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ASSESSMENT OF THE DISTRIBUTION OF AQUATIC MACROPHYTES IN LAFIA AND DOMA METROPOLIS, NASARAWA STATE, NIGERIA

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ABSTRACT

The ecological distribution and taxonomy of aquatic macrophytes were assessed in Lafia and Doma, Nasarawa state Nigeria. Sixteen sampling sites were visited in each metropolis. The different wetlands and macrophytes were categorized based on their attributes. The relative frequencies of the macrophytes were determined in each town. Results showed that in Lafia, 62% are streams, 25% are swamps and only 13% are ponds. This shows that majority of water bodies in Lafia metropolis are streams because of the highest frequency and only few swamps and ponds are present in the study site. In Doma 94% are streams and only 6% are ponds. Nineteen (19) aquatic macrophytes were encountered during the study which belongs to eighteen (18) families. Ludwigia abyssinica was found to be the most highly distributed aquatic macrophyte in Lafia metropolis with a relative frequency of 68%. While in Doma, Mariscus longibracteatus was found to be the most highly distributed aquatic macrophyte as it was observed in twelve (12) locations visited with a relative frequency of 75%. Conclusively Lafia has more aquatic macrophyte than Doma which could be attributed to the differences in the nutrient status and human disturbances of the wetlands.

Keywords: Aquatic macrophytes, Doma, Lafia, Wetlands

INTRODUCTION

Aquatic macrophytes have been identified as sub-emergent or floating plants that grow in or near water (Adigun, 2005). These macrophytes could comprise a diverse group of organism including angiosperms, ferns, mosses and liverworts (Lacoul and freedman 2006). They are very important part of the food chain where they serve as food for fishes and maintain balance in nutrient cycle of aquatic bodies (Thomaz *et al.,* 2008). The spread and occurrence of these macrophytes on some Nigerian water ways was earlier reported by Kio and Ola (1987) where they generated high National interests.

A lot of environmental factors other than nutrients concentrations could explain some of the observed variations in macrophytes species distribution and composition (Wetzel, 2001). However, these plants are highly productive and play important structuring roles on aquatic environments (Jeppensen *et al.,* 2000). Therefore, ecological studies carried in aquatic environment are not complete if aquatic macrophytes communities are not considered as essential components for ecosystem functioning and aquatic biodiversity conservation. Furthermore, aquatic macrophytes have the physiological potential of remediating heavy metals from polluted water bodies thereby regarded as the corner stone of aquatic environments (Uka *et al.*, 2009).

Studies on this group of plants are rare in this part of the world as documented information on their taxonomy, phytogeography and ecology are not adequate and / or sparse. Therefore there is a need for adequate assessment of their occurrence, types, distribution and taxonomy in some wetlands in Lafia and Doma metropolis.

MATERIALS AND METHOD

Study location

This study was carried out at Lafia and Doma Local Government Areas of Nasarawa State, Nigeria. Doma is in the southern part of Nasarawa State, while Lafia is the Capital of Nasarawa State and lies between

latitude 8°25'40"N to 8°34'15"N and longitude 8°24'25"E to 8°39'19" in the Guinea savannah region of Northern Nigeria. Sixteen (16) wetlands were selected at random each in Lafia and Doma respectively. Wetlands assessed include streams, ponds and other types of wetlands.

Site and sample collection

The study was conducted during the rainy season in 2017. Plants specimens were collected at Lafia and Doma Metropolis using non-random sampling methods by collecting only where the plants are closer to the bank. Photographs of the ones far inside the wetlands beyond reach were taken with the aid of a digital camera. The samples collected were all recorded at the field. These specimens were later used for identification and to provide permanent records for future use (Simpson, 2010). The geographical coordinates of each sampling location was taken using a global positioning system (GPS) device.

Sample Identification

Matured aquatic plants species were collected in each location. The collected plants species were pressed, dried and mounted on the standard herbarium sheet. The specimens were taken to the herbarium of Federal College of Forestry Jos, for identification.

