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Aquatic Weed Species Diversity, Abundance and Their Nutrient Values in The Lower River Benue, Ibi Local Government Area, Taraba State, Northeast, Nigeria.

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Abstract: A twelve (12) week investigation was performed in the Lower River Benue (Ibi axis), to determine the diversity, abundance and distribution; nutrient values of some aquatic weed species; three (3) sections of the river were sampled amongst human activities. A total of thirty-five (35) individual aquatic weeds were recorded, nine (9) rooted individual species, ten (10) emergent individual species, ten (10) free floating individual species and six (6) individual submerged species were identified amongst stations. They comprise of fifteen (15) families and fifteen (15) orders; the highest harvested individual species was L. minor (1627) while the least individual species was M. pigra (917); a total of 41447 species of aquatic weed were recorded. Analysis of variance (ANOVA) showed significant difference in various physico-chemical parameters between stations. Pearson correlation was used to determine the relationship between the aquatic chemical property of the ecosystem, aquatic weed species abundance and diversity at ($P<0.05$) significant level. The highest temperature values (27.87±1.00ºC) were recorded in station A while the least (27.33±0.75ºC) were recorded in station B; the highest dissolve oxygen (4.77±0.23mg/l) were recorded in station A while the least (4.40±0.46mg/l) were recorded in station C; the highest pH value (8.37±0.31) were recorded in station B while the least (8.00±0.46) were recorded in station A; the highest total dissolved solid (0.28±0.20) were recorded in station B while the least (0.27±0.05) were recorded in station A. The proximate analysis of the samples was very promising for man and livestock consumption; it showed that P. stratiotes is the richest in crude protein content (17%) and carbohydrate content (13%) and least in fat and moisture contents, (8%) and (2%) respectively. Hence, P. stratiotes is highly recommended for animal (fish and livestock) feed formulation inclusion of its (16.63%) approximately (17%) crude protein with crude fiber (36%) and (13%) carbohydrate contents.

INTRODUCTION

Aquatic weeds are those persistent weeds which develop and complete their lifecycle in water and cause harm to aquatic ecosystem directly and relate to ecological factors in the environment. Water is one of the most essential natural resources and in fact, aids the basis of all life forms on the earth (Krake and Lancar, 2002). Aquatic weeds are different greatly in kind, with some similarity to common terrestrial weeds while others are quite different. They fall into one of the four (4) common class types: algae, floating weeds, submerged weeds and emerged weeds (Lichtenstein, 2010). They constitute a significant component of the aquatic environment and they are of considerable ecological and economic essence: the numerous roles of aquatic weeds in freshwater ecosystems are closely linked to their distributions, which in turn depends on countless factors: light, water temperature, water quality, nutrient enrichment, sediment composition, fluctuations in water levels, etc. (Naseer et al., 2014; Dienye, 2015). Aquatic plants are an essential part of the aquatic food web of aquatic ecosystems as they play a crucial role in aquatic ecosystems worldwide because they provide food and home for fish, wildlife and aquatic flora and faunas (Gross, 2003).

In Nigeria, aquatic weeds infestations in inland aquatic ecosystems are increasing in population. They stressed that the spread is enhanced by human activities like the use of agro-fertilizers and organic wastes in farming and dumping of domestic remains in aquatic ecosystems and drainage canals (Uka et al., 2007). Aquatic weeds are observed to respond to the concentration level of nutrients in municipal and industrial wastewater for their fast growth (Baret and Farno, 1982; Jimin et al., 2023). Most aquatic weeds have good potentials as animal feed for livestock production; such as *Azolla* spp and *Lemna* spp and water hyacinth which seems to be very nutritive in their made ups, since the protein content is higher than some feed ingredients used in fish feed formulation. Fish species may not accept them directly as in *Lemna paucicostata* or *Azzolla* species but the leaves and petioles can be incorporated into animal feed to provide all the proteins, crude fat and minerals required daily at very low cost. Harvesting of useful aquatic weeds for feed production could aid their removal from aquatic ecosystems where they hinder boat movement or cause nuisance. The petioles and leaves of these aquatic weeds could be used as one of the non-conventional feed ingredients (Boyd, 1974; Yusuf et al., 2013).

MATERIALS AND METHODS

Study Area

The research was carried out in the Lower River Benue, Ibi axis, Taraba State, Northeastern Nigeria. Ibi is located at latitude 8°38'00'' North and longitude 10°46'00'' East. The vegetative area is mainly comprised of secondary forest, forbs re-growth and swamp. There are two seasons, April to October is raining (wet) season, while November to March is sunny (dry) season. The annual rainfall ranges from 130 cm to 266.30 cm/annum with temperature between 32°C and 36°C. The area has a population over 244,749 with a scattered settlement of many small to large village settlements throughout the area and is mainly drained by the Tela River (into the Atlantic Ocean) in Gassol Local Government. The majority of the people are agricultural farmers and fisher folks.

