THE AFRICAN JOURNAL OF

Tropical Hydrobiology and Fisheries

(Afr. J. Trop. Hydrobiol. Fish)

Editor: Fred W.B. Bugenyi

Vol. 5 No. 2 1994

(Special Issue)

The New Vision Printing and Publishing Corporation
P.O. Box 9815, Tel: 235209, Kampala.

THE ROLE OF MACROPHYTES IN THE ECONOMY OF THE LOWER SONDU-MIRIU RIVER OF LAKE VICTORIA

JOHN GICHUKI AND WILSON ODHIAMBO
Kenya Marine and Fisheries Research Institute
P.O.Box 136
Pap-Onditi, Kenya.

Present Address:
Kenya Marine and Fisheries Research Institute
P.O.Box 1881,
Kisumu, Kenya.

ABSTRACT

This paper highlights the results of a 12 month's ecological study of macrophytes and their role in the economy of the lower Sondu-Miriu river of Lake Victoria. A total of 34 species of aquatic macrophytes were identified. These were grouped as emergent, floating leaved, free floating and submersed. The major community type identified were dominated by *Cladium jamaicanse* (Crantz) Kurk., *Cyperus paprus* (L.) and *Cyperus latifolius* (Poir). The study observed an over dependence on macrophytes by the local community for the supply of bedding, grazing fields, fuel, roofing and other building materials. The white (heart) of *Typha* shoot, Nile cabbage (*Pistia stratiotes* and a legume *Solanum nigrum* traditionally known as "osuga" are used as vegetables by local community. The only source of protein in this arid region is the fish caught in the swamps and birds which inhabit the swamp. The swamp provides the only source of green pasture in the dry season for the animals. An export oriented economy has developed involving mat making and basket weaving with exports reaching as far as Japan. The study proposes a rational and sustainable exploitation of the littoral zone to support the adjacent rural community.

INTRODUCTION

Macrophytes are an integral and essential part of a complex aquatic ecosystem. Swamps and littoral vegetation provide: breeding ground for fish, waterfowl and mammals, reduce erosion, act as filters to inhibit eutrophication and pollution by absorbing toxic chemicals and metals hence cleaning up polluted water. They act as natural sewage treatment plants. GAUDET (1976) likened them to septic tanks or giant filters.

They provide directly or indirectly enormous range of goods and services such as staple food plants, fertile grazing lands, fuel and maintenance of a gene pool of plants and animals. In Lake Victoria there is evidence of associating recovery of some lost inshore native fish species to the reappearance of macrophytes (CHITAMWEBWA, 1993). Surprisingly enough in present day Africa, swamps have been associated with diseases such as Malaria and Schistosomiasis and normally there is a strong case for their reclamation. Yala swamps and Lower Tana are good examples. This paper will present some work on the ecology of a macrophytic

community in lower Sondu-Miriu and its socio-economic benefit to the adjacent community.

MATERIALS AND METHODS

The lower Sondu-Miriu swamp (Lat. 0°17S' 22°S Long. 34° 04'E34° 49'E) is located at the mouth of river Sondu-Miriu ca. 5Km from Nyakwere bridge on the Kisumu - Homa bay highway. The swamp covers an area of ca. 5.5 km^2 (Fig.1).

The swamp was visited once a week for 12 months between November 1991 and October 1992. The distribution of macrophytic taxa was examined by making careful collections of plants parts with diagnostic features such as shoots, flowers, fruits and rhizomes. The specimen were pressed and labelled with the accurate swamp locality, date of collection, brief habitat description and a note on associated taxa. Replicate samples were taken to the National Herbarium at the University of Nairobi, Botany Department