Relative Frequency and Abundance

The relative frequency (RF) of occurrence of each macrophyte species were determined to assess the distribution of the species.

RF of species = NOIMS x 100/ NTSS --------- Eqn 1

Where:

NOIMS = No of occurrence of individual macrophytes species

NTSS = No of total sampled sites

The relative abundance of each macrophytes species were described in each sampled site using the methods of Bongers *et al.* (1998) and Kayode, (1999) as follows:

Less than 5 individual as rare, 5-10 individuals as occasional, 11-30 individual as frequent, 31-100 individual as abundant and above 100 individual as very abundant.

RESULTS

Description of locations and occurrence of aquatic macrophyes in Lafia

The description of geographical locations of sampled sites and wetlands in Lafia Metropolis is shown in table 1. A total of sixteen (16) locations were sampled of which ten (10) locations are streams which include Akurba Osanya, Gandu, beside College of Agric, opposite College of Agric, Shabu 1, Shabu 2, Shabu 5, Shabu 7, Shabu 8 and Tudun Amba; four (4) locations are swamps which include Tripple zee farm, between Lafia and Shabu 2, Shabu 3 and Shabu 4; two (2) locations are ponds which include between Lafia and Shabu 1 and Shabu 6. From the result, 62% indicates streams, 25% are swamps and only 13% are ponds (Fig. 1).

Table 1: Description of the geographical locations of sample site and water bodies in Lafia metropolis

S/No	Sample sites	Location code	Latitude	Longitude
1.	Akurba Osanya	AKB	8.47104N	8.58747E
2.	Opposite Tripple Zee farm	OTF	8.45695N	8.57489E
3.	Gandu	GAN	8.45116N	8.57304E
4.	Beside college of Agric.	BCA	8.55723N	8.54292E
5.	Opposite college of Agric	OCA	8.51061N	8.52016E
6.	Between Lafia and Shabu 1	B/W L&S1	8.58883N	8.5559E
7.	Between Lafia and Shabu 2	B/W L&S2	8.56688N	8.54802E
8.	Shabu 1	SHB 1	8.57557N	8.55119E
9.	Shabu 2	SHB 2	8.56688N	8.54802E
10.	Shabu 3	SHB 3	8.57405N	8.55062E
11.	Shabu 4	SHN 4	8.58802N	8.55577E
12.	Shabu 5	SHB 5	8.59687N	8.55846E
13.	Shabu 6	SHB 6	8.59092N	8.55659E
14.	Shabu 7	SHB 7	8.59043N	8.55738E
15.	Shabu 8	SHB 8	8.59040N	8.55691E
16.	Tudun Amba	TUA	8.49216N	8.50355E