Experimental Procedure
Sample Location

The research was considered with three (3) sampled locations in the Lower River Benue as shown in Figure 1. The locations were: Locations (A-Gugu-audulahi, B-Baruwana and C-Basini). The stations were sampled for aquatic weeds individually, two (2) times a week (Mondays and Saturdays) using sharp knife and jute bag. The study was carried out from August to November, 2022 (12weeks) during the late raining season.

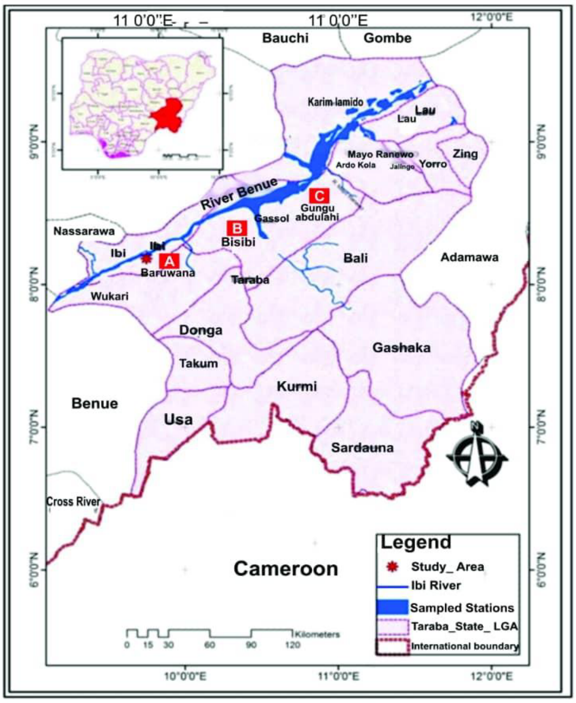

Figure 1. Map of Taraba State showing sampled stations in the Lower River Benue, Ibi Axis.

Aquatic Weeds Harvest and Taxonomy

Aquatic weed species were harvested and identified with the aid of botanical keys (Wood, 1975; Journey, 1993; Pasha, 1996; Kevin and Lancar, 2002; George and Miller, 2005; Akobundu and Agyakwa, 1987).

Determination of Aquatic Weed Species Diversity

Aquatic weed species diversity was calculated with the formula, thus:

$$Fsi\ (\%) = \frac{si}{\sum fsi} \times \frac{100}{1}$$

Here:
F = family or number of species families,
si = individual number of weed species family (Igbani and Uka, 2019).

Determination of Aquatic Weed Species Abundance

The aquatic weed species abundant relationship was determined with the scoring method (Bongers et al., 1998; Kayode, 1999) thus:
Less than 5 individual species for: Rare (R),
5-10 individual species for: Occasional (O),
11-30 individual species for: Frequent (F),
31-100 individual species for: Abundant (A);
Above 100 individual species for: Very Abundant (VA).

Determination of Nutrient Values (proximate composition) Aquatic Weed Species

The proximate composition analysis was determined in the Department of Soil Science Dry Laboratory, Federal University Wukari according to AOAC (1990) (Van Soest et al., 1991).

Determination of Physiochemical Parameters

The following parameters (Water Temperature, Dissolved Oxygen, Electrical Conductivity, Total Dissolved Solid and Power of Hydrogen were measured in-situ using the American Public Health Association standard methods for water and waste water examination (APHA. 2005).

Data Analysis

Data obtained was subjected to One-way Analysis of Variance (ANOVA, *P=0.05*) in Randomized Completely Block Design (RCBD). Significant difference and means values were determined using Duncan Multiple Range Test, "SAS 2010" package (Duncan, 1955). Data was also correlated (at 0.01 level, 2-tailed) to analyze the species nutrient values composition with species relative abundance and diversity.

RESULTS

A total number of thirty-five (35) individual species of aquatic weeds were identified; nine (9) rooted aquatic species, individual ten (10) free floating individual species, ten (10) emergent individual species and six (6) submerged individual species Figure 2, 3, 4, 5 and 6. They comprised of fifteen (15) families and fifteen (15) orders; the highest specie harvested was *L. minor* (1,627) individual species and the least was *M. pigra* (917) individual species. In Table 1, it showed aquatic weed species abundance scores in the Lower River Benue, all the aquatic weed species show very abundant (VA) scores in the ecosystem; *L. minor* recorded the highest abundant scores (1627) while *M. pigra* recorded the least abundant scores (917).

The aquatic weed species family variation showed a total number of 35 aquatic weed individuals belonging to 15 families and 15 orders. The species variation amongst the families found in the aquatic ecosystem during the study were recorded as follows: Poaceae (28.57%); Araceae, Fabaceae and Cyperaceae (8.57%); Pontederiaceae, Salviniaceae, Convolvulaceae and Nymphaeaceae (5.71%); Onagraceae, Polygonaceae, Potamogetonaceae, Typhaceae, Sphenocleaceae, Marantaceae, Ceratophyllaceae and Pteridaceae (2.86%). There is no significant difference in aquatic weed species diversity amongst stations while there is significant difference in aquatic weed species relative abundance amongst stations; stations A and B; stations B and C showed positive correlation of aquatic weed species within stations while stations A and C showed negative correlation of aquatic weed species within stations.

