

UGANDA

Introduction

Uganda had a population of 12 639 076 in 1982, as determined by a census. It has an area of 236 580 km² and therefore, in 1982, had a mean population density of 53.4 persons/km², but subsequent trends in population development are not clear. Uganda is landlocked, being bounded by Tanzania and Rwanda in the south, by Zaire in the west, by Sudan in the north and by Kenya in the east. The country stretches approximately 627.5 km from north to south between latitudes 3°14'N and 1°29'S, and 607 km from west to east between longitudes 29°34' and 35°01'E.

In the main Uganda comprises a plateau of low relief, 1100-1300 m asl, but with four principal highland areas, and some lower land in the northwest, in the valley of the Albert Nile. The highlands are all peripheral. A broken chain of mountains lies along the northeastern border with Kenya in the Karamoja District, with peaks of 2750 m asl at Mt. Morungale (3°49'N/34°01'E), 3083 m asl at Mt. Moroto (2°31'N/34°46'E) and 3068 m asl at Mt. Kadam (1°46'N/34°43'E). In the southeast the great volcanic cone of Mt. Elgon (1°07'N/34°32'E) rises to 4321 m asl astride the border with Kenya, the summit being just inside Uganda. In the southwest the Ruwenzori Mountains on the Zaire border rise to 5110 m asl at Mt. Stanley (0°24'N/29°55'E) providing the highest land in Uganda, and in the extreme southwest the largest highland block in the country rises to 4127 m asl at Mt. Muhavura (1°24'S/29°40'E), one of the Virunga Volcanoes on the border with Rwanda. The lowest land in Uganda is 610 m asl near Nimule (3°37'N/32°03'E).

Around Lake Victoria the landscape is characterised by flat-topped hills, about 1300 m asl, with forested valley sides, and papyrus swamps along the thalwegs leading down to swampy inlets on the Lakeshore. Very nearly 18% of the total national land surface is lake or permanent swamp. Lake Victoria has an open water surface of 3 100 060 ha in Uganda, while in the west Lakes Albert, Edward and George have a combined surface area in Uganda of 405 170 ha, and in the centre Lakes Kyoga and Kwania cover 317 300 ha.

Drainage

All of Uganda drains to the Nile. The land between Lake Victoria and the Western Rift Valley drains either into the rift or to Lake Victoria, but the Katonga River is continuous between Lake Victoria and Lake George in the Western Rift, and the Kafu River is continuous between the Victoria Nile and Lake Albert in the Western Rift. This is due to the fact that since the upwarping of the western side of the Lake Victoria basin, rivers crossing it have in part reversed their directions of flow. Thus swampy watersheds now occur on the Katonga (0°13'N/30°39'E) and Kafu (1°11'N/31°09'E) Rivers from which the rivers flow sluggishly in opposite directions. The greater part of the Katonga flows eastwards to Lake Victoria, and the greater part of the Kafu flows northeastwards to the Nile, despite the fact that the angles of their tributaries suggest that they flow westwards

throughout their courses.

The Virunga Massif is also beset with swampy watersheds from which rivers flow in different directions. The northwestern slopes in Uganda drain to Lake Edward via the Ishasha, Chiruruma, Nchwera and Nyamweru Rivers, and also by several streams which enter the western flowing part of the Katonga River. The northeastern part of the Virunga Range however, drains directly to Lake Victoria via a series of swampy lakes and streams culminating in the Kibale River, which enters Lake Victoria through the swamps at Sango Bay.

The Ugandan slopes of the Ruwenzoris drain to the westward flowing section of the Katonga, and thence to Lakes George and Edward, while the plateau immediately to the north of the Ruwenzoris drains to Lake Albert via the Muzizi River. The Ugandan slopes of Mt. Elgon and the central highlands along the Kenyan border drain via rivers with swampy valleys or seasonal floodplains to Lake Kyoga, while the northeastern highlands and most of the northern plateau drain directly to the Bahr el Jebel in Sudan via the Achwa River.

Climate

The climate is largely determined by the interplay of three major airstreams, the SE Trade Winds, the NE Trade Winds and the SW Monsoon. The latter chiefly influences western districts bringing humid air from the Zaire Basin as the intertropical convergence zone moves northwards. The SE Trade Winds are also humid and blow in from the Indian Ocean, but this airstream tends to veer southerly or southwesterly over Kenya and Tanzania. The western slopes of Mt. Elgon, like those of Mt. Kenya, are wetter than the eastern slopes, where mean annual falls just exceed 2000 mm. The Ruwenzori Mountains are wetter, with falls in excess of 3000 mm/yr on the western slopes, and 2250 mm/yr on the eastern Ugandan slopes. However, the largest area of high rainfall is over Lake Victoria where there is no harsh dry season. Rainfall is highest during March-May and October-November, with comparatively dry periods during December-February and June-July, but thunderstorms occur in these latter months producing intense precipitation. Mean annual rainfall is 1250-1500 mm on the lakeshore, with some 160-170 rainy days/yr, but precipitation exceeds 2250 mm over the Sese Islands and much of the open lake. The Karamoja District, in northeastern Uganda, is the driest part of the country with mean annual falls in the region of 625 mm, but precipitation is higher on the mountains there, and increases to the west. Most of interior Uganda receives 1000-1500 mm rain/yr, the north being more humid than the south, but there is an arid area between Lake Victoria and the Ruwenzoris where falls are only 700-1000 mm/yr.

The figures for some specific centres given below confirm these gross patterns. Kaabong (3°30'N/34°09'E) in the northeast has a mean annual rainfall of 737 mm with one rainy season from August to September. Tororo in the southeast (0°42'N/34°10'E) receives 1396 mm/yr, with a major peak in March-April, but receives more than 50 mm in all months. Jinja (0°25'N/33°12'E) on the northern shore of Lake Victoria receives 1340 mm/yr, with peaks in March-May and

October-November, but again all months receive more than 50 mm. Fort Portal (0°34'N/30°17'E) at the foot of the Ruwenzoris receives an average of 1524 mm/yr with a similar monthly distribution to Jinja, while Gulu (2°46'N/32°18'E) in the central north receives 1546 mm/yr. At this centre it rains for most of the year but with peaks in May and August, although January is dry with a mean receipt of only 17 mm. All other months receive more than 50 mm.

The central northern districts are warmest with mean annual maxima over 35°C and mean annual minima of 17-20°C. Around Lake Victoria mean annual maxima are in the vicinity of 27-30°C, with mean minima between 16-17°C. Corresponding figures for the highlands are 22-24°C and less than 10°C. Permanent snow occurs on the highest peaks of the Ruwenzori Mountains, where small glaciers and icefields cover about 500 ha, while frosts are common on Mt. Elgon and the Virunga Volcanoes. Potential evaporation is about 1250 mm/yr in the mountains, about 1550-1650 mm/yr over the southern half of the country, but over 2000 mm/yr in the far north, e.g. at Kitgum (3°18'N/32°53'E).

