Floral Diversity of Aquatic Macrophytes in Two Water Bodies in Ekiti State, Nigeria.

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ABSTRACT

This study was aimed at investigating the macrophytes composition and species diversity of Rivers Osun and Elemi, located at Ikere and Ado- Ekiti, respectively. Macrophyte samples were collected from both rivers between between the months of May to October, 2023. Nineteen (19) species of macrophytes were collected from each of the two rivers. Osun River had a total number of 730 macrophytes with a percentage relative abundance of 48% while Elemi River had a total number of 794 macrophytes with a percentage relative abundance of 52%. In River Osun, Solenastemon monostachyus was the most abundant (145) and had the highest percentage relative abundance of 19.86% while Coix larcryma-jobi was the least abundant (8) species with a percentage relative abundance of 1.01%. In Elemi River, Alternanthera brasiliana was the most abundant (212) macrophytes species with a percentage abundance of 26.70% while Lepistemon owarianse was the least abundant (7) species with a percentage relative abundance of 0.88%. The diversity indices showed that macrophytes at River Elemi had the highest diversity index (H'= 3.48) and species richness (d = 2.73). It was also noted that macrophyte at River Elemi had the highest evenness index (E'= 1.18). This study also revealed that macrophytes at River Osun had the highest Menhinick index (MH = 0.70) and Simpson index (1-D = 0.91). The dominant macrophytes in both study areas are pollution-tolerant species, and the rivers have been impacted by nutrient enrichment. Hence, both rivers should be adequately monitored and measures put in place to checkmate further enrichment and prevent pollution as macrophytes have been obersved to play significant roles in community-based conservation strategies, effluent control, and policy implications for freshwater biodiversity conservation.

Keywords: Diversity, Abundance, Macrophytes, River Elemi, River Osun.

INTRODUCTION

Aquatic macrophytes are diverse groups of naked aquatic photosynthetic organisms including green algae (Chlorophyta), yellow-green algae (Xanthophyta) and red algae (Rhodophyta), cyanobacteria (Blue Green Algae), mosses and liverworts (Bryophytes), ferns (Pteridophytes) and seed bearing plants (Spermatophytes). Macrophytes are important in providing food and habitats for aquatic invertebrates, zooplankton, fishes and aquatic wild life (Lacoul and Freedman, 2016). They are important components of the aquatic ecosystem because they enhance the physical structure of habitats and biological complexity which increases biodiversity within the littoral zones (Wetzel, 2016, Pelicice et al., 2018). In addition both live and dead materials (detritus) from aquatic macrophyte may serve as food resources for aquatic and terrestrial organisms. The study of aquatic macrophyte is an essential component of understanding a water body due to its important ecological role and its ability to characterize the water quality. Aquatic macrophytes can be efficient indicators of water quality and their presence may enhance water quality due to their ability to absorb excess load of nutrients (Shristhi and Suman, 2020). When the aquatic plants died, they are partially decomposed in detritus and primarily consumed by invertebrates, insects and larger crustacean (Madsen, 2019). Macrophytes are also used as agents in bioremediation (Wood and McAtamney, 1993; Nirmal et al., 2008; Aloke et al., 2022; Seenivasagan et al., 2022).

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The study environments are pristine in nature. No industrial discharge or serious agricultural waste inputs were observed around the two rivers, except municipal runoffs during the rainy season. Absolutely few research work has been carried out on them, hence the need for this study. The study was carried out to survey the diversity and distribution pattern of aquatic macrophytes in two water bodies (River Elemi in Ado-Ekiti and River Osun in Ikere-Ekiti) in Ekiti State.

MATERIALS AND METHOD

Study Areas

The study was carried out in River Osun located in Ikere Ekiti and Elemi River in Ado-Ekiti, Ekiti State. River Osun is the major river of this town. This area is generally characterized by both raining and dry season. Raining season runs from April to November while the dry season runs from December to March. Ikere- Ekiti has a population of 148,558 (NPC, 2006). Activities around the river include farming, car washing, block industry and indiscriminate dumping of refuse beside the river.

River Elemi is a flowing river that has tributaries running across many different paths within Ado-Ekiti. However, this study site is located at Bawa along Iworoko Ekiti road in Ado local government area of Ekiti-State. The river takes its source from River Elemi in Igede-Ekiti which itself was said to take its source from the popular Osun River in Oshogbo, Osun State. The river is subjected to effluent discharges from various sources including mechanic workshops and some businesses cited along its banks. Other activities around this river are lumbering, dredging for sand and domestic sewage inputs, which may lead to wide scale pollution of the river.

