THE ECOLOGICAL STRATIFICATION OF MAMMALS IN THE EASTERN CHERCHER HIGHLANDS OF HARAR PROVINCE, ETHIOPIA

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CHAPTER I

INTRODUCTION

The Empire of Ethiopia in the Horn of East Africa just above the equator, was picturesquely described by Buxton (1957).

> The Ethiopian highlands rise from the wastes of equatorial Africa like an island from the sea. These highlands stand in lonely isolation, for the surrounding desert and semi-arid wilderness has cut them off from the rest of Africa more effectively than the sea itself. The map of Africa presents nothing else like it, no mountain mass so vast, so uniformly high, nor so isolated.

Ethiopia has been virtually isolated from Western civilization until very recent times. This obscurity is paradoxical since it can claim a recorded history of 2000 years (Buxton, ibid.), and of all central African territories, it was the first to become known to western travelers. A key factor in this isolation has been the immensely difficult terrain, broken in numerous places by canyons and deep chasms with precipitous walls, sometimes thousands of feet high. Such terrain rendered communication and travel all but impossible, especially during the rainy seasons.

These natural obstacles, together with the previous aloofness and even open hostility of the people, preserved the country from foreign penetration for centuries. The opening up of Africa in the last century influenced Ethiopia less than any other part of the continent, and she largely maintained her frontiers and kept her independence during the race for colonial empires disturbing the rest of Africa.

Because of this isolation, observations on the fauna of the area have been few, and mostly confined either to the larger game animals, described by private travelers of the last century, or to the naming of the few specimens of smaller species brought back by travelers. Thus, the Empire of Ethiopia, an area of some 450,000 square miles (Luther, 1958), has largely remained a void in the zoological knowledge of the world. The importance of a record of the natural distribution of plants and animals was emphasized by Balinsky (1962) when he stated, "It is the first duty of biologists to make a concise recording of the present state of the distribution of animals and plants, a recording of conditions which will not be discernible much longer."

The present study is quite timely because only a short distance from the main cities and roads conditions are still little changed from those that have existed for hundreds of years. Luther (1958) stated, "Outside of the capital and the few large towns, life goes on much as it always has for centuries." Indeed, many of the descriptions by early travelers (Swayne, 1895; Cutting, 1940; Nesbitt, 1934) are equally applicable today. With this long stability of land use collections of mammals and studies of their habitat still represent conditions as they have existed for long periods of time.

These conditions will certainly not remain for long. Under the aggressive leadership of His Imperial Majesty, Haile Selassie I, new roads are being built which have opened up areas previously inaccessible to the general public. Through education and extension modern agriculture is being introduced which will radically change farming habits and allow the development of new tracts of land which at the time of this study were wilderness. These modernizations will certainly

affect mammalian populations, as they already have in other countries.

The present study was conceived as a survey of the mammals of a relatively small area of Ethiopia (Figure 1), collecting from as many different life zones or habitat types as the area afforded. The writer undertook this study while he was the zoologist on the faculty of the College of Agriculture of Haile Selassie I University, and had the assigned duties of teaching zoology and conducting mammal-related research.

The College is located on Lake Haramaya in Harar Province, and the study area chosen for this survey is the eastern end of the Chercher Highlands, with the College as its center. From this location in the cultivated plateau of the Highlands, access is easy to a diversity of habitats ranging from the lower elevations in the Rift Valley to the Fafan, Dacata, and Errer valleys on the southern slope of the Highlands. To the west of the College, the Gara Mullata massif rises to 11,000 feet and supports a tropical montane forest. The collection of mammals was thus made over a variety of vegetational zones, whose development was influenced by altitude and rainfall. Data were obtained for a seven-year period from September, 1959 to June, 1966, during which time the writer lived in Ethiopia.

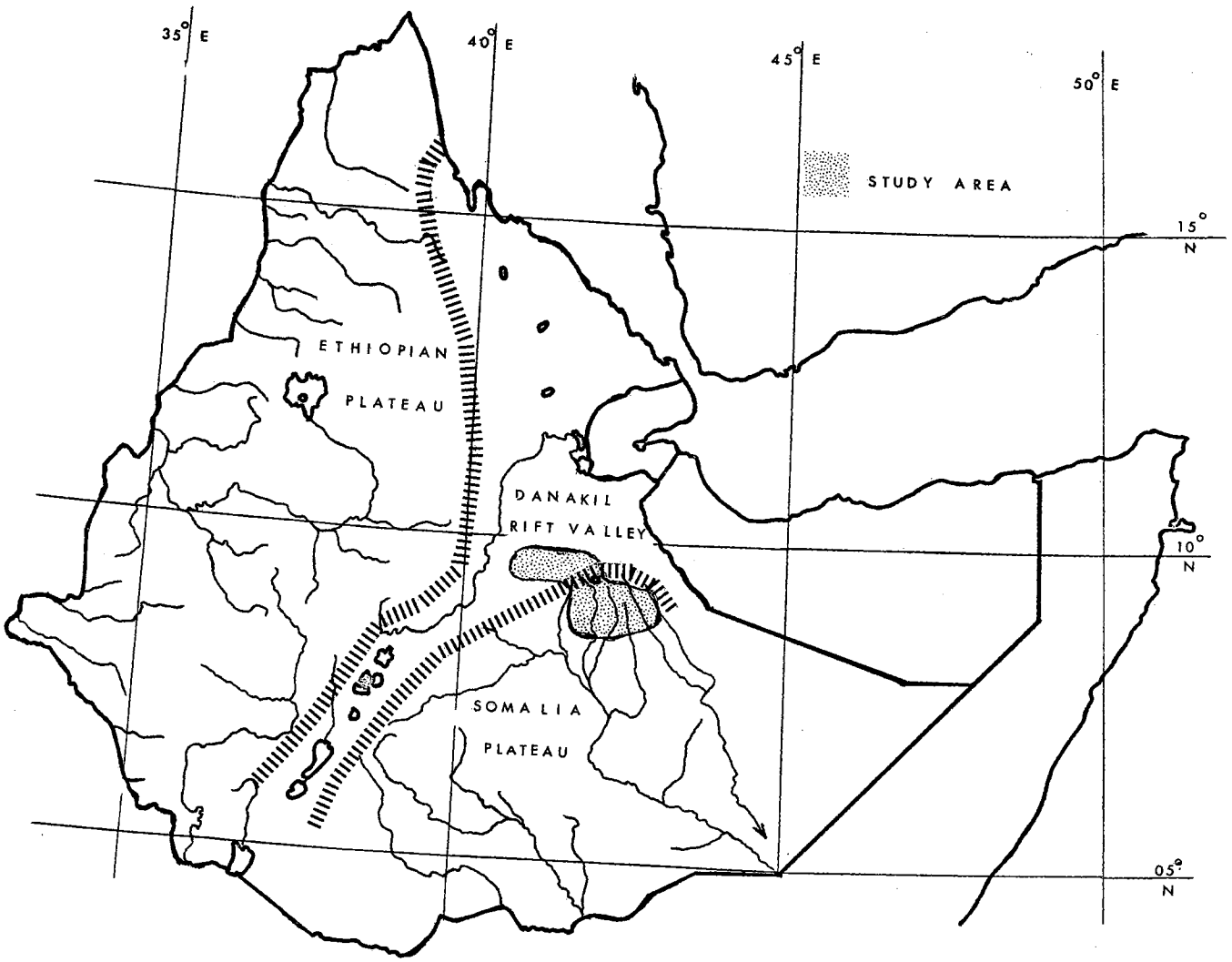

Figure 1. A Map of Ethiopia Showing the Study Area

CHAPTER II

DESCRIPTION OF THE STUDY AREA

The study area, located at the eastern end of the Chercher Highlands and the adjacent Rift Valley, lies between 8°30' to 9°45' N lat and 40°45' to 42°40' E long. This area is composed of five topographic regions which contain the major collecting sites (Figure 2): (i) the Afdem Plain on the floor of the Rift Valley; (ii) the broken foothills at the base of the escarpment; (iii) the intensively cultivated hilly plateau on the crest of the highlands; (iv) the deep-cut river valleys on the southern slope of the highlands; and (v) the Gara Mullata massif which rises to 11,094 feet.

The drainage of the highlands on the Rift Valley side consists of numerous seasonal streams which flow to the north, where they eventually disappear on the surface of the plain. Most of the water falling in the highlands drains to the south in deep-cutting seasonal rivers which connect to the Webi Shebeli River system.

The three major geological features of Ethiopia are the Abyssinian Plateau in the northwest; the Somalia Plateau in the southeast; and the tectonic trough of the Danakil (Afar) Plain which separates them (Figure 1). The Chercher Highlands where the study area was located, make up the eastern end of the Somalia Plateau, and form the southern border of the Danakil Trough.

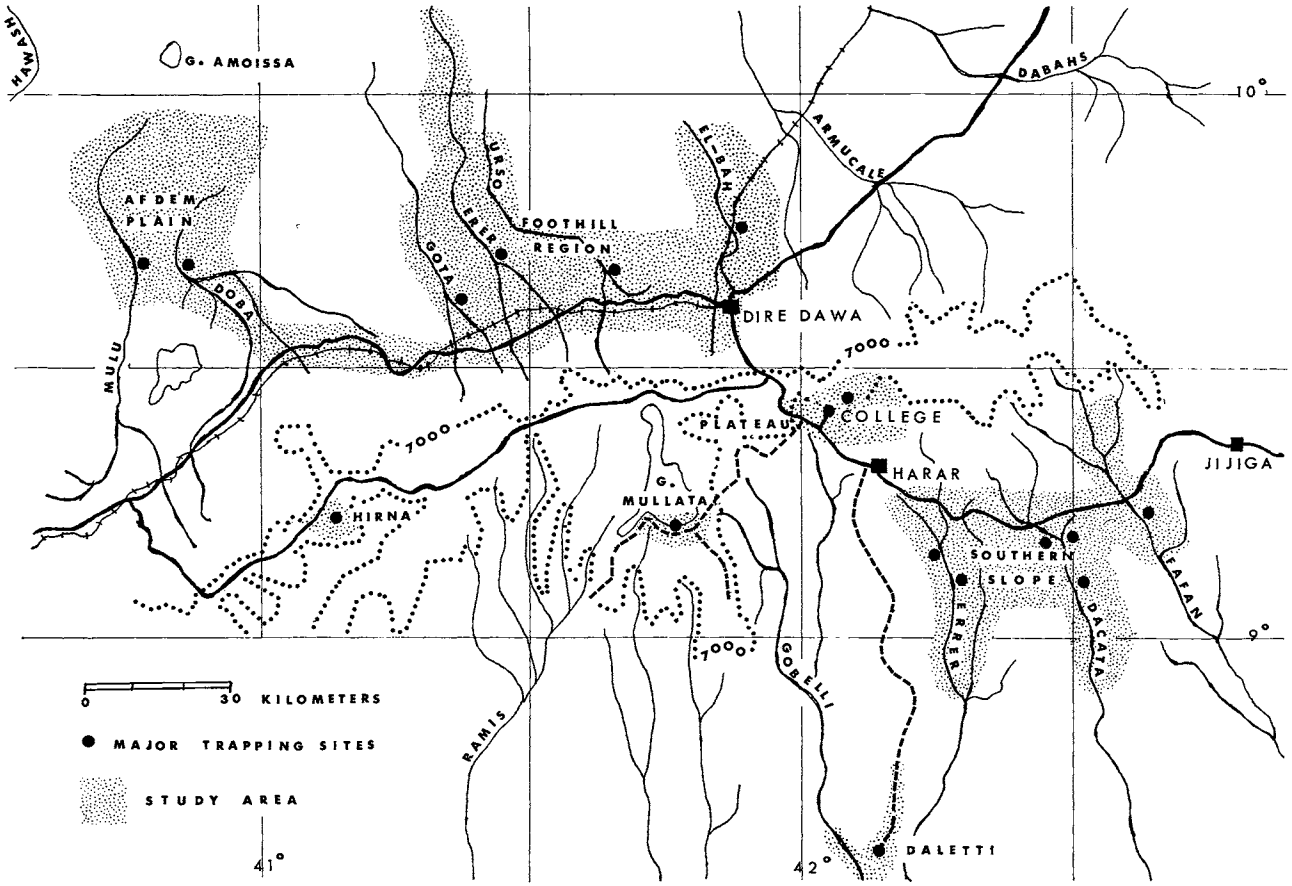

Figure 2. A Map of the Study Area Showing the Five Ecological Regions

The Pre-Cambrian basement outcrops over a large part of Ethiopia. As in most of Africa, it consists of metamorphic schists, quartzites, marbles, mica-schists and granitic bodies of different ages (Furon, 1950). Between Dire Dawa and Harar, the exposed basement complex is frequently micaceous. In the area east of Harar where the rivers have cut deep valleys, granite intrusions are abundant, as is strikingly shown in the Dacata Valley (Figure 13).

In addition to the Pre-Cambrian outcroppings there is ample evidence of the transgressive movement of the Mesozoic sea over much of the eastern half of Ethiopia. The Adigrat sandstone, which is 80 m thick at Harar (Mohr, 1963), is overlain by the marine Antalo limestones of Jurassic age, which make up the greater part of the sedimentary deposits of the study area.

Another major rock formation is the basaltic lava which covers the major part of the Ethiopian Plateau. Contemporaneous with and immediately following the dome-forming uplift of the Miocene, extrusions of immense quantities of flood lava poured from great fissures in the earth's crust (Last, 1962; Mohr, 1963). Several lava flows, which appear to be very recent, are completely devoid of vegetation (Buxton, 1957). Such a flow emerges from one of the small cones on the northern border of the Afdem Plain.

Significant seasonal variations in Ethiopia are based on rainfall rather than temperature. The shifting of the monsoon winds divides the climate into a wet season and a dry season separated by a short period of "small rains." In the study area the dry season lasts from October to May and is usually broken in March and April by periodic thunderstorms. These "small rains," which are of short duration and scattered,

are insufficient to sustain vegetative growth.

The main rainy season occurs from June through September, during which time about 80% of the annual precipitation occurs (Angerer, et al., 1954).

Temperature records are fragmentary and generally unreliable, however, warm days and cool nights are usual throughout the year.

The study area can be divided into five major regions delineated by factors such as altitude, land-use patterns, climate, physiography, and vegetation. Major collecting sites were established in each of these regions, and in addition mammalian specimens were taken wherever they were found.

Afdem Plain Region

The Afdem Plain is a flat acacia savanna comprising several hundred square kilometers on the floor of the Rift Valley (Figure 2), and is located between 9°34' to 10° N lat and 40°45' to 41° E long. It is a part of a more extensive savanna which extends west to the Alaideghi Plain along the Awash River. The part of the Afdem Plain where most mammal collections were made includes the local areas of Maru, Agreli, Fantighera, Galali, Maiugeri, and Fafa; and is bounded on the west by the Mulu River and on the east by the volcanic ridges which border the Doba River. The southern edge of the plain is dominated by the Gara Afdem massif, an old volcanic peak which rises 6790 feet above the valley floor. The northern edge is bordered by volcanic ridges and cones which extend to the east from the old volcano Gara Amoissa.

The altitude of the plain is approximately 2800 feet, with the land sloping gradually to the north and northwest. Rainfall records for the

area do not exist, but rains probably average less than 20 inches per year.

The grey-brown soil of the plain is deep and ranges from sandy loam to silt loam with a silt content sometimes as high as 70% (Murphy, 1959). Old volcanic ridges are covered with weathered basalt, with gravelly soil supporting sparse vegetation at the base.

The principal drainage of the plain is the Mulu River on the west and the Doba River on the east. These rivers ("tugs") are seasonal and carry water only as runoff occurs from rains in the highlands. On the Mulu there are places where rather shallow wells dug in the sandy bottom by the nomads produce water for livestock and wild animals. If the water table is high, wart hogs, oryx, and zebra are able to dig down to water in these places. They were observed doing this during the dry seasons of 1964, 1965, and 1966, a period when nomads were not occupying the plains. Both rivers end in grassy fans, and water which reaches the end during heavy rains spreads out over the surrounding plain.

In the Fafa region, east of the Doba River, in what appears to be the remnant of an old volcanic crater, there is a hot spring where water with a temperature of 63 C collects in pools and marshes and provides the only permanent source of water. Hundreds of head of livestock are watered each day by the nomad tribesmen, and during the evening and night gazelle, oryx, wart hog, and zebra, along with big predators move in to drink.

At Maru near the northern edge of the plain, water fills a depression during years of heavy rain. This lake contained water in 1959, 1964, 1965, and 1966. Other years it was dry, but wells dug in the bottom by the nomads furnished water for livestock and wild animals.

The Afdem Plain is inhabited by pastoral nomadic people who utilize the land for grazing only. From the hot spring west to the Awash River the land is claimed by the Danakil (also known as Adal or Afar) tribe, and from the hot spring east by the Isa tribe. The spring may be utilized by both groups for watering livestock during the dry season, and the two tribal groups are often in conflict over the grass and water of the plain. Old fortifications (Figure 3) on the surrounding ridges attest to the strife which has dominated the area. There is probably little difference in the land use today from what it has been for centuries. Nesbitt's (1934) observations made in 1927 on his journey through the Danakil country would largely apply today.

Both the Danakil and Isa tribes maintain large herds of cattle, sheep, goats, and camels which severely overgraze the entire plain and denude the ground completely near the water holes. When grass becomes scarce the branches of acacia trees are cut off to feed the goats and camels.

During the wet season, when surface water is available, the nomads move completely off of the plain to other areas.

The practice of burning which is common in much of East and South Africa is not practiced by nomads of this area. During the seven years of this study, it was never burnt over.

Foothill Region

Along the base of the escarpment the drainage from the highlands has created numerous ravines and valleys producing an area of rough, eroded foothills. The foothill region in the study area is located between 9°35' to 9°55' N lat and 41°15' to 42° E long. This area is

60 km from Dire Dawa on the east to Gota on the west, and extends for about 30 km out on the Rift floor. Vegetation consists of open acacia woodlands and thorny, mixed shrubs.

The altitude of the foothill region varies from 3850 feet at Dire Dawa to 3520 feet at Erer, and as the land slopes to the north and flattens out on the Rift floor, it falls to below 3000 feet.

An average yearly rainfall of 24.3 inches has been recorded at Dire Dawa with records extending over a 12-year period (Tato, 1964). The soils on the hills are usually rocky or gravelly and deeper soils are found on the floor of the valley. Soils are light to dark grey-brown and the texture varies from sandy loams to clay (Murphy, 1959).

The region is drained by seasonal streams which originate on the escarpment and coalesce to form the major watercourses of the Gota, Erer, Urso, and El-bah Rivers. The Erer River is the longest and extends for 50 km out on the Rift Valley floor. These rivers are seasonal for most of their length with permanent water present for only a few kilometers from the scarp in the Urso, Erer, and Gota drainages. Partly this is due to extensive irrigation near the foot of the escarpment. During the big rains these rivers may be briefly flashflooded. Any water which reaches the end of a watercourse fans out over the surrounding plain, as none of the streams in this region ever discharge into a permanent river system.

Hot springs occur in the Erer-Gota region and have been developed as a hotel attraction.

The major drainage in the Dire Dawa area is by the entirely seasonal El-bah watercourse which disappears a short distance out on the plain. Shallow wells in the riverbed near Scenele provide water in the dry

season for livestock and wild animals.

The population of this region is relatively high since the (Djibuti to Addis) railroad runs along the base of the scarp, with villages occurring at frequent intervals. Dire Dawa, a city of several thousand people, is the major rail and air center of the province.

Some agriculture is attempted around the villages and large tracts of land are under irrigation along the upper Gota, Erer, and Urso Rivers. Where land is irrigated it is quite productive with the major crops being citrus fruits, bananas, and vegetables. The heavy use of irrigation water from the Erer and Urso Rivers during the dry season severely restricts the amount of surface water available to wild animals downstream. Most of the land is used pastorally with village livestock grazing areas adjacent to villages, and the nomadic Esa tribe utilizing the rest.

Mammal collecting was most intense along the Gota, Erer, and Urso drainages and along the railroad from Dire Dawa to Scenele; however, some collections were made elsewhere in the region.

Harar Plateau Region

The Harar Plateau at the eastern extremity of the Chercher Highlands is an intensively cultivated, hilly plateau with forested peaks scattered along its length. The College of Agriculture is situated on the eastern shore of Lake Haramaya in the Alemaya-Harar area. Local agricultural practices are typical of those of most of the Eastern Plateau where farming utilizes all well-drained land.

The elevation of the plateau region varies. The highest point on the farm at the College of Agriculture is 6898 feet, while the level

of Lake Haramaya is 6691 feet (Zerihun and Schnur, 1965). The altitude of the City of Harar, 15 km from the College, is 6048 feet (Angerer, et al., 1954). The high altitude of the region results in cool to mild temperatures throughout the year. Temperatures may drop to 0 C on a few nights of the year, and light frost may occasionally occur in low valley pockets (Zerihun and Schnur, ibid.).

The plateau region is an area of high although locally variable rainfall. Records for eight years at the College of Agriculture show an average yearly amount of 33.5 inches (Zerihun and Schnur, 1965). Soils of the area are red to grey, and the texture varies from clay to clay loam (Murphy, 1959). Erosion over the area is very severe with the surface soil depleted on many of the steeper slopes.

Springs, streams, lakes, and marshes are scattered throughout the region providing permanent surface water during the dry season.

The farmers of the region are members of the Galla tribe and they have farmed the area for generations (Swayne, 1895; Buxton, 1957). Other tribal groups may be found around the towns and commercial centers. The farmers live together in small village settlements which are usually located on slopes overlooking their small farms. The population density is relatively high with one survey showing 317 people in an area of one square kilometer (Davis, et al., 1965). Eighty-five percent of the cultivated land is devoted to sorghum and corn (Murphy, 1959), while land with poor drainage is used for grazing.

Southern Slope Region

The Harar Plateau slopes gradually to the south where it eventually contacts the plains extending to the coast of Somalia, whose Ethiopian

segment is called the Ogaden. The part of this slope in which mammals were most intensively collected lies between 8°55' to 9°15' N lat and 42°10' to 42°45' E long. This region which extends from Harar to Jijiga is generally a rough, mountainous, country broken by deep canyons and valleys cut by the Errer, Dacata, and Fafan Rivers. The region supports a dense Acacia tree and deciduous scrub formation. Erosion and stream action over most of the region has largely removed the sedimentary deposits and left exposed the Pre-Cambrian basement of granite, gneiss, and schist (Murphy, 1959). This is strikingly evident in the Dacata Valley where erosion and weathering has produced formations of huge granite boulders along the valley walls (Figures 13 and 14).

The altitude of the river valleys where most collecting sites were located is between 4000 and 5000 feet, while the upland ridges between the valleys are over 5000 feet. At the southern end of the study area, the Erer and Dacata Valleys fall below 4000 feet. No reliable meterological data are available for the region, but rainfall is less than on the Harar Plateau and greater than the regions in the Rift Valley. Because of the lower altitude, the temperatures are somewhat milder than those on the plateau.

Soils are variable but generally are sandy loam in the valleys and gravelly and stony on the upland ridges (Murphy, ibid.).

During the period of rains the seasonal rivers flow continuously, but are dry for most of their length the rest of the year. Permanent water is present from springs in the upper part of the valleys close to the highlands, and surface seeps and wells provide water in the lower valleys during the dry season.

A single major road crosses this region from Harar to Jigjiga staying mostly on high ground above 5000 feet. Several small towns and settlements are scattered along this road and the land nearby is usually cultivated. Farming in the river valleys is limited to the upper part of the valleys, with most of the area south of the road supporting natural vegetation. Most of the Errer, Dacata, and Fafan Valleys where mammals were collected is used for grazing by Somali herdsmen during the dry season.

Wood cutters are active in the Errer and to a lesser extent in the Dacata Valley, where they cut many of the larger trees for firewood or for making charcoal.

Tropical Montane Forest

The Gara Mullata massif is located between 9°8' to 9°18' N lat and 41°40' to 41°50' E long and contains the highest mountainous terrain of the Eastern Chercher Highlands, with the highest peak rising to 11,094 feet. It consists of over 3000 feet of basalt overlying the Antalo limestone. A single road penetrates this region at the town of Curfacelli and circles at the base of the peaks to the Graua road junction on the southeast corner. The road rises to 8000 feet and continues along the southern slope of the massif above this altitude. The main trapping site was located along this road at the base of the saddle between the peaks Gara Mullata and Gara Ascabani. This mountainous region is an area of high rainfall where a remnant cloud forest of climax vegetation still persists.

The elevation at the principal trapping site was 8300 feet, but some collections were made at both higher and lower altitudes.

Meterological data are not available, but rainfall is high and the region is often shrouded with clouds which, along with gentle afternoon showers, keep the ground and vegetation continuously wet during the rainy season. Soils of the region are dark in color and stony with weathered basaltic rock. Deep accumulations of organic matter occur in the forested areas.

Permanent water in the dry season is supplied by numerous springs and seeps which flow in small mountain streams along the face of the massif or form shallow ponds in small depressions.

This region is occupied by the Galla tribe who have small settlements in the lower valleys. When first visited in 1959, no one lived in the forested areas, and no cultivation was attempted above 8000 feet. In subsequent years the people have encroached on the forests, cutting and burning trees and other vegetation and putting even very steep slopes under cultivation. This has largely destroyed one of the few remaining areas of climax montane forest which was easy of access from the Harar-Dire Dawa area.

CHAPTER III

METHODS

Mammal collecting was started in 1959 as soon after arrival as camping gear and a four-wheel-drive vehicle had been acquired. The College of Agriculture made a good base of operation for trips into all of the five regions of the study area. Trapping sites were selected primarily for accessibility but also for isolation from populated centers so that traps and equipment would not be molested or stolen. The river valleys east of Harar could not be entered during several months in 1964 due to political difficulties between Ethiopia and Somalia. This unsettled condition also prevented collecting trips to the lower part of the southern slope on the edge of the Ogaden.

Many logistical problems are involved in collecting in a wilderness area. The difficulty of access roads to collecting sites was noted by Loomis (1956). A four-wheel-drive vehicle was essential in all of the regions visited. Generally two vehicles were taken into an area. This was necessary both for hauling gear and for reasons of safety. Food supplies and gasoline could only be obtained at the College, Harar, or Dire Dawa, and the College was the only source of potable water.

There is a paucity of information on previous collections of Ethiopian mammals and what does exist is scattered throughout the voluminous literature on Africa, some of which is not readily available. At this preliminary stage in the collecting and cataloguing of

Ethiopian mammals any information which may assist future collectors is most essential. This has led to the inclusion of various natural history notes in the species account which might otherwise have been omitted.

The means and ranges (minima and maxima) of the standard measurements in the flesh, and useful cranial measurements for the series of specimens collected in each region are recorded for each species in the Appendix. These measurements, indicating the amount of variation within a species, are essential for the taxonomic assessment of certain groups, and should be useful to future collectors for comparison with their collections.

Specimens were collected by all possible means including trapping, mistnetting, shooting, and jacklighting from a vehicle at night. Predator calls were particularly effective on animals such as jackals, hyaenas, and small cats, and an amplified taped recording of bawling cattle was effective in attracting large cats.

Traplines were set so as to sample all of the major habitats in each region. Besides trapping, extensive patrolling was done both in the daytime and at night to collect the larger species and those not readily trapped.

Specimens were prepared in the usual manner for museum skins (Anthony, 1950; Hall, 1962). Standard measurements were recorded in millimeters. The collection was divided, with a series of each species being deposited in the Oklahoma State University Museum and the rest placed in the collection at the College of Agriculture, Haile Selassie I University.

The systematics used in this study are those most widely accepted at this time. The taxonomic evaluation of this collection is currently being made by Dr. Glass at Oklahoma State University. There are no publications dealing specifically with Ethiopian mammals and general references pertaining to adjacent area (Allen, 1939; Ellerman, Morrison-Scott, and Hayman, 1953; Swynnerton, 1950; and Setzer, 1956), or in many cases the original descriptions had to be used. Near the end of the study a preliminary identification manual for African mammals (Meester, et al., 1966) has provided provisional identification for many orders, and in most cases it has been followed.

The plant surveys were made by the point-centered quarter method developed by Cottom and Curtis (1956) and modified by Dix (1958 and 1961) for grassland sampling. In this method, the center point of each sampling unit is located by a single pin (surveyor's arrow) which is placed vertically into the soil, guided by a small notch cut into the toe of the sampler's boot. The area around the pin is then divided into four quarters by drawing two imaginary lines through the pin; one line is drawn parallel with the line of traverse, while the second is drawn at right angles to the first. The establishment of these lines was aided by soldering four small metal fins to the pin at right angles to one another. The pin is placed down at predetermined intervals; the species of plant nearest to the pin in each quadrant is recorded, and its distance from the pin measured to the nearest centimeter. From these measurements, the following information can be calculated:

Distance -- The sum of measurements for all species.

Mean distance -- Sum of distances divided by total number of measurements.

Mean area -- The mean distance squared.

Total density -- Unit area divided by the mean area.

Relative density -- Number of occurrences of a species divided by the total number of measurements.

Absolute density -- Total density times the relative density.

Frequency -- Number of quadrats (points) in which the species occurred divided by total number of quadrats.

Relative frequency -- Frequency of species divided by the total frequency.

Density data are given in plants per square meter or plants per hectare except for the tree and shrub cover in the savanna (Afdem Plain) where plants per square kilometer is more meaningful.

The flora of Ethiopia is poorly known, and there were no comprehensive works available during the period of study. Most of the plant species which were encountered in the surveys were identified in the field by Dr. W. A. Burger. A recent publication on the families of Ethiopian plants (Burger, 1967) has been helpful in the preparation of this manuscript.

CHAPTER IV

PLANT COMMUNITIES AND ASSOCIATED MAMMALS

Afdem Plain Region

Savanna-type vegetation covers a large part of Ethiopia, and is botanically one of the most important plant communities (Mooney, 1961). The Afdem Plain is primarily a savanna with scattered acacia trees usually under 8 m high and riparian acacia woodlands along the watercourses. Some parts of the plain have scattered clumps of the evergreen shrub Cadaba rotundifolia, and thorny acacia scrub forms open thickets along the rough lava ridges and in the more hilly southern sections of the plain.

The vegetation of the region was sampled by the point-centered quarter method as described in Chapter III, with trees, woody shrubs, and grasses being surveyed separately. Shrubs were considered to be any woody plant without a well defined bole, which branched within one meter of the ground. Results of the surveys from the Afdem Plain Region are summarized in Tables I, II, and III.

Vegetation on the Afdem Plain is not uniformly distributed as is usual in areas of low or highly seasonal rainfall where plant associations may vary with only slight differences in ground level (Vesey-Fitzgerald, 1963). However, the plant surveys do identify the most common forms and indicate their relative densities.

TABLE I

DENSITY AND FREQUENCY OF TREES AT DOBA RIVER SITE, AFDEM PLAIN

Species Composition	Relative Density %	Absolute Density/ sq km	Frequency %	Relative Frequency %
Acacia tortilis spirocarpa	82.5	177.9	100.0	58.8
Acacia senegal	10.0	21.5	40.0	23.5
Acacia nilotica arabica	7.5	16.2	30.0	17.6
Totals	100.0%	215.6 Trees/sq km	170.0%	100.0%

TABLE II

DENSITY AND FREQUENCY OF SHRUBS AT DOBA RIVER SITE, AFDEM PLAIN

Species Composition	Relative Density %	Absolute Density/ sq km	Frequency %	Relative Frequency %
Cadaba rotundifolia	90.0	5490.0	100.0	71.4
Abutilon sp.	2.5	152.5	10.0	7.1
Solanum sp.	2.5	152.5	10.0	7.1
Grewia tenax	5.0	305.0	20.0	14.2
Totals*	100.0%	6100.0 Shrubs/sq km	140.0%	100.0%

*Columns may not total 100%.

