

HISTORICAL CHANGES IN THE ECOLOGY AND MANAGEMENT OF THE LAKE MWERU WA NTIPA WETLAND ECOSYSTEM OVER THE LAST 150 YEARS: A DRYING LAKE?

¹Chansa Chomba; ²Ramadhani Senzota, ³Harry Chabwela and ⁴Vincent Nyirenda

¹School of Agriculture and Natural Resources, Disaster Management Training Centre, Mulungushi University Kabwe, Zambia

²Department of Zoology and Wildlife Conservation, University of Dar es Salaam, Tanzania

³Department of Biological Sciences, University of Zambia, Lusaka, Zambia

⁴Zambia Wildlife Authority

ABSTRACT

This paper is the first comprehensive historical account of the changes in the ecology and management of Lake Mweru wa Ntipa wetland ecosystem over the period 1867-2013. It highlights major socio-ecological and management regime changes in the last 150 years. This period started when the Scottish explorer Dr. David Livingstone documented it in 1867, through the colonial era when Zambia was called Northern Rhodesia to the present time (2013). In the 1860s there was a red locust outbreak and the area was as a consequence of this outbreak placed under the International Red Locust Control Service until 1956 when it was declared a Game Reserve by the Government of Northern Rhodesia, National Park in 1972 and in 2005 a Ramsar site and Important Bird Area. We also provide an account of the cyclic phases of wet and dry spells of the lake recorded between 1867 - 2013. In the 20th century in particular, the wet and dry spells created an ideal habitat for the locust breeding which attracted in the first instance, the attention of the colonial government and the International Red Locust Control Service. The high diversity and abundance of wild animals on the other hand, compelled government to declare the area as a game reserve and later National Park. The ecological dynamics of this wetland ecosystem also qualified the area for listing under the Ramsar Convention in 2005 and was also listed as an Important Bird Area. Currently, efforts are under way to restock the area with large mammals and fish as a significant step towards the restoration of its ecological integrity for the conservation of biodiversity and promotion of tourism.

Keywords: Mweru wa Ntipa National Park, red locust, ecological dynamics, dry spells, Ramsar site, biodiversity, restoration, Zambia

INTRODUCTION

Concern for effective management and preservation of wilderness areas and of threatened species in Northern Rhodesia (now Zambia) (Fig.1) and Africa in general has a long and interesting history. The Transvaal Republic at the time, approved a game preservation bill in 1846 and the Sabie Reserve was established in 1898 (Hobson, 1996). By 1900 the destruction of the once almost limitless herds of ungulates in American and Africa and the consequent establishment of Yellow stone National Park in 1872 resounded round the world, arousing the need to maintain the ecological integrity of wilderness areas and wildlife. The conference in London, which recognized the dramatic effect of the extending ‘gun frontier’ on Africa’s game inspired many colonial governments in Africa to take measures to reverse the declining trends of most wild animal populations (Anon, 2005). The many large herds reported by the Scottish missionary and explorer Dr. Livingstone in Africa were already on course of decline and some were threatened with extinction within a few generations (Hobson, 1996). As agriculture expanded, more and more wilderness areas were converted to large plantations or human settlements.

The 1933 London Conference listed animals deserving of protection and proposed the establishment of Game Reserves. The government of Northern Rhodesia had already taken measures to secure vast wilderness areas and threatened species of animals and plants. It was on this basis that in 1931 Captain Charles Pitman, an ex-Indian Army officer who had become game warden for Uganda, was upon request seconded to Northern Rhodesia for two years, to carry out faunal survey and among other things, recommend a site for Northern Rhodesia’s first National Park. Based on the recommendations from Pitman’s report and the proceedings of the 1933 London Convention, Vaughan–Jones (1938) a District Commissioner, who later became the first director of Game Department, prepared a comprehensive memorandum to the chief secretary of the Northern Rhodesia government entitled “Memorandum on Policy concerning the foundation of a Game Department and conservation of fauna in Northern Rhodesia”. The memorandum paved the way for the establishment of the Department of Game and Tsetse Control in February 1940, and later on 1st January 1943, the enactment of the Game Ordinance, Chapter 106 of the Laws of Northern Rhodesia (Anon 2010).