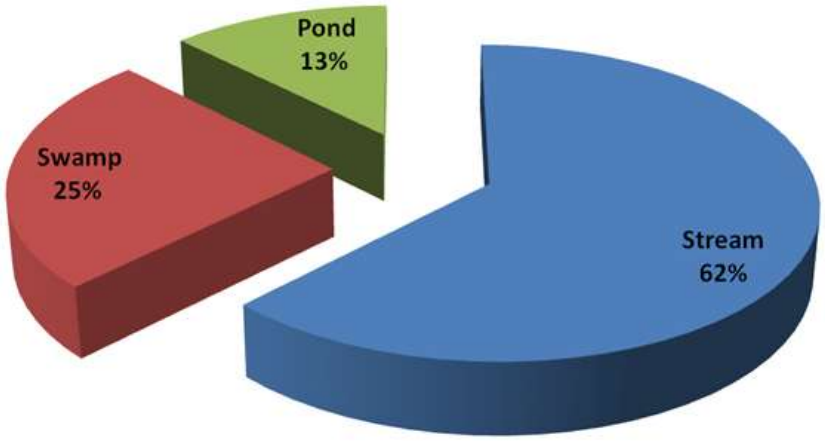

Figure 1: Categories of welands in Lafia Metropolis

From the surveyed sites, a total of fifteen (15) aquatic macrophytes belonging to fourteen (14) families were observed in all the sixteen (16) locations visited in Lafia metropolis (Table 2). These macrophytes include *Ipomea aquatic* (Convolvulaceae), *Lippia javanica* (Verbenaceae), *Sphenoclea zeylanica* (Shenocleaceae), *Mariscus longibracteatus* (Cyperaceae), *Ludwiga abyssinica* (Onagraceae), *Eichonia crassip* (Pentondriaceae), *Oryza sativa* (Poaceae), *Echinocloa cru-sgalli* (Poaceae), *Cyclosorus afer* (Thelypteridaceae), *Eicconia natan* (Pontedriaceae), *Polygonium salicifolium* (Polygonacea), *Commelina bengalensis* (Commelinaceae), *Pandanu candelabrum* (Pandanaceae), *Nymphae lotus* (Nymphaceae) and *Pentondon pentandrus* (Araeceae) respectively.

Table 2: Aquatic macrophytes found in Lafia metropolis

S/No	Family	Scientific Name	Common name	Location/ abundance status															
				AKB	OTF	GAN	BCA	OCA	BWL & S1	BWL & S2	SHB1	SHB2	SHB3	SHB4	SHB5	SHB6	SHB7	SHB8	TUA
1.	Convolvulaceae	*Ipomea aquatic*	Water spinach	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	√VA
2.	Verbenacea	*Lippia javanica*	Lemon brush	√VA	X	X	√VA	X	X	X	X	X	X	X	√VA	X	√VA	√VA	X
3.	Shenocleaceae	*Sphenoclea zeylanica*	Wedgewort gooseweed	√VA	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
4.	Cyperaceae	*Mariscus Longibracteatus*	Papyrus sedges	√VA	X	X	√VA	X	X	√O	X	X	X	X	√VA	√VA	X	√VA	X
5.	Onagraceae	*Ludwiga abyssinica*	Water premise	√VA	√VR	√VA	X	√VA	√VA	√O	√A	√A	X	X	X	√VA	X	√VA	√VA
6.	Pentondriaceae	*Eichonia crassip*	Water hyacinth	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	√VA
7.	Poaceae	*Oryza sativa*	Rice	X	X	X	X	X	X	√VA	X	X	√VA	√VA	X	X	X	X	X
8.	Poaceae	*Echinocloa cru-sgalli*	Barnyard grass	√VA	X	X	√VA	X	X	X	√VA	X	√VA	X	X	√VA	√VA	√VA	X
9.	Thelypteridaceae	*Cyclosorus afer*	Fern	X	√R	X	√VA	X	√VA	X	X	X	X	X	√VA	X	X	√VA	X
10.	Pontedriaceae	*Eicconia natan*	Anchored water hyacinth	√VA	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
11.	Polygonaceae	*Polygonium salicifolium*	Knot weed	X	X	X	X	X	X	X	√VA	X	X	X	√VA	√VA	√VA	√VA	√VA
12.	Commelinaceae	*Commelina bengalensis*	Tropical spider wort	X	X	X	X	√VA	X	√O	√VA	X	X	√VA	√VA	X	√VA	X	X
13.	Pandanaceae	*Pandanu candelabrum*	Screw palm	X	X	X	√VA	X	X	X	X	√VA	X	X	X	X	X	√VA	X
14.	Nymphaceae	*Nymphae lotus*	Water lily	X	X	X	X	X	√VA	X	X	X	X	X	X	X	X	√VA	X
15.	Araeceae	*Pentondon pentandrus*	pentondon	X	X	X	X	X	X	X	X	X	X	X	X	√O	X	X	X

KEY: √ - Present, VA – Very abundant, O – Occasional, R – Rare, F – Frequent, X – Absent,

Ludwigia abyssinica was found to be the most highly distributed aquatic macrophytes in Lafia metropolis, it was observed in eleven (11) locations visited with a relative frequency of 68%. *Eichhornia crassipes*, *Eichhornia natans Ipomoea aquatica*, *Pentondon pentandrus* and *Sphenoclea zeylanica* were found to be the least distributed aquatic macrophytes in Lafia as they were only observed in one (1) location each and with a relative frequency of 6.25% (Fig. 2).