TABLE III

DENSITY AND FREQUENCY OF GRASSES, CENTRAL AFDEM PLAIN

Species Composition	Relative Density %	Absolute Density/ sq m	Frequency %	Relative Frequency %
Eragrostis cilianensis	36.3	125.4	62.5	34.7
Urochloa trichopus	22.5	77.7	37.5	21.0
Cenchrus setigerus	17.5	60.5	35.0	19.4
Tragus berteronianus	11.8	40.8	20.0	11.0
Lasiurus hirsutus*	6.2	21.4	12.5	7.0
Setaria verticillata	.7	2.4	2.5	1.4
Digitaria velutina	.7	2.4	2.5	1.4
Sporobolus sp.*	1.8	6.2	5.0	2.7
Paspalidium desertorum	2.5	8.6	2.5	1.4
Totals	100.0%	345.4 Plants/sq m	180.0%	100.0%

*Perennials

The tree and shrub surveys (Tables I and II) were made on the Doba River side of the plain through the main collecting site where most of the small mammal trapping was done. Samples were taken across the plain along an east-west compass line at right angles to the river. Trees on the plain occurred singly or in small patches fringing sluggish wet-season watercourses or shallow depressions. It is evident from the survey as well as from casual observation that acacia is the dominant tree type, and Acacia tortilis spirocarpa is the most common species with a relative density of 82.5%. The density of 215 trees per square kilometer is an estimate of the tree density on the plain and does not reflect the tree concentrations adjacent to the seasonal rivers, which generally extend for only a few meters on either side. Most of the trees in the gallery are acacia with scattered clumps of Tamarix sp. in the flood plain of the river bottom.

The dominant shrub is Cadaba rotundifolia, which has a relative density of 90.0%. This shrub tends to grow in clumps of various sizes and varies in density in different sections of the plain. It retains its leaves throughout the dry season and furnishes shade and cover for many of the larger animals during the hot part of the day. C. rotundifolia contains tannins which make it unpalatable to livestock, and wild animals were never observed feeding on it. Protective adaptations such as thorns or unpalatability are apparently essential if a tree or shrub is to survive the grazing pressure of livestock and wild herbivores in an area of such low and highly seasonal rainfall.

The grass survey (Table III) was extensive, covering not only the eastern side of the plain through the Doba River collecting site but including samples from the western side toward the Mulu River. The

associations are chiefly annual grasses which spring up during the rains between scattered tufts of perennials. This type of formation with annual grasses predominating is a usual feature of dry areas (Vesey-Fitzgerald, 1963).

While the perennial grasses accounted for only 8.0% of the total composition in the wet season aspect (Table III), they were a conspicuous feature in the dry season after the plain had been subjected to heavy grazing (Figure 4), where grazed-down tufts were all that remained of the grass cover. Annual grasses which grow on open ground between perennial tufts are quickly grazed out by livestock and wild herbivores.

The most common perennial grass is Lasiurus hirsutus, a tall-growing bunch grass. Small depressions and old game trails where water tends to collect are usually marked by a fringe of this grass. It was in such a fringe of grass along an old car track that Microdillus peeli was collected. In some areas of the plain where drainage is poor this grass is abundant, and since the tufts of grass protect the loose silty soil from blowing they tend to be raised several inches above the intervening bare ground. Bermuda grass, Cynodon dactylon, is an important cover on sand banks bordering the seasonal rivers where it provides a major food of the wart hog.

Annual grasses provide 92.0% of the grass cover during the wet season (Table III). They quickly spring up at the start of the rains, and are heavily grazed by livestock and wild herbivores. The most abundant species noted were Eragrostis cilianensis, Urochloa trichopus, Cenchrus setigerus, and Tragus berteronianus.

Following a period of unusually heavy rainfall and a period (September, 1964 to May, 1966) when no people were occupying the plain,

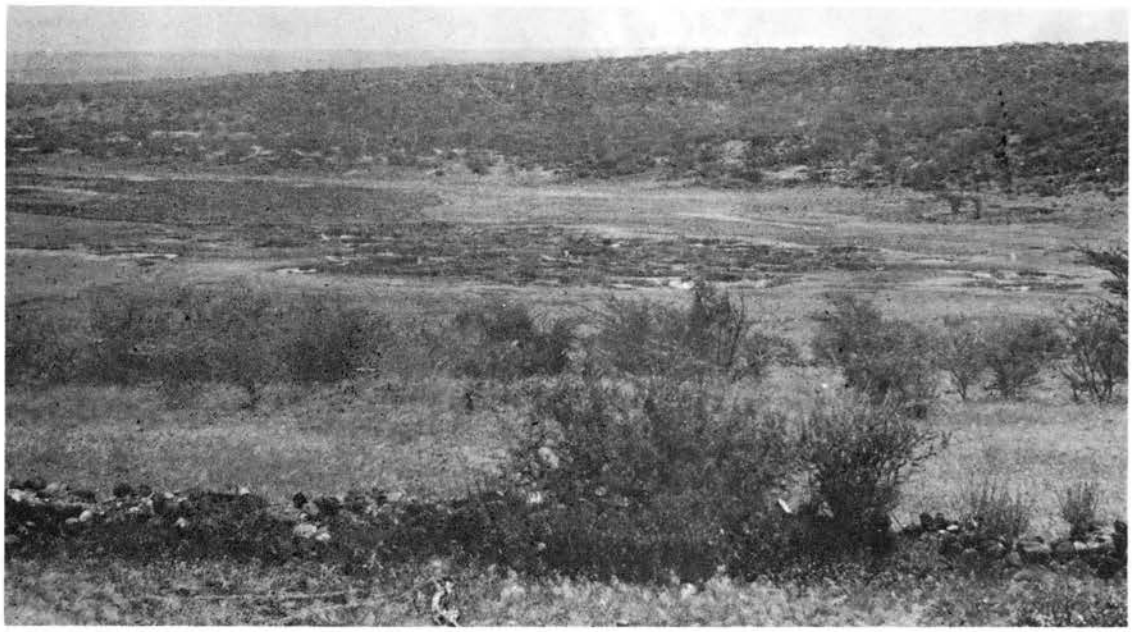

Figure 3. The Hot Spring Which Furnishes Permanent Water for the Afdem Plain. A weathered basalt ridge is in the background.

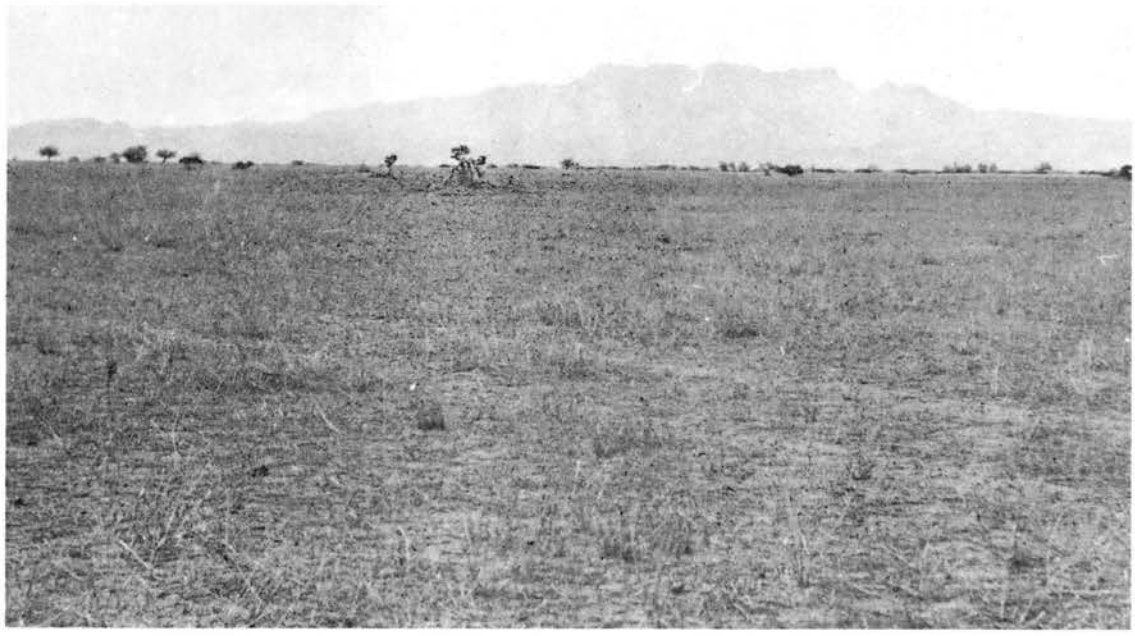

Figure 4. Dry Season Aspect of Afdem Plain Savanna After Heavy Grazing by Livestock. The view is looking south toward Gara Afdem.

Figure 5. Wet Season Aspect of Afdem Plain Savanna, Ungrazed by Livestock for One Year. The shrubs are Cadaba rotundifolia with riparian Acacia tortilis along the Mulu River.

the grasses showed a marked revegetation of previously bare areas. Many annual grasses showed great vigor, growing to heights of up to one meter (Figure 5).

The most characteristic of the savanna animals are the herbivores, and although these occur in relatively large numbers on the Afdem Plain the species diversity is not great compared to the savanna of Kenya to the south. Since the area is difficult of access and the attitude of the nomad tribes is unpredictable, the animals are usually subjected to very little hunting. Poaching by the tribes is slight because guns are scarce and ammunition very expensive.

The following mammals were collected or sighted in the Afdem Plain region:

Order Chiroptera

Tadarida bivittata

Order Primata

Cercopithecus aethiops

Order Lagomorpha

Lepus habessinicus

Order Rodentia

Xerus rutilus; *Tatera robusta*; *Tatera sp.*; *Microdillus peeli*; *Acomys dimidiatus*; *Arvicanthis niloticus*; *Hystrix galeata*

Order Carnivora

Canis aureus; *Canis mesomelas*; *Otocyon megalotis*; *Genetta genetta*; *Genetta tigrina*; *Herpestes sanguineus*; *Crocuta crocuta*; *Hyaena hyaena*; *Proteles cristatus*; *Acinonyx jubatus*; *Felis lybica*; *Panthera pardus*; *Panthera leo*

Order Tubulidentata

Orycteropus afer

Order Perissodactyla

Equus grevyi

Order Artiodactyla

Phacochoerus aethiopicus; *Tragelaphus strepsiceros*; *Tragelaphus imberbis*; *Alcelaphus buselaphus swaynei*; *Oryx beisa*; *Gazella soemmerringi*; *Litocranius walleri*; *Madoqua cordeauxi*

Foothill Region

The vegetation type in the Foothill Region is not uniform across the length of the study area, but tends to change from east to west. Around Dire Dawa and north from the scarp as far as Scenele the vegetation type is tree acacia open woodlands (Gillett, 1941). Acacia trees are dominant and although sometimes adjacent, are usually well-spaced (Figures 6 and 7). Trees are over 3 m in height and have clear boles for at least 1 m above the ground. In the riparian woodlands along the seasonal watercourses of the El-bah river system individual trees are very large. Understory shrubs form open thickets and in open areas, particularly along the sandy watercourses, the introduced prickly pear cactus, *Opuntia sp.* may form pure stands.

The surveys of trees and shrubs on the eastern edge of the foothill region were made near Scenele, and the data are recorded in Tables IV and V respectively.

Westward from Dire Dawa the vegetation gradually changes to open deciduous scrub. The dominant woody plants are deciduous shrubs, without well-defined trunks, which branch within 1 m of the ground (Figure 8).

TABLE IV

DENSITY AND FREQUENCY OF TREES AT SCENELE, DIRE DAWA AREA

Species Composition	Relative Density %	Absolute Density/ ha*	Frequency %	Relative Frequency %
Acacia tortilis spirocarpa	87.5	332.4	100.0	71.4
Acacia senegal	7.5	28.4	20.0	14.3
Balanites aegyptiaca	5.0	18.9	20.0	14.3
Totals	100.0%	379.7 Trees/ha	140.0%	100.0%

*hectare

TABLE V

DENSITY AND FREQUENCY OF SHRUBS AT SCENELE, DIRE DAWA AREA

Species Composition	Relative Density %	Absolute Density/ ha	Frequency %	Relative Frequency %
Acacia tortilis spirocarpa	20.0	272.4	60.0	24.0
Solanum sp.	2.5	34.0	10.0	4.0
Cissus quadrangularis	10.0	136.2	40.0	16.0
Acalypha fruticosa	52.5	715.2	100.0	40.0
Grewia sp.	10.0	136.2	20.0	8.0
Acacia senegal	2.5	34.0	10.0	4.0
Solanum sp.	2.5	34.0	10.0	4.0
Totals	100.0%	1362.0 Shrubs/ha	250.0%	100.0%

TABLE VI

DENSITY AND FREQUENCY OF TREES, GOTA AREA

Species Composition	Relative Density %	Absolute Density/ ha	Frequency %	Relative Frequency %
Acacia tortilis spirocarpa	32.5	13.5	80.0	27.0
Acacia nubica	5.0	2.0	20.0	7.0
Dobera glabra	37.5	15.6	90.0	31.0
Cadaba rotundifolia	10.0	4.1	40.0	14.0
Berchemia discolor	2.5	1.0	10.0	3.5
Salvadora persica	5.0	2.0	20.0	7.0
Acacia nilotica	7.5	3.1	30.0	10.5
Totals	100.0%	41.3 Trees/ha	290.0%	100.0%

TABLE VII

DENSITY AND FREQUENCY OF SHRUBS, GOTA AREA

Species Composition	Relative Density %	Absolute Density/ ha	Frequency %	Relative Frequency %
Solanum somalense	20.0	425.5	40.0	14.8
Abutilon sp.	2.5	53.1	10.0	3.7
Unidentified	7.5	159.5	30.0	11.1
Grewia tenax	2.5	53.1	10.0	3.7
Sansevieria powellii	17.5	372.3	40.0	14.8
Acalypha fruticosa	22.5	478.7	40.0	14.8
Sericocompsis pallida	5.0	106.3	20.0	7.4
Vernonia sp.	10.0	212.7	30.0	11.1
Acacia tortilis spirocarpa	2.5	53.1	10.0	3.7
Cissus rotundifolia	5.0	106.3	20.0	7.4
Acacia nubica	2.5	53.1	10.0	3.7
Unidentified	2.5	53.1	10.0	3.7
Totals	100.0%	2126.8 Shrubs/ha	270.0%	99.9%

This difference in vegetation may reflect a disclimax caused by the felling of trees for fuel with subsequent heavy browsing by sheep, goats, and camels. There is evidence in the Urso area of a formerly more extensive tree cover as old stumps and mounds of old charcoal furnaces are common. Shrubs may occur in thickets but are usually spaced far enough apart so that it is possible to walk between them. Large trees occur but are much more scattered than at the eastern end of the region. Individual gallery trees along the Gota and Erer Rivers may be very large with trunks exceeding 1 m in diameter (Figure 9).

The surveys of trees and shrubs at the western edge of the region were made along the Gota River through a major small mammal trapping site. The results of these surveys are recorded in Tables VI and VII.

Acacia tortilis spirocarpa is a dominant tree throughout the foothill region where it makes up 87.5% of the tree composition in the tree acacia open woodlands at Scenele, and accounts for a third of the tree cover in the Gota area. It is also an important part of the shrub cover in the eastern half of the region. It is evident when comparing the two tree surveys (Tables IV and VI) that the density of tree cover is greatly reduced in the western part of the region (Gota area) where there is a greater species diversity.

The dominant shrub over the entire region is Acalypha fruticosa which makes up half of the shrub layer in the Dire Dawa area, but is only slightly more important than Solanum somalense and Sansvieria powellii at the western end. These three species account for 60% of the shrub cover in the Gota River Area. S. powellii stands (Figure 10) furnished excellent cover for several of the small mammals including Elephantulus, Xerus, Tatera, Acomys, and Arvicanthis.

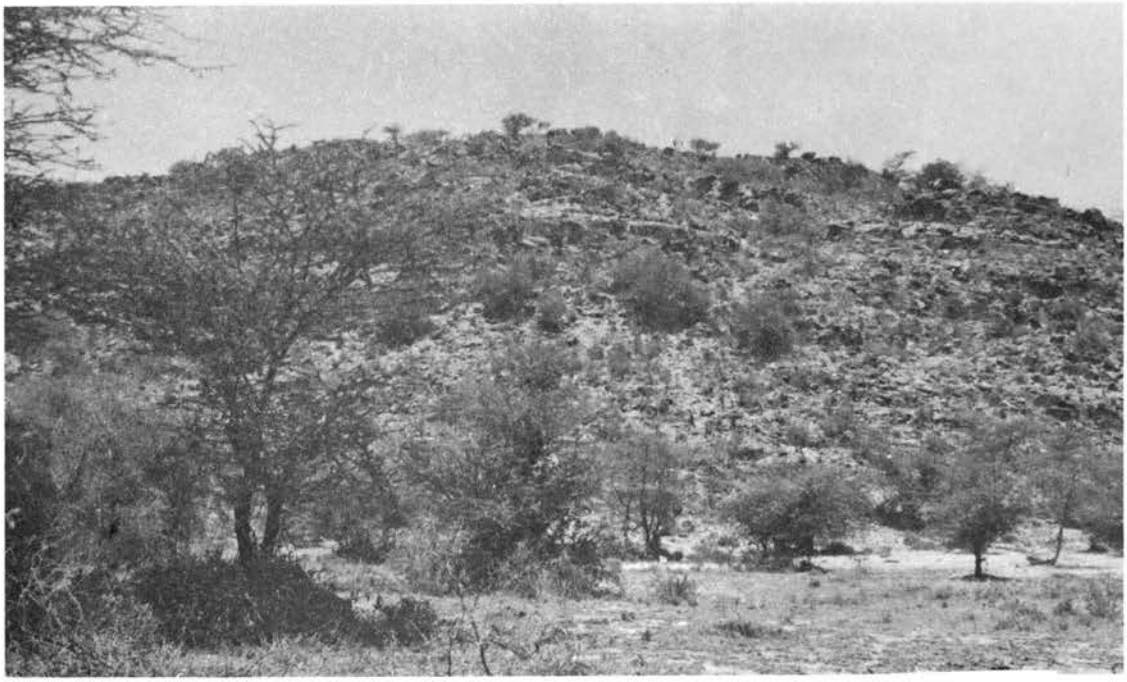

Figure 6. A Limestone Outcrop Near Scenele. Pectinator spekei occurs among the rocky ledges.

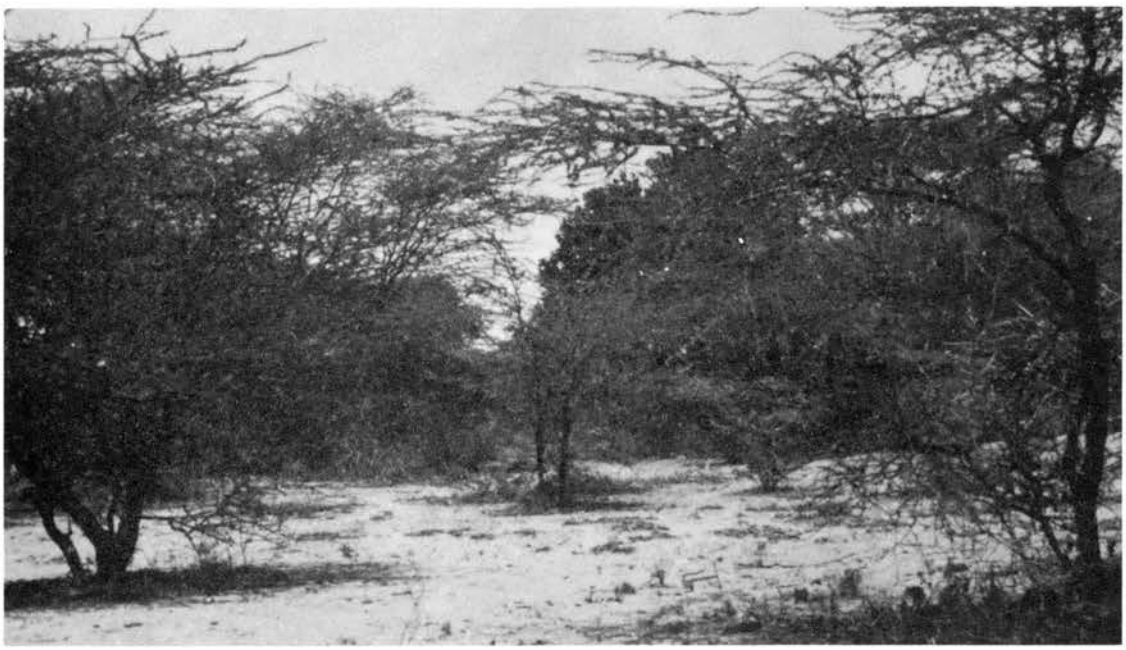

Figure 7. Tree Acacia Open Woodlands Near Scenele. This is typical habitat of Madoqua cordeauxi.

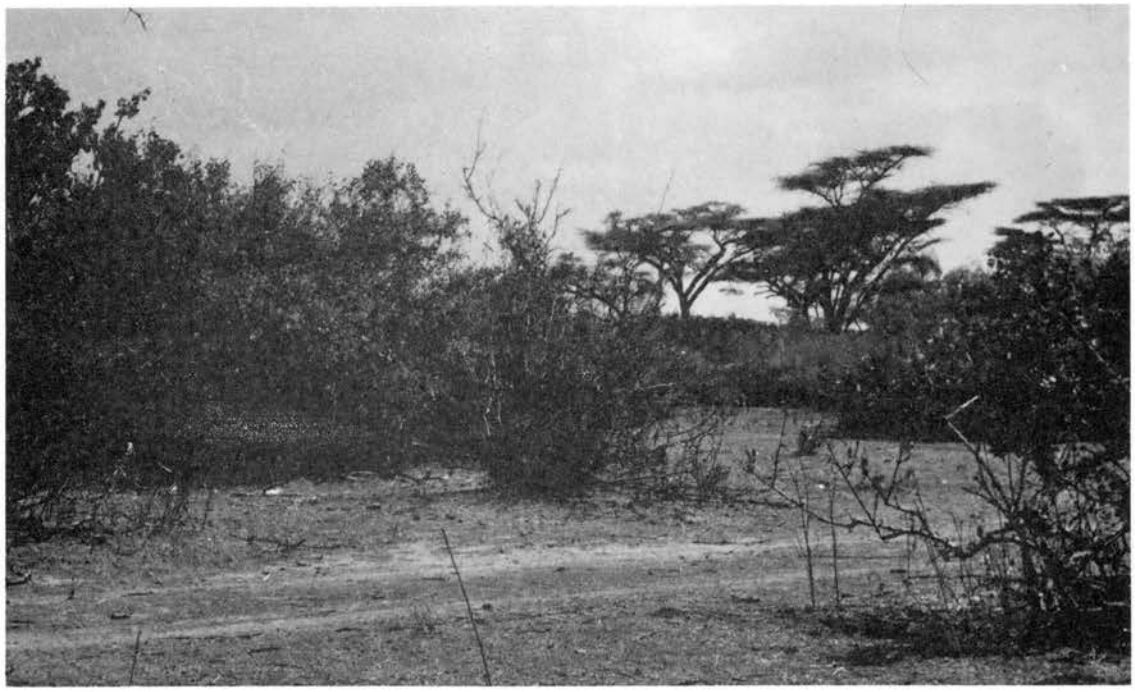

Figure 8. Dry Season Aspect of Open Deciduous Scrub Near the Gota River in the Foothill Region. This is typical habitat of Tragelaphus imberbis.

Figure 9. Riparian Acacia Along the Erer River in the Foothill Region

Figure 10. Sansevieria powellii and Acacia tortilis Near the Gota River. This is typical habitat of Arvicanthis niloticus, Tatera robusta, and Elephantulus rufescens.

Grasses and forbs spring up on the bare spaces soon after a rain, but are quickly grazed out by cattle, sheep, and goats. Along the seasonal rivers, patches of bermuda grass may often be found on sandy banks.

Mammals of this region are subjected to considerable hunting pressure although at the time of this study legal permits could be obtained only for certain animals considered detrimental to agriculture. These animals were wart hog, baboon, hyaena, jackal, and porcupine. Dire Dawa contains a relatively large population of Europeans who have ample transportation and guns; and with the hotel development at the hot springs at Erer being a favorite holiday area, poaching in the region was common.

The following mammals were collected or seen in the foothill region:

Order Insectivora

Elephantulus rufescens

Order Chiroptera

Hipposideros megalotis; Nycteris thebaica; Scotophilus nigrita; Tadarida (Chaerephon) pumila; Tadarida (Chaerephon) nigeriae

Order Primata

Galago senegalensis; Cercopithecus aethiops; Papio hamadryas

Order Lagomorpha

Lepus habessinicus

Order Rodentia

Xerus rutilus; Tatera robusta; Acomys dimidiatus; Arvicanthis niloticus; Mus (Leggada) sp.; Hystrix galeata; Heterocephalus glaber; Pectinator spekei

Order Carnivora

Canis aureus; *Canis mesomelas*; *Vulpes ruppelli*; *Otocyon megalotis*; *Mellivora capensis*; *Genetta genetta*; *Genetta tigrina*; *Crocuta crocuta*; *Hyaena hyaena*; *Felis lybica*; *Felis caracal*; *Panthera pardus*; *Panthera leo*

Order Tubulidentata

Orycteropus afer

Order Hyracoidea

Procavia habessinica

Order Artiodactyla

Phacochoerus aethiopicus; *Tragelaphus scriptus*; *Tragelaphus strepsiceros*; *Tragelaphus imberbis*; *Oryx beisa*; *Gazella soemmerringi*; *Litocranius walleri*; *Madoqua cordeauxi*

Harar Plateau Region

Very little natural vegetation now exists in the Harar-Alemaya area of the Highland Plateau except for isolated remnants on land too steep or rocky to farm. These remnants, and still-forested peaks, suggest that the plateau originally was an evergreen forest formation with two definite associations. Gillett (1941) suggested that the dryer areas supported a *Juniperus* association while at higher altitudes and in more moist areas, a *Juniperus-Podocarpus* association occurred.

Most of the area surrounding the College of Agriculture is now in cultivation (Figure 11), and open areas with grass are kept in a permanent disclimax by heavy grazing and cutting of firewood. Plantings of introduced *Eucalyptus spp*. have largely replaced native trees; however, some remnant *Juniperus* nearby suggests that this part of the plateau was

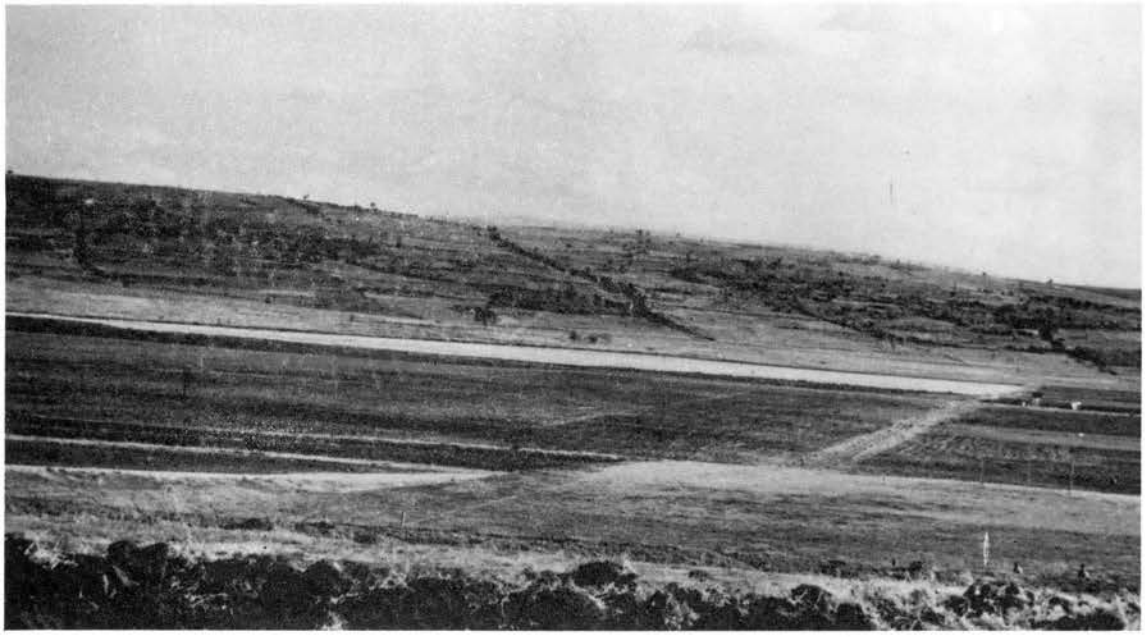

Figure 11. The Harar Plateau at the College of Agriculture. Valley fields are farmed by the College with native farming on the surrounding hills.

Figure 12. The Cultivated Plateau at 7500 Feet

probably a part of the more xeric Juniperus association. As the plateau rises toward the Gara Mullata massif (Figure 12), remnants of the Juniperus-Podacarpus association can still be found.

Mammal collecting from the cultivated plateau was restricted mostly to the College of Agriculture farm, and up the surrounding valley as far as Damota. This area included part of the Lake Haramaya shore line as well as marsh, grasslands, and cultivated fields.

Mammals collected or seen in the Plateau region are:

Order Chiroptera

Rhinolophus clivosus; Hipposideros megalotis; Miniopterus inflatus; Miniopterus schreibersi; Tadarida (Chaerephon) pumila

Order Lagomorpha

Lepus habessinicus

Order Rodentia

Xerus rutilus; Tachyoryctes splendens; Acomys dimidiatus; Arvicanthis niloticus; Lophuromys flavopunctatus; Mus (Leggada) sp.; Mastomys natalensis; Praomys albipes; Rattus rattus alexandrinus Rattus rattus frugivorus; Dendromus insignis; Hystrix galeata

Order Carnivora

Canis adustus; Canis aureus; Mellivora capensis; Viverra civetta; Atilax paludinosus; Herpestes ichneumon; Herpestes (Myonax) sanguineus; Ichneumia albicauda; Crocuta crocuta; Proteles cristatus; Felis lybica; Felis serval; Panthera pardus

Order Tubulidentata

Orycteropus afer

Order Artiodactyla

Sylvicapra grimmia

Southern Slope Region

The vegetation of the southern slope of the Harar Plateau has been described as a deciduous scrub formation by Gillett (1941) who hurriedly visited the area in 1932. It resembles the tree acacia open woodlands of the Scenele area in the Foothill Region, but differs in its greater vegetative density and greater variety of species.

Trees are the dominants in this formation, and away from the rivers they are generally small, with shrubs filling in the gaps making thickets which are difficult to penetrate. The valleys have steep high walls, and differences of several hundred feet may occur in a short distance. Sheer cliffs are not uncommon. This provides many different habitats which may account for the greater number of species both of trees and shrubs.

Trees and shrubs were sampled only in the Dacata Valley which is the central valley of this region. Samples were taken along an east-west compass line at right angles to the valley floor through the major trapping sites, and reflect vegetation from the floor to the top of the granite-covered valley wall. Results of these surveys are recorded in Tables VIII and IX.

The vegetation of this region is not uniform, and much more extensive sampling would be needed to reveal relationships adequately. However, the diverse nature of the tree cover is shown by Table VIII in which 20 species are noted as occurring at least once. Combretum and Commiphora occur most often among the granite boulders along the valley walls (Figures 13 and 14) and on the plateaus between, while Balanites and Acacia are more common on the valley floor.