The results of the average values of physico-chemical characteristics as recorded in Table 2. the pH mean values ranges from (8.37 ± 0.31 to 8.00 ± 0.46^a), the highest values (8.37 ± 0.31^a) were recorded in station B while the least values (8.00 ± 0.46^a) were recorded in station A; the mean values of water temperature ranges from (27.33 ± 0.75^a to 27.47 ± 1.00^a), the highest values (27.87 ± 1.00^a) were recorded in station A while the least (27.33 ± 0.75^a) were recorded in station B; the mean values of dissolved oxygen (DO) ranges from (4.77 ± 0.23^a to 4.73 ± 0.06^a), the highest values (4.77 ± 0.23^a) were recorded in station A while the least values (4.40 ± 0.46^a) were recorded in station C; the mean values of electrical conductivity (EC) ranges from (0.49 ± 0.26^a to 0.39 ± 0.05^a), the highest values (0.42 ± 0.26^a) were recorded in station C while the least values (0.39 ± 0.05^a) were recorded in station A; the mean values of total dissolved solid (TDS) ranges from (0.28 ± 0.02^a to

0.27 ± 0.06^a), the highest values (0.28 ± 0.20^a) were recorded in station B while the least values (0.27 ± 0.06^a) were recorded in station A.

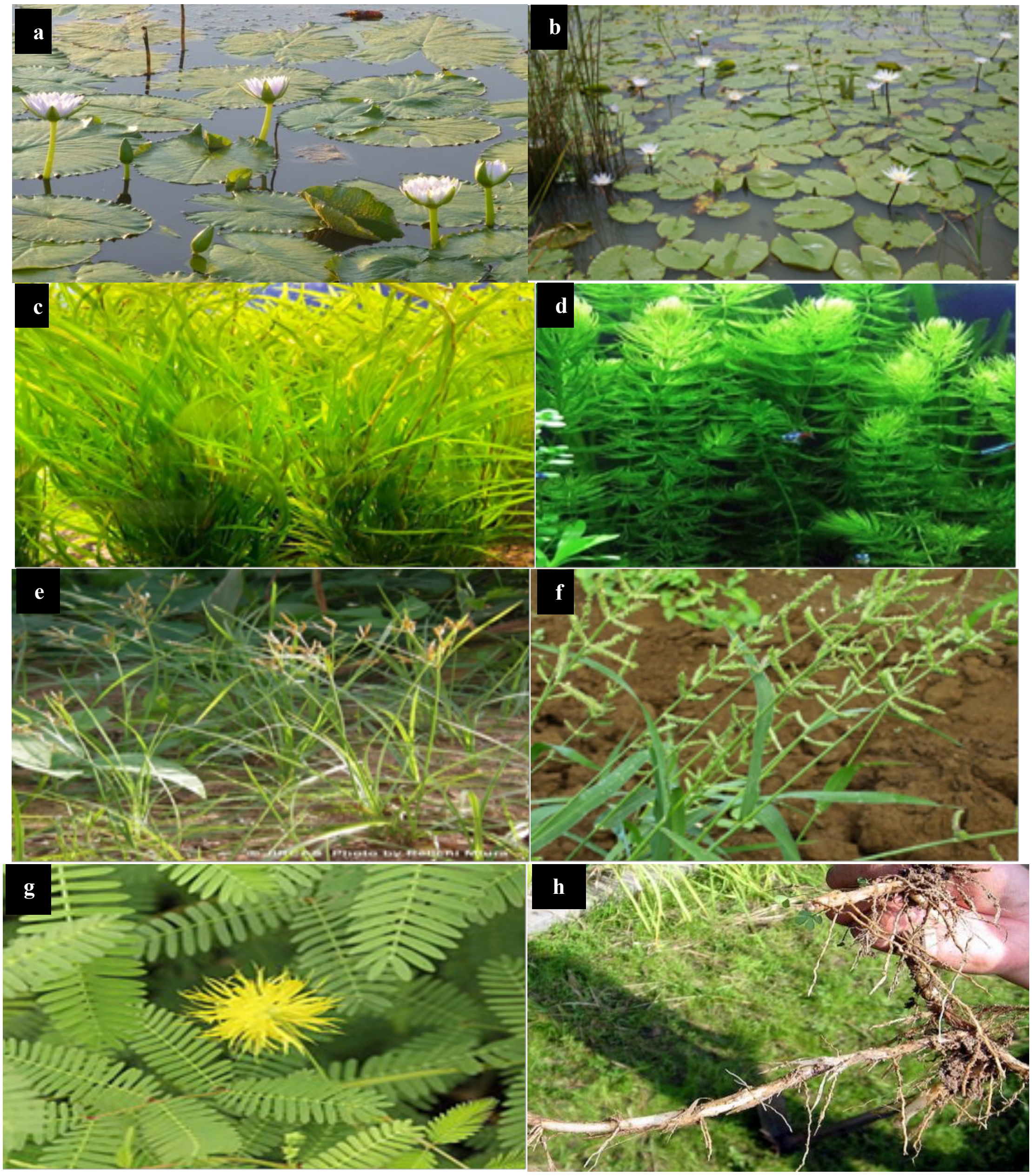

Figure 2. Submerged Weed Species (a) Water lilly, *Nymphea lotus* (Allen, 2018), Local Name (Hausa): Bado (b) Water lilly, *Nymphea micrantha* (Guill and Perr, 2012), Local Name (Hausa): Tafi (c) Pond weed, *Potamogeton octandrus* (Ito, 2013), Local Name (Hausa): Beruwa (d) Horn wort, *Ceratophyllum demersum* (Linnaeus, 1775), Local Name (Hausa): Nakanruwa (e) Foxtail sedge, *Cyperus alopecuroides* (Lansdown et al., 2018), Local Name (Hausa): Aya-aya (f) Jungle rice, *Echinochloa colona* (NRCS. 2013), Local Name (Hausa): Burugu; **Rooted Weed Species** (g) Water mimosa, *Neptunia oleracea* (Parker, 2018), Local Name (Hausa): Gadasin-ruwa (h) Wild rice, *Oryza longistaminata* (Phillips et al., 2017), Local Name (Hausa): Shinkara-daji

