sparse grasses, Chenopodiaceae and *Artemisia*, confirms a wetter phase, with *Cyperus*, around 13,400 b.p., returning to drier, colder conditions marked by less *Cyperus* and more *Artemisia*. The modern flora of the site, dominated by Ericaceae, appeared quite quickly with the warmer, wetter climate of the Postglacial at 11,200 B.P. (Umer *et al.* 2007). Elsewhere, high lake levels are recorded in the immediate post-glacial period 12.0-6.0 ka, and this wetter period is probably the time when Ethiopia's forests regained something like their recent extent (Gasse & Street 1978, Verschuren *et al.* 2009).

Above the giant heath zone, afromontane moorland of *Alchemilla*, giant *Lobelia*,

Helichrysum and montane grasses occurs in small patches on the highest Ethiopian mountains. Mostly this habitat is confined above 3300 m, though it extends down to about 3100 m in some valleys. Its total extent has been well mapped, in order to establish the possible range of various Ethiopian endemics, many of which are typical of or confined to this habitat. Especially, the Ethiopian Wolf is a characteristic and charismatic member of this group. It has been suggested that its total range now consists of only 6 patches of habitat, varying from only 46 km² near Ankober to 1,500 km² in Bale, in total no more than 3,200 km² (Sillero-Zubiri & Macdonald 1997). In their recent mapping of the potential vegetation of Ethiopia, Friis *et al.* (2010) suggest a total for Ethiopia of 8722 km² of afro-alpine vegetation, and another 7003 km² of ericaceous scrub (Friis pers. comm.). These emphasise how scarce both these zones are (only 0.77% and 0.62% of the country, respectively), but also that the potential possible range for the mammals of these habitats is larger than currently realised.

The forests of Ethiopia are not continuous with similar forests further south, and probably have not been for at least 2 Ma. At present, open *Acacia* woodlands occupy a belt below the forests, giving way below 1000 m to semidesert and in the Danakil to true desert. These drier habitats extend into Somalia, NE Kenya and Sudan, so that mammals such as gerbils, gazelles and dik-diks, which occur in lowland Ethiopia, have ranges that extend into these neighbouring countries. These drier habitats seem to have persisted throughout the Pleistocene, effectively isolating the higher ground and its evolving endemics.

Chapter 2

The scientific discovery of the mammal fauna

Two unequal, overlapping, phases characterize the history of mammalogy in Ethiopia. The first phase, much longer and still continuing, concerns the discovery and description of the mammals occurring in the country. This taxonomic work began with numerous collecting trips by foreign-based expeditions, and the subsequent description of the specimens in foreign museums. In the early days, German, British, Italian and American collectors were conspicuous, with in addition and more recently French, Hungarian and especially Russian contributions, and with Ethiopians increasingly participating, on their own and in international cooperations. The immediate output of these expeditions has been the accumulation of important specimens in the major museums of the western world. There they were worked on and described by foreign specialists, most of whom had never set foot in the country. In about 1960, a second phase of research started, concentrating on the ecology and conservation of mammals in Ethiopia. This requires much longer study periods within Ethiopia, and the field work has become more cosmopolitan, with Swiss, Japanese and French participants, as well as Germans, Britons and Americans. Most importantly, this necessarily requires the direct involvement of Ethiopian research workers, at all levels from domestic staff, game guard and field assistant to research scientist.

A third, and quite independent, stream of research involves the fossil mammals described from Ethiopia. The anthropological stimulus, trying to discover early hominids within the Late Pliocene and early Pleistocene deposits of the Rift Valley, has produced also records of their associated mammals, important for dating the hominids, and explaining their ecology, but also beginning to delineate the geological and geographical history of the Ethiopian mammals.

Systematic mammalogy

As the Ethiopian culture spread southwards during the last 200 years or so, mammalogical exploration also extended southwards. From the time of Bruce,

the 1770s. to the 1880s. visiting expeditions operated within Eritrea and northern Ethiopia. usually commencing from Massawa. though sometimes from Sudan. Later, the emphasis moved southwards. as the capital shifted southwards to Ankober and Addis Ababa. and as the British established themselves in northern Somalia (British Somaliland) and Kenya. Expeditions often started in Berbera or Zeila. or in Djibouti on the same Red Sea coast. Even now. southwestern Ethiopia. furthest from all these entry points. remains the least familiar region

1769-1900

The Scot James Bruce provided a large number of important and accurate drawings of plants collected on his travels in 1769-72, but few of the zoological ones have been published (Hepper 1980). Those which have (Bruce 1790) are misleading. A rhinoceros. purportedly from Tscherkin. Ethiopia (and subsequently described as *Rhinoceros brucei* by Lesson 1842). a striped hyaena and a "lynx" from the Sudan. and a jerboa from Cyrenaica were among them. Gmelin (1791) subsequently described the "lynx" as *Felis ochreata* and the jerboa. very unhelpfully. was described by Meyer (1795) as *Dipus abyssinicus*. Bruce's journals make it clear that he did shoot a rhinoceros. but the drawing shows a blend of African and Indian rhinoceroses. and the lynx looks like a mix of caracal and serval. The accurate artistry of his Italian colleague Luigi Balugani. seen in the botanical drawings. was evidently not applied to these mammals (Fig. 2.1).

In 1805. and again in 1809-10. the Englishman Henry Salt explored Eritrea. His zoological collections were largely birds (Salt 1814, Largen 1988). but included the first of a dik-dik, later named *Madoqua saltiana* (Desmarest 1816). Two Germans. W.F. Hemprich and C.G. Ehrenberg. explored NE Africa extensively during 1819-26. mostly in Egypt and Sudan. but also in the Massawa area. They were serious collectors of birds and mammals. and provided several first records of mammal species from Ethiopia (Hemprich & Ehrenberg 1828-1833). Stresemann (1954) describes their activities in detail.

By far the most important of the early mammalogists visiting Ethiopia was Eduard

Rüppell (1794-1884). In 1827, he spent 6 months in the Massawa area, the mammals he collected being described by Cretzschmar (1826-30). They included 3 species new to science: the widespread bat *Chaerephon pumilus* and two Somali-arid endemics, the ground squirrel *Xerus rutilus* and the antelope *Gazella soemmeringi*. In September 1831 he returned to Massawa, and the following April set out for highland Ethiopia, travelling through the Simien Mountains to Gondar and Lake Tana (Fig. 2.1A). When he returned to Frankfurt in April 1834, he was appointed curator at the newly-created Senckenberg Museum, which still houses his collections. He published much of his material in a book (Rüppell 1835-40a) and in an important series of papers (Rüppell 1842a-c). He also described his travels in a two-volume account (Rüppell 1838b, 1840b). He discovered, and described, at least 6 of Ethiopia's important endemic mammals: the Gelada Baboon *Theropithecus gelada*, Ethiopian Wolf *Canis simensis*, Walia Ibex *Capra walie,* Giant Mole-rat *Tachyoryctes macrocephalus* and two smaller montane rodents, *Muriculus imberbis* and *Stenocephalemys albipes*. He also described many more still valid species that occur more widely in NE Africa, including the genet *Genetta abyssinica*, common mole-rat *Tachyoryctes splendens*, Naked Mole-rat *Heterocephalus glaber,* horseshoe bat *Rhinolophus fumigatus*, monkey *Colobus guereza* and two grass rats, *Arvicanthis abyssinicus* and *A. dembeensis*. A fuller appreciation of his contribution to mammalogy is given by his biographer (Mertens 1949).

The next important zoological explorer was another German, the indefatigable Theodor von Heuglin (1824-1876), who visited the area on four occasions during a 25-year career that encompassed 7 expeditions in all. During 1852-53 he travelled from Khartoum to Lake Tana and the Simien Mountains, while in 1857-58 he travelled the length of the Ethiopian coast, including Massawa, en route to Socotra. He was back in Massawa in 1861 at the start of a two-year expedition, returning to Simien and Lake Tana before venturing further south through the mountains to Magdala and beyond. Finally, in 1875, the year before his early death at 52. he explored NE Ethiopia and the adjacent Sudan. Like Rüppell, he amassed a large collection, now housed in the Staatliches Museum für Naturkunde, Stuttgart. He likewise produced an important series of papers (especially Heuglin 1861a-d, 1863a-c) and two books (Heuglin 1868, 1877). Using Ethiopian specimens, he described 4 bats (*Hipposideros megalotis,*

Tadarida bivittata, *T. ventralis*, *Kerivoula eriophora*) and two rodents (*Dendromus mystacalis*, *Otomys typus*) new to science.

Meanwhile, British interest in Ethiopia had persisted. A short diplomatic mission in 1841 to the King of Shoa, Sahle-Selassie, led by W.C. Harris, travelled from Djibouti to Ankober and beyond, through country not previously visited. It was important for obtaining the types of the Lesser Kudu *Tragelaphus imberbis* and the harsh-furred rat *Lophuromys flavopunctatus*, though these were not described until much later (respectively 1869 and 1888). Harris (1844) provided an account of his itinerary, including some observations of game animals. Travels along the Sudanese border took S. W. Baker marginally across the border into Ethiopia in 1861-62, where he shot the type of a distinctive Roan Antelope *Hippotragus equinus bakeri*, later described by Heuglin (1863c).

The Napier expedition of 1868 is best known for its logistical feats (laying a railway from Zula to Senafe, bringing 32,000 men and 55,000 animals from India, including 44 elephants: Moorhead 1962) and for its culmination at the Battle of Magdala with the suicide of Tewodros (Theodore II). Less well known is that its staff included both an official mammalogist, W. Jesse (Jesse 1869), and an official geologist, W.T. Blanford, who seems actually to have been most successful as a zoologist (Blanford 1869, 1872). His collections of hyraces, especially, but also of hares, remain important items in the British Museum (Natural History), London.

The period 1881-1891 saw a final flurry of activity in northern Ethiopia. Central Eritrea was explored by F.L. James and Josef Menges during 1881-2 (James 1883; Menges 1884). The exploration of the W border of Ethiopia by Juan Maria Schuver in 1881-2 was notable not just for his valuable and extensive distribution records (Schuver 1883), but for the fact that these are still, even today, among the few records from this remote region. Giglioni (1888) reported on the mammals collected by Augusto Boutorlini and Leopoldo Traversi in the Assab area and in Shoa during 1884-87. Another Italian, Vittorio Bòttego (1860-1897) travelled along the coastal margin of the Danakil Desert from Massawa to Assab in 1891 (Del Prato 1891, Bòttego 1892). By this time, the

establishment of British colonial rule in Somaliland and Kenya had provided new bases for the exploration of uncharted territories, and attention shifted away from northern Ethiopia towards eastern and southern regions. Among the earliest to exploit these new possibilities were F.L. James who, along with his brother W.D. James, E. Lort Phillips and G.P.V. Aylmer, travelled from Berbera through the Ogaden region to the Webi Shebelli in 1884-5 (James 1885). This first venture was followed quickly by similar expeditions, by H.G.C. Swayne in 1887 and 1892-93 (Swayne 1895), P.H.G. Powell-Cotton in 1895-96, N.D. Ghika (Ghika 1898) and Eduard Wickenburg (Wickenburg 1899).

Most significant were the further contributions by Vittorio Bòttego. Following James' example, he turned his attention southward, and embarked on a series of exploratory travels that almost rivalled those of von Heuglin. During 1892-93 he travelled from Berbera southward though the Ogaden to explore the drainage of SE Ethiopia, particularly the Ganale and Dawa Rivers, before returning to the coast of Italian Somaliland via Dolo. The mammals he collected were described by Thomas (1895). He returned to Ethiopia in 1895, travelling through Dolo again to the southern regions of Lake Abbaya, the Omo River and Lake Rudolph (now Turkana). He was killed by local people in 1897, but his colleagues succeeded in traversing SW Ethiopia to reach the Sudan. Their collections, including the type of the small shrew *Crocidura bottegi*, were also described by Thomas (1897, 1898).

Bòttego was not the first zoological explorer to reach the Omo; the American Arthur Donaldson-Smith explored the same area in 1895, having travelled from Berbera in 1894. He went on to visit Lake Chamo and circumnavigated Lake Stephanie before visiting Lake Rudolph and leaving southwards into Kenya (Fig. 2.1). His travels are notable both for the detail and accuracy of his route maps (Donaldson-Smith 1895, 1896, 1897), and for the attention which he paid to rodents. His collections, housed in the Academy of Natural Sciences, Philadelphia, were described by Rhoads (1896); they include the types of *Gerbillus pulvinatus*, *G. ruberrimus*, *Mus mahomet*, *M. proconodon* and *Steatomys parvus*. A second journey in 1899-1900 covered much the same ground, except that from Lake Rudolph he proceeded to Khartoum. The mammals collected this time were acquired by the British Museum (Natural History) and were described by Thomas (1901a). They included the type of the distinctive shrew

Crocidura smithii.

The final years of the Nineteenth Century saw the start of significant exploration in central Ethiopia (Fig. 2.2). During 1897-98, the Frenchman C. de Bonchamps travelled from Djibouti via Addis Ababa to the White Nile in Sudan. His most valuable achievement was in following the Baro River and making novel observations on the fauna of this region (de Bonchamps 1898). Lord Lovat and Herbert Weld Blundell led an expedition through central Ethiopia in 1898-99, travelling from Berbera to Addis Ababa, and then down the Great Abbai (Blundell 1900). The resulting collection of 22 mammal specimens included the type of the very distinctive endemic mouse *Dendromus lovati*, collected at Managasha.