TABLE VIII

DENSITY AND FREQUENCY OF TREES, DACATA VALLEY

Species Composition	Relative Density %	Absolute Density/ ha	Frequency %	Relative Frequency %
Pappea capensis	6.6	19.0	20.0	6.0
Commiphora africana	13.3	38.3	33.3	10.0
Combretum affimollis	6.6	19.0	20.0	6.0
Lannea schimperi	3.3	9.5	13.3	4.0
Ximenia americana	1.7	4.9	6.6	2.0
Dichrostachys cinerea	10.0	28.8	26.6	8.0
Steganotaenia araliacea	5.0	14.4	20.0	6.0
Ximenia caffra	1.7	4.9	6.6	2.0
Terminalia brownii	6.6	19.0	20.2	6.0
Acacia senegal	3.3	9.5	13.3	4.0
Ochna inermis	1.7	4.9	6.6	2.0
Balanites aegyptiaca	11.6	33.4	40.0	12.0
Acacia tortilis spirocarpa	6.6	19.0	20.0	6.0
Acacia brevispica	6.6	19.0	26.6	8.0
Grewia bicolor	5.0	14.4	20.0	6.0
Grewia villosa	3.3	9.5	13.3	4.0
Acacia nilotica leiocarpa	1.7	4.9	6.6	2.0
Ehretia obtusifolia	1.7	4.9	6.6	2.0
Acacia bussei	1.7	4.9	6.6	2.0
Cordia ovalis	1.7	4.9	6.6	2.0
Totals	99.7%	287.1 Trees/ha	332.8%	100.0%

TABLE IX

DENSITY AND FREQUENCY OF SHRUBS, DACATA VALLEY

Species Composition	Relative Density %	Absolute Density/ ha	Frequency %	Relative Frequency %
Dichrostachys cinerea	6.7	171.7	20.0	7.7
Indigofera sp.	1.7	43.5	6.7	2.6
Ximenia caffra	1.7	43.5	6.7	2.6
Ormocarpum trichocarpum	1.7	43.5	6.7	2.6
Terminalia brownii	3.3	84.6	6.7	2.6
Acalypha volkensii	50.0	1282.0	93.0	35.9
Acacia brevispica	15.0	384.6	40.0	15.3
Grewia bicolor	1.7	43.5	6.7	2.6
Cyclocheilon erianthemum	3.3	84.6	13.3	5.1
Commiphora africana	1.7	43.5	6.7	2.6
Canthium bogosensis	1.7	43.5	6.7	2.6
Grewia villosa	3.3	84.6	13.3	5.1
Acacia senegal	3.3	84.6	13.3	5.1
Balanites aegyptiaca	3.3	84.6	13.3	5.1
Acacia tortilis spirocarpa	1.7	43.5	6.7	2.6
Totals	100.1%	2565.8 Shrubs/ha	260.0%	100.1%

Acalypha volkensii was the most common shrub both on the rocky slopes and on the valley floor where it made up 50% of the total shrub cover. Scrub acacias of various species were the second largest shrub component, accounting for 20%.

On the banks of the seasonal rivers in many places, large Acacia sp. trees formed groves and Tamarix sp. thickets were also numerous. Small groves of Acacia seyal occurred in both the Dacata and Fafan Valleys and appeared to be a favorite food for elephants.

Bermuda grass pastures which were heavily grazed by cattle occupied parts of the valley floor in the Dacata and Fafan, and large stands of the cattail, Typha sp., grew in the sand of the Errer riverbed. The prickly pear cactus, Opuntia sp., occurred in patches throughout the region.

The southern slope of the Harar Plateau with its deep river valleys, and boulder-covered ridges provide a great variety of habitats for mammals (Figures 15 and 16). This slope gradually drops in elevation to the vast plain of the Ogaden. All of the valleys of the Southern Slope Region are a part of the drainage of the Webi Shebeli River, and it is through them that many of the plains' mammals move into the region during the dry season.

Major trapping sites were located on both sides of the Errer Valley, at three locations in the Dacata, and at a single location in the Fafan Valley.

The following mammals were collected or seen in the Southern Slope Region:

Order Insectivora

Elephantulus rufescens; Crocidura smithi; Crocidura occidentalis

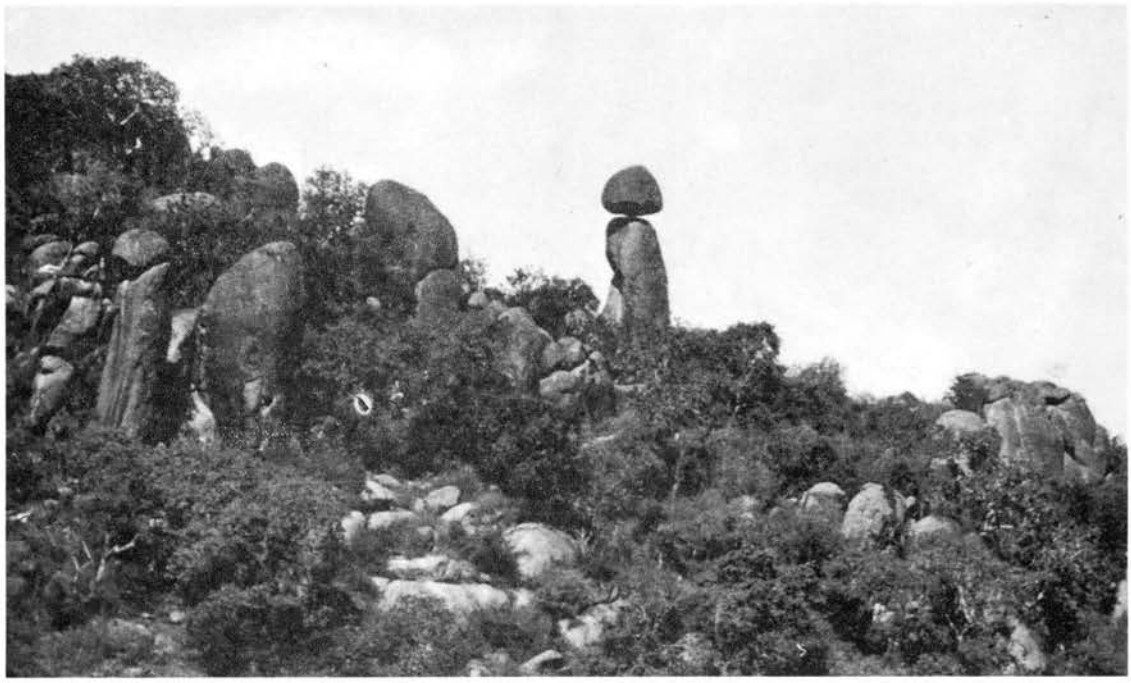

Figure 13. Granitic Formation in the Upper Dacata Valley

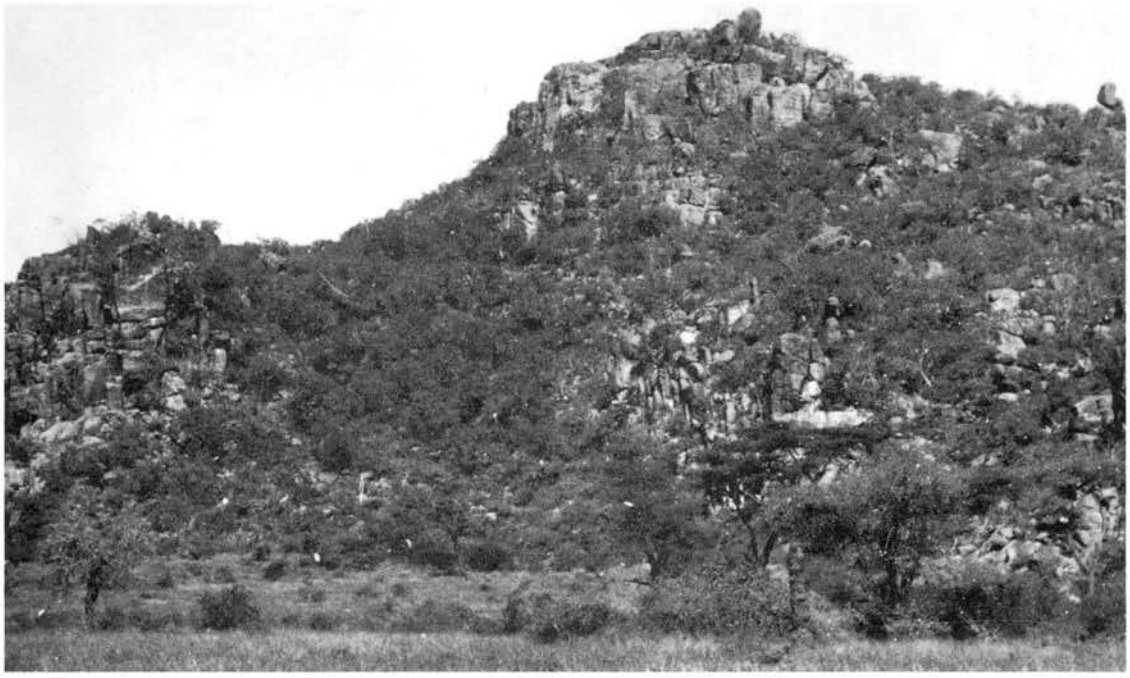

Figure 14. Granitic Walls of the Lower Dacata Valley. Procavia, Dendrohyrax, Felis serval, Panthera pardus, and Oreotragus occur here.

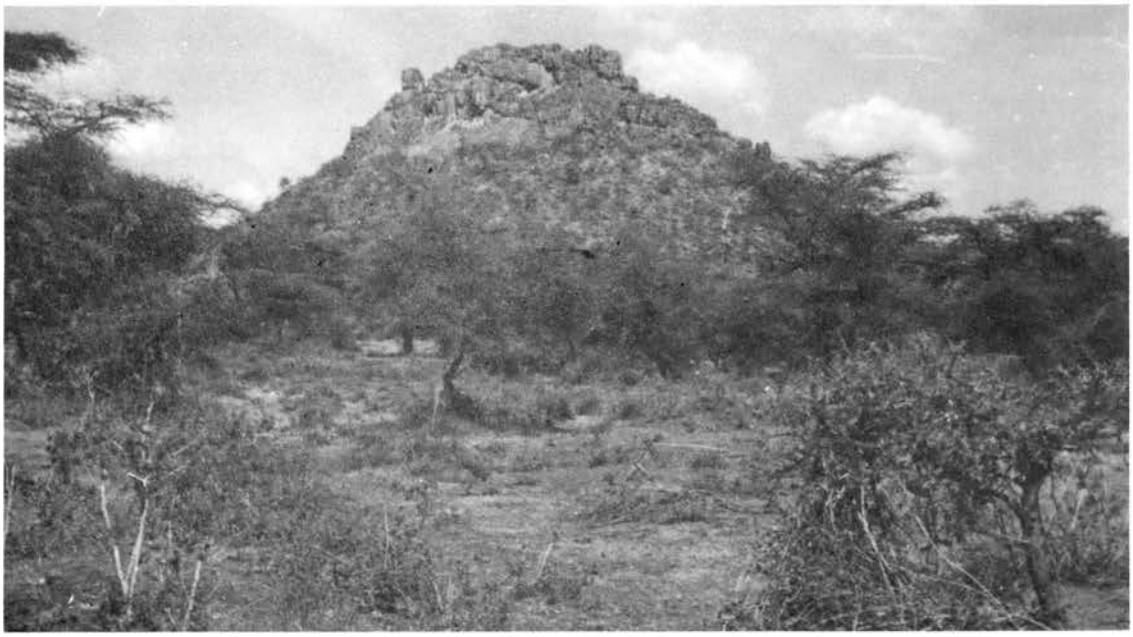

Figure 15. Tree Acacia-Deciduous Scrub in the Errer Valley. A dormitory cliff of Papio hamadryas is in the background. This is typical habitat of Madoqua phillipsi and Xerus rutilus.

Figure 16. Dry Season Aspect of Deciduous Scrub on a Limestone Outcrop Near Daletti. Pectinator and Acomys occur here.

Order Chiroptera

Epomophorus labiatus; *Taphozous perforatus*; *Eptesicus somalicus*; *Scotophilus nigrita*; *Miniopterus inflatus*; Tadarida (Chaerephon) *pumila*; Tadarida (Chaerephon) *bivittata*

Order Primata

Galago senegalensis; *Cerocopithecus aethiops*; *Papio hamadryas*

Order Lagomorpha

Lepus habessinicus

Order Rodentia

Xerus rutilus; *Tatera robusta*; *Acomys dimidiatus*; *Arvicanthis niloticus*; *Mus* (*Leggada*) *sp.*; *Mastomys natalensis*; *Praomys albipes*; *Praomys brockmani*; *Rattus rattus frugivorus*; *Hystrix galeata*; *Heterocephalus glaber*; *Pectinator spekei*

Order Carnivora

Canis aureus; *Canis mesomelas*; *Otocyon megalotis*; *Mellivora capensis*; *Genetta genetta*; *Genetta tigrina*; *Atilax paludinosus*; *Herpestes* (*Myonax*) *sanguineus*; *Ichneumia albicauda*; *Crocuta crocuta*; *Hyaena hyaena*; *Acinonyx jubatus*; *Felis lybica*; *Felis caracal*; *Felis serval*; *Panthera pardus*; *Panthera leo*

Order Tubulidentata

Orycteropus afer

Order Proboscidea

Loxodonta africana

Order Hyracoidea

Dendrohyrax brucei; *Procavia habessinica*

Order Artiodactyla

Phacochoerus aethiopicus; Tragelaphus scriptus; Tragelaphus strepsiceros; Tragelaphus imberbis; Sylvicapra grimmia; Litocranius walleri; Madoqua phillipsi; Madoqua (Rhynchotragus) guentheri; Oreotragus oreotragus

Tropical Montane Forest Region

The vegetation of the Gara Mullata massif was designated by Gillett (1941) as an evergreen forest formation. He noted that a Juniperus-Podocarpus association usually occurs in areas of high altitude and rainfall, but added that plant communities were numerous in this formation, including some in which neither Juniperus nor Podocarpus were present. The cloud forests on the southern face of the massif represent such a community in which neither species occurs (Table X). However, some Podocarpus remnants do remain at 8000 feet at Curfacelli on the east and at the Graua road junction at the southeast end of the mountain.

Trees in the cloud forest above 8000 feet range up to 25 m in height, and form either an open or closed canopy with a definite understory of shrubs and small trees. The shrub layer is interrupted under the closed canopy, but tends to be continuous in the more open forest. Epiphytes are plentiful throughout the region being very conspicuous in the wet season aspect.

Trees and shrubs were sampled at the major trapping site, and the results are recorded in Tables X and XI.

The mixed nature of the cloud forest is evident from the survey (Table X) in which eleven species of trees were noted. The taller trees of the area includes Schefflera abyssinica, which grows to 20 m and made

TABLE X

DENSITY AND FREQUENCY OF TREES, GARA MULLATA SITE

Species Composition	Relative Density %	Absolute Density/ ha	Frequency %	Relative Frequency %
Maytenus englerana	20.0	558.0	50.0	17.2
Dovyalis abyssinica	7.5	209.2	30.0	10.4
Schefflera abyssinica	15.0	418.5	40.0	13.7
Pittosporum lanatum	10.0	279.0	30.0	10.4
Galiniera coffeoides	25.0	697.5	60.0	20.7
Dombeya schimperiana	5.0	139.5	20.0	6.8
Maesa lanceolata	2.5	69.7	10.0	3.5
Premna schimperi	2.5	69.7	10.0	3.5
Lepidotrichilia volkensii	7.5	209.2	20.0	6.8
Hagenia abyssinica	2.5	69.7	10.0	3.5
Allophylus abyssinicus	2.5	69.7	10.0	3.5
Totals	100.0%	2789.7 Trees/ha	290.0%	100.0%

TABLE XI

DENSITY AND FREQUENCY OF SHRUBS, GARA MULLATA SITE

Species Composition	Relative Density %	Absolute Density/ ha	Frequency %	Relative Frequency %
Dombeya schimperiana	7.5	14.1	10.0	4.2
Lepidotrichilia volkensii	7.5	14.1	20.0	8.3
Jasminum abyssinicum	7.5	14.1	30.0	12.5
Galiniera coffeoides	10.0	18.9	40.0	16.6
Allophylus abyssinicus	7.5	14.1	20.0	8.3
Lippia sp.	2.5	4.7	10.0	4.2
Maytenus englerana	15.0	28.3	30.0	12.5
Pavonia ureus	2.5	4.7	10.0	4.2
Dovyalis abyssinica	5.0	9.4	10.0	4.2
Discopodium penninervium	2.5	4.7	10.0	4.2
Acanthus eminens	30.0	56.7	40.0	16.6
Vernonia sp.	2.5	4.7	10.0	4.2
Totals	100.0%	188.5 Shrubs/ha	240.0%	100.0%

up 15% of the total tree composition; Allophylus abyssinicus, which is less common, but may reach 25 m and have a bole of 1 m in diameter; and Hagenia abyssinica, which had a relative density of only 2.5%, but is of particular value to the local people for the anthelmintic properties of its flowers. Smaller trees of the forest are Galiniera coffeoides which is an edge tree that grows to 10 m, and Pittosporum lanatum which may grow to 12 m.

The most common plant of the shrub layer was the woody herb Acanthus eminens which grows to 3 m. Several of the tree species such as Maytenus englerana, Galiniera coffeoides, and Lepidotrichilia volkensii were also important components of the shrub layer.

Epiphytes include the plentiful Usnea sp. and the orchid Diaphananthe schimperiana.

The Gara Mullata massif with its high altitude cloud forest (Figures 17 and 18) constitutes a more uniform habitat for mammals than the other regions studied. Some species were entirely restricted to this region and species of wider distribution usually had a darker pelage in the high forest.

Very little poaching of animals occurs in this region except for some illegal trapping of leopards; however, the continued destruction of the forest is a threat to most of the unique forms from the area.

The following mammals were collected or seen in the Gara Mullata region or on the high Podocarpus-covered ridges near Hirna:

Order Insectivora

Crocidura glassi

Order Chiroptera

Miniopterus schreibersi

Figure 17. The Gara Mullata Massif Above 8500 Feet. The montane forest on the lower slope is the habitat of Crocidura glassi, Colobus, Lophiomys, Lophuromys, and Pelomys harringtoni.

Figure 18. Wet Season Aspect of the Cloud Forest at 8300 Feet on Gara Mullata

Order Primata

Papio hamadryas; *Colobus polykomos*

Order Lagomorpha

Lepus habessinicus

Order Rodentia

Lophiomys imhausi; *Tachyoryctes splendens*; *Lophuromys flavopunctatus*; *Mus* (*Leggada*) *sp.*; *Mastomys natalensis*; *Praomys albipes*; *Pelomys harringtoni*; *Graphiurus* (*Claviglis*) *murinus*

Order Carnivora

Genetta tigrina; *Herpestes sanguineus*; *Ichneumia albicauda*; *Crocuta crocuta*; *Felis serval*; *Panthera pardus*

Order Hyracoidea

Procavia habessinica

Order Artiodactyla

Potamochoerus porcus; *Tragelaphus scriptus meneliki*; *Sylvicapra grimmia*

CHAPTER V

ACCOUNT OF MAMMALS

Order Insectivora

Family Erinaceidae (Hedgehogs)

Atelerix frontalis (A. Smith)

Funaioli and Simonetta (1960) united *A. frontalis* with other species of *Atelerix* and regarded *Erinaceus sclateri* as a subspecies of *A. frontalis*. Corbet (1968) considered *sclateri* as a species of *Erinaceus*, but apparently had overlooked Funaioli and Simonetta's paper.

Two hedgehogs, an adult male and female, were collected alive on the west limestone ridge overlooking the Dabahs River Valley (09°58' N, 42°20' E) 85 km northeast of Dire Dawa on the old Djibuti road. In this area weathered limestone rocks littered the ground. Collections were made in March, 1966, during a period of severe drouth. These two animals were kept alive in the College zoo, where on May 15, 1966, the female gave birth to four young. The male died on May 30, 1966, and the skin and skull were deposited in the Oklahoma State University Museum. It appeared from the mass of undigested exoskeletal material in the feces of the newly captured animals that large millipedes made up the major part of their diet. As far as can be determined from the available literature, this is the first record of *Atelerix* from Ethiopia.

Family Macroscelididae (Elephant shrews)

Elephantulus rufescens Peters

Five specimens of *E. rufescens* were collected along the Urso River (9°39' N, 41°39' E) and one from the Gota River in the Rift Valley, and a single specimen (skull only) was taken from the Bisidimo area of the Errer Valley on the southern slope of the Harar Plateau. The type locality of *E. peasei* (= *E. rufescens*), Hoolul, Abyssinia (Thomas, 1901a), is presumed to be Ullul at the foot of the scarp, west of Dire Dawa. The Urso collecting site is only 8 km to 12 km from Ullul. These six specimens seem to be the only collection made of this animal since the type series was collected. A single specimen was retained at the College of Agriculture Museum, and the rest deposited at the Oklahoma State University Museum.

Family Soricidae (Shrews)

Crocidura smithi Thomas

A single specimen of this shrew was collected from a termite mound by students studying these insects in the Errer Valley in the Southern Slope Region.

Crocidura occidentalis (Pucheran)

This shrew is represented by a single specimen trapped along the Errer River at 4200 feet in an *Opuntia-Acacia* scrub thicket. Previous collections of this shrew were limited to the Central Plateau from southern Gojam, Shoa, Arusi, and Sidamo, where it was thought to be restricted (Osgood, 1936) to altitudes above 6000 feet.

Crocidura glassi de Balsac

Five specimens of this new shrew were collected by Dr. Glass near a rock outcropping in the cloud forest of Gara Mullata at 8300 feet. These specimens were described by de Balsac (1966) as a new species based on skull peculiarities and dentition. The type specimen and one paratype are deposited in the Oklahoma State University Museum and one paratype is in the Museum of Natural History, Paris. Topotypes of this shrew are retained in the Museum at the College of Agriculture in Ethiopia.

Order Chiroptera

Family Pteropodidae (Fruit bats)

Epomophorus labiatus (Temminck)

A long series of the little epauletted fruit bat was collected in the Errer Valley of the Southern Slope Region. These bats feed on the fruit of the prickly pear cactus and are attracted in great numbers to the fruit of the sycamore (false fig) Ficus sycamorus.

Family Emballonuridae (Sheath-tailed bats)

Taphozous perforatus E. Geoffroy

One male and eight female T. perforatus were collected in July, 1963, in the Dacata Valley (09°08' N, 42°29' E) of the southern slope of the plateau. This was the only collection made of these bats which were netted as they emerged from a large fissure in a huge granite block.

Family Nycteridae (Hollow-faced bats)

Nycteris thebaica E. Geoffroy

The type locality of N. t. media is Harar, Abyssinia (Allen, 1939). Two males and two females of this form were collected from the pipe tunnel of an old Italian fuel storage tank 4 km south of Dire Dawa (09°32' N, 41°53' E) at 4100 feet. They were among a cluster of 15 to 20 individuals.

Family Rhinolophidae (Horseshoe bats)

Rhinolophus clivosus Cretzschmar

Four specimens of R. clivosus were collected from buildings at the College of Agriculture, Harar Province. These specimens appear to be the only record of this bat from Ethiopia outside of Eritrea.

Hipposideros megalotis (Heuglin)

The type locality of H. megalotis is Bogos Land, Eritrea (Allen, 1939). H. megalotis is a rare bat in museum collections. Hayman (1960) in reporting on three specimens collected at Sidamo by F. R. Allison, indicated that they were the first to be made in Ethiopia since the original collection. In 1954, Hayman (1960) reported the only other collection of this bat from the Kenya Highlands. A single female was collected in a dormitory room at the College. A second specimen was collected from the hotel at Erer-Gota, in the Foothill Region of the Rift Valley.

Family Vespertilionidae (Simple-nosed bats)

Eptesicus somalicus (Thomas)

Five specimens of E. somalicus were collected from the Errer and Dacata Valleys on the southern slope of the plateau. There seems to be no published record of this bat from Ethiopia. It was reported previously from Hargaisa and Berbera, Somaliland (Thomas, 1901b).

Scotophilus nigrita (Schreber)

This bat was common at lower elevations both on the southern slope and in the Rift Valley. Three specimens were taken with a mist net over water in the Urso River, and fifteen specimens were collected from the Errer and Dacata Valleys on the southern slope. On one occasion two males were taken from a tall termite mound on the sloping plateau between the Dacata and Fafan Valleys. These bats were exposed when the slender chimney of the mound was tipped over.

Miniopterus inflatus Thomas

The type locality of M. i. africana is Sanford's Ranch, Mulo, Shoa district, northwest of Addis Ababa, Ethiopia (Allen, 1939). At the College on the Harar Plateau four specimens were collected when they were attracted to the insects around the lights. Twelve specimens were collected from the Errer Valley on the southern slope at 4200 feet, including two lactating females in July, 1962.

Miniopterus schreibersi (Kuhl)

Four specimens of M. schreibersi were collected over a small open

meadow at 8300 feet in the Gara Mullata Region, and the species is probably sympatric with Miniopterus inflatus on the Harar Plateau.

Family Molossidae (Free-tailed bats)

Tadarida (Chaerephon) pumila (Cretzschmar)

This small free-tailed bat was very common around the College on the Harar Plateau where at least two colonies occupied the attics of houses. A long series was collected from the plateau region, and they were plentiful in the Southern Slope Region especially in the Errer Valley where 16 specimens were taken from under the loose bark of a dead tree.

A single male specimen was collected from the Gota River in the Rift Valley.

Tadarida (Chaerephon) bivittata (Heuglin)

The type locality of T. bivittata is Keren, Eritrea (Allen, 1939). This bat was collected by the Doba River on the Afdem Plain (09°42' N, 40°50' E) and in the Dacata River Valley in the Southern Slope Region.

Tadarida (Chaerephon) nigeriae Thomas

T. nigeriae was collected in the Gota River area of the Foothill Region. A colony was discovered occupying woodpecker holes and the spaces under the loose bark of a dead acacia tree.

Order Primata

Family Lorisidae (Galagos)

Galago senegalensis E. Geoffroy

Galagos were frequently seen in the Foothill Region of the Rift Valley in the riparian acacias along the seasonal streams. Four specimens were taken along the Urso and Gota Rivers.

Galagos were most numerous on the southern slope of the plateau between 4000 and 5000 feet. This area includes the type locality of *G. s. dunni* which is the "headwaters of the Fafan, 35 miles east of Harar, Somaliland" (Dollman, 1910). This is presumed to be Harar, Ethiopia. Seven specimens were collected from the Errer and Dacata Valleys, and seven are topotypes of *G. s. dunni* from the Fafan.

Family Cercopithecidae (Monkeys and baboons)

Cercopithecus aethiops (Linnaeus)

Monkeys were common in the acacia galleries along the seasonal streams, where troops of 40 to 50 were frequently seen. Collections were made in the Errer and Dacata Valleys on the southern slope of the plateau. Stark and Frick (1958) recorded embryos of 110 to 140 mm in females collected in the Errer Valley in March, 1956. In the Foothill Region of the Rift collections were made from the Urso and Gota Rivers. A single male from a small troop was taken from the acacia gallery along the Doba River in the Afdem Plain Region. This was the only time that monkeys were ever observed in that area.

Papio hamadryas (Linnaeus)

The hamadryas baboon occurred throughout the study area where suitable dormitory cliffs were present. They were never seen around

the College or in other intensively cultivated parts of the Harar Plateau except where adjacent to rocky outcrops. They were always numerous near the edge of the scarp where they raided nearby grain fields. Collections of baboons were made on the southern slope in the upper valleys of the Errer, Dacata, and Fafan where they were attracted to the fruit of the prickly pear cactus. Starck and Frick (1958) record a 93 mm embryo from a female collected in the Errer Valley in March, 1956.

Baboons were particularly plentiful in the Foothill Region in the Rift where suitable dormitory cliffs are widespread. Kummer and Kurt (1963) who studied the social structure of P. hamadryas in the vicinity of Erer, reported that nightly concentrations at the cliffs averaged 100, but sometimes were as great as 750. Sixteen specimens were taken from a rock cliff 1 km from the city of Dire Dawa.

Baboons were observed on the Gara Mullata massif above 8300 feet, but were not as numerous as at lower elevations. A single specimen was collected from this region.

Colobus polykomos (Zimmermann)

This beautiful monkey (Figure 19) was common in the Gara Mullata region above 8000 feet where it lived in high trees of the closed-canopy forest. It was also common in the podocarpus forest on the high ridges near Hirna. Five males and three females were collected.

Order Lagomorpha

Family Leporidae (Rabbits and hares)

Lepus habessinicus Hemprich and Ehrenberg

The only lagomorph collected throughout the study area was *L. habessinicus* whose type locality is the "east coast of Abyssinia, near Arkiko" (Allen, 1939). This hare was very common around grassy meadows, and in the grassy river bottoms along seasonal rivers. It was observed and collected at all elevations. Hares were seen along the Doba River at the edge of the Afdem Plain and were collected in the Urso and Gota Valleys and in the dry riverbeds around Dire Dawa. On the College farm at Alemaya they were always present and were common throughout the Harar Plateau. Specimens were collected in the Errer and Fafan Valleys of the southern slope, and a single specimen was collected above 8300 feet at the Gara Mullata collecting site.

Order Rodentia

Family Sciuridae (Squirrels)

Xerus rutilus (Cretzschmar)

The type locality of *X. rutilus* is the "eastern slope of Abyssinia" (Allen, 1939). Ground squirrels were plentiful throughout the drier acacia scrub areas. On the Afdem Plain, seven specimens were collected from the gallery acacia stands and along the acacia bush covered ridges. In the Foothill Region near the escarpment they occurred on the more open ground and around stands of prickly pear cactus. Fifteen specimens were taken from the Valleys of Gota, Erer, Urso, and in the El-bah drainage around Dire Dawa. A female collected on August 2, 1963, contained two fetuses. On the southern slope, ten specimens were collected

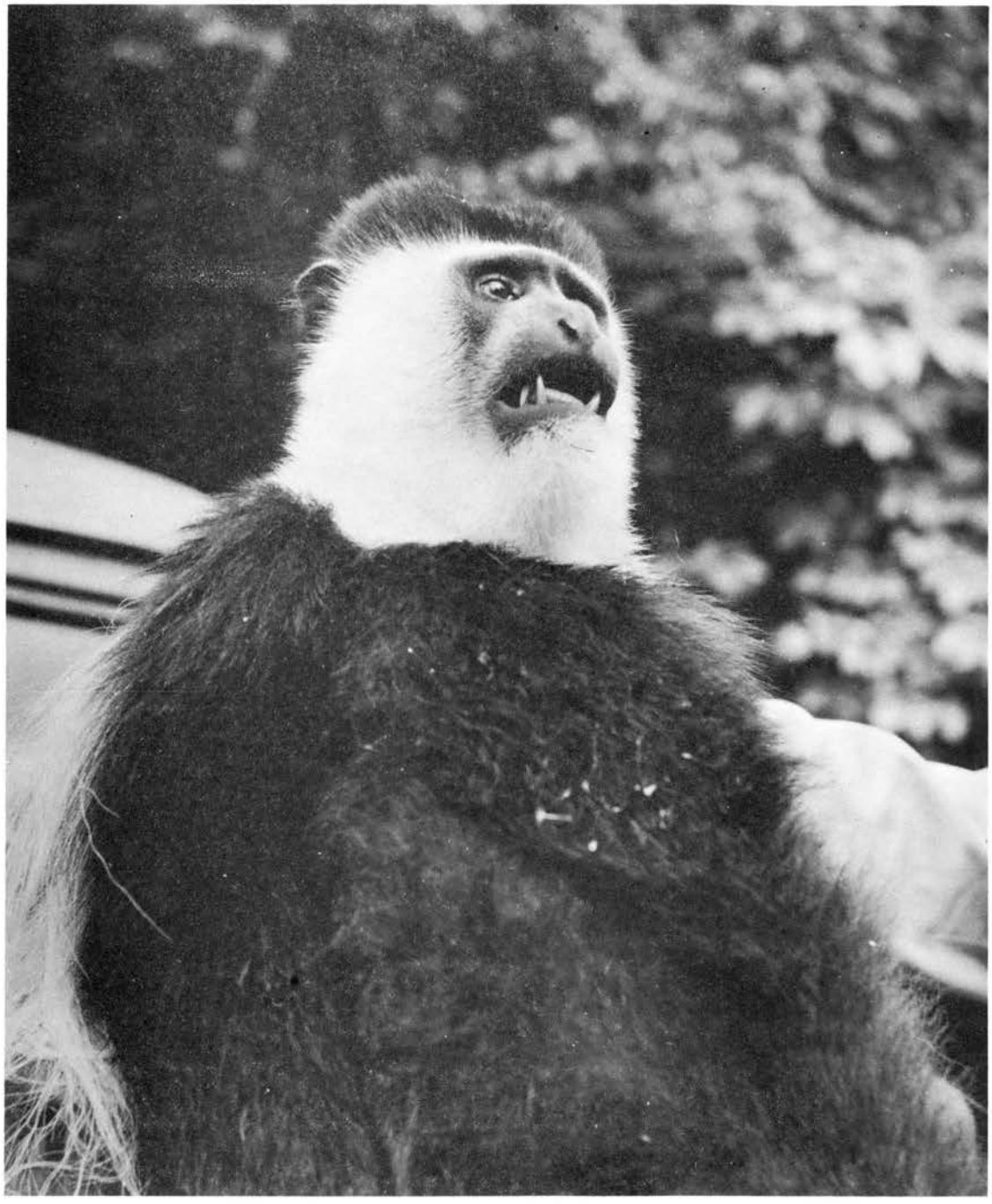

Figure 19. Colobus polykomos Collected at 8300 Feet From the Mixed Cloud Forest on Gara Mullata. They were also found in the Podocarpus forest near Hirna.

from the Errer and Fafan Valleys. A single individual was captured alive at the College on the Harar Plateau. This animal was using a burrow near a corral, and was the only X. rutilus ever seen on the plateau.