Vegetation

Alpine vegetation, dominated by species of *Alchemilla*, *Helichrysum*, *Lobelia* and *Senecio*, occurs on the highest and wettest mountains, below which there is *Hagenia-Rapanea* evergreen forest. *Arundinaria alpina* often occurs at a transition between this and a more luxuriant forest type dominated by *Pygeurn* spp. At lower levels this grades into medium altitude moist ever-green forest or semi-deciduous forest, or into a mosaic of forest and savanna. Here grasses such as *Pennisetum purpureum* or *Hyparrhenia rufa* are important. The southern plateau areas are largely covered by dry *Acacia* or *Combretum* savannas, while in the north, there are large areas of moist well wooded savanna with abundant *Isobertinia* spp. Palm savannas indicate a high water table and have a scattered distribution in the north. Areas of tree and grass steppe occur along the Kenyan border in the northeast. Edaphic vegetation includes herbaceous swamp and swamp forest.

Wetlands

Swamps have developed on several rivers which have been tilted back eastwards by the upwarping of the western margin of the Lake Victoria basin, and these are mainly dominated by papyrus. In the Virunga Massif a number of lakes have formed where valleys have been blocked by volcanic activity, and others have developed on valley floors where upwarping has raised the lower end of the valley so that it has flattened out. Many river valleys carry large strips of papyrus swamp along their thalwegs, especially those entering Lake Kyoga, while some rivers draining the northeastern districts have seasonal floodplains. There are many lacustrine swamps, and some seasonal floodplains at the heads of the rift valley lakes, and several small lakes in the Virunga Mountains.

List of Wetlands Described

1. Natural Lakes & Lacustrine Swamps
 - (a) Lake Victoria

- (b) The Kyoga/Kwania Lake/Swamp Complex
 - (c) Lake George
 - (d) Lake Edward
 - (e) Lake Albert
 - (f) The Bunyoni Lake/Swamp Complex
 - (g) The Kijanebalola Lake/Swamp Complex
 - (h) Lakes Bisina & Opeta
 - (i) Lake Wamala
 - (j) Minor Lakes
2. Riverine Swamps & Floodplains
- (a) The Okere System
 - (b) The Kafu System
 - (c) The Nile

1. Natural Lakes & Lacustrine Swamps

Wetland Name: Lake Victoria

Country: Uganda

Coordinates: 0°30'N-3°12' S/31°37' -34°53' E

Area: 6 889 000 ha (c. 3 100 060 ha in Uganda)

Altitude: 1134 m asl

Nearest Towns: Entebbe (on N lakeshore); Kampala (13 km N)

General: In terms of surface area, Lake Victoria is the 3rd largest lake in the world, with 45% of its area in Uganda. It has a maximum recorded depth of 85 m and a mean depth of 40 m. It stretches 412 km from north to south between latitudes 0°30'N and 3°12'S, and 355 km from west to east between longitudes 31°37' and 34°53'E. It has a highly indented shoreline some 3460 km long (Welcomme, 1972), of which about half is in Uganda. The innumerable bays and inlets of the lake margin occupy valleys of the pre-lake system, and they differ in ecology from inlet to inlet, and from inlets to the main lake. Much of the margin is swampy, especially in the northwest in Uganda. Mean monthly air temperatures over the lake range from 21.0-25.0°C. February and March are the warmest months, while December and January are the coolest ones. A more detailed account of the lake is given in section 2.9.4a, but a brief account is given here as it applies to Uganda.

There are numerous islands off the northwestern lakeshore in Uganda, notably the 18 Sese Islands and 5 Kome Islands, 5 islands in Roseberry Channel, Buvuma and Bugaia Islands, Siguli and Lolui Islands, and the 3 Sagitu Islands. Permanent papyrus swamps with some patches of swamp forest occur around the Ugandan lakeshore. Such swamps are well developed around the mouths of the Kagera and Kibale Rivers, for example, in an area along and inland of Sango Bay immediately north of the Tanzanian border (0°37' -1°00' S/31°27' -31°42' E). Other swamps occur on the lakeshore (0°20' - 0°30'S/31°50'-31°58'E) encompassing Lake Nabugabo, and at the Katonga River mouth in two major blocks (0°08' - 0°19' S/31°51' -31°57' E and 0°02' S/31°55' -32°04' E), and farther east along Salisbury Channel where many short streams enter the lake through a deltaic

zone (0°10'N-0°02'S/32°06'-32°20'E). Smaller swamps are situated (0°16'N/32°41'E) near Port Bell and (0°09'N/32°45'E) near Ntanzi. An extensive seasonal floodplain is situated behind the swamps at Sango Bay, extending 30 km up some of the affluent streams.

Lake Nabugabo (0°20'-0°23'S/31°53'-31°57'E) is 9 km long from SW-NE and 5 km wide. It occupies about 3600 ha at high water and has a maximum depth of 5 m. It is separated from Lake Victoria by a sand bar 1.2 km wide at its narrowest point. The lake is fringed by dense swamps, but the northwestern shore is forested with areas of sandy beach. This lake has been isolated only since the last fall in water levels some 3700 BP, but may have been in contact with the lake for short intervals during this period, possibly even in the late 1890s.

Hydrology & Water Quality: More water enters the lake from direct precipitation, which is heaviest over the Ugandan sector, than from riverine influxes. The most important affluents are situated in Tanzania and Kenya. The Katonga, the largest Ugandan affluent, is an extremely sluggish stream, more a swamp-course than a river in its lower reaches. For further details see section 2.9.4a.

Flora & Fauna: Lake Nabugabo contains 9 species of *Haplochromis*, 4 of which are endemic according to Greenwood (1965b) and must have evolved over the last 3700 years. The other 5 are also found in Lake Victoria. Other fish from this lake include *Alestes nurse*, *Bagrus docinac*, *Clarias mossambicus*, *C. weneri*, *Gnathonemus longibarbis*, *Protopterus aethiopicus*, *Schilbe nzystus* and *Synodontis afrofisheri*. *Oreochromis leucostictus*, *O. niloticus* and *Tilapia zillii* were introduced to this lake in the 1950s.

The lacustrine swamps of Lake Victoria are dominated by papyrus, but in places there are arborescent associates, chiefly *Bridelia nziarantha*, *Ficus verruculosa* and *Phoenix reclinata*. On the fringes of the papyrus, in areas less deeply inundated, there are strips and patches of swamp forest, as described in the regional introduction. For more detail see section 2.9.4a.

Human Impact & Utilisation: The shores of the lake are fairly densely populated. The lake is fished commercially using trawlers, and by artisans using seines and lines from beaches and canoes. The effluent river, the Victoria Nile, is dammed at Owen Falls (0°26'N/33° 11'E).

Conservation Status: Small sanctuary areas have been set aside at Entebbe (5200 ha) and Jinja (800 ha), otherwise the lake and its shore are unprotected in Uganda. Nkosi Island, south of Entebbe, is protected as a Sitatunga Sanctuary, but there is a lot of poaching.

Wetland Name: The Kyoga/Kwania Lake/Swamp Complex

Country: Uganda

Coordinates: 0°33 ' -1°56'N/32°18 ' -34°00 'E

Area: 560 000 ha (total wetland)

Altitude: 1033-1060 m asl

Nearest Towns: Kampala (112 km SSW of Kyoga); Mbale (50 km E of Kyoga)

General: This wetland occupies a shallow dendritic valley system, part of which is permanently flooded to form a series of shallow lakes, which have a combined

maximum open water surface of 341 600 ha, and 218 400 ha of permanent swamps. The system is tributary to the Victoria Nile which flows through the southwestern end of Lake Kyoga, and then receives the discharge of Lake Kwania 32 km downstream. The system owes its existence to the upwarping of the western edge of the Lake Victoria basin, which has reduced the gradient and rate of flow in rivers flowing west, causing 'ponding' and turning them into sluggish swampy tracts.