1900-1945

P.H.G. Powell-Cotton (1866-1940) followed his exploration of the Ogaden in 1895-96 by his well-publicized 1899-1900 expedition (Powell-Cotton 1902), and by a later one to the Arsi and Bale Mountains in 1924. In 1899, he left Zeila for Addis Ababa, and then travelled northwards via Lake Tana and the Simien Mountains to Massawa. He collected an extensive and representative collection of larger mammals, all meticulously documented with measurements, dates and localities. His notes on the abundance of mammals seen during this trip, all also well documented, make his diaries and book as almost as valuable as his collections; his notes on Ethiopian Wolf and Mountain Nyala are especially significant. It is unfortunate that his material has often been overlooked, perhaps because it resides in his own private museum at Quex Park, Birchington in Kent, rather than in a national museum. There it forms part of a much larger collection of mammals from every zoogeographical region of Africa, some of them displayed in splendid dioramas that are not matched anywhere else in Britain. Some important specimens have been transferred to the British Museum (Natural History), which also has a duplicate catalogue.

During 1899-1901, a German expedition led by Carlo von Erlanger and Oscar Neumann, following in the tradition established by Rüppell and von Heuglin,

undertook similarly extensive travels through southern Ethiopia. Starting from Zeila, they headed SW to Harar and then into Bale Province. Inexplicably, they failed to exploit the opportunity for rewarding exploration at high altitude in the Arsi Mountains, travelling instead through the northern foothills to Addis Ababa. From there they explored southwards down the Rift Valley to Lake Chamo ("Lake Ganjule"), where Erlanger and Neumann parted. Erlanger headed firstly NE into the Bale Mountains, but again failed to exploit the opportunity to collect at high altitude, heading down the Ganale into Somalia (Erlanger 1901, 1904). Neumann mean time worked westwards into Kaffa Province and then into the Sudan, returning to Europe via Khartoum (Erlanger & Neumann 1900, Neumann 1902a). Again, the expedition seems not to have explored the forest fauna fully; perhaps after three years in the field, enthusiasm was diminishing. Their mammal specimens, housed in the Zoologisches Museum, Berlin, were mostly described by Neumann himself (Neumann 1901, 1902b-c, Neumann & Rummler 1928). They included a number of new subspecies, including the Giant Mole-rat *Tachyoryctes macrocephalus hecki* and Ethiopian races of hyrax and grivet monkey. Had they explored the Arsi and Bale Mountains more thoroughly, they would surely have discovered a number of undescribed species, notably the Mountain Nyala *Tragelaphus buxtoni*. Instead it was left to Ivor Buxton, on a hunting expedition in 1908 to the Sahatu Mountains, Arsi, to obtain the first specimens (Lydekker 1910).

In 1901-02, Edward Degen collected birds and mammals in central Ethiopia (Fig. 2.2). Starting from Zeila, he travelled via Harar and Lake Zwai to Addis Ababa, then northwards through Gojjam Province to Lake Tana. He returned along roughly the same route, but finished at Djibouti (Ogilvie-Grant & Degen 1904). His 62 mammal specimens were described by Thomas (1903): they included the types of the hare *Lepus fagani* and the endemic rodent *Pelomys harringtoni*. The latter had actually already been collected by Lord Lovat's expedition, but misidentified then as *Arvicanthis dembeensis*, a confusion not sorted out until the 1976 section of the Catalogue (Yalden *et al.* 1976). A number of smaller collections made around this time also ended up in the British Museum to be described by Thomas. They included mammals obtained between Zeila and Lake Zwai in 1900-01 by A.E. Pease (Pease 1901, 1902; Thomas 1901b) and those from the Ogaden collected by

H.N. Dunn in 1904 (Thomas 1904). The latter included the types of the dwarf mongoose *Helogale hirtula* and the gerbil *Gerbillus dunni*. Sordelli (1902) described the mammals collected by Paolo Magretti in Eritrea.

An important collection was made during 1904-05 by a little known embassy official Peter Zaphiro (1877-1933): it contained 127 small mammals from the SW. His expeditions were financed by W.N. McMillan, who donated the collections to the BM(NH), where Thomas (1906) described some of the novelties. These included the types of *Pelomys rex* and *Taterillus harringtoni*. Later, Dollman (1915) described two new shrews, *Crocidura zaphiri* and *C. macmillani*. The taxonomic status of all four has been disputed, and *Pelomys rex* surely belongs in *Mylomys:* current thinking recognises all four as distinct, albeit poorly known, species, including *Mylomys rex*.

As well as supporting Zaphiro's work, MacMillan undertook some collecting of his own, including an expedition to the SW in 1904 (Fig. 2.3): the accounts by Jessen (1905, 1906), who accompanied the expedition as engineer, included useful sightings of larger mammals in the region, as does the report by G. Montandon (1913), who traversed the area in 1909-11. In 1908, the British boundary commission, led by C.W. Gwynn (1911), left Djibouti to establish the boundary between Ethiopia and British Somaliland. The expedition doctor, R.E. Drake-Brockman (1875-1952) had to leave the expedition prematurely due to ill health and return to Djibouti, but not before interesting himself in the taxonomy of the dik-diks *Madoqua*. He made important collections of these little antelopes, especially in 1908-09 (Drake-Brockman 1909b), and the specimens are still in the BM(NH), but have never been fully described. However, he did publish three useful papers himself on the genus (Drake-Brockman 1909a, 1911, 1926), and they formed, with those collected by Powell-Cotton, the basis of a revision by Yalden (1978).

Italian interest in southern Ethiopia resumed with the journey by C. Citerni through the Ogaden region and Arsi Mountains (Citerni 1913). Beyond their intrinsic interest, his collections are notable as inciting their description, the first of many significant contributions to Ethiopian mammalogy, by Oscar de Beaux (1922). The material

from the Gondar region collected by Ugo Ignesi, a commercial agent there, were also described by him (De Beaux 1925), as were many important later Italian collections.

During 1911-12, the American Childs Frick travelled from Djibouti southwards through the Rift Valley into Kenya. His bird collection was described by Friedmann (1930), who included a useful route map (Fig. 2.2). Frick (1914) himself described two new endemic rodents, *Arvicanthis blicki* and *Stenocephalemys albocaudata* obtained in the Arsi Mountains, but the remaining mammal specimens, in the Carnegie Museum, Pittsburgh, have never been properly documented.

Arnold Hodson, serving as British Consul in southern Ethiopia, explored extensively in SW Ethiopia between 1914 and 1926 from his base at Magi (Fig. 2.3), and the reports of larger mammals in his accounts (Hodson 1927, 1929) are useful records from this area; similarly, the hunting expedition to Eritrea, Simien and Arsi by H.C. Maydon and G. Blaine in 1924 is important for the detailed information it provides on larger endemic mammals (especially Walia Ibex and Mountain Nyala) at that time (Maydon 1924, 1925). Meantime, another British Consul, R.E. Cheesman (1878-1962), based at Dangila in Gojjam to smooth trade and relations between Ethiopia and Sudan, began an important exploration of the Lake Tana-Great Abbai basin (Cheesman 1928, 1933, 1936), during which he collected smaller mammals and birds assiduously. The British Museum (Natural History) received 196 immaculately documented mammal specimens from him in 1928, and another collection of 104 specimens in 1937 (Fig. 2.3). Some of the interesting species in the first collection were described by Thomas (1928), including a new form of mole-rat *Tachyoryctes cheesmani* (probably still valid as a subspecies: Afework Bekele 1986), but the second collection was never described. Petter (1963) did however describe the endemic hare *Lepus starcki* on the basis of Cheesman's specimens. During 1926-27, a major American expedition, from the Chicago-based Field Museum of Natural History, explored a wide area of central and northern Ethiopia (Fig 2.2). The artist Louis Fuertes accompanied W.H. Osgood, A.M. Bailey and J.E. Baum, among other participants. The general accounts published by Baum (1927) and Fuertes & Osgood (1936) include useful data on larger mammals, while Osgood himself described some of the smaller species (Osgood 1928, 1936), including the mysterious endemic water rat *Nilopegamys plumbeus* from near L. Tana, which has never been

seen again. He also recognised two endemic shrews (*Crocidura baileyi, C. phaeura)* and others, identified by him as *C. macmillani,* have since been distinguished as *C. thalia* (Dippenaar 1980). However, the full collection has never been described. This is also true of the material collected for the American Museum of Natural History, New York, in 1929. Gertrude Sanford, Morris Legendre and Sidney Legendre set out particularly to collect Mountain Nyala from the Arsi Mountains for a habitat group. They then proceeded to Lake Abbaya, and had been intending to work the southwestern forests and then follow the Baro River into Sudan, but faced with difficulties returned to Addis Ababa and New York. They did take at least 20 Mountain Nyala with them, and they are on display in the Field Museum of Natural History, Chicago, but the other specimens remain largely neglected to this day.

By contrast, material collected in the Danakil Desert by's accounts (Thesiger 1935, Thesiger & Meynell 1935) contain valuable sightings of large mammals along the Awash Valley between Awash Station and Lake Abbe in 1933-34, an inhospitable and still little-explored region. Around this same time, Ludwig von Huyn was travelling in the Arsi and Chercher Mountains. Although primarily concerned with birds, he made useful observations on mammals (Huyn 1934, Huyn & Kalmer 1935), and his small collection of specimens was later reviewed by Kummeloeve (1974).

The brief period (1936-41) when Ethiopia was occupied by fascist Italy saw two important expeditions to the south. The Missione Biologica nel paese dei Borana in 1937 and the subsequent Missione Biologica Sagan-Omo in 1939, both led by Edoardo Zavattari, explored the Borana region from Dolo westwards to Lake Stephanie and the Omo River. The considerable collections of mammals were again thoroughly documented by de Beaux (1939, 1943).

1945-2008

There was then a strange gap of around 30 years in the taxonomic study of Ethiopian mammals. A few enterprising individuals, like Leslie Brown and Robert Ingersol,

made their own ecological contributions (see below), but specifically taxonomic work resumed with two expeditions in 1968. The Museum National d'Histoire Naturelle, Paris, conducted research in central Ethiopia, especially the Rift Valley and Bale, and revisited the area in 1971. Led by Jean Dorst, the extensive collections included primates (Dandelot & Prevost 1972), bats (Dorst & Prevost 1972) and rodents (Dorst, 1972, Petter 1972a), but other groups have not been reported in detail. The description by Petter of two new distinctive endemic rodents *Lophuromys melanonyx* and *Stenocephalemys griseicauda* from the Bale Mountains was one important outcome. The same year, John Blashford-Snell led an exploration of the valley of the Great Abbai (Blue Nile) (Snailham 1970). Among the mainly British army personnel were three zoologists from England (Pat Morris, Derek Yalden, Hilary King) and one Scot already on the staff at Addis Ababa University (Malcolm Largen). Their collecting concentrated on small vertebrates (rodents, bats, shrews, frogs, lizards), and resulted in some 300 small mammal specimens being deposited in the BM(NH), including the type of the bat *Myotis morrisi* (Hill & Morris 1971, Corbet & Yalden 1972). The success of this venture prompted further collecting trips by Largen, Morris and Yalden in 1970-71, 1971-72 and 1975, firstly to revisit Awash and the SW Forests, but especially to exploit the newly available road access to high altitudes in Bale. A further 500 small mammal specimens were presented to the BM(NH) as a result of these trips, among them the type of *Crocidura lucina*. These collections also stimulated the start of, and then contributed to, work on the Catalogue of the Mammals of Ethiopia. At about this time, Melvin Bolton, working for the Ethiopian Wildlife and Conservation Organisation (EWCO), spent some time exploring little-known regions for surviving populations of larger mammals (Bolton 1973, 1976), especially antelopes in the Ogaden.

András Demeter spent 3 months in 1980 collecting in central Ethiopia and subsequently published an analysis of some owl pellet material, a note on *Arvicanthis* and, collaboratively, a review of the Ethiopian specimens in the Hungarian Natural History Museum (Demeter 1982a, b, Demeter & Topál 1982). Collecting by Hans Rupp and his colleagues in the 1970s revealed the existence of a rare and very distinctive large dendromurine mouse *Megadendromus nikolausi* (Dieterlen & Rupp 1978) and a possibly distinct *Stenocephalemys*, (then *Praomys*), *St. ruppi* (Van der Straeten & Dieterlen 1983) as well as a new climbing mouse *Grammomys minnae* (Hutterer

& Dieterlen 1984). In August 1986, the EWCO invited Largen and Yalden back to Ethiopia, to participate in an expedition with staff from Addis Ababa University to the Harenna Forest, on the S side of the Bale Mountains. This previously unexplored region yielded the first record of *Mus triton* in Ethiopia, and the types of two new endemic forest shrews, *Crocidura harenna* and *C. bottegoides* (Hutterer & Yalden 1990, Yalden 1988).

Meantime, the taxonomic study of small mammals in Ethiopia has been revolutionised by the application of "field taxonomy", applying cytological and genetic techniques to carefully targeted collections of small mammals, especially by Russian zoologists. Their earlier trips were almost overlooked, through being published in Russian, but their collecting in SW Ethiopia added the rat *Uranomys ruddi* to the known fauna of Ethiopia, and documented the earliest chromosome studies (Sokolov 1989). Subsequent research has shown that what we had been calling *Praomys albipes* belonged instead in *Stenocephalemys* (Lavrenchenko *et al.* 1999), separated the Ethiopian long-eared bat *Plecotus balensis* from the northern *P. austriacus* (Kruskop & Lavrenchenko 2000), recognized a new species of *Desmomys* (Lavrenchenko 2003), and has uncovered the complexity, outlined in Ch. 1, within what had been supposed to be the single species *Lophuromys flavopunctatus* (Lavrenchenko *et al.* 2004, 2007). Museum taxonomists, specialists who never visited Ethiopia yet contributed significantly to our knowledge of the country's fauna, also deserve a mention. Among the most prolific contributors were Oldfield Thomas at the BM(NH) and Oscar de Beaux at Genoa NHM. Their academic lives are discussed by Hill (1990) and Gippoliti (2006), respectively. John Hill himself and Gordon Corbet, both of the BM(NH), have also contributed, as has Rainer Hutterer in Bonn.