X. rutilus appears to molt at all times of the year as considerable variation in the age of the pelage could be observed on animals collected the same day in the same area.

Family Cricetidae (Crested rat and gerbils)

Lophiomys imhausi Milne-Edwards

The crested rat is represented in the collection by a single specimen trapped at 8300 feet on the Gara Mullata massif (09°11' N, 41°47' E). This seems to be the first collection of this rodent from the Eastern Chercher Highlands. A second specimen was captured alive in the same area and maintained in the College zoo at Alemaya.

Tatera robusta (Cretzschmar)

T. robusta was a common gerbil of the lower elevations where it was found in short grass or scrub brush areas. These rodents were easily trapped or captured by hand as they jumped before the car lights or jacklight. Six specimens were collected on the Afdem Plain in sparse grass cover. In the Foothill Region near the escarpment 34 specimens were taken from the Gota and Urso Valleys. Eight specimens were collected from the Errer Valley on the southern slope of the plateau.

Tatera sp.

Two specimens of a medium-size gerbil with a tufted tail (measurements in Appendix) were collected on the Afdem Plain and in the Bisidimo area of the Errer Valley on the southern slope.

Microdillus peeli (De Winton)

This small gerbil was collected in January, 1964, when two males and two females were taken on the Afdem Plain (09°41' N, 40°50' E). These specimens were collected in the same habitat as T. r. shoana and were captured by hand as they jumped in the jacklight. The type locality is Eyk, Somaliland (De Winton, 1898). M. peeli is extremely rare in museum collections and this collection represents the first record from Ethiopia. These specimens, along with eight more recently received from Dr. John Beadles, are deposited in the Oklahoma State University Museum.

Family Rhizomyidae (Mole rats)

Tachyoryctes splendens (Ruppell)

Mole rats are common throughout the Harar Plateau Region and in the Gara Mullata massif. In some areas they become agricultural pests, especially in forest nurseries (Ingersol, 1966). Eight specimens were collected from open grassy patches in the Gara Mullata region above 8300 feet, and 100 were trapped on the College farm on the plateau. Specimens from the College show considerable color variation in even adult animals from the same field, ranging from a light, pallid buff to dark grey with a dark brown color being most common. The Gara Mullata

specimens were more uniformly colored and matched the darkest specimens from the plateau. Average measurements from this collection are very similar to those recorded for T. s. somalicus by Neumann and Rummler (1928).

Family Muridae (Rats and mice)

Acomys dimidiatus (Cretzschmar)

Spiny mice occur from 6900 feet on the Harar Plateau down to 2800 feet on the Afdem Plain. Three specimens of A. dimidiatus were collected from the limestone ridges in the Damota area (09°25' N, 42°03' E) near the College, where they seem to be restricted to rocky outcroppings. On the southern slope 20 specimens were collected in the acacia scrub of the Errer and Fafan Valleys. At Daletti (08°33' N, 42° 07' E), on the Gobelli River 100 km south of Harar, this was the only murid collected in five hundred trap nights of collecting.

In the Gota and Urso Valleys, at the base of the escarpment, 23 specimens were trapped. A single specimen was taken among surface rocks on the basaltic ridges near the Doba River in the Afdem Plain Region.

The type locality of A. d. mullah is Harar, British Somaliland, (Thomas, 1904), which is assumed to be Harar, Ethiopia.

Arvicanthis niloticus (Desmarest)

This rat was one of the most common murids collected and was trapped at all elevations except in the Montane Forest Region. Several sub-species may be represented.

Two specimens were trapped from Cadaba thickets on the Afdem Plain. In the Foothill Region next to the escarpment this was the most plentiful murid, with easily-observed runways wherever there were scrub thickets. Seventy specimens were trapped from the Urso and Gota Valleys. On the southern slope of the plateau, 10 specimens were taken from the Errer Valley.

Large populations of this rat lived in the pastures and grassy borders around gardens and fields on the Harar Plateau. Fifty specimens were trapped on the College farm and surrounding area.

Lophuromys flavopunctatus Thomas

This reddish-brown mouse was very abundant on the cultivated plateau and at the higher altitude of the cloud forest in the Gara Mullata region and in the podocarpus forest near Hirna. The fur of this mouse is silky and sleek, with the specimens from the Plateau Region being somewhat lighter in color than those from the forested areas above 8000 feet. Twenty-three specimens were trapped from the Plateau Region at Damota and the College farm. Forty specimens were taken from Gara Mullata and ridges near Hirna above 8000 feet.

Mus (Leggada) sp.

Several Mus sp. were collected from the College farm and from areas on both sides of the plateau; however, their specific identity has not been determined.

Rattus-like Genera

There is considerable confusion on the Rattus-like genera of

Africa as pointed out by Setzer (1956). Ellerman et al. (1953) considered Mastomys and Praomys (the genera considered here) as sub-genera of Rattus. Setzer (ibid.), while pointing out the need for a complete revision, stated that for the Anglo-Egyptian Sudan Mastomys and Praomys could be distinguished from Rattus at both the generic and specific level and recognized that Praomys contained the names previously referred to Myomys.

Subject to revision, the Rattus-like specimens from the Chercher Highlands appear to be separated from Rattus on the generic level, and have been so identified tentatively.

Mastomys natalensis (A. Smith)

This multi-mammate rat is the most common rat of the fields on the Harar Plateau, and is plentiful in the Errer Valley of the Southern Slope Region. It was never found in the Danakil Rift. On the Harar Plateau at 6500 feet, M. natalensis is found in the same fields with a long-tailed rat, Praomys albipes. Trapping success indicates an altitudinal distribution of these two forms with P. albipes most numerous over 8000 feet, and plentiful at 6500 feet, while M. natalensis was most numerous at 6500 feet, and plentiful at 4000 feet.

Fifteen specimens of M. natalensis was collected from the Errer Valley on the southern slope, and 52 specimens taken from the Harar Plateau.

Praomys albipes (Ruppell)

Praomys contains the rats formerly referred to Myomys (Setzer, 1956). Osgood (1936) and Allen (1939) suggested that Epimys rufidorsalis

ankoberensis Frick from Ankober, Shoa at 7500 feet and E. r. alettensis Frick from Aletta, Sidamo, at 6000 feet are synonyms of P. albipes. Measurements of P. albipes from the Chercher Highlands closely correspond to those recorded by Frick (1914) for E. r. ankoberensis.

Sixty specimens of P. albipes were collected from the Gara Mullata massif at 8300 feet. Twenty specimens were collected from the Harar Plateau at 6800 feet where they lived in the same fields with M. natalensis.

Praomys brockmani (Thomas)

The type locality of P. brockmani is Upper Sheikh, British Somaliland (Thomas, 1906). Six specimens of this small rat were trapped in the Dacata and Fafan Valleys at 4500 feet on the southern slope, but they did not seem to be plentiful. All specimens came from small areas where there was a dense ground cover of dead grass.

Pelomys (Desmomys) harringtoni Thomas

The type locality of P. harringtoni is Katchisa, Kutai, western Shoa, Abyssinia (Thomas, 1902). Thomas (1928) in commenting on specimens collected by R. E. Cheesman near Lake Tana, included P. harringtoni with animals "only known from one or two previous examples." Four specimens of this rat were taken from the Gara Mullata massif at 8300 feet, which seems to be the first record of this rat for the Eastern Highlands.

Rattus rattus (Linnaeus)

This common house rat was collected many times from the buildings

and houses at the College of Agriculture. Although R. r. alexandrinus was only collected at the College, it is probably present in all regions where man has permanent houses.

The cream-bellied feral race of R. rattus, sometimes recognized as a separate subspecies R. r. frugivorus (Rafinesque) was usually trapped in the fields at the College but a few specimens were taken from outbuildings on the farm. A single specimen was collected in the acacia scrub in the Errer Valley on the southern slope of the plateau.

Dendromus insignis Thomas

The type locality of the Ethiopian form is Mount Albasso, Chilalo Mountains, Arussi, Ethiopia at 11,000 feet (Osgood, 1936). Six specimens of this mouse were collected on the College Farm and in the nearby Damota area at 6800 feet. This buffy brown mouse has a distinct middorsal black stripe and only three well developed digits on the front feet. This seems to be the first record of this mouse since Osgood collected it 30 years ago.

Family Gliridae (Dormice)

Graphiurus (Claviglis) murinus (Desmarest)

Eight specimens of dormice were collected in the cloud forest on Gara Mullata in small snap traps placed at the base of trees or on horizontal branches.

Records of dormice from Ethiopia are apparently rare, as Hayman (1960) stated that he had not seen any published list of Ethiopian small mammals which included it. Hayman (ibid.) reported on a fragmentary specimen in the Allison collection which was taken in Sidamo

Province which he considered to be G. m. saturatus. Hayman listed only one previous Ethiopian specimen in the British Museum, collected by Drake-Brockman in Arussi. The eight specimens collected on Gara Mullata represent the longest series of Ethiopian dormice collected to date.

Family Hystricidae (Porcupines)

Hystrix galeata Thomas

Porcupines (Figure 20) were recorded throughout the study area except above 8000 feet on Gara Mullata. A hole, said by Ethiopians to be a porcupine hole, was seen near Hirna at 8000 feet. A single specimen was collected from the Afdem Plain by the Doba River, and was the only one ever seen in the area. Porcupines were frequently seen in the Foothill Region next to the scarp, particularly around cultivated fields. A single specimen was collected near Dire Dawa in the El-bah drainage. In the cultivated area of the plateau, porcupines lived in old aardvark holes and made nightly raids on neighboring vegetable gardens and fields. Three adults and one juvenile were trapped from a single den at Damota near the College. A specimen was captured alive on the College farm.

Porcupines were seen several times on the southern slope east of Harar.

Family Bathyergidae (Mole rats)

Heterocephalus glaber Ruppell

This small rodent lives entirely underground and appears entirely naked except for scattered tactile bristles and a fringe of fine hair around the edge of the foot. The eyes are rudimentary, but the response

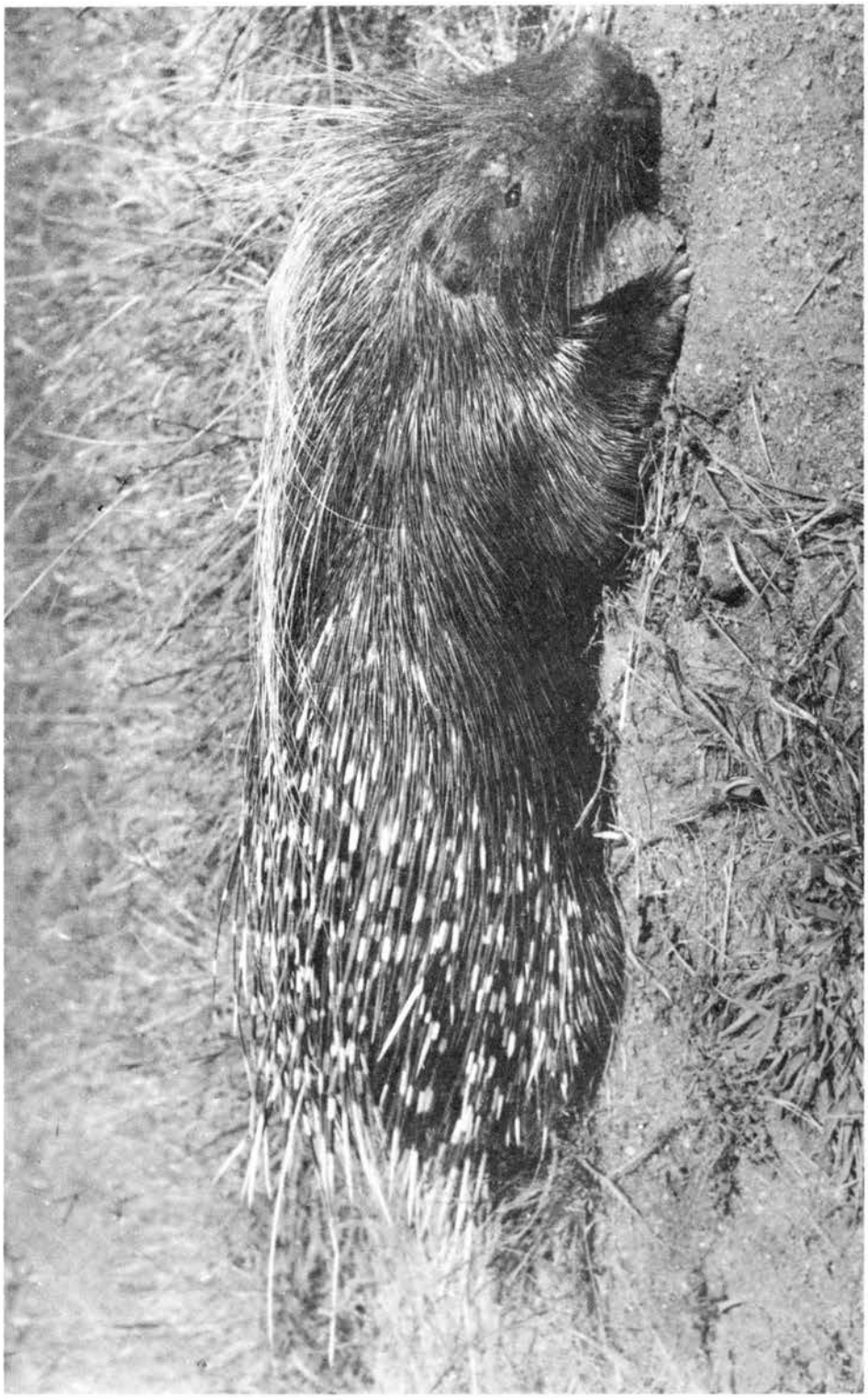

Figure 20. Hystrix galeata. The species occurred throughout the study area up to 8000 feet.

to vibrations is acute. The presence of H. glaber is easily determined by the presence of fresh cone-shaped mounds of loose earth which resemble miniature volcanoes. When an animal is actively excavating at a mound a small stream of dirt sprays out of the center. Conventional gopher traps were too large to be inserted in the tunnel, so the best collecting success was achieved by thrusting a long-bladed shovel under the animal while it was ejecting dirt.

In the foothill region specimens of H. glaber were collected in the city of Dire Dawa among patches of prickly pear cactus, and active funnels were observed at various places along the road west to Erer. Large colonies were found as far as 25 km out on the Rift floor between the Erer and Urso Rivers. This may well be the western limit of their distribution in this part of the Rift, as no colonies were ever seen west of the Erer River.

On the southern slope of the plateau H. glaber was observed only in the Errer Valley, but it doubtless also occurs in the Fafan Valley and in other places where the soil is suitable. Several colonies were found on the east side of the river and along the sandy banks far downstream. A colony near Bisidimo was studied by Stark (1957).

Family Ctenodactylidae (Gundis)

Pectinator spekei Blyth

This small rodent is the only Ethiopian representative of the family Ctenodactylidae. Two specimens were collected on the rocky hill Gara Barcia (09°42' N, 41°09' E) 45 km east of Dire Dawa and, along the west ridge above the Dabahs River Valley at 95 km.

The only other place these animals were collected was at Daletti (08°33' N, 42°07' E) above the Gobelli Valley, 100 km south of Harar on the southern slope where twelve specimens were taken. A female collected on August 8, 1963, contained a 32 mm embryo.

P. spekei were seen only in areas of exposed and weathered limestone in rock piles and ledges which were also being used by Procavia. They were never found among granite outcroppings which Procavia also used.

Previous Ethiopian collections of P. spekei have been made by O. de Beaux at Assab, Eritrea (Allen, 1939). Blanford (1870) collected P. spekei at Hadoda on the Eritrean coast and in the passes from Zoullea to Senafe, and he supplied specimens to Peters (1871) who described the soft anatomy.

The type locality is "between Goree Bunder and Nogal, Somaliland" (Allen, 1939).

Order Carnivora

Family Canidae (Jackals, Foxes)

Canis adustus (Sundevall)

Coetzee (1967) has assigned all Canis adustus from Ethiopia to the kaffensis subspecies. Six specimens of this jackal were collected from the Harar Plateau at 6800 feet, where it was a common visitor to the College farm. Two animals were captured alive on the farm for exhibit in the College zoo.

Canis aureus Linnaeus

Canis aureus was collected throughout the study area except on Gara Mullata above 8000 feet. This was the most common jackal on the Afdem Plain, where they could often be seen in the daytime in the shade of cadaba bushes. Three specimens were collected from the plains area.

Two specimens of C. aureus were collected near Jaedorra on the Erer River and they were common throughout the Foothill Region, especially in the El-bah drainage near Dire Dawa. Four specimens were taken from the College farm on the Harar Plateau and three were collected from the Errer and Fafan Valleys on the southern slope.

Canis mesomelas (Schreber)

The black-backed jackal was occasionally seen on the Afdem Plain, and two specimens were collected from this region. In the Foothill Region next to the escarpment it was collected in the Gota and Urso Valleys. On the southern slope of the plateau C. mesomelas was the most common jackal of the region and eight specimens were taken from the Errer, Dacata, and Fafan Valleys.

Vulpes ruppelli (Schinz)

A single female specimen of Ruppell's fox was collected on the open plain adjacent to the Erer River (09°53' N, 41°20' E) in November, 1964. These animals are apparently rare in the study area as this was the only one ever seen. This fox is about the size of Otocyon megalotis but has a longer white-tipped tail. The head and back of ears are a rufous red, and a reddish dorsal stripe extends to the base of the tail.

The type locality is Berbera, Somaliland (Thomas, 1918). Measurements of this specimen (Appendix) are identical in several respects to those recorded by Thomas (1918) for the type specimen of V. r. somaliae.

Lycaon pictus (Temminck)

Hunting dogs were never seen or collected from the study area although natives of the Afdem Plain Region reported having seen them there. Von Rosen (1953) reported them present on the Mulu River of the Afdem Plain, and a record is reported from Edaballa, near the Hawash River (Allen, 1939) to the west. The hunting dog is not a common animal anywhere in Ethiopia (von Rosen, 1953), but it probably comes on the Afdem Plain at intervals. There is a mounted head in the administrative office of the Leprosarium at Bisidimo, which probably was from an animal shot in the upper Errer Valley.

Otocyon megalotis (Desmarest)

The bat-eared fox was a common animal of the Afdem Plain where they usually were seen in pairs or small family groups. Four males and two females were collected from this region. In the Foothill Region these animals were often seen along the road or in the dry riverbeds. Three specimens were collected near the Urso River.

The southern slope of the plateau at 4500 feet was the highest elevation at which O. megalotis was found, and here they do not seem as plentiful as in the Rift Valley. Two specimens were collected in the Errer Valley.

Family Mustelidae (Ratel)

Mellivora capensis (Schreber)

Ratels were seen on several occasions, but were never collected except for a sub-adult male which was captured alive on the College farm at 6800 feet. This animal was kept alive in the College zoo and became very tame. In the Foothill Region of the Rift Valley ratels were occasionally seen in the dry riverbeds. On one occasion in the Erer Valley an adult pair were observed as they repeatedly tried to climb a tree to reach a leopard's cache.

On the southern slope of the plateau ratels were seen in the Errer and Dacata Valleys but could never be collected. Two very small juveniles were seen on the road a few kilometers southeast of Harar in late October. These animals are difficult to collect as they do not hold under a jacklight.

Family Viverridae (Civits, genets, and mongooses)

Genetta genetta (Linnaeus)

Coetzee (1967) synonymized G. g. hararensis Neumann with G. g. senegalensis but stated that it might well represent the Ethiopian and Somalia forms. The type locality of G. g. hararensis is Harar, Abyssinia (Allen, 1939).

G. genetta was found in all regions of the study area except on Gara Mullata above 8000 feet, where only G. tigrina was taken. On the Afdem Plain at 2800 feet three specimens were collected from riparian acacia along the seasonal rivers. Five specimens were taken from the

Gota, Erer, and Urso Rivers next to the escarpment, and genets were common in the El-bah drainage near Dire Dawa.

Two specimens of G. genetta were collected from the College farm on the plateau, which would be virtual topotypes of G. g. hararensis. In the thick scrub of the Southern Slope Region G. genetta was very common, with eleven specimens being taken from the Errer and Dacata Valleys. Although G. genetta and G. tigrina may occur in the same area, G. genetta seems to prefer the lower drier habitats as observed by Coetzee (1967) and G. tigrina is more common in higher and more moist regions.

Genetta tigrina (Schreber)

Coetzee (1967) rejected Genetta amer Ruppell as unidentifiable, and used G. t. schaderi Matschie for the Ethiopian form of G. tigrina. He regarded G. t. matschiei whose type locality is Harar, Abyssinia as a synonym of G. t. schaderi.

G. tigrina was the only genet taken in the Gara Mullata region above 8300 feet, where four specimens were collected. A single specimen was taken on the College farm at 6800 feet and two were collected from the Dacata and Errer Valleys in the Southern Slope Region.

The only collection made in the Rift Valley was a single specimen taken from the riparian acacia by the Doba River on the Afdem Plain, but they doubtless occur in small numbers throughout the Foothill Region closer to the escarpment.

Viverra (Civettictis) civetta Schreber

The older name Civettictis was given subgeneric rank under Viverra

by Ellerman et al. (1953), and this is followed by Coetzee (1967).

Civets were a common animal on the Harar Plateau and in the Southern Slope Region, but were not collected in the Rift Valley or the Montane Forest Region. Seven specimens were collected from the College farm, and four from the Errer and Dacata Valleys of the southern slope.

Atilax paludinosus (G. Cuvier)

Five specimens of A. paludinosus were collected and they were frequently seen along the marshy shore of Lake Haramaia on the College farm. A single specimen was collected near Bisidimo in the Errer Valley on the southern slope, and others were seen along the Errer River on several occasions.

The pelage of these specimens is a brownish-black with much more obscure banding of the guard hairs than in the grizzled variety from East Africa.

This collection seems to be the first made from the Eastern Highlands of Ethiopia. Thomas (1928) included A. p. mitis in a list of Ethiopian mammals collected by Major Cheesman near Lake Tana.

Herpestes ichneumon (Linnaeus)

A single specimen of H. ichneumon was collected at Damota near the College in November, 1963. This mongoose was never recognized or collected at any other time. Von Rosen (1953) reported the species as occurring in the valleys east of Harar.

Herpestes (Myonax) sanguineus (Ruppell)

Myonax was used as the generic name for this mongoose by Allen

(1939), but it was regarded as a subgenus of Herpestes by Swynnerton (1950), Setzer (1956), and Coetzee (1967).

H. sanguineus was found throughout the study area at all elevations. They were common along the rocky volcanic ridges and around cadaba thickets in the Afdem Plain Region. Specimens taken from this region appear somewhat smaller and lighter in color than those from the highlands. A single specimen was collected from the limestone ridge at the top of the valley near the College. Two melanistic specimens were collected among granite boulders in the Fafan Valley on the southern slope and others of this coloration were seen in the Dacata Valley. Two dark reddish-brown specimens were collected from the Gara Mullata region at 8300 feet.

Ichneumia albicauda (G. Cuvier)

The white-tailed mongoose appeared to be most plentiful on the cultivated plateau. At the College these animals could be seen each night around garbage cans and under the lights where they were attracted by insects. Fifteen specimens were collected from the College farm and the Damota area. A single specimen was collected at 8300 feet in the Gara Mullata region, and five specimens were taken in the Errer and Dacata Valleys in the Southern Slope Region.

Family Hyaenidae (Hyaena)

Crocuta crocuta (Erxleben)

Allen (1939) recognized C. c. habessynica as a valid subspecies of Ethiopian and Somalian hyaenas, but Coetzee (1967) recognized no subspecies.

The spotted hyaena was a common animal at all elevations from the Afdem Plain at 2800 feet to the Montane Forest Region at 8300 feet. Large packs of spotted hyaenas converge on the cities of Dire Dawa and Harar each night, and periodic poisoning has been necessary to control their numbers on the College farm. Specimens were taken from all regions.

Hyaena hyaena (Linnaeus)

The striped hyaena is less noisy and much shyer than *Crocuta*, and was found in the drier less populated areas. Two males and one female were collected on the Afdem Plain, and a single male was taken near the Urso River at the foot of the escarpment. The species was more plentiful in the valleys of the southern slope where five specimens were collected from the Errer, Dacata, and Fafan Valleys.

Family Protelidae (Aardwolf)

Proteles cristatus (Sparrman)

Anderson and Jones (1967), Swynnerton (1950), and Setzer (1956) considered *Proteles* in the sub-family Protelinae under family Hyaenidae. Ellerman et al. (1953) and Coetzee (1967) have kept it in a separate family Protelidae. Coetzee (ibid.) provisionally recognized only two races with *P. c. septentrionalis* including forms from central and northeast Africa. The literature does not reveal any previous collections from Ethiopia.

Two specimens of the aardwolf were collected on the Afdem Plain and animals were seen on two other occasions. These animals are nocturnal and resemble a miniature striped hyaena. They occurred singly

and always on the open plain. The stomach contents of collected specimens consisted entirely of termites. The dentition of the aardwolf reflects their insect diet, with the cheek teeth consisting of small, rudimentary, peg-like teeth separated by wide diastemas, although the canines are well developed. The tongue is modified into a long slender organ with numerous large papillae. A female taken in May, 1964, contained three embryos.

The only other specimen of P. cristatus collected was a female found dead on the road at Amarresa (09°18' N, 42°07' E) near Harar on the plateau, where it apparently had been killed by a car. This record is quite unusual because the Amarresa area is heavily populated and is surrounded by cultivated land.

Family Felidae (Cats)

Acinonyx jubatus (Schreber)

Allen (1939) recognized three races of East African cheetahs but Swynnerton (1950) considered it doubtful if any deserved subspecific distinction from the typical form of South Africa. In the event a subspecies name is required Swynnerton (ibid.) concluded that A. j. ngorongorensis would have priority over A. j. velox and A. j. raineyi, although all three were published in 1913 and the date of publication of A. j. ngorongorensis seems to be in doubt. Funaioli and Simonetta (1960) applied the name A. j. velox Heller to specimens collected from Somalia.

Cheetahs were seen in small grassy areas close to acacia bush on the Afdem Plain on four occasions. They were never observed on the

open plain. Although gazelles are probably their principal prey and were plentiful in the area a female with half-grown cubs was observed on one occasion killing a hare. The only other record of cheetah in the Rift Valley was a pair which were photographed 30 km east of Dire Dawa near Gildessa.

On the southern slope of the plateau cheetahs were seen on several occasions around open meadows in the Dacata Valley where two sibling subadults were collected.

Felis lybica Forster

No records of previous collections of F. lybica from the Eastern Ethiopian Highlands have been found.

The African wildcat was common at lower elevations and on the plateau at 6800 feet. Five specimens were taken on the Afdem Plain where they were frequently seen in areas of tall bunch grass. Three specimens were collected along the Erer and Gota Rivers and sight records were made in the Urso and El-bah areas.

Two specimens were collected in the Damota area near the College at 6800 feet, and this cat was sometimes seen in the fields on the College farm. F. lybica were plentiful on the scrub-covered southern slope, particularly in the Dacata Valley.

Felis caracal Schreber

The generic name for the caracals has been changed repeatedly between Lynx and Felis, with most American mammalogists using Lynx and most European mammalogists using Felis (Anderson and Jones, 1967). Setzer (1956) followed Ellerman et al. (1953) in using Felis, although

stating that his usage was not an attempt to arbitrate. Funaioli and Simonetta (1960) have used Lynx in describing Somalian caracals. Anderson and Jones (1967) recognized Felis. Allen (1939) used Caracal Gray.

Caracals were seen several times in areas which had shrub thickets. In the Foothill Region next to the scarp they were seen in the Erer Valley and were collected in the Gota and El-bah areas. On the southern slope of the plateau they were collected from the Errer and Dacata Valleys.

Felis serval Schreber

Serval cats were never collected or seen in the Rift Valley. On the Harar Plateau these cats were very common at night in cultivated fields. Twelve specimens were collected from the College farm. Servals were also very common in the Southern Slope Region where five specimens were taken from the Errer, Dacata, and Fafan Valleys. A single specimen was collected in the Gara Mullata region at 8300 feet.

Panthera pardus (Linnaeus)

Leopards occurred in all parts of the study area. On the Afdem Plain at 2800 feet a handsome pair was photographed by a colleague in August, 1965. This pair had emerged from the dry Mulu River onto the open plain.

Leopards were common in the Foothill Region west of Dire Dawa, where villagers reported their raids on sheep and goats. Leopards were sighted on the upper and lower Erer River and in the Urso area.

They were never seen in the immediate vicinity of the College, but

wooded areas on the plateau have occasionally been visited. A pair of young cubs were seen 30 km west of the College catching locusts during a locust swarm.

Leopards were seen several times in the valleys in the Southern Slope Region, most often in the Dacata Valley (Figure 21). The granite boulders in this valley provided not only good cover for the leopards, but supported a large population of hyrax which were apparently easy prey. Stomach contents of three leopards from the Dacata Valley consisted only of hyrax remains. The preying of leopards on hyrax has been noted by Turner and Watson (1965).

A single adult female leopard was collected on Gara Mullata at 8300 feet.

Panthera leo (Linnaeus)

Lions were common at the lower elevations in both the Rift Valley and on the southern slope of the plateau. On the Afdem Plain lions were the most common of the big predators, but were never as plentiful as might be expected with such a large population of potential prey. When the plain was heavily grazed by livestock sightings were restricted to the area around the hot spring. During a period (September, 1964 to May, 1966) when people were out of the area, a lion was recorded on the Mulu River in the open plain. A female with small cubs was sighted in May, 1964.

