PHYSICO-CHEMICAL PARAMETERS AND PHYTOMACROFAUNA COMMUNITIES ASSOCIATED WITH ROOTS OF WATER HYACINTH (*Eichhornia crassipes*) IN A TIDAL CREEK IN SOUTH-WESTERN NIGERIA

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ABSTRACT
Physico-chemical parameters and phytomacrofauna communities associated with roots of water hyacinth (*eichhornia crassipes*) in a tidal creek in south-western Nigeria was investigated for a period of six months. The physico-chemical characteristics of the water recorded were Air temperature (24-34°C), surface water temperature (22 - 32°C), total dissolved solids (8329 - 22620mgl-1), sulphate (3.80- 2750.20mgl-1), silica (2.10- 3.90mgl-1), dissolved oxygen (47 - 97mgl-1), conductivity (12600 - 34800 S/cm), salinity (7.05- 19.81‰) chloride (3878.50- 10556.6015,015mgl-1), pH (7.14-7.97), acidity (4.10- 12.10mgl-1), alkalinity (13.30- 152.20mgl-1), total hardness (1211.40 - 5000.10mgl-1), calcium (73.20 - 640.00.mgl-1) and magnesium (187.70- 859.20mgl-1) recorded increased values in the dry than wet season. On the other hand chemical oxygen demand, biological oxygen demand, total suspended solids (23.00 - 402.00mgl-1), nitrate (0.68 – 18.80mgl-1), phosphate (0.11 – 7.90mg), Values for chlorophyll *a* were higher in the dry than wet season for the lagoon. Positive correlation coefficient was recorded between chlorophyll *a* and salinity. Four major classes in this study, (Crustacea, Insecta, Gastropoda and Polycheate) and eight taxa were identified from a total of 175 individuals collected from the five stations. The most abundant organism found in all stations was species of *Exocirolana sp. Penaeus sp* and *Littorina sp.* Were also abundant but their occurrence was affected by seasonal variation. *Nereis sp*. was the only polychaete recorded throughout the study.
Key words: *Physicochemistry, phytomacrofauna, Eichhornia crassipes, tidal creek*

INTRODUCTION AND LITERATURE REVIEW

Creeks and Lagoons are common hydrological features of South-Western Nigeria and form part of the numerous ecological niches associated with the Nigerian coastal environment (1). Benthic macro-invertebrates offer advantages in biomonitoring which explains their popularity. Some of these are intrinsic to the bioassay of the animals. Physical and chemical factors such as temperature, turbidity, light intensity, pH, and Dissolved ions among others are reported by several workers (2, 3). Earlier studies have also shown that organic waste dump caused environmental stress in coastal waters which resulted to low landing of some important fisheries (4; 5; 6). Several studies in Nigeria had identified anthropogenic activities as easy source of water pollution (7, 8, and 9). The role of aquatic macrophytes in the structure and function of aquatic system has long been recognized (10, 11), and numerous studies support the claim that shifts in the species composition of macrophyte communities will likely have significant effects on the community structure, biomass and density of phytophilous macroinvertebrates (12).

The ecology of aquatic systems is bound to change with the overwhelming preponderance of alien species like the water hyacinth. This study is aimed at checking physico-chemical parameters and phytomacrofauna communities associated with roots of water hyacinth (*Eichhornia crassipes*) in a tidal creek in south-western Nigeria.

MATERIALS AND METHODS

DESCRIPTION OF STUDY AREA

The Abule-Eledu creek, situated within the University of Lagos (Brackish water creek) forms part of the many sluggish tidal creeks that drain into the Lagos lagoon. The creek is shallow (≤1m), tidal and sheltered. It is fed by water from the adjoining Lagos lagoon at high tide, and at low tide the water ebbs into the lagoon.

Its harbors many aquatic macrophytes which at certain times of the year completely cover the water surface and affect navigation of canoe. The creek meanders through a riparian mangrove swamp which is inundated at high tide and partially exposed at low tide. Notable riparian flora of the creek includes *Paspalum orbiquilare, Eichhornia crassipes, Acrotiscum aureum, Phoenix reclinata ,Rhizophora racemosa, Avicenia nitida,*. Notable fauna includes *Balanus pallidus, uca tangeri, Seserma huzardi,* and *Tympanotomus fuscatus*. The creek is located in south-western Nigeria and hence exposed to two distinct seasons, the wet (May-October) and dry season (November-April) (13) and this season has effect on the availability of macrophytes.