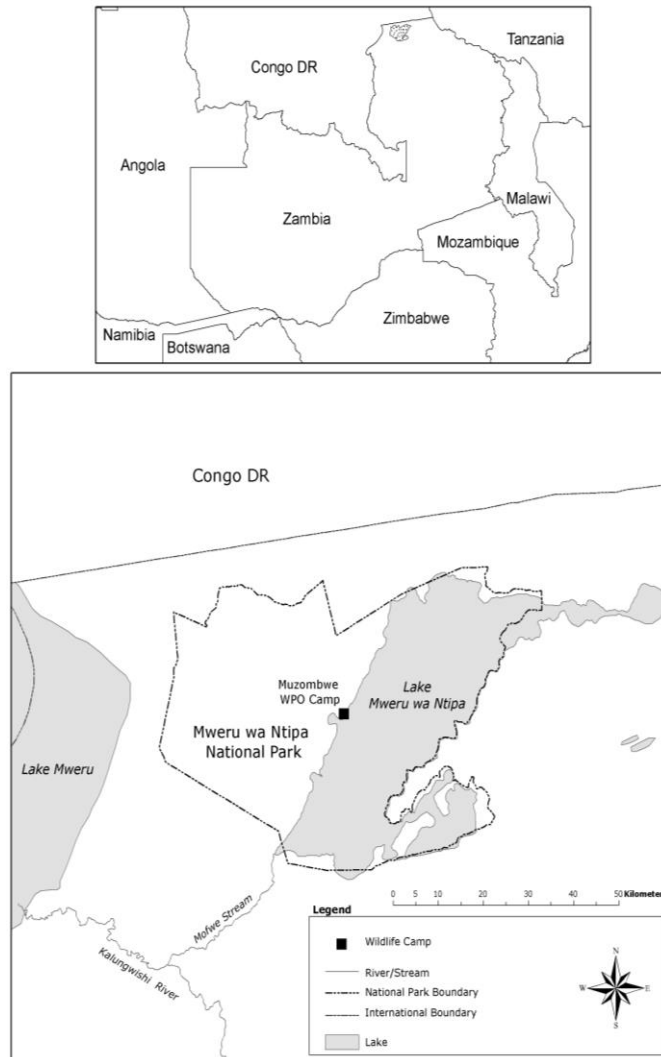


Fig. 1 Location of Mweru wa Ntipa National Park and the most preferred site at the time for the establishment of the first National Park in Zambia

With the appropriate legislative frame work and institution in place, the government of Northern Rhodesia was then ready to establish its first National Park, but did not have an idea of which area would be the best for the purpose. The government was in a hurry to establish a National Park because some of the countries in Africa had already established National Parks (Fig. 2). Some of the National Parks that had already been established in Africa were: Bamingu-Bangoran and Manovo-Gounda Saint Floris in Central African Republic 1933; Odzala in Congo Brazzaville 1940; Garamba and Upemba in Congo Kinshasa (now Democratic Republic of Congo -DRC) 1938 and 1939 respectively; Virunga in Rwanda/Congo border 1925 and this is perhaps the first National Park to be established in Africa and Akagera in 1934; Day forest in Djibouti in 1939; Kruger, Kalahari Gemsbok, Addo elephant, Bontebok, and mountain Zebra in South Africa in 1926, 1931 and 1937

respectively; Dinder and Southern in Sudan 1935 and 1939 respectively; and Hwange/Wankie and Matopo in Southern Rhodesia (Zimbabwe) in 1949 and 1926 respectively (Encyclopedia Britannica, 2010) (Fig. 2).



