KENYA MARINE AND FISHERIES RESEARCH INSTITUTE

FRESH WATER SYSTEMS

FACT SHEET

KMF/BAR/GoK/2026

A TECHNICAL REPORT ON THE ASSESSMENT OF THE DISTRIBUTION OF MACROPHYTES AND INVASIVE WEEDS AND THEIR IMPACT ON THE FISHERIES OF LAKE BARINGO TO INFORM MANAGEMENT DECISIONS



TECHNICAL REPORT

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INTRODUCTION

Lakes Baringo is a Ramsar designated lake that provide ecological services such as provisioning, regulating and cultural to the riparian communities. It is a highly vulnerable ecosystem because its hydrological budget is not only influenced by high evaporation but its entire catchment is highly degraded hence considered as a perturbed ecosystem. Due to its high rate of evaporation, it is very sensitive to changes in air temperature and precipitation and hence facing biodiversity crisis. One of the most important biodiversity of any water body is the presence of macrophytes because they form the base of primary productivity (Smart et al., 2002) hence they sustain life in such ecosystems. Many forms of the aquatic macrophytes including macroalgae of the divisions Chlorophyta (green algae), Xanthophyta (yellow-green algae), Rhodophyta (red algae), the ‘‘blue-green algae’’ (Cyanobacteria), Bryophyta (mosses and liverworts), Pteridophyta (ferns) and Spermatophyta (seed-bearing plants) have been studied and documented to be found in almost all aquatic systems. They are classified into four main classes: emergent macrophytes, floating-leaved macrophytes, submersed macrophytes and free-floating macrophytes. Aquatic macrophytes play vital roles including the energy transfer and the influence of the physical and chemical conditions in the water column as well as nutrient cycling. They are also used bioindicators of environmental conditions and long-term ecological changes in water quality.

Lake Baringo is known for its freshwater although it has no known surface outlet The river currently receives water by one perennial river (Perkerra) and ephemeral rivers such as Endau, Mukutani and Molo which has recently joined the named temporal rivers (Nyakeya et al., 2022). It is characterized by seven islands and the hot springs that occur near Ol Kokwe Island, at the centre of the lake. It is a highly influenced lake in terms of human- induced changes as a result of land- and water-use. ome of the pronounced activities include: intensive agricultural systems on the catchment leading to heavy soil erosion,; unregulated water abstraction resulting into changes in hydrology; mining; industrialization; urbanization and siltation & sedimentation. Siltation of Lake Baringo occur at a rate of about 315-350 tonnes per year This is likely to be associated with both natural and human. The lake lies in a depression with loose soils which are easily washed into the lake during rains. During dry season, the areas around the lake experience wind erosion which are swept into the lake. Communities around this lake are pastoralists who keep large numbers of livestock, especially goats and these animals

graze around the lake causing soil degradation which results in soil erosion. These people also fell trees to clear land for cultivation or to harvest wood for fuel. The clearing of trees around the lake region has left the catchment area bare and exposed to soil erosion Due to the topography of the area heavy rains around the lake there are flush-floods from inflowing rivers due to poor farming practices on the Turgen hills surrounding the lake. These rivers carry enormous amounts of soils into the lake (Oloo, 2002). The Water quality according to (Aloo, 2002) conditions indicate the DO values between 6.4 mg/l with a secchi depth of 11.5m in 2000 and 7.02 mg/l with a secchi depth of 54m in 1965 (Table 1). However, Walumona *et al*., 2021) indicated that Lake Baringo is eutrophic with a value of TSI >80

Although significant efforts have been made, many restoration programs have failed because of a lack of knowledge about the crucial environmental factors and how they regulate the macrophyte community in the lake.

Macrophytes are higher plants that grow in water or wet soils and usually occur along the shores of water bodies like dams and lakes and along banks of rivers (Omondi *et al*. 2024). They are regarded to be the most productive plant communities in the world (Reddy 1984) and are also known to be the cradles of biological diversity, providing water and primary productivity upon which countless species of plants and animals depend for survival (Chapman *et al*. 2001). Macrophytes are also known to provide food and shelter, directly or indirectly, for many organisms; erosion control; oxygen enrichment of water through photosynthesis; nutrient cycling; absorption of pollutants (Cook 1974, Halls 1997); reduction of sediment suspension; refuges for zooplankton from fish grazing; and suppression of algal growth by competing for nutrients and light and the release of allelopathic substances (Takamura *et al*. 2003). However, macrophytes can also be considered to be invasive and may in fact impact many biodiversity hotspots, potentially leading to substantial changes in the functioning of ecosystems and in the services they provide, Gherardi *et al*. (2011).

For a long time, the status of macrophytes in Lake Baringo has not been studied despite their importance in determining the community structure. Macrophytes are known to modify habitat structure and thus influence associated organisms for example fish. Macrophytes are also known to regulate the incoming materials, particularly soluble and particulate nutrients (Zalewski 2002). Since 2011. Lake Baringo has experienced sudden water level rise that saw many riparian residents getting

displaced (Nyakeya *et al*., 2022). The lake broke its banks claiming new territories. Although an increased fish catches especially for Tilapia (*Oreochromis niloticus)* has been reported, the state of all the classes of macrophytes is not well understood especially the emergent and the sub-merged species. More so, macrophytes and invasive weeds impact on the fisheries of Lake Baringo remains unstudied. Currently there is lack of updated information on Macrophytes species composition and distribution in different environments in the lake thus limiting the establishment of clear guidelines for biodiversity restoration and conservation. The aim of this study therefore, was to assess the distribution of macrophytes and invasive weeds and their impact on the fisheries of Lake Baringo to inform management decisions.

The specific objectives were:

i. Determine Physical Chemical parameters of Lake Baringo
ii. Make an inventory of macrophytes and invasive weeds in Lake Baringo and determine their composition and distribution.
iii. To assess fisher community's perception on macrophytes and invasive weeds impact on the fisheries of Lake Baringo.

Determine the impact of Macrophytes on fish abundance, composition and size structure

2.1 Methodology(Data Sourcing and Analysis)

Lake Baringo is located between latitude 0°30'N and 0°45'N and longitude 36°00'E and 36°10'E (Fig. 1) and lies approximately 60 km north of the equator at an altitude of 900 metres above sea level. It has a mean depth of 4.7 m with the deepest point being about 11.0 m at high water levels Other morphometric and hydrological characteristics of Lake Baringo are summarized in Table 1. The lake area has two rainy seasons and a mean annual rainfall of 635 mm. The surface area covers slightly over 130 km2. The catchment area which is about 6820 km2 includes a large part of the western escarpment of the Rift Valley, where most of the water is derived from. In the lake are five major islands, the biggest being the volcanic Kokwa Island, from which a number of hot-springs discharge into the lake. In this study, the lake was apportioned into three ecological zones based on earlier studies, the southern, central and northern. The southern zone drains

rivers Molo, Endau, Perkerra, and Ol Arabel. The central zone has only River Mukutan draining its waters into the lake via the eastern side. The northern zone is characterized by stony substrata, but the deepest part of the lake.

2.2 Data collection and analysis

Secondary data for physicochemical parameters was obtained from existing literature. Sampling for macrophytes was done in predetermined three ecological zones of the lake namely the southern, central and Northern sites (Figure 1). Each zone had three sites totaling nine stations such that the southern part comprised of Salabani (S1), Ngambo (S2) and Kiserian (S3); Central zone had C1 (a place near former KMFRI offices), C2 (Kokwa Island) and C3 (Long'icharo); and the northern side included N1 (Ngenyin), N2 (Loruk), and N3 (Komolion).

Sampling was carried out over two periods during the year i.e. during the dry season, which corresponds to the period of drawdown or lower water regime over the lake, and during the rainy season, which corresponded to the high-water regime (when the lake holds the highest volume of water). The macrophytes in Lake Baringo were sampled using quadrats measuring 1 m × 1 m. They were placed along transects perpendicular to the shoreline. Systematic sampling design was employed such that the number of transects in each sampling site ranged from one to three. The distance between successive quadrats was kept constant in each transect, and the number of quadrats per transect varied from three to eight depending on the habitat area and the size of the macrophytes stands. This arrangement ensured representative inventory of aquatic flora. This was also done in order to take care of macrophytes variation in different stations. Inside each 1 m × 1 m quadrat, macrophytes species were then visually counted and percent abundance noted.

In order to access submersed macrophytes, a rake was used. Where possible plant samples were identified in-situ and where identification was not possible samples of aquatic macrophytes were photographed and collected for a thorough scrutiny and identification in the laboratory. The samples of aquatic macrophytes were identified using plant identification manuals

RESULTS

3.0 Results

3.1 Physicochemical parameters

Physical and chemical variables in Lake Baringo observed in the are shown in all the physical and chemical parameters were significant among sampling sites ($P < 0.05$) spatial variations. Sites S1, S2 and S3 located near inlets exhibited significantly lower temperature, pH, conductivity, TSS and secchi depth, but had higher turbidity, TDS, DO. The northern sites had significantly ($P < 0.05$) higher temperature, pH, conductivity and secchi depth (Table 1).

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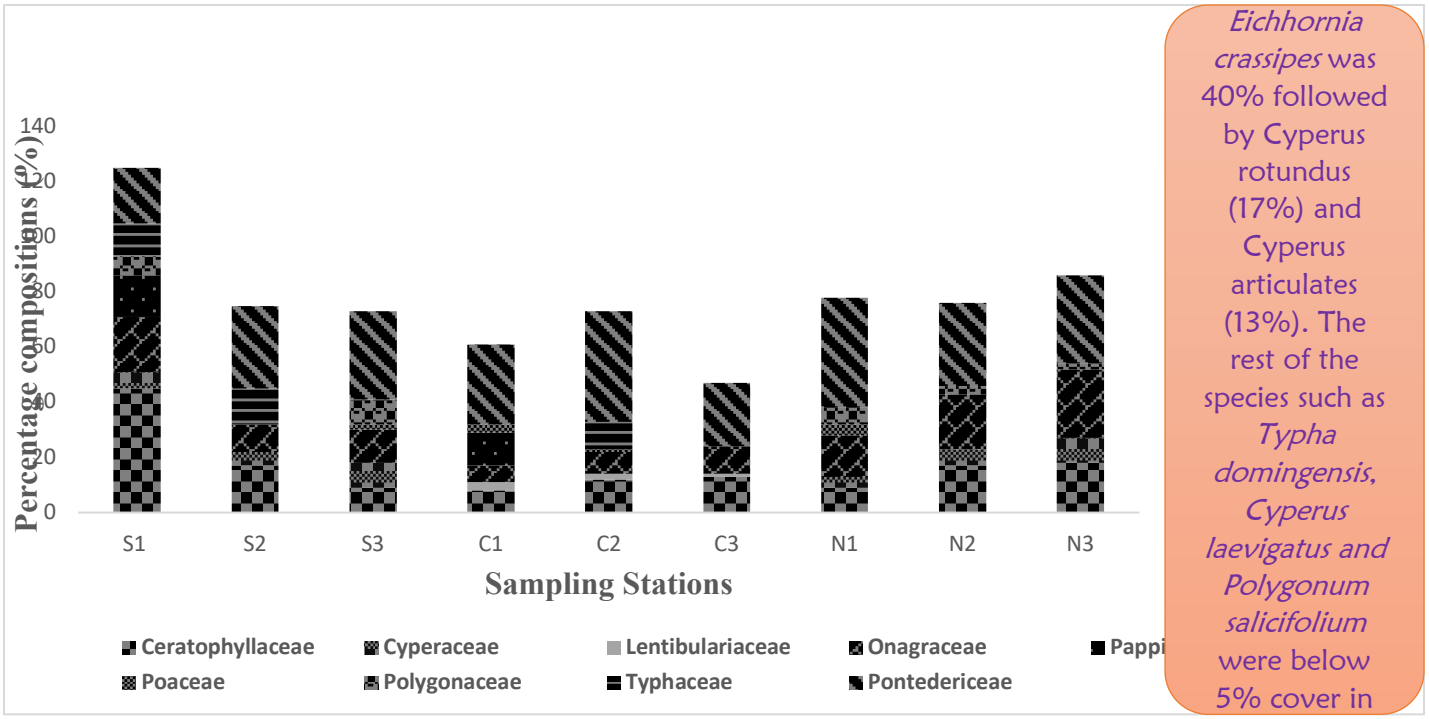
A total of 25 plant species belonging to 6 families were identified in Lake Baringo at nine sampling sites between September and December 2025 (Table 2). Overall, the family Poaceae had the highest number of species (five) followed by Cyperaceae with four species whereas Pappilionaceae and Onagraceae had three species each.

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Species	Type	% Cover
Cyperus articulatus L	Emergent	10
Cyperus rotundus L.	Emergent	10
Cyperus laevigatus Makaloa	Emergent	5
Typha domingensis Pers.	Emergent	10
Eichhornia crassipes (Mart.) Solms	Free floating	40
Polygonum salicifolium Willd.	Emergent	6
Nymphaea lotus L.	Free floating	9
Ceratophyllum dermasum L.	Submerged	5
Ceratophyllum submersum L.	Submerged	5
		100

3.2.2: Percentage Composition of Macrophyte Species in Lake Baringo

In terms of species percentage composition, *Eichhornia crassipes* was 40% followed by Cyperus rotundus (17%) and Cyperus articulates (13%). The rest of the species such as *Typha domingensis, Cyperus laevigatus and Polygonum salicifolium* were below 5% cover in the Lake Baringo sampling stations (Fig 2).



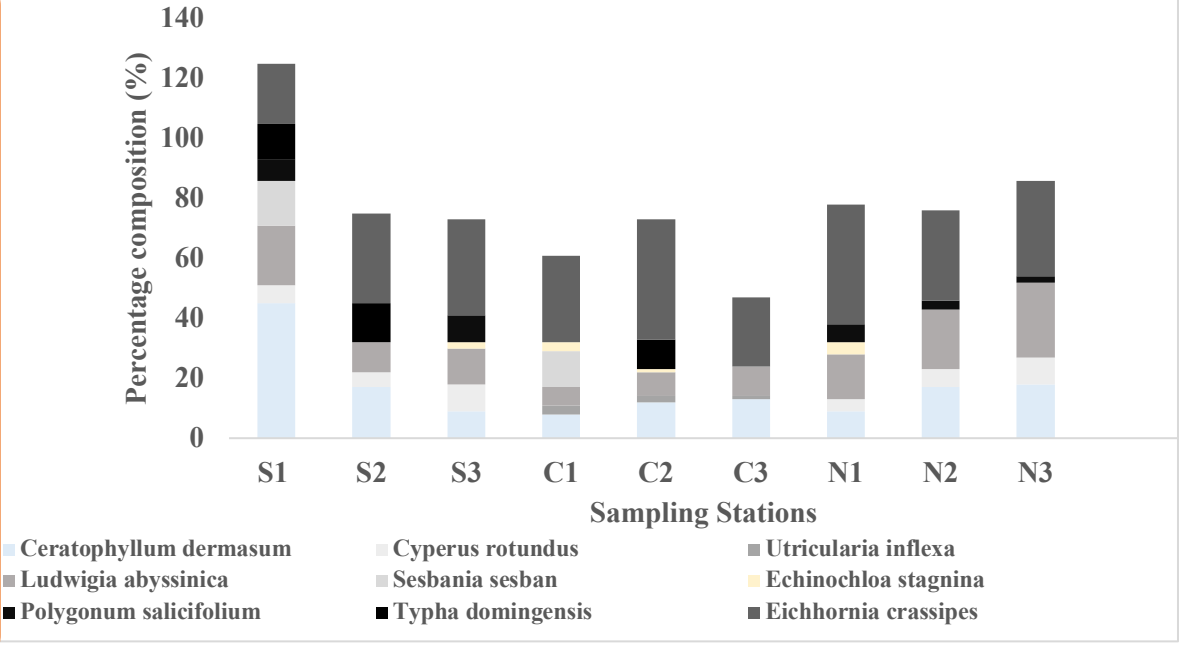
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3.2.3: Percentage Composition of Macrophyte Species in Lake Baringo

In terms of families representation Pontedericeae had highest percentage ranging from 23% in C1 to 40% in N1. Followed by Onagraceae from 6% tin C1 to 20% in S1 and C1. The rest of the families CyperaceaePoaceae,Lentibulariaceae,Typhaceae,Pappillionaceae and Polygonaceae, had below 10% in all stations except

Ceratophyllaceae had 45% in S1 nd 17% in S2 (Fig. 3). It was observed that the southern zone of Lake Baringo was relatively rich in macrophyte species (25 species) compared with the central (21 species) and northern zones (18 species).

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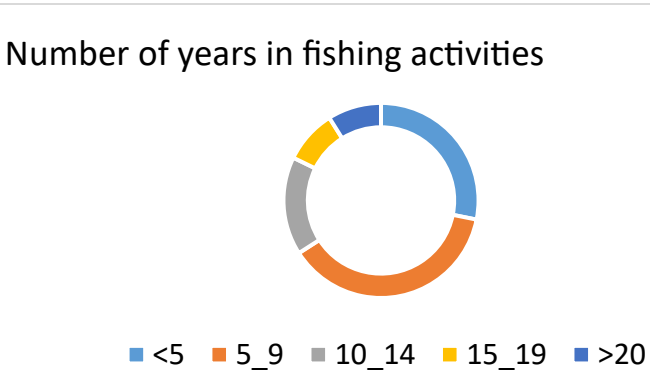


3.3 Community's perception on macrophytes and invasive weeds impact on the fisheries of Lake Baringo

3.3.1: Factors perceived to be affecting macrophytes and invasive weed distribution and abundance as perceived by communiy

The majority (82.7%) of respondents indicated that macrophytes affected their normal fishing activities in both positive and negative ways (Fig.4). The most commonly cited negative impact (43%) was the destruction of fishing nets by macrophytes. Positive impacts included an increase in fish populations due to enhanced refugia for fish breeding areas. Most of the interviewees indicated that they have been undertaking activities related to fishing for a number of years ranging from <5 to >20 years with a larger proportion having been in the sector for between 5-9 years (Table 4).

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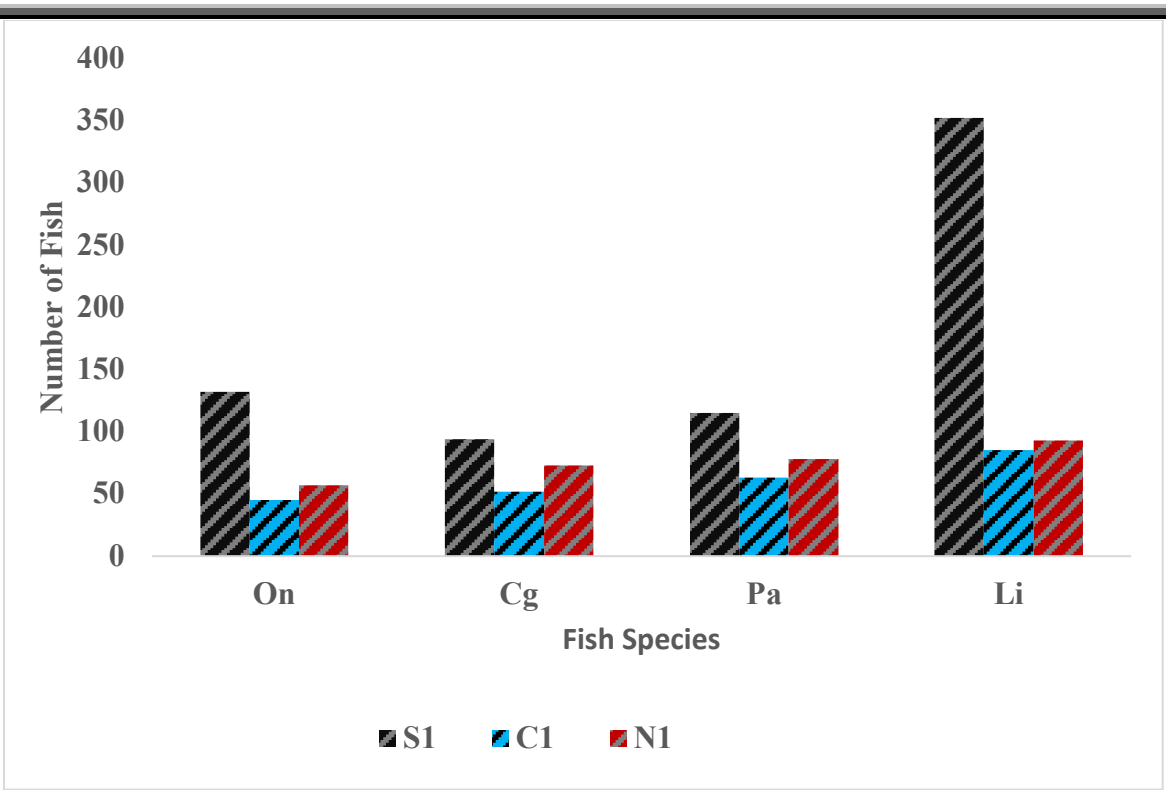
3.3.2: Environmental Factors perceived to be affecting macrophytes and invasive weed distribution and abundance as perceived by communiy

During that duration many sighted to have encountered various macrophytes on the lake. The majority (97.8%) of respondents indicated that seasonal variations significantly affected the distribution and abundance of macrophytes, with rainfall being the major influencing factor (Table. 4).

Factors	% Respondents
Rainfall	49.8
Drought	25.8
Wind	23.5
Climate change	0.9
	100

3.4: Impact of macrophytes for fish abundance, composition and size structure

The highest number of fish abundance, composition and abundance was reported on the southern part of the catchment next to the river mouth, followed closely by the Northern part of the catchment (Fig.5). However, the northern and midwestern shoreline which are rocky and basically devoid of macrophytes which also recorded less fish.



4.0: Conclusion

The purpose of this study was to assess the distribution of macrophytes and invasive weeds and determine their impact on the fisheries of Lake Baringo to inform management decisions. From the preliminary findings, 9 species of macrophytes belonging to 6 families were observed. The results further revealed macrophytes species composition and assemblage exhibited significant spatial differences, where southern side of the lake near river inlets had higher macrophytes species composition and percentage cover. The Southern Side of Lake Baringo was similarly reported to be recording higher fish landings and be sheltering potential fish breed grounds in Lake Baringo.

The wetland is endangered by poor land use practices by human activities in the catchment. Algae dominate the open water.

Recommendations

The wetland is endangered by poor land use practices by human activities in the catchment. Algae dominate the open water.

The study recommends:

iv. Adherence to a lakeside buffer zone and its extension to 100 m width

v. Development of conservation awareness of the catchment communities undertaking agricultural activities to reduce the impact sedimentation in the river mouths that is affecting macrophytes.