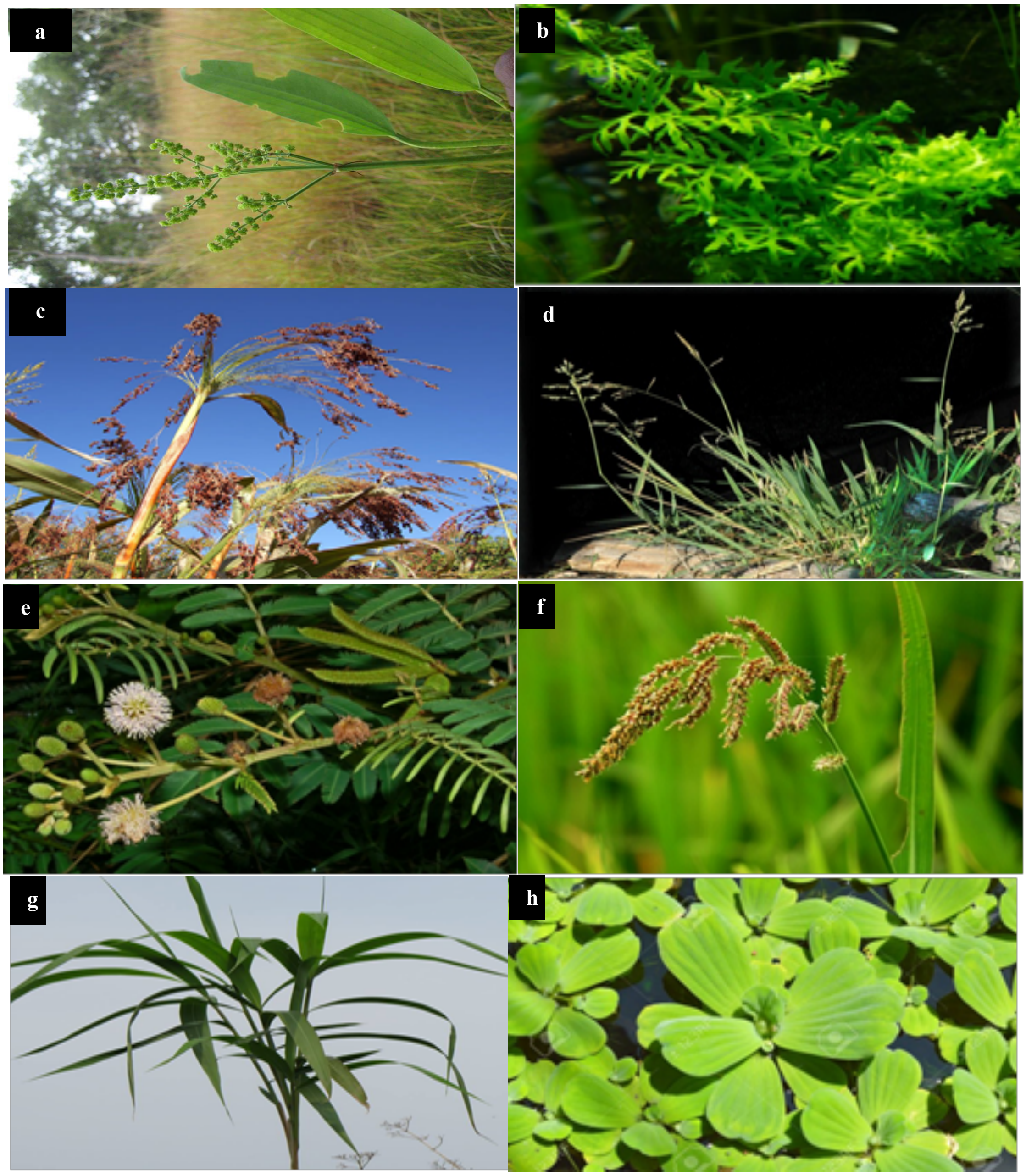

Figure 3. Rooted Weed Species (a) Water lettuce, *Burnatia enneandra* (Haynes et al., 1998), Local Name (Hausa): Haki (b) Water sprite, *Ceratopteris cornuta* (Barthelat, 2019), Local Name (Hausa): Hakimi (c) Wild sorghum, *Sorghum arundihaceum* (Desv and Stapf 2021), Local Name (Hausa): Dawa-dorina (d) Swamp rice grass, *Leersia hexandra* (Pyrah, 2013), Local Name (Hausa): Shinkafa-fadama (e) Giant sensitive tree, *Mimosa pigra* (Lonsdale et al., 1995), Local Name (Hausa): Karji (f) Hippo grass, *Echinochloa stagnina* (Moran et al., 2016), Local Name (Hausa): Burugu (g) Tropical reed, *Phragmites karka* (Kiviat, 2013), Local Name (Hausa): Esun; **Free Floating Weed Species** (h) Water lettuce, *Pistia stratiotes* (Buzgo, 1994), Local Name (Hausa): Kainwawa