Fig. 2 Countries in Africa that had their National Parks established before 1950
(Source: ZAWA GIS, 2012)

In view of the National Parks that had already been established in other parts of Africa, the governor of Northern Rhodesia felt challenged and immediately made arrangements to identify the most appropriate area where the first National Park would be established in the territory. It was this time that the Governor referred to the areas recommended by Pitman (1931). The four sites nominated by Pitman were; (i) Luangwa Valley, (ii) Mweru Marsh, (iii) The area around Livingstone memorial and (iv) Kafue (Fig. 3). Pitman (1931) however, showed preference for Mweru wa Ntipa which he said was the most suitable area because of the species diversity and abundance and the diverse and dynamic wetland ecosystem which passed through cycles of wet and dry spells creating a unique environment for terrestrial and aquatic life forms (see Table 1). Regarding elephant populations in the Mweru marsh area, Gouldsbury and Sheane (1911) having met an old timer Mickey Norton who was one of the greatest elephant hunters of Central Africa, wrote that Norton told them that he had by 1890 shot over 2,000 elephants in the Mweru Marsh to area of Northern Rhodesia in a period of less than a decade, yet the elephant population did not seem to show any signs of decline.

Despite this recommendation for Mweru wa Ntipa to be the first National Park, the government of Northern Rhodesia ignored Pitman’s recommendation of Mweru Marsh and decided to nominate Kafue which was much closer to the capital city, Lusaka (Fig. 3).

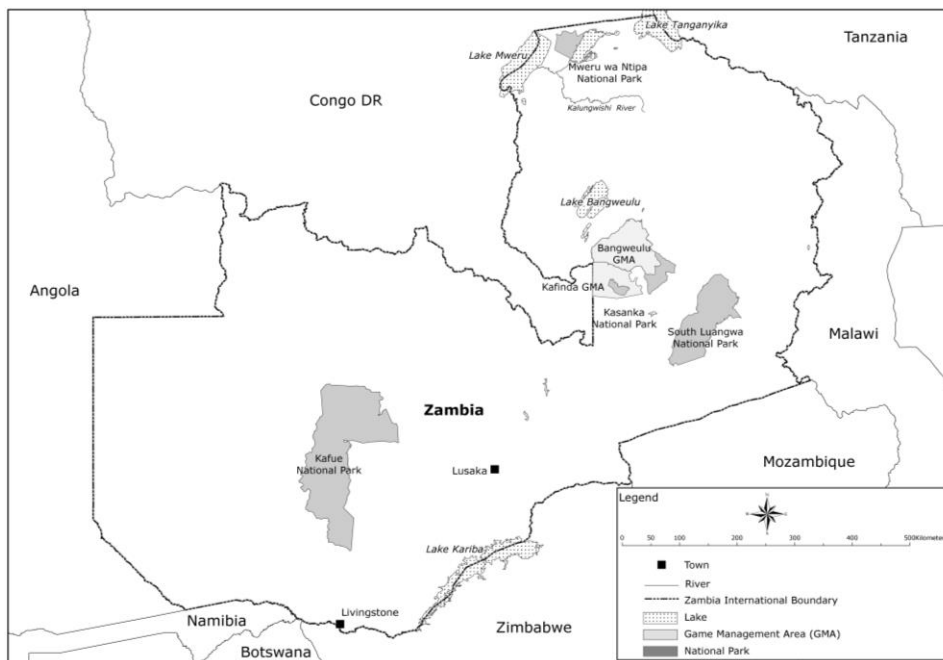


Fig. 3 Location of the proposed sites for the establishment of the first National Park in Zambia in relation to Livingstone the former capital city and Lusaka the current capital city

The choice of Kafue was influenced by the District Commissioner based at Mumbwa who for a long time had dreamed of putting a replica of the huge shallow-draft stern wheel paddle steamers that plied on the Mississippi, so that from the decks of that floating hotel visitors would be able to watch game along the 100 km stretch of the Kafue River (Hobson, 1996).

