

Current Status and Floristic Diversity of Aquatic Macrophytes of Two Freshwater Bodies in Southern Nigeria

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Abstract: Aquatic vegetation is important part of aquatic ecosystem as they contribute in no small measure to the well being of other components of the dynamic system. The survey was carried out at low water regime (between 15th to 20th May 2005) and high water regime (between 17th to 20th November 2005) to provide basic information on the diversity, extent of coverage and evaluate the ecological and economic implication of aquatic vegetation on two of Nigerian water bodies. Few aquatic macrophytes were encountered on Ojirami dam and most prominent among them is *Leersia hexandra*. Due to aging of the water body, silting up of the Lake was evident and the development of emergent macrophytes increases siltation process in the lake. Also, the flood plain and heavy human population around the Lake gave room for more human activities which is highly intensive around the Lake. All these factors definitely supported and will always encourage massive proliferation of aquatic macrophytes on the lake. The most abundance emergent aquatic macrophyte on Oguta lake is *Nymphaea lotus* and is about 20% of all macrophytes load on the lake. This is followed by *Ceratophyllum demersum*, *Azola africana*, *Ipomoea spp* and *Lemna paucostata* which belong to submerged and floating weed category based on life form classification *Ipomoea asarifolia* (Desr.) Roem. & Schul, *Ipomoea aquatica* Forsk, *Mimosa pigra* Linn.

Key words: Aquatic vegetation • Macrophyte • Ecosystem • Siltation and abundance

INTRODUCTION

Generally, aquatic plants are found to grow on permanent or semi-permanent water surface such as ponds, ditches, lakes, rice fields, rivers and irrigation canals [1]. Aquatic vegetation is one of the major components of the ecosystem, which must be considered for proper management. Aquatic plants are biologically productive, but when the population increases tremendously they can become a nuisance and thereby regarded as weeds. Aquatic plants in water bodies are important because they contribute essentially to the life within the ecosystem. In eutrophic waters, aquatic plants grow vigorously and many play a significant role in removing nutrient from polluted water [2]. Aquatic plants also provide either directly or indirectly food, shelter and habitat for a large number of aquatic organisms, which include wildfowl and economically important fish species; they also enrich pond water with oxygen during photosynthetic activities.

The diversity of macrophytic species around the Nigerian inland water bodies and aquacultural systems are different from one ecological zone to the other [3]. Ojirami dam was constructed basically for domestic water supply and this dam serves larger percentage of the people in Edo State. Fishing activities was not allowed by the State government on the water body and this was to prevent pollutant which could be introduced by fishermen using obnoxious fishing methods.

Oguta Lake is very important to the people of Imo State, as it is one of the major tourist attraction sites in the eastern part of the country. It provides fishery resources, means of transportation and source of potable water for the communities around the lake and beyond. Presently, a larger percentage of the economy of the riparian communities depends on this water body. The study was carried out to determine the extent of infestation and the floristic diversity of aquatic vegetation on the Ojirami dam and Oguta lake with a view to formulating proper strategies for the management of the

vegetation. In addition, the study attempted to determine (assess) the ecological and economic importance of these aquatic vegetation to the riparian communities.

MATERIALS AND METHODS

Study Areas: Ojirami dam was created from river Ojirami. The reservoir which is located in Ojirami village, Akoko Edo Local Government Area of Edo State lies within Latitude $7^{\circ} 18' - 7^{\circ} 20'$ and Longitude $6^{\circ} 09' - 6^{\circ} 11'$. The maximum depth of the dam is 11.5 m and the maximum length is about 2 km. The dam is bounded on the West by Kukuruku hills on the East by an extensive floodplain. The river from which the dam was constructed flows southwards (Figure 1a).

Oguta Lake is one of the natural lakes in Nigeria and is relatively small when compared with other bigger natural and artificial lakes like Chad, Tiga, Kainji and Jebba. It is located in Imo State, Nigeria between Latitude $5^{\circ} 41' - 5^{\circ} 44'$ and Longitude $6^{\circ} 45' - 6^{\circ} 50'$ (Figure 1b).