Palaeontology

Much of Ethiopia is a dome of volcanic rock, placed where it is by the rift separating northeastern Africa and Arabia from the rest of Africa. Recent evidence suggests that the dome developed in a relatively short 1 Ma interval, about 30 Ma (million years ago) in the early Oligocene (Rupelian) age; the lavas that form a similar dome in Yemen date to the same time (Hofman *et al.* 1997). The Rift Valley bisecting this dome, marked by a

line of more recent volcanism, is thought to have begun opening around 3 Ma. Erosion of its sides by both the Awash and Omo rivers has produced a series of sedimentary deposits that are well known as the source of important fossil mammal collections, most notably including some of the earliest and most famous hominids. These show a largely savanna, that is lowland, semiarid, fauna in these areas, and suggest that the distinctive Ethiopian highland fauna has been isolated from the similar highland faunas of Kenya and S Sudan for at least the whole of the Pleistocene (about 2 Ma).

The earliest fossil faunas (Fig. 2.4) to be described from Ethiopia were discovered by the French Mission Scientifique de l'Omo in 1932-33, which included the paleontologist Camille Arambourg (Aram-bourg 1947). Work here resumed in 1967, and an early summary of results has been presented by Coppens *et al.* (1976). A major concern has been to establish the stratigraphical correlations both within the Omo Basin faunas and with those further south in Kenya, at East Rudolf, and those even further afield, such as at Olduvai in Tanzania. The best correlations seem to be provided by the Suidae, an actively evolving group at this time (White & Harris 1977). The Omo faunas cover the period from 4-1.4 Ma. Modern genera of plains game (including *Ceratotherium, Diceros, Giraffa, Tragelaphus, Kobus, Aepyceros*) were present, along with extinct genera of suids and elephantids. The primates included *Theropithecus oswaldi* and the even larger *T. brumpti*, species related, though not ancestral, to the extant Gelada (Eck 1976), as well as extinct colobines (*Paracolobos, Rhinocolobos*) and of course *Australopithecus*. The small mammal faunas described by Wesselman (1984) are particularly interesting. At 3.1 Ma, the most abundant species were *Mastomys minor*, a close relative of *M. natalensis*, and the living squirrel *Paraxerus ochraceus*. Rarer elements included species associated with forest (*Eidolon helvum, Taphozous, Galago*), dry woodland or savanna-woodland (*Helogale, Lemniscomys* and the now Asian genus *Golunda*), and grassland (*Arvicanthis, Thryonomys gregorianus, Thallomys, Xerus erythropus*). This was the fauna of a mosaic of habitats, probably with riverine forest along the Omo and dry grassland further away from it. By 2 Ma, forest species had largely disappeared, and species of dry open country (*Lepus, Heterocephalus, Jaculus, Gerbillus*) contributed a quarter of the specimens, though dry savanna-woodland species predominated (*Xerus, Acomys, Tatera, Thallomys, Aethomys, Helogale*). A

few riverine woodland species (*Thryonomys, Lemniscomys*) persisted. The area seems to have been drier, though it retained a mosaic of habitats, as it does to today (Hubert 1978)

Excavations in the Awash Valley began in 1973 (Johnson & Taieb 1976). Initially, activity was concentrated around Hadar, in deposits of Late Pliocene age, around 3-2 Ma. This yielded the famous skeleton of "Lucy", formally *Australopithecus afarensis*, one of the earliest and most complete early hominids. More recent research has extended further S along the Awash, and taken the fossil sequence back into the Miocene at about 14 Ma (Kalb 1978, Kalb *et al*. 1982). In the earlier mammal faunas, a "plains game" spectrum (*Kobus, Tragelaphus, Aepyceros, Giraffa, Hippopotamus, Loxodonta, Ceratotherium, Diceros*), much as in East Africa now, and much like the contemporary Omo faunas, predominated - not necessarily the modern species, but clearly related to them. The equid *Hipparion*, present in the upper Miocene-Pliocene beds, is replaced in the Pleistocene by the immigrant *Equus*. The dominant primate was the grassland-dwelling *Theropithecus oswaldi*, as at Omo, though cercopithecine and colobine monkeys suggest some riverine woodland. The Pliocene (c. 3 Ma) rodent fauna described by Sabatier (1978a, b, 1982) also suggests a mix of riverine forest and open plains: *Oenomys, Pelomys, Praomys, Mus* but also *Thryonomys* and *Hystrix* suggest bushy savanna, while *Tatera* and *Xerus* imply drier plains. Most significant is the description by Sabatier (1978b) of *Tachyoryctes pliocaenicus*, which seems to be ancestral to the extant *T. splendens* but also shows resemblances to fossil rhizomyids from Asia. The Rhizomyinae is known to have originated in Asia, and Sabatier's observation that *T. pliocaenicus* is the earliest member of the family yet found in Africa matches Kingdon's (1974) speculation that the genus is a comparatively recent arrival on the continent.

Recently, the important hominind record has been extended back in time by the discovery of *Ardipithecus ramidus* at yet earlier levels in the Awash valley, dating back to around 4.1 Ma, at Aramis. The associated large mammal fauna seems to be dominated by woodland, browsing, species, particularly *Tragelaphus*, and two other primates, *Pliopapio* and *Kuseracolobos*. The small mammal fauna is dominated by two species of *Uranomys* and the now-Asian *Golunda*, which are genera of woodland habitats at present,

as are *Praomys* and *Oenomys*. Small numbers of other, grassland, rodents, such as *Xerus, Arvicanthis* and *Tatera*, suggest a savanna habitat with riverine woodland, like the other Pleistocene sites (White *et al*. 2009, Louchart *et al*. 2009).

A potentially interesting palaeontological site for Ethiopian mammal history is the ancient lake basin, dated at perhaps 1 Ma, in the Gadeb area on the Wabi Shebelle (Clark & Karushina 1979). While there are rather few mammalian fossils so far reported there (notably a butchered Hippopotamus, but also bovids and zebra), the site has considerable potential because it is at 2300-2400 m asl, so well within the altitudinal range of the modern highland endemics. It thus has the chance to show us something about the origins of the distinctive montane mammal fauna of Ethiopia. So far, the best site for this is Melka Kuntoure, on the edge of the Shoa plateau where the Awash valley cuts down to the Rift Valley. The site, at 2000 m, seems to have been grassland, with antelope and zebra (Chavaillon 1973). It has yielded a sequence of rodent faunas, spanning from 1.7 to 0.4 Ma. Throughout, *Tachyoryctes* was a dominant rodent, but at around 0.7 Ma, a new form of *Tachyoryctes*, close to *T. macrocephalus*, appeared, along with a new rodent fauna of *Stenocephalemys, Oenomys* and *Otomys* (Sabatier 1978a). This is currently the first evidence that some of the distinctive endemic mammals of Ethiopia had evolved.

Ecology and Conservation

Inevitably, altitudinal zonation is the most striking feature of Ethiopian natural history, and it was the earliest to be described, by Heuglin (1862). Hugh Scott developed the theme of high altitude ecology during expeditions to Shoa and Arsi in 1926-27 (Ormer-Cooper 1930), Gughe in 1948-49 (Scott 1952) and Simien in 1952-53 (Scott 1958), but his expeditions were more important for their botanical and entomological studies. He did however discover the endemic bat *Myotis scotti*. The theme of altitudinal zonation has been explored further by the American Robert Ingersol and the German Hans Rupp. Ingersol (1968), based at the College of Agriculture in Alemaya, near Harar, studied especially the Chercher Mountains With his supervisor Bryan Glass (collector of the type of the shrew

Crocidura glassi) and another American member of staff. John Beadles. he collected a valuable series of mammals. deposited in the museum at the college. but this was apparently destroyed during fighting in 1988. Rupp worked mainly on rodents and in southern Ethiopia. especially the Gughe Highlands. producing an important collection. now in Stuttgart (Rupp 1980. Hutterer 1981). The altitudinal zonation of mammals in Bale has been considered by Yalden (1988) and Afework Bekele (1988).

The first ecological studies. a response to the need for conservation of the large endemic species. were the surveys by Leslie Brown in 1963, of Walia Ibex in Simien and Mountain Nyala in Bale. Brown (1965. 1969) thought that Nyala in the Arsi Mountains were less than 10-15% of their former numbers. and that in Bale they had been halved. He estimated a total population in 1963 of 7-8000. but it has declined further since then. Later. in combination with Emil Urban at Addis Ababa University. he reported studies on the birds and mammals of SW Ethiopia (Urban & Brown 1968. Brown & Urban 1970). Important ecological work on the Mountain Nyala. carried out by Chris Hillman while he was conservation advisor based in the Bale Mountains National Park in the early 1980s. was never published. but the deficit is currently (2007-2011) being remedied by a PhD student. Anagaw Meshesha.

The Walia Ibex. symbol of both EWCA and the Ethiopian Wildlife and Natural History Society (EWNHS). is restricted to the Simien Mountains. where it has been subject to thorough ecological studies by Bernhard Nievergelt (Nievergelt 1969. 1974. 1981). The combination of habitat destruction by farming and indiscriminate hunting reduced its population to around 500 animals. dependant on the ledges of the most precipitous cliffs. Brown (1969) argued that this difficult terrain was likely to ensure its survival even from the worst persecution. and better conservation at times of less turmoil. as in the 1970s and again since 2000. has shown that the population can increase quickly Perhaps more strikingly distinctive. and about as rare. is another endangered endemic. the Ethiopian Wolf *Canis simensis*. more familiar from earlier literature as the Simien Fox. A pioneering study by Morris & Malcolm (1977) suggested that the only healthy population was in Bale. a numerical

conclusion supported by later work. They thought that there were 350-475 animals in Bale; more recent studies have indicated that "healthy" was an unfortunate term to use, in view of the rabies outbreaks that have killed substantial numbers of individuals during four episodes (1990, 1992, 2003. 2009). Overall. the world population is around 460 animals. scattered across 7 populations. but over half are in Bale (Marino 2003). Thorough ecological studies of its biology, and that of its prey, have provided a firm foundation on which to establish conservation activities (e.g. Sillero-Zubiri *et al.* 1995a. b, c).

The fourth of the emblematic endemic large mammals, the Gelada Baboon, is not endangered, but remains abundant in the mountains of northern Ethiopia, above 2,350 m, where both British and Japanese primatologists have carried out extensive ecological and behavioural studies. John Crook. from Bristol University. established in early behavioural studies the basic social structure of the herds, and the possibilities of studying it at close quarters (Crook 1966, 1974). Subsequent, more prolonged, studies by Robin and Patsy Dunbar, then of Cambridge University (Dunbar & Dunbar 1975. Dunbar 1980). and by M. Kawai and his colleagues (Kawai 1979) have made this not only the best researched of the Ethiopian endemics, but also one of the better studied primates of the world. Moreover, a small population in SE Ethiopia, beyond the Rift Valley. has also been discovered (Mori & Belay 1990). The ecological and behavioural relationships of this and other baboon species in Ethiopia have also been well studied (Crook & Aldrich-Blake 1968, Dunbar & Dunbar 1974a),. including observations of the production of apparently fertile hybrids between *Theropithecus gelada* and *Papio anubis* in a limited area of ecological overlap, and occasionally also between *T. gelada* and *P. hamadryas* in Simien. The hybridization between *P. anubis* and *P. hamadryas* along the Awash River has been especially well studied (Kummer 1968, Kummer *et al.* 1970, Aldrich-Blake *et al.* 1971, Nagel 1973. Sugawara 1979). Such anomalies probably reflect the interference by human activity in the previous habitat separation; *P. anubis* has probably spread eastwards along the gallery forest of the Awash into previous dry *P. hamadryas* habitat aided by irrigation and agriculture, and similarly into the high-altitude range of *T. gelada.*

While primarily studying Gelada, the Dunbars also found time to describe the population

dynamics of the leaf eating monkey *Colobos guereza* (Dunbar & Dunbar 1974c) and the duiker *Sylvicapra grimmia* (Dunbar & Dunbar 1979), examine the thermoregulatory behaviour of the Klipspringer *Oreotragus oreotragus* (Dunbar 1979) and examine the interrelationships of the different herbivores at high altitude in Simien (Dunbar 1978).

With the interesting larger mammals attracting most attention, the ecology of small mammals suffered some neglect. The pioneering studies by Müller (1977) on *Arvicanthis abyssinicus* at high altitude in the Simien Mountains National Park, as part of the Swiss contribution to the development of that Park, were noteworthy. Trapping carried out monthly, using capture-mark-recapture techniques, showed that, contrary to the usual murid adaptation, *A. abyssinicus* has a low reproductive rate, with small litters, and breeds in the dry season. Much briefer studies by Yalden (1975) into the ecology of the Giant Molerat *Tachyoryctes macrocephalus* in Bale, and by Hubert (1978b) into the relations between rodents and habitats in the Omo River area, have been overtaken by more prolonged studies subsequently. In a study intended to remedy previous ignorance of the most widespread endemic, Afework Bekele carried out a monthly live-trapping programme for *Stenocephalemys albipes* in the Menagesha Forest, combining it with a survey of the rodents in the area and with a laboratory-based study of growth rates of the young (Afework Bekele 1995, 1996a, b; Afework Bekele & Corti 1997). In Bale, studies on those rodents (*Arvicanthis blicki, Lophuromys melanonyx, T. macrocephalus*) that constitute the major prey for Ethiopian Wolves have explained much about variation in both their own abundance in relation to vegetation types and that of their predator (Sillero-Zubiri *et al.* 1995a, b, c). A more recent study of the raptors of that region has provided yet more information on the relative abundance of those rodents and the other prey of Golden Eagles *Aquila chrysaetos*, Augur Buzzards *Buteo augur*, Lanner Falcons *Falco biarmicus* and African Eagle Owls *Bubo capensis* (Anteneh Shimelis 2008), using a combination of trapping, line transects and sign surveys.