ECOLOGICAL DYNAMICS OF THE LAKE MWERU WA NTIPA

Water Level Fluctuations

Lake Mweru wa Ntipa which means the lake of mud, and from which the name of the National Park 3,134 square kilometers in extent and the seventh largest in Zambia is derived. The western side of the lakeshore is flanked by *itigi* thicket a vegetation community peculiar to this region and only reported in Nsumbu National Park along the coast of Lake Tanganyika and along Lake Rukwa in Tanzania. It is surrounded by hills lying roughly mid-way between Lake Mweru wa Muchanga and Lake Tanganyika (Fig.1). Its elevation varies between 900 - 1,400 metres and lies in the extreme north of Zambia, mostly in Kaputa and Nsama districts of Northern Province but overlapping slightly into the Nchelenge district of Luapula Province (Anon, 2013).

It is a dynamic lake, which sometimes changes from a lake to a swamp and some times becomes totally dry (Table 1). It has no outlet and during the periods of drying up the water becomes brackish and red and fish and crocodiles die (Brelsford 1955). During the time when it is a lake, its fishing industry flourishes raising thousands of dollars in cash for the artisanal fishing communities. In 1949 for instance, communities earned £ 30,000 (Gunn, 1960). In the past, before the control of red locust (*Nomadacris septemfasciata*) was put under control, the alternating flooding and drying made the area a suitable breeding ground for the red locust which in the 1900s -1960s was a menace to crops in the northern part of Northern Rhodesia. If only the water level could be stabilized not only would a steadily fishing industry be assured, but the lake would be in effect a productive fishery as the lake is shallow having its depth with the photic zone.

There are indications and records not only of the fluctuating water levels in Mweru wa Ntipa but also of irregular alternating periods when it was a swamp and not a lake. A glance at the Scottish explorer Dr. David Livingstone's map in his last journals shows that in 1867 he approached the eastern side, and then he switched his tracks for a time skirting Mweru wa Ntipa to the north (Gunn, 1955). It seems strange that at the height of the dry season in September, Livingstone's guides did not go straight on to Lake Mweru wa Ntipa which was the objective, unless as seems likely, Mweru wa Ntipa was at that time a lake and so a barrier (Gunn, 1960). There are indications both in the last journals and in the article by L.A. Wallace that Mweru wa Ntipa was a lake about 1867 (Table 1). Further details indicate that Livingstone crossed the Chishela River which he said was a large river, which took him about an hour and half to find a crossing point and crossing at what was assumed to be the shallowest point was often waist deep (Gunn, 1955). This account implies that in 1867 when Dr. David Livingstone reached Mweru wa Ntipa it was a lake (Table 1). This picture is so different from that described later in 1892. In September 1892, Dr. Alfred Sharpe reached Lake Mweru wa Ntipa and described it as the old lake, the south eastern corner of which he crossed in 1890. It was at this time a vast sea of green reeds and swamp with occasional patches of open water. It was therefore concluded that the area was a swamp and not a lake (Gunn, 1955). The next written account was in 1898. Mr. Hector Croad of the Provincial administration based at Mporokoso wrote in June 1898 that although the area is called a swamp, there was not much swamp about it. There was only a stretch of swamp at the north end. It would appear that from 1892 the area had filled up again to form a lake (Gunn, 1955) (Table 1).

It would appear that factors influencing the water levels in the lake are determined by rainfall. One year of heavy rains seems to fill the lake and it probably dries slowly for years. Apart from the effects of rainfall there are no obvious ecological explanations why Mweru wa Ntipa periodically becomes a lake and at other times a swamp or drying up. There is no outlet to drain the water out of the lake and rainfall therefore, appears to be the main factor. Rainfall records at Mporokoso for the intervening period 1913-1945 show an average of 1,252mm (49.25 inches). In the three seasons 1915-1918 an average of 4,589mm (180.68 inches) was received. No other combination of three seasons equaled that record during the period 1913-1945. It was noted to be the highest on record and no reasons were given for such exceptionally high rainfall figures (Breslford, 1950). This was followed by rainfall of 1,254mm (49.36 inches) in 1918 – 1919 then 1,018 mm (40.09 inches) in 1919-1920, 1,444mm (56.84 inches) in 1920-1921, and 1,286mm (50.62 inches) in 1921-1922. All these rainfall figures were above the average seasons (Breslford, 1950).