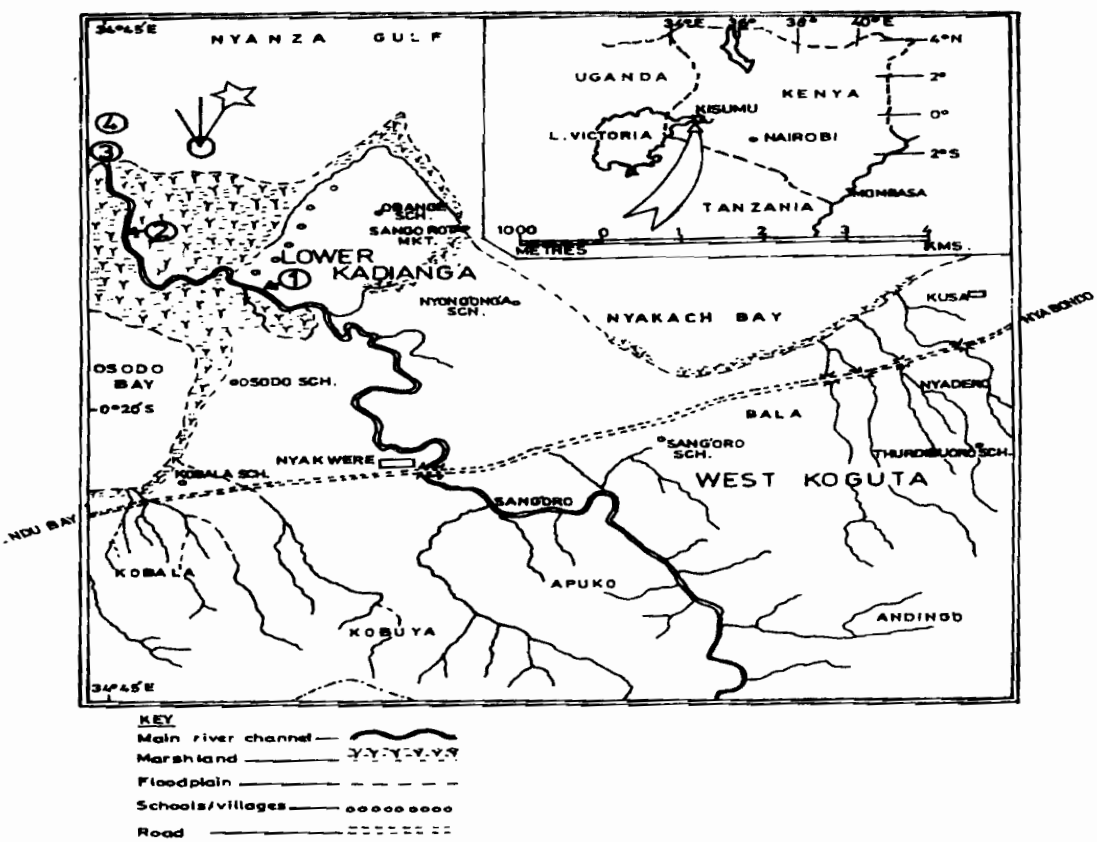

Fig. 1. The lower Sondu-Miriu river showing the swamp and the sampling points 1 - 4.

for identification. Three hundred homes were visited and a questionnaire based on a key informant system used to evaluate the benefits of the macrophytes to the adjacent community. As regards the physico-chemical characteristics, water samples were collected in a two litre plastic Van Dorn sampler at the swamp, river, interface and the lake proper and analyzed for dissolved oxygen and secchi disc transparency using the Winkler method and a 25 cm diameter secchi disc respectively. A beach recorder took monthly records of the fish species landed at the only swamp landing beach.

RESULTS

A total of 34 species of aquatic macrophytes were identified. These were grouped as emergent, floating leaved, free floating and submerged (Table 1). Table 2 lists some selected macrophytes and their various uses. The seasonal variations in some limnological parameters obtained at sites in Fig.2 are shown in Fig. 3 (a and b). Low values of dissolved oxygen were recorded in the swamp as compared to either the river, the interphase or the lake except in the months of April and May when the swamp was flushed by the flood water. Very high values of dissolved oxygen were recorded at the interphase zone (Fig. 3b). There was a general trend in water clarity from the river through the swamp, interphase and to the lake. The fish caught at the only landing beach included 59% *Oreochromis niloticus*, 20% *Clarias gariepinus*, 16% *Protopterus aethiopicus* and 5% other mixed species. The *C. gariepinus* and *P. aethiopicus* dominated in the swamps. Most of the fish caught at the interphase consisted of juvenile *O. niloticus*.