Meanwhile, in the wider countryside, studies of rodents that are pests of cereal crops have documented also the different rodent communities in various parts of the country, and added to knowledge of the distribution of species as well as their relative abundance. Studies on population ecology of rodents in maize fields and grasslands

of central Ethiopia showed that *A. dembeensis* and *M. erytholeucus* were the dominant species (Afework Bekele & Leirs 1997). Damage by rodents in Wonji sugarcane plantation was primarily caused by *M. natalensis* and *A. dembeensis,* which had high proportions of sugarcane fibre in their stomachs (Serekebirhan Takele *et al.* 2008, 2011). Similarly, in maize farms at Ziway *A.dembeensis* and *M. erythroleucus* were the most abundant rodents. Percentage seedling loss was about 10%, and the loss of maize yield at harvesting where the field was not fenced was estimated to be 26.4% (Afework Bekele *et al.* 2003). Workneh Gebresilassie *et al.* (2004, 2005, 2006) carried out studies on microhabitat choice and diet of rodents in Maynugus irrigation fields (Tigray). They found that *M.erytholeucus* occurred frequently in vegetable fields while *A. dembeensis* frequented monocot plants.

The attack by these rodents was more intense during the fruiting phase of the plants. In Bilalo area (Arsi), a study on pest rodents showed *S. albipes* and *A. dembeensis* to be the dominant species (Tsegaye Gadisa & Afework Bekele, 2006) and the population size reached a peak during the pre-harvest season. Most recently, in studies from Arba Minch forest and farmlands, *M. natalensis, A. dembeensis, Mus musculus* and *H. cristata* were the most frequent species causing 5.75% damage on the maize farm. However, damage was high at the periphery (7.1%) and less in the centre (4.4%) (Demeke Datiko *et al.* 2007a,b). Clearly, *Arvicanthis dembeensis* and the various *Mastomys* species cause most problems as rodent pests.

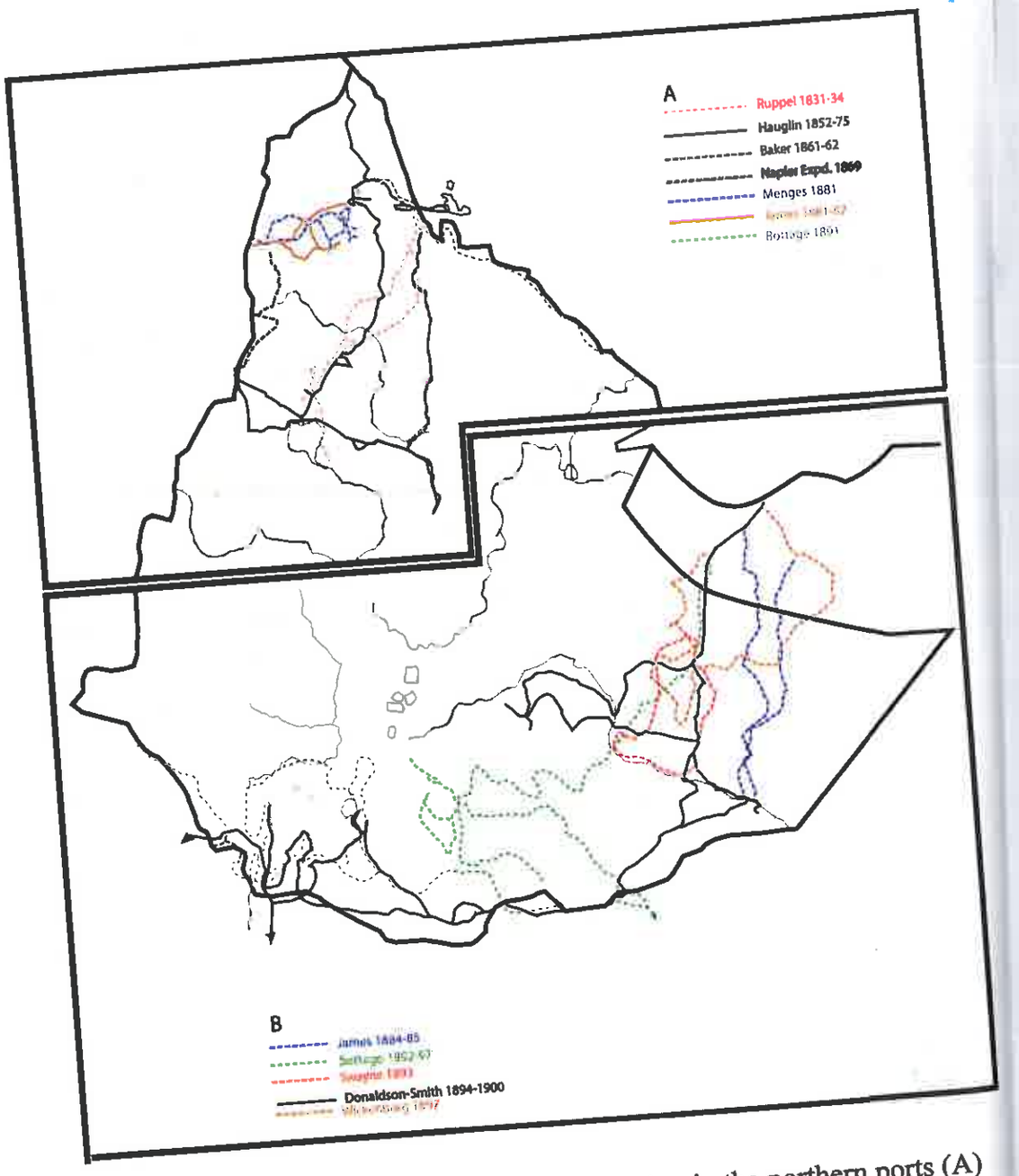


Fig. 2.1 Routes of zoological explorers beginning in the northern ports (A) and to S Ethiopia from Somali ports (B).

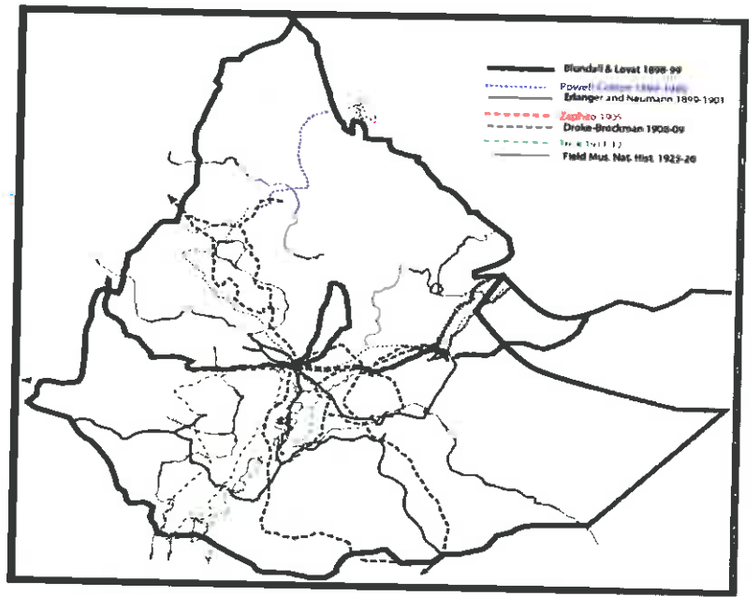


Fig. 2.2 Routes of zoological explorers in Central Ethiopia.

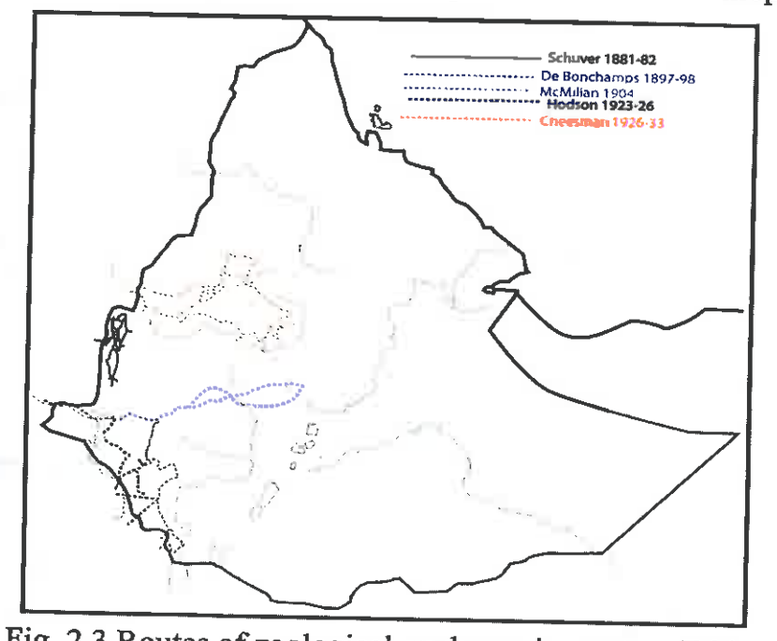


Fig. 2.3 Routes of zoological explorers in western Ethiopia.

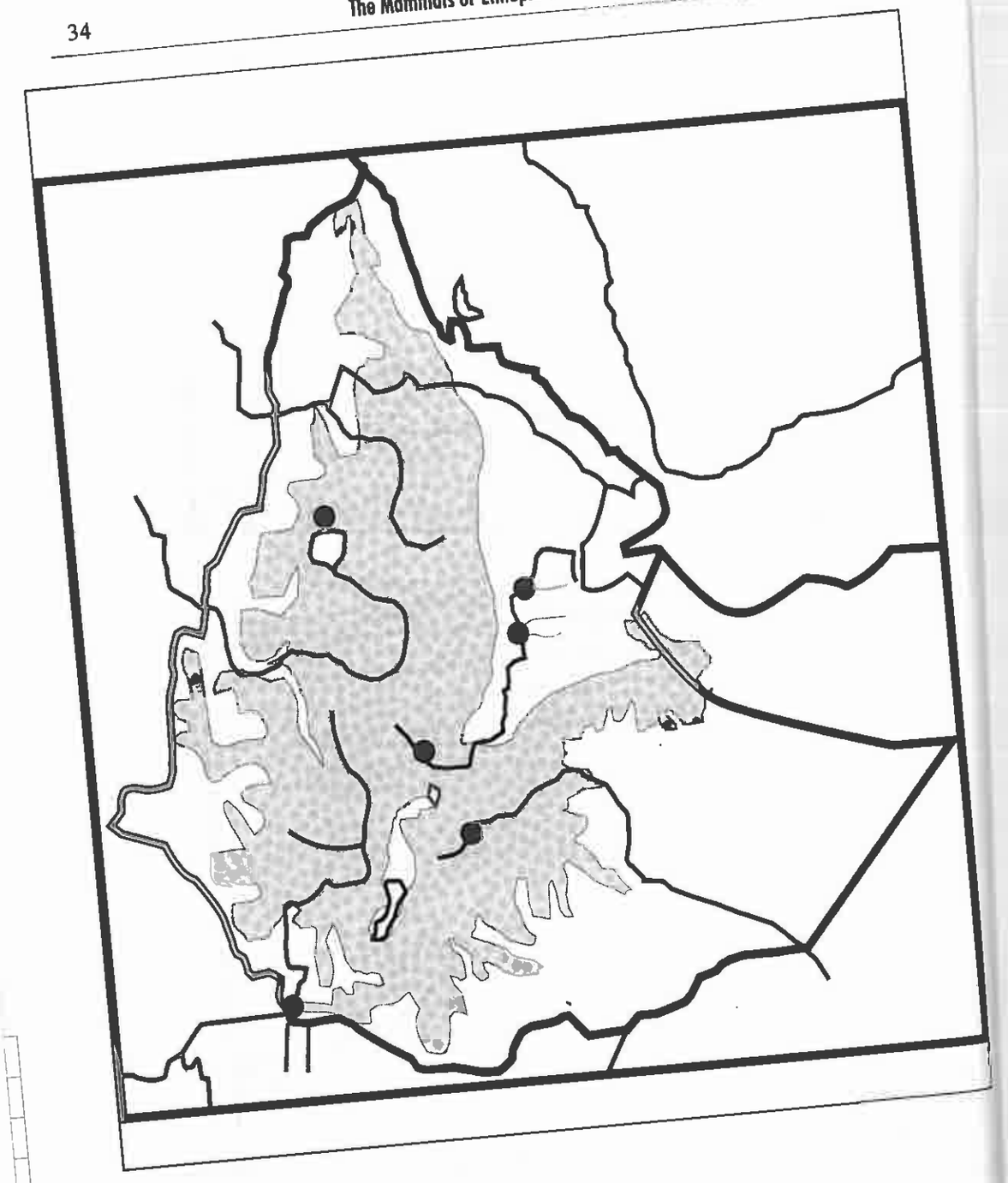


Fig. 2.4 Palaeontological sites in Ethiopia.

Figure Captions (general)

The dot maps for species are simplified and updated from those in the Catalogue of the Mammals of Ethiopia. Records with uncertainties over placement or identification (shown as hollow symbols or with a question mark, respectively, in that source) are here simply shown as records. Hollow symbols on these maps, especially for the larger game animals, are used to indicate where species were recorded historically but are now reliably known to be extinct. The "present" distributions shown may still be very optimistic assessment of current ranges. A few exceptional maps use hollow symbols (as indicated) to show different species.The background shading shows land above 1500 m.

Chapter 11

Rhinos and horses

The Order Perissodactyla, or odd-toed ungulates, includes the rhinoceroses, zebras and horses. Before the Miocene, they were the dominant ungulates, but the increasing diversity since then of the artiodactyls, both pigs and antelopes, leaves them a much smaller group at the present.