Collection and Identification of Macrophytes.

A quadrat of $1x1m^2$ (Goswami et al., 2014) was laid across each randomly selected sampling point. All emergent and floating plants within the quadrat frame were hand picked, cleaned and identified. The collection was done for a period of six months. In deep areas a sampling rake was use to bring plants up from the bottom. The identification was made using a hand book of common aquatic plants of the Kainji Lake, Nigeria (Obot and Ayeni, 1987) and (Annelise et al., 2004) and recorded as described by (Nedungadi et al., 2013).

Statistical Analysis

Biodiversity indices were calculated using abundance and relative abundance of macrophytes species as well as the use of other standard formulas. Diversity of macrophytes species at all study areas was calculated using Shannon-Weaver diversity index (H). The Shannon index is given by the formula below; -

$$H = -\Sigma pilnpi$$

Where pi = S/N, S is the total number of individuals of one species, N is the total number of all individuals in the sample and ln = logarithm to base e. The proportion of species relative to total number of species (pi) was calculated, and multiplied by natural logarithm of this proportion (ln pi). The results were summed across the species, and multiplied by -1.

Species richness of macrophytes was calculated using the Margalef index (D). The index is given by the following formula

Margalef Index (ml) = $\frac{(S-1)}{\ln N}$

Where S is the total number of species, N is the total number of individuals in the sample and ln is the natural logarithm (logarithm to base e).

Menhinick Index (Mh) = $\frac{S}{\sqrt{N}}$

Where S is the total number of species, N.

RESULTS

Macrophytes Composition of Study Stations

The macrophytes species encountered in the various study areas are shown in Tables 1 and 2 for River Osun and Elemi River respectively. A total of 1524 macrophytes, 38 species were recovered from River Osun and Elemi River. Figure 1 showed that Osun River had a total number of 730 macrophytes with a pecentage relative abundance of 48% while Elemi River had a total number of 794 macrophytes with a pecentage relative abundance of 52%. Both study areas recorded equal number of species (19) during the course of this study. The populations of the various species are shown in Table 1 and for River Osun and Elemi River.

Table 1-2 and Figure 2-3 showed the abundance and relative abundance of Macrophytes in each study area. In Osun River, Solenastemon monostachyus was the most abundant (145) and had the highest pecentage relative abundance of 19.86% while Coix lacoyma-jobi was the least abundant species (8) with a pecentage relative abundance of 1.10%. The table also showed that in Elemi River, Alternanthera brasiliana was the most abundant macrophytes species (212) with a pecentage abundance of 26.70% while Lepistemon owarianse was the least abundant species (7) with a pecentage relative abundance of 0.88%.

Table 1. Relative Abundance of Macrophytes in Osun River Ikere -Ekiti, Ekiti- State.

Species	Abundance	Relative Abundance
Pennisetum purpureum	19	0.03
Corchorus aestuans	81	0.11
Solenastemon monostachyus	145	0.20
Adenostemon perrottetii	77	0.11
Laportea aestuans	14	0.02
Asyrtaria gangetica	24	0.03
Ageratum conyzoides	31	0.04
Coix lacryma-jobi	8	0.01
Ludwigia octovalvis	32	0.04
Acacia ataxacantha	25	0.03
Melanthera scandens	11	0.02
Lepistemon owariense	57	0.08
Ipomoea hederifolia	9	0.01
Dactyloctenium aegyptium	30	0.04
Sporobolus pyramidalis	15	0.02
Desmodium aescendes	67	0.09
Tridax procumbens	53	0.07
Trema orientalis	19	0.03
Setaria megaphylla	13	0.02
Total	730	

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Fig. 1: Percentage Relative Abundance of Macrophytes in Osun River

