

Distribution and abundance of aquatic plants of Oyan Lake, Ogun State, Nigeria

HENRY EYINA DIENYE[▼], OLANIYI ALABA OLOPADE

Department of Fisheries, Faculty of Agriculture, University of Portharcourt, Choba P.M.B.5323, Rivers State, Nigeria. Tel.: +234-8036809439,
[▼]email: henrydienye@gmail.com

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Abstract. *Dienye HE, Olopade OA, 2017. Distribution and abundance of aquatic plants of Oyan Lake, Ogun State, Nigeria. Bonorowo Wetlands 7: 11-15.* The distribution and abundance of aquatic plants from Oyan Lake were assessed bi-monthly between October 2012 and January 2013. In total, 20 species of aquatic plants were recorded, representing 13 families. Cyperaceae and Poaceae families had the highest species with four species each. A further study showed that *Azolla africana* had the highest abundance (richness), followed by *Salvinia nymphellula*, while the species with the lowest abundance (richness) was *Ceratophyllum demersum*. *Ludwigia decurrens* and *Rhynchospora corymbosa* had the lowest evenness (distribution), followed by *Nymphaea lotus*. *Fimbristylis ferruginea* had the highest evenness, followed by *Echinochloa stagnina*. The three most prominent species found at the Stations in order of prominence were: *Azolla africana*, *Salvinia nymphellula*, and *Polygonum lanigerum* occupying 42.33% of the area covered by aquatic plants. The biotic indices of species richness, Shannon - Wiener information function, evenness, and Simpson's Dominance were fairly distributed in the study area.

Keywords: Aquatic plants, distribution, classification, distribution, Oyan Lake

INTRODUCTION

Macrophytes are important components of the freshwater (aquatic) ecosystem because they enhance habitats' biological complexity and physical structure, increasing biodiversity within the littoral zones (Esteves 1998; Wetzel 2001; Pelicice et al. 2008). In addition, both live and dead materials (detritus) from aquatic macrophytes may serve as food resources for aquatic and terrestrial organisms (Lope et al., 2007). Macrophytes play a significant role in the hydro ecosystem by providing a breeding substrate for organisms, including fish, aquatic insects, and zooplankton. Many of them serve as food for fish (Ratusshnyale 2008). However, in most rivers and lakes, the excessive growth of macrophytes may provoke some negative effects (Bini et al. 2005), and it develops into an explosively large population only when the environment is altered

Nigerian inland water bodies serve as an important refuge for numerous animals and vascular plants that have sustained their communities. But in recent times, both natural and human-induced environmental problems have either destroyed or altered the associated ecosystem with consequent impact on the endowed natural resources. And yet little is presently known about Nigerian inland water bodies associated with flora and fauna, including their inventories, socio-economic values, and overall management (Daddy et al. 1993).

Among the least understood and least studied components of urban streams and rivers biota are aquatic macrophytes. This is rather unfortunate since changes in macrophytes communities may be especially indicative of

major categories of urban stress. The health and structure of macrophytes communities are likely to be important determinants of water quality (Gregg and Rose 1982; Suren 2000; Balanson et al. 2005). There is very little information on aquatic plants, particularly the freshwater ecosystem. In this present study, an attempt has been made to analyze the pattern of species diversity and distribution of the aquatic macrophytes of the Oyan Lake, Ogun State, Nigeria.

MATERIALS AND METHODS

Description of the Study area

Oyan Lake is situated at about 26km North-West of Abeokuta, Ogun State, Nigeria (Figure 1) that lies on latitudes between 7° 15' and 7° 25' and longitude 3° 5' and 3° 15'. It is a gated spillway lake and covers an area of 40km² with a normal reservoir capacity of 140million m³. The Lake was constructed on the Oyan River, a significant tributary to Ogun River with a catchment area of 9,000km²; it is an artificial lake in Ogun State. It is the second-largest lake in the southern part of Nigeria (Adekoya 1991).

The lake has a tributary where the water flows in from the Oyan River and meets with the Ofiki River; the Hausas are predominantly the inhabitants of Ofiki while the Ilajes dominate the Oyan River. The climate of the study area is warm and humid. Two distinct seasons are felt during the year: rainy (March-October) and dry (November-February). The range of rainfall was between 1600mm and 2900mm to provide all-year-round pictures of the aquatic plants of the study area.