Lions ranged throughout the Foothill Region. Prides were seen on the Gota River, at several places on the Erer, and also around Dire Dawa where they patrolled the dry rivers to the edge of the city. In 1965, a large pride of lions moved into the Scenele area where they

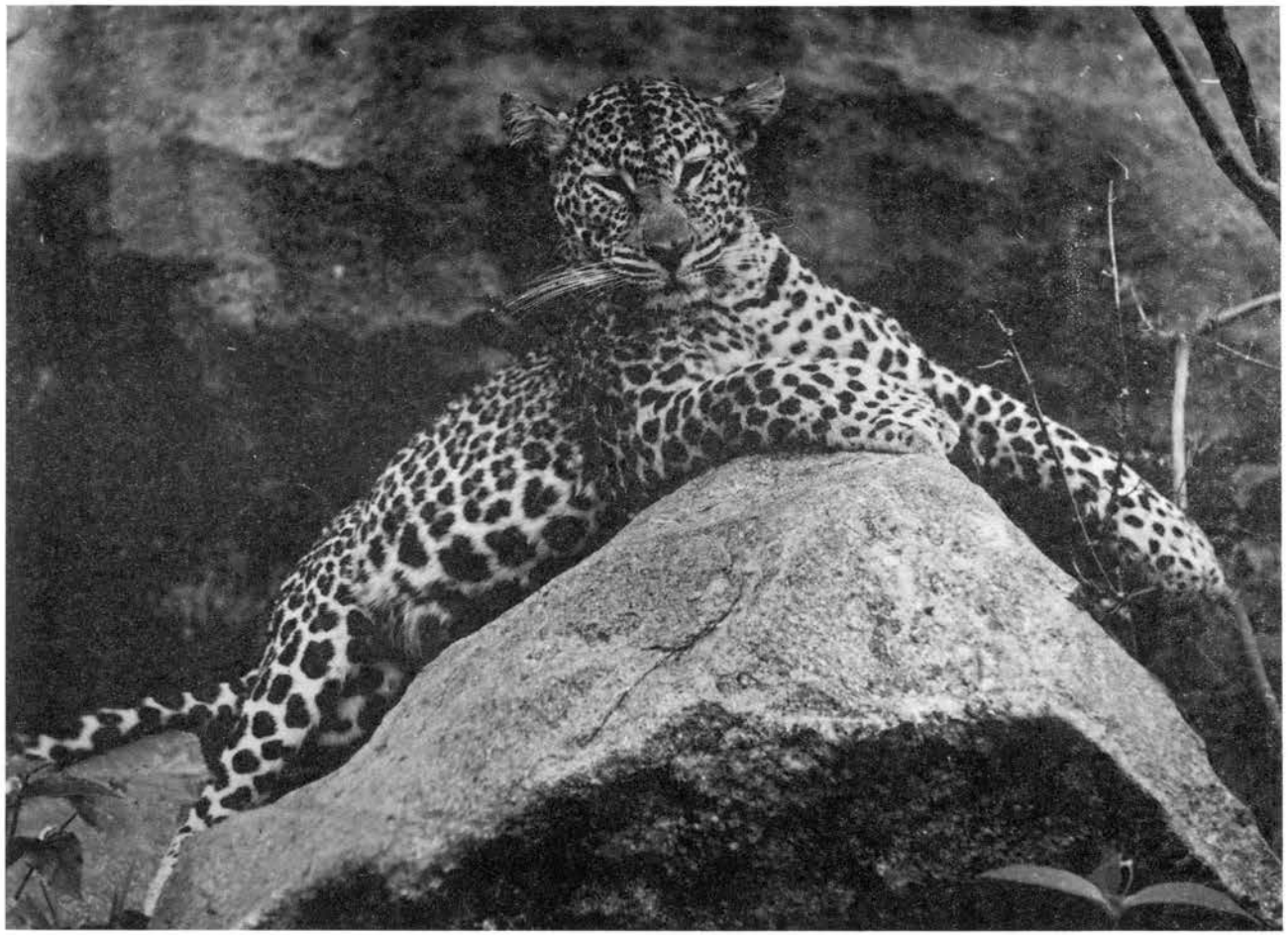

Figure 21. Panthera pardus in the Dacata Valley of the Southern Slope Region. There was no vertical stratification of leopards in the study area.

killed two men and made nightly raids on village livestock.

Lions were found in all of the valleys on the southern slope of the plateau, and were particularly plentiful when the Somalis' cattle herds were in the area. Some lions follow the herds as they move into the valleys during the dry season. In September, 1965, the kills of five different prides were located in a single afternoon in the Dacata Valley within a radius of 15 km. Lions preyed mostly on domestic livestock, but warthog kills were sometimes found. The valleys east of Harar are noted for occasional man-eating lions (von Rosen, 1953), and one was present in the Errer Valley in 1961.

Order Tubulidentata

Family Orycteropodidae (Aardvark)

Orycteropus afer (Pallas)

Aardvarks were numerous and active throughout the study area except above 8000 feet in the Montane Forest Region. Their extensive digging provided holes and dens for many other animals. Four specimens were taken from the Afdem Plain, and their diggings were often seen in the Erer and Urso areas of the Foothill Region.

On the College farm at 6800 feet, aardvarks were seen on several occasions and signs of nightly digging were plentiful. A single specimen was collected on the College farm and one was taken from the Dacata Valley on the southern slope of the plateau.

Order Proboscidea

Family Elephantidae (Elephants)

Loxodonta africana (Blumenbach)

Allen (1939) listed several subspecies of elephants, but pointed out that their status was uncertain. Ansell (1967a) has recognized two races with the name L. africana applying to the bush elephant.

Elephants occurred in the study area only in the valleys east of Harar in the Southern Slope Region. They were recorded in this region by early travelers (Swayne, 1895; Paulitschke, according to von Rosen, 1953) and were apparently numerous up to 1900 when they were mercilessly hunted for their ivory (Pankhurst, 1964). However, the conclusion of von Rosen (ibid.) and Pankhurst (ibid.) that elephants no longer occurred in the area is erroneous. In 1959 the writer observed a herd in the upper Fafan Valley and these had been seen by other Americans several years earlier. In 1964 elephants were seen in both the Fafan and Dacata Valleys, and in 1966 they had come up the Errer Valley as far as Bisidimo. A recent census (Edosa, 1967) made by the Ethiopian Wildlife Department has shown that there are approximately 80 elephants in the Errer Valley herd, and 50 animals in the Fafan Valley. Several young animals are present in these herds. In June, 1965, a one-month-old male elephant was "rescued" from the Fafan Valley by the army and brought to the College, where it survived for three weeks.

Order Hyracoidea

Family Procaviidae (Dassies, "Rock Rabbits")

Dendrohyrax (Heterohyrax) brucei (Gray)

Allen (1939) recognized three genera of Hyracoidea: Procavia, Heterohyrax, and Dendrohyrax. Ellerman et al. (1953) recognized only

two genera, Procavia and Dendrohyrax and considered Heterohyrax as a subgenus of Dendrohyrax. Hayman (1964, according to Turner and Watson, 1965) considered Heterohyrax as a subgenus "since the cranial and dental distinctions between the two groups are so small." Bothma (1966) and Anderson and Jones (1967) recognized three genera. Bothma (1966) concluded that the subspecies H. b. somalicus includes H. b. hararensis Brauer. The type locality of H. b. hararensis is "near Harar, Galla country, Abyssinia," which is only a few kilometers from the Erer collecting sites.

Eight specimens of D. brucei were collected from the Erer, Dacata, and Fafan Valleys on the southern slope, where they lived among the same granite boulders with Procavia. A female collected on July 18, 1962, contained two near-term fetuses.

Turner and Watson (1965) have shown that D. brucei relies almost entirely on Acacia tortilis for food and is not found in an area where it does not grow nearby. Acacia tortilis spirocarpa made up 6.6% of the trees in the part of the Dacata Valley which was surveyed (Table VIII), and was probably even more common in the Errer and Fafan Valleys where D. brucei was collected.

Procavia habessinica (Hemprich and Ehrenberg)

Bothma (1966) has noted that the systematics of Procavia in Ethiopia are far from clear, and in much need of revision. The specimens collected in the course of this study indicate that the big-toothed hyraxes of the entire study area are all of one form, which occurs at all elevations.

P. habessinica were found to be numerous wherever rock piles occurred. A single specimen was collected from the lower Urso Valley, and a large population lived in the upper Urso next to the escarpment. They were observed on Gara Barcia near Scenele where Pectinator spekei were collected, and all along the escarpment east of Dire Dawa.

On the southern slope of the plateau, fourteen specimens were taken from the Errer, Dacata, and Fafan Valleys where they were extremely numerous. P. habessinica were found in the Gara Mullata massif and a single female was collected from a ridge in the podocarpus forest near Hirna at 8000 feet. The stomach of the female leopard collected on Gara Mullata contained the remains of several Procavia.

Order Perissodactyla

Family Equidae (Zebras and Asses)

Equus grevyi Oustalet

Rzasnicki (1951, according to Ansell, 1967b) considered the species monotypic.

The Afdem Plain supports a relatively large population of Grevy's zebra, and they appear to be widespread throughout most of the Danakil Rift Valley (Glass, 1965) where water is available. Several herds occur to the west of the Afdem Plain on the Alaideghi Plain which borders the Awash River. The Grevy's zebra is the tallest of the zebras, and is the most northerly, being endemic to the Somali Arid Zone (Ansell, 1967). Herds usually ranged in size from five to twenty animals, but larger herds of mares and sub-adults containing up to 30 animals were seen on several occasions. Lone stallions were not uncommon, usually in the

company of one or two oryx. The oryx accompanying zebra were always nervous, and were the first to run when approached.

The Grevy's zebra is shy and tends to occupy the parts of the plains away from people. In years when the Danakili were not using the plain, zebra spread over the entire area, and could be observed grazing at any time of day. Young foals were present in April and May. An adult male and female and one sub-adult were collected.

Equus asinus Linnaeus

The Somali wild ass, E. a. somalicus Sclater, was never seen on the Afdem Plain, but the Danakil nomads said they occurred in some areas and recognized pictures of the animal. Their presence at times seems highly probable since they have been photographed on the Alaideghi Plain to the west (Gebre Tsadik, 1965).

Order Artiodactyla

Family Suidae (Pigs and hogs)

Phacochoerus aethiopicus (Pallas)

Wart hogs are common over much of Ethiopia. Lone males and family groups were always plentiful along the seasonal rivers of the Afdem Plain, where they grubbed out the stolons of bermuda grass. They were also seen on the open plain where tall bunch grass was abundant. Wart hogs made regular use of old aardvark holes, particularly when with young pigs, and on one occasion four adult males were found occupying an extensive burrow in the sand of the Mulu River. Small pigs were observed in May. Wart hogs are never far from water, and during one

particularly dry year as many as forty animals could be seen at one time at the hot spring at the eastern edge of the plain. Ten specimens were collected from the Afdem Plain Region.

Wart hogs were always plentiful throughout the Foothill Region along the escarpment especially around the permanent water of the Gota, Erer, and Urso Rivers. Three specimens were taken from this region. On the southern slope of the plateau hogs were found in the river bottoms of the Errer, Dacata, and Fafan.

Potamochoerus porcus (Linnaeus)

Bush pigs (Figure 22) were common on the Gara Mullata massif as numerous fresh-used trails were observed throughout the forest area. Pigs were sighted on three occasions above 8300 feet and are represented in the collection by one juvenile and two adult males. Bush pigs were also seen in the podocarpus forests at 8000 feet near Hirna.

Family Bovidae (Gazelles, duikers, and bushbuck)

Tragelaphus scriptus (Pallas)

Several races of T. scriptus have been described from Ethiopia, with differences largely based on color variations.

A reddish-brown form occurred at low elevations along permanent water. Three specimens were collected from riparian situations on the Gota River in the Rift Valley, and two specimens were taken from the upper Errer River in the Southern Slope Region.

Figure 22. Potamochoerus porcus Collected in the Cloud Forest of Gara Mullata

Tragelaphus scriptus meneliki Neumann

The dark-phase bushbuck was common on the Gara Mullata massif above 8300 feet where they could regularly be found at night by using a jacklight. On two occasions herds of seven to ten animals were observed grazing on high mountain meadows in the late afternoon.

Tragelaphus (Strepsiceros) strepsiceros (Pallas)

Ellerman, et al. (1953) considered Strepsiceros and Tragelaphus as congeneric, with Tragelaphus Blainville having priority. Anderson and Jones (1967) have followed this usage.

The greater kudu is locally plentiful in some parts of the study area. They were seen on three occasions along the basalt ridges bordering the Afdem Plain where they were attracted to the permanent water of the hot spring. In the Foothill Region along the base of the escarpment, greater kudus were regularly seen on the upper Erer and along the Urso and El-bah drainage near Dire Dawa (Figure 23). This scrub-covered hilly terrain supports a relatively large population. A single adult male was collected from the Urso River.

Greater kudus were less plentiful on the southern slope of the plateau, and were recorded on only two occasions from the Dacata Valley.

Tragelaphus (Strepsiceros) imberbis (Blyth)

Lesser kudus were frequently seen in the thick scrub-covered valleys of the Errer, Dacata, and Fafan Rivers. Three specimens were collected in the Errer and Dacata Valleys.

In the Rift Valley lesser kudus were observed along all the rivers of the Foothill Region, and were present on the Afdem Plain along the

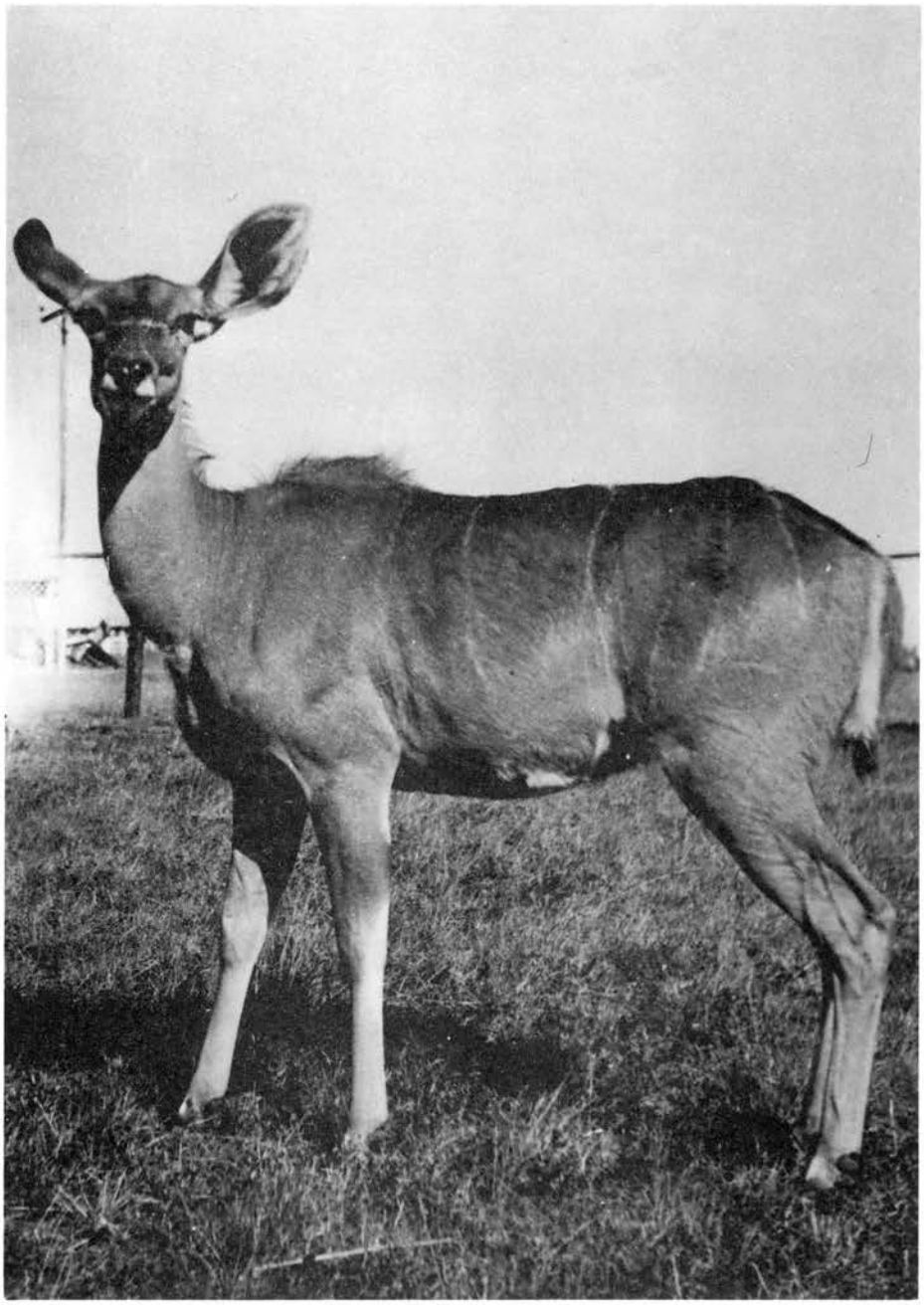

Figure 23. Tragelaphus strepsiceros From the Foothill Region of the Rift Valley

seasonal rivers, where the Tamarix sp. and Cadaba rotundifolia thickets offered cover. Young calves were observed on the plain in April.

Sylvicapra grimmia (Linnaeus)

S. grimmia were never collected or seen in the Rift Valley. On the Harar Plateau, duikers have adapted to land modifications caused by the intensive cultivation practices in the area. They were regularly seen on the College farm, and were widespread throughout the plateau region where they found cover in brush or grass patches and visited gardens and fields at night. Breeding is apparently not seasonal, as local farmers have brought baby animals to the College throughout the year. Several S. grimmia are maintained in the College zoo.

Duikers were plentiful in the brushy valleys of the southern slope where collections were made along the Errer, Dacata, and Fafan Rivers. They were also collected around open meadows in the Gara Mullata region above 8000 feet.

Alcelpahus buselaphus (Pallas)

Although the writer had frequently visited the Afdem Plain for seven years, hartebeests were never seen. In February, 1968, Dr. John Beadles (Personal communication) recorded seeing two hartebeests west of the Mulu River on the Afdem Plain. This is a noteworthy record as the species has not been reported east of the Hawash River since 1910, although a few are still reported around the Rift Lakes in Arusi Province. Drake-Brockman (1910) recorded Swayne's hartebeest as having previously occurred around Mounts Assabot and Fantali but at that time they could only be found on the slopes of Mount Fantali which is west

of the Hawash River.

At one time Swayne's hartebeests were present in great numbers on the lower levels of the southern slope of the plateau, as Swayne (1895) records seeing "immense herds of hartebeests" on the plains outside of Jigjiga. There are no reports of the animal occurring in this region today.

Kobus defassa (Ruppell)

A single male waterbuck was taken from the Hawash River Valley near Gawani in June, 1963. This specimen was collected about 70 km down-river from the type locality of K. d. hawashensis Matschie which is given as: Hawash River, between Ankober and Assabot Hills, Abyssinia (Allen, 1939).

Oryx beisa (Ruppell)

The largest of the ungulates on the Afdem Plain was the oryx (Figure 24), which could commonly be seen in herds of 20 to 30, and large herds of 100 to 200 animals were not uncommon. On one occasion a concentration of 350 to 400 oryx was observed at one time from a single vantage point. Old bulls were often seen by themselves. The plain was never visited when oryx could not be found in plentiful supply. Breeding was observed in April, 1966, and very young calves were seen with herds from March to May.

In the Foothill Region nearer the escarpment oryx were sometimes found on the lower Gota and Erer Rivers, but they generally stayed near the limit of available water. During one particularly dry year, a herd of 20 oryx were seen on the road between Urso and Erer.

Figure 24. Oryx beisa Near a Basalt Ridge in the Afdem Plain Region

Figure 25. Gazella soemmerringi on the Afdem Plain

Oryx were never seen in the upper valleys of the Southern Slope Region but occurred in the Ogaden to the south and have been reported in the lower Dacata Valley.

Gazella soemmerringi (Cretzschmar)

Several races of G. soemmerringi from Ethiopia are listed by Allen (1939). The type locality of G. s. erlangeri Matschie, which is the nearest record to the Afdem Plain, is: Hawash Valley between Dadadschamalka and Filoa, seven days east of Addis Ababa, Abyssinia (Allen, 1939). Presumably, Dadadschamalka refers to T'adacha Maleka and Filoa to the hot spring area of Fil-Ua on the west side of the Hawash River.

The soemmerring gazelle (Figure 25) is the most common gazelle in Ethiopia (von Rosen, 1953), and is the only one present on the Afdem Plain. Here gazelles are plentiful, occurring in groups of five to seventy animals. Old males are often seen alone. It was common to find herds of these gazelles grazing with oryx, and they were sometimes seen grazing close to cattle herds. Six specimens were collected from the region.

Soemmerring gazelles were also found in the flatter areas of the lower Gota, Erer, and Urso Rivers in the Foothill Region.

Gazella dorcas (Linnaeus)

This small gazelle was found in the Rift Valley 95 km east of Dire Dawa (Figure 26). Six specimens were collected on the east side of the Dabahs River, between the Dire Dawa-Djibouti Road and Biobai (10°05' N, 42°28' E). This seems to be the first record of G. dorcas from this

Figure 26. Gazella dorcas From the Dabahs River in the Foothill Region East of Dire Dawa

part of the Rift Valley.

Litocranius walleri (Brooke)

In the Afdem Plain Region gerenuks were plentiful in the acacia brush on lava ridges and in the riparian acacia woodlands. They were usually seen in pairs or small groups of three to six. Three males and one female were collected from this region.

Gerenuks were also found in the scrub thickets of the Urso and Gota Rivers in the Foothill Region, and were plentiful east of Dire Dawa. They were not seen as often on the southern slope but were observed a few times in the lower Dacata Valley.

Madoqua phillipsi Thomas

Several species of Madoqua have been described from Ethiopia and Somalia with four races of M. phillipsi alone being recognized by Allen (1939). The type locality of M. p. hararensis is Kumbi, Ennia-Galla Land, Abyssinia (Allen, 1939).

M. phillipsi (Figure 27) is widely distributed throughout the Southern Slope Region and extends on into the Ogaden. Twenty specimens were collected over the region where they were found on the upland slopes as well as the bottoms of the river valleys. Specimens were collected from the Fafan, Dacata, and Errer Valleys and from the intervening upland regions at Daletti and near Farso.

Madoqua cordeauxi Drake-Brockman

The type locality of M. cordeauxi is Dire Dawa, Abyssinia (Drake-Brockman, 1909).

Figure 27. Madoqua phillipsi From the Southern Slope Region

M. cordeauxi was the only dikdik collected in the Rift Valley. M. cordeauxi resembles M. phillipsi of the southern slope, but is somewhat larger and the coloring is a lighter red instead of the bright rufus red of M. phillipsi.

Five specimens of M. cordeauxi were collected from the Afdem Plain where they occurred in large numbers in the acacia and cadaba thickets along the seasonal rivers.

Ten specimens of M. cordeauxi were collected in the Foothill Region from the Valleys of Gota, Erer, Urso, and the El-bah drainage near Dire Dawa.

Madoqua (Rhynchotragus) guentheri Thomas

Four races of guentheri were recognized by Allen (1939). The type locality of the typical race is Central Ogaden, while that of M. g. wroughtoni is Sheikh Husein, Gallaland.

Gunther's dikdik is the largest of the three species collected, and is easily identified by the long pendulous nose. This dikdik was never collected from the floor of the valleys, but seemed to be limited to the drier bush-covered upland slopes. Ten specimens were collected from the Errer Valley.

Oreotragus oreotragus (Zimmermann)

Neumann (1902) gives the range of the subspecies O. o. saltatrixoides as including the mountain ridges of Harar.

Klipspringers were only collected on the southern slope of the Harar Plateau, and were seen throughout this region wherever there were suitable rocky hills. This animal was especially common among the

granite boulders on the ridges of the Fafan and Dacata Valleys. Ten specimens were collected from this region. One specimen was seen and photographed by Dr. W. Burger near the summit of Gara Mullata above 10,000 feet.

Hypothetical Species

Molossid ?

On three separate occasions a solitary, whitish-winged bat was dislodged from under loose bark of an acacia tree. These bats were thought to be molossids because of their rapid flight. One sighting was made in the Gota Valley and two in the Afdem Plains Region.

Canis simensis Ruppell

Allen (1939) has recognized two subspecies of the Simenian Fox with C. s. simensis Ruppell limited to the Simen Mountains north of Lake Tana, and C. s. citerni de Beaux found on the east side of the Rift Valley in the Arussi area. Von Rosen (1953) has listed this animal as occurring in the Gara Mullata massif near Harar but quoted no authority.

Ictonyx striatus (Perry)

A possible sighting of I. striatus on the road up the escarpment from Dire Dawa to the College was reported by a colleague. His description of a small black and white, skunk-like animal would not seem to fit any other known species in the area.

Diceros bicornis (Linnaeus)

Swayne (1895) reported rhinoceros as "most common in the valleys of the Tug Jerer and Tug Fafan," and he noted their presence in the upper Fafan Valley near Bacaca. While there is a possibility that in some remote section of the southern slope valleys a remnant still exists, no report of its presence was ever received from the local inhabitants.

Tragelaphus buxtoni (Lydekker)

The Mountain Nyala which is endemic to Ethiopia has only been reported from the mountains in Arussi Province (Allen, 1939; von Rosen, 1953; von Wolff, 1955). On one occasion in the Gara Mullata area, the writer sighted a large animal with spiraled horns as it was silhoutted against the sky. This animal was traveling on the crest of a ridge above the tree line at over 9500 feet elevation. While the distance was too great for positive identification, the animal was assumed to be a Greater Kudu. After subsequent study of the habitat and altitude of the area, the sighting seems more typically suited to the Mountain Nyala than for the Greater Kudu.

Ammodorcas clarkei (Thomas)

Records indicate that the Dibatag does not come into the Southern Slope Region (Swayne, 1895; von Wolff, 1955), but a colleague reported a long-necked, gazelle-like animal "which definitely was not a gerenuk" sighted on the lower plateau ridge between the Dacata and Fafan Valleys.

CHAPTER VI

DISCUSSION

The major emphasis of this study was on the qualitative distribution of mammalian species under different ecological conditions. As already noted, the study area could be stratified into five major ecological regions on the basis of several factors including altitude, climatic conditions, topography, land use, and vegetation. These factors were not equally important in the delineation of each zone.

Altitude was important to the Harar Plateau and Montane Forest Regions as it strongly affected rainfall and temperature. Weather patterns in northeast Africa are such that high altitude regions are also areas of high rainfall, and normal tropical temperatures due to proximity to the Equator are modified by elevation. Land use was important on the Harar Plateau as this densely populated and intensively cultivated region had only remnants of natural vegetation remaining. Mammals present in this region had to be adapted to the presence of man as well as to his modification of the environment.

On the Southern Slope and the Foothill and Plain Regions of the Rift Valley topography, soil types, and vegetative cover were the important factors which imparted distinctive characters to these zones. Altitude influenced the temperature, but the location in relation to the highlands had more influence on the amount of rainfall. The Southern Slope Region, situated on the upwind side of the Highlands was more

favorably positioned to benefit from the inflow of moist air than the Rift Valley regions, which were in the rain shadow of the Highlands.

The stratification of mammalian species in relationship to ecological regions is shown in Figure 28. The most restrictive and uniform habitat is found in the tropical montane cloud forest on the Gara Mullata massif above 8000 feet. Twenty-three species of mammals were recorded from this region and Rattus rattus was probably present around native housing. Six species and one subspecies representing 33% of the collection from this region were found in this habitat type only. These mammals were:

Crocidura glassi
Colobus polykomos
Lophiomys imhausi
Pelomys harringtoni
Graphiurus murinus
Potamochoerus porcus
Tragelaphus scriptus meneliki

The mammalian fauna of the intensively cultivated Harar Plateau consisted largely of small rodents which had adapted to agricultural land modification, or mammals which were mobile and could move in and out of the region. Larger mammals were nocturnal, which reduced their conflict with man's activity. Thirty-six species of mammals were collected on the plateau, including four which were not recorded in any other area. Rattus rattus, which is normally associated with man, was collected only on the plateau but this was the only place where trapping was done around buildings. It is no doubt distributed at all elevations where man has permanent structures. Mammals collected only on the plateau were:

Rhinolophus clivosus
Dendromus insignis
Canis adustus
Herpestes ichneumon

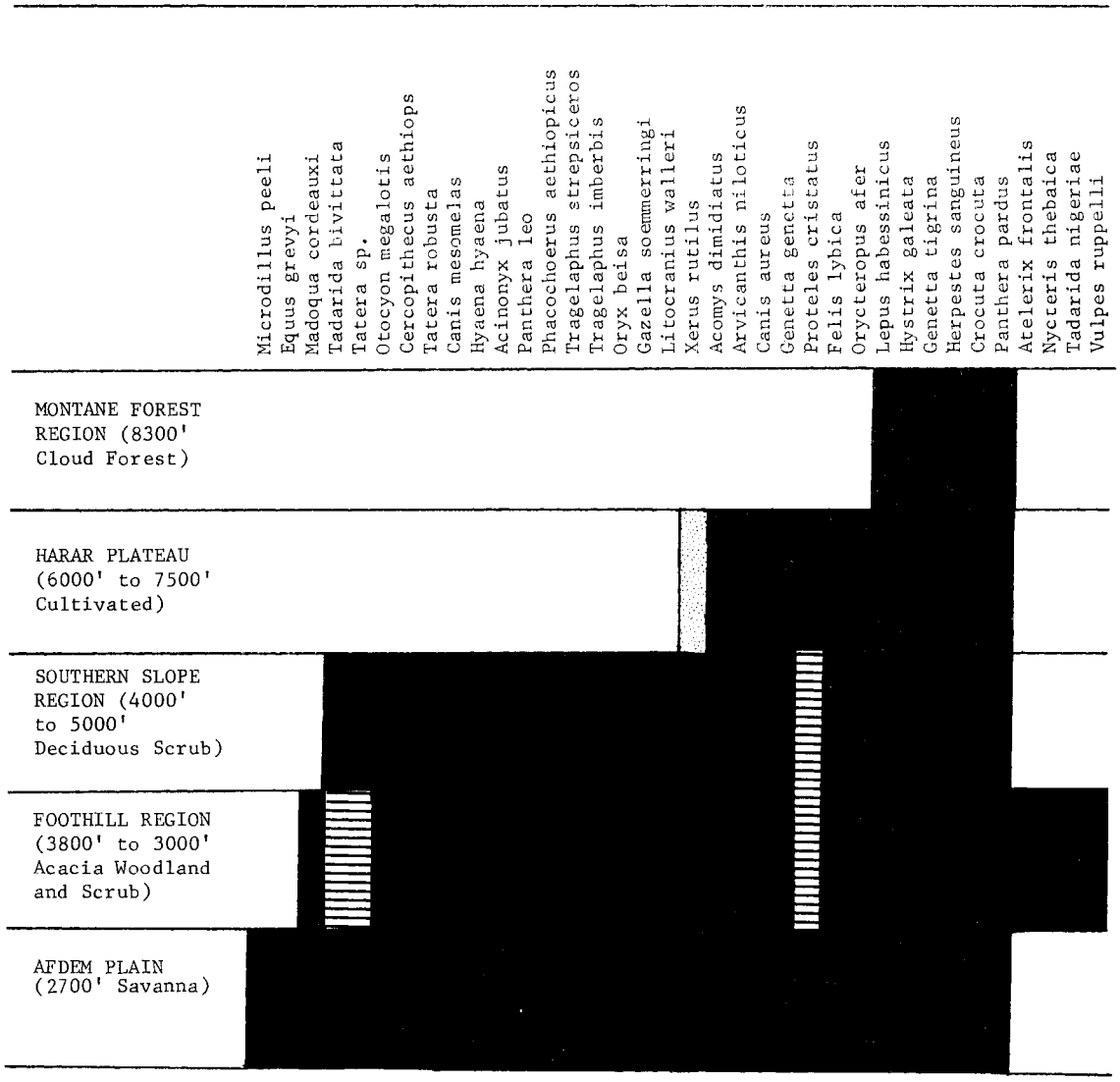

Figure 28. Stratagraph of the Vertical Distribution of the Mammalian Fauna Recorded in Harar Province, Ethiopia

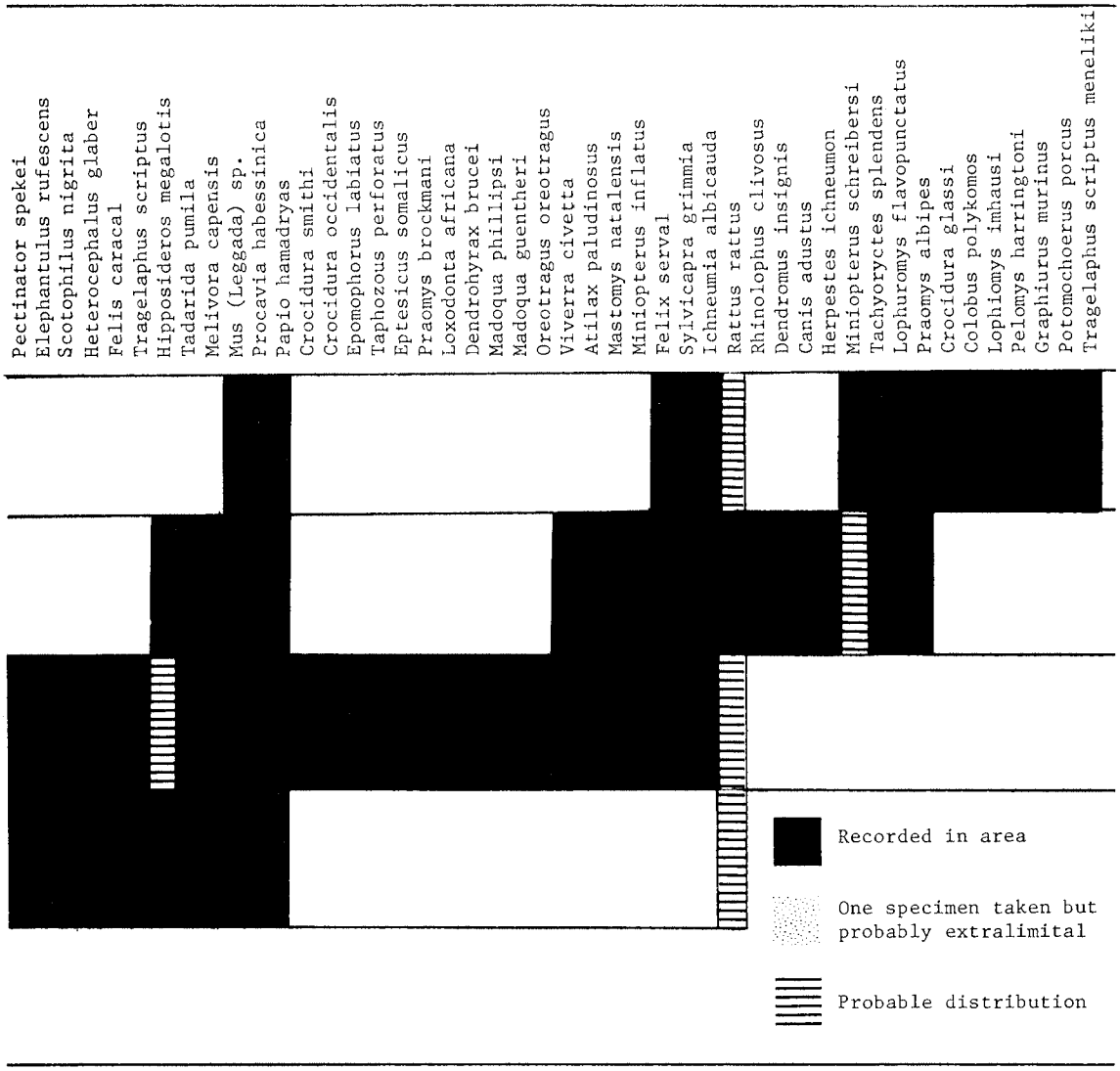

Figure 28 (Continued)

The southern slope from 4000 to 5000 feet, was the the most diversified zone studied. This region with its deeply incised river valleys, steep granite-covered walls, and variety of soil types, provided numerous microhabitats. This diversity is reflected in the abundance of plant species (Tables VIII and IX) as well as in the large number of mammals. Fifty-seven species of mammals were recorded in this region with Rattus rattus and Proteles cristatus probably present but not collected. The eleven species which were recorded only in this region were:

Crocidura smithi
Crocidura occidentalis
Epomophorus labiatus
Taphozous perforatus
Eptesicus somalicus
Praomys brockmani
Loxodonta africana
Dendrohyrax brucei
Madoqua phillipsi
Madoqua (Rhynchotragus) guentheri
Oreotragus oreotragus

The Foothill and Afdem Plain Regions in the Rift Valley have similar climates, but differ in topography and vegetation. The broken terrain of the foothills provides a diversity of habitats somewhat resembling the Southern Slope Region. Forty-two mammalian species were collected from the foothills and three others were probably present. Four species recorded only from the foothills were:

Atelerix frontalis
Nycteris thebaica
Tadarida nigeriae
Vulpes ruppelli

The level grassland savanna of the Afdem Plain, while climatically similar to the foothills next to the scarp, differs from it especially in vegetation. Grasses are dominant and the few species of woody plants are scattered. Thirty-two species of mammals were recorded in the area,

but only two were unique to the Afdem Plain. These were:

Microdillus peeli *Equus grevyi*

There is a greater similarity between the mammalian fauna of the Rift Valley regions and the southern slope on the opposite side of the plateau, than between the southern slope and the adjacent plateau. Twenty-eight out of 32 mammals recorded on the Afdem Plain and 37 out of 42 species from the Foothill Region were also recorded in the Southern Slope Region. Only 25 of 58 species from the southern slope were collected on the adjacent plateau.