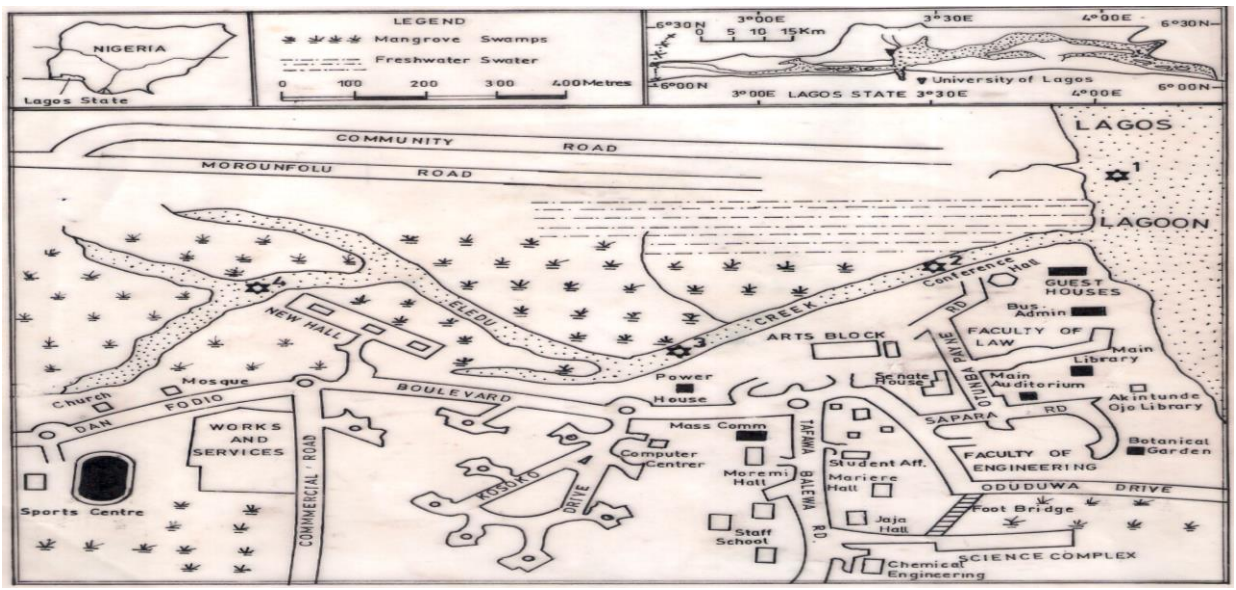


Figure 1: Map of Abule-Eledu creek (Lagos lagoon) showing the Sampling stations

Sampling protocol

Sampling for environmental quality parameters and benthic phytomacrofauna were carried out in twelve sites between 10:00 and 15:00 hrs on each sampling day at monthly intervals between January, 2011 and June, 2011, covering parts of the rainy and dry seasons.

In situ measurements and collection of samples

In situ measurements of surface water temperature (0C), pH and electrical conductivity (µS/cm) were carried out using battery operated Horiba U10 Water Quality Checker Model. Transparency was determined using a 20 cm diameter Secchi disk painted black and white. Water samples for the determination of dissolved oxygen (DO) and biochemical oxygen demand (BOD) were collected in transparent and amber coloured 250ml reagent bottles. The samples for DO were fixed on the field with 1ml each of Winkler's solutions A (Manganese sulphate) and B (Sodium hydroxide and sodium hydroxide). Water samples for the analysis of Biochemical Oxygen Demand (BOD) were collected with 250 ml prewashed amber coloured reagent bottles. The water sample in the transparent bottle was fixed with 1ml each of Winkler's solutions A and B, while the water samples in the amber coloured bottle were taken to the laboratory and incubated for 5 days at 200C (14) . Samples for the analysis of other physico-chemical properties of water were taken below the water hyacinth canopy in each sampling sites before organisms were sampled in order to avoid sampling disturbance of water quality.

Phytomacrofauna samples were collected within water hyacinth canopy by placing a 0.1m2 quadrant over stands of the plant, the roots of water hyacinth stands enclosed in the quadrant were carefully placed in a bowl containing 10% formalin solution (this facilitates removal of attached organism). The plants were then vigorously shaken to detach all the animals inhabiting the roots into the bowl. Detached animals were then washed into a screw cap plastic container through a 0.5mm mesh size sieve. The remaining animals were handpicked into the plastic container. The samples were fixed in 10% formalin solution and taken to the laboratory.

Sample analyses

In the laboratory, macroinvertebrate samples were washed to remove the fixative and sorted under a dissecting microscope. Specimens of macroinvertebrates were identified to the lowest possible taxonomic level using the available keys of (15, 16, and 17).

