

His Excellency fished each day with the spoon only, but on the 26th and 27th J. used spoon and natural bait alternately.

On the 27th His Excellency killed seven King-fish weighing 20, 20, 18, 14, 13, 11, and 10 lb., also one small Barracuda of 6 lb.—total weight 112 lb.

J. secured five King-fish of 18, 18, 18, 14, and 14 lb. respectively—total 82 lb.

H. F. W. landed one King-fish of 9 lb.

Total for three hours' fishing on the 27th, 203 lb.

Thus during two afternoons and one morning the party killed thirty-five fish weighing altogether 515 lb., average weight 15 lb. The only regret expressed was that fishing ground had to be left so soon.

THE DESICCATION OF AFRICA

BY R. L. HARGER

This question is one that has formed the subject of many notes made during wanderings in Africa, extending over a number of years.

My interest in it was revived by the article by Mr. C. W. Hobley, which appeared in No. 9 of the Society's Journal.

I will first quote a few extracts bearing on the subject from the works of some of the older travellers, and will then venture to add some notes of my own observations.

The work called 'The Native Races of South Africa,' by George W. Stow, which deals with travels in South Africa from about 1843 onwards, contains some facts of interest.

(a) 'It is authoritatively stated that since the early days of the Korana occupation (end of fourteenth or beginning of fifteenth century) of the portion of the country we are now speaking of (South O.F.S. and N. Cape Colony) a great alteration has taken place in its water supply. Then the Kuruni is declared to have been a great river, which sometimes rose and continued high so long that women who happened to be on

the other side at the time of its rise frequently lost all hope of being able to recross it and, in their despair, married other men. It is also asserted that great quantities of reeds grew in it. Much water is said to have come down from the Molopo, which formed a junction near the Korana village as well as down another river called Misiri. The Koranas stated that the Battaru dried up the rivers by witchcraft.'

(b) 'The Bushmen state that in the days of their forefathers a number of large animals lived in the country which became extinct and disappeared from the face of the earth. On the plains drained by the Swart Kei, giraffes browsed on the trees of the Tsomo and other portions of the lower country. Immense herds of buffalo must have frequented the brakes, and thousands of elephants roamed through the forest glades, not only of the coastline, but also in every portion of the country, while the abounding hippopotami laved their sides in every deep pool to be found throughout the land. *Instead of the deep chasms now found cutting through and draining the water from the plains*, chains of deep Zeekogats or hippo pools occupied their place, and wide spreading beds of reeds not only surrounded them, but frequently linked them in one unbroken line.'

(c) 'Such then are the companions of the Bakalahari, whilst the Kalahari which affords them shelter and protection, is also one of the last places of refuge of the fast disappearing Bushman race. This great area has been called a desert because, though intersected by beds of ancient rivers, it contains no running water and very little in wells. The beds of the former streams contain much alluvial soil, which being baked hard by the burning sun, rain water in places stands in pools for several months of the year.'

(d) Visit of J. Campbell to Battaru, a branch of the Bakuena, 1820, 'Lakesi' (chief) stated that when he was a boy the Koeromanie river ran along the desert, but since that time it has ceased to do so.

'Dr. Livingstone's Travels' also contains references to this question. Writing of his journey to Lake Ngami in 1849, he says: 'We proceeded down the dry bed of the River Makoko. The name refers to the water-bearing stratum before alluded

to, and in this ancient bed it bears enough water to admit of permanent wells in several parts of it. The ancient Mokoko must have been joined by other rivers below this, for it becomes very broad and spreads out into a large lake, of which the lake we were now in search of formed but a very small part. We observed that, wherever an ant-eater had made holes, shells were thrown out with the earth identical with those now alive in the lake. The water supply of this part of the river system, as will be more fully explained later on, takes place in channels prepared for a much more copious flow. It resembles a deserted Eastern garden, where all the embankments and canals for irrigation can be traced, but where, the main dam and sluices having been allowed to get out of repair, only a small portion can be laid under water. In the case of the Zouga the channel is perfect, but water enough to fill the whole channel never comes down. It (Ngami) is shallow. It is with difficulty cattle can approach the water through the boggy reedy banks. These are low on all sides, but on the West there is a space devoid of trees showing that the waters have retired thence at no very ancient date. This is another of the proofs of desiccation met with so abundantly throughout the country.'

Livingstone, in his mention of the journey of Dr. Cowan and Capt. Donovan through Bechuanaland in 1808, says: 'The Bakwains were then rich in cattle,' and it is one of the many evidences of the subsequent desiccation of the country that streams are pointed out where thousands and thousands of cattle formerly drank, and in which now no water flows. (1845-1849.)

During his residence at Kolobeng from 1845 to 1849, Livingstone reported: 'In our second year again scarce any rain fell. The third was marked by the same extraordinary drought, and during those two years the whole downfall did not amount to ten inches. The Kolobeng ran dry, and so many fish died that the hyenas from the country round collected to the feast, and were unable to clear away the putrid mass. A large old alligator (crocodile) was left high and dry in the mud among the victims. The fourth year was equally unpropitious, the rain being insufficient to bring the grain to maturity.'

Since Livingstone's day the process of desiccation has not abated in the south-central plateau of Africa, but in news from South Africa I have lately heard that Bechuanaland is again being used as pasture land by white settlers—this being possible owing to very extensive water-boring operations for watering stock.

From 1894 to 1903 I travelled through several of the districts mentioned above, with Livingstone and others for reference, but did not know enough to grasp the magnitude of the subject until I went north of the Zambesi in 1903. The above extracts are from the Library books.

My observations then extended to Lake Nyasa, south end and western side; the Loangwa Valley, nearly whole length; Lake Tanganyika, south end; Lake Mweru, north-east and south shores, including the Luapula river; Lake Bangueulu, almost right round; and Chambezi river (extreme source of Congo), which rises at Mt. Sunzu near Abercorn (South Tanganyika District), south side of Nyasa, Tanganyika plateau ridge. In every direction the words of Moffat, Oswell, Vardon, Livingstone, Harris, Selous, and other early South African travellers could be applied, almost word for word, with certain reservations. My notes were mentioned in my reports to the Chartered Company, 1903 to 1906, when I was investigating the distribution of Tsetse, Game, Native Products, Timber, &c.

The Loangwa Valley.—This valley, which is roughly forty miles wide by four hundred miles long north to south, discharges into the Zambesi. For two-thirds of its upper length it affords clear evidence of having held large areas of water for long periods. This is supported by the existence of miles and miles of old lake shores composed of well-rolled and water-worn stones and pebbles, which can be traced for great distances in the thorn bush at distances of sixteen to twenty miles from the present sandy bed of the dwindling river.

Mr. W. P. Kenelly (who was then Native Commissioner of the District) and myself traced some of these old shores for miles through the dry thorn bush country. They have in many places been cut through by sandy stream beds, which now never hold running water, only rain season pools. Nawalia Bowa, sixteen miles from the river, was an excellent point for

observation, being on a foot-hill of the Muchinga range, and with well-defined ancient beaches in its vicinity. All the beaches throughout the valley are evidently not on the same level, and therefore cannot be of the same age. The intervening flats between old beaches and present river are of deep alluvium, and are still inundated for miles during a good rainy season, but the water soon drains off. There are very few depressions with permanent growth of reed, such as can be seen at the salt lakelets of Pachicherri, some thirty miles south of Nawalia. (Cherri is the local Senga name for salt, which is an article of native trade.) The old shores are to be seen right up at the northern end of the valley, comparative levels of which could only be determined by careful survey. Since my travels in the valley it has been closed to travellers by the local form of sleeping sickness due to the local form of Trypanosome, *T. Rhodesiense*, which is carried in dry country by *Glossina morsitans*, not the moisture-loving *Palpalis*. The valley is bounded on the eastern side by the Nyika plateau, which rises to 7000 feet, and where *Juniperus procera* occurs as a rare tree. (Nyika means plateau in the local languages.) On the west the boundary is the Muchinga range (here again Muchinga means hills) which rise to over 5000 feet on to the Awemba plateau.

Lake Nyasa, south end.—From the present Domira Bay it is very apparent that the lake extended far south of its present limits in very recent times. The sand beaches can be traced for many miles back in a gentle rise. Native tradition and the present shallow, sandy, and muddy bay both denote that the water is receding. My personal observations do not carry me inland at this point for more than a few miles. In 1903 land was forming on a large scale with the assistance of extensive lines of native fishing barriers of reed, which readily takes root and grows. The same remarks apply to the low sandy shores of Kota-Kota on the western side. In both instances the recession of water is more noticeable than on the more northern shores, which abruptly rise from great depths to 3000 feet or more.

Some ten years ago Sir Alfred Sharpe published a paper in the *Geographical Society Journal* on the shrinkage of Nyasa and its southern extension Malombe. He also mentioned

that the Shire river sometimes flows slowly back into Lake Nyasa in exceptionally dry periods.

On the precipitous shores of deep bays such as Monkey Bay, Mkata Bay, and Karonga, the former water levels are very noticeable.

In 1895 the steamer *Queen Victoria*, 150 tons, was built and launched at a certain spot on the Shire river (below Lake Malombe), where in 1903 it was only possible to force through the vegetation a boat drawing three or four feet. I took note of the former water level, which was over ten feet above the then water level. The decrease of water continued to the extent that in 1910 the shallow-draught stern-wheelers with great difficulty managed to reach Port Herald at extreme south end of British Nyasaland. It has since been found absolutely necessary to extend the Nyasaland Railway southwards into Portuguese territory some forty miles.

Lake Shirwa (south-east end of Nyasa, near Zomba) is rapidly becoming a papyrus and reed-covered marsh. The surrounding country and flats towards Nyasa invite the conclusion that the Shirwa was an arm of Nyasa at no very remote date.

The Elephant Marsh, Chiromo, on the lower Shire, is no longer a marsh. My first visit was in 1903. Since then I have traversed it in many directions, and have camped in it for weeks on end away down towards the Zambesi and the Portuguese border. During the rains I have certainly had to circumvent stretches of water held in depressions by the kaolin sub-soil, but which rapidly evaporates when rains cease. During a long dry season one must depend on water holes in certain places. Some of these appear to be getting deeper and deeper every year by native efforts to reach the receding permanent water from the sloping hole down which steps were cut. With the records of Livingstone and Mackenzie to refer to on the spot, it was difficult to realise that so much and such expanses of water as they described had drained off and evaporated in forty years. The Sangasi, a tributary which enters the Shire at Chiromo, which must once have had a considerable volume of water, judging from old sand levels, 1905-1910, is now, except for a few days during the rains, a river of sand with well-defined banks which

are in places twenty feet high on the lower reaches. On the northern boundary of the plains are the Cholo Hills, down which several small streams flow from the plateau land, but these streams disappear into the ground after a few hundred yards on the flat. In one instance, to my certain knowledge, one stream sinks with very perceptible current into a small bed of reeds and does not reappear. It has often occurred to me that the underground water can here be traced by the position of the great belt of Borassus Palms (among which are a few Hyphæne Palms) which extends right across the flats in the Shire depression. These palms must have water, but they can go down twenty feet for it.

Lake Tanganyika.—Despite the rumours of alleged temporary rises in the water level of this large lake with a small basin, the general study of the shores shows the old story of permanent and steady decrease in the level, which perhaps has been more rapid than in the case of Nyasa. Even allowing for the fact that the strong winds, which blow from the north, have piled the sand into long dunes, it must be admitted that the sand had to be exposed in the first instance before coming under wind action. I speak now of Cameron Bay at the beaches, Kasankalawe and Mbete. Old beaches can be traced back right into the tree-covered land. At the former place the regular formation of the old beaches is very noticeable. Furthermore, fragments of delicate mollusc shells are to be found in the most recent beaches, but are lost sight of in the older ones, doubtless owing to the dissolving action of the overlying vegetable humus. I refer to two shells which are only found alive in permanently submerged sand. One is a very delicate Pecten-like bivalve, name forgotten, very fragile. The other is a new (1906) species—*Cleopatra Hargerii*. These forms, with many others more robust, must have been left by the water, and could not have been blown back such distances, even in fragments.

Such conjecture can be accepted when it be remembered that the old town of Ujiji is about three-quarters of a mile from the present lake shore, and so is the old beach where old natives, still living in 1906, remembered having dipped up water.

Tanganyika had one outlet on the western side to the Congo, the Lukuja river. I have it from Mr. Irwin (now in Mombasa) who was on the lake in 1890, that the old Arabs regularly took large dhows down the Lukuja and into the Congo. In my time the mouth of this river was nearly closed by vegetable growth, and no outflow was perceptible.

The Chambezi, Lake Bangueulu, Luapula River, and Lake Mweru.—These can be taken in the above sequence, and comprise the most westerly and perhaps one of the largest headwaters of the Congo. The Chambezi river is of fairly rapid, though fluctuating, volume. Most of its upper feeders, such as the Mansia, Luatikila, and Lukulu are permanent streams, which originate on the Chambezi-Tanganyika cum Nyasa watershed. On the flats towards Bangueulu the stream is considerable and well defined. It was once supposed to flow into Lake Bangueulu, but is now known to flow into the vast swamps at the south end of the lake. From these swamps another river arises known as the Luapula, which evidently takes the Chambezi water in addition to drainage from the lake and swamps. The Luapula then turns sharp to the north, passing Bangueulu to the westwards, and flows into Lake Mweru. Thus a continuous flow of permanent water can be traced and which continues in the Luvua, which flows from the north end of Lake Mweru into the Congo. But a different story is unfolded on examination of the vast flats on the east, north, and west confines of Lake Bangueulu. It is then that one can realise the former extent of the lake. Although Bangueulu is marked as well defined on most maps, it is in reality most difficult to define on its south end, because immense sheets of water occupy the old permanent lake bed during the rains. This water is held on the surface by the vast and continuous deposit of kaolin clay, bog-iron, and limonite, which underlies the whole country between the Chambezi on the east and the Luapula on the west. The lake has undoubtedly shrunk, but without these vast clay flats with a gentle fall lakewards, it is conceivable that the lake would by now have been yet smaller in area. Of course much evaporation must take place on the confines of this basin, where the water advances and recedes every year, but the

central portion is everywhere covered with great areas of water-loving vegetation, such as rush and other plants, which require shallow but permanent water. Thus evaporation is arrested. These areas imperceptibly merge with the sudd of the lake, chiefly composed of papyrus, of which there are huge floating islands interspersed by areas of open water.

On the south and east sides of the lake it is just about impossible to say when the lake proper is reached. On the north-west shores the lake is bounded by cliffs, rising in places to about fifty feet with sand beaches below. There are square miles of open water, too deep generally for aquatic plants and evidently kept clear of floating sudd by the prevailing winds from the north extremity, and very rapid desiccation is thus not so apparent in this Banguelu basin of granite and allied rock which has decomposed into the impermeable kaolin clay. In two places I found outcrop ridges of granite near the lake laid bare by running water. A strange sight where stone is otherwise absent.

The Luapula River, which forms the Belgo-British boundary, is a large river 500 to 600 yards wide in parts. It is flanked for the most part by large lagoons and swamps, especially on the Belgian side. Nevertheless, examination of the adjacent country leaves no doubt that these lagoons are but remnants of extensive chains of lakes through which the river has run as a drain, like water draining from a mud flat. After leaving Banguelu and turning north it flows over a rock bed of horizontal strata, which produce short falls and rapids for about half its length. From thence onwards to Lake Mweru, lagoons and swamps are much in evidence, and through which the river runs.

Lake Mweru.—This well-defined lake, some seventy miles long by about thirty wide, does not show signs of extreme shrinkage, although a slight rise in its present level would again inundate its old western extension, now a fertile plain about twenty miles by ten. Within a mile of the north-east end are dry flats and diminishing swamps, but the height of the intervening land ridges leads to the conclusion that these flats belong to the Luvna and Lualaba (Upper Congo) system of drainage. The same can be said of the Choma river and

marshes which lie between Mweru and Tanganyika and run northwards.

Of the Luvua I know little. There are vast sheets of open water and reed marshes along its course, linked up in endless ramifications, as occurs elsewhere in this region of Congo head-waters. Such abundance of water can hardly be included under the heading—desiccation.

In reviewing the foregoing facts, the inland plateau of Africa, up to the Equator, can be roughly divided into three lateral zones :—

1. From about the latitude of the Orange river to the Zambesi, where vast rivers and lakes have disappeared, leaving mere remnants, such as Lake Ngami.

2. From the Zambesi to the latitude of Lake Mweru, where large river systems and huge lake areas are in process of being drained.

3. The Equatorial belt, excluding Tanganyika, where the climate, rainfall, and vegetation is such, together with abundance of water, as to warrant the supposition that drainage and desiccation have not yet commenced.

With the aid of geology and palæontology, a fourth zone can be investigated in the north of Cape Colony and south of Orange Free State, where a semi-fossil form of *Cobus* has been found (cannot name exact locality without my notes). This form of *Cobus* is regarded as intermediate between the highly specialised, long-hoofed and water-loving *C. lechwe* and *C. ellipsiprymnus*. (*Vide* 'Animals of Capetown Museum and South African Geological Society.')

The Loangwa Valley is worthy of special attention. Drainage evidently took place here on a large scale, and at a time when the lake areas were fully inundated and were impassable barriers to certain dry land fauna, such as Giraffe, Suni (*Neotragus*), and Spiny Mice (*Acomys*) (to mention extremes in size), on their migration to South Africa.

Take Giraffe; it is a native of North and East Africa down to German territory. It is also a native of South Africa. In the Loangwa Valley there was one known herd of some dozen animals in 1903. I knew this herd, which was pro-

ted by the Administration. In all the country on either side of the valley, i.e. Nyasaland and Mozambique to the sea on the east and the lake areas on the west, it does not exist. I am convinced that the former distribution of African water has had much to do with the distribution of its present fauna and native races.

Giraffe, Oryx, one Gazelle, the Springbuck, White Rhino, and Ostrich are South African forms (south of Zambesi). They are also North African forms. There are many other instances. In the intervening belt, with its east to west distribution, they are unknown in the Central Lake areas. They probably reached South Africa by way of the Loangwa Valley on the east and Damaraland and Angola on the west. This theory I base on the present lines of zoological distribution. Conclusive evidence can only be obtained from the geology and palæontology of these regions (Loangwa and Bangweolo), about which, in these respects, very little is known.

The report of the Irrigation Commission on the Orange River basin, carried out some twelve or fifteen years ago by engineers from India, also contains some interesting facts regarding desiccation.

{ GAME FISH IN TANALAND

BY R. SKENE

KOLI-KOLI

Scombridae—near Tuna Group

Migratory Habits.—During the first days of June the first koli-koli are caught—that is, as soon as the big rains are over and the sea inshore has become clear. They continue to increase in numbers till the end of September, when they reach their maximum. In October they begin to decrease, and go on decreasing till about the end of January. In February and March there are very few indeed. In April and