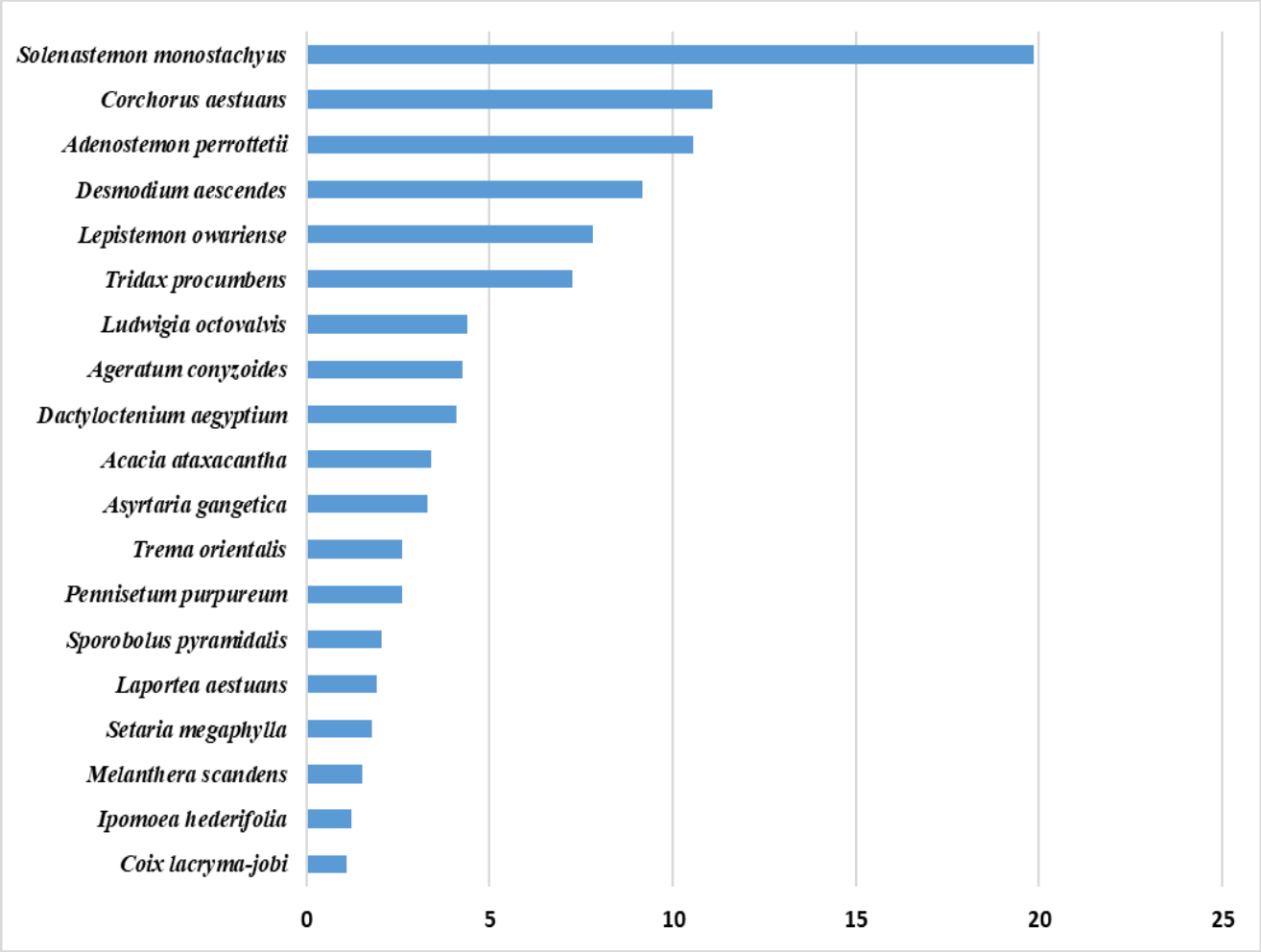

Table 2. Relative Abundance of Macrophytes in Elemi River Ado-Ekiti,Ekiti-State.

Species	Abundance	Relative Abundance
Spilanthus filicaulis	32	0.04
Pennisetum purpureum	57	0.07
Scleria verrucosa	18	0.02
Alternanthera brasiliana	212	0.27
Tithonia diversifolia	51	0.06
Luffa cylindrical	17	0.02
Synedrdla nodiflora	19	0.02
Vernonia galamensic	17	0.02
Ipomoea involucrata	25	0.03
Panicum maximum	8	0.01
Chamaecrista mimosoides	11	0.01
Asystasia gangetica	71	0.09
Ageratum conyzoides	65	0.08
Ludwigia decurrens	23	0.03
Sida garckeana	96	0.12
Adenostemma perrottetii	11	0.01
Lepistemon owarianse	7	0.01
Ipomoea spp	35	0.04
Hewitia sublobata	19	0.02
TOTAL	794	