RESULTS

Physical and Chemical Parameters: The results of physical and chemical parameters of water samples from the four stations in the Abule-Eledu creek of Lagos lagoon are presented in Table 1.

	Station 1			**Station 2**			**Station 3**			**Station 4**		
	MEAN ± SD	**MIN**	**MAX**	**MEAN ±SD**	**MIN**	**MAX**	**MEAN ±SD**	**MIN**	**MAX**	**MEAN ±SD**	**MIN**	**MAX**
Parameter												
Air temperature (°C)	28.66 ± 2.50	24	31	28.5 ±2.56	24.5	32	28.66±1.59	26	31	30.33 ±2.42	28	34
Water temperature (°C)	28.66 ±1.03	28	30	27.91 ±2.90	23	31.5	27.53 ±3.20	22	32	29.08 ±1.56	27.5	32
Total suspended solid (mg/L)	93.16± 100.99	24	296	68.83 ±35.45	28	132	162.16 ±1.13	23	330	196.66 ±117.42	70	402
Total dissolved solid (mg/L)	16108.83 ± 5158.03	8855	22500	16499.17 ±4174.54	8441	20480	14908.67 ±2819.76	9644	17090	15289.83 ±4691.74	8329	22620
Rainfall (mm)	137.33 ± 132.78	0	317.4	137.33 ±145.46	0	317.4	137.33 ±145.46	0	317.4	137.33 ±145.46	0	317.4
pH @ 25°C	7.63 ±0.26	7.22	7.87	7.56 ±0.28	7.14	7.88	7.68 ±0.25	7.32	7.95	7.63 ±0.31	7.2	7.97
Salinity (‰)	14.13 ±4.72	8.3	19.62	14.88 ±3.97	7.2	18.4	7358.33 ±2.65	8.15	15.2	13.54 ±4.08	7.05	19.81
Chloride (mg/L)	7674.26 ±2450.2	4597.9	9999.9	8071.1 ±2178.50	8700	9989.9	7358.33 ±4605.91	4515.1	8266.1	7484.5 ±2173.78	3905.8	10556.6
Conductivity (µS/cm)	24910.83 ±7919.98	14865	31700	26146.17 ±6858.30	12770	30200	23448.33 ±4605.91	14590	8266.1	24000.83 ±7065.05	12600	34800
Acidity (mg/L)	5.93 ±1.70	4.1	8.6	6.75 ±3.10	4.3	12.1	7.08 ±2.70	4.9	12.1	7.21 ±2.62	4.5	11.2
Alkalinity (mg/L)	80.36 ±46.45	13.3	113.4	89.21 ±51.49	22.6	126.2	92.18 ±61.50	15	152.2	97.51 ±54.009	19.9	141.2
Total Hardness (mg/L)	3159.95 ±707.87	2994.4	3593.2	3101.5 ±1168.04	3117	5000.1	2904.9 ±763.44	1482	3672.8	2964.85 ± 962.34	1211.4	3930
Dissolved oxygen demand (mg/L)	3.41 ±1.67	0.2	4.7	4.15±0.58	3.1	4.6	3.95 ±1.39	1.2	4.9	3.26 ± 1.83	0.1	4.6

Biochemical oxygen demand (mg/L)	24.66 ±36.24	4	97	21.66 ±31.9	3	86	19.16 ±19.91	3	47	26 ±23.03	3	56
Chemical oxygen demand (mg/L)	225.33 ±399.97	10	1034	185.33 ±351.51	9	902	70.83 ±58.02	11	167	3592.046 ±65.36	9	163
Calcium (mg/L)	255.78 ±157.24	111.5	550.4	276.28 ±207.055	108.3	400.1	265.81 ±189.86	78.1	582.3	252.06 ± 187.49	73.2	400
Magnesium (mg/L)	610.31 ±159.97	358.8	859.2	573.4 ±202.42	211	809.5	538.1 ±149.92	243.9	651.7	501.01 ±168.02	187.7	635.7
Nitrate (mg/L)	8.03 ±5.01	0.68	13.4	7.44 ±6.25	0.82	18.2	6.60 ±4.53	1.04	10.1	6.94 ±6.71	187.7	635.7
Phosphate (mg/L)	2.103 ±2.26	0.26	0.48	2.12 ±3.24	0.26	7.9	1.27 ±1.79	1.27	0.31	1.56 ±1.73	0.48	4.8
Sulphate (mg/L)	1121.71 ±760.21	7.7	2400.9	1182.783 ±882.07	3.8	2750.2	1151.4 ±861.63	4.4	2677.3	1158.8 ± 877.47	6	2720.2
Silica (mg/L	3.166 ±0.17	2.9	3.4	3.01 ±0.24	2.6	3.3	2.82 ±0.52	2.1	3.4	3.36 ±0.33	3.1	3.9

AIR TEMPERATURE (ºC)

The air temperature observed at the sampling point showed minimal variations. The maximum and minimum air temperatures for the stations were 24 and 34ºC respectively. The mean air temperature for the sampling period was 29.065ºC while the standard deviation was ±2.348.