Stabilizing water levels in the lake is very critical to the ecology of the area. Since the lake has no out let, stabilizing water levels would involve increasing the flow into the basin so as to avoid dry spells. This is important because the five rivers which flow directly into Mweru wa Ntipa do not seem to be large enough and adequate to maintain a high water level inflow over a period of years.

Evaporation seems to be excessive and drains water which results in the water becoming saline and not suitable to drink and of the colour of strong tea (Hobson, 1996). Bresford (1955) recorded evaporation of up to 1.8m (six feet) per annum, and as such, as soon as the rains and rivers fail to supply the lake it would definitely dry up. Furthermore, of the five rivers flowing into the lake, Choma River in the north and Mukubwe River in the southeast are the only ones with perennial waters flowing into the lake. The Chishela River which is probably the largest of the rivers and Mwewe are blocked with papyrus and a full flow of their water is hindered. The Mwambeshi a perennial stream on the east flows into Lake Chishi but from there the Kasenga stream flowing to Mweru wa Ntipa is again blocked by papyrus.

The Kalungwishi River which is the largest river in the area, flows past the southern end of the basin on its way to Lake Mweru wa Muchanga (see Fig. 1) which in seasons of above average rains it over flows into the Mofwe canal which is connected to Lake Mweru wa Ntipa. The solution seemed to lie in making a large quantity of Kalungwishi River water to flow along the Mofwe canal into Lake Mweru wa Ntipa every year not only in good years.

Table 1: Fluctuations in the water levels of Lake Mweru wa Ntipa

Year	State of the lake	Year	State of the lake
1867	Probably a lake	1922-1923	A swamp
1890	A Lake	1930	A Lake but low water
1892	A Swamp	1937	A Lake: High water
1895-1896	A Swamp	1938	A lake
1897-1898	A shallow lake	1940	A Lake: biggest extent of recent years
1900-1911	A Swamp	1946	A Lake: High water
1911-1912	A Lake	1947	A Lake: but water level dropping
1912-1918	A Swamp with one complete dry period	1949	A Swamp
1919	A lake	1950	Dry
1922-1923	A swamp	1951	Beginning to flood
1930	A Lake but low water	1952	A Lake
1937	A Lake: High water	1953	Very dry
1938	A lake	1954	Low water
1940	A Lake: biggest extent of recent years	2004	A lake
1946	A Lake: High water	2005	A lake
1947	A Lake: but water level dropping	2006	A lake
1949	A Swamp	2007	A lake
1950	Dry	2008	A lake
1912-1918	A Swamp with one complete dry period	2009	A lake
1919	A lake	2010	A lake
		2011-2013	Lake, but partially drying up particularly in the Kasongole area

Source: Brelsford (1955), Anon (2013)

It may be that the blocking of the five rivers and streams has had a good deal to do with the falling of the lake level over time. We also speculate that it may be true that freeing of their silted mouths of the rivers would cause the swamp to become a lake.