Equidae Horses

With a simpler stomach than the ruminants, but a much larger hind gut that confers similar or better abilities to digest cellulose, horses can feed on longer, drier grass, enabling them, as a group, to exploit the drier grasslands of the world better than the grazing ruminants with whom they often share the grasslands. Poorer food, held up in the rumen while it is broken down, inhibits ruminants from performing as well in these circumstances. The 3 equids in Ethiopia occupy a range of open habitats, from dry to driest!

Equus africanus (Fitzinger, 1857). Wild Ass; Yedur Ahia

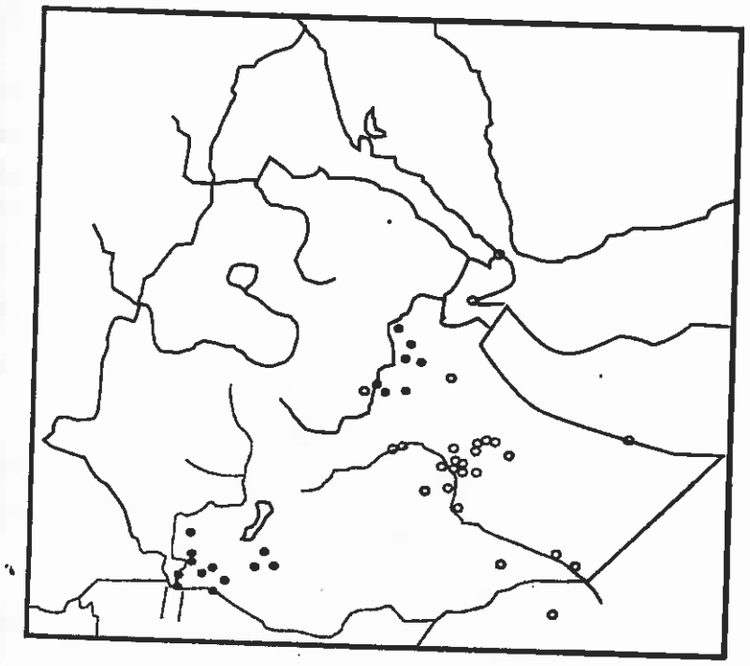
In its former range, the Wild Ass occurred in the driest, lowest areas, at -100-1500 m. Its range extended from the Sudanese border, throughout Eritrea, Djibouti and N Somalia, into Ethiopia in the Danakil Desert and Awash Valley. It overlapped marginally with Grevy's zebra in the Awash Valley, but climatically it differed strongly, preferring the hottest desert areas with the poorest least productive vegetation (Bauer *et al.* 1994). Klingel (1972) surveyed the Danakil region of Ethiopia for the species, suggesting a total then of 2-3,000, at densities ranging from 0.18-0.3/km² in different areas. It is thought that the population in the plains of the Awash Valley is the only viable surviving one, and the establishment of the Yangudi-Rassa N. Pk., first proposed in 1972, is intended to safeguard it.

Moehlman *et al.* (1998) resurveyed its range in Eritrea and Ethiopia in 1994-96. They found no more than 0.01-0.02/km², a massive reduction in a limited period. They saw just 9 in Eritrea, where locals thought the total population might be 100. In the Awash Valley, the largest groups they saw were 6 in the Serda-Mille area and 10 S of Sardo. The one encouraging feature was the high proportion of young animals, suggesting that, with protection, the population has a chance of recovering. When the route to Assab was the main entry point for fuel and other imports, it passed through the main range of the surviving Wild Asses, and there were concerns about the levels of poaching. However, the ready availability of weapons during the turmoil of 1990-91 was the main cause of the decline. The possibility of interbreeding with domestic donkeys, and confusion with feral herds of donkeys (themselves descended from Wild Asses), add to the uncertainties surrounding the current range and numbers of the species. It is, however, thought to be extinct in Djibouti and N Somalia; its range in Eritrea is limited to the Buri peninsula and the Danakil depression.

Wild Asses have a social structure like that of Grevy's Zebra: the solitary stallions occupy territories, defending essential sources, often water holes, which the herds of females and young wander through. Drought is a severe threat, and that in 1974 is thought to have reduced the population in the Nugal plains of Somalia.

Equus grevyi (Oustalet), 1882. Grevy's Zebra, Yegrevy Meda Ahia

Grevy's Zebra always had a rather restricted historical range, limited to parts of Ethiopia and N Kenya. Despite some claims to the contrary, there is little evidence that it ever occurred in Eritrea, Djibouti or N Somalia, though it probably did so in distant times during the variable climates of the Pleistocene. Rather surprisingly, within Ethiopia, it seems to have occurred in three discrete areas, in the Awash Valley, in the Webi Shebelli basin in the Ogaden, S into S Somalia, and in the S Rift Valley/ Borana area, extending S into N Kenya. It occurred at 400-1600 m. Compared with Plains Zebra, it occupies drier, less productive grasslands, receiving 300-1200 mm of rainfall annually (Bauer *et al.* 1994), but in two, somewhat unreliable, rainy seasons. However, the two species' ranges overlap extensively in S Ethiopia and N Kenya, where they often form mixed herds. Few still survive in Alledeghi Wildlife Reserve (Fanuel Kebede *et al.* 2012).



Across its range, its numbers have declined substantially during the last decades of

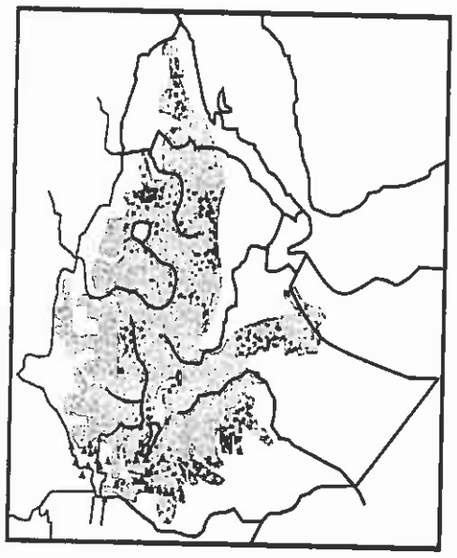
the 20 th C. In N Kenya, there were thought to be 15,000 in the 1970s, declining by 70% to 4,200 by 1988. In Ethiopia, there were thought to be 1.500 in 1978, 1.200 of then in the L. C ew Bahir area and the rest in the Awash Valley. Those we saw in the Awash N. Pk in the early 1970s have gone, the few that still existed in the Ogaden are believed to have gone, and no more than 40 survive in the Omo area (Sariti), where it only occurred in Mago N. Pk., E of the river, and not in the Omo N. Pk.

The type specimen was one presented by Menelik, then still King of shoa, to the President of France, Jules Grévy, in 1881. It came from what was then called "Galla Country", and since Menelik did not invade further S or E of the Awash until 1882, it seems likely that this example came from the neighbourhood of what is now the Awash N.Pk.

Much the largest of the three equids (350-450 kg), Grevy's Zebra has finer stripes and larger ears. Females live in loose groups, which move through the territories of the solitary stallions. These establish their territories around water sources, which the females have to visit at daily intervals. They feed on coarse grasses (*Pennisetum, Eleusine*) in dry conditions as well as better grasses (*Chrysopogon, Enteropogon, Cenchrus*), grazing away from water during the night and returning to drink after dawn. They rest in the heat of the day, under trees or standing on higher ground, in the breeze, in pairs, head to tail. Because the gestation period is around 13.5 months, annual breeding is not possible. It is probable that breeding success varies considerably between wetter and drier years, and fails entirely in drought years (Churcher 1993).

Equus burchellii (Gray, 1824).

Plains Zebra (Common Zebra), Meda Ahia



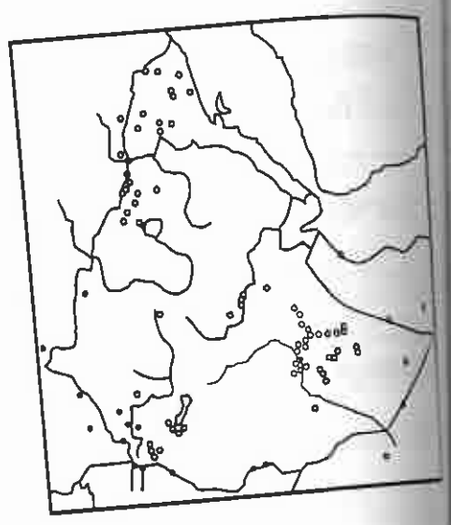
Though the Common Zebra across most of eastern Africa, it has a limited range in S Ethiopia, where it reaches the extreme N limit of its range. It occurs in the S part of the Rift Valley, around the Omo valley, and across to S Borana. Formerly it extended N through the Rift to the neighbourhood of Lake Zwai, but Nechisar is now its N limit. A total of 4,500 individuals with a density of 16.6/km² were recorded from Nechisar N. Pk. (Yisehak Doku *et al.* 2006, 2007).

However, there were also 250 households with 7080 head of livestock. Conservation action should focus on limiting this anthropogenic pressure. Elsewhere, it occurs widely in the savannas of eastern Africa, from Kenya to northern South Africa. In Ethiopia, it ranges from 400-1800 m. An analysis of its overall range in NE Africa suggests that it prefers areas with an annual rainfall of at least 600 mm, and the more productive grasslands that these produce (Bauer *et al.* 1994). It typically lives in family groups, a harem of a stallion with several mares and their young. With a gestation period of 11.5 months, it has an annual breeding season, foals being born at the start of the wet season. In E Africa, where the single rainy season is generally predictable, this breeding pattern works well. Further N, in drier areas of Kenya and S Ethiopia, where there are two, rather erratic, rainy seasons, a failure of the rains can cause the family groups to break down. Rather smaller (175-350 kg) than Grevy' Zebra, and with smaller ears, the stripes are fewer but broader.

Rhinocerotidae Rhinoceroses

Diceros bicornis (Linnaeus, 1758).
Black Rhinoceros, Awraris

The Black Rhinoceros was once common and widespread in Eritrea and Ethiopia, in the lowlands from 400-2300 m. It was especially well recorded in the NW and in the Ogaden, but also occurred in the Awash and Rift Valleys, and sparingly around the W and S borders. By 1909, it was extinct in the central Rift Valley, and had gone from the NW by about 1920.



It seems to have suffered a population crash (overhunting?) in the Oga den around 1910-2
but survived in small numbers to the 1930s, as it did in N Somalia, and disappear
from the Awash valley about 1940. By the late 20th century, there may have been a fe
animals remaining in the Omo N. Pk., and perhaps in the Dabus basin on the Sudan
frontier (Largen & Yalden 1987). The last traces, foot prints, were observed in O
area in 1983. The sharp decline, through poaching for its horns, in the rest of Af
in the 1980s means that it is unlikely to be able to recover its status in S Ethiopia
immigration. The Black Rhino is a browsing species, using its hooked upper lip to s
leaves off twigs of *Acacia* and other shrubs. Invariably solitary, except that calves
with their mothers for about 3½ years, they are never-the-less not territorial, but requi
area of some 90 km² of thorn-bush, and require sources of water within their home r

Chapter 12

Pigs, antelopes and cattle

The Order Artiodactyla, or even toed ungulates, is the most diverse group of large herbivores in the world, and enjoys a world-wide distribution (Australasia excepted). Two large families, the mostly northern deer (Cervidae, 51 species) and the Bovidae, including antelopes, sheep, goats and cattle(143 species), provide most of the diversity; Pigs (Suidae), Peccaries (Tayassuidae), Hippopotamuses (Hippopotamidae), Camels (Camelidae), Musk-deer (Moschidae), Giraffes (Giraffidae),Chevrotains (Tragulidae) and Pronghorns (Antilocapridae) add another 46 species between them. Four of these families are represented in Ethiopia, by 4 pigs, Hippopotamus, Giraffe and probably 33 bovids. Features common to this diverse group are mostly rather hidden. but they have four toes on each foot; of these, the side toes are usually much smaller, sometimes reduced to almost absent (in Giraffes), leaving a pair of large central toes that leave a distinctive cloven footprint. An important but cryptic characteristic is the form of the astragalus, one of the ankle bones, which has a double pulley (one for the tibia, one for the rest of the foot), giving the bone the shape of a figure 8 (all mammals have the proximal pulley. for the tibia, but others have a flat distal end for the rest of the foot). All of the artiodactyls are essentially herbivorous, though pigs include some animal food as opportunity allows. Many specialise in eating grasses, and have the tall cheek teeth needed to resist abrasion; some specialise on browsing shrubs and trees, most will eat some fruit if it becomes available.

Chapter 14

Biogeography, conservation and the future of mammals in Ethiopia

Zoogeography

The interesting thing about the mammal fauna of Ethiopia (and Eritrea) is the mix of species that occur within the bounds of the countries. In part 7 of the Catalogue (Yalden *et al.* 1996), we listed 288 species, of which 277 were terrestrial species (a number, of course, that is changing continually, as taxonomic knowledge changes). That total is used here (though the current listing is 315 spp). Savanna species which occur in W Africa reach into the W lowlands (e.g. Anubis Baboon, Roan, Kob: 27 species, 10%) and similarly those of E African range reach into the S of Ethiopia (e.g. Eland, Thompson's Gazelle: 40 species, 14%). Many African species occur throughout the African savannas (e.g. Side-striped Jackal, Grey Duiker, Greater Kudu: 64, 23%). Most surprising, given the importance of montane forests in the SW of Ethiopia, especially, is the paucity of forest species (e.g. Colobos, De Brazza's Monkey: 18 species, 7%). However, the ornithologists have also remarked on the paucity of forest birds in Ethiopia, and the suspicion is that forests were reduced severely in the drier phases of the glacial periods. In support of this notion, Yalden *et al.* (1996) suggested a list of 50 forest mammals (such as Chimpanzee, Bongo and many smaller species including duikers, pangolins, and rodents) that occur in the forests of S Sudan, W Uganda, N Kenya and NE Zaire but are not known from Ethiopia. It has been remarked that these forests are under-explored, and that some of these species might yet be discovered in Ethiopia (Bongo and Chimpanzee have often been rumoured to occur in Ethiopia, but with little evidence). It is also true that

taxonomic revisions e.g. of *Lophuromys* have discovered rather more forest small mammal species in Ethiopia than were listed by Yalden *et al.* (1996).