SURFACE WATER TEMPERATURE (ºC)

The surface water temperature ranged between 27.2 and 34 ºC. The maximum temperature was recorded in June while the minimum temperature was recorded in the January; the mean surface temperature for the sampling period was 28ºC while the standard deviation was ±2.2837.

RAINFALL (mm)

The rainfall values ranges between 0 and 317.4 (mm). The lowest rainfall occurred in January (0 mm) while the highest rainfall occurred in May (317.4 mm). The mean value for the sampling period was 128.0 mm while the standard deviation was ±122.5.

DEPTH (m)

The value of depth was recorded throughout six month duration of this study. Most of which were less than 1m.

CONDUCTIVITY (μScm^{-1})

Conductivity was recorded for all stations throughout the study period. Station 4 recorded the highest conductivity value from January to June while Station 1 had the lowest value in January.

TOTAL SUSPENDED SOLIDS (TSS) (mg/l)

Total Suspended Solids (TSS) ranged from 23 to 402mg/L. The highest value was obtained in station 4 in the month of March while the lowest value occurred in station 3 in the month of May. The month of May recorded the lowest set of values but with sharp rise in station 4.

TOTAL DISSOLVED SOLIDS (mg/l)

Monthly variation of total dissolved solids (TDS) ranged from 8329 to 22620mg/L. The highest value was recorded in station 1 in the month of January (22620mg/L) while the lowest values were recorded in the month of May (8329mg/L).

ANALYSIS OF CHEMICAL PARAMETERS

SALINITY (‰)

Salinity ranged widely throughout the period of investigation with highest value recorded in the month of February (19.81‰) in station 4 and lowest value in month of June (7.05‰) in station 1. Low values were recorded in June due to freshwater incursion from rainfall, while high values were recorded mainly in February and April. The mean salinity value for the sampling duration was 13.94292‰ while the standard deviation was ±3.723432

ACIDITY (mg/L)

Acidity was relatively low throughout this investigation. The highest value (12.1 mg/L) was recorded in station 3 in the month of April while the lowest (4.1 mg/L) was recorded in June in station 1. The mean acidity value for the sampling duration was 6.7458‰ while the standard deviation was ±2.2657

ALKALINITY (mg/L)

The alkalinity fluctuation was quite irregular in all stations throughout the study period. There was a sharp temporal increase in alkalinity from the months of March to May and the highest value (152.2

mg/L) was recorded in station 3 in April and the lowest value (13.3 mg/L) was also recorded in station1 in the month of January. The mean alkalinity value for the sampling duration was 80.8478 while the standard deviation was ±48.989

TOTAL HARDNESS (mg/L)

The total hardness ranged from 1211.4 to 5000.0mg/L for the six months period of investigation. The highest value was recorded in May (5000.0mg/L) while the lowest value occurred in January with the value of 1211.4 mg/L.

CALCIUM (mg/L)

The calcium level ranged from 73.2 to 640.0 mg/L. The highest (640.0) value was recorded in station 4 in the month of May while the lowest value occurred in April. The highest sets of values were recorded in month of May. The mean calcium value for the sampling duration was 264.48 while the standard deviation was ±173.972

MAGNESIUM (mg/L)

The magnesium level ranged from 187.7 to 859.2mg/L. The highest (859.2mg/L) value was recorded in the month of February in station 1 while the lowest value occurred in January (187.7) in station 4. The mean Magnesium value for the sampling duration was 555.708 while the standard deviation was ±164.970

NITRATE (mg/L)

The values of nitrate recorded ranged from 0.68 to 13.4 mg/L with the maximum value (13.4 mg/L) recorded in May while the minimum value (0.68 mg/L) was recorded in January. The mean nitrate value for the sampling duration was 7.2583 while the standard deviation was ±5.3438

SULPHATE (mg/L)

The Sulphate values recorded fluctuated between the lowest value (3.8 mg/L) recorded in the month of January at station 2 while the highest value (mg/L) was observed in May, at station 2. The mean sulphate value for the sampling duration was 1153.675 while the standard deviation was ±789.9688

PHOSPHATE (mg/L)