Table 1: Macrophytic vegetation of the Sondu-Miriu river mouth identifed in 1991

SPECIES	AUTHORITY	COMMON NAME
EMERGENT		
Marsilea macrocarpa	Prerst	
Phragmites karka	Retz	Common reed
Melanthera scandens	(Schumach and Thonn.) Robderty	
Ludwigia abyssinica	A. Rich	
Echinochloa pyramidalis	Lam	Sedge grass
Cyperus latifolius	Poir	
Cayratia ibuensis	Hook.	
Ipomoea aquatica var.aquatica	Forssk.	Swamp cabbage or water spinach
Cladium jamaicanse	Crants	Sedge grass

Vigna schimperi	Baker	Wild cow-pea (legume)
Typha domingensis	Pers.	Bulrush (Reed mace)
Aeschynomene elaphroxylon	Guill. and Perr.	
Desmodium solicifolium		
Ludwigia stolonifera	Poir.	
Convolvulus kilimandscharicum	Guiil and Perr	
Mimosa pigra	Linn.	Touch me not
Sesbania sesban	Linn.	Legume
Mikania cordata	Burn.	
Trumfetta macrophylla	K. schum.	
Solanum nigrum	Linn.	Stock night shade (Osuga)
Hibiscus diversifolium	Jacq.	
Cyperus papyrus	Linn	Common papyrus
Cyclosorus (Dryopteris striata)		Common fern
Amaranthus dubius	Mart.	African spinach
SUBMERGED		
Ceratophyllum demersum	Linn.	Hornwort
Najas capensis		
Vallisneria spiralis	Linn.	Eel grass
Myriophyllum spicatum		Water milfoil
FLOATING LEAVED		
Polygonum - senegalensis	Meisn	Amphibious bisort
Nymphaea lotus	Thumb.	White waterlily
Nuphur lutea	Thumb.	Yellow waterlily
FREE FLOATING		
Lemna perpusilla	Decne.	Common duckweed
Azolla nilotica	Torrey.	Water fern
Pistia stratiotes	Linn.	Nile cabbage

Table 2: Some selected useful macrophytes of Lower Sondu - Miriu Swamp (a) Food and medicinal plants.

MACROPHYTE	COMMON NAME	PART USED	USES
Amaranthus dubius	Amaranth Odondo, Omboga (Luo) Terere (Kikuyu) "Mchicha"	Leaves	Makes stew, souce soup. Eaten with ugali or chapati.
Pistia stratiotes	Nile cabbage	Leaves	Made into sauce, useful in the dry season. (Drought fall back plant)
Ipomoea aquatica var. aquatica	Water spinach	Leaves	Soup and stew. Nutritive value protein 2.7%, fat 0.4%, calcium 60mg water 90%, rich in phosphorus and vitamines.
Solanum nigrum	Black nightshade Osuga (Luo) Managu (Kikuyu)	Leaves	Soup and stew. Nutritive value:- Water 89%, calories 38, protein 4.3% fats 0.8%, Carbohydrates 5%, calcium 442mg, phosphorus 75 mg. Berries: poisonous, contain alkaloids solanine and solanidines. Leaves: contain some methionine.
		Unripe fruit leaves	Cures aching teeth, applied to the gum ease pain during teething in small children. Cures stomach upset. Cures tonsilitis - inflamation of the tonsils.
Typha domingensis	Bulrush	Shoot (heart of the shoot) stem base	Vegetable, eaten raw (drought fall back plant)