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Fig. 2: Pecentage Relative Abundance of Macrophytes in Elemi River

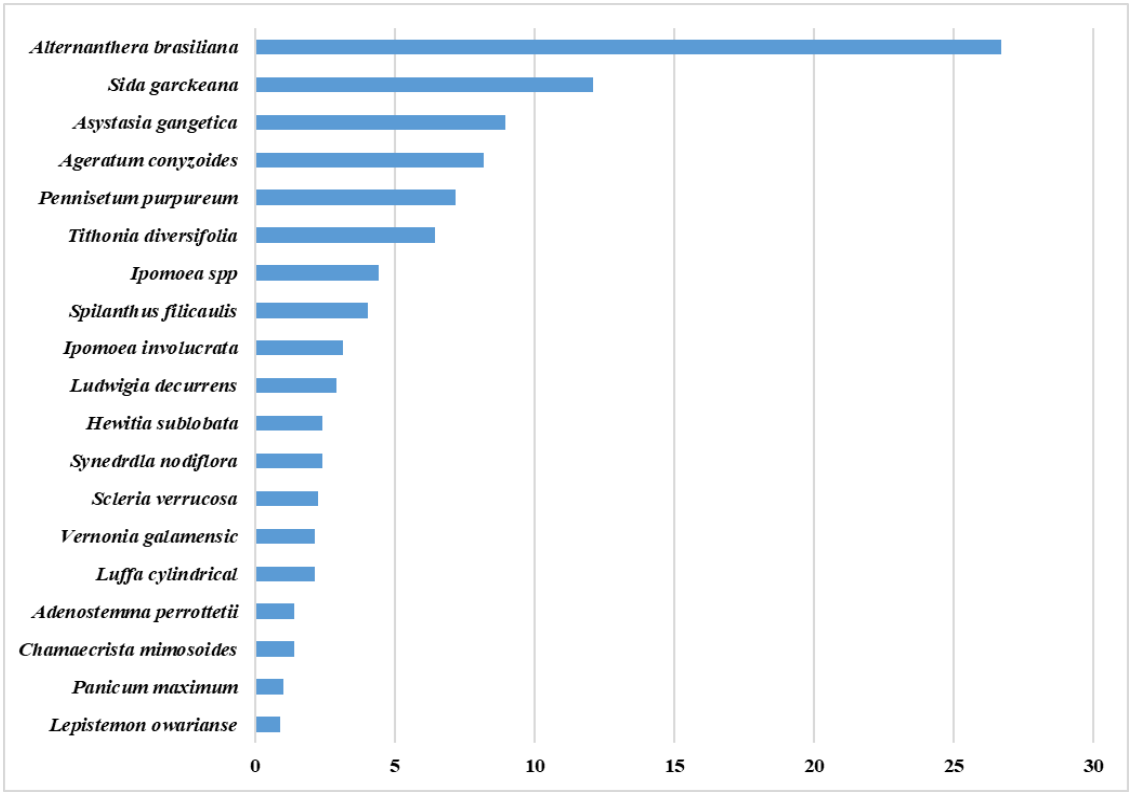

Fig. 3. Comparative Abundance of Macrophytes in Osun and Elemi River

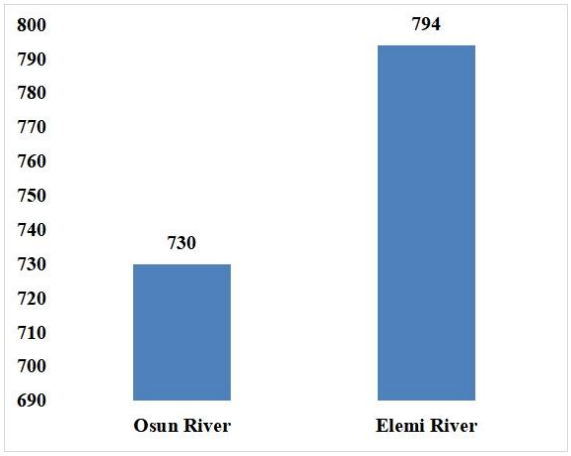

Figure 4. Species Population of Macrophytes Composition of Osun River, Ikere-Ekiti