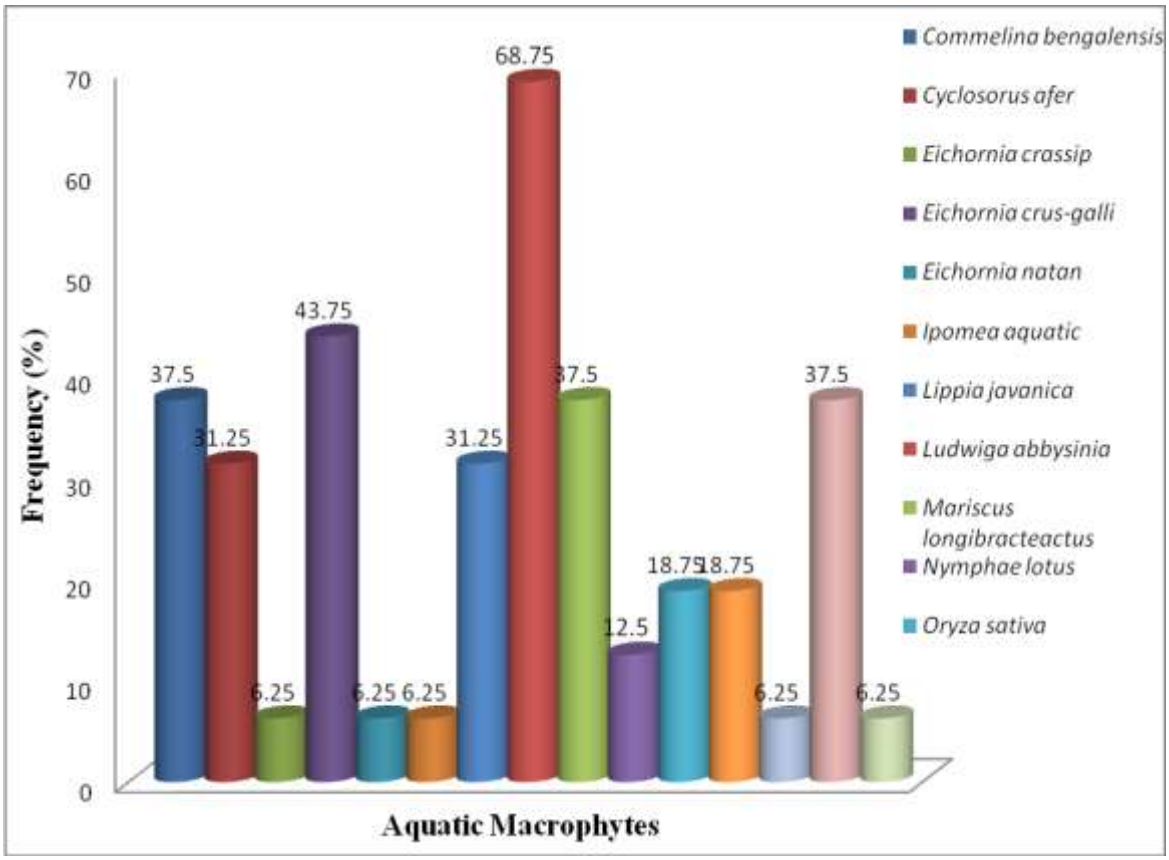

Figure 2: Relative Frequency (%) of Aquatic Macrophytes in Lafia Metropolis

Description of locations and occurrence of aquatic macrophyes in Doma

In Doma Metropolis, sixteen (16) locations were also sampled of which fifteen (15) are streams which includes Omenza 1, Omenza 2, Osota 1, Osota 2, GSS Doma, Government College Doma, Arumangya, Ogbobula 1, Ogbobula 2, Okuripu, Okusupa, Ipugigu, GSS Doma former hostel, Compo 1 and Compo 2; only one (1) is pond which is Federal Science and Technical School Doma (Table 3). From the results of the percentage disstribution, 94% are streams and only 6% are ponds (Fig. 3). This shows that most wetland in Doma metropolis are streams.

Table 3: Description of geographical locations of sample sites and water bodies in Doma Metropolis

S/No	Sample sites	Location code	Latitude	Longitude
1.	Omenza 1	OMZ 1	8.35005N	8.35 005E
2.	Omenza 2	OMZ 2	8.3901N	8.34801E
3.	Osota 1	OST 1	8.39013N	8.3481E
4.	Osota 2	OST 2	8.39278N	8.35039E
n5.	GSS Doma	GSSD	8.39188N	8.35039E
6.	Govt college Doma	GCD	8.39024N	8.35762E
7.	Arumangya	ARG	8.39004N	8.35762E