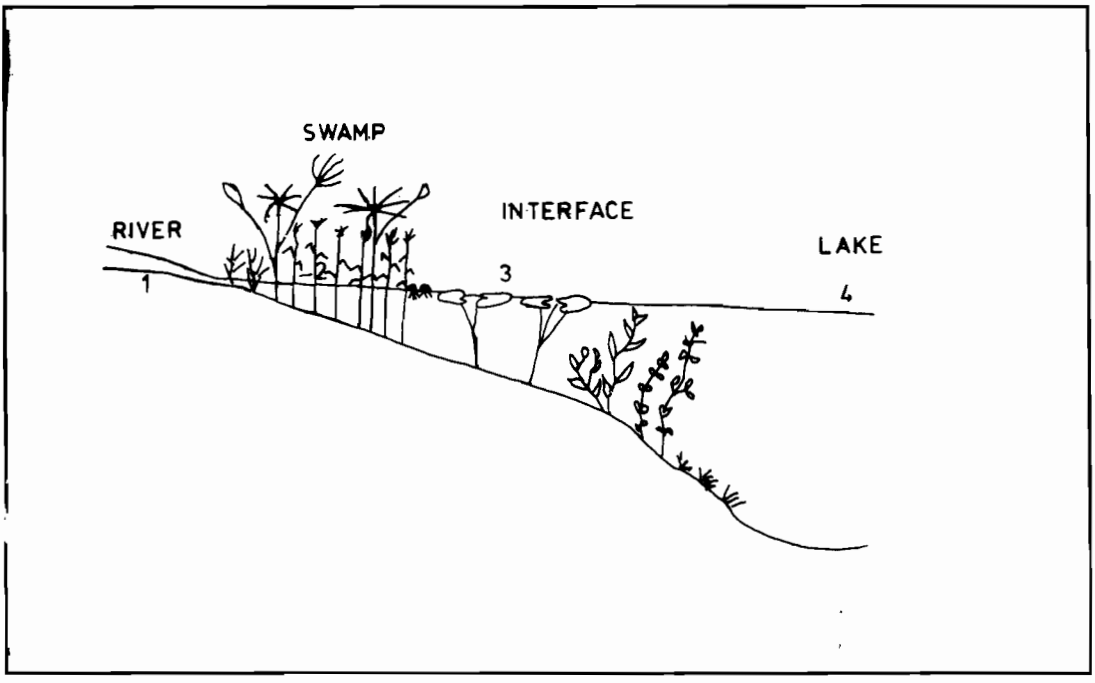

Fig. 2. Schematic diagram of four sampling points along a transect through the swamp from river tolake.

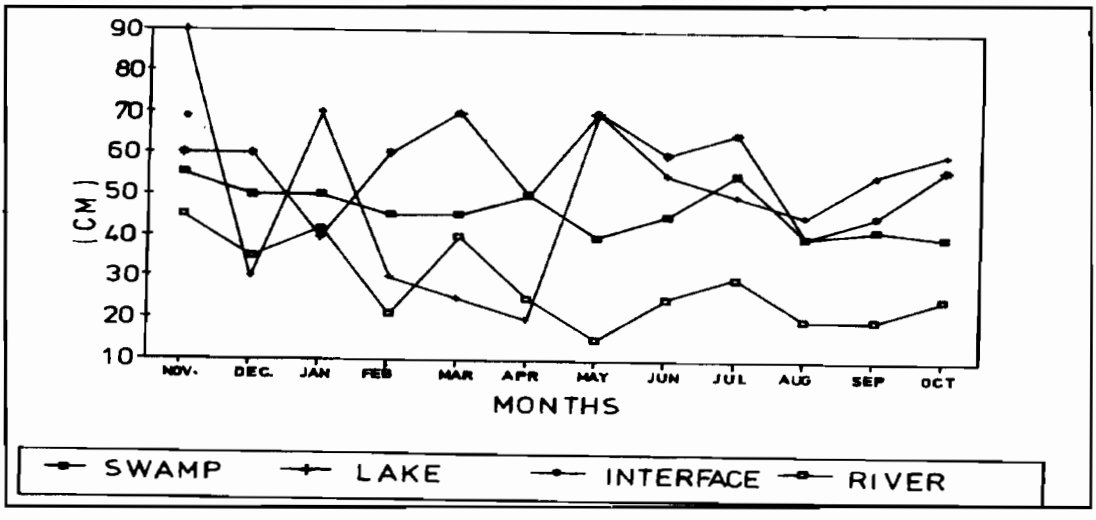

Fig. 3a. Seasonal variation in secchi depth along the transect.