Only six species of mammals showed no vertical stratification and were recorded in all five ecological regions. These were:

Lepus habessinicus *Herpestes sanguineus*

Hystrix galeata *Crocuta crocuta*

Genetta tigrina *Panthera pardus*

While the major emphasis in this study was on qualitative distribution of mammals, trapping successes would indicate that the most dense small mammal populations and the greatest species diversification occurred in the more xeric strata where the broken terrain, higher plant densities, and less human disturbance provided a greater variety of microhabitats.

CHAPTER VII

SUMMARY

1. A qualitative study of the distribution of the mammalian fauna in various ecological habitats in the Eastern Chercher Highlands of Harar Province, Ethiopia was conducted from November, 1959 to June, 1966.
2. The study area consisted of five major ecological regions delineated by altitude, physiography, climate, land-use, and vegetational cover. These regions included a grasslands savanna, broken foothills with acacia woodlands, the high intensively cultivated plateau, the southern slope of the plateau with its dense deciduous scrub vegetation, and a high tropical montane cloud forest.
3. Natural vegetation in each ecological region was sampled using the point-centered quarter method to obtain relative densities and frequencies of the dominant plants.
4. Eighty-four species of mammals representing 31 families were recorded in the study area. An account of each species as it occurs in each region has been made, and general information on habitat preference, reproduction, food preference, and collecting success noted.
5. A comparison of species diversity of the five ecological regions is presented.

6. Only six mammalian species showed no vertical stratification, being recorded in all regions from 2700 to over 8300 feet.
7. Standard measurements in the flesh and useful cranial measurements for the series of specimens collected in each region are recorded for each mammalian species. One thousand two hundred ninety-four specimens were examined.

CHAPTER VIII

GAZETTEER

Afdem Plain (Dobo R. collecting site): 9°42' N, 40°50' E

Afdem Plain (Mulu R. collecting site): 9°43' N, 40°46' E

Afdem Plain (Hot spring): 9°42' N, 40°51' E

Alemaya: 9°23' N, 42°00' E

Amarresa: 9°18' N, 42°07' E

Armucale River (At Djibouti Road): 9°48' N, 42°09' E

Awash River (=Hawash, Auasc)(At Awash Station): 9°00' N, 40°10' E

Biobai: 10°02' N, 42°31' E

College of Agriculture: 9°23' N, 42°02' E

Curfacelli: 9°15' N, 41°49' E

Dabahs River (At Djibouti Road): 10°02' N, 42°23' E

Dacata River (Collecting site): 9°08' N, 42°25' E

Daletti (Collecting site): 8°32' N, 42°07' E

Damota: 9°25' N, 42°04' E

Dire Dawa: 9°35' N, 41°52' E

El-bah: 9°44' N, 41°52' E

Erer River (Collecting site): 9°45' N, 41°24' E

Errer River (Collecting site): 9°05' N, 42°17' E

Fafan River (Collecting site): 9°11' N, 42°38' E

Farso: 8°25' N, 42°54' E

Fich: 8°08' N, 42°17' E

Fil-Ua: 9°07' N, 42°02' E

Gara Afdem (=Afdab): 9°29' N, 40°50' E

Gara Amaissa: 10°05' N, 40°49' E

Gara Ascabni: 9°12' N, 41°48' E

Gara Assabot: 9°15' N, 40° 35' E

Gara Barcia: 9°15' N, 41°54' E

Gara Mullata (Collecting site): 9°10' N, 41°46' E

Gariboldi Pass: 8°48' N, 39°42' E

Gawani: 10°10' N, 40°38' E

Gildessa (=Jildessa): 9°43' N, 42°08' E

Hawash River: See Awash River

Harar: 9°18' N, 42°08' E

Hirna (Collecting site): 9°15' N, 41°07' E

Jaedorra: 9°56' N, 41°21' E

Jigjiga (=Giggiga): 9°20' N, 42°47' E

Lake Haramaia (=Lake Alemaya): 9°24' N, 42°00' E

Maru (Afdem Plain): 9°54' N, 40°54' E

Scenele: 9°40' N, 41°51' E

T'adacha Maleka: 9°07' N, 39°55' E

Ullul: 9°31' N, 41°45' E

Urso River (Collecting site): 9°38' N, 41°38' E

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APPENDIX

APPENDIX

DEFINITION OF MEASUREMENTS USED IN TABLE XII

External Measurements in the Flesh

Height of ear from notch: Distance from notch at bottom of ear to the tip of fleshy part of ear.

Length of forearm (bats): Distance from angle of elbow to the end of the carpus.

Length of hind foot (cum ungue): Distance from the heel to the tip of the claw on the longest toe.

Shoulder height: Distance from the top of the withers to the base of the foot.

Tail length: Distance on the dorsal side from the base of tail to tip of fleshy part of tail.

Total length: Distance from the tip of the nose pad to the tip of the fleshy part of tail.

Cranial Measurements

Breadth across orbital ring (primates): Greatest breadth of orbital ring.

Breadth of braincase: Greatest width of braincase.

Breadth of skull (shrew): Greatest breadth of skull.

Condylobasal length: The least distance from the anteriormost margin of the median incisive alveoli (anteriormost projections of the premaxillary bones in Bovidae) to the plane of the posterior border of the exoccipital condyles.

Condylo-canine alveolar length: The least distance from the anterior margin of the canine alveolus to the posterior border of the exoccipital condyle on the same side of skull.

Greatest length of skull: Distance from posteriormost bulge of braincase to anteriormost part of premaxilla.

Length of upper tooth row (shrew): Self explanatory.

Breadth of auditory meatus: Greatest breadth across the external auditory meatus.

Interorbital constriction: Least width between orbits.

Length of auditory bullae: Greatest distance from the anterior to the posterior margin of bullae.

Length of P^4: Greatest crown length of fourth upper premolar.

Length of palate: The distance from the anteriormost point on the posterior border of the palate to posterior border of the median incisive alveoli.

Mastoidal width: Greatest width of skull across mastoidal processes.

Maxillary breadth (shrew): Width of skull at ends of the zygomatic processes of the maxillae.

Maxillary tooth row: Length of toothrow in one maxillary bone taken at alveolar level.

Nasal length: Distance along the median suture from the anteriormost part of either nasal to the posteriormost part of the same nasal.

Postorbital constriction: Least distance across skull posterior to the postorbital processes of the frontal bone.

Width of palate at last molars: Greatest width of palate measured inside of last molars.

Width of rostrum at level of canines: Self explanatory.

Zygomatic breadth: Greatest distance across zygomatic arches at right angles to long axis of skull.

Abbreviations used in Table XII:

M	Male	Juv	Juvenile
F	Female	Subad	Subadult
Av	Average	Orb	Orbital
Min	Minimum	Antiorb	Antiorbital
Max	Maximum	For	Foramen
c u	Cum Ungue (Claw included)		

TABLE XII

MEASUREMENTS OF SPECIMENS FROM HARAR PROVINCE, ETHIOPIA

Atelerix frontalis

Region	External						Cranial								
	Number of Specimens	Total Length	Tail Length	Hind Foot c.u.	Ear From Notch		Number of Specimens	Condylobasal Length	Zygomatic Breadth	Nasal Length	Interorb. Width	Maxillary Tooth Row	Length of Palate	Width of Rostrum at Antiorb. For.	Postorb. Constriction
Foothill Region, (Dabahs R.)	1 M	175.0	11.0	30.0	27.0		1	45.3	26.5	12.4	13.6	16.6	25.5	15.2	11.2
	1 F	170.0	18.0	30.0	26.0										

Elephantulus rufescens

Region	External						Cranial								
	Number of Specimens	Total Length	Tail Length	Hind Foot c.u.	Ear From Notch		Number of Specimens	Condylobasal Length	Zygomatic Breadth	Nasal Length	Interorb. Width	Entire Upper Tooth Row			
Foothill (Urso R.)	1 M	265.0	135.0	30.0	23.0										
	4 F Av	267.5	129.5	37.7	23.2		3	35.8	21.3	13.1	6.6	18.6			
	Min	250.0	120.0	36.0	21.0			34.6	20.6	12.7	6.4	18.0			
	Max	280.0	138.0	40.0	25.0			37.1	22.1	13.5	6.9	19.3			
Southern Slope (Errer V.)	F						1	33.3		13.7	6.4	18.4			

TABLE XII (continued)

Region	Number of Specimens	Total Length	Tail Length	Hind Foot c.u.	Ear From Notch		Number of Specimens	Condylobasal Length	Maxillary Breadth	Nasal Length	Interorb. Width	Entire Upper Tooth Row	Length of Palate	Breadth of Braincase
	External						Cranial							
Crocidura smithi														
Southern Slope	1 F	137.0	38.0	12.0										
Crocidura occidentalis														
Southern Slope	1 F	160.0	60.0	20.0	12.0		1	27.4	8.9	10.3	5.4	11.8	11.8	11.6
Crocidura glassi														
Montane Forest (8300 feet)	2 M Av	139.0	55.0	17.0	10.5		3	23.3	6.8		4.8	9.7	9.8	10.3
	Min	133.0	55.0	17.0	10.0			23.2	6.6		4.8	9.5	9.7	
	Max	145.0	55.0	17.0	11.0			23.4	7.0		4.8	9.9	10.0	
	2 F Av	132.5	52.0	17.5	9.5		1	21.5	6.5		4.6	9.3	9.5	10.3
	Min	130.0	51.0	17.0	9.0									
	Max	135.0	53.0	18.0	10.0									

TABLE XII (continued)

Epomophorus labiatus

Region		External					Cranial								
	Number of Specimens	Total Length	Tail Length	Hind Foot c.u.	Ear From Notch	Forearm	Number of Specimens	Condylobasal Length	Zygomatic Breadth	Nasal Length	Interorb. Width	Maxillary Tooth Row	Mastoidal Width	Length of Palate	Breadth of Braincase
Southern Slope	8 M Av	103.9		15.9	18.8	61.2	5	33.5	20.1		7.0	11.9	13.9	20.1	13.5
	Min	95.0		12.0	17.0	60.7		29.0	17.6		5.9	10.5	13.2	16.8	13.1
	Max	110.0		19.0	20.0	63.0		35.3	21.0		8.8	12.5	14.3	21.5	13.9
	33 F Av	97.0		14.9	17.9	58.6	24	32.0	19.3		6.4	11.2	13.6	19.0	13.3
	Min	85.0		11.0	16.0	53.1		28.3	17.2		5.5	10.0	12.9	16.5	12.7
	Max	115.0		19.0	20.0	61.9		34.1	20.4		7.2	12.4	14.4	21.0	13.9

Taphozous perforatus

Region		External					Cranial								
	Number of Specimens	Total Length	Tail Length	Hind Foot c.u.	Ear From Notch	Forearm	Number of Specimens	Condylo-Canine Length	Zygomatic Breadth	Nasal Length	Interorb. Width	Maxillary Tooth Row	Mastoidal Width	Breadth of Braincase	
Southern Slope	1 M	105.0	25.0	16.0	20.0	62.1	1	18.6	12.4		5.9	8.1	11.0	10.2	
	8 F Av	116.1	29.4	16.0	20.6	63.7	7	19.0	12.6		5.7	7.9	11.0	10.1	
	Min	109.0	25.0	14.0	18.0	61.9		18.6	12.3		5.1	5.7	10.9	10.0	
	Max	125.0	35.0	18.0	22.0	65.6		19.6	12.9		6.2	8.4	11.2	10.3	

TABLE XII (continued)

Nycteris thebaica

Region		External					Cranial							
	Number of Specimens	Total Length	Tail Length	Hind Foot c.u.	Ear From Notch	Forearm	Number of Specimens	Condylobasal Length	Zygomatic Breadth	Nasal Length	Interorb. Width	Maxillary Tooth Row	Breadth of Braincase	Mastoidal Width
Foothill (Dire Dawa)	2 M Av	113.0	58.5	34.0	32.0		2	18.4	11.5		5.6	6.5	8.9	
	Min	112.0	56.0	33.0	31.0				11.4		5.6	6.5		
	Max	114.0	61.0	35.0	33.0				11.6		5.7	6.6		
	2 F Av	106.5	52.5	34.0	33.5		2	18.1	11.5		5.6	6.5	8.7	
	Min	105.0	50.0	33.0	31.0			18.1			5.6	6.3	8.6	
	Max	108.0	55.0	35.0	36.0			18.2			5.7	6.8	8.9	
Rhinolophus clivosus														
Harar Plateau (College Farm)	3 M Av	87.5	30.5	28.0	20.0	50.9	1	18.4	10.3		2.4	7.3	8.0	7.1
	Min	85.0	27.0											
	Max	90.0	34.0											
	1 F					50.3								
Hipposideros megalotis														
Harar Plateau (College Farm)	1 F	45.0	8.0	4.0	20.0	35.0	1	12.8			2.2	4.4	7.2	

TABLE XII (continued)

Region	Number of Specimens	External: Total Length	External: Tail Length	External: Hind Foot c.u.	External: Ear From Notch	External: Forearm	Number of Specimens	Cranial: Condylobasal Length	Cranial: Zygomatic Breadth	Cranial: Nasal Length	Cranial: Interorb. Width	Cranial: Maxillary Tooth Row	Cranial: Breadth of Braincase	Cranial: Mastoidal Width	Cranial: Length of Palate
Eptesicus somalicus															
Southern Slope	1 M	72.0	30.0	7.0	10.0	33.6									
	4 F Av	78.0	33.0	7.0	10.8	31.5	2	12.0	8.2		3.2	4.3	6.2		
	Min	70.0	32.0	6.0	8.0	30.9		11.4	7.8			4.2	6.0		
	Max	81.0	36.0	7.0	12.0	32.1		12.5	8.5			4.4	6.4		
Scotophilus nigrita															
Foothill (Urso R.)	3 F Av	122.3	56.3	10.3	12.0	50.1	3	18.0	13.4		4.5	6.7	9.0	11.6	9.2
	Min	110.0	50.0	10.0	11.0	48.6		18.0	13.3		4.4	6.5	8.9	11.4	9.1
	Max	130.0	63.0	11.0	13.0	51.7		18.1	13.5		4.5	7.0	9.3	11.9	9.3
Southern Slope	8 M Av	126.3	52.9	11.0	15.0	50.7	7	18.2	13.5		4.4	6.7	9.1	11.4	9.5
	Min	120.0	48.0	10.0	13.0	48.4		18.0	13.1		4.3	6.5	9.0	11.1	9.3
	Max	143.0	55.0	12.0	18.0	53.8		18.5	13.9		4.5	6.9	9.3	11.9	9.7
	7 F Av	123.6	52.6	10.9	15.0	50.8	7	18.4	13.6		4.5	6.8	9.1	12.0	9.5
	Min	113.0	49.0	10.0	14.0	49.0		17.7	13.2		4.3	6.5	8.8	11.8	9.3
	Max	138.0	65.0	12.0	18.0	52.6		18.7	14.0		4.8	6.9	9.3	12.3	9.8

TABLE XII (continued)

Miniopterus inflatus

Region		External					Cranial							
	Number of Specimens	Total Length	Tail Length	Hind Foot c.u.	Ear From Notch	Forearm	Number of Specimens	Condylobasal Length	Zygomatic Breadth	Nasal Length	Interorb. Width	Maxillary Tooth Row	Mastoidal Width	Breadth of Braincase
Southern Slope	2 M Av	122.0	58.0	11.5	12.5	49.6	2	16.3			4.1	6.5	9.2	8.3
	Min	119.0	56.0	11.0	12.0	49.3		16.0			4.1			8.2
	Max	125.0	60.0	12.0	13.0	49.9		16.5			4.2			8.5
	5 F Av	121.6	58.0	11.4	12.0	49.6	5	16.2	9.2		4.1	6.4	9.0	8.5
	Min	115.0	50.0	11.0	11.0	48.2		15.9	9.1		4.1	6.3	8.6	
	Max	129.0	64.0	12.0	13.0	50.7		16.4	9.3		4.1	6.5	9.1	
	2 Juv	113.0	55.0	11.0	10.5	46.3	2	15.7	8.8		4.0	6.4	8.8	8.5
Harar Plateau (College Farm)	2 M Av	122.5	57.5	12.0	12.5	49.0	2		9.3		4.2	6.5		
	Min	122.0	57.0		12.0	48.5								
	Max	123.0	58.0		13.0	49.5								
	2 F Av	116.5	55.0	11.5	12.0	49.5	2	16.5	9.1		3.9	6.3	8.1	8.5
	Min	115.0		11.0								6.2		
	Max	118.0		12.0								6.4		
Miniopterus schreibersi														
Montane Forest	1 M					44.5	1	14.4	8.1		3.6	5.6	8.0	7.6
	3 F Av	112.0	54.0	9.0	11.3	46.3	3	14.3	8.3		3.6	5.7	7.8	7.6
	Min	110.0	50.0		11.0	45.8		14.1	8.3		3.5	5.3	7.7	7.3
	Max	115.0	56.0		12.0	46.9		14.6	8.4		3.6	6.2	8.0	7.7

TABLE XII (continued)

Tadarida (Chaerephon) pumila

Region		External					Cranial								
	Number of Specimens	Total Length	Tail Length	Hind Foot c.u.	Ear From Notch	Forearm	Number of Specimens	Condylobasal Length	Zygomatic Breadth	Nasal Length	Interorb. Width	Maxillary Tooth Row	Mastoidal Width	Length of Palate	Breadth of Braincase
Foothill (Gota)	1 M	100.0	25.0	10.0	10.0	43.6									
Southern Slope	4 M Av	86.5	32.5	7.8	11.8	37.3	4	15.5	9.7		3.8	6.0	9.1	7.0	8.4
	Min	83.0	32.0	6.0	11.0	36.7		15.1	8.9		3.6	5.7	8.7	6.5	8.3
	Max	94.0	33.0	9.0	14.0	38.0		16.2	10.4		4.1	6.5	9.5	7.9	8.5
	12 F Av	86.4	33.0	8.2	13.5	37.8	7	15.7	10.2		3.6	6.1	9.3	6.9	8.1
	Min	82.0	29.0	6.0	9.0	36.6		15.1	9.8		3.5	5.9	8.0	6.6	7.9
	Max	92.0	37.0	10.0	17.0	39.1		16.2	10.8		3.7	6.3	9.7	7.2	8.5
Harar Plateau (College Farm)	23 M Av	92.0	33.3	8.5	17.0	37.4	19	16.0	10.5		3.7	6.1	9.6	7.1	8.4
	Min	85.0	30.0	7.0	16.0	35.9		15.3	10.0		3.5	5.8	9.2	6.6	8.0
	Max	100.0	40.0	10.0	19.0	39.1		18.0	11.0		3.8	6.3	10.0	7.4	8.6
	35 F Av	91.9	33.3	8.3	15.9	38.0	21	15.6	10.3		3.8	6.0	9.6	6.6	8.4
	Min	82.0	27.0	7.0	15.0	36.4		15.1	9.2		3.4	5.6	8.8	6.2	7.8
	Max	101.0	40.0	10.0	18.0	39.4		16.0	11.0		4.7	6.4	10.0	7.2	8.8
Tadarida (Chaerephon) bivittata															
Afdem Plain	3 M Av	110.6	31.6	10.3	17.0										
	Min	110.0	30.0	10.0	16.0										
	Max	112.0	35.0	11.0	18.0										
Southern Slope (Erer V.)	1 M	107.0	35.0	12.0	19.0										
	1 F	111.0	36.0	11.0	21.0										
Tadarida (Chaerephon) nigeriae															
Foothill	1 M	105.0	39.0	11.0	21.0										
	1 F	114.0	46.0	11.0	20.0										

TABLE XII (continued)

Galago senegalensis

Region	External						Cranial							
	Number of Specimens		Total Length	Tail Length	Hind Foot c.u.	Ear From Notch	Number of Specimens	Greatest Length	Zygomatic Breadth	Nasal Length	Interorb. Width	Maxillary Tooth Row	Breadth of Orbital Ring	Breadth of Braincase
Foothill	3	M Av	463.3	270.0	59.3	41.3	2	44.3		12.9	5.4	15.6	31.1	23.6
		Min	450.0	260.0	55.0	36.0		44.2		12.7		15.2	30.7	23.4
		Max	480.0	280.0	62.0	46.0		44.5		13.1		16.0	31.5	23.8
	1	F	410.0	262.0	65.0	37.0	1	44.4		13.2	4.9	14.5	29.7	23.2
	1	Juv	300.0	206.0	60.0	32.0	1			11.9	4.6	15.0		22.8
Southern Slope	7	M Av	423.9	268.6	63.0	37.2	6	45.5		12.7	5.2	15.0	32.0	24.1
		Min	360.0	220.0	60.0	30.0		43.8		12.1	5.0	14.7	30.5	23.6
		Max	460.0	280.0	67.0	42.0		47.2		13.6	5.6	15.1	32.7	24.4
	5	F Av	423.6	251.0	62.4	36.6	5	44.8		12.7	5.4	15.0	31.2	23.8
		Min	400.0	235.0	60.0	30.0		44.6			5.1	14.5	30.8	23.5
		Max	450.0	260.0	70.0	40.0		44.9			5.5	15.6	32.0	24.1

TABLE XII (continued)

Cercopithecus aethiops

Region	External						Cranial								
	Number of Specimens		Total Length	Tail Length	Hind Foot c.u.	Ear From Notch		Number of Specimens	Greatest Length	Zygomatic Breadth	Nasal Length	Interorb. Width	Maxillary Tooth Row	Least Postorbital	Breadth of Orbital Ring	Breadth of Braincase
Afdem Plain (Doba R.)	1	M	1180.0	710.0	145.0	30.0		1	96.0	66.8	15.3	6.5	30.5	40.5	56.5	50.0
Foothill	1	M	1085.0	570.0	140.0	30.0		1	112.1	62.9	17.8	7.1	30.9	39.6	56.5	51.4
	1	F	985.0	555.0	115.0	33.0										
Southern Slope	1	M	1090.0	652.0	135.0	31.0		1	97.4	63.8	12.5	5.9	31.5	40.4	54.0	54.0
	1	M Juv	715.0	435.0	97.0	33.0		1	73.9	48.5	13.9	3.7	18.3	39.0	39.1	53.1
	1	M Subad	960.0	580.0	120.0	30.0		1	92.3	57.1	13.0	5.4	30.0	40.7	49.8	53.3
	1	F Subad	940.0	530.0	120.0	25.0										
Colobus polykomos																
Montane Forest	5	M Av	1253.8	661.0	183.2	42.2		4	111.1	81.5	13.2	11.1	39.1	46.1	68.2	59.2
		Min	1174.0	620.0	175.0	36.0			108.3	76.5	12.1	9.6	37.0	43.9	65.6	58.1
		Max	1324.0	710.0	190.0	45.0			114.0	84.6	13.8	12.6	40.1	47.8	70.9	60.5
	2	F Av	1197.5	640.0	167.5	41.0		2	105.7	77.3	12.5	10.9	36.5	46.5	65.0	58.1
		Min	1190.0	620.0	164.0	40.0			101.8	75.9	11.1	10.6	36.1	45.3	63.7	57.5
		Max	1205.0	660.0	171.0	42.0			109.6	78.6	13.8	11.1	36.9	47.7	66.2	58.7

TABLE XII (continued)

Papio hamadryas

Region	External						Cranial							
	Number of Specimens		Total Length	Tail Length	Hind Foot c.u.	Ear From Notch		Number of Specimens	Condylobasal Length	Zygomatic Breadth	Nasal Length	Interorb. Width	Maxillary Tooth Row	Least Postorbital	Breadth of Braincase
Foothill	2	M Av	1155.0	465.0	175.0	45.0		14	143.8	112.0	58.7	8.8	61.2	53.8	76.1
		Min	1100.0	460.0	170.0	40.0			135.1	105.5	51.3	8.0	58.3	51.5	74.6
		Max	1210.0	470.0	180.0	50.0			156.0	117.5	63.7	10.6	66.4	55.7	78.6
		F Av						4	113.3	91.8	41.0	6.2	49.7	52.8	72.6
		Min							111.3	90.0	39.1	5.5	48.2	50.2	71.6
		Max							119.0	95.5	42.3	6.9	50.6	56.3	73.6
Southern Slope	3	M Av	1111.0	482.5	191.0	52.5		3	146.9	115.3	58.0	9.8	61.4	54.8	76.8
		Min	1110.0	470.0	182.0	50.0			133.9	107.4	54.7	8.4	60.6	53.2	74.4
		Max	1112.0	495.0	200.0	55.0			153.8	120.0	60.4	11.0	63.0	55.6	79.5
Montane Forest	1	F	915.0	400.0	155.0	47.0		1	111.0	90.9	35.5	7.0	42.7	52.0	43.4

TABLE XII (continued)

Lepus habessinicus

Region	External						Cranial						
	Number of Specimens		Total Length	Tail Length	Hind Foot c.u.	Ear From Notch	Number of Specimens	Condylobasal Length	Zygomatic Breadth	Nasal Length	Interorb. Width	Maxillary Tooth Row	
Foothill	3 M	Av	509.6	79.0	115.6	113.6	3	72.1	38.7	25.6	15.3	13.7	
		Min	499.0	72.0	110.0	111.0		65.5	37.5	23.3	14.0	12.5	
		Max	530.0	89.0	120.0	115.0		78.0	39.9	28.0	16.8	14.9	
Southern Slope	3 M	Av	510.0	85.0	115.7	132.0	2	77.3	40.2	26.5	22.1	15.7	
		Min	500.0	70.0	110.0	124.0		76.3	40.0			15.2	
		Max	530.0	93.0	122.0	142.0		78.3	40.5			16.3	
	1 M	Juv	240.0	60.0	69.0	70.0							
Harar Plateau (College Farm)	4 M	Av	470.0	87.5	106.3	124.3	3	74.8	38.9	26.0	17.2	14.0	
		Min	410.0	80.0	105.0	110.0		73.9	37.4	24.6	16.3	13.0	
		Max	520.0	90.0	110.0	143.0		75.7	39.5	27.0	18.8	14.6	
	1 F		530.0	90.0	120.0	120.0	1	78.0		26.3	19.3	14.5	
	1 F	Juv	230.0	35.0	70.0	54.0				10.9	10.4	8.3	
Montane Forest	1 F		492.0	80.0	120.0	100.0	1			29.4	20.2	13.8	

TABLE XII (continued)

Xerus rutilus

Region		External					Cranial						
	Number of Specimens	Total Length	Tail Length	Hind Foot c.u.	Ear From Notch		Number of Specimens	Condylobasal Length	Zygomatic Breadth	Nasal Length	Interorb. Width	Maxillary Tooth Row	
Afdem Plain	3 M Av	396.0	185.0	55.0	11.0								
	Min	380.0	180.0	50.0	7.0								
	Max	408.0	190.0	60.0	15.0								
	4 F Av	388.0	167.5	53.0	11.8		1	42.3	26.5	12.3	14.2	9.1	
	Min	320.0	120.0	45.0	10.0								
	Max	402.0	200.0	60.0	13.0								
Foothill	6 M Av	378.1	173.0	54.1	13.1		2	45.7	29.3	13.6	14.6	9.3	
	Min	353.0	165.0	47.0	12.0			45.5	29.2	13.5	14.0	9.1	
	Max	397.0	185.0	57.0	15.0			46.0	29.4	13.8	15.2	9.6	
	9 F Av	383.0	181.5	55.0	12.8		4	43.6	28.6	12.8	14.0	9.6	
	Min	372.0	171.0	54.0	10.0			41.9	27.8	12.5	13.4	9.1	
	Max	400.0	190.0	57.0	15.0			45.8	29.3	13.2	14.9	10.0	
Southern Slope	6 M Av	403.7	187.5	57.2	14.2		3	47.9	30.1	15.6	13.9	9.9	
	Min	370.0	170.0	55.0	10.0			47.5	29.9	15.0	12.9	9.6	
	Max	440.0	208.0	60.0	17.0			48.4	30.3	16.6	14.8	10.3	
	3 F Av	385.7	183.3	55.7	16.0		4	46.0	28.9	14.6	13.0	9.6	
	Min	370.0	172.0	55.0	14.0			43.5	26.4	14.0	12.0	8.6	
	Max	395.0	203.0	57.0	19.0			48.3	30.6	15.2	13.8	10.1	
					Lophiomys imhausi								
Montane Forest	1 M	512.0	214.0	55.0	22.0		1	55.6	37.0	20.5	10.9	12.7	