Lake Kyoga (1°13'-1°47'N/32°33'-33°29'E) is the largest lake in the system. At high water its surface is 1034 m asl and covers 263 600 ha. The maximum depth is then 10.7 m and the mean depth about 3 m, and the surface level fluctuates by as much as 3.8 m during a year. The lake discharges at the western end into the Victoria Nile, and is oriented roughly E-W for 55 km immediately above the confluence, at which point it divides into two arms. The northeastern arm continues up the valley of the Omunyal River for a further 55 km, while the southeastern arm extends up the valley of the Mpologoma River for some 34 km. Many tributaries enter the Omunyal Arm the valley of which carries only minor swamps. By contrast, a vast permanent swamp extends up the Mpologoma Arm for 102 km above the lakehead, including many minor lakes, the largest of which are Lakes Adois (1°20'-1°25'N/33°30'-33°37'E), Kiando (1°23'N/33°24'E), Naragaga (1°23'N/33°27'E), Nyaguo (1°20'-1°22'N/33°41'-33°45'E), Nyasala (1°17'-1°22'N/ 33°34'-33°40'E), Namasajerl (1°21'N/33°22'E), Nakuwa (1°05'-1°17'N/33°24'-33°30'E), Nawampasa (1°16'N/33°22'E), Kawi (1°12'N/33°37'E) and Lemwa (1°07'N/33°41'E). The swamp belt reaches widths of 20 km and extends up several side valleys, covering more than 106 000 ha if the very variable lake surfaces are included.

The Victoria Nile enters Lake Kyoga on its southern shore through a swampy valley, with a continuous block of swampland extending upstream for 21 km above the lake, while to the west another large swamp belt extends southwards from the lake, up the valley of the Sezibwa River. Here the swamps are continuous for 80 km above the lake, and thereafter, following the bifurcation of the valley, for a further 25 km SSW up the Lwajali Valley and for 27 km SSE up the Sezibwa. There are close to 16 000 ha of swamps on the Victoria Nile above Lake Kyoga and 47 000 ha on the Sezibwa system. Other extensive swamps (approximately 44 000 ha) occur at the northwestern end of the lake, between it and Lake Kwania, and also along the south bank of the Victoria Nile between Lakes Kyoga and Kwania, and along the north bank of the effluent channel joining Lake Kwania to the Nile. In addition there are numerous small swamps around the lakeshore, and a seasonal floodplain of some 5000 ha on the Mukate River immediately above its mouth on the southwestern shore of Lake Kyoga.

Lake Kwania (1°35'-1°55'N/32°20'-33°02'E) is situated northwest of Lake Kyoga. It is 66 km long above the 25 km channel which connects it to the Victoria Nile. It is oriented roughly SW-NE and branches into two short arms near its northeastern end. At high water the lake surface is 1033 m asl and covers some 54 000 ha if the effluent channel is included. The maximum recorded depth is 5.4 m at high water and mean depth is estimated as 4 m. There are several small swamps around the lake margin.

Hydrology & Water Quality: The catchment of the complex is enormous. The principal inflow to Lake Kyoga is from the Nile which drains Lake Victoria and contributes an average of 25.6 billion m³ of water each year. The other affluents are much smaller, the most important being the Mpologoma, which brings some 610

million m³ of water from southeast Uganda each year, and the Okere which contributes an average of 373 million m³ water/yr, and drains much of the north and central eastern parts of the country. The Sezibwa discharges some 217 million m³ of water to Lake Kyoga each year, while the Omunyal contributes a further 40 million m³/yr, and the Adip and Abalang Rivers jointly discharge a similar volume into Lake Kwania. Direct precipitation over the major lakes amounts to about 6 billion m³/yr, while the mean annual outflow from the system is 27 billion m³.

The water temperatures vary from 26-30°C and oxygen concentrations are moderate, but may fall to 3.8 mg/l in some of the small lakes. The pH values of Lake Kyoga range from 7.6-9.0, and conductivities from 210-365 µSiemens/cm. Concentrations of the principal ions are sodium 10.8 mg/l; potassium 9.6 mg/l; calcium 21.7 mg/l; magnesium 13.8 mg/l; carbonates 2.2 meq/l; chloride 12.0 mg/l; sulphate 31 mg/l and silicate 34 mg/l.

Flora & Fauna: The lake margins are fringed by *Cyperus papyrus*, which often detaches to produce floating islands, because of the substantial changes in water levels. There are extensive and dense carpets of floating macrophytes along the fringes of the open water, and beds of submerged macrophytes throughout the lakes. The swamps are dominated by papyrus, but seasonal floodplains carry grasses with some trees in less deeply inundated areas.

The fish fauna is nilotic. There was no effective barrier separating the fish faunas of Lakes Kyoga and Victoria until the Owen Falls Dam was completed in 1954, thus the fish fauna of the lakes in the complex is similar to that of the inshore waters of Lake Victoria. By contrast the Murchison Falls have always been a barrier to interchange between these lakes and Lake Albert. *Oreochromis variabilis* is endemic to this system and Lake Victoria. *Oreochromis esculentus* occurs in Lake Kyoga, while *O. leucostictus*, *O. niloticus* and *Tilapia zillii* were introduced. *Lates niloticus* was introduced in 1954 and was the most important commercial species by 1970.

Crocodylus niloticus is now scarce around the lakes, having been systematically killed as the human population has increased around the lakeshores. There is an abundant avifauna which includes many piscivorous species. Among mammals the semi-aquatic species *Aonyx capensis*, *Atilax paludinosus*, *Hippopotamus amphibius* and *Lutra maculicollis* are present, together with the swamp dwelling *Tragelaphus spekei*.

Human Impact & Utilisation: The lakes of the complex support important commercial fisheries, in which *Lates niloticus* comprises 60 -70% of the total annual catch, which amounted to 48 900 tonnes on Lake Kyoga in 1969. The small lakes are however, fished only by artisans. Crocodiles have long been shot for their skins and are in consequence now on the point of extinction in the large lakes.

Conservation Status: Unprotected.

Wetland Name: Lake George

Country: Tanzania

Coordinates: 0°05'N-0°05'S/30°02'-30°18'E

Area: 22 850 ha (including islands)

Altitude: 914 m asl

Nearest Towns: Fort Portal (64 km N); Kampala (255 km E)

General: This lake, which straddles the equator, is situated on the floor of the Western

Rift Valley. It has a maximum E-W length of 30 km, a N-S width of 16 km, a maximum depth of 7 m and a mean depth of 2.4 m. It is fed by several rivers and drains from the southwestern end by the Kazinga Channel which leads to Lake Edward. This is 36 km long with a mean width of about 1 km. The principal affluent streams (Nyamwamba, Rukoki, Mubuku, Ruimi Rivers) drain the eastern slopes of the Ruwenzori Mountains and enter the lake through extensive swamps (0°03' - 0°16'N/1130°09'-30°19'E) on the north shore. These swamps are 21 km long, up to 14 km deep, and occupy some 26 00 ha. The Mpanga also enters these swamps from the eastern edge of the Rift Valley Escarpment, while two other affluents enter on the southern shore, from the Virunga Massif, and the westward flowing section of the Katonga River enters the eastern extremity of the lake. Other swamps occur to north and south of the small western basin of the lake, and another is situated on the central southern lakeshore. There are three large islands close to the western shore, one of which almost blocks the channel connecting the main basin with a smaller basin in the northwest.