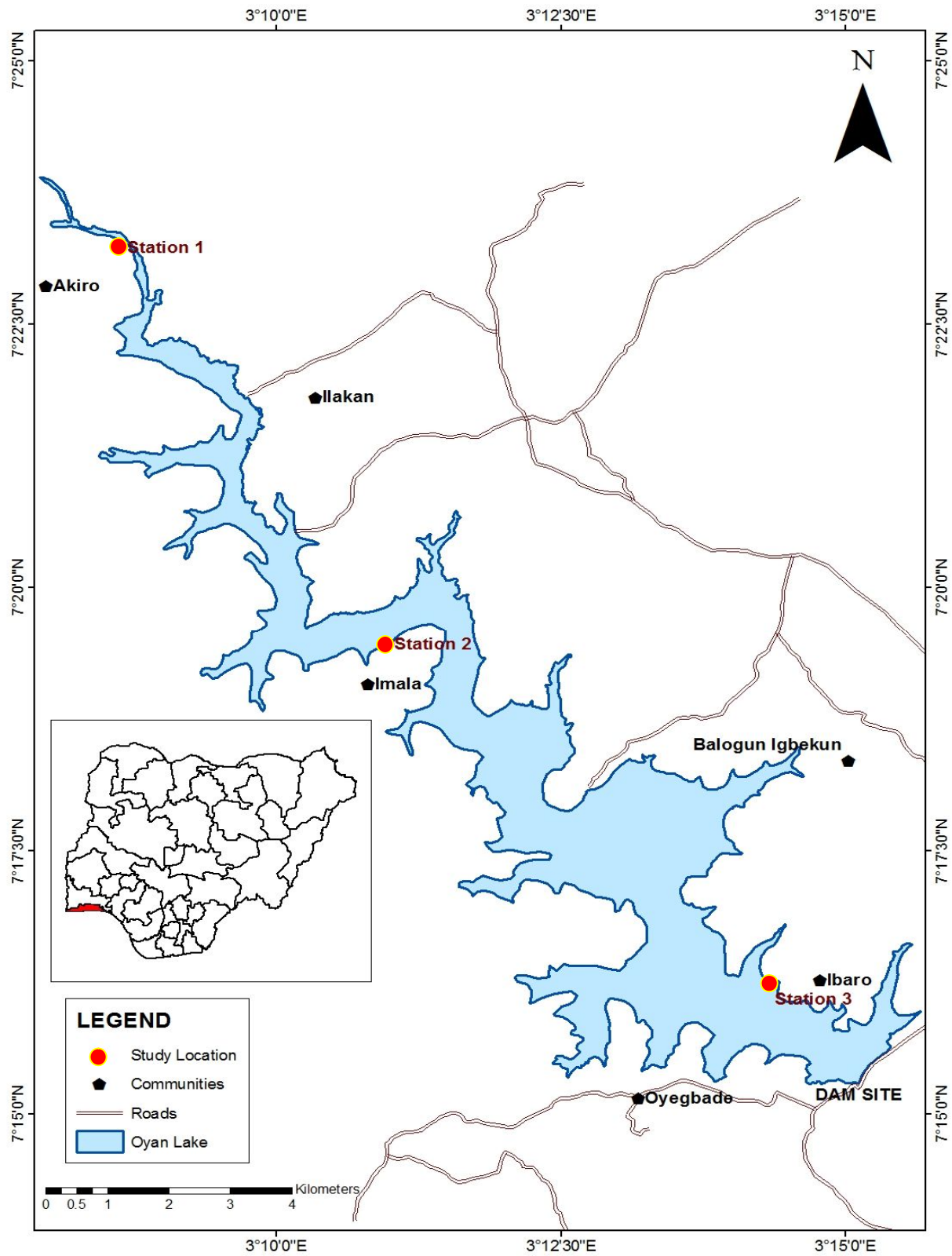


Figure 1. Study area showing the different sampling Stations in Oyan Dam, Ogun State, Nigeria

Table 1. Morphometry of Oyan Dam, Ogun State, Nigeria (Adekoya 1991)

