The status of the fishery resource in, the wetlands of Tanzania

P.O.J. Bwathondi and G.O.J. Mwamsojo

Tanzania Fisheries Research Institute
P.O. Box 9750
Dar es Salaam

Summary

The main types of wetlands in Tanzania are described as an introduction to a coverage of the fisheries of the large lakes, the minor waters, the rivers and the intertidal ecosystems. Fisheries potential is estimated and details of catches for each wetland type are given. Fishing techniques and the future of the fisheries are discussed and recommendations made for future wetlands fishery conservation.

Introduction

The term 'wetlands' includes a wide range of coastal and marine habitats, freshwater ponds, dams, swamps, rivers and lakes. The definition of wetlands provided by the Ramsar Convention (see Introduction) is used in this paper.

The freshwater fishery in Tanzania is divided into two main areas: the large bodies of water which include the Great Lakes (Victoria, Tanganyika and Nyasa), Lake Rukwa, Nyumba ya Mungu Dam and Mtera Dam; and the minor waters which include all small water bodies in Arusha, Dodoma, Iringa, Shinyanga, Singida, Tabora and Morogoro Regions and the Rufiji River.

The fishery of the deep Rift Valley lakes Tanganyika and Nyasa is concentrated in the pelagic zone offshore. In the other lakes the fishing is concentrated close to the shoreline, and in most cases, less than 20 m deep. Lake Rukwa, Mtera Dam and Nyumba ya Mungu Dam are very shallow (mean depth less than 5 m). In such shallow lakes the fishery is spread throughout the lake, with some concentration close to the shoreline. Fishing is very lucrative in the man made lakes (Nyumba ya Mungu Dam and Mtera Dam) and small inland lakes and swamps. .

In the coastal zone, mangrove forests and estuarine ecosystems playa significant role in both finfish and shellfish fisheries. The major prawn fishing grounds are in Kisiju, Rufiji, Sadani and Bagamoyo (influenced by Ruvu and Wami Rivers). Prawns are harvested at a depth of between 1 m and 15 m. During high tides, prawn

trawlers come to within a kilometre of the shore. Artisanal prawn fishermen, who drag their nets by hand, walk into shoulder-high water to set their nets.

Most fish use the estuarine ecosystem as nursery grounds for their young. The mangroves are nursery areas for prawns, crabs and fish, and settling sites for oysters. Studies on the mangrove crab *(Scylla serrata)* and the blue crab *(Portunus pelagicus)* have shown that these species have high potential in Tanzania.

General review of the wetlands of Tanzania

The major wetlands in Tanzania are shown in the Introduction to this volume. These include the major lakes Tanganyika, Nyasa and Victoria; the small lakes Rukwa, Manyara, Eyasi, Natron, Kitangiri, Burigi, Ikimba; and the rivers. There are many permanently flowing rivers whose catchments cover a wide area of the high altitudes of inland Tanzania. Table 1 shows the major drainage basins with their associated rivers and catchment areas. Most run through extensive basins which have either permanent marshes or are temporarily inundated by flood waters to form floodplains or swamps during the rainy season.

River Malagarasi, which flows westward into Lake Tanganyika, drains the Malagarasi swamp which is formed by the inland flowing Moyowosi and Gombe streams. The Katavi Swamp drains into Lake Rukwa through the Umba stream. Wembere Swamp is formed by Wembere and Manonga streams and is connected with Lake Eyasi through seasonal streams, forming a closed drainage system. Ugalla Swamp is drained by the Ugalla River, which joins the Wala stream to form the Sagara Swamp. Seasonal streams connect the Sagara Swamp to the Malagarasi River. Bahi Swamp has no outlet and is fed by the River Bubu.

Among the big rivers associated with extended basins is the River Ruaha, a major tributary of the River Rufiji, whose floodplains have deteriorated due to the construction of Mtera and Kidatu Dams. The Rufiji flows along a wide valley and has a delta covering 80,000 ha, the largest on the East African coast (Mbwana, 1986). Another major tributary is the River Kilombero, which floods annually and flows over a wide basin with small swamps and pools scattered throughout the length of the valley.