The two groups of most interest are the Somali-arid species, endemic to the Horn of Africa, and the Ethiopian endemics. The Somali-arid species (e.g. Gerenuk, Lesser Kudu, 31 species, 11%) indicate that this part of Africa has been dry throughout the Pleistocene, when most modern mammal species evolved. At drier times, the dry lands of E Africa spread through central Africa to join the arid areas of SW Africa, so that several (e.g. Oryx, Black-backed Jackal, Aardwolf, Bat-eared Fox) now have disjunct (NE-SW) African ranges.

The endemic species, conversely, argue for the persistence of moist montane habitats throughout the Pleistocene. The Gelada, Ethiopian Wolf and Mountain Nyala are the most distinct and emblematic of these. Other, notably Walia and Menelik's Bushbuck, are less distinct taxonomically but also culturally important. More of the endemics are small mammals, especially rodents and shrews.

They are much less well known, but are very important ecologically (e.g. the rodents that supply the Ethiopian Wolf its diet), and zoogeographically are as important as the large species, boosting the total to 29 species (11%). Moreover, this is a group that taxonomic research amongst the rodents and shrews has expanded considerably, so that it might now number 36 species (Table 14.1) or more: *Mus bunnomet, Mastomys awashensis* and *Otomys typus* are among potential additions.

Table 14.1. An updated list of the endemic mammals of Ethiopia and Eritrea. Those marked ? are of uncertain taxonomic status

Crocidura thalia Dippenaar, 1980
Crocidura glassi Heim de Balsac, 1966
Crocidura baileyi Osgood, 1936
Crocidura lucina Dippenaar, 1980
Crocidura macmillani Dollman,1915
Crocidura zaphiri Dollman, 1915

Myotis scotti Thomas, 1927
Plecotus balensis Kruskop & Lavrenchenko, 2000
Theropithecus gelada (Rüppell, 1835)
?Chlorocebus djamdjamensis Neumann, 1902.
Dendromus lovati De Winton, 1899.
Megadendromus nikolausi Dieterlen & Rupp, 1978.
Muriculus imberbis (Rüppell, 1842).
Stenocephalemys albipes (Rüppell, 1842).
?Stenocephalemys ruppi Van der Straeten & Dieterlen, 1984.
Stenocephalemys albocaudata Frick, 1914.
Stenocephalemys griseicauda Petter, 1972.
Arvicanthis abyssinicus (Rüppell, 1842).
Arvicanthis blicki Frick, 1914
Desmomys harringtoni (Thomas, 1903).
Desmomys yaldeni Lavrenchenko, 2003.
?Mylomys rex (Thomas, 1906).
Lophuromys flavopunctatus Thomas, 1888.
Lophuromys chrysopus Osgood, 1936.
Lophuromys brunneus Thomas, 1906.
Lophuromys menageshae Lavrenchenko *et al.*, 2007.
Lophuromys simensis Osgood, 1936.
Lophuromys pseudosikapusi Lavrenchenko *et al.*, 2007.
Lophuromys brevicaudus Osgood 1936.
Lophuromys chercherensis Lavrenchenko *et al.*, 2007.
Lophuromys melanonyx Petter, 1972.
Tachyoryctes macrocephalus (Rüppell, 1842).
Lepus starcki Petter, 1963.
Canis simensis Ruppell, 1835.
Tragelaphus buxtoni (Lydekker, 1910).
Capra walie Ruppell, 1835.

A small group of Palaearctic species (6.2%) is important for understanding the zoogeographical history of the Ethiopian fauna. The Walia is clearly closely related to the Nubian Ibex, which is in turn a southern isolate of a genus with a largely Asian range. Evidently, they infiltrated into the dry NE corner of Africa through the

Middle East in the last 2 million years. It has been argued that the Ethiopian Wolf and Starck's Hare are also related to northern species (Grey Wolf and Brown Hare, respectively). Molecular evidence supports the former judgement but not the latter. Several bats are clearly members of Palaearctic groups, or are Palaearctic species (Lesser Horseshoe, Long-eared, Scott's Myotis). It seems that in wetter phases of the Pleistocene, more wooded vegetation spread down the Red Sea Hills, and allowed such species to enter Ethiopia, as also implied above for Walia.

Conservation

Rather obviously, this zoogeographical analysis sets some of the conservation priorities for Ethiopia and Eritrea. At present, Eritrea does not have a formal protected area system. The former Dahlak Marine N. Pk. does not sound functional. However, recently 13 potential wildlife protected areas have been identified and prioritized. The forestry and wildlife conservation office was proclaimed in 2006. However, more needs to be worked out to save the dwindling wildlife of the area. The southern edge of Eritrea, bordering Ethiopia, has significance for the migration of the unique northern remnant of African elephants along the Kafto Shiraro N. Pk.

In Ethiopia, the high altitude Afro-alpine moorlands, above 3500 m, are important for their plants, as well as for the endemic mammals that occur there. The Ethiopian Wolf is the most critical of these. With a World population of around 500 animals, it is certainly the rarest canid in the World, and the rarest of the large endemics in Ethiopia. Agricultural pressures on the grasslands that support its rodent prey, as well as the risks of rabies spreading from domestic dogs, are major threats. The encouraging thing is the realisation, internationally and within Ethiopia, of the importance of safeguarding the small surviving Ethiopian Wolf populations, and the efforts being made to encourage the local human populations to respect and conserve them and their habitats.

Forest is a highly threatened habitat, in Africa generally and especially in Ethiopia.

Wood is important fuel, still, which might in due course be supplanted by solar and hydroelectric power. More critical, perhaps, its clearance reflects the need for further agricultural land in a still largely agricultural community. The contrasting pressure, less perceptible to the local community but critical nationally, is the essential safeguarding of forests for soil conservation on steep mountain slopes and, especially, in safeguarding the water-gathering grounds (water catchments). In Bale, the forests are home not only to the Mountain Nyala but also to the Bale Monkey, and the increasing number of small mammals, still being recognised (e.g. *Crocidura harenna, Lophuromys chrysopus, L. brevicaudus*).

The principal agent for promoting conservation in Ethiopia is the Ethiopian Wildlife Conservation Authority (EWCA), and the most obvious tool at its disposal is the establishment and conservation of protected areas (national parks, wildlife sanctuaries, wildlife reserves, wilderness areas and private or community conserved areas). Control of hunting and promotion of ecotourism are also valuable tools. The term wildlife (in Amharic *Yedur hiwot*) has broad connotations. It includes all forms of wild-living organisms and their habitats. Recently, culture has also been included as a component as the concept involves community as well. A protected area is a clearly defined geographical space, recognized and managed through legal means to achieve the conservation of nature with its ecosystem services and cultural values. At present protected areas include a wide range of management approaches, from those where human uses of resources are prohibited to multiple-use areas where limited sustainable exploitation of resources is allowed.

The history of conservation in Ethiopia dates back to the period of Emperor Zereaya in the sixteenth century when the Wachacha area (Menagesha Forest) was replanted by collecting seeds and seedlings of Juniper trees from Wofwasha forest to protect from being deforested. Formal wildlife conservation was initiated by Emperor Menelik proclaiming the regulations that consisted of nine chapters in 1909 (1901 E.C.). A further regulation was proclaimed by Emperor Haile Selassie in 1944 (1936 E.C.) to conserve, develop and sustainably use resources. The follow up and execution of this mandate were given to the Ministry of Agriculture in 1946 (1938 EC.) as part

the forestry and hunting department. Initially, the focus was on sport hunting and little attention was given to conservation and community participation.

However, EWCA was officially inaugurated in 1965 (1957 E.C.) with a portfolio that included responsibility for 9 national parks (including Dahlak in Eritrea), three wildlife reserves, 8 wildlife protected areas and 18 controlled hunting areas. It was initially established as an authority managed by an established board. However, during the military regime, it was amalgamated with the forestry division as the Forestry and Wildlife Department in the Ministry of Agriculture. Since then, it has continually changed status under different names, which has contributed to its inactivity or ineffectiveness through these years. In 1996, it was thought that the protected areas belonged to the local communities and as a result the seven national parks and one wildlife reserve were transferred to the responsibility of regional governments. Through time, many of these protected areas showed little improvement and some even became impoverished as a result of scant attention provided by regional governments, except the Amhara and Southern Nations Regional States. This led to pressure to change these views, and recently a proclamation was introduced to help protect the dwindling wildlife. Responsibility for protecting wildlife was transferred to the Ministry of Culture and Tourism, within which EWCA has authority status.

In 2007, a proclamation (541/2007) for the development of conservation and utilization of wildlife became functional. This proclamation is supposed to control the unplanned and inappropriate utilization of wildlife, and to allow the participation of local communities and investors. The existing regulations did not consider the objectives of the existing reality and to maximize economic profit obtained from the wildlife resources, the need for this new proclamation was necessary. According to this proclamation, national parks that are nationally and globally significant, that harbour endemic and endangered species, areas that border within the regions and areas that are trans-boundary were to be administered by the Federal Government.

Then in 2008, the council of ministers approved regulation number 163/2008, printed in *Negarit Gazeta*, on wildlife development, conservation and utilization. This regulation

clearly explains that the existing boundaries of conservation areas shall be maintained or re-delineated by the Federal Government in consultation with the Regional Governments to improve their management. It also itemized wildlife conservation areas (National Parks) administered by the Federal government as: Simien, Bale, Nechisar, Omo, Abijata-Shala Lakes, Awash, Senkele Swayne's Hartebeest Sanctuary, Babille Elephant Sanctuary, Gambella, Alatish, Kafta-Shiraro and Geralle. The regulation itemizes the list of 54 mammal species to be hunted under licence. At the same time, it enumerates 26 species of mammals that can be exported live with licence. The list identifies 25 species of mammals as protected species whose hunting is not allowed. Unfortunately, Mountain Nyala is not included in this list while Black Rhinoceros, which is supposedly extinct in the country, is listed optimistically among the protected species. At the same time, Dugong, which cannot occur in the current jurisdiction of Ethiopia, is included in the protected list, as are the female and young of any species. The authors stress that detailed ecological information and population size of a given species should be known before a licence is provided.

At present, Ethiopia possesses 49 protected areas under different IUCN categories, covering 73, 279 km² (6.5% of the total land mass). However, if forest priority areas are included, the percentage might reach about 12%. Recently, most governments throughout the world have agreed to increase the extent of land-based protected areas to 17% of the earth's surface. The government manages national parks, wildlife sanctuaries and wildlife reserves, whereas controlled hunting areas are managed by hunting companies under concession. Wildlife reserves act as a buffer zone and wildlife corridors are necessary for adjacent conservation areas with the objective of future transformation to national parks or sanctuaries. At present, there are 14 national parks, 3 wildlife sanctuaries, 4 wildlife reserves and 24 controlled hunting area managed by federal, regional and private parties. Protected areas managed by different institutions are given in Tables 14.2-14.4. Protected areas of Ethiopia including forests are given in Table 14.5.

Table 14.2 Protected area types of Ethiopia

Protected area	Type	Managed	Area in km²	Established Year (E.C.)
Awash	NP	Federal	756	1958
Semien Mountains	NP	Federal	412	1959
Omo	NP	Federal	3566	1959
Bale Mountains	NP	Federal	2,200	1962
Abijata-Shalla Lakes	NP	Federal	887	1963
Gambela	NP	Federal	5061	1966
Nechisar	NP	Federal	514	1966
Yangudi-Rassa	NP	Federal	4731	1969
Alatish	NP	Federal	2666	1997
Geraile	NP	Federal	3558	1998
Kafta-Shiraro	NP	Federal	5000	1999
Borena Sayint	NP	Amhara R.S.	44	2001
Bahirdar Blue Nile River Millenium	NP	Amhara R.S.	4729	2008
Mago	NP	S.N.N.P.R.S.	1942	1974
Chebera Churchura	NP	S.N.N.P.R.S.	1190	1997
Maze	NP	S.N.N.P.R.S.	202	1997
Gibe Sheleko	NP	S.N.N.P.R.S.	248	2001
Lake Abaya	NP	S.N.N.P.R.S.	500	2001
Dati Wolel	NP	Oromia R.S.	1031	1998
Yabello	NP	Oromia R.S.	2500	1978
Arsi Mts./Galema Boraluku	NP	Oromia R.S.	1,072	2003
Babile	S	Federal	6982	1962
Senkele	S	Federal	54	1964
Dera Delfakar	S	Oromia R.S.	20	1986
Kuni Muktar	S	Oromia R.S.	50	-
Alledeghi	WR	Afar R.S.	1832	-
Awash West	WR	Afar R.S.	1781	-
Gewane	WR	Afar R.S.	2439	-
Mille-Serdo	WR	Afar R.S.	8766	-
Shire	WR	Tigray R.S.	753	-

(NP=National Park, S=Sanctuary, WR=Wildlife Reserve, CHA=Controlled Hunting Area, OHA=Open Hunting Area, CCP=Community conservation area)

Table 14.3. Controlled Hunting Areas managed by Regional offices

Controlled Hunting Area	Area (km^2)	Region
Abasheba-Demero	61	Oromia
Agarfa-Adaba	170	Oromia
Adaba-Dodola	33	Oromia
Arbagugu	35	Oromia
Berbere (Goba)	151	Oromia
Besmena-Oddu Bulu	46	Afar
Blen-Hertele	154	Afar
Chifra	203	Oromia
Dati	555	Oromia
Dindin	788	Oromia
Eastern Harerghe	4161	Oromia
Hanto	26	Oromia
Haro Aba Diko	72	Oromia
Hurufa Soma	215	Gambella
Jikao	353	Oromia
Munessa-Kuke	76	Oromia
Shedem-Berbere	26	Oromia
Sororo-Torgam	77	Gambella
Tedo	1443	Afar
Telalk-Dewe	728	Southern Nations
Welshet-sala	139	Oromia
Werganbula	138	Afar
Western Awash	967	Southern Nations
Murle	639	

The major ecosystems represented by these protected areas include arid and semiarid areas, grasslands, savannah, woodlands, forests, lakes, wetlands and mountains. Currently, EWCA manages 11 national parks and 2 wildlife sanctuaries in addition to regulating and administering quota setting and providing licences for controlled hunting areas. EWCA has also responsibility to help protected areas that have been already established and managed by regional centres or would be established protected areas.