8.	Fed science and technical school	FSTC	8.39131N	8.34863E
9.	Ogbobula 1	OGB 1	8.39695N	8.34863E
10.	Ogbobula 2	OGB 2	8.39074N	8.34881E
11.	Okpuripu	OKPU	8.39145N	8.3498E
12.	Okussupa	OKSP	8.3906N	8.34861E
13.	Ipugigu	IPG	8.39102N	8.3492E
14.	GSSD Former Hostel	GGDFH	8.4043N	8.36809E
15.	Compo 1	CMP 1	8.46461N	8.43512E
16.	Compo 2	CMP2	8.44435N	8.41107E

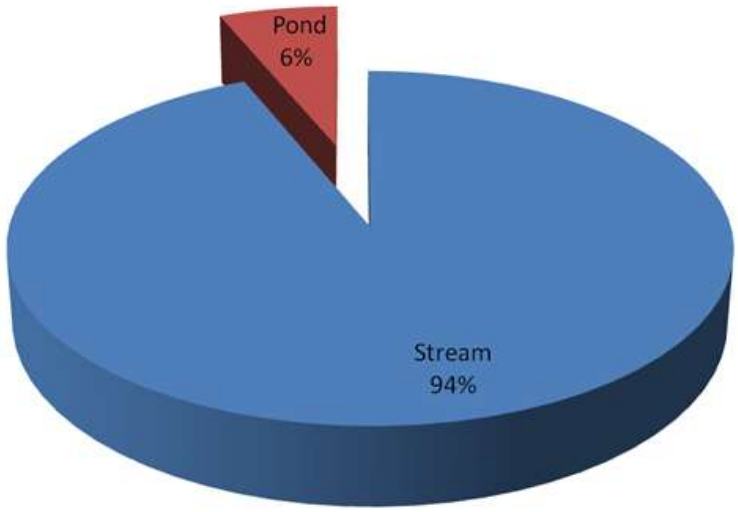

Figure 3: Categories of wetlands in Doma Metropolis

Also, a total of fourteen (14) aquatic macrophytes belonging to thirteen (13) families were present in fifteen (15) locations out of the sixteen (16) locations visited (Table 4). They include *Sacciolepis africana* (Poaceae), *Thalia geniculate* (Maranthaceae), *Ceratophyllum demersum* (Ceratophyllaceae), *Xanthosoma sagittifolium* (Araceae), *Ipomea aquatic* (Convolvulaceae), *Commelina bengalensis* (Commelinaceae), *Polygonium salicifolium* (Polygonaceae), *Ludwiga Abyssinia* (Onagraceae), *Eichornia natans* (Pontedriaceae), *Mariscus longibracteatus* (Cyperaceae), *Cyclosorus afer* (Thelypteridaceae), *Oryza sativa* (Poaceae), *Nymphae lotus* (Nymphaceae) and *Pandanus candelabrum* (Pandanaceae).

Table 4: Aquatic macrophytes found in Doma metropolis

S/No	Family	Scientific Name	Common name	Location/ abundance status															
				Omz1	**Omz2**	**Ost1**	**Ost2**	**GSSD**	**GCD**	**ARG**	**FSTC**	**OGB1**	**OGB2**	**OKPU**	**OKSP**	**IPG**	**GGFH**	**CMP1**	**CMP2**
1.	Poaceae	*Sacciolepis Africana*	Cupscale grass	X	X	X	X	X	X	X	X	X	X	X	X	X	X	√VA	√VA
2.	Maranthaceae	*Thalia geniculata*	Water canna	X	X	X	X	X	X	X	√VA	X	X	X	X	X	X	X	X
3.	Ceratophyllaceae	*Ceratophyllum demersum*	Hornwort	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	√VA
4.	Araceae	*Xanthosoma sagittifolium*	Arrow leaf	√VA	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
5.	Convolvulaceae	*Ipomea aquatica*	Water spinach	X	X	√VA	√VA	√VA	X	X	√VA	X	X	X	√A	√VA	√VA	√VA	X
6.	Commelinacea	*Commelina bengalensis*	Tropical spider wort	√VA	√VA	√VA	X	X	√A	X	X	X	√VA	√VA	√VA	X	X	X	X
7.	Polygonaceae	*Polygonium salicifolium*	Knot weed	X	√VA	X	X	X	X	X	X	X	X	X	X	√R	X	X	√A
8.	Onagraceae	*Ludwiga Abyssinia*	Water premise	√O	√R	X	√A	√VA	X	X	√VA	X	√O	X	√O	√R	X	√VA	√VA
9.	Pontedriaceae	*Eichornia natans*	Anchored water hyacinth	X	X	X	X	X	X	X	X	X	√VA	X	X	X	X	X	X
10.	Cyperaceae	*Mariscus longibracteatus*	Papyrus grass	√VA	√A	X	√VA	√VA	X	X	√VA	X	√F	√A	√F	√VA	√VA	√VA	√VA
11.	Thelypteridaceae	*Cyclosorus afer*	Fern	√VA	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
12.	Poaceae	*Oryza sativa*	Rice	√VA	X	X	X	X	X	X	√VA	√VA	X	X	X	X	X	X	X
13.	Nymphaceae	*Nymphae lotus*	Water lily	√VA	√VA	X	X	X	X	X	√VA	X	X	X	X	X	X	√VA	√ F
14.	Pandanaceae	*Pandanus candelabrum*	Screw palm	X	X	X	X	X	X	X	X	X	X	√VA	X	X	X	X	X

KEY: √ - Present.VA – Very abundant, O – Occasional, R – Rare, F – Frequent, X – Absent,

Mariscus longibracteatus was found to be the most highly distributed aquatic macrophytes as it was observed in twelve (12) locations visited with a relative frequency of 75% (Fig. 4). *Cyclosorus afer*, *Eichhornia natans*, *Pandanu candelabrum*, *Thalia geniculata* and *Xanthosoma sagittifolium* were found to be the least distributed aquatic macrophyte in Doma metropolis as they were observed in one (1) location each and with a relative frequency of 6.25%.