Morphometry	
Dam	
Length of the crest	1.1km
Maximum height of the crest	32.5m
1st service spillway capacity	2271m ³ per second
2nd Service spillway capacity	3340m ³ per second
Reservoir	
Length	27km
Maximum width	6km
Water storage capacity	270 million cubic meters
Surface area	40km ²

Collection of samples

The study was conducted on Oyan Lake from October 2012 to January 2013, and sampling was done twice a month. A general survey of the Oyan Lake was made at three different study sites (Inlet of the Lake, Centre of the Lake, and dam site). In each field visit, aquatic plants from each of the three studies were collected following a standard approach (Janauer, 2003). Aquatic plants found at the edge of the Lake were easily collected, while the ones in the lake were collected with a paddled boat to the different zones through the assistance of a fisherman. A wooden square quadrat of 1m² was placed on the vegetation at random bearings at each zone, and counting was also carried out per square meter. These samples were respectively tagged for ease in identification following Akobundu and Agyakwa (1987).

Data analysis

The data generated were statistically analyzed using means and some ecological indices. These were:

Shannon-Weiner diversity index (H^1) = $-E [(ni/N) \times \ln (ni/N)]$ (Shannon and Weaver 1963)

Where:

H^1 =Diversity index, ni =the total number of individuals belonging to the i th species=total number of individuals for the site, and \ln =the natural log of the number.

Simpson diversity ($1-\Delta$) = $1 - E n(n-1)/N(N-1)$

Where:

N =the total number of organisms of all species, and n =the total number of organisms of a particular species

Margalef-value is the measure of species richness. It is expressed as

$d = S - 1 / \ln N$,

Where:

d =Margalef value, S =number of species collected in a sample, and N =total number of individuals in the sample.

Menhinicks Index (D) = S/\sqrt{N}

Where:

S =Number of species in a population and N =Total number of individuals in S species

Pielou index measures how evenly the species are distributed in a sample community. It is expressed as:

$J = 1/H_{max}$ (Pielou 1969)

Where:

J =Diversity evenness or Equitability Index. H_1 = calculated Shannon-Weiner diversity index. (Shannon-Weiner) $H_{max} = \ln S$ S =total number of species in a population \ln =natural log of the number

Simpson dominance index (C) = $\sum (n/N)^2$ (Ogbeibu 2005)

Where:

N =the number of species in the i th species and N =total number of individuals.

RESULTS AND DISCUSSION

The samples collected during the survey were classified into 20 aquatic macrophytes species representing 13 families. Cyperaceae and Poaceae families had the highest species of four each, followed by Mimosaceae with two species. At the same time, the other ten families recorded one species each, respectively, as shown in Table 1. Bini et al. (1999) reported that Poaceae and Cyperaceae are among the best-represented families and the most important families in other freshwater ecosystems. Daddy et al. (1993) reported that in the herbarium of Kainji and Jebba Lake, 13 different aquatic plants families constituted thirty-one species. Family Poaceae ranked the commonest with fourteen species, representing another family. Ikenweiwe (2005) also classified macrophytes of Oyan Lake into 10 Families and 9 species, respectively. Family Poaceae and Cyperaceae ranked the commonest with 2 species each. In comparison, other families were represented by 1 species each Dienye (2015) classified macrophytes of the New Calabar River into ten families made up of 12 different species. The resulting family Cyperaceae recorded the highest number of species with 3 species, while the other nine families recorded one species each. According to Obot (1987), in the classification of aquatic plants of Nigeria, the family Poaceae has the highest number of species of 12, according to the results of this study.

The species samples were zoned into floating, submerged, and emergent groups. Table 2 shows that 15 out of twenty identified species were grouped as emergent, two as submerged, and the remaining three as floating aquatic plants. Obot and Ayeni (1987) grouped aquatic plants of Kainji Lake, marginal flora species (31),

submerged species (15), and floating and marginal species (4). Dienye (2015) reported that the zonation of the different species of macrophytes in the New Calabar River into floating, submerged and emergent. Among the 12 species samples, 10 were grouped as emergent, 2 as floating, and none were grouped as submerged during the sampling period. This finding shows that emergent species ranked the highest in the zonation of macrophytes, which is in line with this result.