The Lake George area has seen much volcanic activity over the past 12 000 years and a small crater lake is connected to the main lake by a narrow channel just south of the beginning of the Kazinga Channel. There are 4 isolated crater lakes north of the Kazinga Channel and a dozen south of it, all discussed in section 2.10.1i.

Hydrology & Water Quality: Direct precipitation over the lake is about 820 mm/yr and produces 12% (240 million m³) of the annual influx. Rainfall over the Virunga and Ruwenzori catchments is much higher, exceeding 2000 mm/yr in the latter. The total catchment is 9705 km² yielding an estimated 1948 million m³ water to the lake each year. Evaporation is estimated as 456 million m³ and discharge via the Kazinga Channel at 1697 million m³/yr (Burgis, 1987). The Kazinga Channel is essentially lacustrine in character, there being only 1 m difference in altitude between Lakes George and Edward.

Lake George is fresh, and its water chemistry is known to have remained fairly constant over the last 40 years, suggesting that the residence time of water in the lake is short, and that evaporation does not lead to the concentration of solutes. The surface water temperature of the lake varies considerably with a range conceivably in excess of 25-36°C, but the bottom water is always close to 25.5°C. The water is quite turbid with Secchi depths of only 24-46 cms. The pH range is 8.5-9.5, but an extreme reading of 10.4 has been obtained, and conductivities range from 210-240 μ S/cm through the year, being highest in the dry seasons. The lake water exhibits a diurnal pattern of stratification, but is generally very well oxygenated. When mixing fails to occur during occasional periods of exceptionally calm weather the bottom water becomes deoxygenated, which may result in fish mortalities. Viner (1969) gives an account of the water chemistry.

Flora & Fauna: The phytoplankton is dominated by *cyanophytes*, 29 out of 58 species and 70-80% of the biomass, but diatoms (11 *spp.*) and *chlorophytes* (18 *spp.*) are important. The greatest phytoplankton density is in the centre of the lake. The zooplankton is dominated by a *cyclopoid copepod*, *Thermocyclops hyalinus*, but *cladocerans* (3 *spp.*) and rotifers (15 *spp.*) are present.

The peripheral swamps are dominated by *Cyperus papyrus*, rich in climbers such as *Cayratia ibuensis*, *Ipomoea rubens* and *Melanthera scandens*, but there are dense

patches of arborescent species including *Ficus verruculosa* and *Phoenix reclinata*. *Vossia cuspidata* is common along the outer fringe of *papyrus*, and the lake surface supports dense carpets of floating vegetation containing much *Pistia stratiotes*. Some muddy shallowly flooded shores sustain communities of *Cyperus articulatus* and *C. latifolius* with sprawling *Commelina diffusa* and *Spilanthes oleracea*. Elsewhere, *Hydrocotyle ranunculoides* is common in shallow water. Submerged aquatics occur at the mouths of affluent streams where the incoming water sweeps floating vegetation away. *Paspalidium geminatum* occurs on the sandy eastern shores of the islands.

Some 32 species of fish have been identified to date. Of these 21 are cichlids and 17 belong to the genus *Haplochromis*. *Oreochromis niloticus* comprises 20% of the fish biomass and is the basis of the commercial fishery. Other common species include *Aplocheilichthys* spp., *Bagrus docmac*, *Clarias lazera*, *Haplochromis angustifrons*, *H. spamipinnis* and *Protopterus aethiopicus*. Crocodiles survive in the affluent rivers and there are large numbers of piscivorous birds including *Haliaeetus vocifer*, *Pelecanus onocrotalus*, *Phalacrocorax carbo* and various herons and kingfishers. There are also many storks and ibises. Important mammals include *Atilax paludinosus*, *Hippopotamus amphibius*, *Kobus ellipsiprymnus*, *Loxodonta africana*, *Lutra maculicollis*, *Redunca arundinum*, *Syncerus caffer* and *Tragelaphus spekei*.

Human Impact & Utilisation: The lake supports an important fishery which produced 4264 tonnes in 1970. Fish were both frozen and salted at Kasenyi by the Uganda Fish Marketing Corporation until 1973, which exported frozen fish to Zaire or sent frozen or salted fish by road to Kampala. Although this operation has ceased, the fishery continues, fish being sold directly to buyers with lorries who cart the fish to market. There is a ferry service across the lake from Kasenyi to Mayhoru, and a road runs down to Kasenyi, where there is also an airstrip. The railway crosses the swamp on the north side of the lake, and since the embankment inhibits drainage, it has led to the development of open water areas in the swamp on the north side, with *Cladium mariscus* and *Nymphaea* sp.

Conservation Status: The Ruwenzori National Park abuts most of the western and northern shores of the lake, while the south shore is included in the Kyambura Game Reserve. The Kazinga Channel is protected in the Kazinga Sanctuary. The Ruwenzori Park was established as the Queen Elizabeth National Park in 1952 with an area of 198 600 ha, encompassing all the land between Lakes Edward and George. Heavy poaching has occurred in the park, reducing the elephant population to 150 in 1981.

Wetland Name: Lake Edward

Country: Uganda

Coordinates: 0°05'- 0°56' S/29°16'-29°56'E

Area: c. 234 200 ha (63 750 ha in Uganda)

Altitude: 912 m asl

Nearest Towns: Fort Portal (100 km NNE); Kampala (305 km E)

General: Lake Edward is 76 km long with a maximum width of 39 km. Just over 29% of its surface is situated in Uganda. It is connected to Lake George, effectively a bay of Lake Edward, by the Kazinga Channel, 36 km long and about 1.5 km wide. Lake Edward reaches a maximum depth of 112 m, just 5 km from the western shore, above which the land rises precipitously to a high plateau, over 2000 m asl, carrying mountain peaks over 3000 m. By

contrast the lake floor slopes up gradually to the Ugandan shore. There are extensive swamps at the mouths of the Ishasha and Chiruruma Rivers covering about 14 000 ha.

Hydrology & Water Quality: Lake Edward has numerous affluent streams, the most important being the Nyamugasani River from the Ruwenzori Mountains and the Ishasha, Rutshuru and Rwindi Rivers from the Virunga Massif and the Rwanda Highlands.

Further inflow, estimated at 1650 million m³/yr, comes from Lake George, which also drains the Ruwenzori Range, and to the east shares a watershed with Lake Victoria. However, flow through the Kazinga Channel is very sluggish, along a gradient of 1:80 000 over the first 24 km. The junction of the waters between Lakes Edward and George is indicated by a change in colour and chemistry, and can usually be seen in the Kazinga Channel. The position of this boundary oscillates up and down the channel over a distance of about 3 km. Precipitation over Lake Edward is only 500-650 mm/yr, but is much higher in the adjacent mountains, e.g. approaching 3000 mm/yr on the western slopes of the Ruwenzori Massif. Lake Edward discharges into the Semliki River, and thence to Lake Albert and the Nile. Water spills over a rock shelf at the northern extremity of the lake, which functions as a natural weir.