Method of Study: A survey was conducted on each of the sites, on two different occasions in 2005 during the period of low water regime (between 15th - 20th May 2005) and high water regime (between 17th - 20th November 2005), based on the hydrological cycle of the water bodies. These periods coincided with the onset of the rainy and dry seasons, respectively. A systematic-sampling technique was adopted in this study and Line intercept method was used [4]. During the first sampling period, 10 sampling points were established on the Ojirami reservoir at an approximate distance of 200 m from each other; while six sampling points were established at Oguta Lake. Not all the sampling points established on the Ojirami reservoir were assessed during the high water regime (second survey periods) due to unavailability of a good boat to (move) navigate the water body. Fewer sampling points were established at Oguta Lake due to communal clash among the fishermen on the Western and Eastern parts of the lake which did not give the survey team an opportunity to assess the whole lake.

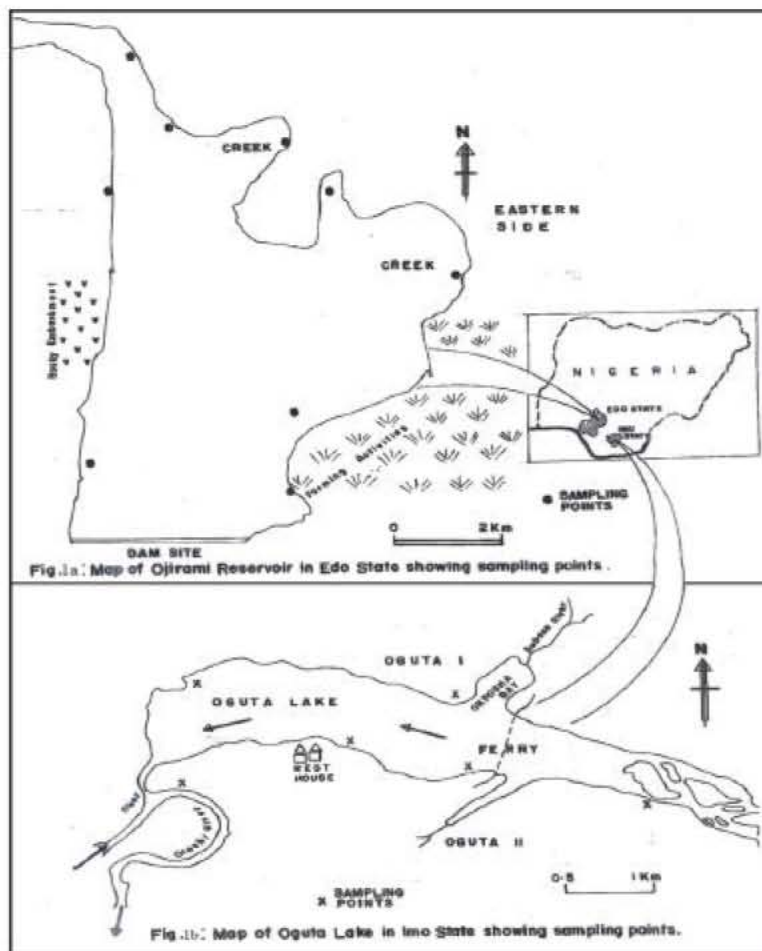


Fig. 1: Map of Ojirami Reservoir in Edo State and Oguta Lake in Imo State showing sampling points and other features

At each sampling point, a perpendicular 20 m line transect was laid from the open water of about 1.5 m in depth to the littoral zone. At 1 m intervals, species presence or absence was recorded. All plant species encountered, which touched the transect line were identified to species level (Using a standard flora book). Unidentified samples were collected for proper identification in the herbarium at Obafemi Awolowo University, Ile Ife.

Anthropogenic data on the impact and use of the aquatic vegetations on these water bodies were collected informally from the fishermen and some of the riparian communities and the results were discussed.