The evenness is the distribution of species sampled among species in the community. *Fimbristylis ferruginea* had the highest distribution, followed by *Echinochloa stagnina*, while *Ludwigia decurrens* recorded the lowest distribution. In the study of the ecology of macrophytes of Jebba Lake carried out by Adesina et al. (1993), *Vossia cuspidata* has the highest calculated value while *Ceratophyllum demersum*, *Tephrosia bracteolata*, *Nymphaea lotus*, and *Setaria pumila* had the lowest in distribution.

The richness is the number of species present in a community Table 3 shows the abundance in each zone and the mean abundance of the community. The species *Azolla africana* had the highest richness, followed by *Echinochloa stagnina* and *Oryza longistaminata* with the same level of richness. *Ceratophyllum demersum* recorded the lowest richness among the species sampled in the community.

The similarity index shows the similarity between the different zones, i.e., the presence and absence of other species in each Station. The comparison of the stations and the respective percentages are shown in Table 4. The Stations compared, which has the highest percentage of 73.68%, had the highest similarity of all the sampled stations, i.e., Station 2 and 3, followed by Station 1 and 3 with 31.58%, with the slightest similarity.

Table 1. Checklist of aquatic plants species in Oyan Lake, Ogun State, Nigeria

Family	Species	Common name
Cyperaceae	<i>Rynchospora corymbosa</i>	
	<i>Mariscus longibracteatus</i>	
	<i>Cyperus esculentus</i>	Yellow Nutsedge
	<i>Fimbristylis ferruginea</i>	
Poaceae	<i>Echinochloa pyramidalis</i>	
	<i>Echinochloa stagnina</i>	
	<i>Sacciolepis africana</i>	
	<i>Oryza longistaminata</i>	Wild rice
Onagraceae	<i>Ludwigia decurrens</i>	Water primrose
Araceae	<i>Pistia stratiotes</i>	Water lettuce
Polygonaceae	<i>Polygonum lanigerum</i>	Smartweed
Curcubitaceae	<i>Luffa aegyptiaca</i>	Loofah, Loofah gourd
Azollaceae	<i>Azolla africana</i>	Water velvet
Hydrophyllaceae	<i>Hydrolea glabra</i>	
Mimosaceae	<i>Mimosa pigra</i>	Giant sensitive plant
	<i>Neptunia oleracea</i>	
Salviniaceae	<i>Salvina nymphellula</i>	Salvinia
Convolvulaceae	<i>Ipomea triloba</i>	
Nymphaeaceae	<i>Nymphaea lotus</i>	
Ceratophyllaceae	<i>Ceratophyllum demersum</i>	Water lily

Table 2. Zonation of aquatic plants in Oyan Lake, Ogun State, Nigeria

Species	Floating	Submerged	Emergent
<i>Ludwigia decurrens</i>			+
<i>Pistia stratiotes</i>	+		
<i>Polygonum lanigerum</i>		+	
<i>Echinochloa pyramidalis</i>			+
<i>Neptunia oleracea</i>			
<i>Rynchospora corymbosa</i>			+
<i>Echinochloa stagnina</i>			+
<i>Oryza longistaminata</i>			+
<i>Luffa aegyptiaca</i>			+
<i>Azolla africana</i>	+		
<i>Fimbristylis ferruginea</i>			+
<i>Mariscus longibracteatus</i>			+
<i>Cyperus esculentus</i>			+
<i>Hydrolea glabra</i>			+
<i>Sacciolepis africana</i>			+
<i>Mimosa pigra</i>			+
<i>Salvina nymphellula</i>	+		
<i>Ipomea triloba</i>			+
<i>Nymphaea lotus</i>			+
<i>Ceratophyllum demersum</i>		+	