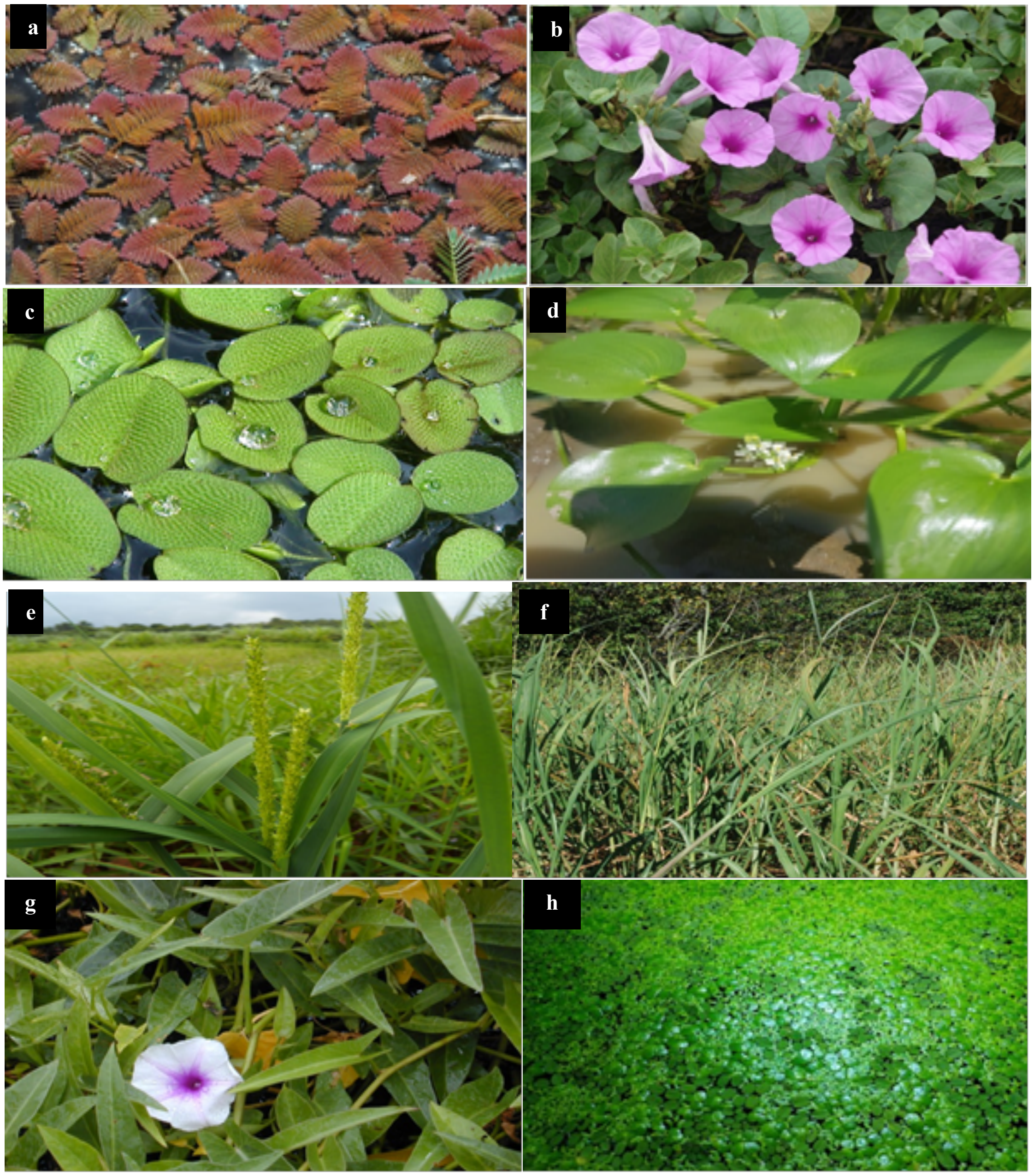

Figure 4. Free Floating Weed Species (a) Feathered mosquito fern, *Azolla pinnata* (Watanabe and Berja, 1983), Local Name (Hausa): Mairike-ruwa (b) Ginger-leaf morning-glory, *Ipomoea asarifolia* (NRCS, 2015), Local Name (Hausa): Riga-yara (c) Water moss, *Salvinia nymphelulla* (NRCS, 2015), Local Name (Hausa): Tarfo (d) Mud plantain, *Heteranthera callifolia* (Moran et al., 2016), Local Name (Hausa): Kargonruwa (e) Cupscale grass, *Sacciolepis indica* (Simon, 1972), Local Name (Hausa): Geron-fadama (f) Hippo grass, *Vossia cupidata* (Wallich and Griffith, 1836), Lacal Name (Hausa): Burugu-mai-kaya (g) Water spinach, *Ipomoea aquatica* (Gupta and Sayer, 2018), Local Name (Hausa): Riga-yara (h) Duck weed, *Lemna minor* (Lansdown, 2019), Local Name (Hausa): Sa-ruwa sanya

Figure 5. Free Floating Weed Species (a) Water hyacinth, *Eichhornia natans* (Pellegrini et al., 2018), Local Name (Hausa): Mahuch; **Emergent weed Species** (b) Giant sedge, *Cyperus exaltatus* (Balkrishna, 2018), Local Name (Hausa): Aya (c) Antelope grass, *Echinochloa pyramidalis* (Diop and Lansdown, 2020), Local Name (Hausa): Buru (d) Yerba De Jicotea, *Ludwigia erecta* (Wagner et al., 2007), Local Name (Hausa): Shajaya (e) Burhead Sedge, *Scirpus cubensis* (Bianchini and Antonio, 2003), Local Name (Hausa): Karejiwa-rua (f) Arrow root, *Maranta arundinacea* (Heuzé and Tran, 2017), Local Name (Hausa): Mai-ranaku (g) Mende foni, *Rhytachne triaristata* (Clayton, 1978), Local Name (Hausa): Iwa (h) Gooseweed, *Sphenoclea zeylanica* (Catindig et al., 2017), Local Name (Hausa): Buduwan-safe

Figure 6. Emergent weed Species (a) Bulrush, *Typha australis* (Clegg, 1986), Local Name (Hausa): Kurnuwa (b) Knotweed, *Polygonum lanigerum* (Nogueira et al., 2006), Local Name (Hausa): Numen n'ruwa (c) Cover grass, *Leptochloa coerulescens* (Peterson et al., 2012), Local Name (Hausa): Gyasua

Table 1. Aquatic weed species abundance and diversity in the Lower River Benue

	Species	Family	Order	Stations A	B	C	S.C	A	D (%)
1	*Echinochloa colona*	Poaceae	Fabales	319	357	312	988	VA	28.57
2	*Echinochloa stegnila*	Poaceae	Poales	461	363	97	1129	VA	28.57
3	*Echinochloa pyramidalis*	Poaceae	Cyperales	346	242	439	1027	VA	28.57
4	*Learsia hexandra*	Poaceae	Poales	422	381	397	1200	VA	28.57
5	*Leptochloa coerulescens*	Poaceae	Poales	466	454	304	1224	VA	28.57
6	*Oryza longiostaninata*	Poaceae	Cyperales	426	262	464	1152	VA	28.57
7	*Phragmites karka*	Poaceae	Poales	338	325	388	1051	VA	28.57
8	*Sorghum arundinaceum*	Poaceae	Poales	565	348	405	1318	VA	28.57
9	*Sacciolepis indica*	Poaceae	Poales	432	320	356	1108	VA	28.57
10	*Vossia cuspidata*	Poaceae	Poales	593	336	318	1247	VA	28.57
11	*Polyganum lanigerum*	Polygonaceae	Carysphyllales	486	494	396	1376	VA	28.57
12	*Eichhornia natans*	Pontederiaceae	Commelinales	516	395	339	1250	VA	2.86
13	*Heteranthera collifolia*	Pontederiaceae	Commelinales	411	384	395	1190	VA	2.86
14	*Potamogenton octandrus*	Potamogetonaceae	Alismatales	376	360	329	1065	VA	5.71
15	*Salvinia nymphelulla*	Salviniaceae	Polypodiopsida	351	424	429	1204	VA	5.71
16	*Sphenochlea zeylanica*	Sphenocleaceae	Solanales	344	361	406	1111	VA	2.86
17	*Ludwigia eracta*	Onagraceae	Myrtales	519	377	310	1206	VA	5.71
18	*Maranta arundinacea*	Marantaceae	Zingiberales	421	328	446	1195	VA	5.71
19	*Typha australis*	Typhaceae	Poales	363	451	464	1278	VA	2.86
20	*Ceraptoteris cornuta*	Pteridaceae	Alismatales	411	373	458	1242	VA	8.57
21	*Burnatia enneandra*	Araceae	Alismatales	524	446	400	1370	VA	8.57
22	*Pistia stratiotes*	Araceae	Arales	517	438	429	1384	VA	8.57
23	*Azolla pinnata*	Salviniaceae	Salviniales	411	366	402	1179	VA	2.86
24	*Ceratophyllum demersum*	Ceratophyllaceae	Ceratophyllales	536	295	268	1099	VA	2.86
25	*Ipomoea asarifolia*	Convolvulaceae	Solanales	396	350	232	978	VA	5.71
26	*Ipomoea aquatica*	Convolvulaceae	Solanales	459	408	434	1301	VA	5.71
27	*Cyperus alopecuroides*	Cyperaceae	Poales	393	414	485	1292	VA	8.57
28	*Cyperus hexaltatus*	Cyperaceae	Poales	386	357	472	1215	VA	8.57
29	*Scirpus cubensis*	Cyperaceae	Poales	432	293	383	1108	VA	8.57
30	*Neptunia oleracea*	Fabaceae	Fabales	389	386	417	1192	VA	2.86
31	*Rhytachne triaristata*	Fabaceae	Fabales	339	311	295	945	VA	2.86
32	*Mimosa pigra*	Fabaceae	Poales	362	277	278	917	VA	5.71
33	*Lem na minor*	Araceae	Alismatales	629	546	452	1627	VA	5.71
34	*Nymphea micrantha*	Nymphaeaceae	Nymphaeales	282	319	361	962	VA	5.71
35	*Nymphea lotus*	Nymphaeaceae	Nymphaeale	427	390	508	1325	VA	5.71
				15048	12931	13468			
			Total Abundance				41447		
			Total Number of Species	35	35	35			
			Total Number of Individual Species	15048	12931	13468			
			Margalef Species Richness Index	3.53	3.59	3.58			

S.C = number of species cropped, A= abundance scores, D= percentage diversity (%)
<5 = Rare for (R), 5-1 = Occasional for (O), 11-30 = Frequent for (F), 31-100 Abundant for (A); >100 = Very Abundant for (VA), (Kayode, 1999).

Table 2. Physico-chemical characteristics (within stations) and proximate composition of aquatic weed species in the lower river benue

Parameters	Stations A	B	C	World bank range for freshwater aquaculture	
pH	8.00 ± 0.46[a]	8.37 ± 0.31[a]	8.20 ± 0.44[a]	6.5 – 9.0 Desirable range for fish Prodn (Ronald et al., 1999).	
DO (Mg/L)	4.77 ± 0.23[a]	4.73 ± 0.06[a]	4.40 ± 0.46[a]	>5.0 – 6.0 Mg/L (Ronald et al., 1999).	
TDS (Mg/L)	0.27 ± 0.06[a]	0.28 ± 0.02[a]	0.27 ± 0.10[a]	<1500 Mg/L (Nayla, 2019).	
Temp (˚C)	27.87 ±1.00[a]	27.33 ± 0.75[a]	27.43 ± 0.40[a]	29°C – 30˚C for Optimal Growth (Ronald *et al*., 1999).	
EC (µScm^{-1})	0.39 ± 0.05[a]	0.39 ± 0.20[a]	0.42 ± 0.26[a]	0.005 – 0.05 S/m (Nayla, 2019)	
*** Sample Description**					
	Ludwigia decurrens	*Pistia stratiotes*	*Phragmaties karka*	*Nymphia lotus*	*Maranta arundinacea*
Moisture (%)	6.13 ± 0.40	2.22 ± 0.25	3.84 ± 0.32	2.44 ± 0.30	3.10 ± 0.31
Ash (%)	4.08 ± 0.20	24.26 ± 1.00	11.48 ± 060	31.96 ± 1.21	10.93 ± 0.59
Crude Protein (%)	12.38 ± 0.62	16.63 ± 0.86	15.44 ± 0.86	11.69 ± 0.62	15.38 ± 0.85
Fat (%)	26.00 ± 1.01	8.16 ± 0.51	26.31 ± 1.01	11.36 ± 0.59	22.22 ± 0.95
Crude Fibre (%)	48.70 ± 1.35	35.60 ± 1.21	35.93 ± 1.23	39.59 ± 1.30	35.71 ± 1.21
Carbohydrate (%)	2.71 ± 0.30	13.13 ± 0.63	7.00 ± 0.49	2.96 ± 0.30	12.66 ± 0.65

The Mean values within the rows with different superscripts differ significantly, P<0.05. Values are expressed as mean ± S.D.
**Means in each row are significantly different (P< 0.05)*

DISCUSSION

A total number of thirty-five (35) individual species of aquatic weeds were identified along the Lower River Benue, Ibi axis during the period of this research. There is no direct data for comparison regarding the macrophytes in Ibi axis (Jimin et al., 2014; Obot and Ayeni, 1987). The aquatic weed species abundance of this river showed richness in its abundant scores and highest in very abundant (VA) score, in the ecosystem; *L. minor* recorded the highest abundant score (1627) while *M. pigra* recorded the least abundant score (917), the least in abundant score maybe due to the effect of human activities along the river, it is in agreement with (Ekpo et al., 2016; Akomolafe and Nkwocha, 2017). The aquatic weed species diversity showed a population of 35 individuals in 15 families with 15 orders, this is not in consonant with (Dienye, 2015). The aquatic weed species diversity amongst the families recorded highest in Poaceae (31.43%) while Onagraceae, Polygonaceae, Potamogetonaceae, Typhaceae, Sphenocleaceae, Ceratophyllaceae and Pteridaceae (2.86%) were recorded the least, it is in consonant with (Ekpo et al., 2016). The physico-chemical characteristics of the ecosystem varied with location, pH recorded the highest values (8.37±0.31[a]) in station B while the least values (8.00±0.46[a]) was recorded in station A; water temperature recorded the highest values (27.87±1.00[a]) in station A while the least values (27.33±0.75[a]) in station B; DO recorded the highest values (4.77±0.23[a]) in station A while the least values (4.40±0.46[a]) in station C; EC recorded the highest values (0.42±0.26[a]) in station C while the least values (0.39±0.05[a]) in station A; TDS recorded the highest values (0.28±0.20[a]) in station B while the least values (0.27±0.06[a]) in station A; all the physico-chemical parameters are within the World Bank Range for Freshwater Aquaculture threshold limits (Nayla, 2019; Ronald, 1999). The proximate analysis of the samples was very promising for man and livestock consumption. The moisture content values (6.13±0.40%) were highest in *L. decurrens* while the least values (2.22±0.25%) were recorded in *P. stratiotes*; Ash content values (31.96±1.21%) were highest in *N. lotus* while the least values (4.08±0.20%) were recorded in *L. decurrens*; Crude protein content values (16.63±0.86%) were highest in *P. stratiotes* while the least values (11.69±0.62%) were recorded in *N. lotus*; Fat content values (26.31±1.01%) were highest in *P. karka* while the least values (48.70±1.35%) were recorded in *P.*

stratiotes; Crude fibre content values (26.31±1.01%) were highest in *L. decurrens* while the least values (35.50±1.21%) were recorded in *P. stratiotes* and Carbohydrate content values (13.13±0.63%) were highest in *P. stratiotes* while the least (2.96±0.30%) were recorded in *L. decurrens*. It also showed that *P. stratiotes* is the richest in crude protein content (17%) and carbohydrate content (13%) and least in fat and moisture contents, (8%) and (2%) respectively. *P. stratiotes* is not as rich as *E. crassipes* (Okoye *et al*., 2008).

Based on the above submission, it may be recommended that more durable investigation should be carried out, especially covering the whole wet (raining) season on the aquatic weed species assessment in the study area; it is also necessary that constant monitoring of the river on anthropogenic activities such as bush burning, river dumping, sand diving, bathing and washing of plates/clothes, illegal fishing (the use of dynamite and plant extract poisoning should be stopped) to protect the aquatic natural resources from aging and extinction; it will also be of a great deal to also conserve these aquatic weed species for biodiversity sustainability for food sovereignty and security to better the health of the inhabitants amidst evapotranspiration and climate change. The identified aquatic weed species could be used by students and specialists in the field of Science (Plant Science, Botany, Biochemistry, Biology, Microbiology, Zoology, Water Science, Hydrology and Chemistry); Agriculture (Crop Science, Crop Production, Animal Science, Animal Production, Forestry, Fish Nutrition, Animal Nutrition, Fisheries and Aquaculture); Medicine (Pharmacy, Animal and Human Medicine); Ornamental breeders and the pharmaceutical industry. Hence, *P. stratiotes* is highly recommended for animal (fish and livestock) feed formulation inclusion of its (16.63%) approximately (17%) crude protein with crude fiber (36%) and 13% carbohydrate contents.

Furthermore, the presence of saponins, phenols, and steroids in these weeds can be explored for potential medicinal properties in animal and human medicine. The study also highlights the importance of monitoring water temperature and dissolved oxygen levels in the river to maintain the availability of safe water quality to flora and fauna. Therefore, it is recommended that farmers and fisher folks in the area should be aware of these factors and take necessary steps to maintain a healthy aquatic ecosystem for sustainability.

CONCLUSION

The utilization of aquatic flora as a source of edible protein has received small consideration. Large stands of vascular plants and non-planktonic algae are produced in many natural and aquatic ecosystems which frequently interfere with beneficial uses of water to the extent that various control measures are important. In view of the problems associated with the control of aquatic weeds and the global need for additional sources of food, to evaluate the nutritional values of aquatic weeds is of great essence. The said Lower River Benue, at Ibi axis maybe described to be very abundant in macrophytes considering the aquatic weed species diversity in the ecosystem, regarding the short period of sampling, in spite of its anthropogenic activities. The research assessed the aquatic weed species that are in abundance amongst the sampled stations (Gugu-audulahi, Basini and Baruwana); it also aimed to determine the diversity and the nutrient values of the macrophytes. The results of the present investigation compared with literatures of other rivers in Nigeria, revealed that there is very abundant aquatic weed species in the Lower River Benue (Ibi axis), the ecosystem and the activities around the river has significant effects on the water quality as indicated by the different records of the aquatic chemical properties. Finally, the research determined the aquatic weed species taxonomy, abundance; diversity and nutrient values of some selected species due to huge cost of proximate analysis in the locality.

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