Biodiversity Hotspot Areas of Ethiopia

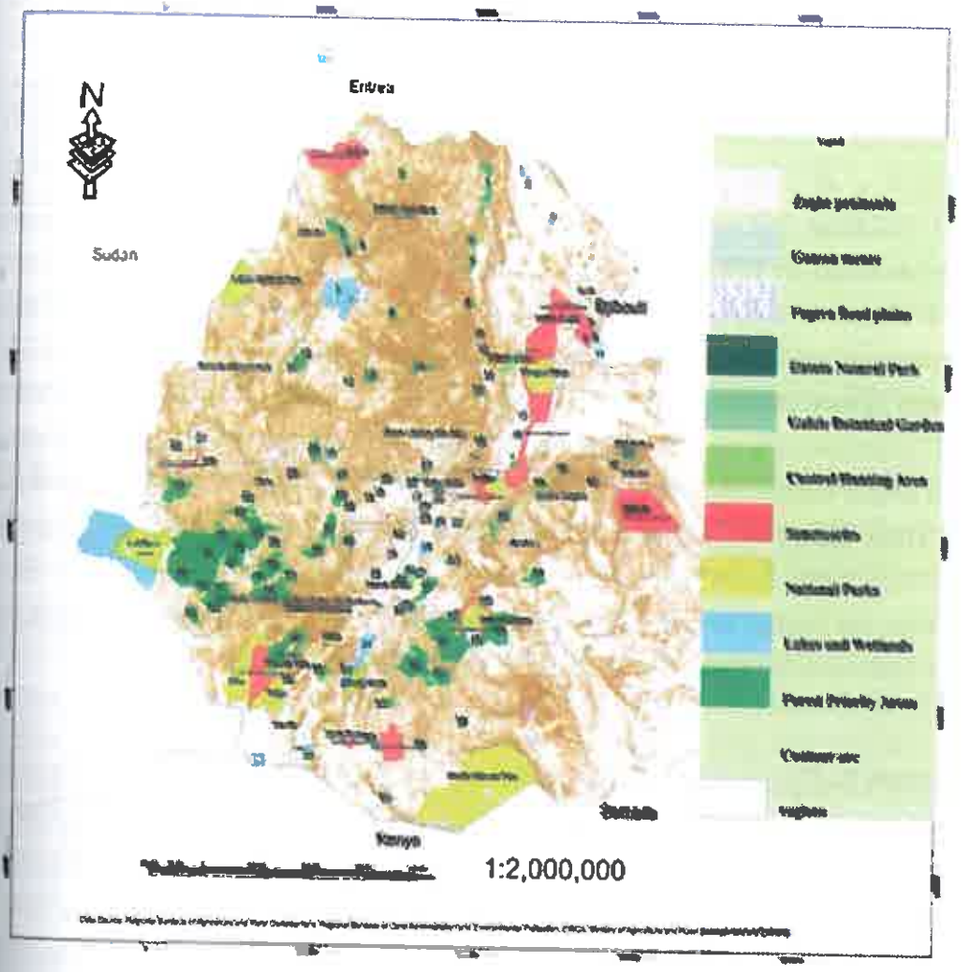


Figure 14.5 Protected areas of Ethiopia (EWNHS)

The **Simien Mountains N. Pk** covered 179 km^2, and ranges from 1900-4543 m. It is long established, proposed in 1963 and gazetted in 1969, and covers 75% of the range of the Walia, as well as spectacular scenery. Moreover, it is currently being extended to over 400 km^2. The breath-taking landscape has led to its recognition

as a World Heritage Site by UNESCO in 1978. Trekking is the most important tourist attraction, in addition to viewing the endemics. It suffers from agricultural encroachment, with tef and barley cultivation extending above 3200 m, and grazing animals have further degraded the long grasslands that should provide habitat for small mammals. Small numbers of Ethiopian Wolf and large numbers of Gelada also occur. It has also benefited from extensive involvement of foreign advisors, park managers and research teams, especially the Swiss (e.g. see Müller 1977, Nievergelt *et al.* 1998). It was well established in the 1970s-80s, with a staff of 24, 45 buildings and a regular stream of tourists. Rebellion and banditry caused its abandonment in 1983, and fighting during the military revolution of 1990-1991 caused complete destruction of all infrastructure. This has been reinstated, and tourism, based on Gondar and the nearby headquarters at Debark, is again a feature. The rainy season extends from June to September with annual rainfall of about 1500 mm. It experiences a cool climate ranging from -2.5 to 18°C. As a result of follow up and proper conservation action, the Walia population is building up, approaching about 1000. However, human-wildlife conflict still in progress (Mesele Yihune *et al.* 2008a,b. With funds obtained from the regional government and international donations, the settlers are being compensated and removed to a different location. A plan is underway by EWCA to translocate the settlers from Gich as well.

The **Awash N. Pk** was established in 1966, and gazetted in 1969, on the site of a royal hunting preserve in the floor of the Rift Valley, not far (210 km) from Addis Ababa. It covers 756 km², between the Awash and Cassam Rivers. It ranges from 750-2007 m in altitude. Mt Fantalle, a dormant volcano, dominates the landscape; former lava flows and blister caves, important for bats and other mammals, are an important feature, as are the hotsprings (Filhoa). The headquarters are located at Gotu, near the Awash River. The average annual rainfall is about 570 mm, with temperatures ranging from 9.6 to 42°C. The small rain extends from February to April and the main rain from July to September. The area conserved a good variety of the main game, especially the Somali-arid species including Wild Ass, Oryx, Grevy's Zebra, Soemmering's Gazelle and Lesser Kudu. Black Rhinoceros, Elephant and Buffalo, which once occurred, were long extinct when the park was founded. An attempt

to reinstate Swayne's Hartebeest has failed; 89 were brought from Senkelle in 1974, but only 10 survived in 1996, and none now. Wild Ass's have been absent for 50 years, and Grevy's Zebra also seem to have disappeared since 1970, when DWY saw them there. Incursions by pastoralists and their livestock caused ecological damage even in the 1970s, but tourism, helped by the proximity to Addis Ababa and good transport links (rail and road), was then well developed. Sadly, the turmoil of 1991 caused some damage, to both the park and its livestock, but it is now recovering. The current manpower of the park stands at 67. However, additional manpower is needed for its proper protection.

The **Bale Mtns N. Pk** is the most important for endemic small and large mammals. Proposed in 1971 and established in 1975, but still not gazetted, it covers 2471 km², and ranges from 1500 m in the S to 4377 m at the summit of Tulu Deemtu. The head quarters are located at Dinshu. The reserve includes extensive Afro-alpine moorland on the Sanetti Plateau which is the largest extent of Afro-al-pine habitat in the African continent. Below a treeline at about 3300 m, the park extends, especially on the S side, through a Giant Heath zone into the Harenna Forest, with *Hagenia* and *Schefflera* at higher altitudes, *Aningeria* and *Podocarpus* at lower levels, reaching a natural lower limit at 1500 m with *Combretum* woodland. On the N side are important dry forests with *Juniperus*. It is most important for the 1500 or so Mountain Nyala and over 400 Ethiopian Wolves that it protects, but Bale Monkey, Giant Forest Hog, Giant Mole-rat and numerous endemic small mammals are also important. The continuity of the forest zonation and the mix of forest and moorland species, as well as the active research and conservation activities, all reinforce its importance. Staff now number 65, but need to be doubled. Within an easy day's drive (557 km) of Addis Ababa, since the tarmac road was extended, the park is well founded with a lodge, herbarium, museum and research building.

In May 1991, many Nyala and Wolves were killed, and the staff had to be withdrawn; there was also some damage to infrastructure. However it has now been reinstated, and research has been resumed. November to February are the dry months followed by eight months of rainfall with temperatures ranging from -15 to 26°C.

The **Mago N. Pk** was proposed in 1971 and established on the ground in 1975, but is not gazetted. Covering 2162 km², at 450-2528 m, on the E bank of the Omo, it was established to conserve the good numbers and variety of large game animals in this area. The other attractive feature of this area is the immense ethnic diversity, and cultural tourism is well developed as a result. At present, the park is managed by the Southern Nations and Nationalities Regional office. The fauna is similar to that in the Omo N. Pk, but differs in having Grevy's Zebra and Gerenuk, which are not known to cross the Omo River. Buffalo, Elephant, Plains Zebra and both kudus frequent the area. The park receives 900 mm of rainfall a year. The wet seasons are March to June and September, while the dry season extends from December to February; temperatures range from 20 to 40°C.

The **Omo N. Pk**, on the W bank of the Omo River, also protects a diversity of large game. Proposed in 1963, established in 1966, but not yet gazetted, it covers 4068 km² of savanna. Some 867 km south of Addis, it has an altitude range between 440-1183 m asl, interspersed with *Acacia-Com-miphora* woodland and thickets of thornscrub and riparian woodland. The park receives 810 mm of rainfall annually. The wet seasons are from March to June and September. Temperatures range from 20 to 40°C. The large herds of Eland, as well as Elephant, Plains Zebra, Giraffe, Hartebeest, Tiang, Grant's Gazelle and Buffalo are important. Black Rhinoceros survived to about 1980, but is feared now extinct. The Park used to be accessible by vehicle through the Mago-Omo bridge. Unfortunately, the bridge has collapsed and never been repaired. The Park is accessible only by ferry boat from the Mago side. The alternative is to drive through Jima-Bonga-Mizanteferi and Maji. The Park has a staff of 52, but needs more than double for effective conservation work; they struggle to maintain an active presence against the logistic problems, and the pressures of poachers from both locally and far away.

The **Nechisar N. Pk**, near Arba Minch and on God's Bridge between Lakes Chamo and Abaya was proposed in 1967 and established in 1972, though still not gazetted. It covers 514 km², including some 78 km² of lake surface, at 1108-1650 km². Much is a boulder-strewn grassland, but with *Acacia-Com-miphora* woodland, dense *Acacia*

in the gulleys, and riparian gallery forest along the lake shores and the rivers. The area receives 800 mm of rainfall annually. The wet seasons extend from April to June and September to October. December to February are the hottest months of the year and temperature ranges from 17 to 36°C. It was established especially to protect the small population of Swayne's Hartebeest, though it is not thriving. The native 80-100 were supplemented by 110 more in 1974, moved from Senkelle, but had declined to 40 in 1990 and only 10 in 2010. There are good herds of Plains Zebra, Grant's Gazelle and Greater Kudu. Once, Oryx, Elephant, Black Rhinoceros and Buffalo also occurred here, but they had long gone before the park was established. So far, 53 individuals form the human resources, which need to be enlarged. There was an attempt to promote the area through the African Parks franchise as a concession, but this has recently failed due to disagreement on management and the unsuccessful attempt to translocate the two ethnic groups to different sites.

The **Gambela N. Pk** was proposed in 1973, but has never been properly established. It should cover 5061 km², in the W lowlands at 400-768 m, and should protect the migratory populations of Kob as well as the Nile Lechwe. At present, as a result of vast plots of agricultural land being allocated to entrepreneurs, there is a need to redefine the boundary without jeopardizing development activity. EWCA is pushing hard in collaboration with the regional authorities to finalize the boundaries because of its importance as a trans-boundary park. There is even a suggestion of working closely with Boma National Park in Sudan as the Boma-Gambela heartland or biosphere reserve. The area receives 1400 mm of rain annually, with the rainy season extending from April to October. The main dry season is from November to March with temperatures exceeding 40°C. In the 1960s, there were large herds of Elephant, Giraffe, Buffalo, Tiang, Hartebeest and Roan Antelope, but by the 1970s these had been reduced to small remnants by overhunting due to the civil war in southern Sudan. At present, the population of White-eared kob is increasing and about a million have been counted at the border in the Sudan. The area harbours the second largest migration of mammals in the world, next to Masai-Mara. Recently, the area has been strengthened by the allocation of more manpower (59) and conservation effort is

being initiated. These staff are mostly stationed in the nearby town of Gambela, on the far side of the R. Baro from the Park, so logistical and other problems have hindered any attempt at serious conservation efforts here.

There are in addition four game sanctuaries set up to protect specific species. The **Yagundi-Rassa N. Pk** was proposed in 1972 to protect one of the last populations of Wild Ass in 4731 km² of semidesert grassland on the E bank of the Awash. The altitude ranges from 400-1460 m asl. February and March as well as July and August have rains and the temperature can exceed 42°C. Besides the Wild Ass, Soemmerring's Gazelle, Hamadryas Baboon, Gerenuk, Cheetah, Leopard, Lion, Greater and Lesser Kudus occur. At present, 19 staff are allocated and the headquarters are located at Gewane town, 45 km from the border of the park. As a result, conservation activities are limited and no sightings of Wild Ass have been recorded recently in Yangudi-Rassa except in nearby Mile-Serdo wildlife reserve.