From Table I, it can be seen that the majority (47%) of Tanzania drains into the Indian Ocean, 26% to interior drainage, 22% to the Atlantic ocean and 5% to the Mediterranean Sea. The importance of interior drainage and the associated fishery cannot be overemphasised.

Tanzania has a coastal zone which stretches for 800 km from 401' S in Tanga and 1005'S in Mtwara Region (Banyikwa, 1986). Most rivers draining into the coastal zone originate in the highlands and flow to the Indian Ocean. The important rivers are shown in Table 1. At the entrance to the ocean, these rivers form an intertidal ecosystem, characterised by deltas and estuaries. Most of these deltas are covered by intertidal forests of mangrove trees.

Table 1 Major river systems and hydrological zones in Tanzania

Drainage basin	Major river systems	Catchment (1,000 km2)
Indian Ocean	Rufiji	177.4
	Ruvuma	52.1
	Wami	46.4
	Pangani and others	42.1
	Matandu	18.6
	Ruvu	18.4
	Mbwemkuru	16.3
	Lake Nyasa-Ruhuhu	14.0
	Mbezi and others	7.7
	Umba	6.7
	Lukuledi	6.0
	Others	32.4
	Total	438.1
Interior Drainage	Rift Valley rivers	64.5
	Lake Eyasi and Kitangiri	64.4
	8abu River	25.6
	Masai Steppes	10.9
	Others	78.7
	Total	244.1
Atlantic Ocean	Malagarasi	126.1
(Lake Tanganyika)	Luiche	2.6
	Others	80.3
	Total	209.0
Mediterranean Sea	Grumeti	11.7
(Lake Victoria)	Simiyu	11.6
	Mblageti	5.7
	Mirare/Mori	0.8
	Mara	0.8
	Others	21.3
	Total	50.3

Table 2 The distribution of mangrove swamps in Tanzania (Source: Mbwana, 1986; Banyikwa, 1986)

Zone	Area covered (ha)	Per cent coverage %
Tanga Region		
Tanga District	10,004	
Pangani District	600	
	Total 10,604	10.8
Coast Region		
Rufiji District	40,500	
Bagamoyo District	1,501	
Kisarawe District	3,501	
Mafia District	405	
	Total 45,907	46.7
Lindi Region		
Kilwa District	14,005	
Lindi District	1,418	
	Total 15,423	15.7
Mtwara Region	8,003	8.2
Pemba Island	12,000	12.3
Zanzibar Island	6,000	6.1
TOTAL	97,937	99.8