TABLE XII (continued)

Tatera robusta

Region	External						Cranial						
	Number of Specimens		Total Length	Tail Length	Hind Foot c.u.	Ear From Notch		Number of Specimens	Condylobasal Length	Zygomatic Breadth	Nasal Length	Interorb. Width	Maxillary Tooth Row
Afdem Plain	2 M	Av	295.0	160.0	32.5	19.0		1	35.7	20.4	17.1	7.6	6.3
	3 F	Av	298.7	163.3	31.7	19.7							
		Min	295.0	160.0	30.0	18.0							
		Max	301.0	170.0	35.0	21.0							
Foothill	21 M	Av	304.0	169.2	35.2	20.0		8	34.4	19.4	16.1	6.6	6.2
		Min	280.0	150.0	32.0	17.0			33.8	17.4	14.7	5.7	5.7
		Max	348.0	190.0	37.0	21.0			36.4	20.4	17.8	7.4	6.5
	3 M	Subad	223.0	118.0	31.3	18.3		1	31.7		15.0	6.4	6.3
	12 F	Av	291.0	165.4	34.5	19.2		3	34.2	19.5	16.3	6.7	6.3
		Min	256.0	140.0	32.0	17.0			33.1	19.2	16.1	6.5	6.2
		Max	328.0	185.0	37.0	21.0			35.5	19.9	16.7	7.2	6.4
Southern Slope	4 M	Av	312.5	168.5	38.8	20.8		1	37.5	19.9	17.6	7.9	6.9
		Min	280.0	160.0	36.0	20.0							
		Max	330.0	180.0	40.0	22.0							
	3 F	Av	299.0	156.6	37.0	20.3							
		Min	280.0	140.0	35.0	18.0							
		Max	317.0	165.0	38.0	22.0							
	1 F	Subad	244.0	115.0	35.0	21.0							
Tatera sp.													
Afdem Plain	1 F		179.0	112.0	25.0	11.0		1			9.3	5.0	4.1

TABLE XII (continued)

Microdillus peeli

Region		External					Cranial					
	Number of Specimens	Total Length	Tail Length	Hind Foot c.u.	Ear From Notch		Number of Specimens	Condylobasal Length	Zygomatic Breadth	Nasal Length	Interorb. Width	Maxillary Tooth Row
Afdem Plain	6 M Av	141.5	76.5	16.5	9.7		5	19.8	12.1	7.6	3.9	3.3
	Min	134.0	66.0	13.0	9.0			18.5	11.4	7.3	3.7	3.1
	Max	150.0	81.0	18.0	11.0			20.9	12.6	7.8	4.2	3.5
	6 F Av	144.5	78.5	17.2	9.5		5	20.3	12.0	7.8	4.1	3.3
	Min	137.0	76.0	15.0	9.0			19.6	11.5	7.2	4.0	3.2
	Max	151.0	80.0	20.0	10.0			21.3	12.3	8.5	4.3	3.4
	2 F Subad	113.0	59.5	14.5	8.0		1	17.3			3.8	3.1
Tachyoryctes splendens												
Harar Plateau (College Farm)	23 M Av	234.5	51.6	29.6	5.8		22	42.5	30.1	15.8	6.8	8.1
	Min	203.0	40.0	25.0	4.0			39.6	27.9	13.0	6.2	7.3
	Max	260.0	66.0	40.0	9.0			44.7	32.4	18.4	7.4	9.1
	6 M Juv	180.2	40.2	23.5	4.2		4	33.9	26.6	12.3	7.0	7.1
	54 F Av	231.0	53.6	27.6	5.6		38	42.3	29.9	15.2	6.8	8.2
	Min	200.0	40.0	23.0	4.0			36.4	27.1	14.0	6.2	7.5
	Max	260.0	70.0	30.0	8.0			45.0	32.8	17.5	7.5	9.2
	7 F Juv	176.4	42.8	23.7	5.3		4	33.1	25.3	11.4	7.5	7.1
Montane Forest (8300 feet)	2 M Av	222.5	55.0	27.5	7.5		1	37.0	26.9	13.3	6.5	7.8
	6 F Av	229.8	57.5	27.7	7.0		3	40.1	28.6	15.3	7.0	8.2
	Min	218.0	56.0	26.0	6.0			38.1	27.3	15.1	6.6	8.0
	Max	247.0	60.0	29.0	9.0			41.5	29.5	15.5	7.5	8.4

TABLE XII (continued)

Acomys dimidiatus

Region	External						Cranial						
	Number of Specimens		Total Length	Tail Length	Hind Foot c.u.	Ear From Notch		Number of Specimens	Condylobasal Length	Zygomatic Breadth	Nasal Length	Interorb. Width	Maxillary Tooth Row
Afdem Plain	1	M	153.0	90.0	15.0	16.0							
	1	F	152.0	95.0	15.0	17.0		1	27.5	13.5	11.8	4.7	4.5
Foothill	11	M Av	184.5	76.2	17.7	16.0		7	26.2	14.1	10.9	4.8	4.6
		Min	160.0	69.0	16.0	12.0			24.2	13.1	10.0	4.5	4.3
		Max	205.0	100.0	20.0	19.0			27.9	15.1	12.0	5.0	4.8
	7	F Av	191.5	87.8	17.1	14.1		5	26.5	13.6	11.1	4.6	4.6
		Min	177.0	65.0	16.0	13.0			25.7	13.4	11.0	4.5	4.3
		Max	210.0	98.0	20.0	17.0			27.7	13.9	11.4	4.8	4.9
	5	M Juv	126.0	67.0	17.6	14.8		3			9.7	4.6	4.3
(Armucale R.)	2	F	194.0	102.5	19.5	18.5							
Southern Slope	11	M Av	184.5	87.6	18.5	15.5		4	27.5	14.2	11.5	4.9	4.7
		Min	150.0	80.0	15.0	13.0			27.0	13.8	10.8	4.8	4.4
		Max	210.0	109.0	20.0	20.0			28.2	14.6	12.2	5.0	5.0
	9	F Av	181.5	88.8	16.9	15.7		4	25.3	13.8	10.9	4.6	4.7
		Min	155.0	75.0	13.0	13.0			23.9	13.3	10.3	4.5	4.5
		Max	230.0	118.0	19.0	18.0			26.1	14.2	11.2	4.8	5.0
(Daletti)	6	M Av	166.3	77.2	17.0	15.2		5	25.8	13.3	10.7	4.6	4.3
	3	F Av	182.3	98.7	15.7	17.0		2	25.0	13.7	10.4	4.6	4.1
Harar Plateau (Damota Area)	1	M	205.0	105.0	17.0	15.0		1	27.6	14.3	12.5	4.8	4.4
	2	F Av	172.5	97.5	15.0	15.5		1	24.8	12.7	10.2	4.5	4.2

TABLE XII (continued)

Arvicanthis niloticus

Region	External					Cranial					
	Number of Specimens	Total Length	Tail Length	Hind Foot c.u.	Ear From Notch	Number of Specimens	Condylobasal Length	Zygomatic Breadth	Nasal Length	Interorb. Width	Maxillary Tooth Row
Afdem Plain	1 M	270.0	120.0	30.0	17.0	1	32.3	17.1	13.4	5.3	6.9
	1 F	250.0	110.0	22.0	16.0						
Foothill	30 M Av	293.0	150.5	32.5	18.4	29	34.0	18.0	13.4	5.4	6.9
	Min	230.0	125.0	31.0	14.0		31.2	15.7	12.4	4.9	6.3
	Max	320.0	180.0	36.0	23.0		35.8	19.1	14.2	5.8	7.5
	4 M Juv	211.3	105.8	29.5	17.0	3		16.2	11.6	4.8	6.6
	34 F Av	290.7	144.3	32.4	18.2	27	32.5	17.4	12.9	5.2	6.8
	Min	240.0	120.0	30.0	16.0		27.4	16.0	11.0	4.6	6.5
	Max	333.0	160.0	36.0	25.0		33.9	19.0	13.9	5.6	7.1
	3 F Juv	202.7	106.3	29.7	16.0	3	23.2	15.3	10.9	4.8	6.7
Southern Slope	6 M Av	246.3	118.0	31.5	18.3	6	32.7	17.8	13.4	5.1	6.8
	Min	240.0	110.0	30.0	16.0		30.8	16.1	12.8	4.8	6.4
	Max	263.0	129.0	34.0	20.0		34.1	18.5	13.9	5.4	7.2
	4 F Av	265.3	131.5	30.5	18.5	4	33.5	17.9	13.2	4.9	6.9
	Min	257.0	121.0	30.0	18.0		32.8	17.5	12.6	4.4	6.8
	Max	279.0	150.0	32.0	19.0		34.7	18.4	13.7	5.2	7.0
Harar Plateau (College Farm)	26 M Av	250.0	110.7	30.2	16.2	23	32.8	18.1	12.5	5.1	6.9
	Min	200.0	83.0	25.0	10.0		28.7	16.0	10.0	4.7	6.1
	Max	290.0	120.0	33.0	20.0		35.0	20.1	14.2	5.8	7.1
	3 M Juv	181.0	73.3	27.0		3			10.8	4.9	6.7
	18 F Av	252.4	113.5	30.3	17.8	16	33.1	17.9	13.1	5.0	6.9
	Min	222.0	95.0	25.0	15.0		28.4	16.3	10.9	4.2	5.6
	Max	295.0	140.0	35.0	20.0		36.5	19.5	14.8	5.6	7.3

TABLE XII (continued)

Lophuromys flavopunctatus

Region	External						Cranial					
	Number of Specimens	Total Length	Tail Length	Hind Foot c.u.	Ear From Notch		Number of Specimens	Condylobasal Length	Zygomatic Breadth	Nasal Length	Interorb. Width	Maxillary Tooth Row
Harar Plateau (Damota and College)	13 M Av	186.9	60.9	20.5	16.4		11	29.0	15.9	12.2	6.0	5.3
	Min	150.0	55.0	18.0	15.0			27.9	15.4	11.3	5.8	4.9
	Max	215.0	78.0	22.0	19.0			30.0	16.8	13.3	6.2	5.6
	1 M Juv	125.0	46.0	21.0	15.0		1	21.6			5.2	4.4
	6 F Av	162.5	61.3	20.5	15.3		3	29.2	15.9	12.1	6.0	5.1
	Min	150.0	55.0	19.0	15.0			28.9	15.4	11.5	5.8	5.0
	Max	183.0	69.0	23.0	16.0			29.5	16.4	12.5	6.1	5.2
	2 F Juv	120.0	47.5	20.5	13.5			21.6	13.1	9.7	5.3	4.8
Montane Forest	21 M Av	177.8	61.3	22.2	17.6		16	28.1	14.8	11.6	5.8	5.3
	Min	150.0	52.0	19.0	16.0			27.0	14.1	10.6	5.3	5.0
	Max	205.0	70.0	25.0	19.0			30.0	16.4	12.6	6.4	5.5
	4 M Juv	117.5	42.5	19.3	16.0		4	24.5		10.0	5.6	5.2
	14 F Av	178.0	61.0	21.1	18.0		13	28.4	14.8	11.8	5.8	5.2
	Min	149.0	48.0	18.0	17.0			26.3	13.7	11.1	5.6	4.9
	Max	195.0	75.0	23.0	19.0			30.3	15.8	12.5	5.9	5.3
					Mus (Leggada) sp.							
Foothill	2 M Av	84.5	34.5	12.0	8.5		2			6.4	3.1	3.0
Southern Slope	1 M	105.0	46.0	15.0	12.0		1	18.5	9.7	7.8	3.5	3.7
Harar Plateau	1 M	103.0	34.0	12.0			1			6.7	3.6	3.3
	1 M	72.0	29.0	13.0	5.0		1	14.1	7.8		2.8	
	3 F Av	111.0	46.7	14.3	7.5		2	17.6	10.4	7.5	3.5	3.4
	Min	110.0	43.0	13.0	5.0			16.0		7.0	3.5	3.3
	Max	113.0	52.0	15.0	8.0			19.2		8.0	3.5	3.6

TABLE XII (continued)

Mastomys natalensis

Region	External						Cranial						
	Number of Specimens		Total Length	Tail Length	Hind Foot c.u.	Ear From Notch		Number of Specimens	Condylobasal Length	Zygomatic Breadth	Nasal Length	Interorb. Width	Maxillary Tooth Row
Southern Slope	9	M Av	245.4	118.2	24.4	17.3		9	31.4	16.0	13.0	4.5	5.4
		Min	216.0	105.0	20.0	15.0			30.2	15.5	10.9	4.0	5.2
		Max	267.0	134.0	27.0	20.0			32.3	16.6	13.9	4.9	5.8
	2	M Juv	122.0	56.5	16.5	14.5		1			7.5	4.0	4.9
	5	F Av	230.6	106.2	23.8	19.6		5	30.2	15.6	12.7	4.3	5.3
		Min	205.0	80.0	23.0	15.0			29.1	14.7	12.4	4.1	5.0
		Max	252.0	119.0	25.0	22.0			31.3	16.5	13.4	4.6	5.6
Harar Plateau (College Farm)	26	M Av	221.6	102.8	24.6	17.9		22	30.4	15.4	12.1	4.3	5.3
		Min	195.0	85.0	20.0	13.0			27.0	14.3	11.0	4.1	4.9
		Max	265.0	120.0	29.0	23.0			32.7	16.5	13.5	4.6	5.7
	7	M Juv	184.1	83.1	24.4	17.0		6	27.3	14.6	11.2	4.2	5.1
	19	F Av	228.6	104.8	23.0	18.4		10	29.3	15.6	12.0	4.3	5.3
		Min	200.0	74.0	17.0	14.0			28.2	14.6	10.1	4.1	4.9
		Max	265.0	126.0	26.0	22.0			32.8	17.4	13.4	4.8	5.5
	5	F Juv	181.4	86.6	22.6	17.0		4	28.0	14.8	10.6	4.1	5.1

TABLE XII (continued)

Praomys albipes

Region	External						Cranial						
	Number of Specimens		Total Length	Tail Length	Hind Foot c.u.	Ear From Notch		Number of Specimens	Condylobasal Length	Zygomatic Breadth	Nasal Length	Interorb. Width	Maxillary Tooth Row
Harar Plateau	7	M Av	283.6	153.7	27.1	22.1		6	33.2	16.4	12.3	4.6	6.0
		Min	245.0	135.0	25.0	20.0			31.3	14.1	10.0	4.5	5.7
		Max	320.0	171.0	30.0	28.0			34.8	17.7	14.6	4.8	6.4
	1	M Juv	150.0	80.0	15.0	8.0		1					4.9
	2	M Subad	225.0	131.5	25.5	19.0		2	27.1	14.2		4.5	5.5
	8	F Av	279.4	152.1	26.0	21.1		5	29.7	15.4	12.7	4.5	5.7
		Min	255.0	140.0	25.0	20.0			28.4	15.0	11.9	4.3	5.6
		Max	310.0	170.0	30.0	25.0			30.5	15.8	13.3	4.6	5.9
	1	F Subad	190.0	100.0	25.0	19.0		1	27.1		11.5	4.2	5.1
Montane Forest	37	M Av	286.8	160.4	28.0	22.7		32	30.8	15.7	12.5	4.6	5.8
		Min	250.0	140.0	23.0	20.0			27.0	13.6	10.3	4.1	5.4
		Max	320.0	185.0	33.0	26.0			33.2	16.9	13.5	4.8	6.2
	5	M Subad	214.6	132.0	27.5	21.0		5	28.5	14.9	12.1	4.5	5.6
	22	F Av	285.0	161.0	27.2	22.3		17	30.5	15.9	12.8	4.6	5.7
		Min	250.0	150.0	25.0	18.0			28.5	15.0	11.8	4.3	5.2
		Max	325.0	180.0	30.0	26.0			32.4	16.7	13.7	5.8	6.1
	2	F Subad	204.0	116.5	25.0	20.5		2	25.2		9.8	4.5	5.7

TABLE XII (continued)

Praomys brockmani

Region		External					Cranial					
	Number of Specimens	Total Length	Tail Length	Hind Foot c.u.	Ear From Notch		Number of Specimens	Condylobasal Length	Zygomatic Breadth	Nasal Length	Interorb. Width	Maxillary Tooth Row
Southern Slope	3 M Av	233.7	132.3	21.7	15.7		3	27.1	13.3	10.9	4.2	4.7
	Min	207.0	113.0	20.0	15.0			27.1	11.6	9.8	4.0	4.7
	Max	254.0	154.0	23.0	17.0			27.1	14.2	11.8	4.3	4.7
	2 F Av	255.5	144.5	21.5	16.0		1	26.2		9.8	4.2	4.6
	Min	247.0	142.0	20.0	16.0							
	Max	264.0	147.0	23.0	16.0							
Pelomys (Desmomys) harringtoni												
Montane Forest	3 M Av	264.0	131.0	30.0	17.7		3	31.1	16.2	12.1	4.7	6.5
	Min	245.0	125.0	30.0	16.0			30.8	15.8	11.9	4.6	6.2
	Max	277.0	138.0	30.0	20.0			31.4	16.8	12.2	4.9	6.7
	3 F Av	246.7	126.7	26.7	17.3		1	27.2	15.1	10.4	4.3	6.0
	Min	220.0	110.0	25.0	15.0							
	Max	280.0	150.0	28.0	20.0							

TABLE XII (continued)

Rattus rattus alexandrinus

Region		External					Cranial					
	Number of Specimens	Total Length	Tail Length	Hind Foot c.u.	Ear From Notch		Number of Specimens	Condylobasal Length	Zygomatic Breadth	Nasal Length	Interorb. Width	Maxillary Tooth Row
Harar Plateau (College Farm)	20 M Av	339.0	177.5	32.0	20.0		17	34.7	17.9	13.4	5.4	6.3
	Min	260.0	140.0	28.0	15.0			29.5	16.2	11.9	4.8	5.6
	Max	420.0	220.0	35.0	23.0			39.1	19.7	15.9	5.9	6.7
	4 M Juv	218.3	123.3	26.0	16.0		3			9.7	5.0	5.8
	16 F Av	339.7	189.1	31.4	21.1		12	35.5	18.4	13.5	5.5	6.3
	Min	278.0	150.0	25.0	15.0			31.2	16.7	10.8	4.8	6.0
	Max	412.0	237.0	36.0	26.0			38.5	20.4	15.4	6.0	6.6
Rattus rattus frugivorus												
Southern Slope	1 M	307.0	200.0	35.0	22.0		1		21.1	15.7	6.1	6.4
Harar Plateau (College Farm)	14 M Av	344.4	192.5	32.1	21.5		12	35.1	18.5	14.3	5.6	6.1
	Min	265.0	180.0	30.0	20.0			31.4	17.9	13.0	5.1	5.0
	Max	390.0	210.0	34.0	24.0			39.4	20.1	15.9	6.4	7.0
	6 F Av	331.5	191.6	31.7	22.7		4	34.7	18.5	13.8	5.8	6.2
	Min	270.0	130.0	30.0	21.0			33.0	17.3	12.6	5.6	5.6
	Max	380.0	220.0	35.0	24.0			37.7	20.0	15.1	6.0	6.8

TABLE XII (continued)

Dendromus insignis

Region		External					Cranial						
	Number of Specimens	Total Length	Tail Length	Hind Foot c.u.	Ear From Notch		Number of Specimens	Condylobasal Length	Zygomatic Breadth	Nasal Length	Interorb. Width	Maxillary Tooth Row	
Harar Plateau (Damota)	3 M Av	152.3	95.0	16.7	9.7		1			6.4		3.4	
	Min	137.0	85.0	15.0	8.0								
	Max	180.0	105.0	20.0	12.0								
	2 F Av	165.0	85.0	16.0	14.5								
	Min	160.0	85.0	15.0	14.0								
	Max	170.0	85.0	17.0	15.0								
		Graphiurus (Claviglis) murinus											
Montane Forest	2 M Av	158.0	73.5	16.0	16.0								
	Min	155.0	71.0	15.0	16.0								
	Max	161.0	76.0	17.0	16.0								
	3 F Av	153.5	74.5	16.0	14.0		3	23.6	14.9	9.8	4.3	3.3	
	Min	140.0	70.0	15.0	12.0					9.6	4.2	3.2	
	Max	167.0	79.0	17.0	16.0					10.0	4.5	3.5	

TABLE XII (continued)

Hystrix galeata

Region	External						Cranial							
	Number of Specimens		Total Length	Tail Length	Hind Foot c.u.	Ear From Notch	Number of Specimens	Condylobasal Length	Zygomatic Breadth	Nasal Length	Interorb. Width	Maxillary Tooth Row	Length of Palate	Breadth of External Audit. Meatus
Afdem Plain	1	F	840.0	110.0	110.0	50.0								
Foothill (Dire Dawa)		M					1	140.5	79.9			34.4	75.1	55.2
Harar Plateau (Damota)	1	M Juv	330.0	50.0	52.0	30.0								
	1	F	910.0	110.0	111.0	44.0	1	153.0	78.0			37.2	80.5	56.4
	1	F Subad	630.0	120.0	85.0	40.0	1	105.2	60.0	27.8	26.8	24.0	50.4	46.1
Heterocephalus glaber														
Foothill	1	M Av	162.0	50.0	21.0	1.0	2	23.3	18.3	9.4	5.7	4.0		
		Min						21.8	17.2		5.7	3.7		
		Max						24.9	19.5		5.8	4.3		
	2	F Av	146.5	42.5	20.0	1.0	1	20.0	15.2	7.0	5.6	3.8		
		Min	140.0	40.0	20.0	1.0								
		Max	153.0	45.0	20.0	1.0								

TABLE XII (continued)

Pectinator spekei

Region	Number of Specimens	Total Length	Tail Length	Hind Foot c.u.	Ear From Notch	Number of Specimens	Condylobasal Length	Zygomatic Breadth	Nasal Length	Interorb. Width	Maxillary Tooth Row	Least Postorbital
	External					Cranial						
Foothill (Scenele)	1 M Juv	140.0	30.0	25.0	15.0							
	1 F	200.0	50.0	30.0	20.0							
Southern Slope (Daletti)	6 M Av	225.8	57.7	33.5	20.7	4	40.2	25.4	15.4	12.7	8.0	
	Min	210.0	55.0	30.0	19.0		36.8	23.9	13.7	12.2	6.8	
	Max	250.0	62.0	35.0	23.0		42.0	27.0	16.6	13.2	8.7	
	2 M Subad	183.5	52.0	29.5	17.0	2	32.3	22.0	12.4	11.7	6.8	
	3 F Av	224.3	56.0	36.0	21.3	3	39.2	25.5	14.4	11.8	7.5	
	Min	213.0	54.0	35.0	20.0		36.6	24.4	13.3	11.6	6.7	
	Max	232.0	58.0	37.0	22.0		41.7	26.5	16.2	12.0	8.0	
	1 F Juv	138.0	38.0	25.0	16.0	1			9.6	10.9	4.7	
						Canis adustus						
Harar Plateau	3 M Av	880.0	287.5	155.7	88.3	3	154.6	83.4	54.3	25.5	67.3	26.5
	Min	760.0	270.0	150.0	65.0		152.0	78.9	53.7	23.0	66.1	23.9
	Max	1020.0	305.0	167.0	100.0		156.4	92.0	54.6	30.5	69.7	31.4
	2 F Av	1000.0	302.5	162.5	75.0	1	153.1	77.2	55.3	23.8	65.0	22.2
	Min	965.0	295.0	150.0	70.0							
	Max	1035.0	310.0	175.0	80.0							

TABLE XII (continued)

Canis aureus

Region	External						Cranial								
	Number of Specimens		Total Length	Tail Length	Hind Foot c.u.	Ear From Notch	Number of Specimens	Condylobasal Length	Zygomatic Breadth	Nasal Length	Interorb. Width	Maxillary Tooth Row	Least Postorbital	Length of Auditory Bullae	Breadth of Braincase
Afdem Plain	2 M	Av	875.5	280.0	150.0	100.0	2	147.5	77.6	50.4	25.1	66.4	27.5	23.8	50.6
		Min	809.0	270.0	150.0	100.0		142.9	76.4	46.8	24.9	65.0	26.8	23.3	50.5
		Max	906.0	290.0	150.0	100.0		152.0	78.7	53.9	25.3	67.8	28.3	24.2	50.7
(Maru)	1 F		910.0	280.0	149.0	99.0	1	144.4	81.0	47.0	25.3	64.4	29.1	23.9	48.8
Foothill	M						1	145.5	78.5	46.0	27.4	66.2	30.2	22.8	49.9
	1 F		920.0	290.0	150.0	117.0	1	141.3		48.5	23.6	63.0	27.9	21.5	50.3
Southern Slope	M						1	132.8	78.5	45.9	27.4	61.1	34.0	20.7	50.6
	1 F		925.0	268.0	145.0	97.0	1	142.3	82.8	47.1	28.5	63.7	33.1		53.1
Harar Plateau (College Farm)	6 M	Av	942.3	286.8	153.7	106.0	3	153.4	84.4	53.0	26.2	68.4	29.7	24.3	51.2
		Min	920.0	251.0	140.0	88.0		149.1	80.7	49.9	22.8	67.3	27.7	24.1	49.5
		Max	1022.0	325.0	166.0	115.0		157.7	87.5	55.0	29.0	70.5	31.9	24.5	52.5
	3 F	Av	860.0	260.0	140.7	91.7	1	143.8	76.9		25.3	62.5	31.0	24.4	48.7
		Min	760.0	230.0	120.0	90.0									
		Max	950.0	290.0	152.0	95.0									
	1 F	Juv	660.0	180.0	120.0	60.0									

TABLE XII (continued)

Canis mesomelas

Region		External					Cranial								
	Number of Specimens	Total Length	Tail Length	Hind Foot c.u.	Ear From Notch		Number of Specimens	Condylobasal Length	Zygomatic Breadth	Nasal Length	Interorb. Width	Maxillary Tooth Row	Least Postorbital	Length of Auditory Bullae	Breadth of Braincase
Afdem Plain	2 M Av	890.0	280.0	152.5	95.0		1	137.9	75.5	46.1	25.9	61.6	31.6	24.1	51.0
	Min	880.0	260.0	150.0	90.0										
	Max	900.0	300.0	155.0	100.0										
	1 F	960.0	300.0	170.0	110.0		1	130.4	78.7	41.9	28.1	61.0	32.9	20.0	49.7
Foothill	1 M	950.0	360.0	157.0	105.0		1	134.4	73.0	43.1	25.9	62.7	29.5	20.6	48.3
	2 F Av	965.0	340.0	155.0	107.5		2	136.5	82.6	46.2	28.6	62.3	33.7	20.8	50.9
	Min	930.0	330.0	150.0	105.0			134.5	82.0	42.6	27.3	61.3	33.4		50.3
	Max	1000.0	350.0	160.0	110.0			138.6	83.2	49.9	30.0	63.3	34.1		51.6
Southern Slope	3 M Av	949.3	313.3	163.3	110.7		4	147.7	81.8	52.3	26.4	65.2	28.5	23.0	50.9
	Min	873.0	250.0	153.0	102.0			141.9	75.6	49.0	22.8	64.2	23.1	22.2	48.7
	Max	999.0	350.0	172.0	120.0			148.7	87.5	56.7	31.1	66.0	33.6	24.5	52.9
	4 F Av	966.0	326.8	147.3	106.5		3	136.4	79.6	47.4	28.6	62.6	33.6	21.1	52.3
	Min	900.0	270.0	105.0	100.0			133.4	76.5	44.3	26.8	61.2	32.4	20.3	51.5
	Max	1014.0	350.0	174.0	112.0			138.4	82.0	49.5	30.0	65.0	34.2	21.5	53.1
Vulpes ruppelli															
Foothill (Erer River)	1 F	840.0	370.0	120.0	100.0		1	108.4	81.9	34.6	22.0	48.9	21.4	21.6	42.1

TABLE XII (continued)

Otocyon megalotis

Region	External						Cranial						
	Number of Specimens	Total Length	Tail Length	Hind Foot c.u.	Ear From Notch		Number of Specimens	Condylobasal Length	Zygomatic Breadth	Nasal Length	Interorb. Width	Maxillary Tooth Row	Least Postorbital
Afdem Plain	4 M Av	698.2	223.0	106.2	105.7		2	106.0	61.5	37.8	24.1	41.1	30.5
	Min	670.0	206.0	102.0	101.0			105.0	60.0	37.2	23.8	40.4	28.8
	Max	720.0	250.0	110.0	110.0			107.1	63.1	38.5	24.4	41.9	31.3
	2 F Av	736.0	305.0	118.0	106.0		2	108.8	58.6	36.6	20.9	42.7	26.0
	Min	704.0	300.0	102.0	101.0			108.7	58.5	35.8	19.8	42.6	25.8
	Max	768.0	310.0	134.0	111.0			109.0	58.7	37.5	22.1	42.9	26.2
Foothill	2 M Av	690.0	270.0	128.5	105.0		1	109.0	60.9		23.8	42.3	32.8
	Min	660.0	255.0	127.0	101.0								
	Max	720.0	285.0	130.0	109.0								
	1 F	820.0	285.0	138.0	122.0		1	112.8	62.0	39.4	21.3	42.4	27.1
Southern Slope	1 M	730.0	260.0	122.0	116.0		1			34.9	21.2	40.5	26.4
	1 F	710.0	240.0	120.0	100.0		1	105.9	58.0	36.9	20.7	42.2	26.9

TABLE XII (continued)

Genetta genetta

Region	Number of Specimens		External: Total Length	External: Tail Length	External: Hind Foot c.u.	External: Ear From Notch	Cranial: Number of Specimens	Cranial: Condylobasal Length	Cranial: Zygomatic Breadth	Cranial: Nasal Length	Cranial: Interorb. Width	Cranial: Maxillary Tooth Row	Cranial: Least Postorbital	Cranial: Length of Auditory Bullae	Cranial: Breadth of Braincase
Afdem Plain	2 M	Av	970.5	493.0	85.0	50.0	2	87.4	43.9	18.5	13.3	33.9	13.9	18.6	29.6
		Min	940.0	480.0	80.0	50.0		86.3	42.9	16.6	12.4	32.7	13.2	18.1	29.0
		Max	1001.0	506.0	90.0	50.0		88.6	45.0	19.5	14.2	35.1	14.6	19.2	30.3
	1 F		890.0	415.0	70.0	49.0	1	88.0	45.4	16.9	13.6	33.4	15.0	18.5	30.0
Foothill	3 M	Av	956.7	471.6	81.0	52.0	1	88.8	46.1	16.9	12.7	35.0	15.5	18.0	29.4
		Min	950.0	450.0	76.0	50.0									
		Max	965.0	500.0	84.0	55.0									
	2 F	Av	902.0	479.5	90.5	49.5	2	87.2	42.0	18.5	12.8	33.2	14.0	18.8	30.0
		Min	892.0	470.0	87.0	45.0		82.7	42.0		12.5	31.5	13.3	18.4	28.8
		Max	912.0	489.0	94.0	54.0		91.8	42.0		13.1	34.9	14.8	19.2	31.3
Southern Slope	9 M	Av	893.6	439.0	83.4	50.1	9	87.3	44.5	16.3	13.1	33.9	13.7	18.0	29.6
		Min	835.0	411.0	72.0	44.0		84.7	40.6	14.9	11.3	32.6	13.2	16.7	28.5
		Max	958.0	460.0	90.0	55.0		91.3	46.5	17.9	14.3	35.5	18.0	18.6	31.2
	3 F	Av	885.0	432.0	81.7	47.7	3	84.3	42.0	17.5	12.4	32.6	14.4	17.8	29.7
		Min	840.0	418.0	80.0	46.0		78.8	38.9	15.7	11.5	30.3	13.5	16.9	29.1
		Max	930.0	453.0	85.0	50.0		90.2	44.2	19.3	13.2	34.8	15.3	18.6	30.3
Harar Plateau (College Farm)	1 F		900.0	440.0	80.0	45.0	1	87.8	44.5	16.8	13.5	34.3	14.7	18.2	29.9