Water leaving the lake has a temperature of 25-26°C and a pH close to 9.1. The concentrations of the major ions are sodium 110 mg/l; potassium 9 mg/l; calcium 12 mg/l; magnesium 48 mg/l; carbonates 9 meq/l; chloride 36 mg/l; sulphate 31 mg/l; silicate 6 mg/l (falling & Talling, 1965). Total dissolved solids amount to 521 mg/l.

Flora & Fauna: *Potamogeton pectinatus* is the dominant submerged macrophyte, in association with *Najas marina* and *Vallisneria aethiopica*. Some *Potamogeton schweinfurthii* and *Najas pectinata* occur along the Ugandan shores. *Vallisneria* and *Najas* are best developed in the vicinity of river mouths where waters are better aerated. *Cyperus papyrus* and *Phragmites mauritianus* form swamps at the mouths of the Ishasha, Chiruruma and Nchweru Rivers in Uganda on the northeastern shore.

The present fish fauna comprises about 23 cichlids and 30 non-cichlid species. However, the fauna is impoverished, with certain widespread families being entirely absent, e.g. Centropomidae, Characidae, Malapturidae, Mastacembalidae, Mochokidae and Schilbeidae. Further, *Citharinus*, *Distichodus*, *Hydrocynus*, *Polypterus* and *Lates* which are found in Lake Albert and the Nile are also absent, although both *Hydrocynus* and *Lates* are known to have been present in the middle Pleistocene. From palaeontological studies a picture emerges of Lake Edward being in a phase of recolonisation, its fauna having been partially eliminated at least twice during the late Pleistocene. Although the lake once contained crocodiles, as well as the Nile fish cited, they are also now absent. The rapids prevented their re-introduction from the lower Semliki where they persisted until the middle of this century, before they were finally eliminated by hunters. However, it appears that fish have entered from the east, where there is now a watershed with Lake Victoria, and these have begun speciating. Among the cichlids there are several species with close relatives in Lake Victoria, e.g. *Haplochromis guiarti*, *H. ishmaeli* and *H. ntacrops*, and two common species, *Astatoreochromis alluaudi* and *Haplochromis nubilis*. Two species present in the Nile have either re-entered or survived, *Bagrus docmac* and *Oreochromis niloticus*. *Oreochromis leucostictus* is confined to Lakes Edward and Albert, perhaps having originated in Lake Edward and passed downstream. Considering the history of the lake the invertebrate fauna is surprisingly rich.

The avifauna of the lake and associated river valleys and swamps is very diverse and includes herons, ibises, egrets, bitterns, ducks, geese, darters, cormorants, skimmers, shoebills, openbills, ospreys, gulls, francolins, warblers and weavers. Species of interest include *Acrocephalus schoenobaenus*, *A. scirpaceus*, *Anas querquedula*, *Ardeola ralloides*, *Calidris ferruginea*, *C. minuta*, *Charadrius hiaticula*, *Chlidonias leucoptera*, *Gelochelidon nilotica*, *Hirundo rustica*, *Philomachus pugnax*, *Riparia riparia*, *Tringa glareola*, *T. nebularia* and *T. stagnatilis*.

Human Impact: The area is sparsely populated and there has been relatively little disturbance since the proclamation of the Ruwenzori National Park in Uganda in 1959 and the Virunga National Park in Zaire in 1969, but illegal fishing and poaching are chronic problems. Growing tourism could prove a threat, and the proposal to dam the Rutshuru River (in Zaire) would almost certainly have a major, and adverse, impact upon the riverine wetland ecosystem.

Conservation Status: Almost the entire Ugandan shore of the lake is protected in the Ruwenzori National Park, as is the lower course of the Rutshuru and several other tributary rivers.

Wetland Name: Lake Albert

Country: Uganda

Coordinates: 1°01 ' -2°20 'N/30°23 ' -31°26 'E

Area: 565 915 ha (318 570 ha in Uganda)

Altitude: 619 m asl

Nearest Towns: Masindi (45 km E); Kampala (220 km SE)

General: Lake Albert lies between two parallel escarpments in the Western Rift Valley, at an altitude of 619 m, with an extreme length of 180 km and a maximum width of 43 km. Just over 56% of its surface is in Uganda. Its deepest point, 56 m, lies 7 km off the western shore, from where the land rises steeply to a high plateau more than 2000 m asl. The lake floor slopes gently upwards towards the east, but the eastern escarpment rises abruptly just a few km from the east bank in Uganda. The lake is subject to violent windstorms which cause the upwelling of bottom waters, but even without these happenings, the lake is generally well mixed. During calm periods, which frequently occur between November and February, a degree of stratification develops and dissolved oxygen levels fall, but not deleteriously for the fauna.

Hydrology & Water Quality: The principal affluent streams are the Semliki, which enters at the southern end from Zaire, and the Victoria Nile, which enters in Uganda very close to the northern end. Both rivers have built deltas into the lake, that of the Semliki is the larger and 90% of it is in Uganda. Although the Nile carries more water than the Semliki, it has little influence on the ecology of the lake, other than to maintain water levels. The Nile water is fresh, with a salinity of 0.1‰, while the main body of the lake water, up to 10 km from the delta which the Victoria Nile has built into the lake, has a salinity of 6‰. Lesser streams entering the lake from Uganda are, from south to north, the Waiga, Waisoke, Wald, Waisembe, Wambabya, Nkusi, Muzizi and Wasa Rivers. However, all these, and numerous small streams from Zaire, are highly seasonal and of only minor importance to the hydrology of the lake. Much periodically inundated land occurs around the southern margin of the lake in the Semliki Delta, and

also at isolated sites along the eastern shore, most notably in the delta of the the Victoria Nile.

The surface temperature is usually within the range 26-29°C and the pH between 8.4 and 9.5. Total dissolved solids amount to 565 mg/l and the concentrations of the principal ions are sodium 96 mg/l; potassium 65 mg/l; calcium 10 mg/l; magnesium 32 mg/l; carbonates 7.3 meq/l; chloride 31 mg/l; sulphate 32 mg/l and silicate below 1 mg/l (Tailing & Tailing, 1965). The results of detailed hydrobiological surveys were published by the Institut Royal des Sciences Naturelles de Belgique (Brussels) between 1957-1962. General information is provided by Bishop (1965; 1969) and Livingstone (1976).