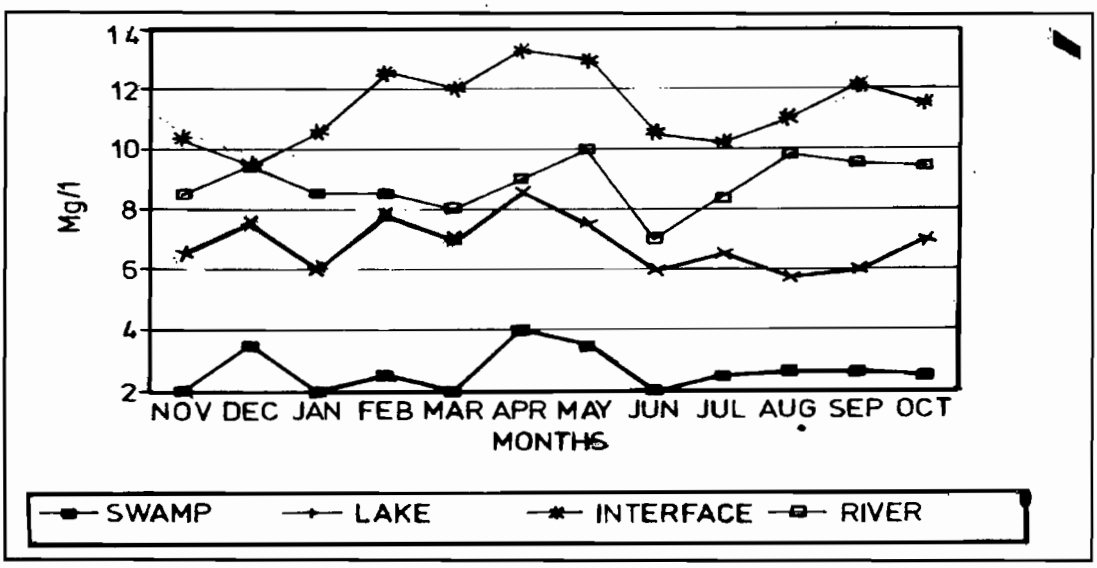

Fig. 3b. Seasonal variation in dissolved oxygen (DO) along the transect.

DISCUSSION

The lower Sondu-Miriu swamp forms an integral and essential life supporting system to the local community both economically and ecologically. This is reflected in the various uses the local community put to the swamp macrophytes as shown in table 2. There is an over dependence on the macrophytes for the supply of food plants and non food plants in this arid region where few other sources of income exist. The swamp is ecologically useful as it cleans the river water before it enters the lake by slowing down its velocity allowing siltation. This is supported by our secchi disc transparency values recorded in this study. Submerged macrophytes of the interphase zone make an important contribution to the oxidation of the water from the swamp. Indeed oxygen levels are higher than in the lake water (Fig. 3b). This may contribute to the rich fish harvest of the interface zone. Though not investigated in this study there is documented evidence of macrophytes reducing the nutrient and toxic substances from the water body when harvested. Values of 1.3% according to PETERSON et al. (1974), 20% (WILE, 1975), 37% (CARPENTER and ADAMS, 1977) and even up to 60% (WELCH et al., 1979) for phosphorus removal have been recorded. The same could be expected of the lower Sondu-Miriu swamp and this is especially important as the river derives its water from the rich farmland of Kisii and Kericho utilizing heavy doses of pesticides and fertilizers.

Fish and Fisheries:

The fishing industry in the swamp provides the bulk of the protein in the diet of the people. The fishing uses gillnets, fence, weir traps, baskets and spears. Other methods

are restricted by the macrophytes. Many of the fish species are trapped when they leave the lake to spawn in the shallow rising waters over the floodplain. The tall fence are successful when the flood water is rising . Basket fishing is carried out during all seasons but is mostly rewarding when receding water trap the fish in the small pools during the month of June and July.