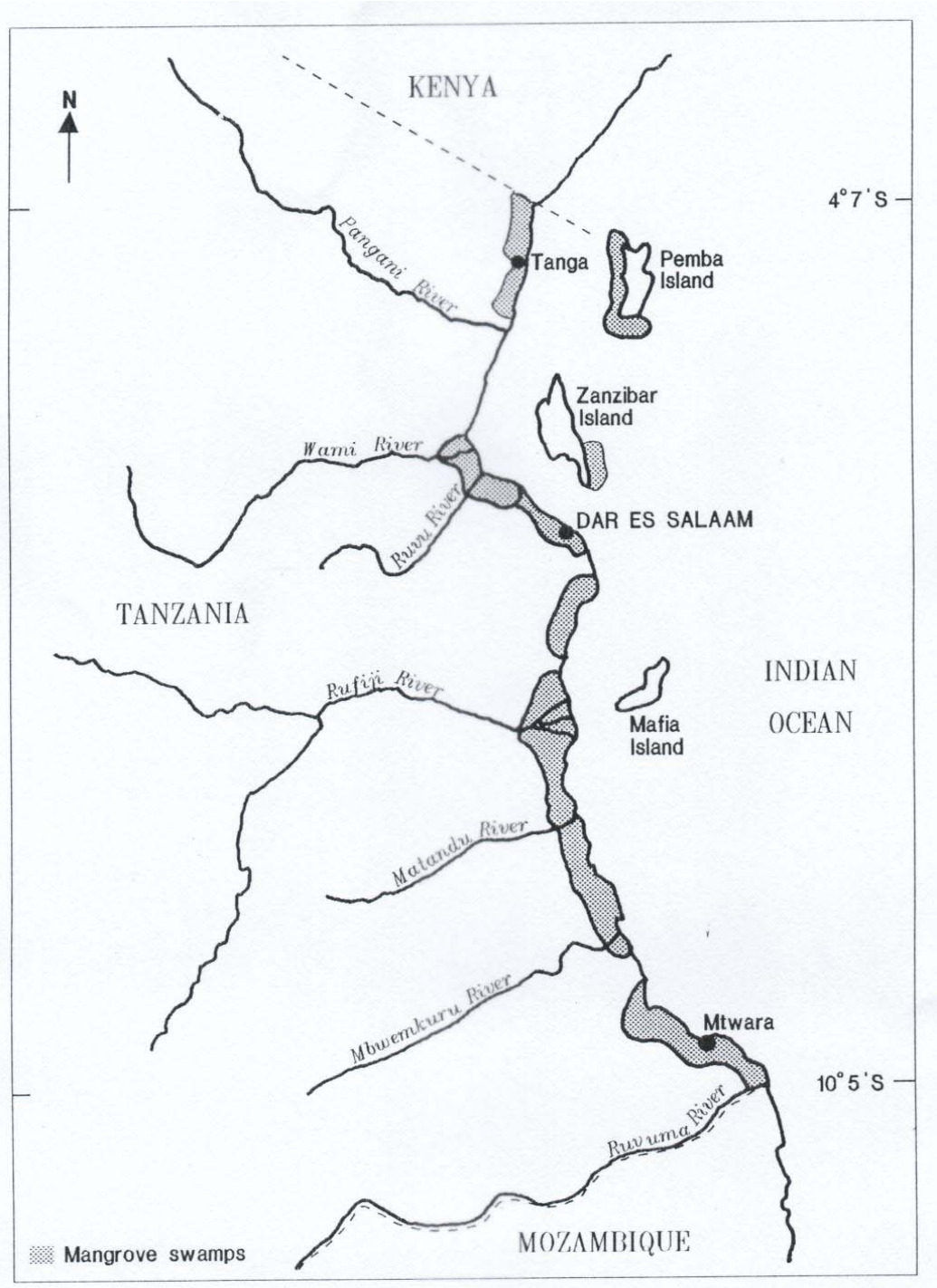

Figure 1 Mangrove swamps along the Tanzanian coast

Table 2 and Figure 1 show the distribution and area of mangrove forests in Tanzania; the Rufiji Delta contains 41.4% of Tanzania's mangroves.

Outside the intertidal zone is the seagrass bed area which also acts as the nursery ground for many juvenile, coastal fish, especially herbivores. It is in this area that the artisanal fishery, using mainly beach seines, is concentrated.

The Tanzanian fishery

The potential fishery resource

The fishing population in Tanzania is estimated to be 64,241 permanent, full-time fishermen and about 300,000 part-time fishermen. The majority use simple equipment such as gill nets, cast nets, traps, hooks and seine nets. Simple crafts, dugout canoes, dhows, outrigger canoes and planked canoes are used as well as modern wooden boats using outboard or inboard engines.

The potential, annual fishery production in Tanzania (both freshwater and marine) is estimated to be over 730,000 t (Bwathondi, 1990) although the present catches are less than 400,000 t (Tables 3, 4 and 5). Catches from freshwater account for more than 87.5% of to_f11 fish catches.

Current *per capita* consumption of fish in Tanzania is 13.5 kg (Bwathondi, 1990) which is estimated to rise to 20 kg by the year 2000. This can only be achieved if more investment is injected into the fishery and less fish are exported. However, research and fisheries reports indicate that some artisanal fisheries are either fully exploited or over-exploited, hence the expected catches may not be achieved unless alternative sources, mainly in the inland waters, are identified. The major source of freshwater fish is Lake Victoria (54.2%) followed by Lake Tanganyika (31 %) and Lake Nyasa (10.4%). Reports by Bwathondi and Mahika (1989) show that deep water prawns are underexploited whereas shallow water penaeid prawns are nearing full exploitation or are overexploited in certain areas.