Flora & Fauna: *Potamogeton schweinfurthii* is the dominant submerged macrophyte over most of the lake, by contrast with Lakes Kivu and Edward where *P. pectinatus* is most common. However, the latter species is present in Lake Albert. The principal associate species are *Najas marina* and *Vallisneria aethiopica*, and as in the other lakes, they are most abundant in the vicinities of river mouths, but this phenomenon is not so pronounced as it is in the two other lakes, possibly because Lake Albert is shallower and its waters are generally well oxygenated. There are extensive stands of *Cyperus papyrus* and *Phragmites mauritianus* in the river deltas, with flowering culms up to 5 m high. Aquatic meadows of *Vossia cuspidata* flourish on the lakeward side of the papyrus swamp, with twining thickets of *Cyclosorus striatus* on the landward side. In ponds in the swamps, and in sheltered coves around the lake, there are floating-leaved and free floating associations, notably a *Lemna paucicosta*-*Pistia stratiotes*-*Azolla nilotica* association, and a *Nymphaea calliandra* association. In the latter, *Najas marina*, *Nymphaea lotus* and *Vallisneria aethiopica* are usually to be found, together with free floating plants of *Ceratophyllum demersum* and *Utricularia thoningii*. Species of *Nitzschia* and *Stephanotis* are the chief planktonic diatoms, undergoing periodic fluctuations in density. Blooms of the blue-green alga, *Anabaena* sp., occur from time to time, and lead to the mass mortality of fish, especially *Lates niloticus*.

The fish fauna comprises 46 species, of which 22 are also found in the Nile. Some genera, e.g. *Bagrus*, *Heterobranchus* and *Lates*, have long histories in the lake, having been recognised from mid-Pleistocene sediments, while *Clarotes*, which was present in the Pleistocene, is no longer there. *Alestes baremose*, *Citharinus citharus*, *Lates niloticus* and *Oreochromis niloticus* form the basis of the present fishery. Two distinct populations of *Lates niloticus* are present, one which breeds in the lake, and another which migrates into rivers to spawn. In Lake Albert this species is an inshore form, and is largely piscivorous, whereas another species, *Lates microphthalmus*, is pelagic and feeds mainly on *Caradina* (a freshwater prawn). Among the other piscivores, both *Hydrocynus vittatus* and the smaller *H. forskalii* occur in the lake, but the latter, here, tends to be pelagic and also feeds very largely upon *Caradina*. Of 36 non-cichlid species, 3 are endemic, while of 10 cichlids, 4 are endemic. These are all species of *Haplochromis*. The cichlid fauna is poor compared with that of most other East African lakes, including some other 'nilotic' lakes, such as Lake Edward. Accounts of the fish fauna are given by Worthington (1929) and Holden (1967; 1970). The invertebrate fauna is discussed by Green (1967a,b, 1971) and Verbeke (1957).

Crocodylus niloticus survives on the affluent streams, and is quite dense on the Albert Nile below the lake in the Kabalega National Park. Birds of interest found along the lakeshore are *Buteo buteo*, *Chlidonias leucoptera*, *Ciconia ciconia*, *Crex crex*, *Cuculus*

canorus, *Gallinago media*, *Gelochelidon nilotica*, *Lanius collurio*, *L. minor*, *Lynznocryptes minimus*, *Merops apiaster*, *Muscicapa striata*, *Pernis aprivorus*, *Phylloscopus trochilus*, *Porzana porzana*, *Riparia riparia*, *Tringa glareola* and *T. ochropus*. Many of the mammals cited in the regional introduction are present around the lake and in its swamps, including *Atilax paludinosus*, *Hippopotamus amphibius*, *Kobus ellipsiprymnus*, *K. kob*, *Loxodonta africana*, *Lutra maculicollis*, *Phacochoerus aethiopicus* and *Syncerus caffer*.

Human Impact & Utilisation: There are important fisheries on the lake, which by 1970 were producing some 28 000 tonnes fish/yr, the Ugandan catch amounting to 17 530 tonnes in 1970.

Conservation Status: The northern extremity of the lake on the Ugandan side is protected in the Kabalega (Murchison Falls) National Park. The park is bisected by the Victoria Nile and the river delta and the Kabalega Falls (where the Albert Nile leaves the lake) are included. About 25 km of the lakeshore is included in the Bugundu Game Reserve, a buffer zone on the south side of the national park. A similar stretch is included in the Toro Game Reserve at the southern extremity of the lake, where there are grassy lakeshore flats, lacustrine swamps, and heavily wooded affluent streams.

Wetland Name: The Bunyoni Lake/Swamp Complex

Country: Uganda

Coordinates: 1°05'-1°28'S/29°39'-30°02'E

Area: 18 000 ha (total wetland)

Altitude: 1798-1990 m asl

Nearest Towns: Mbarara (112 km NE); Kampala (340 km NE)

General: Lake Bunyoni (1°13'-1°24'S/29°49'-29°58'E) was formed when a steep-sided dendritic valley system was blocked by volcanic activity about 18 000 BP. It covers about 6100 ha, 1974 m asl, and is fed at its southern end by the Kabirita River from Rwanda, and by numerous affluents from the surrounding hills which rise to heights of 2200-2478 m asl. The lake is 25 km long, 7 km wide at maximum, and oriented roughly SE-NW. It has a maximum depth of 44 m and contains 23 small islands. Swamps extend back up the Kabirita for 8 km, and are present at the heads of 25 of the little arms of the lake. In total these cover about 1500 ha. Upwarping in the area has led to the curious situation where streams in steep-sided mountain valleys flow very sluggishly, sometimes with the creation of watersheds midway along rivers. Thus Lake Bunyoni drains sluggishly from its northern end to the Ruhuhuma (Ruvuma) Swamp (1°07 'S/29°48'-29°52'E) which lies on a watershed from where streams flow both east and west.

The Ruhuhuma Swamp is 10 km long from E-W and covers a little more than 4000 ha at an altitude of 1940 m asl. The eastern part of the swamp drains by a short stream to the swampy upper course of the Ishasha River, which rises in Rwanda and flows north and northwest to Lake Edward and the Nile. A strip of permanent swamp, 40 km long and about 1 km wide, accompanies the Ishasha from the Rwanda border northwards to a point just beyond the confluence with the effluent from the Ruhuhuma Swamp, so that a permanent wetland of 4000 ha is situated here. The western part of the swamp drains to Lake Mutanda (1°10'-1°16'S/29°39'-29°42'E), 1798 m asl. This lake is 9 km long and 2.5 km wide and contains one large island. It has an open water surface of 1600 ha and is fed by short streams which enter the northern end. It discharges from the southwestern corner

via the Kako River and the Tshengere Swamp (1°14'S/29°32'E) in Zaire, to the Rutshuru River and thence to Lake Edward and the Nile.

Lake Muanga or Muhele (1°13'S/29°44'E) is situated about 1800 m asl, just to the east of Lake Mutanda. It has a maximum depth of 7.5 m, a length of 3 km and a width of 1 km. It is ringed by high hills, but drains to Lake Mutanda through a papyrus swamp at its southwestern corner.

Hydrology & Water Quality: The water level of Lake Bunyoni fluctuates about 75 cm during the course of a year, but the mean level rose some 2 m after the 1962-63 season, c.f. Lake Victoria. Lake Bunyoni is stratified and apparently remains so for many years at a time without mixing. The bottom temperature remains close to 19°C, but the surface temperature rises to 25°C. Oxygen concentrations reach 8 mg/l, but the bottom water is anoxic, while pH values range from 7.4 at the bottom to 8.6 at the surface. The water is clear with Secchi depths of up to 2.9 m. Denny (1972) gives an account of the chemistry of this lake.