Domestic Animals:

The swamp is fired in the months of February and March and new grass grow rapidly which is a relish for cattle. The ash is rich in nutrients. This occurs at a time when grassland outside the swamp are exhausted. During the period of high water in April and May the villages adjacent to the swamp are vacated. As the flood recedes, the cattle enter the swamp behind the falling water where good grazing landing is available.

Mat making and Basket Weaving:

Mostly done by men but women also participate. Sleeping mats are sold to distant markets around the lake region. The mats are used for sleeping and drying fish, maize, beans and cassava. Mats are also soon replacing hard boards for ceiling and wall carpeting. An export oriented small-scale mat making organized by Lake Basin Development Authority has exported mats to Japan. Mats of sizes 1 m^2 and 2 x 1 m were made. The labour for 1 m^2 was 80 shillings using split papyrus (small ones) and 150 shillings using large splits papyrus.

CONCLUSION

The swamp is very important and it is tempting for Government to try to harness it for economic development of their country. This study proposes that any development on a swamp must consider its fragility and should take into account the ecological structure of the system if benefits are to be reaped on a sustainable basis. Exploitation should ignore short-term profit for any destruction will reduce the number of people the swamp can support. Macrophytes play a significant role in maintenance of variation among the populations within the drainage. A decline in the swamp area will subsequently lead to a decline in the diversity of indigenous fishes by loss of habitat, destruction of refugia and faunal mixing.

MANAGEMENT OPTIONS

Enhance macrophytic recolonization by introduction of desired species and conservation of the existing population while controlling the dangerous ones such as the water hyacinth (*Eichhornia crassipes*) mechanically or manually and putting these weeds to better use such as compost, biogas, animal food, paper and board products using the Indian and the Chinese experiences. Second option is to put to use macrophytes as emergent hydrophyte based waste water treatment systems for small scale waste water producers (small towns) using the British and the Danish experiences. Finally, set up a protective registration for all swamps so that wetlands are accorded the same protection as National Parks and Game Reserves.

SUMMARY

A total of 34 species of aquatic macrophytes from Lower Sondu- Miriu are categorized into emergent, submergent (euhydrophyte), free floating and floating leaved. Their role in the economy of this arid region with no other source of income is over emphasized. A proposal for management of this crucial ecological resource and the need to accord it and others similar protection as National parks and Game reserve is stressed.

ACKNOWLEDGEMENT

The authors wish to record their gratitude to the Director, Kenya Marine and Fisheries Research Institute for providing the facilities to carry out this research and Mr. Manyala J.O. for his encouraging interest in this work. Mr. A. Mathenge of the National Herbarium University of Nairobi assisted with the identification of the macrophytes.

REFERENCES

Carpenter, S.W. and Adams, M.S. (1977). The macrophytes nutrient pool of a hard water eutrophic lake: Implications for macrophyte harvesting. *Aquatic Bot.* 239-255.

Chitamwebwa, D.B.R. (1993). Enhancing macrophyte recolonization for recovery and sustenance of lost inshore fish species of Lake Victoria. In: *sub-regional symposium on conservation of the Biodiversity of Lake Victoria and other East Africa Lakes*: Kisumu Jan 17th - 22nd 1993 (Abstracts).

Gaudet, J.J. (1976). Nutrient relationship in the detritus of a tropical swamp. *Arch. Hydrobiol.* 213 -239.

Peterson, S. A., Sanville, W.D., Stay F.S. and Powers, C.F. (1976). Laboratory evaluation of nutrient inactivation compounds for lake restoration. *J. Water pollution control federation, 817 - 831.*

Welch, E.B., Perkins, M.A. Lynch, D., and Hufschimdt, P. (1979). Internal phosphorous related to rooted macrophytes in a shallow lake (*In: Proc. Conf. Aquatic plants. Lake management and Ecosystem. Consequences of lake harvesting*) Institute of Environmental studies. University of Wisconsin Madison, Wisc. 81 - 89.

Wile, I. (1975) Lake restoration through mechanical harvesting of aquatic vegetation *Verh. Int. Ver. Limnol.*660 - 71.