Major waters

lake Victoria

Tanzania owns 47% of Lake Victoria. Since 1960, the fishery of this lake is in a state of flux following the introduction of Nile Perch *(Lates niloticus,* 'sangara') and several species of tilapia *(Oreochromis niloticus,* O. *leucosticus* and *Tilapia zillii)* (Bwathondi, 1990). Before these introductions, and soon afterwards, there was a multispecies fishery in the lake, with more than 150 species of *Haplochro11lis* and several genera of fish being caught. With the rapid colonisation of the lake by *L. niloticus,* the fishery has been reduced to a few important species. By the end of 1990, only were considered economically important, *L. niloticus,* the tilapias (mainly O. *niloticus,* 'sato') and *Rastrineobola argentea* ('dagaa') were considered economically important.

Most fish in Lake Victoria are captured by the simple fishing gear mentioned in the previous section. Gill nets, generally 4" to 5" mesh, are set in deeper waters of less than 20 m. Some fishermen set the nets in the evening, leave them overnight and haul them in the next morning, while others leave them permanently in the water and inspect them every morning (Bwathondi, 1991).

Beach seine nets are popular along the sandy shore of the lake. The net is set in less than 5 m of water and hauled in within a few hours. Catches include adults and juveniles of most shallow water species. There are large seine nets whose operations take up to 8 hours from setting to retrieving.

Traps are usually set in rivers, marshes and close to the shoreline. Those set in the rivers and marshes capture riverine fish which spawn in the rivers but grow and feed in the lake (potamodromous fish) or those which spawn in the lake but feed in rivers (Bwathondi *et al.,* 1991). The most common genera found in the rivers and marshes of Lake Victoria include *Labeo, Schilbe* and *Protopterus.* The capture of these fish, especially at breeding time during the rainy season, has contributed substantially to their decline in the lake.

Besides the large piscivorous fish of Lake Victoria *(Lates, Bagrus* and *Clarias)* and the riverine fish mentioned above, there is a growing fishery of freshwater sardines ('dagaa') in Lake Victoria. The 'dagaa' are pelagic and ;are caught with a purse seine or lift net using light attraction.

The fishery of Lake Victoria has grown rapidly from 72,600 t in 1983 to over 200,000 t from 1986 onwards and accounts for 54.2% of the total catch from major lakes (see Table 3).

Table 3 Annual fish production from major freshwater wetlands in Tanzania (1983-1989)

Wetland	'1983	1984	1985	1986	1987	*1988t*	1989	%
	thousand tonnes							
lake Victoria	72.6	99.7	100.8	217.2	159.9	205.5	207.5	54.2
lake Tanganyika	99.4	107.1	115.2	70.0	93.7	62.7	53.5	31.0
lake Nyasa	19.5	18.1	27.0	35.9	30.0	39.3	34.5	10.4
lake Rukwa	4.8	4.6	4.6	5.9	8.1	5.8	8.9	2.2
Nyumba ya Mungu Dam	3.4	1.8	1.8	2.0	2.0	5.0	3.9	1.0
Mtera Dam	2.4	3.6	2.4	3.3	3.4	3.8	4.3	1.2
Total	202.1	234.9	251.8	334.3	297.1	322.1	312.6	100

Lake Tanganyika

Tanzania owns 45% of Lake Tanganyika. The fish stocks of Lake Tanganyika consist mainly of pelagic species such as *St%thrissa tanganicae. Limnothrissa miodon* and the predators, *Lates* spp. No current estimates are available for potential yield but it is known that the Tanzanian part of the lake is less productive than either the Burundian or Zambian parts, where both artisanal and commercial fisheries are well developed and the sustainable catches are estimated to be

116 kg/ha and *140* kg/ha respectively.

The commercial fishery is localised within a small area of the Kigoma waters and reflects symptoms of local overfishing. This fishery is adversely affected by continuously falling levels of the total catch from *100,000* t in 1983 to 60,000 t in

1989 (see Table 3). There have been prolonged low levels in abundance of *St%thrissa tanganicae* accompanied by damping of catch oscillations during the last twelve years. The abundance of *Limnothrissa miodon,* an inshore species, has increased in offshore waters, negatively correlated with oscillations of its predator, *Lates mariae.*

Fishing in Lake Tanganyika is carried out by scoop netting and gill netting using light attraction. Gill nets and traps are deployed in the rivers draining into the lake, especially the Malagarasi system. The importance of the Malagarasi River system, including swamps, on the fishery of the lake cannot be overemphasised. The decline of the lake species could be related to the productivity of fish species in the Malagarasi River.