Table 3. Distribution of aquatic plants in Oyan Lake, Ogun State, Nigeria

Species	Akio	Imala	Ibaro	Total	Mean Value
<i>Ludwigia decurrens</i>	0.06	0.12	0.11	0.29	0.10
<i>Pistia stratiotes</i>	0.05	0.10	0.09	0.24	0.08
<i>Polygonum lanigerum</i>	0.03	0.06	0.06	0.15	0.05
<i>Echinochloa pyramidalis</i>	0.05	0.09	0.08	0.22	0.07
<i>Neptunia oleracea</i>	0.08	0.14	0.14	0.36	0.13
<i>Rynchospora corymbosa</i>	0.08	0.14	0.14	0.36	0.12
<i>Echinochloa stagnina</i>	0.03	0.06	0.06	0.15	0.05***
<i>Oryza longistaminata</i>	0.03	0.07	0.06	0.16	0.05***
<i>Luffa aegyptiaca</i>	0.06	0.12	0.11	0.29	0.10
<i>Azolla africana</i>	0.02	0.04	0.04	0.10	0.03**
<i>Fimbristylis ferruginea</i>	0.06	0.11	0.11	0.28	0.09
<i>Mariscus longibracteatus</i>	0.08	0.15	0.14	0.37	0.12
<i>Cyperus esculentus</i>	0.08	0.15	0.14	0.37	0.12
<i>Hydrolea glabra</i>	0.06	0.11	0.10	0.27	0.09
<i>Sacciolepis africana</i>	0.05	0.09	0.09	0.23	0.08
<i>Mimosa pigra</i>	0.05	0.10	0.09	0.24	0.08
<i>Salvina nymphellula</i>	0.03	0.06	0.05	0.14	0.05
<i>Ipomea triloba</i>	0.05	0.10	0.09	0.24	0.08
<i>Nymphaea lotus</i>	0.05	0.09	0.08	0.22	0.07
<i>Ceratophyllum demersum</i>	0.10	0.18	0.17	0.45	0.15*

Note: *Highest, ** Lowest, *** Same calculated mean value

Table 4. Percentage of similarity index between species of different stations in Oyan Lake, Ogun State, Nigeria

Station	1 and 2	1 and 3	2 and 3
Percentage	36.84	31.58	73.6

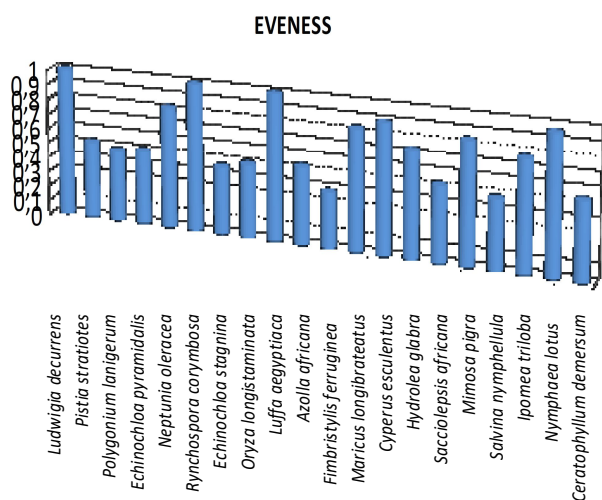


Figure 2. The evenness (distribution) of aquatic plants of Oyan Lake, Ogun State, Nigeria

In conclusion, the aquatic plants of Oyan Lake constitute different species with different families. A total of 20 species of aquatic plants representing 13 families were encountered; the family Cyperaceae and Poaceae had the highest species. *Azolla africana* dominated the area and is evenly distributed. The species is of high economic importance, while *Ceratophyllum demersum*, a submerged plant, was the least species in the study area. From most research carried out on aquatic plants of Lakes and dams, it has been observed that the families Cyperaceae and Poaceae dominated the water body with the highest corresponding species.

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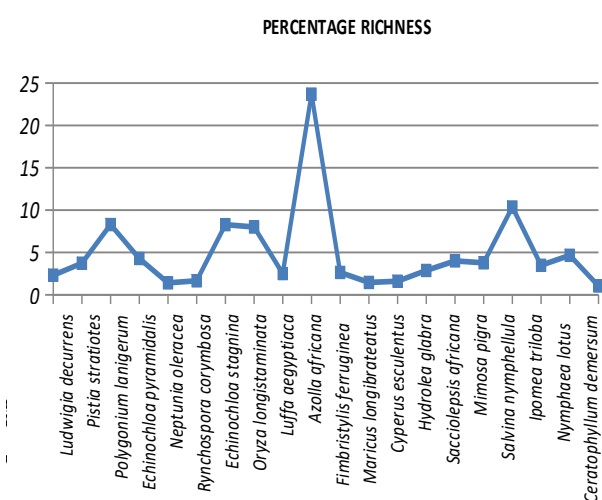


Figure 3. The percentage richness (abundance) of aquatic plants of Oyan Lake, Ogun State, Nigeria

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