The values of phosphates recorded ranged from 0.26 to 2.17 mg/L The highest value (2.17 mg/L) of phosphate recorded occurred at station 4 in January but the lowest value was recorded at station 1 in February (0.26). The mean phosphate value for the sampling duration was 0.9 while the standard deviation was ±0.424

SILICA (mg/L)

The silica (S_iO_2) values ranged from 2.1 to 3.9mg/L. The highest value (3.9) was obtained at station 4 in month of June while the lowest value occurred in February (2.1) at station 3. The mean silica value for the sampling duration was 3.104 while the standard deviation was ±0.0368

BIOCHEMICAL OXYGEN DEMAND (BOD) (mg/L)

The highest value of the biochemical oxygen demand was recorded in January with 97mg/L and the lowest value was 3mg/L in February. The mean BOD value for the sampling duration was 22.875 while the standard deviation was ±26.776

CHEMICAL OXYGEN DEMAND (COD) (mg/L)

The chemical oxygen demand values ranged from 9 to 1034mg/L. The highest value was obtained in January while the lowest value occurred in February. The mean COD value for the sampling duration was 146.9583 while the standard deviation was ±259.2849

DISSOLVE OXYGEN (mg/L)

The level of dissolve oxygen fluctuated throughout the period of study ranging between 0.1 to 4.9. The month of February recorded the highest value (4.9) in station 3 while the lowest (0.1) was recorded in station 4. The mean DO value for the sampling duration was 3.6958 while the standard deviation was ±1.406.

CHLOROPHYLL *a* (µg/L)

Chlorophyll *a* concentration ranged from 8.8µg/L recorded in February to 18mg/L recorded in March. The mean chlorophyll value for the sampling duration was 10.8 while the standard deviation was ±2.82.

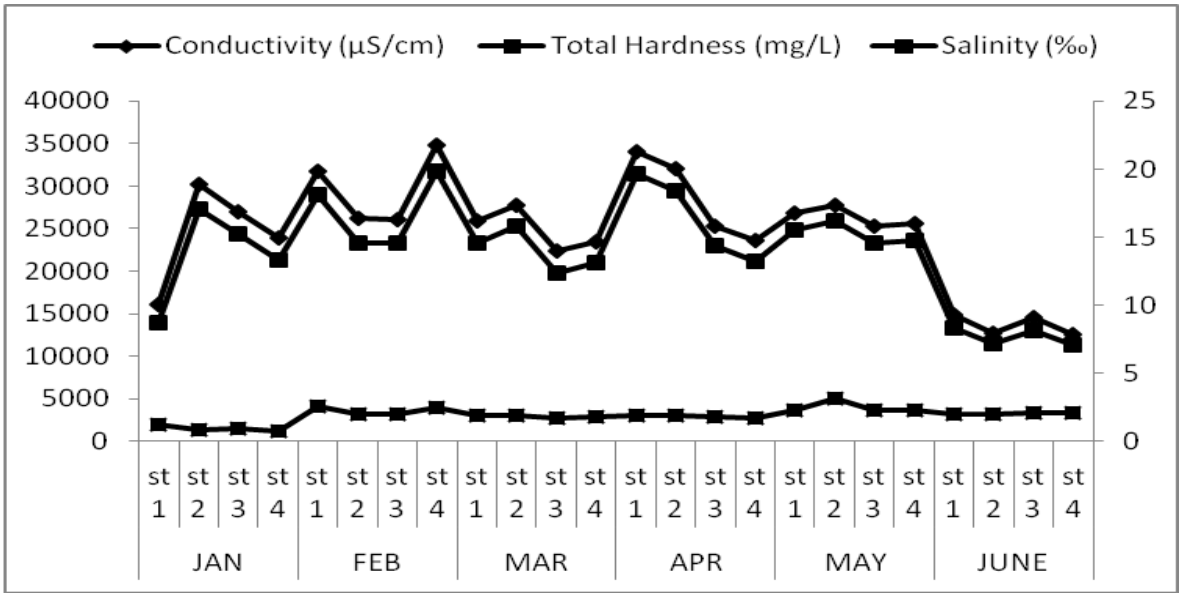


Fig 2: Monthly variation in Conductivity, Total Hardness, and Salinity at the Abule -Eledu creek (January 2023- June 2023)