A project funded through FAO and FINIDA will investigate the productivity of Lake Tanganyika, with a view to advising on the development of fisheries in the lake.

Lake Nyasa

Lake Nyasa is shared by Tanzania, Malawi and Mozambique and has a diverse fish fauna. The main genera found in the Tanzanian side are Oreochromis ('perege'), Haplochromis ('utapi'), Engraulicypris ('dagaa'), Rhamphochromis ('ngerewa'), Clarias ('kamb'alc'), Bagrus ('kitoga'), Opsaridion ('mbasa'), Synodontis ('ngogo') and Labeo ('ningu'). Bioproductivity is generally Iowan the Tanzania side due to the steepness of the shore. The main fishing crafts, dugout canoes, can operate over short distances offshore using gill nets, chilimila nets and long lines. Annual fish production increased from 19,500 t in 1983 to 39,300 t in 1988 (Table 3).

Lake Rukwa

A shallow lake, Lake Rukwa is surrounded by a highly vegetated fringe which supports a productive fishery. The most important fish are *Oreochromis* spp., *C/arias gariepinlls* and *Bagrus* spp., caught from dugout canoes with gill nets and long lines. Fish productivity has increased as a result of the rise in the level of the lake and an increase in vegetation around the margins.

Mtera Dam

Mtera Dam was completed in 1982 on the River Ruaha, changing the riverine system into a lacustrine environment. The population of fish increased quickly due to plentiful food provided by decomposing plant material and submerged vegetation. The dam was colonised by genera which were found in the River Ruaha, including *Oreochromis, Clarias, Synodontis, Schilbe, Labeo, Alestes* and *Hydrocyan.* Annual fish catches have almost doubled from 2,400 t in 1983 to 4,300 t in 1989 (Table 3). Fish are caught with gill nets and long lines from dugout canoes. Recently the population of fishermen has increased rapidly and must be controlled to avoid overfishing in the dam.

Nyumba ya Mungu Dam

Nyumba ya Mungu Dam is a multipurpose impoundment covering 18,000 ha. Construction was completed in 1965 to store water for hydropower generation on the Pangani River. Soon after its construction, the fish population in the dam increased and attracted many fishermen. The resulting fishing pressure has caused overfishing of tilapia, the major fish stock.

Minor Waters

A total of 10,500 t of fish were caught in minor waters in 1989 (Table 4). Singida, Arusha and Dodoma Regions produced 35.6%, 23.5% and 18.6% *pf* fish from minor waters respectively. The fishery resource in minor waters consists mainly of riverine genera, such as *Oreochrumis* and *Clarias,* which arc caught from dugout canoes with traps, hooks, gill nets, weirs and occasionally beach seines. In floodplains, fishing is carried out during the rainy season and in pools which become isolated as the river levels drop. In such pools, fish are caught with basket traps and spears.

Although fishing activities may take place all year round, the most important fishing period is during the rainy season, as at this time fish ascend the rivers to spawn and are easy prey.

The River Rufiji plays an important role in the riverine fishery of Tanzania. Most fishing activities are carried out in the major tributaries, the Ruaha and Kilombero Rivers. However, fishing activities in parts of River Ruaha, the largest tributary of River Rufiji, have been reduced by construction of Mtera and Kidatu dams, which control the floods. The Kilombero River contributes considerably to the *Clarias, Distichodus, Bagrus* and tilapia fisheries.

The catch from the minor waters is summarised in Table 4. In the Dodoma Region, the major contributors of fish are the Bahi Swamp and the Hombole Dam; the latter is important for the production of fingerlings for aquaculture projects in the region. Lake Kitangiri contributes 60% to the total production of the Singida Region and future fishery development and planning should be focussed on this lake.

The new Sola Dam and Mhumbi Dam contribute more than 50% to the total catch of the Shinyanga Region.