Flora & Fauna: There are floating swamps of *Cyperus papyrus* and *Cladium mariscus* in the shallow sheltered bays of Lake Bunyoni, with *Phragmites australis* present in a narrow strip on steep exposed shores. *Potamogeton* and *Nymphaea* spp. dominate the floating leaved vegetation in front of the papyrus swamps, and *Ceratophyllum demersum* is the commonest submerged species, often with *Hydrilla verticillata*. Floating islands of papyrus have as associates *Hydrocotyle ranunculoides*, *Polygonum salicifolium*, *Pycnostachys coerulea*, *Thelypteris squalnigera* and *Utricularia* sp. *Typha domingensis* is present along affluent streams. Denny (1973) gives an account of the vegetation of this lake.

Oreochromis niloticus was introduced and still persists in the lake. The most common fish however, is a species of *Haplochromis* and local fishermen take a species of *Clarias*.

Human Impact & Utilisation: The lake was stocked with fish earlier this century, but recently there have been mass fish mortalities. These have been attributed to violent mixing. There is an artisanal fishery.

Conservation Status: Unprotected.

Wetland Name: The Kijanebalola Lake/Swamp Complex

Country: Uganda

Coordinates: 1°10' -1°34' N/30°50' -31°25' E 5

Area: 25 950 ha

Altitude: 1226-1250 m asl

Nearest Towns: Mbarara (33 km WNW); Kampala (180 km ENE)

General: This complex has, as its principal affluent, the Ruizi River which rises from a headwater swamp (0°46'S/30°11'E) and flows eastwards to a central swamp (0°32'-0°45'S/30°51'-31°16'E) oriented E-W, which has a number of peripheral lakes. These latter are situated at the lower ends of valleys which run down to the swamp from both north and south. The largest are from west to east, Lakes Nakivali (0°45'-0°50'S/30°53'E), Mburo (0°39' S/30°55' E), Kachira (0°30' -0°40' S/31°06' E) and Kijanebalola (0°43' S/31°19' E). Other small lakes, also from W-E, are Lakes Kiretwa, Kasasa, Mutukura, Kazuma, Mishera, Ruma, Karitima, Bwara and Karunga. The swamp drains from Lake Kijanebalola at the eastern end of the system to Lake Victoria via the Kibale River which reaches the lake in an extensive swamp at Sango Bay, north of the mouth of the Kagera River.

The central swamp occupies a tract of land 44 km long and up to 15 km wide, covering 15 000 ha. Lake Nakivali is 14 km long and 3 km wide, and has an area of 3080 ha at high water, when the maximum depth is 3.5 m. Lake Mbura, to the north, is 6.2 km long and 3 km wide at maximum, and has a mean area of 1190 ha at high water. Lake Kachira is the largest lake, 22.8 km long and up to 3.4 km wide, with a maximum depth of 4.1 m. It has an area of 3960 ha. However, Lake Kijanebalola is the best known lake of the complex. It is 17 km long and up to 4.3 km wide, and has a maximum depth of 4.8 m. It contains two large islands at its western end.

Hydrology & Water Quality: The chief inputs are from the Ruizi River and from direct precipitation. There is little information as to water quality, but lake water temperatures generally range from 23-26°C, with pH values of 7.5-8.5. The pH of Lake Kachira is close to 8.4 and that of Kijanebalola is usually 8.3. The waters of the lakes are turbid with Secchi depths of 40-50 cm. The depth and size of the lakes varies considerably from year to year. Lake Kijanebalola overflows into the Kibale River about once every decade, otherwise the system is endorheic.

Flora & Fauna: The central swamp is a papyrus swamp, but with some *Ficus verruculosa* and other woody species, and prairies of aquatic grasses. There are extensive grasslands subject to seasonal inundation on the periphery of the swamp and around parts of the lakes which support much free-floating and floating-leaved vegetation. Among fishes *Clarias mossambicus*, *C. weneri*, *Haplochromis* spp., and *Protopterus aethiopicus* are indigenous, while *Oreochromis* spp. have been introduced. There are crocodiles and many piscivorous birds, and almost all the small semi-aquatic mammals cited in the regional introduction. Among the larger mammals using the wetlands are *Damaliscus lunatus*, *Hippopotamus amphibius*, *Panthera pardus*, *Phacochoerus aethiopicus*, *Redunca redunca*, *Syncerus caffer* and *Tragelaphus spekei*.

Human Impact & Utilisation: The lakes were first stocked with commercial species of fish in 1935, but catches, which include *Clarias mossambicus*, *Haplochromis* spp., *Protopterus aethiopicus*, *Oreochromis esculentus*, *O. niloticus* and *O. variabilis* have declined since 1971. About 1000 canoes are employed on the four major lakes, almost 500 on Lake Kijanebalola. The area is heavily grazed by domestic cattle.

Conservation Status: An area including Lake Mburo, some small lakes, and much of the western shore of Lake Kachira are protected in the Mburo National Park, gazetted in 1983.

Wetland Name: Lakes Bisina & Opeta

Country: Uganda

Coordinates: 1°28'-2°01'N/33°49'-34°26'E

Area: 120 000 ha (25 000 ha open water)

Altitude: c. 1040-1060 m asl

Nearest Towns: Jinja (150 km SSW); Kampala (205 km SW)

General: These lakes are situated on drainage lines leading from the Karasuk Hills in Kenya, and from Mts. Elgon and Kadam, to the Okere Valley and Lake Kyoga. The Ukutat, Muchilmakat and Kelim Rivers all enter Lake Opeta (1°39'N/34°09'-34°14'E) through a zone of permanent swamps east of the lake, above which each river has a seasonal floodplain. Lake Opeta is 10 km long, 5 km wide and has an open water area of 4000 ha. The entire lake is fringed by wide swamps, except along parts of the southern

shore. The Kamirya and Siroko Rivers from Mt. Elgon also enter Lake Opeta, but do so through the swamps on the southern shore, and neither stream has an important floodplain. Water then passes west for 5 km from Lake Opeta, through a dense swamp, to Lake Bisina (1°35'-1°44'N/33°49'-34°06'E). This lake (formerly Lake Salisbury) has few affluents, the largest being the seasonal Apedura River which rises to the north on the slopes of Mt. Akim. Lake Bisina is oriented E-W and is 30 km long and up to 9 km wide, with a maximum surface area of 21 000 ha at high water. It drains from its western end through swamps, to the Okere system which leads in diffuse fashion to the swamps at the head of the Mpologoma Arm of Lake Kyoga.

The permanent swamps around Lake Opeta cover about 30 000 ha. The floodplain on the Ukutat is 40 km long and up to 7 km wide with an area of 20 000 ha at high water, that on the Muchilmakat is 25 km long and about 5 km wide with an area of 11 000 ha, while that on the Kelim is 25 km long and up to 10 km wide with a high water area of 17 500 ha. The Apedura River has a floodplain 30 km long and up to 6.5 km wide, which at high water covers 16 500 ha.