RESULT

Ojirami Dam: Table 1 shows the list of 14 aquatic macrophytes found on Ojirami dam during the lowest and highest water regime. A total of 12 aquatic and semi-aquatic plants were found during the lowest water regime which coincided with the onset of the raining season when dam was filling up. During the highest water regime, only 11 plant species were recorded and these species differ slightly in species composition from those encountered during the first period of sampling. The most abundant of these macrophytes is *Leersia hexandra* followed by *Polygonum salicifolium*

Table 1: Checklist and level of occurrence of aquatic macrophytes and littoral vegetation at Ojirami dam and Oguta Lake

Species Name	Ojirami Dam			Oguta Lake	
	A/P	Low Water Regime	High Water Regime	Low Water Regime	High Water Regime
Athyriaceae					
<i>Diplazium sammatti</i> (Kuhn) C. Chr		+	+	-	-
Azollaceae					
<i>Azolla africana</i> (Desv.)	P	-	-	+	++
Caesalpinioideae					
<i>Senna obtusifolia</i> (L.) Irwin & Barneby	A/P	+	-	-	-
Ceratophyllaceae					
<i>Ceratophyllum demersum</i> (Linn.)	P	-	-	++	++
Commelinaceae					
<i>Commelina benghalensis</i> (Lin.)	A/P	-	-	+	+
Convolvulaceae					
<i>Ipomoea asarifolia</i> (Desr.) Roem. & Schult	P	++	++	+	++
<i>Ipomoea aquatica</i> Forsk.	P	-	-	+	++
Cyperaceae					
<i>Rhynchospora corymbosa</i> (Linn.) Britt.	A	+	++	-	-
<i>Mariscus longibracteatus</i> (Chern.)	A	-	-	+	+
Lemnaceae					
<i>Lemna paucicostata</i>	A	-	-	+	++
Mimosoideae					
<i>Mimosa pigra</i> Linn.	P	+	+	+	+
Nymphaeaceae					
<i>Nymphaea lotus</i> Linn.	A	+	+	+++	+++
Onagraceae					
<i>Ludwigia decurrens</i> Walt. Syn.	A	-	-	+	+
<i>Ludwigia hyssopifolia</i> (G.Don) Excell	A	-	-	+	+
Poaceae					
<i>Andropogon gayanus</i> (Kunth) var)	A	+	-	-	-
<i>Echinochloa obtusiflora</i> Stapf	A/P	-	+	+	++
<i>Hyperrhenia rufa</i>	P				++
<i>Leersia hexandra</i> Sw.	A	+++	+++	-	-
<i>Panicum repens</i> Linn.	A	+	+	+	+
<i>Paspalum scrobiculatum</i> Linn.	P	+	+	-	-
<i>Phragmites karka</i> Steud.	P	-	-	+	+
<i>Rottboellia cochinchinensis</i> (Lour.) Clayton.	A	-	-	+	+
<i>Vossia cuspidata</i> Griff.	P	-	-	+	+
<i>Vetiveria nigriflora</i> (Benth.) Stapf	P	-	-	+	+
Polygonaceae					
<i>Polygonum salicifolium</i> Brouss.ex Willd.	P	+	++	-	-
Verbenaceae					
<i>Stachytarpheta cayennensis</i> (L.C. Rich) Schau	A	+	+	-	-

A= Annual; P= Perennial

Key to Level of prominence:

+ = Species present and covered less than 5% of the area or sparsely present

++ = Dominant Species covered at least 5 - 20 % of the area

+++ = Highly Dominant Species and covered about 25 - 50% of the area

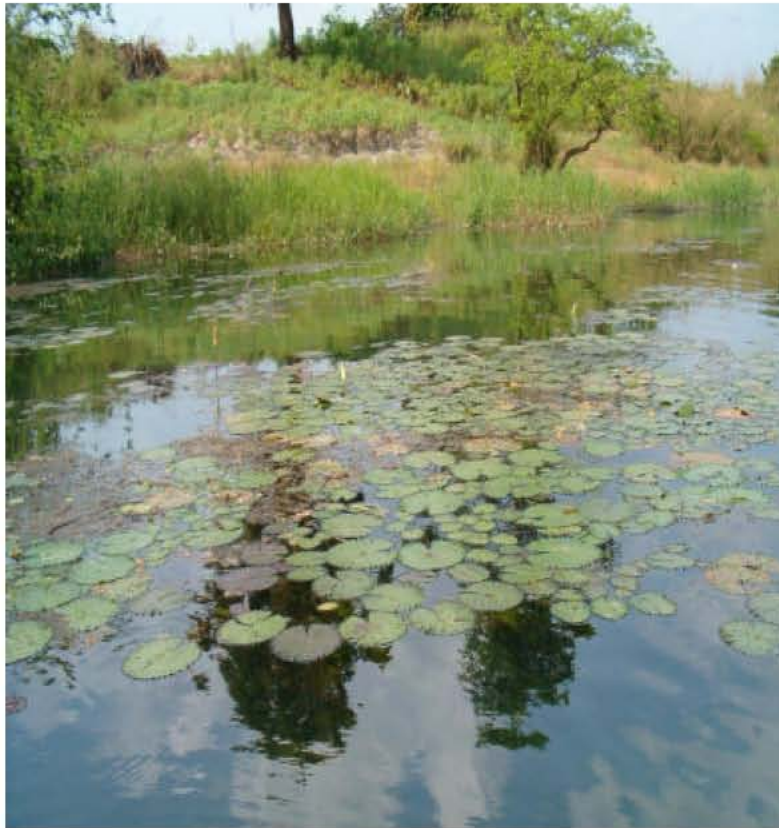


Plate 1: Farming activities around Lake Oguta and *Nymphaea lotus* infestation

and *Rhyncospora corymbosa* respectively. *Echinochloa* spp and *Diplazium samanthii* were frequently sighted during the highest water regime. Generally, the pelagic zone of the dam is free of aquatic macrophytes throughout the period of study. The dam embankment was bushy during the lowest water regime (on-set of rainy season) but clearing of the bushy embankment had commenced during the dry season. Different shrubs and woody species like *Danielia oliveri* (Rolfe) Hutch. And Dalz., *Isobertina doka* Craib and Stapf, *Piliostigma thonningii* (Schum.) Milne-Redhead and *Albizia zygia* (DC.) J.F. Macbr including Palm tree and pawpaw were found growing on the embankment.

Oguta Lake: Table 1 further shows the list of macrophytes encountered on the Oguta lake. The number of macrophytes on the lake was increased from 12 during the period of low water to 21 at the period of high water level. There is the total of 12 plant families in all. Comparing the result of the current study with earlier reports [5], about 55% of 21 species found on the lake are new entrants and these include *Ipomoea asarifolia* (Desr.) Roem. & Schul, *Ipomoea aquatica* Forsk,

Mimosa pigra Linn. *Ludwigia decurrens* Walt. Syn. and *Ludwigia hyssopifolia* (G.Don) Excell. Others are *Echinochloa obtusiflora*, *Phragmites karka* Steud. Stapf, *Rottboellia cochinchinensis* (Lour.) Clayton, *Vetiveria nigriflora*, *Polygonum lanigerum* R.Br. Var. *africanum* Meisn (Benth.) Stapf and *Sphenoclea zeylanica* Gaertn. The most abundance emergent aquatic macrophyte on Oguta lake is *Nymphaea lotus* and which constituted about 20% of all macrophyte load on the lake. This was followed by *Ceratophyllum demersum*, *Azola africana*, *Ipomoea* spp and *Lemna paucicostata* which belong to submerged and floating weed category based on life form classification (Plate 1).

DISCUSSION

Ojirami Dam: Generally, the level of aquatic vegetation infestation on the Ojirami dam surface area was very low (on the dam) during the period of low water regime, at the onset of rainy season. There was hardly any aquatic vegetation on the open water or pelagic zone of the lake except the shorelines where there were few emergent aquatic macrophytes. Due to the nature of vegetation

found on the embankment of the dam, the roots of these plants may contribute to the weakening of dam barrier and lead to eventual collapse in the nearest future if proper maintenance is not put in place.

The economic importance of plant species found on Ojirami dam cannot be ascertained as the number of fisherfolks around the water body was quite low. Throughout the period of study, only between two and three fishermen were encountered at a time. It was observed that most of the villagers around the water body were crop farmers and they deal with farm produce (Palm kernel). According to information gathered from the people around the dam area, majority of the fishermen exploiting the fisheries of the water body were not from that locality. It is worthy of note that the Western side of the dam has rocky embankment and only shrubs were found growing on the edge of the water while the Eastern side had human disturbance through farming activities. Only about 2 m radius of the Eastern side of the dam was covered predominantly by *Leersia hexandra*.

Human activities around the dam at high water level were increased as the size of the farmlands on the Eastern side increased when compared the lowest water level. With this factor, there is the possibility of further enrichment of the dam through the use of fertilizers by farmers in the drawdown areas of the dam. The overall effect could lead to massive proliferation of aquatic vegetation on the water body.

Oguta Lake: Based on the findings from this study, it was evident that human activities around the lake ranging from farming, processing of agro-allied produce and industrial and domestic effluent from town were very intensive. Invariably, these factors contribute to the development of aquatic macrophytes on the lake. If the level of infestation of the lake by aquatic vegetation continues unabated, in a short distant future, the level will rise above the economic threshold on the lake. Thus, it is expedient to put in place a monitoring team for a close watch on the vegetation development on the lake. The team report should indicate precautionary measure to keep the development of weed on the lake in check.

The overall economic importance of aquatic macrophyte in Oguta lake is enormous as the level of infestation and diversity has increased over time. Mass proliferation of aquatic vegetation will be affected by the above stated as the nutrient load of the water body will be increasing gradually. Other factors that can be implicated as contributing to the development of aquatic macrophytes on the lake include lake depth and speed of the water current [6,7]. When the vegetation load particularly, the emergent species is spreading on a lake,

gradual silting up of such lake will be taking place and this will eventually reduce the volume of water that will be available on such lake. As this is taking place in a lake like Oguta, transportation and fisheries of the lake will be affected as it was evident during the period of this study that fishermen were all complaining of low fish catch though other factors like numbers of fishermen per unit area of the lake surface cannot be ruled out as the population density of the area is very high judging from the number of size of villages/town that surround the water body. The fishery potential of the water body will be adversely affected.

The gradient of the shoreline is relatively steep and the high water current as reported earlier by Odigi and Nwadiaro [5] and which was also confirmed in this study ought to discourage the development of emergent macrophyte on the lake. The situation on the lake is changing gradually as emergent plant like *Nymphaea spp* are gaining ground on the lake with a large number of the plant dotting the lake surface area (Plate 1). Almost the 10 km shoreline and up to 2 m depth of the lake are now covered. Moreover emergent grasses like *Echinochloa spp*, *Phragmites karka*, *Rottboellia cochinchinensis* and *Vetiveria nigritana* cover almost the entire area. Though the lake is a shallow water body, the presence of these emergent macrophytes encourages siltation and therefore causing further spread of aquatic plants infestation. In addition, the age of the lake and the high level of human interference around the lake basin in terms of farming activities and obnoxious fishing method will also expose the lake to high macrophyte proliferation and this will negatively affect the economic potential of the lake.

Relationship Between Ojirami and Oguta Lake Flouristic Composition:

The differences between the two water bodies are apparent in terms of their formation and age. Oguta Lake is a natural and older lake than Ojirami which is man-made lake and relatively young in age. These two reasons among others contributed in no small way to the development of vegetation within aquatic ecosystem. It was therefore not out of place to see more serious aquatic vegetation development in Oguta Lake than what was obtained at Ojirami dam. Due to aging of the water body, silting up of the Lake was evident and the development of emergent macrophytes increases siltation process in the lake. Also, the flood plain and heavy human population around the Lake gave room for more human activities which is highly intensive around the Lake. All these factors definitely supported and will always encourage massive proliferation of aquatic macrophytes on the lake.

Contrary to what was observed on Oguta Lake, Ojirami dam had lesser human impact and the terrain of the dam on the Western side did not favour aquatic vegetation development. It was evident from the list of vegetation found on the water body that many of them were plants associated with aquatic ecosystem and native vegetation which were not posing any threat to the water body potential except for normal maintenance routine which must be taken serious so as not to be in jeopardy of possible dam collapse.

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