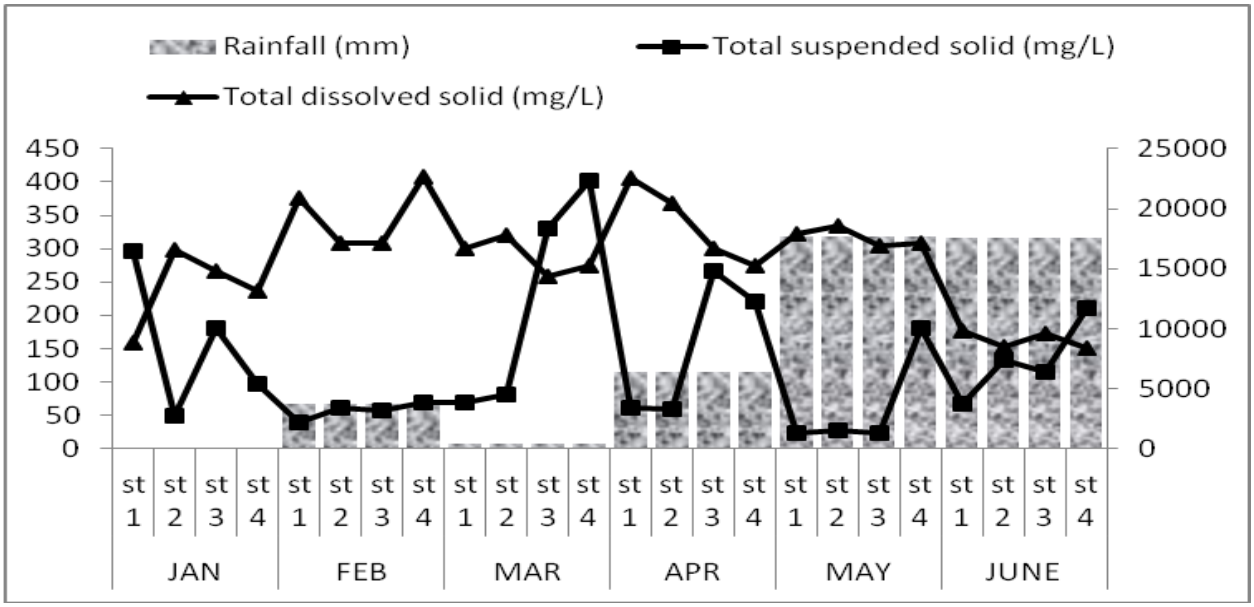


Fig 3: Monthly variation in Rainfall, Total suspended solid, Total dissolved solid at the Abule -Eledu creek (January 2023- June 2023

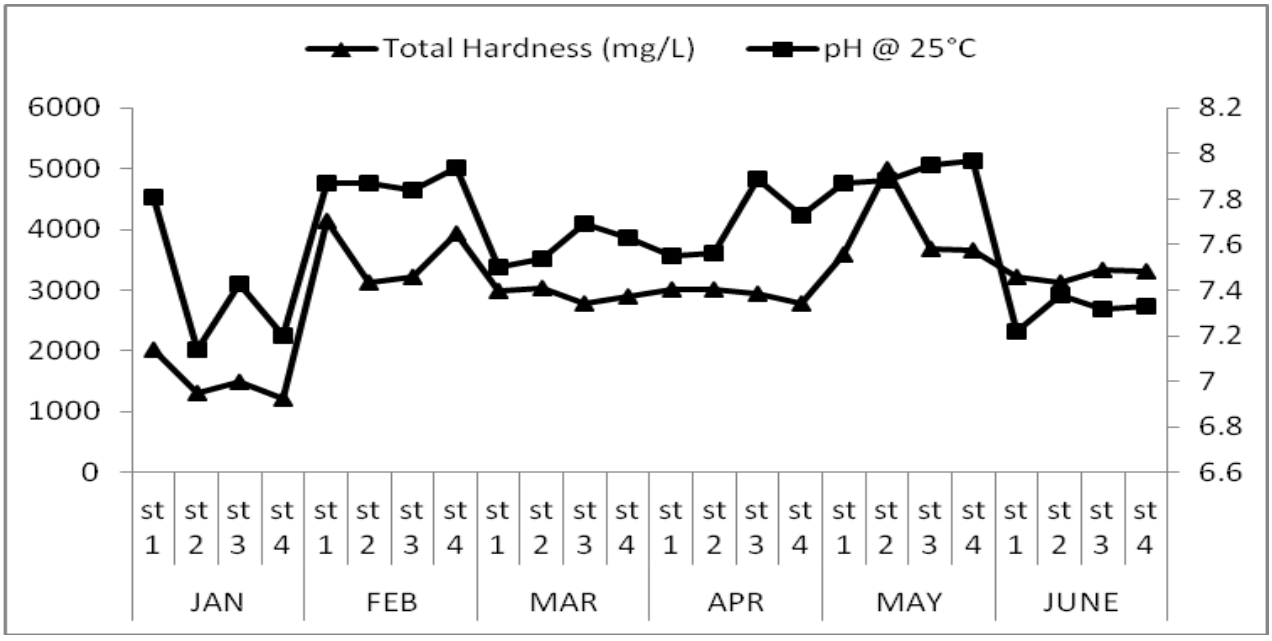


Fig 4: Monthly variation in Total hardness and pH at the Abule -Eledu creek (January 2023- June 2023)