The challenge of maintaining high water levels in Mweru wa Ntipa to prevent it from drying compelled the colonial government of Northern Rhodesia to dig a canal and enlarge the Mofwe stream to connect with Kalungwishi River. In 1932 however, a road embankment was built across the Mofwe stream at about 24m in a straight line from the Kalungwishi which later caused the canal to be completely blocked by thickets and reeds. Local people took advantage of the out growth to set fish weirs which completely hindered water flow from the Kalungwishi River into Lake Mweru wa Ntipa. There was little doubt that the embankment, thickets and fish weirs had reduced water flow from Kalungwishi River into Lake Mweru wa Ntipa and if government did not take any measures to open up the channel, the lake would experience another dry spell. No wonder in 1949, the colonial government of Northern Rhodesia again increased the depth and widened the canal to expand the Mofwe stream using low cost manual labour (Brelsford, 1955). The effect of this work was expected to increase the flow during normal seasons. But during the low rainfall seasons of 1953-1954 no Kalungwishi water flowed into Lake Mweru wa Ntipa. The value of the canal was again reviewed and in 1959 the canal was revisited (Ian and John, 1972), but soon after, the Federation of Rhodesia and Nyasaland broke and the liberation struggle for self rule in Northern Rhodesia gained momentum. After independence in 1964, the newly established government of the Republic of Zambia was overwhelmed by other developments related to poverty reduction and the Lake Mweru wa Ntipa water flow project was abandoned. At the moment, the Mofwe canal which was thought to be the only long term solution to sustain high levels in the lake has been severely encroached by human settlements and fields and no longer serves its original purpose. This canal needs to be reclaimed and rehabilitated to stabilize water levels in Lake Mweru wa Ntipa. It can also serve as an animal corridor between Mweru wa Ntipa and Lusenga Plains National Parks in addition to providing an inlet/out let for the fish fauna. With the expected global climatic change and its impacts on rainfall, it is not known whether the lake will continue to retain its current status as a lake or would dry up. If the lake dried up completely it would spell disaster to the surrounding communities that depend on it for fish. It still remains desirable for Zambia Wildlife Authority to maintain high water levels in the lake.

MWERU WA NTIPA AND THE RED LOCUST OUTBREAK

Lake Mweru wa Ntipa area was recorded to be the source of the last great plague of the Red locust (*Nomadacris septemfasciata* Serv.) of 1928-1944 (Macrae, 1955). He noted that the marshes which were to be carefully controlled to prevent any other such plague, also contained Lake Mweru wa Ntipa one of the most productive fisheries in Africa at the time (Uvarov, 1951). Between 1942-1952 the Mweru Marsh were under surveillance being managed from Abercorn (now Mbala), which was also responsible for the Rukwa Valley in Tanganyika (now Tanzania). In 1949, the International Red locust Service (IRLSC) was set up by Treaty (Anon, 1949) and all territories south of the equator were compelled to contribute to the Treaty.

During this period, the IRLSC while controlling locusts also opened up the Mweru Marsh area by building roads and houses including the Muzombwe Locust Control Post which is now used by Zambia Wildlife Authority (ZAWA) as a Wildlife Police Officer's Outpost (Fig.4).

The commonest methods used at the time to control the red locust were chemical insecticides which were spread by native Africans using grass brushes to throw the mixture of arsenic and flour (Gunn, 1960) (Fig. 5), but this was considered costly and never ending, so search was made for measures which would solve the problem once and for all. One proposal put forth by a Mr. Bredo (Gunn, 1955) was to enlarge Lake Mweru wa Ntipa to keep its water level up by digging a canal and diverting water from the Kalungwishi River. It was expected that such a measure would increase the value of the fishery and reduce the area of locust breeding plains by maintaining high water levels.

Keeping high water levels was reported to be the only long term solution of controlling the red locust from using the Mweru Marsh for breeding. This was based on the report by Gunn (1955) who showed that red locust outbreaks coincided with the time when the lake was a swamp and then disappearing when water levels increased and perhaps it was on that basis that the Mofwe channel was in the first place dug. If this was so, then possibly the first outbreak reported by Allan (1931) in Northern Rhodesia in 1892 would be attributed to the Mweru swamps (Table 1). From about 1892 - 1910 there were a widespread plague of the red locust in Northern Rhodesia (Allan, 1931) and this was the decade when the cycle of open water and swamp was most frequent (Table 1).