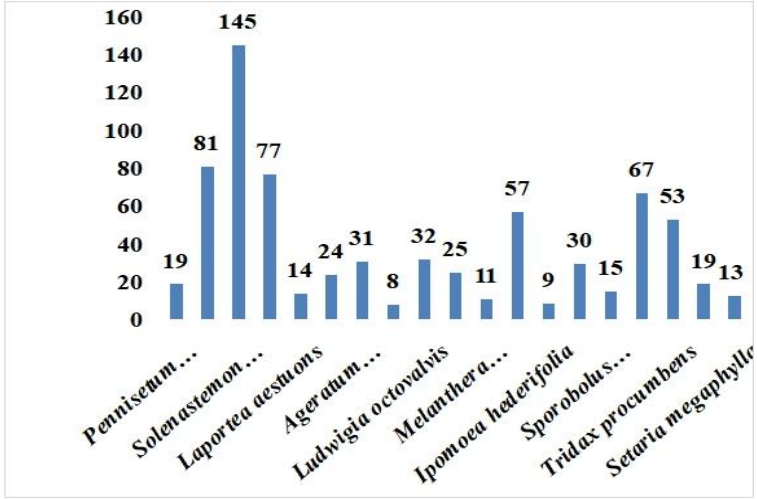

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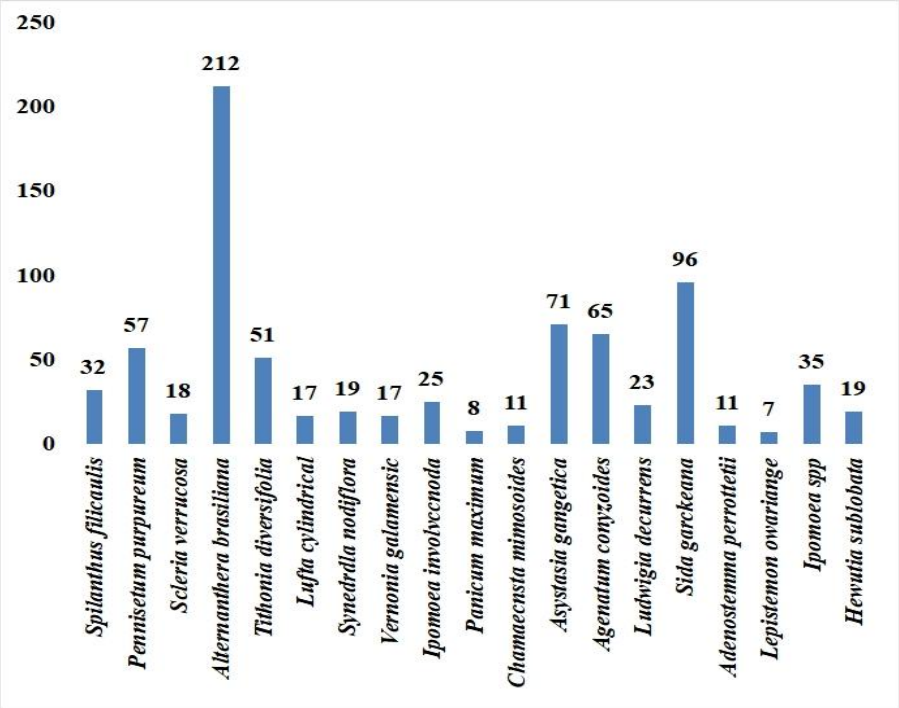
Figure 5. Species Population of Macrophytes Composition of River Elemi



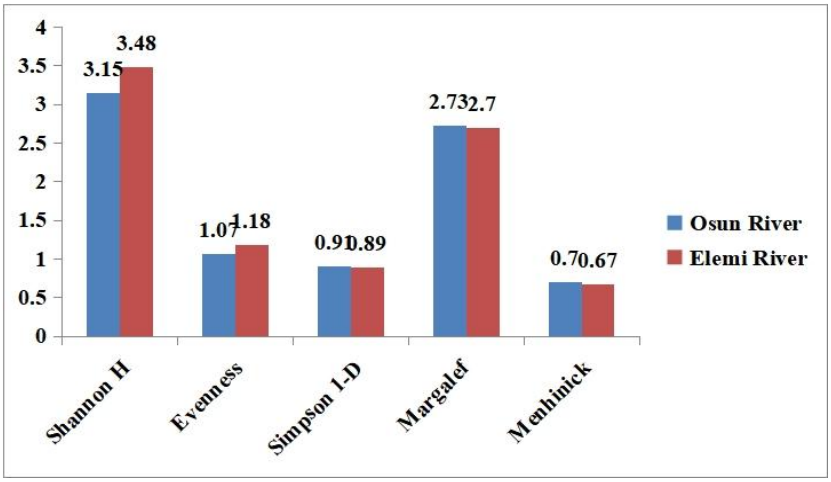
Alpha Diversity Indices in the Various Study Areas