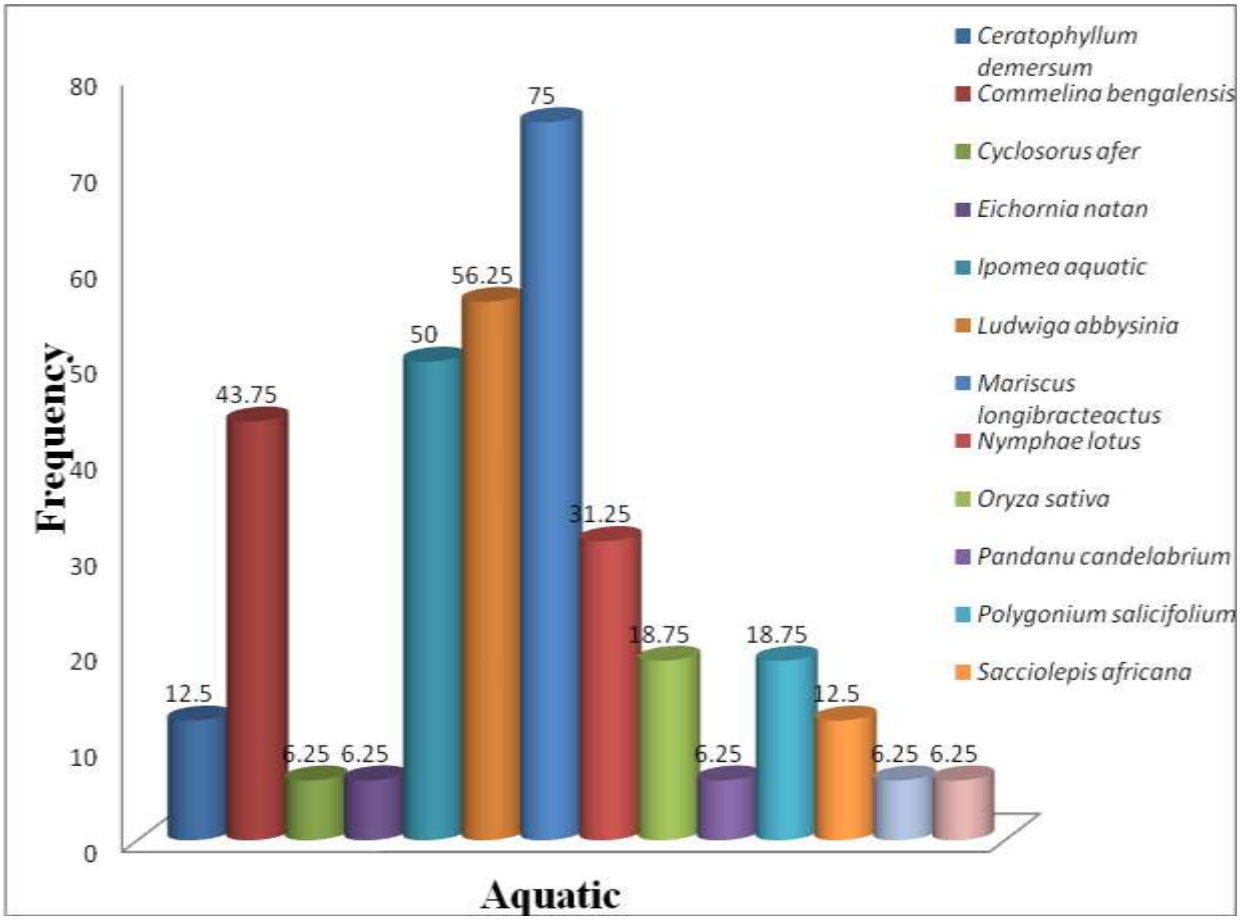

Figure 4: Relative Frequency (%) of Aquatic Macrophytes in Doma Metropolis

Life forms of Aquatic Macrophytes

The life forms of aquatic macrophytes present in Lafia and Doma metropolis is shown in table 5. A total of nineteen (19) aquatic macrophytes were observed in both study sites, fifteen (15) were classified according to their life forms as emergent. They include *Commelina benglalensis, Cyclosorus afer, Eichnochloa crusgalli, Ipomoea aquatica, Lippia javanica, Ludwigia abyssinica, Mariscus longibracteatus, Oryza sativa, Pandanu candelabrum, Pentondon pentandrus, Polygonum salicifolium, Sacciolepis africana, Sphenoclea zeylanica, Thalia geniculata and Xanthosoma sagittifolium.* Two macrophytes were classified as submerged namely: *Ceratophyllum demersum* and *Eichhornia natans* and two were also classified as floating including *Eichhornia crassipes and Nymphaea lotus* respectively. The result shows that majority of the aquatic macrophytes in both study sites are emergent in life forms.

Table 5: Life forms of aquatic macrophytes

S/No	Macrophytes	Classification
1.	*Ceratophyllum demersum* L	Submerged
2.	*Commelina benglalensis*	Emergent
3.	*Cyclosorus afer* (Schum.) Ching	Emergent
4.	*Eichhornia crassipes* (Mart.) Solms-Layb.	Free-floating
5.	*Eichhornia natans* (P.Beauv) Solms-Layb.	Submerged
6.	*Eichnochloa crusgalli* (L.) Beauv	Emergent
7.	*Ipomoea aquatica* Forsk.	Emergent
8.	*Lippia javanica* Brum. F.	Emergent
9.	*Ludwigia abyssinica* A. Rich	Emergent
10.	*Mariscus longibracteatus* Chaerms	Emergent
11.	*Nymphaea lotus* Linn.	Floating-leaved
12.	*Oryza sativa* L	Emergent
13	*Pandanu candelabrum* P.Beauv	Emergent
14.	*Pentondon pentandrus*	Emergent
15.	*Polygonum salicifolium* Bronss. ex wild	Emergent
16.	*Sacciolepis africana* (Hubb and snowden)	Emergent
17.	*Sphenoclea zeylanica* (Gaertner)	Emergent
18.	*Thalia geniculate* L.	Emergent
19.	*Xanthosoma sagittifolium* L. Schott	Emergent

DISCUSSION

The results show that majority of wetlands in Lafia and Doma metropolis are streams because of the highest frequency and only few swamps and ponds are present in the study sites. According to Wandell (2007), a lake's or water body fertility and its amount of aquatic plant is greatly influenced by its watershed characteristics and size, soil, fertility, drainage patterns and land use. It was also reported in Davies *et al.* (2009), that the productivity of water is determined by the amount of planktons and macrophytes it contains as they are the major primary producers. Invariably, this means that all the wetlands sampled in Lafia are all productive because they all have at least one population of macrophyte.

From the study sites in Doma, aquatic macrophytes were absent in Arumangya indicating that the wetland is inactive. Previous work done by Chowdhury *et al.*, (2012) also states that the physiochemical conditions of wetlands such as high salinity indicate very poor number of macrophyte that can grow in such wetlands. Therefore some of the sampled wetlands in both Lafia and Doma with absence of macrophyte or low number of macrophyte species could be as a result of unfavourable physiochemical conditions of the water and soil.

Peterson and Lee (2005), observed that aquatic weed problem typically occur in clear, shallow water that is higher in nutrients. The comparative higher number of macrophytes species in Lafia may be as a result of fertility status of wetlands of the metropolis. *Eichhornia crassipes* which is listed as one of the invasive problematic aquatic plant by Cronk and Fuller (1995) was found only in Tudun Amba in Lafia metropolis. Although this aquatic plant was not prominent before as reported by Obot and Mbagwu (1988) but it is now spreading at alarming rate across wetlands in Nigeria (Sooknah and Wikie, 2004).

In conclusion, aquatic macrophytes are important part of the riverine environment. It was observed that more aquatic macrophytes were observed in Lafia as compared with Doma where less macrophytes species were ovbservved. These observed differences could be attributed to the fertility status of the wetlands and rate of human activities such as farming.

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