Fig.4 Muzombwe camp in 1957 used as a camp for locust control scouts now a Zambia Wildlife Authority out post, (Source: Gunn, 1960)



Fig.5 Muzombwe red locust scouts controlling locusts with a thin gruel containing arsenic and flour, using grass brushes to throw the mixture on grass, 1958 (Source: Gunn, 1960)

CURRENT MANAGEMENT OF MWERU WA NTIPA

Mweru wa Ntipa National Park was established in 1972 and has since received less attention from Zambia Wildlife Authority management. It had a lower priority compared with the adjacent Nsumbu National Park located on the southern shores of Lake Tanganyika. For that reason, most of its mammal fauna fell below the ecological carrying capacity of the area. However, species diversity is high and the following animals are sighted frequently; elephant (*Loxodonta africana*), buffalo (*Syncerus caffer* Sparr.), bushbuck (*Tragelaphus scriptus*), sable antelope (*Hippotragus niger*), roan antelope (*Hippotragus equines*), liechtenstein hartebeest (*Alcelaphus lichtensteinii*), eland (*Taurotragus oryx*), reedbuck (*Redunca arundinum*), ant bear (*Orycteropus afer*), defassa waterbuck (*Kobus ellipsiprymnus*), yellow backed duiker (*Cephalophus silvicultor*), blue duiker (*Philantomba monticola*), warthog (*Phacochoerus africanus*), common duiker (*Sylvicapra grimmia*) and sitatunga (*Tragelaphus spekei*). Klipspringer (*Oreotragus oreotragus*) inhabits the hilly areas. Lion (*Panthera leo*), leopard (*Panthera pardus*) and hyaena (*Crocota crocuta*) occur but are rare. The rare mongoose (*Bdeogale crassicauda*) has been recorded. Certain species of colobus monkey occur at certain times of the year as a vagrant from Congo Democratic Republic. Vervet monkey (*Cercopithecus aethiops*) and yellow baboon (*Papio cynocephalus*) are common. Hippopotamus (*Hippopotamus amphibius*) and two species of crocodile occur in the lake; Nile crocodile (*Crocodylus niloticus*) and African slender snouted crocodile (*Crocodylus cataphractus*). Bird life is abundant with 283 species recorded (Leonard, 2005). Many species of ducks, ibises, and herons occur. It is for this reason and that of securing the wetland ecosystem and human livelihoods dependent on the lake that Zambia Wildlife Authority added the Mweru wa Ntipa National Park to the national list of Ramsar sites (Fig. 6).



Fig. 6 Map of Zambia showing the Ramsar sites including Mweru wa Ntipa, Zambia.

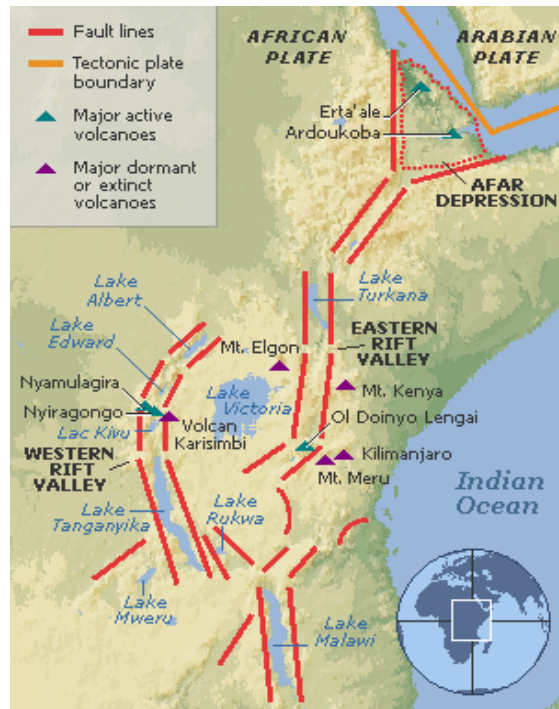
Owing to high concentration of salts however, the variety of fish In Lake Mweru wa Ntipa is limited to 12 species (Anon, 1965). As for crocodile, Cott (1961) considered the Lake Mweru wa Ntipa to be one of the major crocodile populations of Africa though he gave no numbers or density. In 1980 Kaweche and Munyenyenbe (1980) estimated 4,466 individuals of both Nile crocodile and African Slender snouted. On that basis, in the same year the Department of National Parks and Wildlife Service (NPWS) initiated a massive culling of about 1 000 crocodiles from which the population failed to recover (Connat, 1980; Anon, 2005). After the culling, poaching of crocodiles also increased with eggs, meat and skins being illegally exported to DRC where most of the poachers appeared to originate (Anon, 1988).

CONCLUSION

The 150 years history of Mweru wa Ntipa is worth recounting. It missed the opportunity of being the first National Park in Zambia and was given low priority listing by government. In the last ten years however, government has recognized its ecological importance and started the process of restoring its biodiversity for the development of tourism. The area still has suitable habitats for a wide range of species, for instance, the marshes provide a good habitat for sitatunga and several species of water birds including flamingo and shoebill. The habitat for elephant, hippopotamus, buffalo, zebra, lion, leopard, sable, roan, eland, common duiker, bushbuck, and sharpe's grysbok, black rhino is available. Its value as a habitat for

crocodile cannot be rivaled by any other water body in the country as it was and perhaps could still be the only lake in Zambia where two species of crocodile co-exist (Anon, 2005). The wet and dry spells the lake experiences cannot be explained, although some authors contend that the lake could be in its dying phase. It is assumed that it is a remnant of a large lake that once straddled between Rukwa in Tanzania and Mweru in Zambia. Upon the formation of the Great East African Rift valley which formed Lake Tanganyika about 10-12million years ago (Michele, Robin, Melanie & Skelton, P 2005), the new Lake Tanganyika cut across this huge lake and allegedly drained its water and only small portions of the former old lake remained in Tanzania and Zambia (Fig.7).

The two remnants being Lake Rukwa in Tanzania and Lake Mweru wa Ntipa in Zambia. These two remnants, thus Rukwa and Mweru wa Ntipa seem to share similar characteristics of being shallow, slightly saline, being covered by *itigi* thickets on their shores and both pass through dry and wet spells. It therefore, remains a challenge to all of us and the scientific community to find ways of preventing the lake from drying up completely so that it can retain its Ramsar status. At the moment the area provides one of the best opportunities for the scientific fraternity to study wetland ecosystem dynamics. Detailed study of the historical and geographic facts about Mweru wa Ntipa will definitely continue to be of great scientific value to human society. Due to its proximity to the border with the DRC which is also a member of the Southern African Development Community (SADC), provides an opportunity for the establishment of a transfrontier conservation area so that animal corridors between Zambia and Congo DRC could be restored and maintained, while maintain high water levels would support fishing communities.



Note: The Great Rift Valley is a geologic depression that extends from Syria in southwestern Asia to Mozambique in southeastern Africa. It takes the form of a series of valleys and bodies of water that are bounded by parallel fault lines. The Great Rift Valley is widening slowly but surely, in the process causing many volcanic eruptions and earthquakes in the area.

Fig. 7 Suspected severance of Lakes Mweru wa Ntipa and Rukwa during the formation of the Great East African Rift Valley which also formed Lake Tanganyika. (Source : Microsoft ® Encarta ® 2009. © 1993-2008 Microsoft Corporation)

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ABOUT THE AUTHORS

Chansa Chomba: a Lecturer in Environmental Sciences at Mulungushi University and is former Director of Research; Planning, Monitoring and Evaluation; Information Technology and Veterinary Services in Zambia Wildlife Authority. Has a Ph.D. in Conservation of Biodiversity with more than 28 years of experience in Wildlife and Environmental Management.

Ramadhani Sensota is a Professor of Range Ecology in the Department of Zoology and Wildlife Conservation, University of Dar es Salaam, Tanzania where he has taught for more than 30 years.

Harry Nixon Chabwela is Professor of Ecology at the University of Zambia in the Department of Biological Sciences and is former Director of the Department of National Parks and Wildlife Service in Zambia. He has more than 30 years of experience.

Vincent Nyirenda has a Ph.D. from Tswane University of Technology, Pretoria, South Africa and has more than 15 years of experience in Wildlife Management.