Flora & Fauna: Permanent swamps are dominated by papyrus, but there are areas of *Typha* and *Phragmites*, and strips of swamp forest. The fish fauna of the lakes is essentially nilotic, but with some species characteristic of the Lake Victoria Basin. *Clarias* spp., *Haplochromis* spp., *Labeo victorianus*, *Mornzyrus macrocephalus*, *Oreochromis esculentus*, *O. variabilis*, *Protopterus aethiopicus* and *Schilbe mystus* are important species. However, *Barbus* and *Bagrus* spp. are absent and probably have not been able to cross the swamp barrier from Lake Kyoga. There is an abundance of piscivorous birds and almost all the semi-aquatic mammals cited in the regional introduction are present.

Human Impact & Utilisation: There was a thriving crocodile skin industry on Lake Bisina up until the late 1950s, with the result that these animals are now very scarce. A gill net fishery was started on Lake Bisina in 1950 for *Oreochromis* spp., but the state of this is not clear. Both lakes are still fished by artisans however, using long lines and baskets, and the floodplains are grazed and cultivated locally.

Conservation Status: The Pian-Upe National Reserve includes the western ends of the floodplains on the Muchilmakat and Kelim Rivers, immediately above Lake Opeta.

Wetland Name: Lake Wamala

Country: Uganda

Coordinates: 0°12' - 0°25' N/31°41' -32°02' E

Area: 51 000 ha (25 000 ha open water)

Altitude: c. 1290 m asl

Nearest Towns: Kampala (58 km E); Masindi (138 km N)

General: Lake Wamala is surrounded by swampland, the whole system occupying some 51 000 ha. The lake has a mean length of 27 km and a mean maximum width of 10 km. It has a variable area of 16-25 000 ha. The peripheral swamp is 44 km long, oriented WSW-ENE, and has a maximum width of 16 km. The system receives numerous minor affluent watercourses and drains via the Kibimba River to the Katonga River. However, the Kibimba is almost permanently dry and only occasionally does it carry overflow from Lake Wamala, and when it does, this may not be sufficient to reach the Katonga. The Wamala Basin (2654 km²) is therefore usually quite separate from the Katonga Basin. Direct

precipitation over the lake is estimated as 1200 mm/yr, and this, plus the contribution of the affluents, is lost by evapo-transpiration. The inflow of the largest affluent, the Mpamujugu, is 97 million m³/yr.

Flora & Fauna: The swamps throughout the system are dominated by *Cyperus papyrus*, but there is much swamp forest and riverine forest along the Katonga. The fish fauna has many species common to the shallow waters and inlets of Lake Victoria. Bird life is prolific, and the river and its swamps are important to a range of mammals, including *Hippopotamus amphibius*, *Kobus ellipsiprymnus*, *Loxodonta africana*, *Redunca redunca* and *Syncerus caffer*.

Human Impact & Utilisation: Lake Wamala supports an important fishery. 250 canoes were licensed in 1975, at which time no outboard motors were permitted. *Oreochromis niloticus*, which was introduced in the 1950s, provides the bulk of the catch, but other important species are *Clarias mossambicus*, *Protopterus aethiopicus*, *Oreochromis leucostictus* and *Tilapia zillii*.

Conservation Status: A section of the north bank of the river is protected in the Katonga Game Reserve.

(J) MINOR LAKES

General: Several small lakes are situated high in the hills near Bunyoni Lake, but are not in connection with that system. The largest are Lakes Mugisha (1°20'S/29°47'E), 1894 m asl, and Tshahafi (1°21'S/29°46'E), 1894 m asl. These lakes are swamp-fringed. A dozen small crater lakes are situated immediately south of Lake George in an area 0°06'-0°19'S/30°01'-30°11'E. They are, from N-S, Lakes Moseche, Bagusa, Mshenyi, Chibera, Kyamwiga (0°11'S/30°08'S), Bugwagi, Katinda, Mirambi, Niamsigeri (0°17'S/30°01'E), the largest, Mugogo, Kyasanduka and Murunuli. Four other crater lakes, Kikorongo, Kitagata, Murunuli and Nyamunuka, are situated west of Lake George, just north of the Kazinga Channel and between Lakes George and Edward. There are said to be no less than 87 crater lakes in the Rift Valley south of the Ruwenzori Mountains, many of which are saline and shallow.

2. Riverine Swamps & Floodplains

(A) THE OKERE SYSTEM

General: The most northern source of this system is the Dopeth River which rises in a small swamp (3°35'N/34°23'E) 2000 m asl near the Kenyan border. From this swamp the Dopeth flows west and south and the Napass River, which also rises here, flows northeast across Kenya to Lake Turkana. This river joins the Longira, which also rises in a swamp near the northeastern border, at a point (2°46'N/34°00'E) below which a seasonal floodplain develops. Other floodplains occur on two other tributaries flowing in parallel to the east, and the streams unite (2°24'N/34°00'E) to form the Okok River.

The Okere River has numerous sources in the highlands along the Kenyan border, including several streams which drain Mt. Moroto. These unite to form the Okere (2°31'N/34°17'E), some little distance below which this river also develops a floodplain. The

Okok and Okere Rivers reach a confluence at a point 2°05'N/33°54'E, where their joint floodplain is 7.5 km wide. The river flows south from here, but quickly loses its integrity in a swampy floodplain which encompasses the western end of Lake Bisina, towards the swamps at the northern end of the Mpologoma Arm of Lake Kyoga. Water from Lake Bisina passes this way to reach Lake Kyoga. The lower floodplain of the Okere is studded with lakes, and merges into permanent swamps at its southern extremity. The floodplain is continuous for 110 km below the Okuk/Okere confluence, and above it for a further 29 km up the Okuk and 46 km up the Okere. It has a total high water area of approximately 80 000 ha, including the numerous lakes of the lower reaches.

Flora & Fauna: *Cyperus papyrus*, *Phragmites mauritianus* and *Typha domingensis* all occur along the river, with various arborescent species in shallowly inundated places. These include *Acacia tortilis*, *Borassus aethiopum*, *Ficus* spp., *Phoenix reclinata* and *Syzygiunz guineense*.

The floodplains are important grazing areas for wildlife during the dry seasons when they may be visited by a variety of large mammals as discussed in the regional introduction. *Acinonyx jubatus* and *Panthera leo* are found here.

Human Impact & Utilisation: Cattle are grazed on the floodplains during the dry seasons.

Conservation Status: Unprotected.

(B)THE KAFU SYSTEM

General: The Kafu River flows east from a swampy watershed to the Nile, and west from the same watershed as the Nkusi to Lake Albert. Along the eastward flowing section it receives two tributaries on its right (southeastern) bank, both of which flow through extensive permanent swamp systems. These are the Mayanja, which traverses a 30 km papyrus swamp (1°45 ' -1°57'N/31°59'-32°15'E) with an area of 13 500 ha, and the Lugogo which flows through a continuous strip swamp (1°00 ' -1°29 'N/31°57 ' -32°24 'E) for 82 km above its confluence with the Kafu. This latter swamp has an area of 24 600 ha.

(C)THE NILE

General: The Okole River, a right bank tributary of the Victoria Nile, traverses a continuous swamp belt (2°03'-2°19'N/32°19'-32°45'E) of 16 000 ha for 52 km above its confluence. Farther downstream the delta swamps in Lake Albert occupy some 6500 ha, and below Murchison Falls the Albert Nile traverses a swamp 115 km long and some 5-10 km wide (2°30'-3°35'N/31°16'-31°58'E), with an area of about 52 000 ha