Table 4 Annual fish production from minor freshwater wetlands in Tanzania (1983-1989)

Region	1983	1984	1985	1986	1987	1988	1989	%
	thousand tonnes							
Arusha	0.18	0.18	3.64	0.10	1.00	4.30	1.10	23.5
Dodoma	1.80	0.69	0.25	0.66	1.31	2.22	1.40	18.6
Singida	1.53	2.04	0.98	2.18	2.14	2.20	4.90	35.6
Shinyanga	-	0.03	0.03	0.02	0.03	0.03	0.03	0.4
Tabora	0.11	0.18	1.04	0.36	0.36	0.68	0.22	6.6
Iringa	-	-	-	-	0.06	-	0.16	0.5
Morogoro	-	-	0.02	0.91	0.69	-	2.18	8.5
Coast	-	-	2.02	-	0.35	-	0.52	6.3
Total	3.62	3.12	7.98	4.23	5.94	9.43	10.51	100

Table 5 Annual fish production from marine wetlands in Tanzania (1983-1989)

Region	1983	1984	1985	1986	1987	1988	1989	%
	thousand tonnes							
Tanga	6.02	6.22	4.55	4.40	4.86	7.62	5.44	13.6
Coast	11.95	11.46	10.74	10.75	11.40	11.95	11.00	27.4
Oar es Salaam	5.31	4.81	6.84	10.66	6.35	14.00	15.26	21.9
Lindi	6.13	9.80	11.59	14.05	7.05	5.97	8.04	21.8
Mtwara	3.97	7.50	7.96	5.33	7.33	5.33	7.41	15.3
Total	33.38	39.79	41.68	45.19	36.99	44.87	47.15	100

The Ugalla River complex contributes substantially to fish production in the Tabora Region. Attention should be paid to fishery development in the Mbona and Shela waters.

Near the mouth of the Rufiji River there is an important fishery fot estuarine fish. The file fish *(Amanses),* milkfish *(Chanos chanos)* and catfish *(Arias)* are caught within the delta and in the coastal waters of the Rufiji River system.

Intertidal waters

Table 5 summarises the fish production in marine waters in Tanzania, which accounts for only 12.6% of the total fish production in Tanzania. The Coast Region contributes more than any other region (27.4%) to total marine landings. The high figure for Dar es Salaam is partly due to landings at both Banda and Kunduchi beaches of fish from Mafia, Bagamoyo and Zanzibar. Some of these fish may have been recorded first in their respective fishing districts and again in Oar es Salaam. The major landings of the coast include the groupers, catfish, sardines, rabbitfish, sharks, lobsters and prawns. Important wetland habitats include the mangrove swamps and estuaries. Mangrove areas are rich in organic material due to foliage drop and decay. Alluvium, which is rich in hoth organic and inorganic nutrients, is deposited by the incoming river. The common fish found in the mangrove and estuarine habitats include milkfish, catfish and file fish; several prawn species use mangroves as nursery areas.

There are more than 30 species of prawns in Tanzanian waters but the economically important ones include *Penaeus monodon, P. indicus, P. semisulcatus* and *P. latisulcatus.* The largest, and most valuable prawn is *P. monodon,* whereas *P. indicus* is the most abundant in Tanzanian waters.

Presently there are more than 10 trawlers fishing for prawns in Tanzania. As well as prawns, these trawlers also catch fish (by-catch) which can account for up to 70% of the total catch. Because of the limited storage space on board most trawlers, the fish are often discarded. TAFIRI (Tanzania Fisheries Research Institute), in collaboration with experts from NORAO, is designing a method to separate prawns from fish and reduce by-catch waste.

Seagrass beds are nursery and feeding grounds for herbivorous fish, such as parrotfish *(Scarus),* rabhitfish *(Siganus)* and as habitats for *Bech-de-mer* and the bivalves *Anadara antiquara.* Men usually catch fish using seine nets, while *A. antiquata* and *Bech-de-mer* are hand picked by women. This type of fishery is very prominent in areas close to Oar es Salaam and the mudflats of Ocean Road, Kaole and Mjimwema beaches, and around Zanzibar, Mafia and Pemba Islands.

Recommendations

It is recommended that the swamps, especially in the Malagarasi River and the hinterland drainage system, should he conserved and not used for rice growing, as they are a major source of freshwater fish.

As several diverse user groups are involved in the utilisation of man-made lakes and dams, management of these areas should be under one administration which could cater for the interests of the different groups.

More research should be carried out on the fish fauna and ecology of wetlands. Studies on the control of the Water Hyacinth, which is becoming a threat to Lake Victoria and its fisheries, should be carried out with the assistance of donor agencIes.

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