TABLE XII (continued)

Genetta tigrina

Region	Number of Specimens	Total Length	Tail Length	Hind Foot c.u.	Ear From Notch		Number of Specimens	Condylobasal Length	Zygomatic Breadth	Nasal Length	Interorb. Width	Maxillary Tooth Row	Least Postorbital	Length of Auditory Bullae	Breadth of Braincase
	External						Cranial								
Afdem Plain	1 M	950.0	480.0	70.0	45.0		1	88.9	47.9	17.9	13.5	34.3	13.7	17.8	29.3
Southern Slope	1 M Av	932.0	426.0	72.0	38.0		2	91.6	44.0	18.3	12.1	34.8	12.4	18.2	29.9
	Min							88.4	43.2	14.6	11.3	33.0	10.1	17.5	29.6
	Max							94.7	44.7	22.0	12.9	36.5	14.6	18.8	30.2
Harar Plateau (College Farm)	1 M	900.0	400.0	75.0	40.0		1			14.7	12.7	32.0	11.5	17.0	
	1 F	890.0	430.0	70.0	45.0										
Montane Forest	3 M Av	851.0	396.3	81.7	36.3		3	84.2	42.1	15.9	11.5	31.8	10.4	17.9	29.5
	Min	820.0	370.0	80.0	35.0			80.5	38.6	13.7	10.8	30.8	8.6	17.2	29.1
	Max	880.0	419.0	83.0	38.0			87.0	44.2	18.0	12.1	32.9	13.4	18.5	30.3
	1 F	809.0	382.0	78.0	37.0		1	80.2	39.8	13.8	11.6	30.2	11.9	16.9	28.7
							Viverra (Civettictis) civetta								
Southern Slope	1 M	1285.0	401.0		47.0		1	151.2	78.7	30.0	31.0	58.1	24.8		
	3 F Av	1130.0	390.0	125.0	53.3		1	153.2	82.5	33.9	32.7	59.9	23.5		
	Min	990.0	360.0	120.0	50.0										
	Max	1200.0	430.0	130.0	55.0										
Harar Plateau (College Farm)	3 M Av	1152.5	387.5	132.0	56.6		2	149.2	77.3	31.3	31.9	57.7	25.7		
	Min	1170.0	380.0	120.0	50.0			148.8	76.1	30.0	31.0	56.1	24.2		
	Max	1210.0	440.0	148.0	60.0			149.6	78.4	32.6	32.7	59.3	27.2		
	2 M Subad	1055.0	340.0		45.0		1	128.5	60.7	26.6	25.6	45.2	24.5		
	1 F	1200.0	402.0	104.0	50.0		1	147.4	74.7	28.5	30.7	56.2	25.9		
	1 F Subad	800.0	410.0	120.0	50.0		1	136.5	67.1	28.6	28.2	48.7	25.5		

TABLE XII (continued)

Atilax paludinosus

Region	External						Cranial								
	Number of Specimens		Total Length	Tail Length	Hind Foot c.u.	Ear From Notch		Number of Specimens	Condylobasal Length	Zygomatic Breadth	Nasal Length	Interorb. Width	Maxillary Tooth Row	Least Postorbital	Length of Auditory Bullae	Breadth of Braincase
Southern Slope	1	M	870.0	320.0	100.0	40.0										
Harar Plateau	3	M Av	775.0	337.3	101.7	30.0		3	98.5	58.7	18.3	19.0	35.8	15.7	19.0	37.3
		Min	700.0	312.0	100.0	20.0			93.3	52.0	18.1	16.8	34.5	14.1	18.1	35.8
		Max	825.0	380.0	105.0	38.0			101.7	62.1	18.4	20.3	36.5	17.0	20.1	38.8
	1	M Subad	640.0	360.0	98.0			1	92.1	51.0	20.9	18.3	34.7	19.2	18.4	38.1
	1	F	740.0	305.0	100.0	30.0		1	94.5	55.6	19.4	17.1	35.1	17.6	18.3	38.3
Herpestes ichneumon																
Harar Plateau (Damota)	1	M	930.0	400.0	90.0	32.0		1	63.5	32.3	10.8	12.5	21.5	11.8	14.7	25.7
Herpestes (Myonax) sanguineus																
Afdem Plain	3	M Av	504.0	224.6	47.0	22.0		1	54.8	31.6	10.9	12.4	19.4	9.7		23.3
		Min	500.0	204.0	45.0	20.0										
		Max	510.0	240.0	50.0	25.0										
Southern Slope	1	M	560.0	300.0	55.0	10.0		1	60.6	29.2		10.0	17.0	13.7	14.2	25.3
	1	F	601.0	290.0	58.0	17.0										
Harar Plateau (Combulcia)	1	F Juv	395.0	170.0	40.0	13.0		1	48.8	28.4	5.6	10.8	15.9	10.2		21.2
Montane Forest	1	M	606.0	325.0	63.0	27.0		1	64.9	34.5	9.1	12.4	17.9	11.3	14.8	25.5
	1	F	630.0	310.0	55.0	30.0										

TABLE XII (continued)

Ichneumia albicauda

Region	External						Cranial								
	Number of Specimens		Total Length	Tail Length	Hind Foot c.u.	Ear From Notch		Number of Specimens	Condylobasal Length	Zygomatic Breadth	Nasal Length	Interorb. Width	Maxillary Tooth Row	Least Postorbital	Length of Auditory Bullae	Breadth of Braincase
Southern Slope	1 M		920.0	380.0	80.0	25.0		1	106.3	57.9	16.2	23.3	40.0	22.2	20.4	34.0
	4 F	Av	991.3	460.0	123.5	38.8		1	103.6	53.2	23.3	22.2	39.6	21.5	20.5	32.9
		Min	980.0	440.0	110.0	31.0										
		Max	1010.0	490.0	130.0	47.0										
Harar Plateau (College Farm)	12 M	Av	950.5	419.9	119.6	36.4		12	106.9	57.8	20.8	22.7	40.2	22.4	20.8	35.4
		Min	920.0	350.0	100.0	30.0			102.4	51.5	19.0	21.0	37.9	20.9	19.4	34.6
		Max	980.0	450.0	130.0	40.0			109.1	62.0	24.3	24.6	41.6	23.4	21.8	36.5
	2 F	Av	896.5	473.0	125.0	30.0		2	109.2	58.8	21.8	22.5	40.3	22.4	21.0	36.0
		Min	775.0		120.0	30.0			106.8	56.1	20.5	21.4	39.4	21.5	19.8	35.2
		Max	1018.0		130.0	30.0			111.6	61.5	23.1	23.5	41.2	23.3	22.2	36.8
	1 F	Subad	950.0	455.0	125.0	35.0		1	96.4	48.0		19.9	33.3	20.9	20.6	35.8
Montane Forest	1 M		1025.0	455.0	130.0	45.0		1	108.3	53.7	19.6	22.8	40.5	22.3	19.9	33.9

TABLE XII (continued)

Crocuta crocuta

Region		External					Cranial							
	Number of Specimens	Total Length	Tail Length	Hind Foot c.u.	Ear From Notch		Number of Specimens	Condylobasal Length	Zygomatic Breadth	Nasal Length	Interorb. Width	Maxillary Tooth Row	Least Postorbital	Length of p^4
Afdem Plain	F						1	227.0	165.3	45.1	55.5	93.5	46.5	32.9
Southern Slope	3 M Av	1400.0	255.0	232.3	93.0		2	233.5	155.9	43.1	52.7	95.9	42.2	33.5
	Min	1340.0	235.0	222.0	89.0			230.0	152.9	43.1	50.2	95.9	38.5	33.1
	Max	1440.0	290.0	245.0	100.0			237.0	158.8	43.2	55.1	96.0	45.8	33.9
	2 F Av	1365.0	255.0	240.0	107.5		4	228.0	151.5	37.0	52.8	95.7	41.3	32.4
	Min	1360.0	240.0	240.0	105.0			226.0	149.4	34.5	47.1	93.1	34.3	30.2
	Max	1370.0	270.0	240.0	110.0			231.0	153.3	38.5	55.9	101.3	44.7	34.9
Harar Plateau	M Av						3	221.3	154.2	33.7	52.5	94.5	45.6	33.5
	Min							216.0	152.5	33.0	51.0	92.7	44.6	31.2
	Max							227.0	156.9	34.3	55.2	96.7	46.8	35.7
Montane Forest	1 M	1450.0	280.0	230.0	110.0		1	237.0	162.3	44.1	56.0	97.1	47.7	32.8

TABLE XII (continued)

Hyaena hyaena

Region	External						Cranial								
	Number of Specimens		Total Length	Tail Length	Hind Foot c.u.	Ear From Notch	Number of Specimens	Condylobasal Length	Zygomatic Breadth	Nasal Length	Interorb. Width	Maxillary Tooth Row	Least Postorbital	Length of P^4	
Afdem Plain	2 M	Av	1260.5	299.0	200.0	122.0	2	204.5	141.2	41.7	44.3	86.3	37.7	28.7	
		Min	1220.0	298.0	200.0	104.0		194.0	134.0	38.6	41.4	81.3	37.6	27.5	
		Max	1301.0	300.0	200.0	140.0		215.0	148.4	44.8	47.2	91.3	37.9	30.0	
	1 F		1450.0	240.0	200.0	130.0	1	199.0	140.1	40.3	46.1	82.2	39.0	29.0	
Foothill	1 M		1300.0	345.0	210.0	138.0	1		141.4	38.1	44.5	89.3		27.9	
Southern Slope	1 M	Av	1250.0	325.0	217.0	149.0	2	211.0	148.3	39.0	45.3	86.1	36.1	29.3	
		Min						207.0	144.3	38.0	43.3	85.5	34.5	28.6	
		Max						215.0	152.3	39.9	47.3	86.7	37.6	30.0	
	2 F	Av	1227.5	285.0	202.5	135.0	2	196.0	132.2	39.0	42.7	83.9	37.3	27.4	
		Min	1225.0	280.0	200.0	135.0		195.0	131.2	37.5	41.9	83.6	36.2	26.6	
		Max	1230.0	290.0	205.0	135.0		197.0	133.1	40.5	43.5	84.2	38.3	28.2	

Proteles cristatus

Region	External						Cranial								
	Number of Specimens		Total Length	Tail Length	Hind Foot c.u.	Ear From Notch	Number of Specimens	Condylobasal Length	Zygomatic Breadth	Nasal Length	Interorb. Width	Maxillary Tooth Row	Least Postorbital	Width of Palate at Last Molar	Width of Rostrum at Canines
Afdem Plain	1 M		945.0	264.0	160.0	115.0	1	141.2	84.8	39.1	31.2	46.1	34.7	42.4	41.4
	1 F		840.0	210.0	150.0	100.0	1	139.9	79.4	41.1	29.0	44.2	36.7	38.4	39.2
Harar Plateau (Amaresa)	1 F		920.0	220.0	150.0	110.0	1	138.5	77.7	38.8	29.5	39.9	31.0	40.3	38.6

TABLE XII (continued)

Acinonyx jubatus

Region	Number of Specimens	Total Length	Tail Length	Hind Foot c.u.	Ear From Notch	Shoulder Height	Number of Specimens	Condylobasal Length	Zygomatic Breadth	Nasal Length	Interorb. Width	Maxillary Tooth Row	Least Postorbital	Length of P^4
	External						Cranial							
Afdem Plain	1 F	1585.0	660.0	266.0	74.0	712.0								
Southern Slope	M Av						4	146.2	113.7	44.0	35.8	48.5	52.7	
	Min							142.1	109.8	41.5	34.1	47.4	51.2	
	Max							150.5	120.4	46.0	37.7	49.2	54.0	
	1 F Juv	970.0	390.0	160.0	60.0									

Felis lybica

Afdem Plain	1 M	950.0	400.0	150.0	70.0		1	96.3	72.8	22.3	18.1	32.4	33.6	10.2
	2 F Av	879.0	357.5	141.0	60.0		2	87.5	66.3	21.1	17.9	31.3	32.5	10.3
	Min	878.0	350.0	140.0	60.0			87.4	64.9	19.6	17.4	30.9	32.0	10.3
	Max	880.0	365.0	142.0	60.0			87.7	67.8	22.6	18.4	31.7	33.0	10.4
	2 F Subad	780.0	305.0	130.0	59.0		2	83.1	61.1	19.5	16.0	29.3	33.1	10.5
Foothill	1 M	892.0	377.0	142.0	71.0		1	88.8	64.8	23.8	16.7	32.9	30.1	11.7
	1 F	850.0	362.0	127.0	64.0		1	82.3	60.5	19.4	15.7	29.1	32.2	9.4
Harar Plateau	1 M	950.0	380.0	130.0	65.0									
	1 F Subad	680.0	240.0	100.0	55.0		1	76.5	59.1	18.0	12.5	17.3	28.7	9.2

TABLE XII (continued)

Felis caracal

Region	External						Cranial							
	Number of Specimens		Total Length	Tail Length	Hind Foot c.u.	Ear From Notch	Number of Specimens	Condylobasal Length	Zygomatic Breadth	Nasal Length	Interorb. Width	Maxillary Tooth Row	Least Postorbital	
Foothill (Scenele)	2 F	Av	832.5	247.5	159.0	72.0								
		Min	800.0	235.0	150.0	70.0								
		Max	865.0	260.0	168.0	74.0								
Southern Slope	2 F	Av	872.5	227.5	167.5	68.0	1	102.8	80.8	24.1	22.8	34.3	29.0	
		Min	840.0	210.0	162.0	66.0								
		Max	905.0	245.0	173.0	70.0								

Felis serval

Southern Slope	1 M		1070.0	310.0	195.0	90.0	1	112.2	77.9	27.0	22.0	37.8	33.4	
	3 F	Av	1011.7	256.7	166.0	83.7	1	102.9	69.3	25.4	20.1	34.0	31.3	
		Min	995.0	200.0	140.0	80.0								
		Max	1020.0	310.0	180.0	90.0								
	1 F	Subad	730.0	215.0	150.0	82.0	1	87.0	62.4	22.0	17.4	30.1	35.4	
Harar Plateau (College Farm)	6 M	Av	925.0	251.7	165.0	71.7	1	115.2	81.8	26.3	24.8	39.0	33.7	
		Min	790.0	210.0	140.0	60.0								
		Max	1070.0	300.0	180.0	80.0								
	5 F	Av	924.0	243.0	165.0	79.0	3	107.1	77.0	26.0	21.9	35.4	34.6	
		Min	860.0	220.0	150.0	75.0		99.1	71.9	22.9	20.1	33.3	32.3	
		Max	1000.0	280.0	175.0	80.0		112.7	79.6	27.8	23.1	37.6	36.6	
	1 F	Juv	680.0	200.0	130.0	68.0	1	80.3	56.4	20.0	16.4	27.0	36.9	
Montane Forest	1 M		920.0	235.0	165.0	82.0	1	106.5	77.1	24.5	22.3	35.9	31.7	

TABLE XII (continued)

Panthera pardus

Region	External						Cranial						
	Number of Specimens	Total Length	Tail Length	Hind Foot c.u.	Ear From Notch	Shoulder Height	Number of Specimens	Condylobasal Length	Zygomatic Breadth	Nasal Length	Interorb. Width	Maxillary Tooth Row	Least Postorbital
Southern Slope	1 M	1760.0	761.0	220.0	70.0								
	1 F	1750.0	760.0	215.0	65.0								
	1 F Subad	1064.0	750.0	210.0	74.0								
Montane Forest	1 F	1765.0	690.0	215.0	70.0		1	172.0	122.9	46.7	34.6	60.6	45.4
					Panthera leo								
Foothill	1 M Juv	1900.0	690.0	315.0	38.0		1	212.0	164.0	58.6	45.0	78.5	62.7
Southern Slope	2 M Av	2475.0	865.0	370.0	123.5	1045.0							
	Min	2400.0	850.0	370.0	120.0	1010.0							
	Max	2550.0	880.0	370.0	127.0	1080.0							
	2 M Subad	2181.5	793.5	330.5	103.0		2	253.5	193.0	71.9	50.6	94.2	58.1
	1 F	2220.0	820.0	300.0	120.0	1000.0	1	287.0	219.0	85.5	64.7	106.9	63.6

TABLE XII (continued)

Orycteropus afer

Region	External						Cranial							
	Number of Specimens	Total Length	Tail Length	Hind Foot c.u.	Ear From Notch		Number of Specimens	Greatest Length	Zygomatic Breadth	Nasal Length	Interorb. Width	Maxillary Tooth Row	Least Postorbital	Greatest Width of Nasals
Afdem Plain	2 M Av	1562.5	525.0	248.5	177.5		1	228.0	90.7	81.5	59.4	50.5	46.9	42.9
	Min	1540.0	520.0	235.0	169.0									
	Max	1585.0	530.0	262.0	186.0									
	2 F Av	1475.0	495.0	231.0	166.0		1	214.0	81.4	80.6	54.4	50.8	40.0	41.5
	Min	1440.0	480.0	220.0	165.0									
	Max	1510.0	510.0	242.0	167.0									
Southern Slope	1 M	1540.0	490.0	250.0	170.0		1	227.0	85.8	82.7	54.4	56.1	43.5	40.9
Harar Plateau (College Farm)	1 F	1530.0	550.0	225.0	155.0		1	229.0	82.0	89.6	54.7	48.5	44.2	38.5

TABLE XII (continued)

Dendrohyrax brucei

Region	External						Cranial							
	Number of Specimens		Total Length	Tail Length	Hind Foot c.u.	Ear From Notch		Number of Specimens	Condylobasal Length	Zygomatic Breadth	Nasal Length	Interorb. Width	Maxillary Tooth Row	Least Postorbital
Southern Slope	2	M Av	390.0	0.0	52.5	30.0		1	71.8	43.3	14.0	16.8	29.4	
		Min	380.0	0.0	50.0	30.0								
		Max	400.0	0.0	55.0	30.0								
	3	M Juv	259.0	0.0	44.3	20.0		3	53.2	31.2	8.9	12.1	18.1	20.4
	1	M Subad	335.0	0.0	54.0	27.0		1	61.1	34.2	12.0	14.1	23.1	22.7
	2	F Subad	377.5	0.0	52.5	28.0		2	71.9	39.9	12.0	16.7	27.3	22.8
	2	F Av	412.5	0.0	53.5	31.0		2	73.7	41.1	14.1	16.1	28.4	23.4
		Min	405.0	0.0	53.0	30.0			72.1	40.5	13.7	15.4	27.4	22.9
		Max	425.0	0.0	54.0	32.0			75.3	41.7	14.6	16.9	29.5	24.0
Procavia habessinica														
Foothill (Urso River)		M						1	98.2	56.0	28.8	25.0	39.4	25.0
Southern Slope	4	M Av	538.8	0.0	73.5	32.5		4	92.8	56.1	22.5	23.7	38.3	25.6
		Min	500.0	0.0	70.0	30.0			82.2	49.3	18.2	21.6	36.2	24.9
		Max	580.0	0.0	75.0	35.0			97.9	60.0	25.5	27.3	39.3	26.6
	6	F Av	528.3	0.0	71.0	33.3		5	87.2	51.1	19.9	21.2	39.2	23.5
		Min	501.0	0.0	66.0	29.0			81.9	49.0	18.4	19.4	35.0	20.6
		Max	560.0	0.0	74.0	37.0			92.3	52.6	22.8	24.0	40.7	26.4
	1	F Subad	450.0	0.0	65.0	31.0		1	71.3	42.5	16.0	16.4	28.7	24.3
Montane Forest	1	F	557.0	0.0	80.0	32.0		1	95.0	56.6	22.2	22.1	44.4	25.0

TABLE XII (continued)

Equus grevyi

Region	Number of Specimens	External: Total Length	Tail Length	Hind Foot c.u.	Ear From Notch	Shoulder Height	Cranial: Number of Specimens	Condylobasal Length	Zygomatic Breadth	Nasal Length	Interorb. Width	Maxillary Tooth Row
Afdem Plain	1 M	2710.0	512.0	595.0	237.0	1435.0						
	1 F	2062.0	430.0	572.0	225.0	1400.0	1	555.0	215.0	273.0	149.4	174.0
	1 F Subad	1970.0	357.0	535.0	194.0	1150.0						

Phacochoerus aethiopicus

Afdem Plain	3 M Av	1545.0	256.0	242.6	121.3	726.6	2	320.5	219.0	237.0	111.9	156.5
	Min	1430.0	135.0	208.0	104.0	700.0		313.0	212.0	236.0	107.5	156.0
	Max	1605.0	328.0	270.0	154.0	750.0		328.0	226.0	238.0	116.4	157.0
	1 M Juv	1303.0	209.0	206.0	103.0		1	243.0	147.0	170.0	90.8	99.0
	3 F Av	1502.0	252.6	237.3	116.3	652.0	3	298.6	189.6	222.3	110.4	138.0
	Min	1408.0	140.0	204.0	104.0	604.0		289.0	180.0	217.0	104.0	130.0
	Max	1590.0	315.0	258.0	140.0	700.0		310.0	196.0	230.0	117.3	149.0
	2 F Subad	1335.0	297.5	260.0	125.0		1	247.0	150.0	176.0	85.8	100.0
Foothill	1 M	1625.0	370.0	280.0	150.0	730.0						
	2 F Subad	1213.5	288.5	250.0	125.0	650.0						

TABLE XII (continued)

Potamochoerus porcus

Region	Number of Specimens	Total Length	Tail Length	Hind Foot c.u.	Ear From Notch	Shoulder Height	Number of Specimens	Condylobasal Length	Zygomatic Breadth	Nasal Length	Interorb. Width	Maxillary Tooth Row
	External						Cranial					
Montane Forest	2 M Av	1520.0	339.5	263.5	178.5		2	297.5	158.1	173.5	70.4	143.0
	Min	1480.0	297.0	262.0	172.0			287.0	153.2	167.0	68.8	137.0
	Max	1560.0	382.0	265.0	185.0			308.0	163.0	180.0	72.0	149.0
	1 M Juv	890.0	105.0	185.0	130.0		1	191.0	108.2	94.0	51.5	76.7
	Tragelaphus scriptus											
Foothill	1 M	1330.0	220.0	310.0	128.0		1	204.0	84.1	62.8	48.3	58.9
	1 M Subad	1200.0	200.0	310.0	128.0		1	195.0	84.1	58.6	48.0	51.1
	1 F	1108.0	107.0	115.0	102.0		1	197.0	80.3	55.6	41.8	58.9
Southern Slope	1 M	1350.0	165.0	340.0	130.0		1	207.0	85.5	62.2	47.6	64.1
	1 M Subad	900.0	170.0	290.0	120.0							
	Tragelaphus scriptus meneliki											
Montane Forest	4 M Av	1341.3	205.0	329.3	133.8		3	213.7	89.2	72.4	51.4	57.9
	Min	1245.0	190.0	322.0	130.0			205.0	85.5	68.0	48.5	50.5
	Max	1490.0	215.0	340.0	143.0			229.0	91.8	80.0	56.7	62.5
	4 F Av	1243.5	179.5	304.3	128.8	695.0	4	198.7	83.9	60.2	47.1	57.3
	Min	1205.0	173.0	300.0	127.0	680.0		197.0	79.6	57.2	43.4	51.9
	Max	1280.0	190.0	313.0	130.0	710.0		200.0	86.5	67.0	49.2	60.9
	1 F Juv	945.0	144.0	282.0	113.0		1	159.0	72.6		38.1	40.3

TABLE XII (continued)

Tragelaphus strepsiceros

Region	External						Cranial						
	Number of Specimens	Total Length	Tail Length	Hind Foot c.u.	Ear From Notch	Shoulder Height	Number of Specimens	Condylobasal Length	Zygomatic Breadth	Nasal Length	Interorb. Width	Maxillary Tooth Row	
Afdem Plain	M						1		165.0	122.0	115.0	121.0	
Foothill	1 M	2255.0	355.0	570.0	240.0		1	355.0	167.0	120.0	123.3	112.5	
Tragelaphus imberbis													
Southern Slope	2 M Av	2065.0	340.0	512.5	210.0	1025.0							
	Min	2060.0	320.0	490.0	210.0								
	Max	2070.0	360.0	535.0	210.0								
Sylvicapra grimmia													
Southern Slope	3 M Av	876.0	110.0	256.7	103.3		2	153.3	76.4	58.2	39.9	49.2	
	Min	808.0	100.0	250.0	100.0			149.5	73.7	57.6	39.0	49.0	
	Max	950.0	125.0	260.0	105.0			157.0	79.1	58.8	40.8	49.3	
	M Subad						1	142.2	69.2	46.5	36.0	42.0	
	3 F Av	920.0	101.7	254.3	108.7		2	152.4	72.8	58.1	36.4	48.6	
	Min	890.0	90.0	253.0	105.0			148.2	72.1	53.4	35.1	46.5	
	Max	950.0	120.0	255.0	111.0			156.5	73.4	62.8	37.6	50.6	
Montane Forest	1 M	935.0	73.0	255.0	107.0		1	150.9	74.8	61.3	44.5	48.9	
	1 F	935.0	95.0	260.0	98.0		1	151.8	73.4	52.2	42.3	51.0	

TABLE XII (continued)

Region	External						Cranial						
	Number of Specimens	Total Length	Tail Length	Hind Foot c.u.	Ear From Notch	Shoulder Height	Number of Specimens	Condylobasal Length	Zygomatic Breadth	Nasal Length	Interorb. Width	Maxillary Tooth Row	
						Kobus defassa							
Hawash River (Gauani)	1 M	2145.0	365.0	495.0	194.0								
						Oryx beisa							
Afdem Plain	1 M	1970.0	307.0	459.0	180.0	1155.0	1	342.0	135.4	121.5	102.7	106.9	
	1 M Subad	1400.0	230.0	450.0	144.0								
						Gazella soemmerringi							
Afdem Plain	1 M Av	1601.0	206.0	404.0	160.0	807.0	2	246.5	103.6	69.5	75.0	72.9	
	Min							243.0	103.2	69.0	74.0	68.8	
	Max							250.0	104.0	70.0	76.0	77.0	
	1 F	1500.0	208.0	403.0	166.0	808.0	1	234.0	94.7		66.2	72.0	
	2 F Subad	1085.0	209.5	343.0	150.0		2	176.5	79.3	34.3	52.2	48.7	
						Gazella dorcas							
Foothill (Dabahs River 95 K east of Dire Dawa)	4 M Av	1136.8	172.0	330.3	141.5	666.5	1	188.0	76.2	48.1	50.9	55.6	
	Min	1100.0	155.0	310.0	139.0	620.0							
	Max	1210.0	185.0	341.0	145.1	721.0							
	3 F Av	1056.7	164.7	313.3	145.0	625.0							
	Min	1030.0	155.0	310.0	145.0	615.0							
	Max	1110.0	179.0	320.0	145.0	640.0							

TABLE XII (continued)

Litocranius walleri

Region	External						Cranial					
	Number of Specimens	Total Length	Tail Length	Hind Foot c.u.	Ear From Notch	Shoulder Height	Number of Specimens	Condylobasal Length	Zygomatic Breadth	Nasal Length	Interorb. Width	Maxillary Tooth Row
Afdem Plain	3 M Av	1549.0	250.6	434.6	140.0	920.0	2	241.0	96.4	67.6	74.1	52.4
	Min	1500.0	208.0	407.0	105.0			228.0	93.7	64.8	72.1	52.0
	Max	1645.0	297.0	452.0	160.0			254.0	99.1	70.5	76.1	52.9
	1 F	1500.0	200.0	430.0	154.0		1	213.0	81.0		55.6	54.1
Foothill (Armucale R. 45 K east of Dire Dawa)	M						1	245.0	93.4	65.2	68.4	51.1
					Madoqua phillipsi							
Southern Slope	9 M Av	542.8	33.6	174.1	65.3		7	93.0	52.3	19.4	36.9	31.6
	Min	525.0	30.0	170.0	61.0			91.6	48.4	16.8	33.9	30.1
	Max	555.0	38.0	183.0	70.0			94.5	54.2	23.0	39.7	33.1
	9 F Av	540.2	31.4	174.7	64.4		9	92.1	47.3	18.0	34.1	30.3
	Min	500.0	21.0	160.0	60.0			87.6	44.0	16.1	30.8	28.1
	Max	590.0	40.0	188.0	70.0			97.1	49.2	22.2	38.3	32.6
(Daletti)	1 M	550.0	45.0	165.0	68.0							

TABLE XII (continued)

Madoqua cordeauxi

Region	External						Cranial					
	Number of Specimens	Total Length	Tail Length	Hind Foot c.u.	Ear From Notch		Number of Specimens	Condylobasal Length	Zygomatic Breadth	Nasal Length	Interorb. Width	Maxillary Tooth Row
Afdem Plains	3 M Av	518.3	33.6	190.0	70.0		3	96.4	54.1	22.0	39.6	33.8
	Min	506.0	30.0	190.0	70.0			93.9	52.9	19.7	39.0	33.7
	Max	540.0	36.0	190.0	70.0			97.8	55.4	23.5	40.1	34.1
	2 F Av	603.5	30.0	200.0	70.0							
	Min	603.0	30.0	200.0	70.0							
	Max	604.0	30.0	200.0	70.0							
Foothill	5 M Av	579.6	31.6	177.3	70.0		5	98.1	52.8	21.1	39.2	33.6
	Min	550.0	24.0	157.0	62.0			92.6	49.8	20.5	37.2	31.9
	Max	610.0	40.0	187.0	81.0			113.3	55.6	21.8	41.2	35.2
	1 M Subad	504.0	30.0	185.0	70.0		1	93.5	48.2		35.1	30.0
	4 F Av	594.3	32.5	174.5	68.8		4	98.9	51.7	19.3	37.9	33.1
	Min	560.0	27.0	156.0	64.0			95.8	49.2	17.7	36.5	31.3
	Max	617.0	40.0	187.0	70.0			103.2	53.1	20.6	39.1	34.2

TABLE XII (continued)

Madoqua (Rhynchotragus) guentheri

Region		External					Cranial					
	Number of Specimens	Total Length	Tail Length	Hind Foot c.u.	Ear From Notch		Number of Specimens	Condylobasal Length	Zygomatic Breadth	Nasal Length	Interorb. Width	Maxillary Tooth Row
Southern Slope	6 M Av	573.3	29.7	181.8	67.5		6	98.4	52.2	12.5	35.6	32.7
	Min	550.0	22.0	180.0	61.0			95.6	50.0	10.9	32.6	32.2
	Max	585.0	40.0	185.0	70.0			101.7	53.5	15.1	37.3	33.9
	2 F Av	565.0	29.0	175.0	69.0		3	101.0	50.9	11.6	34.0	33.0
	Min	540.0	20.0	175.0	68.0			97.7	50.3	11.3	33.1	31.5
	Max	590.0	38.0	175.0	70.0			103.1	51.3	12.1	35.3	35.5
					Oreotragus oreotragus							
Southern Slope	5 M Av	855.6	70.0	220.2	80.6		5	126.8	75.8	37.0	53.2	48.8
	Min	805.0	60.0	203.0	60.0			125.3	72.3	32.5	51.0	46.2
	Max	905.0	80.0	230.0	90.0			127.5	80.2	44.3	55.0	52.1
	5 F Av	876.2	73.2	229.2	97.0		2	127.2	75.2	38.6	53.7	48.3
	Min	840.0	60.0	210.0	90.0			126.4	73.0	37.0	52.7	47.2
	Max	915.0	85.0	240.0	104.0			128.0	77.3	40.3	54.8	49.3

VITA

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