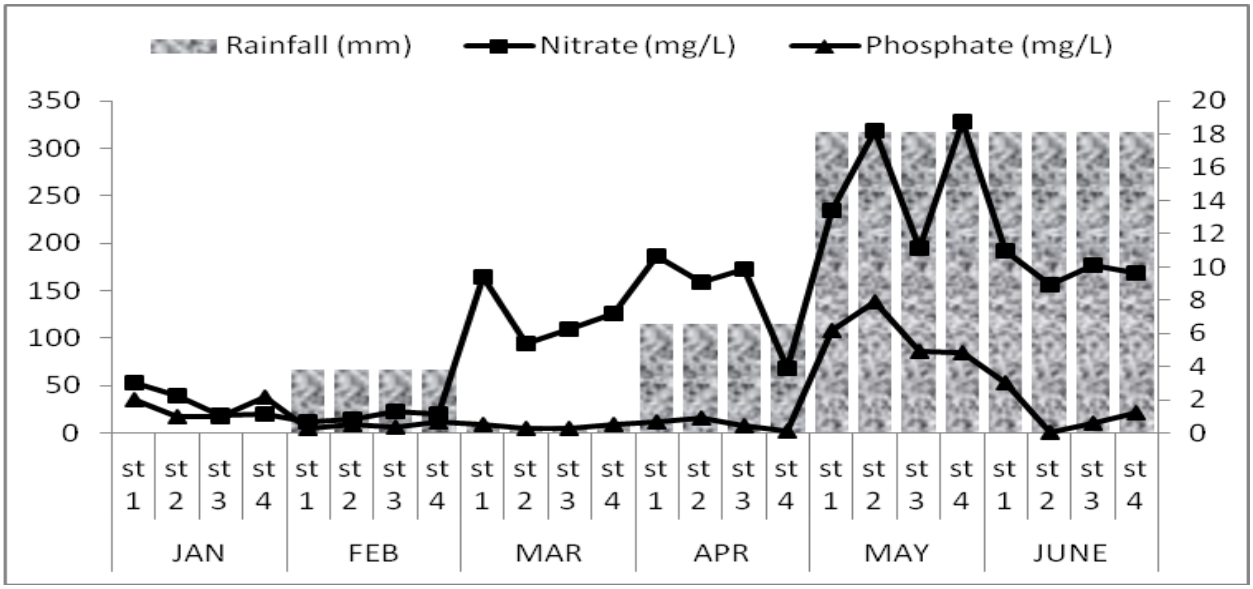


Fig 5: Monthly variation in Rainfall, Nitrate and Phosphate at the Abule -Eledu creek (January 2023- June 2023)