Alpha diversity indices in the two study areas are shown in Table 3 and Figures 4. The diversity indices showed that macrophytes at Elemi River had the highest diversity index (H'= 3.48) and species richness (d = 2.73). It was also noted that macrophytes at River Elemi had the highest evenness index (E'= 1.18). The study also revealed that macrophytes at River Osun had the highest Menhinick index (MH = 0.70). And River Osun had the highest Simpson index (1-D = 0.91).

Table 3. Alpha Diversity Indices for the study areas

Parameters	Osun River	Elemi River
No. of species	19	19
Shannon H	3.15	3.48
Evenness	1.07	1.18
Simpson 1-D	0.91	0.89
Margalef	2.73	2.70
Menhinick	0.70	0.67

Figure 6. Alpha Diversity Indices for the study areas



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Pictures of some macrophytes collected during the study

Plate 1: Tithonia diversifolia (Asteraceae)

Plate 2: Tridax procumbens (Asteraceae)

Plate 3: Seteria megaphylla (Poaceae)

Plate 4: Luffa cyclindrical (Cucurbitaceae)

Plate 5: Dactyloctenium aegyptium (Poaceae)

Plate 6: Synedrella nodiflora (Asteraceae)

Plate 7: Ageratum conyzoides (Asteraceae)

Plate 8: Desmodium aescendes (Fabaceae)

Plate 9: Ipomoea involucrate (Convolvulaceae)

DISCUSSION AND CONCLUSION

The macrophytes in the Osun and Elemi Rivers were the subject of this investigation. The most prevalent macrophyte species in the Elemi River was Alternanthera brasiliana, whereas Solenastemon monostachyus dominated the Osun River. The presence of diverse physical and physiological characteristics in this plant species may be the cause of this family's dominance. This may include the capability to change surroundings by altering the nature of fire and animal herbivory, effective long-distance dispersal, successful establishment biology, ecological flexibility, and resilience to disturbance (Linder et al., 2018).

The most emergent macrophytes were found among growth forms, which is a sign of the disruption produced by varied anthropogenic activities in the riparian zone of the rivers. The fact that emergent species have the highest species diversity and the lowest free-floating species indicates that species richness increases as water level drops (Sharma and Singh, 2017), Roka (2019) and Dongol et al. (2014) all came to the same conclusion.

Elemi River's highest species composition may be caused by anthropogenic disturbance, mild riparian erosion, and riparian disturbance. The river's amount of water may also be to blame. Zerlin and Henry (2014) found a similar outcome.

Low primary plant production due to mechanical stress from river water circulation may also result in fewer species of macrophytes in rivers than in lakes. According to Rui et al. (2013), the river's discharge regime and flow velocity limit the growth of diverse aquatic plants in the river channel's interstices. Another crucial element that promotes roots and the formation of macrophyte communities is a stable substrate (Haslam, 2006).

CONCLUSION

Aquatic plants have a significant role in the environment of rivers. They are the main producers, support animal habitats, and maintain sediment. Aquatic plants can be used to identify a variety of anthropogenic influences. Additionally, the presence of aquatic plants in every aquatic ecosystem has a significant impact on water quality. Human activities in the area also have an impact, as was seen in the study sites. The species of aquatic macrophytes that are present there are also influenced by the physical and chemical characteristics of the water body and the type of soil surrounding it. Macrophytes in the river when properly checked, help as substrate ground, feed and habitat for aquatic animals, hence there is a need to monitor the growth of the macrophytes of these two rivers at regular intervals. It was observed that in Osun River, Solenastemon monostachyus was the most abundant, while in Elemi River, Alternanthera brasiliana was the most abundant macrophytes species. The dominant macrophytes in both study areas are pollution-tolerant species, and the rivers have been impacted by nutrient enrichment. This study has provided baseline information on the diversity of macrophytes of the two rivers.

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