The **Babille Elephant Sanctuary**, covering a limited area of the Dacatta, Fafan, Erer and Gobelle Valleys, was intended to protect the small population of the Somali race of the Elephant, the only known survivors. The sanctuary was established in 1970 covering an area of 6982 km². However, this has been reduced recently due to human and agricultural expansion. It is situated at the boundary of the Oromiya and Somale Regions, 560 km east of Addis Ababa at 08°25'-09°06'N, 42°01' - 43°06'E. The altitude ranges between 850 - 1785 m asl. Scrub woodland and bushland vegetation are the dominant ones. The area receives about 600 mm of rainfall annually. So far, 59 species of mammals are recorded, including eastern range extensions of some small mammals and two undescribed species (Lavrenchenko *et al.* 2010). It is a significant conservation area with distinctive zoogeographical affinities.

The **Abijata-Shalla Lakes N. Pk** was proposed especially to protect the aquatic birdlife, specifically the Great White Pelican *Pelecanus onocrotalus* and Lesser Flamingo *Phoeniconaias minor*, though the northernmost Grant's Gazelle occur here. It has proved impossible to regulate human activities in this area, and the whole of the park's infrastructure was thoroughly destroyed in 1991, though rehabilitated immediately. Located at 207 km from Addis along a tarmac road, it

is a significant ornithological site for tourists. The altitude ranges from 1540 to 2075 m. It receives about 600 mm rain annually and the main rain is from June to September. The temperature ranges from 5 to 45°C.

Alatish N. Pk was established in 2006 and covers an area of 2665 km². It is located 1025 km northwest of Addis in the Amhara Region. It is part of the Sudan-Guinea Biome. Elephant and Greater Kudu are the key species. At least 20 species of large mammals were recorded (Girma Mengesha & Afework Bekele 2008). Infrastructure development is in progress. It borders with Dinder N. Pk. of the Sudan and opens an opportunity for transboundary tourism development in the future.

Kafto Sheraro N. Pk, established recently, covers an area of 5000 km² in the northwest part of Ethiopia bordering with Eritrea. The park harbours the northern remnant of African Elephants in addition to Greater Kudu, Roan Antelope and Red-fronted Gazelle. Elephants frequently migrate to Eritrea and as a trans-boundary park, there is a need and opportunity to develop the park in cooperation with the Eritrean government.

Geralle N. Pk was established in 2006, covering an area of 3858 km² in the Somale Region. It is rumoured that Black Rhinoceros might survive here, but this is not yet confirmed. Unusually high numbers of Elephants and a few Grevy's Zebras have been observed during last year's drought in Kenya. Although no study has been carried out, many of these animals might have migrated from Kenya to avoid the drought. In view of the wide home range required for elephants, the area nearby should be conserved to act as a corridor. The area is part of the Somali-Masai Biome. Faunal information from this newly established park is scant and there is a need for further study.

Chebera-Churchura N. Pk was established in 2005 for its good populations of Elephants and Buffaloes. It covers an area of 1215 km² and is managed under the Southern Nations and Nationalities Region, 460 km from Addis.

Mazie N. Pk was established in 2005 and covers an area of 210 km², also administered

by Southern Nations and Nationalities Region. The area harbours good numbers of Oribi, Swayne's Hartebeest and Buffalo.

The **Dahlak Marine N. Pk** was intended to protect marine life, including Dugong, though the dwarf Soemmering's Gazelle might also be protected by it. We have no further information on its current status.

Fully organised and implemented, this network of National Parks and Reserves would offer reasonable chances of conserving all the large endemic mammals, and most of the small ones, for the future. Some of the forest species of the SW merit further concern. Most serious, however, is the plight of the Somali-arid species, most of which have suffered severely from the years of misrule and anarchy in Somalia. Some extend to N Kenya, and might be safeguarded by the parks there, but others do not reach that far. Dibatag is the prime example, highly vulnerable, poorly known but very distinct. Salt's Dikdik, Beira and Speke's Gazelle, as well, obviously, as Wild Ass, Swayne's Hartebeest and Grevy's Zebra all need urgent attention.

In addition to protected areas run by Federal Government, regional governments have been working to add new protected areas as parks. The Amhara Regional Government is working hard to include Denkoro Chaka in Wolo and the one at Tsisabay Falls as national parks. The Lake Tana region is also being considered as a sanctuary for birds. In addition, the Oromia Regional State, which covers 31% of the country and more than 50% of the country's fauna and flora, plans to upgrade three areas as national parks: Dhati-Welel in the western part of the region that harbours thousands of Buffaloes and Hippos, which is part of the Sudan-Guinean Biome assemblage; Yabello Wildlife Sanctuary in the southern part which represents the Somali-Masai Biome assemblage and harbours both species of zebra in addition to its unique endemic birds; Arsi Highland Park, including three mountain blocks - Chilalo, Galama and Kaka - as well as the lowland area of Dera-Difekar along the Adama-Asela road, with a good population of kudus. The Arsi highland blocks have similar vegetation and fauna to Bale. Most of these highland areas are being seriously affected by human settlement, agriculture and cattle grazing. There is an urgent need to properly protect this area before it is too late.

Although there are a number of wildlife or nature clubs in schools and universities, they have not been aggressive enough to have a big impact in conservation action. The one conservation-based organization that makes a big impact in the community and advocates the wise use of natural resources is the Ethiopian Wildlife and Natural History Society (EWNHS). This is an independent membership based society which became a legally registered society in 1966. It is the oldest non-governmental environmental conservation organization in Ethiopia. It is also the first national NGO in Ethiopia to sign agreements with EWCA to carry out studies in biodiversity conservation. It also has international links, e.g. in partnership with RSPB, and publishes its own journal *Walia*. The society has been legally registered under the new law as Charity number 0720. The main objectives of the society are conservation, development and sustainable utilization of the country's biodiversity through education, awareness raising, advocacy and research. Its major objectives include saving species, protecting sites, conserving habitats and empowering and improving the livelihood of Ethiopians (Clark, 2010).

Research

Continuing research underpins our knowledge of the mammals, and other wildlife, of the country, and is essential for both guiding conservation and identifying when it is needed and when it is effective. The various studies of Gelada and Walia in Simien established that reserve, and our knowledge of those species, as well as the associated rodents. Small mammals were importantly studied by Rupp and Nikolaus in the 1970s, and since then by the Russian expeditions to the SW, Bale and elsewhere. Research into Ethiopian Wolves in Bale has highlighted the threats from rabies and from interbreeding with feral dogs, and has also indicated how well the vaccination campaign has worked. It has also prompted work on other small populations, further N in Shoa and Wello. The University of Addis Ababa has had a sequence of research projects and research

students who have examined the role of raptors in the Bale ecosystem, on Mountain Nyala, Bale Monkey and Reedbuck ecology, and on rodent ecology in farmland and reserves. It is entirely appropriate that this research is increasingly undertaken by staff and students at Addis Ababa and elsewhere, though the assistance, cooperation and sometimes encouragement of "ferenjis" is still valuable.

Population growth and sense of value

The biggest threats to wildlife in Ethiopia come from the increasing human population, increasing livestock and associated habitat changes. Given the need to conserve water supplies and forest cover, it is essential for the human population that practical conservation is effective. Simple procedures such as terrace construction and replanting trees can help enormously. Native trees make better ground cover, and habitat for native species, than *Eucalyptus*, however effective that introduced tree might be for replenishing fuel and for (termite-resistant) construction purposes.

A human population that numbered around 7 million in 1940, increased to 42 million in the 1984 census, 55 million in 1992 and at present over 85 million poses increasing, and increasingly severe, pressures on the agricultural industry. Livestock have always been important to the economy, reflecting the preferences for meat eating of much of the population and the relative merits of pastoralism and arable agriculture in a fluctuating climate in a mostly grassland habitat.

Ecotourism

Ecotourism has become one of the most influential concepts in the world of conservation. It emerged from terms like wildlife tourism and nature tourism, to become a universal conservation catch-word for sustainable development. Ecotourism in developing countries like Ethiopia, rich in natural and cultural heritage, is often considered to offer a sustainable source of revenue, giving indigenous and rural communities the chance to benefit from and contribute to the global economy. At present, protected areas are

facing a number of challenges due to the population explosion (especially settlement, agricultural expansion and cattle grazing). Properly planned and managed ecotourism can maximize the environmental impacts, significantly contributing to the well being of protected areas. Ethiopia has diverse wildlife species in addition to unique cultural and traditional resources which could sustain ecotourism. While ecotourism in Ethiopia is still in its infancy, it has significant potential for growth and development. The protected areas can offer leisure activities such as wildlife viewing, trekking, mountaineering and bird watching.

Formerly, Awash provided an attractive venue for tourists and residents of Addis Ababa, and its proximity ensures that it could do so again. It should be relatively easy to restore the large herds of antelopes here if domestic livestock were removed; it might be necessary to extend its protective influence northwards into the Afar triangle to enable Grevy's Zebra and perhaps even Wild Ass to recover here. Bale is also relatively accessible, and the relative ease of seeing such spectacular endemics as Ethiopian Wolf, Mountain Nyala and even the Giant Mole-rat, as well as many of the endemic Ethiopian birds, as already well appreciated by tourist guides to Ethiopia. Simien too has become again a specialist tourist venue. In addition to Walia and Gelada, the scenery is a major attraction. Even the locals are benefiting, by hiring their mules/horses to tourists on a shift basis. There are already specialist bird watching tours arranged in countries like the UK and Germany to allow and encourage keen ornithologists (twitchers) to see as many as possible of the 30 or so endemic species in a three-week tour (Francis & Shirihai 1999). The formerly almost unknown Ruspoli's Turaco *Tauroco ruspoli* is now not only regularly seen on such tours, but local guides appreciate its value, and will show visitors to the best sites - for a small and welcome fee. Bird trips arranged to see all the endemics typically range as far N as the Great Abay gorge, to see Harwood's Francolin *Francolinus harwoodi*, then head to the Rift Valley Lakes, before travelling via Bale and the Sanetti Plateau to the dry country beyond Negheli for the specialist larks and sparrows of the Ogaden.

Returning from Negelli to Javello to see Ruspoli's Turaco, Stresemann's Bush-crow *Zavattariornis stresemanni* and White-tailed Swallow *Hirundo megaensis*, the tour then returns to Addis Ababa up the Rift Valley. A similar mammal circuit could easily extend to Simien to see Walia and Gelada, and go via Awash for Soemmering's

Gazelle to Bale, to see Mountain Nyala, Ethiopian Wolf and Giant Molerat. It would offer a good chance of seeing most of the high altitude endemic birds and flowers at the same time.

New policies and legislation have been introduced that support the conservation of biodiversity and the sustainable use of these natural resources. The government of Ethiopia has recognized the value of developing and promoting ecotourism and provided consultancy services for a number of ecotourism sites. A few investors have begun involving themselves in the development of ecotourism in different areas of Ethiopia. Tourist numbers in Ethiopia have grown by 50% during 2003-2008. The potential to develop the tourist industry further is high. Such tourism would offer EWCA income from park fees and guides as well as support hotels, tour companies and airlines. They would especially benefit remote rural communities, and offer an additional diversification of tourism, along with the historical sites of Axum, Gondar, Bahir Dar, Lalibela, the Monastery of Debre Damo, Sof Omer cave, Temple of Yeha, the city walls of Harar and the archaeological and palaeontological sites in the lower valleys of the Awash and Omo. Encouraging ecological tourism among the urban populace of Addis Ababa would encourage also a pride in the national fauna and flora which is going to be increasingly important. Visual arts, music, museums and exhibitions could also be part of ecotourism development. If properly managed and developed, we see a bright future in ecological, cultural, historical and religious tourism in Ethiopia.

In summarising some 25 years of work on the *Catalogue of the Mammals of Ethiopia*, Malcolm Largen hoped that we had helped to draw the attention of Ethiopia's citizens to the magnificent fauna of the country in time to spur its active conservation, and we hope that our summary in this book fulfils the same role. He added "The alternative - that we have merely written the obituary for a fauna in terminal decline, destined to become nothing more than a memory, recorded only by articles in foreign journals and specimens in foreign museums - is a prospect altogether too depressing to contemplate".

Glossary, Abbreviations

Baculum	penis bone, a taxonomic character in e.g. bats and rodents
BM(NH)	British Museum (Natural History), (now Natural History Museum, London)
c-m^2	Length of upper teeth, front of canine to rear of 3rd molar
Condyle	Boss on lower jaw, forming jaw joint
Diastemma	Gap between front teeth and cheek teeth
EA	Ear length, notch at base to ear tip
E.C.	Ethiopian Calendar
EWCA	Ethiopian Wildlife Conservation Authority
EWCO	Ethiopian Wildlife and Conservation Organisation (forerunner of EWCA)
FA	Forearm length (for bats)
HB	Head-and-Body length, tip of snout to base of tail
HF	Hind Foot length, heel to tip of longest toe (omitting claws)
IUCN	International Union for the Conservation of Nature
ka	Thousand years ago ("kilo-annum")
NPk	National Park
M^1-m^3	Length of upper cheek teeth, front of 1st to back of 3rd molar
m$_1$	Ist lower molar
Ma	Million years ago ("Mega-annum")
mtDNA	Mitochondrial DNA, genetic material inherited, in the cytoplasm of the egg, from the mother, only; rapidly changing, and therefore much used to compare individuals and species.
noseleaf	Complex folds of skin on the noses of some families of bats

P^3-m^3	Length of upper cheek teeth, front of 3rd premolar to rear of 3rd molar
P^4	4th upper premolar
p^4-m^3	Length of upper cheek teeth, front of 4th premolar to rear of 3rd molar
TL	Tail Length, tail base to tip (excluding any long hairs at the tip)
Tragus	Fold of skin in the opening of the ear found in some families of bats
Wt	Body mass (Weight)

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