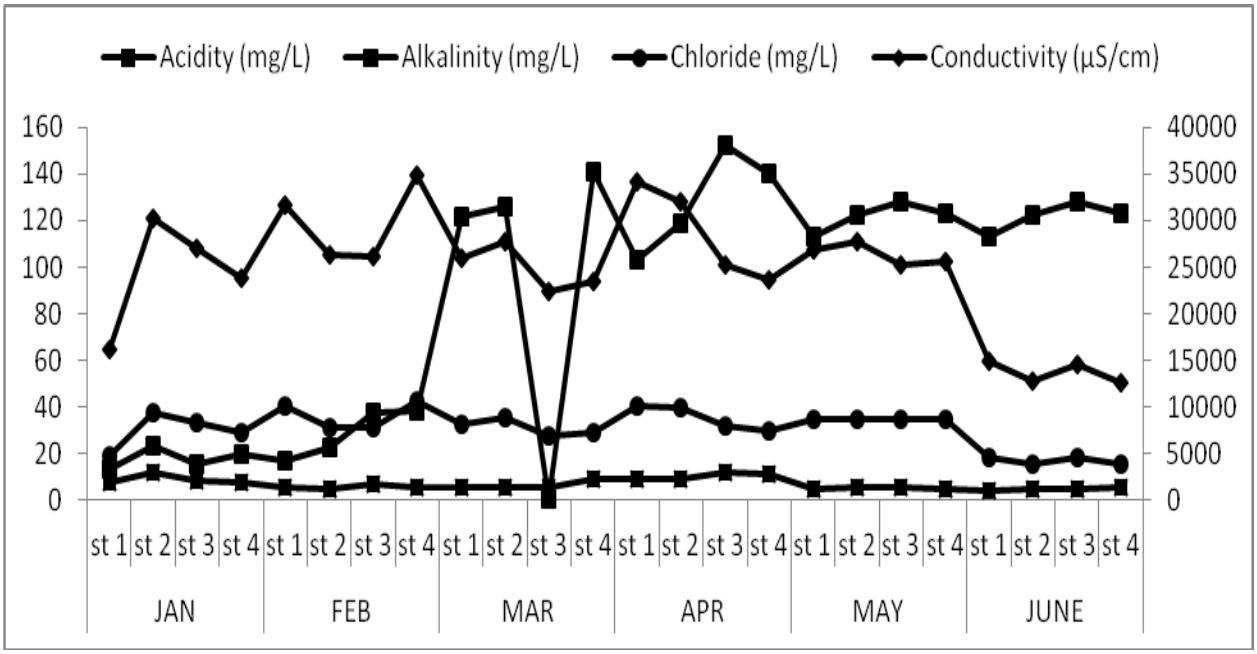


Fig 6: Monthly variation in Acidity, Alkalinity, Chloride and Conductivity at the Abule -Eledu creek (January 2023- June 2023)

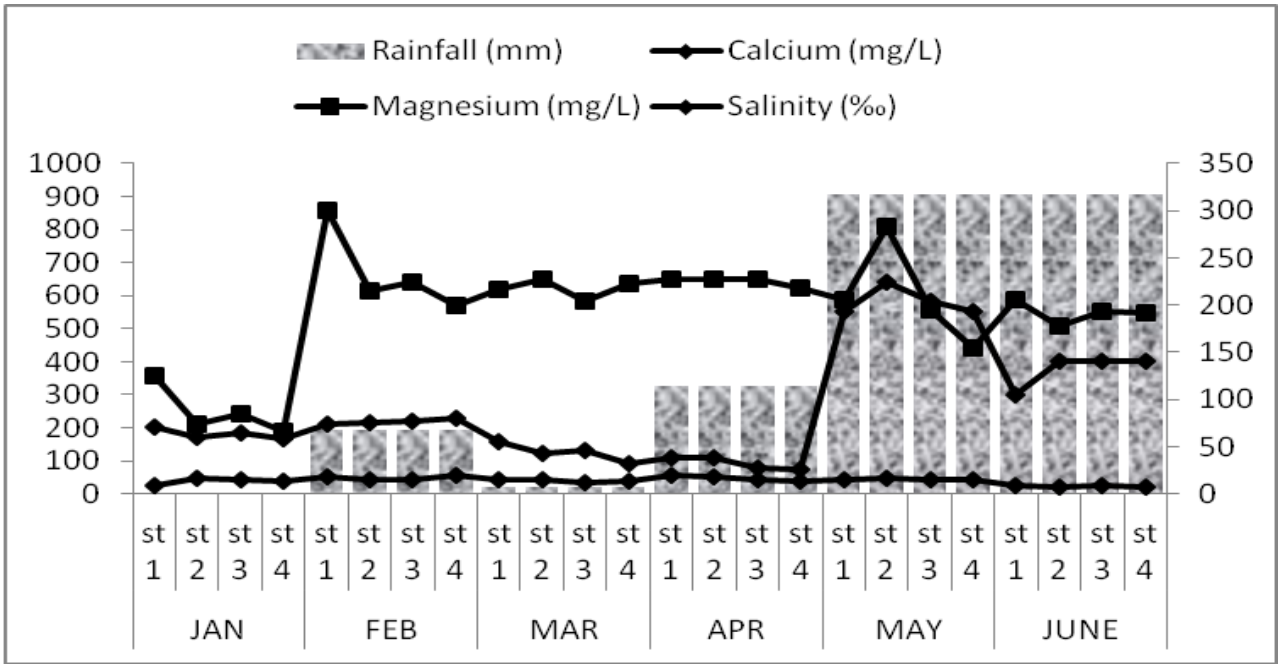


Fig 7: Monthly variation in Rainfall, Magnesium, Calcium and Salinity at the Abule -Eledu creek (January 2023- June 2023)

COMMUNITY STRUCTURE OF BENTHIC PHYTOMACROFAUNA

Phytpmacrofauna infaunal were collected at the study stations monthly within the Abule-Eledu creek (Lagos lagoon area) in south western part of Nigeria. A total of 175 individuals were obtained throughout the study period. They belong to three phyla: Mollusca, Arthropoda and Annelida and three classes: Crustacea, Insecta, