

A NATURAL HISTORY OF THE TURKANA FAUNA.

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(*Photographs by D.R.B.*)

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I. INTRODUCTORY.

This article attempts to give a general idea of the fauna, more especially the invertebrate fauna, of the Turkana district. Turkana is the driest part of Kenya, drier even than any part of the Northern Frontier, and within its borders there are patches of desert almost as barren as the most desolate stone-wastes of the Sahara or Arabia. At the same time the country as a whole can only be described as semi-desert, and there is much to show that this semi-desert is of very recent origin. The fauna, as will appear, is by no means of pure desert character, but presents a mixture of elements, some truly typical of the desert, others deriving rather from the widespread savannas of tropical Africa. Nevertheless, the Turkana fauna is so far reduced and simplified by the very difficult conditions of life prevailing there that it can be much more easily studied than that of more favoured surrounding districts, where the innumerable forms of life interact in ways so devious and complex as to defy analysis.

Though this description refers more especially to Turkana, it will be found to apply almost equally well to the arid plains of the Northern Frontier District east of Rudolf; also in some degree to the adjoining parts of the Sudan and of Italian Somaliland, though in both these regions the appearance of more or less copious grasslands must modify the fauna. Further, the drier parts of Southern Kenya and Tanganyika, especially the Rift Valley bottom around the soda-lakes Magadi and Natron and the Masai country adjacent, appear to have much in

common with the northern wilderness; but there can be no doubt that the highland barrier has served to exclude from this southern territory many dry-country creatures whose centre of distribution is to the north.

It is curious to find in these similar but more or less disconnected areas, forms of life closely akin and at first sight identical, which nevertheless turn out on examination to show slight but constant differences. This may be true of many groups but is most noticeable among certain large beetles, especially the flightless Tenebrionids, whose comparative immobility has doubtless contributed to the isolation of local species or races within quite small geographical areas.

The area now in question is, however, a very compact geographical and faunistic unit. It lies entirely in the floor of the eastern or Kenya Rift Valley, bounded on the west by the Uganda escarpment and on the east by Lake Rudolf. To the south lie the Highlands of West Suk, Kamasia, and Lorogi (though a wedge of dry country pushes south between these latter to Baringo); to the north comes the desolate nomad's-land of the Ilembi triangle (where the Sudan serves in theory to separate Kenya from Abyssinia) whose stony hills merge into the Ethiopian mountains.

The level of Lake Rudolf is about 1,200 feet, and probably the greater part of the Turkana plains lie below 2,000 feet. It is therefore the lowest part of East Africa, with the exception of the coastal strip; it is also by far the hottest and driest, though hardly to be compared in this respect to parts of the Sudan.

The annual rainfall at Lodwar averaged less than five inches over the period 1923-1932, a figure generally low enough to induce desert conditions. Moreover, this rain is extremely erratic and commonly torrential when it falls at all; it therefore flows straight off the bare surface of the ground, fills the stream beds for a few hours and runs to waste. The temperatures prevailing in Turkana have a narrower range than is usual in a true desert, a fact which renders the climate trying to Europeans, since the nights are seldom cool enough to be refreshing. The maximum daily temperature usually approaches or slightly exceeds 100° F., while the minimum seldom falls to 70° and is usually much higher. This relatively equable temperature regime is probably due to the proximity of Lake Rudolf, which is a very large sheet of water. On the lake shore itself conditions are more equable still, with lower maximum and higher minimum temperatures. Relative humidity is generally very low, falling to 25 or 30% during the hottest part of the day, though by the lake, where the wind is generally blowing inshore, the figures are always higher.

These climatic conditions have determined a landscape and a vegetation of decidedly desert aspect. The constant dry weathering of the hills, helped by occasional downpours to clear away the debris of erosion, has produced a characteristic type of symmetrical, cone-shaped

hill rising with surprising abruptness from the plain. And the extreme flatness of the plains must itself be partly due to the torrential rains, which from time to time send a "sheet-flood" sweeping clean across country, depositing here and eroding there, so gradually reducing the entire surface of the country to a single level.

The plains bear but a sparse and scattered covering of drought-resisting plants. There are indeed areas of stony ground almost utterly devoid of vegetation; but usually a thin thorn-bush prevails, the individual bushes or clumps being separated by stretches of smooth bare sand. Looking down upon the plains from some steep hill, one may see that the area of bare ground generally far exceeds that occupied by vegetation and the general colour of the landscape is that of the ground. Only the courses of the dry stream beds, lined with thick bush and occasional trees, stand out dark by contrast to the intervening sands.

If one refers to Schantz's map in "the Vegetation and Soils of Africa" it appears that he classifies the Turkana vegetation with that of the Northern Frontier area, as "Acacia-Desert-Grass Savanna." The description applies well enough to the Northern Frontier (especially the more easterly parts which quite wrongly figure as "desert shrub") but not to Turkana, since here grass is almost entirely absent. Many parts of Turkana fit better into his description of "desert shrub."

In general the landscape is well furnished with flat-topped *Acacia* bushes of several species, growing up to about ten feet high. Often one may see them lying on their heads, having been picked up and thrown about by a whirlwind. Bushes of *Cadaba* and *Commiphora* are likewise numerous in places. Sometimes small tufted undershrubs, notably a *Disperma* (*Acanthaceae*) and a *Sericocomopsis* (*Amarantaceae*) occur in some abundance, and much resemble dried grass when seen from a distance. Elsewhere large succulent *Euphorbiae* abound and may even dominate the vegetation; they are accompanied by another *Euphorbia* which suggests a tangle of string thrown on the ground, and by a *Sanseveria* with long spiky leaves.

The banks of the Turkwell and a few other large river beds have thickets of branching Dom Palms, and occasionally, as at Lodwar, groves of huge acacias. But the most noteworthy feature of these situations is *Calotropis procera*, a large fleshy-leaved Asclepiadaceous plant, sometimes ten or fifteen feet high, which commonly grows in the river beds themselves. It has a wide distribution in dry situations from West Africa to Asia.

Here and there throughout the plains tall chimney-shaped termites' nests rise to surprising heights above ground; these are perhaps more characteristic of the Turkana landscape than any other single feature, and nowhere can they be seen so finely developed.

Such a country gives little scope for the life of larger mammals or of human beings. The mammals must abstain from drinking, either permanently or for most of the year, as water (except at the lake) exists only at the bottom of water-holes and in a few rock-pools, accessible only to the baboons. Giraffes exist, and a few Grant's gazelles may be seen inland; but the prevailing mammals are smaller: dik-diks no more than a foot high, are most characteristic of all, and ground squirrels and small mongooses abound in most parts.

A few birds reside constantly on the sandy plains. Apart from the Ostrich, one may mention a Bustard (*Afrotis gindiana*), a Stone Curlew (*Burhinus capensis affinis*) and a Courser (*Cursorius cursor*) as very characteristic of the arid, waterless country inland from the lake. Sandgrouse occur in small parties in the dry bush far from water, but are very difficult to see. They make regular daily flights to the lake or to water-holes, the Pin-tailed species (*Pterocles senegalensis*) arriving early in the morning; the Bridled (*Eremiolector sukensis*) after sunset. Doves are extremely numerous in the immediate neighbourhood of the water-holes, and arrive in thousands to drink in the early morning. Nightjars are locally common, probably preferring the neighbourhood of large river beds where the thicker vegetation harbours a large population of moths. They are mysterious and elusive birds: one may hear their "yap-yap" continually by night, but they are quite invisible on the sands and so seldom seen by day.

Early in 1934, when I first saw Turkana, it was a matter for surprise that any animal could support life there. It was towards the end of a long drought; the rains had failed for several successive seasons, and the previous year's fall at Lodwar had totalled less than an inch. The vegetation appeared almost entirely leafless and dead, but for a few trees growing in or near the river beds, which could still tap underground water. Yet even then the lesser fauna proved to be abundant and active to a quite remarkable extent; and when, at the end of April, rain at last fell in superabundance, the hordes of insects which made their appearance were an astonishment to see.

The Turkana tribesmen who populate this country to the extent of about two per square mile lead (apart from those few established by the lake) an entirely nomadic life, their movements dictated by the changing distribution of water and grazing. Towards the end of periods of drought they necessarily congregate near the few permanent water holes in the larger river beds, and certain rock-pools in the hills. After rain they spread themselves instantly over the whole country, to profit by the surface water and sudden crop of new grazing. The Turkana once depended largely on cattle, but now no longer so, for the grass, never abundant, has almost ceased to exist, except near the tops of the higher hills. Camels are now the mainstay of tribal existence, and Turkana, however dry, is good camel country.

The Turkana are an almost isolated community of camel users, for the neighbouring tribes in Abyssinia and the Sudan have none; in fact the whole southern Sudan is without camels. The connections of the Turkana breeds are with the Northern Frontier and Somaliland, whence they were derived, less than a century ago, via the south end of Lake Rudolf.

In this article the Turkana fauna is first classified according to various habitats, each of which is separately described. Finally, in the third section, some remarks are made upon the fauna from a more general point of view, and a summary given (as far as this is possible) of its zoogeographical composition.

The original collections and observations on which the account is based were made in 1934 in association with the Lake Rudolf Rift Valley Expedition. The collections have been handed over to various members of the staff of the South Kensington Natural History Museum, whom I have to thank for their kindness in furnishing identifications and information.

II. REVIEW OF THE FAUNA ACCORDING TO HABITAT.

I. THE PLAINS.

Most of Turkana is a level, sandy plain, though in many parts stones are freely scattered, and where the ground rises even slightly the winds and rains have prevented the accumulation of sand, so that in such places one finds little but loose stones, and crumbling masses of native rock here and there project from the surface.

It is the fauna of the level sands that presents most points of interest, for it includes most of those forms of life which connect Turkana with the northern and eastern deserts. One must distinguish between the ground fauna proper, and that which belongs rather to the vegetation of the plains; these are distinct, though they have their interactions.

The birds have been mentioned; the sandgrouse and coursers especially are part of the Turkana landscape, and seem to belong to the sands. But even these must fly to water—the sandgrouse daily, the coursers perhaps only occasionally—to satisfy their thirst. The creatures now to be described live entirely on the sands, and are totally independent of a water-supply.

Predators of the Sands.—The sand fauna is almost entirely nocturnal. A lamp placed on the ground at night will reveal many of its members, scurrying over the bare surface, and the flyers will gather from a distance, attracted by the light. It is a carnivorous community, presenting a scene of ceaseless mutual consumption. The ants and termites, deriving their sustenance largely from living or

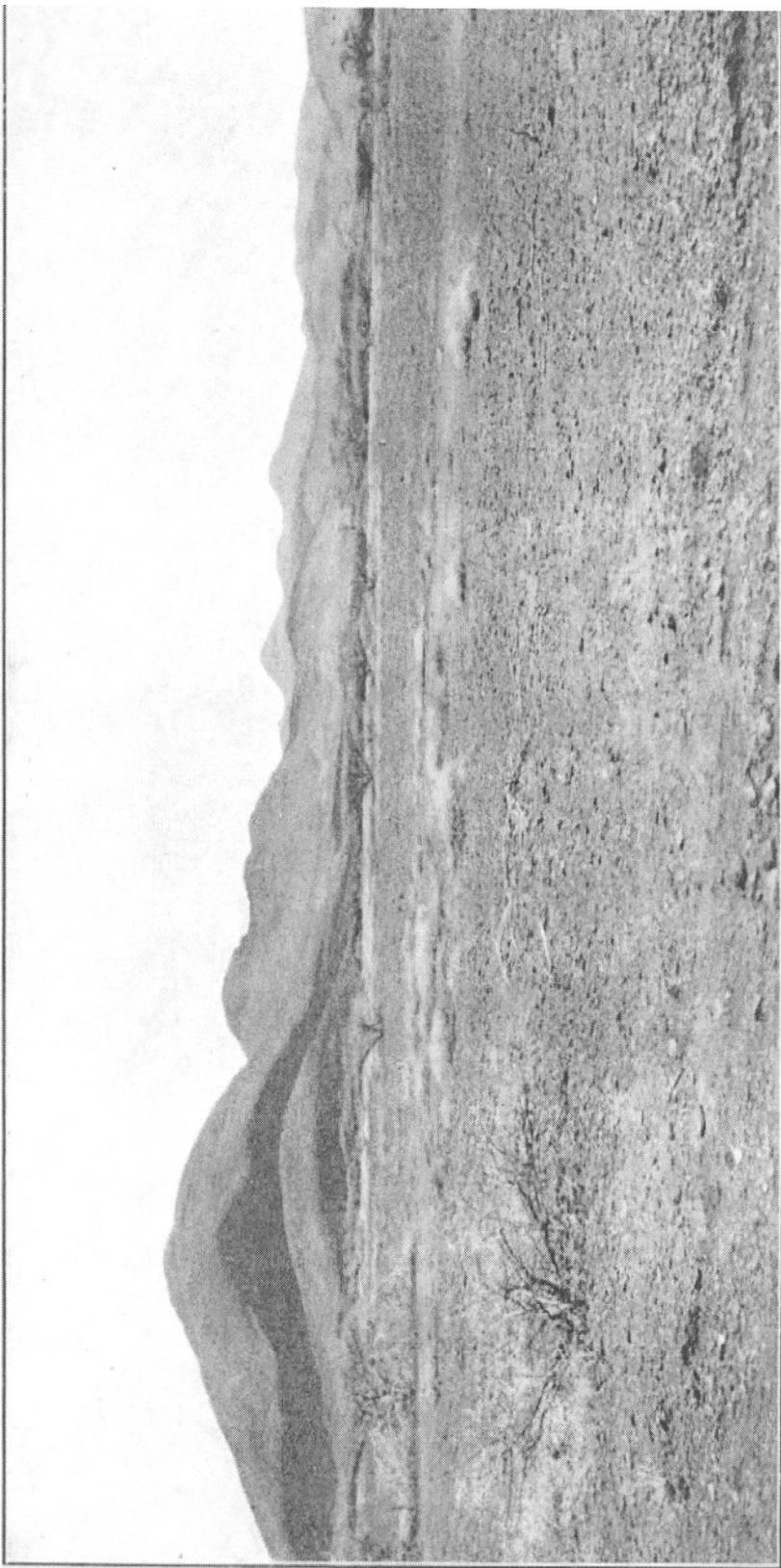
dead vegetation and miscellaneous refuse, form the chief basis of existence, though moths and other immigrants furnish their share to the carnivores.

At night the ants and termites run freely over the sands, and many fall a prey to the small ant-lions, species of *Nesoleon* and *Creoleon*, whose funnel-shaped excavations often cover the ground. The ant-lions are nocturnal in Turkana; by day, when the sand is hot, and little prey abroad, they lie at a depth in the ground, but every evening they may be seen reconstructing their pits in preparation for the night's trapping.

The many other creatures which prey on the ants and termites run in pursuit, and many of them are swift runners. The Coleoptera are represented by many large and handsome ground-beetles: there are species of *Calosoma*, much like the English ones; *Megacephala*, of brilliant metallic green colour; *Anthia hexasticta*, a large black insect with white spots; and yellow-spotted species of *Chlaenius* and *Pheropsophus*, some of which eject an explosive liquid when disturbed. Almost all the bugs of the sands are carnivores of the family *Reduviidae*. The most conspicuous are *Rhaphidosoma* and *Lopodytes*, the former apterous, both strangely elongated so as to resemble Hydro-metrids; and *Holotrichius*, of more normal form, with fully winged male and apterous female. All these genera are characteristic arid forms, widespread in the palaeo-arctic deserts.

More formidable predators are the arachnids, which always flourish in dry sandy country. Large long-legged spiders of the family *Sparassidae* are frequent in Turkana, living under stones. Scorpions also come abroad at night in numbers; the prevailing genus is *Buthus*, but a huge species with flattened claws (*Pandinus*) also occurs. Most interesting of all are the *Solifugae* (locally called Tarantulas) which race with extraordinary swiftness over the sand, but sometimes come to a standstill when dazed by the light of one's camp fire. They run on only six legs, the front pair being tactile, and held up in the air behind the larger pedipalae. They are provided with exceptionally large and powerful chelicerae. These *Solifugae* are of all sizes up to six inches long (though it may be that they exceed this length). The genus *Galeodes* has the longest and hairiest legs, and is small-bodied; *Solpuga* is intermediate, while the species of *Rhagodes* have very short legs but large bodies and terrible jaws, which can readily deal with the hardest beetles within reach of their gape. These arachnids are unequalled for sheer ferocity. If one of them be confined along with some insects, it will not rest until every one is killed. The moment something touches one of its sensitive hairs the *Solifuge* whirls round, mangles the offender in its formidable jaws, and, should it want no more food, abandons it until startled to furious activity by the next comer.

PLATE A.



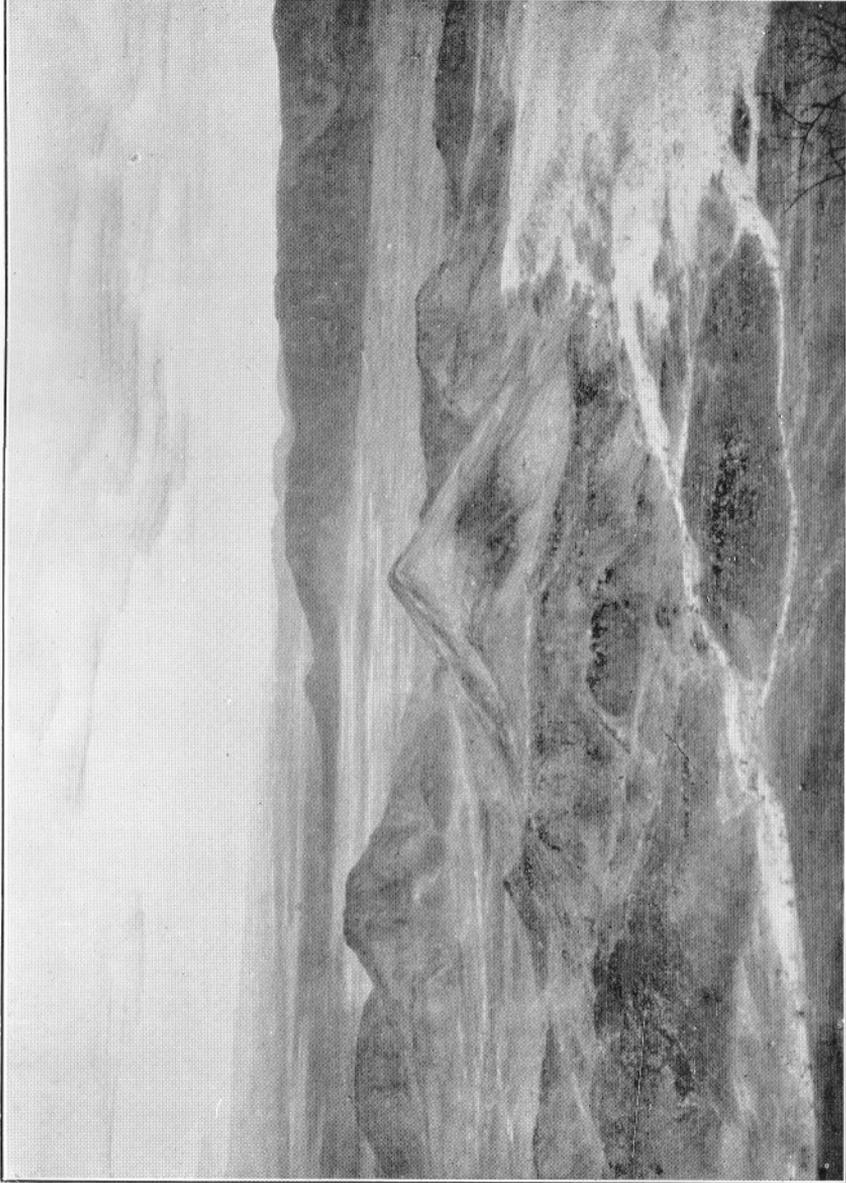
Murueris Hills, near Lokitaang. A very characteristic Turkana landscape.

PLATE B.



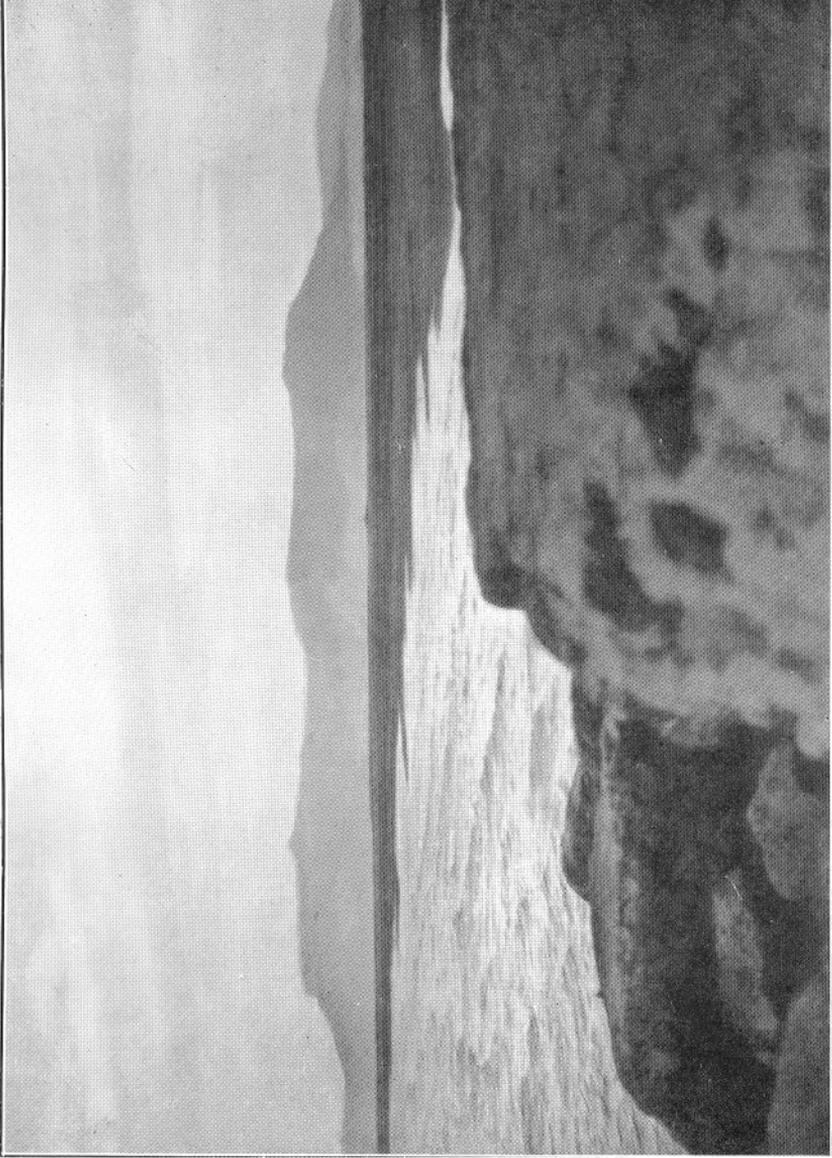
Kitale—Lodwar road. View south towards Napau escarpment, with a double termites' nest.

PLATE C.



From Lodwar Hill. View north-west.

PLATE D.



Loke Rudolf and Labour.

These great arachnids—spiders, scorpions, and *Solifugae*—themselves form the exclusive food of the sand-vipers (*Echis carinatus*). These are fierce little snakes, which lie coiled up under stones and fallen timber by day and make a hissing noise (apparently by the friction of their scales) when disturbed.

Other reptiles, insect feeders, take their toll of the sand fauna, and of those insects which live in the vegetation, but fly abroad at night. Such are the skinks, which preponderate over true lizards in the desert. Many of those which live in the sand have much reduced limbs, and progress by wriggling in the manner of snakes (genus *Riopa*). The true lizards remain runners; they are represented by the small long-tailed desert lizards *Eremias* and *Latastia*. The geckoes (*Hemidactylus*) are active nocturnal insectivores, feeding for preference on moths. All these reptiles probably fall a prey to the Sand Boa, *Eryx colubrinus*, a stumpy sand-coloured desert snake which constricts its prey after the fashion of the large Boas, and when inactive lurks buried in the sand.

The Scavengers.—Leaving the predators, one must refer to the scavengers, another important community of the sands. Among these are numbered the large black Tenebrionid beetles which are more characteristic than any other insects of the desert fauna. Commonest of all is *Pimelia hildebrandti*, which might be called the national insect of Turkana. It is a well armoured insect, and can have few enemies; but nevertheless falls a victim to the great monitor lizards (*Varanus ocellatus*) which live among rocks and trees. The *Pimelia*'s feeding habits are obscure, but it will eat such unattractive fare as the chitin of dead scorpions. It scours the ground very thoroughly, for any stretch of smooth sand will be found in the morning to be covered with tracks, running in all directions. *Phrynocolus placidus* is a Tenebrionid of similar dimensions, with heavily corrugated elytra. The genus *Vieta*, all brown and hairy sand dwellers, is represented by several species. *Arthroditibus major* and the species of *Zophosis* are further black wingless ground-dwellers of the same family; many others, furnished with wings, come to light in the evening; they do not appear to belong to the sands and their way of life is little known.

One of the commonest scavengers is a *Trox* (*T. incultus*) which lives on dead animal matter and dung, and flies to light in numbers. The dung-beetles proper (*Coprinae*) also abound wherever wild or domestic animals are numerous.

The crickets (*Gryllidae*) are a frequent group, and their song is seldom silent after sundown. They include a large species (*Gryllus bimaculatus*) as well as the smaller house-cricket (*Gryllulus domesticus*), which has become cosmopolitan as a domestic insect. *Blattidae* (cockroaches) are also fairly numerous, and a curious desert genus, *Polyphaga*, is sometimes found lurking under stones. Its members

are very short and broad, and apterous, so as somewhat to resemble certain marine Isopods. One may also mention, in this category of scavengers, the *Thysanura* (*Machilis*, etc.), *Collembola*, Pseudo-scorpions, and mites.

Immigrants.—Among those insects which depend obviously on the vegetation, but wander abroad at night (sometimes to be eaten by the predators of the sands), the *Cerambycidae* or longicorn beetles whose larvae burrow in wood are conspicuous. A great many species live in Turkana, and many of them are attracted to light. Some of the large species, which are among the most handsome of insects, may be found by day under the loose bark of dead acacias. Others are extremely cryptic, and spend the day fully exposed on the branches and trunks of trees, but can seldom be seen. The *Bostrychidae* and other small families of wood-boring beetles are abundant; so are Rutelids, Melonhids, and Elaterids, whose larvae are all root feeders.

Many moths come forth at night, and are much sought after for food, especially by the geckoes, bats, and nightjars. The commonest and most conspicuous are certain large Noctuids of genera widespread in tropical Africa. The most abundant is *Sphingomorpha chlorea*, closely followed by *Gyligrama latona*, a large moth with a great expanse of wing, but with very drab white and grey coloration.

Another group of insect carnivores, the Mantids, invade the sands at night and may be observed to feed there, though they belong rather to rough stony ground and the thin dry bush which grows in such places. Certain genera of small grey or brown coloured mantids—*Elaea*, *Tarachodes*, *Charieis*, *Tarachina*—apparently flourish in these dry habitats, and are very frequent in Turkana. The individuals attracted to light are invariably males, the females being of much heavier build and often quite flightless. I never myself collected the females of any of these genera, but I once unearthed a burrowful of provisions buried in the sand by a large Sphecoid wasp (*Stizus lughensis*) and these consisted exclusively of the brachypterous females of *Elaea* and *Tarachodes*. They had evidently been collected by the wasp from the bare rocky ground of the surrounding country, which they very closely resembled in colour.

Two other Mantids of occasional occurrence near the larger riverbeds, where there is vegetation sufficiently luxuriant to house them, do not properly belong to the dry-country fauna. These are *Tenodera superstitiosa* and *Hierodula viridis*, both large species of green colour, very widely distributed in Tropical Africa.

Other members of this interesting group—one sand dweller, and two from the mountain grasslands—will be mentioned in their proper places.

The diurnal fauna of the sands.—The sand fauna described above is almost entirely nocturnal. The large white-spotted Carabid *Anthia* has indeed the reputation of having diurnal habits, but I never saw one abroad in Turkana until dusk. The sand fauna is not even particularly easy to find by day, for the smaller loose stones do not afford enough protection from the heat, unless they lie in shady places. The nocturnal creatures mostly lie up under the largest boulders or prostrate tree trunks (where such exist), or they resort to deep crevices among rocks, or holes in the ground.

There remain to be described a small assemblage of insects whose period of activity is the heat of the day. These are undoubtedly the most interesting members of the desert fauna, since they have to withstand temperatures on the sands which one would expect to be lethal. During the greater part of the year the Turkana sands reach a surface temperature of 130 to 150° F. for some hours daily, yet even at this hottest period certain members of the fauna remain active.

The only beetles to be seen are members of the Tenebrionid genus *Zophosis*, small oval black creatures, which may be seen running and tumbling with desperate haste on sand or among stones at any time of day. *Hemiptera* are represented by the Reduviid genus *Holotrichius*, especially by their young, which are generally so coated with sand and debris as to be unrecognisable. The wingless females sometimes patrol the sands, but the males, which fly to one's lamp by night, apparently spend the day elsewhere.

The remaining diurnal ground-dwellers are all *Orthoptera*. They include the typical desert grasshoppers, mostly species of depressed form closely matching their environment. Of these the much flattened genus *Chrotogonus* is found wherever there is bare ground in Africa. Other species, special to desert or semi-desert country, are four of *Sphingonotus*, two of *Platypterna*, two of *Pycnodictya*, an *Acrotylus*, and a *Scintharista*. Of these, three species are new and as far as yet known endemic to Turkana (*Sphingonotus turkanae*, *Pycnodictya dimorpha turkanae*, *Platypterna safiana*). Many other Turkana species belong to genera characteristic of dry savanna rather than desert country; others again are not specially characteristic of arid country at all.

The geophilous genera are often remarkably variable, and closely resemble the background on which they live. Thus *Sphingonotus canariensis* and *savignyi* are both of lighter colour and more speckly when they occur on open sandy ground, while in a stony habitat where stones of different colours are strewn on the ground they exhibit a range of grey, brown, and pinkish shades. Some species, though extremely inconspicuous when at rest on the ground, leap into prominence as soon as they take flight; such are *Scintharista notabilis brunneri* and *Acrotylus longipes incarnatus*, both with red on the wings.

Perhaps the most interesting of all the sand dwellers is a curious desert Mantid identified as *Eremiaphila cordofana*. The genus is peculiar to desert country, and is represented by several species in the various Palæartic deserts. These insects live on the bare sand often far from stones or any other cover, and it would be difficult to say what other creatures they can find to feed on. In form they are unlike other Mantids, being very short and broad, with almost circular abdomen partly covered by vestigial elytra; but their four running legs are long and enable them to move with surprising speed. Their colour matches that of the sand so well that it is practically impossible to see these insects unless they move.

Termites.—The termites play an important part in the economy of nature in Turkana just as do their nests in the outward semblance of the landscape. But for their unceasing and ubiquitous activities, the country would be largely encumbered with dead brushwood, which in that arid climate could never rot away. The amount of dry vegetable matter annually disposed of by the termites must be quite beyond computation.

Some termites wander at large on the sands at night, and these, as has been mentioned, are liable to be eaten by various carnivorous insects and arachnids. But the chief insect enemies of the termites are Ponerine ants, which invade the nests in companies, and finally emerge bearing numbers of mangled termites in their jaws. One sometimes meets processions of some hundreds of these large stinging ants on the march; they break up and scatter when approached too closely, producing at the same time a very audible stridulation. One of the most peculiar of African mammals, the Ant Bear, inhabits the Turkana plains, and probably lives entirely off termites, ripping open the nests at night with its exceedingly powerful claws. The large soldier termites, which readily draw blood on the human skin, would be an annoyance to most animals interfering with the nests, but the Ant Bear is protected against these by an unusually tough hide.

The principal termite of Turkana, builder of the chimney-nests, is *Macrotermes bellicosus*, a species of immensely wide distribution in Africa, though it does not by any means always build the same type of nest, and in some places builds none at all. The material of the nests, consisting of sandy soil compacted with a salivary secretion, is extremely hard when dry, but readily softened by rain; it is doubtless for this reason that the finest specimens of the chimney nests occur in the exceedingly dry Turkana climate. There they may be seen rising to 25 feet or more, but stories of nests exceeding thirty feet tend to arouse one's scepticism.

These nests have a more or less conical base accounting, in well-developed specimens, for little more than one-third of the total height. This is surmounted by a tall chimney of almost constant diameter; a

genuine chimney, hollow inside and open at the top. It is impossible to say what prompts the termites to build these extraordinary nests, and difficult to be sure what useful function is served by the chimneys. If one's hand is introduced into the chimney of a flourishing colony the air inside feels warm; but in fact this air is no warmer, by day, than the outside atmosphere, and feels so only because it is damp. The inside air may have a humidity of 80° while outside it is no more than 30°; this is due to constant evaporation from the fungus gardens maintained by the termites in the inner regions of the nest. There is certainly no regular circulation through the chimney; but since the inside temperature must be relatively constant one would expect some upward movement at night, when the inner air should be warmer than outside, while during the heat of the day the tendency would be the other way.

One can only speculate as to the source of the water with which the fungus gardens are kept perpetually moist, but it seems probable that the termites bring it up from the subsoil. Their excavations certainly penetrate to great depths below ground. In the ordinary course they cannot obtain water in sufficiency for building; this happens only after rain. When a substantial fall has occurred the termites build tirelessly, even during the day, when they are not usually to be seen in the upper parts of the chimneys, exposed to the light of day.

A considerable community of strangers share the great termite-tries with those that build them, on terms of mutual toleration. A small "parasitic" termite, probably *Microtermes incertus*, is almost invariably present in the lower part of the nests, where it excavates its own system of galleries, and chambers where large fungus gardens of most beautiful construction may be found. Many species of ants also take up their quarters in the termites' nests, and make their own passages, which never meet with those of the other tenants of the structure. The chimneys of these nests, with their very humid atmosphere, afford perfect shelter for the soft-skinned geckoes, one or two of which are almost always present. When the colonies are moribund or dead—as most of those in some of the driest parts appear to be—the nests develop numerous holes, in which mice and other creatures find temporary refuge.

2. THE MOUNTAINS.

The rocky ground near the foot of the mountains has a somewhat different assemblage of inhabitants from the neighbouring sands. The arachnid groups are not prominent here, for they prefer to run on open sandy grounds. The small grey dry-country Mantids, whose females are mostly short-winged, seem to flourish in these stony places, and certain grasshoppers (notably *Sphingonotus rubescens*, whose colour closely harmonises with the dark volcanic rocks) are

almost confined to such situations. Some very fine large Myrmeleonids, unknown to the sandy country, also occur here (*Palparellus rothschildi*, *Palpares klugi* and *papilionoides*).

Some parts of the mountain slopes are clothed with a very thick scrub which harbours a considerable insect population, and in these places lizards are particularly numerous. There are skinks, all swift runners with fully developed limbs (*Mabuya*), true lizards, monitors, and Agamids with their usual brilliant red and blue decoration.

Wherever a large outcrop of deeply fissured rock occurs one may expect to find the giant millipedes living. As a rule their presence is made known only by numbers of dead specimens and odd rings which litter the ground, for these creatures only emerge (at least by day) after rain has fallen—an uncommon occurrence in Turkana. They very quickly expire when exposed to strong sunlight, and it seems that they must sometimes be caught and killed in numbers by the sun, when drawn out from their rock-recesses by a day-time shower. One commonly finds fresh specimens lying dead on the ground on such occasions.

The mountains have their special fauna of mammals. Ignoring the nocturnal carnivora, such as leopards, hyaenas, and jackals, one may mention a few highly characteristic creatures which can be seen by the light of day. Hyrax live among the rocks, and, like marmots or rabbits in Europe, lie out in the sun by day, within easy reach of their retreats into which they quickly bolt when approached. Troops of baboons, whose agility in rock-climbing is almost incredible, are often met with in the hills. They pay frequent visits to rock-pools, which they reduce to a very messy condition. Higher in the mountains one may meet the Klipspringer, a small greenish-brown antelope which alone of its tribe has taken to a life among rocks. It is wonderfully sure-footed and takes prodigious leaps from rock to rock.

The grasslands which occur towards the tops of the higher mountains are the only habitat in Turkana where the typical dry-grass fauna of the African savannas can find congenial conditions of life. In these habitats, at four to five thousand feet above sea-level, one can collect grasshoppers and Mantids, mostly straw-coloured and of slender form, quite unlike those of the plains. Some of these are species characteristic of grassy country at the same level to the west and south of Turkana. On the other hand the isolation of these mountain masses has enabled endemic species to develop; thus a new grasshopper (*Brachycrotaphus brevis*) and a new Mantid (*Oxyothespis parva*) were collected on Mount Kaitherin.

3. THE LAKE SHORE.

The shore of Lake Rudolf has a community quite distinct from that of the inland sands, for it provides two habitats which have no

counterparts away from the lake : a belt of permanently green grass-land, and a narrow zone of damp sand close to the water's edge.

The damp sandy zone, saturated with the soda-solution of the lake water, harbours thousands of midge (Chironomid) larvae, and is dotted with small vertical burrows in which the carnivorous young of the Tiger Beetles live. These larvae are evidently sought after by the sandpipers and other small waders which frequent the shoreline. Under every loose stone one finds earwigs, probably *Labidura riparia*, a species which always affects the vicinity of salt or soda-containing water. These earwigs show an extraordinary variation in individual size, the largest adults, about two inches long, being almost double the length of the smallest. The earwigs are probably the scavengers of the shoreline.

Various small flies frequent the water's edge, and these constitute the chief food for the remainder of the community. A certain black-and-yellow solitary wasp (*Bembex* sp.) is always present, engaged in hawking the flies with which to provision its burrow. The wasp flies steadily up-wind, following the shoreline, and maintaining a height of about a foot above ground. If disturbed it immediately loses equilibrium and is blown out of sight by the strong wind, but soon regains control and reappears, working up persistently in the same direction as before.

The most conspicuous insects of the shore region are Tiger Beetles (*Cicindelidae*) which live here in enormous numbers, probably preying upon the smaller flies which abound near the water. They take so readily to flight when disturbed and are so active on the wing that one might mistake these beetles for flies at first sight. Three species are represented, two of which, *Cicindela nilotica* and *brevicollis*, both small, are extremely abundant, while a third larger species, *C. dongalensis*, is comparatively uncommon. The common Pratincole of the lake shore, *Glareola pratincola fulleborni*, a bird of somewhat tern-like flight and great agility on the wing, was found to be feeding almost exclusively on these *Cicindelids*, together with an occasional earwig.

The dragonflies are a group well represented in numbers by the lake, though the species are only two. One of them, *Brachythemis leucosticta*, is an abundant insect near water all over East Africa. The other, *Paragomphus pumilio*, is known mainly from the Sudan region. These dragonflies, like the other carnivorous insects of the shoreline, feed on small flies, and it is noteworthy that they remain active long after sundown so as to profit by the midges which then come abroad. Other insects noted by the lake were a caddis and a small mayfly, both dependent on the water for their larval stages.

The sand fauna away from the immediate shoreline includes many of the same creatures as inland : the same large Tenebrionid beetles *Pimelia* and *Phrynocolus*, the same Arachnids, and the small sand-viper

Echis carinatus which feeds on them. But the lake-shore sands are never heated to such high temperatures as elsewhere, with the result that these creatures spend the day much nearer the surface and can be found under small stones, and in similar accessible places. One special grasshopper, *Conipoda gracilis*, is found only on the open sands near the lake; it is a speckly species hardly visible on the sand. Two species of *Sphingonotus*, *S. canariensis* and *savignyi*, also occur on these sands, where they assume a lighter colour and more speckly pattern than elsewhere.

Some parts of Lake Rudolf shore, such as Ferguson Bay in the middle of the west coast, have considerable areas of natural grassland, consisting almost entirely of a prickly species, *Sporobolus spicatus*. These are the only areas of permanently green grassland in Turkana. The same areas are utilised by the natives for cultivating mtama or millet (*Sorghum*), and wherever a plantation has been established grazing is prevented, so that the grass, usually cropped down to the ground, is enabled to grow long. These occasional patches of longer grass have a very large population of grasshoppers, most of which are not to be found elsewhere in Turkana.

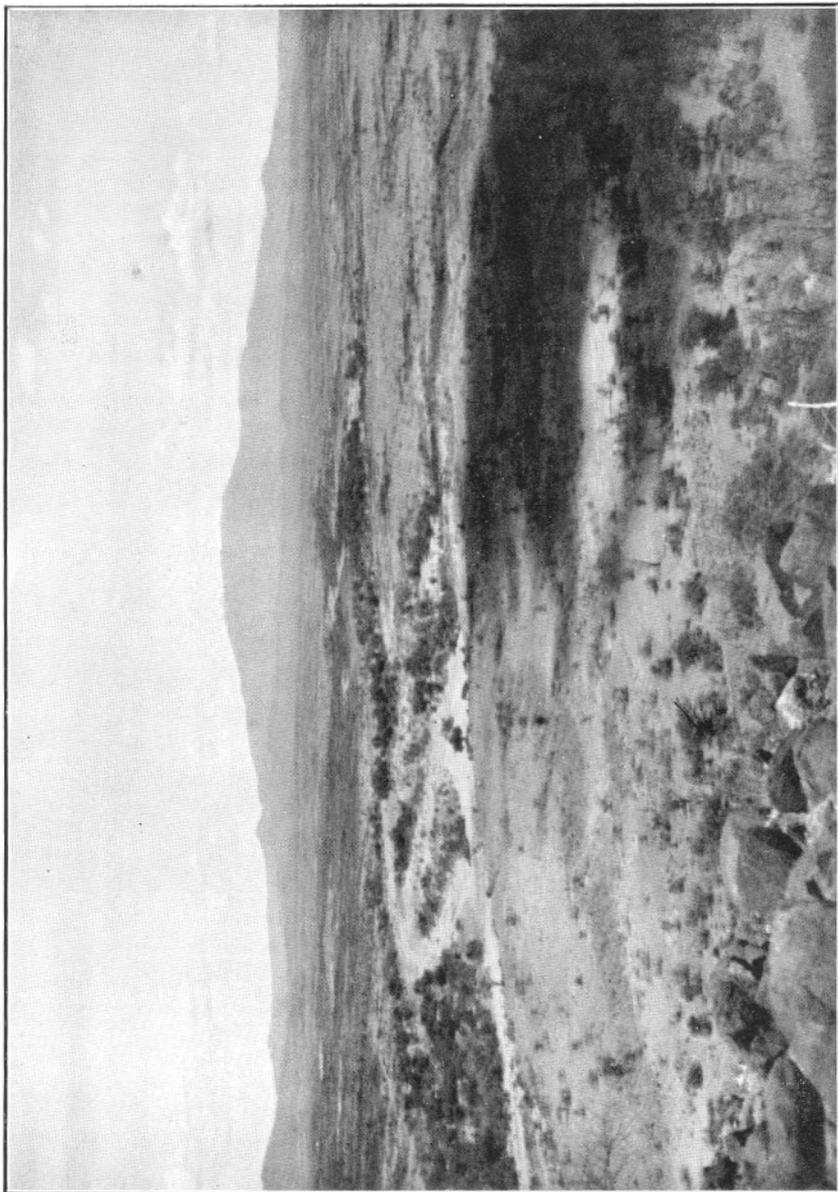
The grassland genera include *Oedaleus*, *Aiolopus*, and *Platypternodes*, of which an endemic species, *P. rudolfi*, was collected. A very characteristic species, found only in dry conditions where water and good grassland nevertheless occur, is *Calephorus venustus* (formerly *compressicornis*). Finally, these grasslands were found to harbour an apparently permanent colony of the African Migratory Locust, *Locusta migratoria migratorioides*, the habitat requirements of whose solitary phase are very similar to those of the *Calephorus*.

4. THE ROCK POOLS.

These are virtually the only permanent and stable aquatic habitats away from the lake in Turkana, since even the largest water-holes in the river beds change their location from time to time, and provide little opportunity for continuity of life. Both water-holes and rock-pools do however serve as drinking places for numbers of creatures which require water regularly, so a considerable terrestrial community depend upon these sources of water for their continued existence in the arid country.

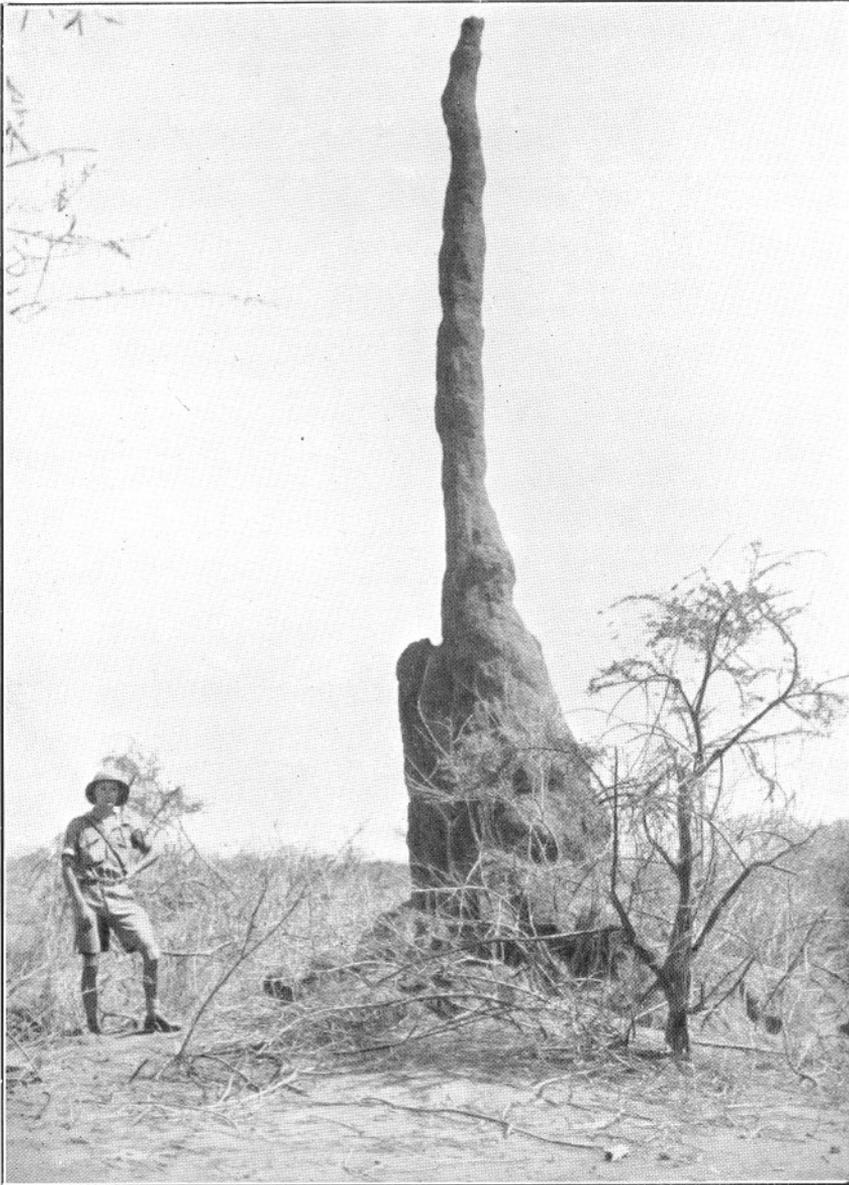
The birds have already been mentioned in this connection; the most regular visitors are the Pin-tailed and Bridled Sandgrouse, whose drinking hours are respectively the early morning and the evening, and the doves, which live only within easy reach of water. Among insects the most persistent frequenters of the water-holes are *Hymenoptera*, including various bees and solitary wasps, mainly *Eumenidae*. Syrphids (hover-flies) and a few butterflies also assemble there.

PLATE E.



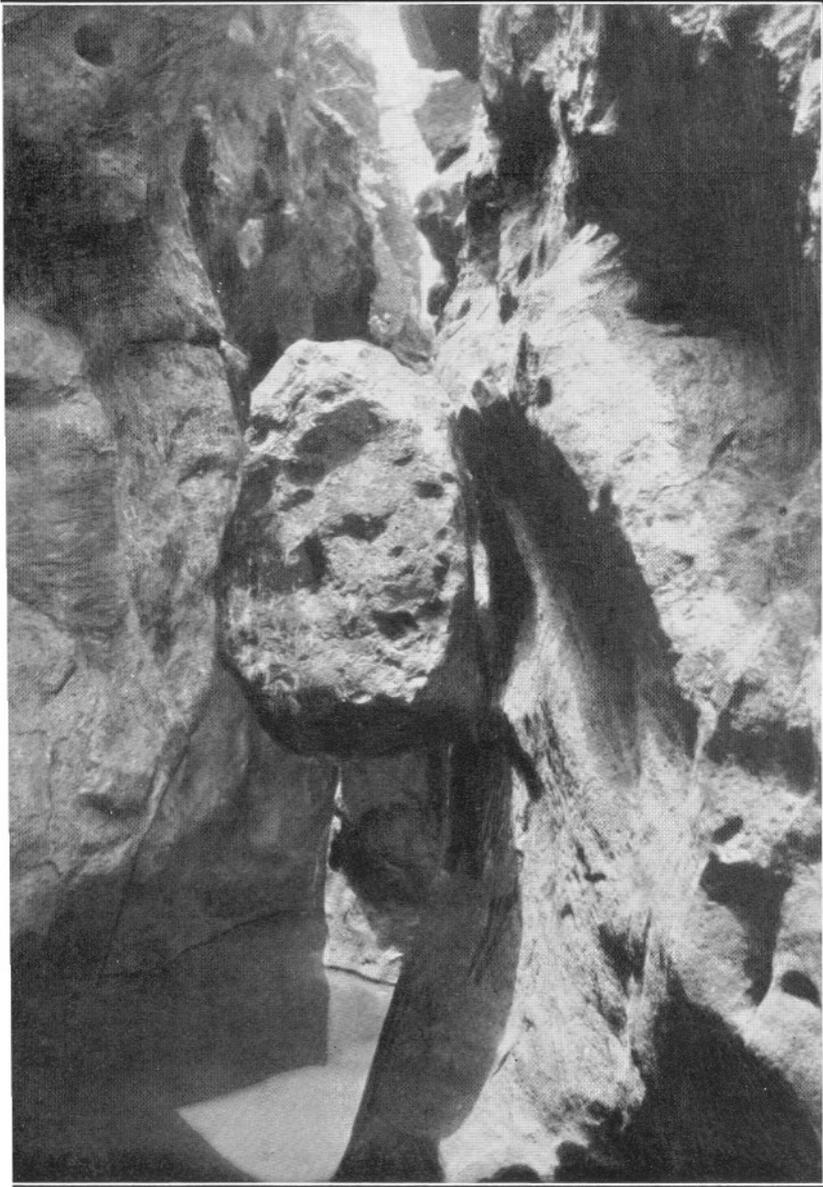
Moroto Hill from a small hill near the Moroto Road.

PLATE F.



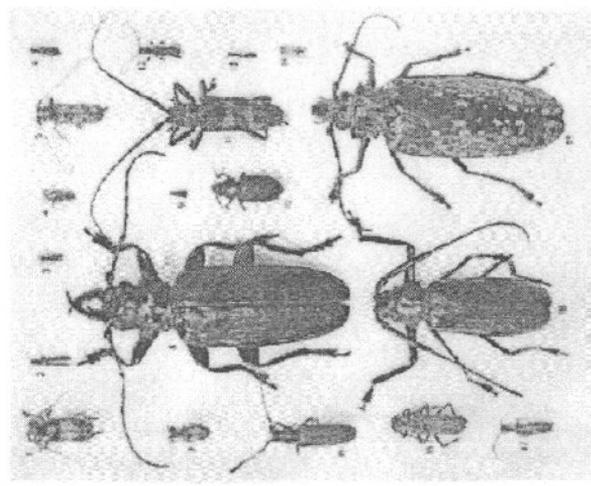
Termites' nest 22 or 23 feet high.

PLATE G.



Rock pool at Naramum (Sudan territory).

FIGURE 1

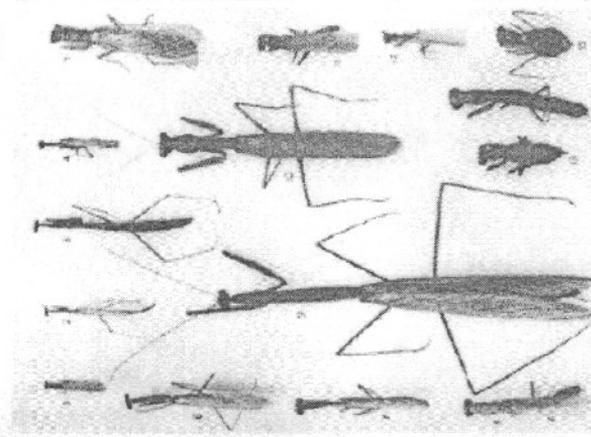


GROUP OF LONGICORN BEETLES (CERAMBYCIDEAE)

Five or six of the best represented families of insects in Turkana, and country area very common. The longicorns are distinguished into two groups, whose they range of night. Some of the smaller ones are very especially colored. 1, 2, 3, 4, 5, 6, 7, and 8 are heads of the same when young, measured on the back of a line. The illustrations are as follows:

1. *Acrotylus* (Cerambycidae) 2. *Phyllocolpa* (Cerambycidae)
 3. *Phyllocolpa* (Cerambycidae) 4. *Phyllocolpa* (Cerambycidae)
 5. *Phyllocolpa* (Cerambycidae) 6. *Phyllocolpa* (Cerambycidae)
 7. *Phyllocolpa* (Cerambycidae) 8. *Phyllocolpa* (Cerambycidae)
 9. *Phyllocolpa* (Cerambycidae) 10. *Phyllocolpa* (Cerambycidae)

FIGURE 2

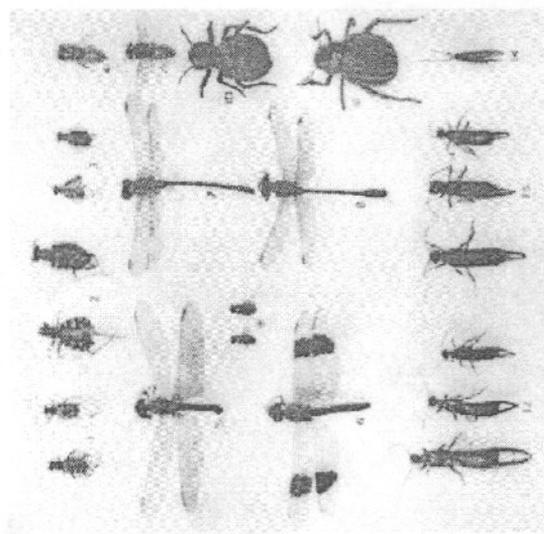


GROUP OF MANTIDAE

A great number of Mantidae are found in Turkana. 1 and 2 are very good in the same specimens on their heads. 3 and 4 are very good in the same specimens on their heads. The mantids are very common to live in grassy dry banks, but they are not in the same amount in the same area. 1 and 2 are the same wings, scales of 1 and 2.

1. *Mantodea* (Mantidae) 2. *Mantodea* (Mantidae)
 3. *Mantodea* (Mantidae) 4. *Mantodea* (Mantidae)
 5. *Mantodea* (Mantidae) 6. *Mantodea* (Mantidae)
 7. *Mantodea* (Mantidae) 8. *Mantodea* (Mantidae)
 9. *Mantodea* (Mantidae) 10. *Mantodea* (Mantidae)

FIGURE 3



FAUNA OF THE LAKE RUDOLF SHORE

All these insects are confined to the lake shore with the exception of 10 and 11, which are common throughout the country. 12 is a common fly throughout the country. 13 is a common fly throughout the country. 14 is a common fly throughout the country. 15 is a common fly throughout the country.

1. *Phyllocolpa* (Cerambycidae) 2. *Phyllocolpa* (Cerambycidae)
 3. *Phyllocolpa* (Cerambycidae) 4. *Phyllocolpa* (Cerambycidae)
 5. *Phyllocolpa* (Cerambycidae) 6. *Phyllocolpa* (Cerambycidae)
 7. *Phyllocolpa* (Cerambycidae) 8. *Phyllocolpa* (Cerambycidae)
 9. *Phyllocolpa* (Cerambycidae) 10. *Phyllocolpa* (Cerambycidae)
 11. *Phyllocolpa* (Cerambycidae) 12. *Phyllocolpa* (Cerambycidae)
 13. *Phyllocolpa* (Cerambycidae) 14. *Phyllocolpa* (Cerambycidae)
 15. *Phyllocolpa* (Cerambycidae)

16. *Phyllocolpa* (Cerambycidae) 17. *Phyllocolpa* (Cerambycidae)
 18. *Phyllocolpa* (Cerambycidae) 19. *Phyllocolpa* (Cerambycidae)
 20. *Phyllocolpa* (Cerambycidae) 21. *Phyllocolpa* (Cerambycidae)
 22. *Phyllocolpa* (Cerambycidae) 23. *Phyllocolpa* (Cerambycidae)
 24. *Phyllocolpa* (Cerambycidae) 25. *Phyllocolpa* (Cerambycidae)

Something may now be said of two rock-pool faunas. The one belongs to a series of pools at Lokitaung, in the Labur mountains near the northern end of Lake Rudolf; the other to a very isolated pool at Naramum, beyond the Kenya border.

The Lokitaung pools have a fauna much resembling that of similar habitats anywhere. An abundant growth of green algae supports the herbivorous members of the Hemiptera and other usual aquatic groups. The Larvae of mosquitoes and midges doubtless provide the principal food of the carnivorous insects, which include Dytiscid beetles, water-scorpions (*Nepidae*) and the larvae of several very widely distributed dragonflies. A frog, *Rana oxyrhinchus*, is common and probably makes use, in its various stages, of the greater part of the other life of the pools.

A Tiger Beetle, *Cicindela alboguttata* (a species never found by the lake shore) finds breeding sites near the edge of these pools, as also does a luminous Lampyrid (glow-worm), whose larviform females seem to be almost amphibious. The rocks which in places overhang the water of the pools harbour a gecko, *Hemidactylus brookii*, the same species which occurs in the chimneys of termites' nests.

The Naramum pool, which is the only source of water for a very large area, lies in a deep rock-crevice, so narrow that a large boulder has become wedged between its walls and hangs over the heads of those who come for water. This pool is twenty to thirty feet long by about seven feet deep, and its water maintains a constant temperature of 74°F. It contains an animal community quite different from that of Lokitaung; one almost as limited and as peculiar as it is possible to imagine.

Aquatic insects were found to be very scarce in the pool, and totally inadequate to support a huge population of frogs which seemed to be the chief occupants of the place. The frog is a species of *Xenopus* (*X. clivii*), a genus of entirely aquatic habits, related to the so-called Surinam toad of S. America. The pool swarmed with the curious transparent larvae of the frog, which grow to an enormous size and resemble small cat-fishes rather than tadpoles. They swam together in shoals, until the period of transformation when their habits changed. The adult frogs spent most of their time at the bottom of the pool, but sometimes floated at the surface for a considerable time; if these were disturbed they took a hasty gulp of air before diving to the bottom.

The food of the tadpoles must have been the green algae and microscopic plankton of the pool; but that of the adults was by no means obvious, for insect life was altogether insufficient for their needs. A snail (*Physopsis ovoidea*) was present in some numbers, and it seemed that these might contribute to the food supply of the adult frogs. However an examination of the stomach contents of the single

adult captured has revealed no trace of snails, or of insects. The specimen in question had been feeding exclusively on the larvae of its own species.

This strange form of cannibalism was perhaps induced by the unusual economy of the habitat, where there was a dearth of intermediary organisms fitted to make the microscopic life available for the adult frogs. It may be that only by falling back on their own abundant tadpoles to fulfil this necessary function could the frog population exploit to the full the resources of the pool.

A Giant Water-bug, *Lethocerus niloticus*, one of the few insects directly predatory on vertebrates, completed the fauna of the Naramum pool. A specimen was caught actually holding a young frog transfixed on its large raptorial fore-limbs.

5. THE EFFECTS OF RAIN: TEMPORARY HABITATS.

A heavy fall of rain has very remarkable effects in the semi-desert country. The innumerable seeds which have lain on the ground through the period of drought at once germinate, so that in a few days the ground is turned green by thousands of seedling plants. The dry acacias put out leaves, and here and there handsome bulbous plants, especially the red and yellow *Crinum* lilies, spring up from the bare ground.

Simultaneously there occurs an outburst of insect life. The species observed before the rains mostly appear in vastly greater numbers, and many new ones are seen for the first time. Among the beetles which came to light immediately after the Turkana rains of April, 1934, swarms of small chafers (*Melolonthinae* and *Rutelinae*) and of small longicorns were especially conspicuous. Later on extraordinary numbers of grasshoppers (mainly *Oedaleus*) made their appearance along with the ephemeral vegetation, and in places Meloids (oil-beetles) whose larvae had probably been feeding on the grasshoppers' eggs, occurred in great numbers. The species included several black-and-yellow or black-and-red *Mylabris*, and a beautiful metallic-purple *Cyaneolytta*. Butterflies appeared, though in small numbers; the commonest species were *Danaida chrysippus* and its mimic *Hypolimnas mysippus*, both of wide distribution.

The acacias after the rains resounded with the song of Cicadas; the wet must have prompted their nymphs to emerge from the ground and transform. A huge brown Buprestid beetle, *Sternocera druryi*, had also emerged in great numbers. These creatures generally hung among the topmost twigs of the acacia bushes, where they were absurdly conspicuous and impossible to overlook; but their extreme hardness no doubt protected them from the attacks of birds.

A further effect of the rain was greatly to activate the whole of the ground fauna. The scorpions and *Solifugae* appeared in largely in-

creased numbers, and some of the nocturnal Tenebrionid beetles, notably *Arthrodibius major*, began to show themselves by day. Still more remarkable was the appearance on the sand of innumerable monstrous mites (*Trombidium*) which had never been seen anywhere before the rains. These mites were of beautiful velvety texture and brilliant red colour, and grew to nearly half an inch in length. They belong to the same genus as the European Harvest Mites, whose adults are believed to lead a subterranean life, living on the root systems of plants. Possibly these large African species of *Trombidium*, which seem to spend the greater part of their existence buried in the sand, maintain life in the same way.

An unexpected result of the Turkana rains was the hatching out of locusts (*Locusta migratoria migratorioides*) from eggs which must have lain in the ground some considerable time. Occasional individual locusts arose under natural conditions, but a far larger number appeared at Lodwar, in the mtama (millet) plantations which had been established after the flooding of the Turkwell. There is reason to suppose that the eggs which gave rise to this population had lain in the ground for two years. A smaller number of other large grasshoppers, *Gastrimargus volkensi* and *Cyrtacanthacris tatarica*, as well as the long-horned grasshopper *Homorocoryphus nitidulus*, appeared along with the locusts.

Another notable creature brought out by the rains was a large tortoise, *Testudo pardalis*. It is an uncommon animal in Turkana, and contact with it is supposed by the natives to have beneficial effects. If one be encountered on the march one's Turkana retainers will rush to the beast in high excitement, and then alternately lay their hands on its shell and touch their head or chest.

One effect of the rain is to produce a multitude of temporary pools, and these are quickly colonised by various water-loving insects—dragonflies, mosquitoes, water-beetles (especially the Dytiscid *Eretes*) and *Hemiptera*. Probably most of them—and certainly the dragonflies—reach these temporary habitats by flying or being blown there, but it is remarkable that certain pools, at great distances from any permanent water, should be colonised so rapidly, especially by the mosquitoes. One is led to speculate whether the eggs of some mosquitoes and perhaps other insects can survive periods of drought, like those of the phyllopod Crustacea.

The rivers which flow for a time after rain also acquire a large fauna, remnants of which one finds inhabiting puddles after the river has ceased flowing. Vast numbers of frogs (*Rana delalandii*) appeared in the Turkwell at Lodwar when that river had been flowing; it is even said that small fishes occurred. Probably the eggs of both frogs and fishes had been washed down from the permanently flowing headwaters of the river. On the other hand various flying insects (dragon-

flies, Tiger-beetles, the wasp *Bembex*, etc.) must have followed up the course of the flowing river from the lake. Very few of the creatures can be of local origin, for the water-hole-fauna is extremely limited; and most of them must perish when the rivers cease to flow and the numerous puddles dry up.

At least one group of river-dwellers do, however, contrive to live through the long periods of drought between the rare and short occasions when the rivers flow. These are the small turtles, *Pelomedusa galeata* and others. During the dry periods they lie buried at great depths in the sand of the river beds, where they must be able to remain, on occasion, for years at a stretch.

III. GENERAL REMARKS, AND ZOOGEOGRAPHICAL SUMMARY.

The leading characteristic of the Turkana fauna, as compared with that of typical African savanna country, is the preponderance of groups dependent on animal food. Owing to the comparative scarcity of green vegetation, leaf and flower-haunting species are rare; vegetable feeders are represented mainly by the wood-boring or root-feeding groups.

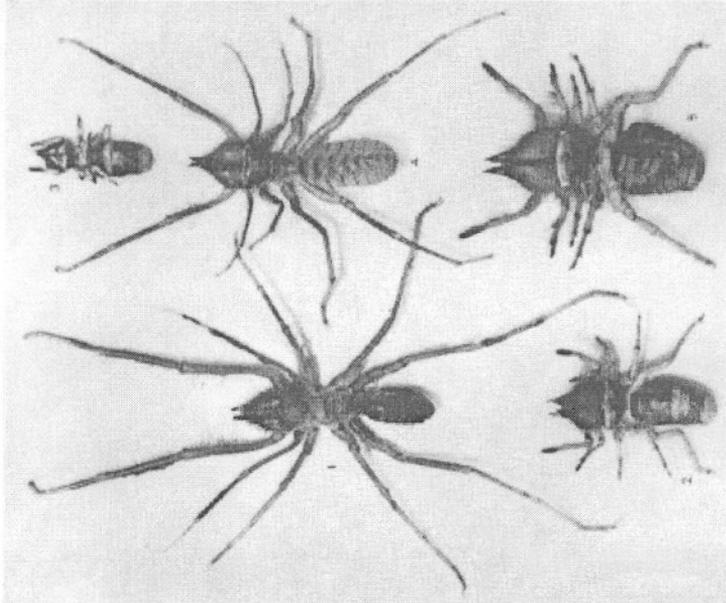
In illustration of this fact one may take the beetle. The *Carabidae* and *Cicindelidae* are active predators, both as larvae and adults; the *Meloidae* are carnivores as larvae. The *Coprinae* are uniformly dung-feeders. The common *Trox* and most of the *Tenebrionidae* probably depend on dead animal matter. The *Cerambycidae* and *Bostrychidae* have wood-boring larvae; those of the *Melolonthinae*, *Rutelinae*, *Buprestidae*, and *Elatерidae* are root feeders. Families conspicuously rare are the *Cetoniinae* (Rose-chafers), *Coccinellidae* (lady-birds), *Chrysomelidae* (leaf-beetles, etc.), and *Cantharidae*—all these being foliage-haunting insects.

Among the *Hemiptera*, by far the most abundant family is that of the carnivorous *Reduviidae*, whereas in most ordinary environments these are in a small minority. Other carnivorous groups which play an unusually important part in the dry-country fauna are the Mantids and Myrmeleonids, and the Arachnid orders—scorpions, spiders, and *Solifugae*.

The Butterflies, *Hymenoptera*, and many groups of flies are poorly represented as compared with neighbouring regions; the *Pentatomidae* and other plant bugs are very scarce.

In spite of the numerous absentees mentioned and the general dry-country facies of this fauna, it is far too rich to be described as of desert character. Probably well over half the entire fauna consists of wide-spread tropical savanna species. Only two groups have been worked out from a distributional point of view—the Reptiles (with Amphibians) and the *Acridiidae* (Short-horned grass-hoppers). The

Plate IV



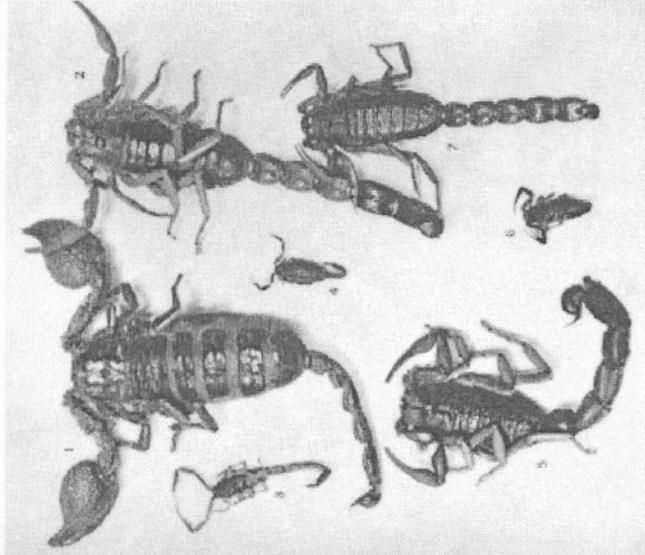
SOLIFUGAE (often called "Tarantulas")

Natural size

Highly characteristic nocturnal arachnids in Turkana. 1 and 4 are long-legged, light-bodied, swift running types; 2 and 5 are short-legged, heavy-bodied, and slow going, but very powerful.

1. *Gilgaster* sp. 2 and 3. *Ruggerus* sp. 4. *Siphon* sp. 5. *Ruggerus* sp.

Plate V



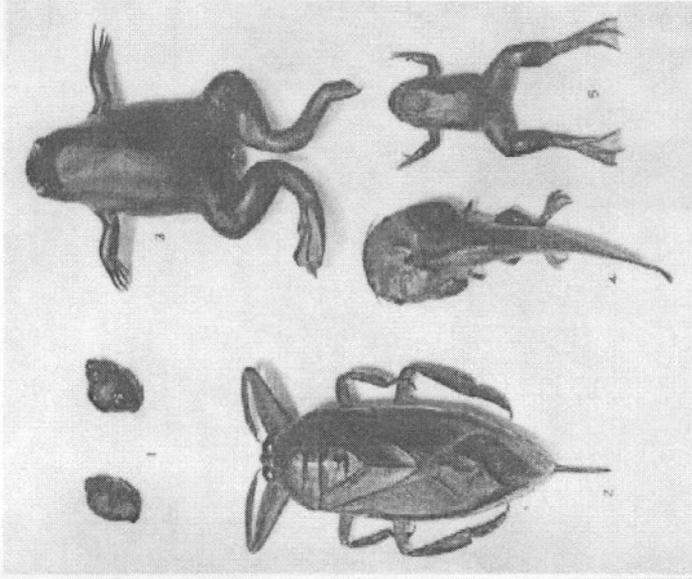
SCORPIONS

Natural size

An abundant group in Turkana as in other dry regions. They come abroad at night, but are slow moving and not so often seen as the Solifugae.

1. *Pandanus* sp. 2-7. *Buthus* spp. or related genera.

Plate VI



FAUNA OF THE ROCK POOL AT NARAMUM

Natural size

The principal inhabitant of this pool is the frog, which belongs to the small group *Aghana* and is entirely aquatic in all stages. The skiffs appear to feed on their own species, which are curious transparent creatures with a very thin, almost invisible, membrane. They feed on microscopic animal life. The great water bug feeds on the algae. The small (1) lives on the rock walls of the pool, feeding on minute green algae.

1. *Polydora arctica*. 2. *Ephydra subdila*. 3. *Scaphiopus*. 4 and 5. Advanced stage tadpole and newly transformed young of the same.

proportions of such widespread species in these cases are respectively 70% and 60%. The remaining species are legitimate arid or desert forms of northern or eastern derivation. There is little doubt that most of the other groups will be found to have a similar composition. Certain of the butterflies, especially the genera *Colotis*, *Herpaenia*, and *Glycestha*, and a similar small proportion of the moths, already appear to be desert forms.

Although, as has been said, the Turkana fauna is too rich for a desert, it is also too poor for a savanna. The composition of the fauna suggests, to those most competent to judge, a recently desiccated savanna, into which a certain number of desert animals have been able to penetrate as the desiccation progressed. This conclusion has been independently reached by Uvarov, on the basis of the grasshoppers, and by Parker on the basis of the reptiles. Thus Parker, comparing the reptile fauna of Somaliland with that of Turkana (which now has an essentially similar climate) finds that the latter has fewer endemic species, while the widespread African savanna forms are both better represented and less differentiated as sub-species.

These conclusions are to a great extent confirmed by much other evidence which points to the recent desiccation of Turkana. Geological and archaeological evidence show that the maximum extension of Lake Rudolf, when its level stood some 350 feet higher than now, occurred in Upper Pleistocene times, and that since then it has been sinking steadily. This presumably implies progressive desiccation, though the process was doubtless interrupted from time to time. There can be no doubt that a very much more favourable climate than now obtains existed when men of Mousterian and Aurignacian culture lived in the present area of Turkana, for one finds their implements scattered abundantly, in places now quite uninhabitable.

The Rudolf region has been known to modern geography only some fifty years, but it seems that considerable drying-up has occurred within that period. Even during the last few years serious desiccation has been experienced there, though this may mean only a temporary oscillation in climate. The level of the lake has persistently dropped, grassy plains have become desert, and cattle, once abundant in Turkana, have almost ceased to exist there.

From the zoogeographical point of view, the Turkana fauna is of mixed composition, having elements derived from several different parts of Africa. This variousness of origin is illustrated by the somewhat curious association in the Naramum pool, for here the snail, *Physopsis ovoidea*, is of South African distribution, while the frog, *Xenopus clivii*, is Abyssinian.

The derivation of the land fauna, especially of that part of it which shows a desert character, is however, a more interesting matter. Again, only the reptiles and the grasshoppers have been classified from

this point of view; but the results in the two cases are similar, and probably apply to most of the other groups as well.

Four-fifths of the reptiles of desert distribution found in Turkana belong to the Somali region. Similarly the desert grasshoppers are mostly related, some of them very closely, to Somali species. It follows that these creatures, though their ultimate origin may have been in the Sahara region, have reached Turkana not directly, but *via* the Somali country east of Ethiopia. This is indeed natural, since, as was pointed out at the beginning of this article, it is only to the east that Turkana connects with really arid country. The immigrants above mentioned were followed in modern times by another desert animal, the camel; it was introduced by human agency, by the same route, and for the same reason—the continuity of the desert habitat.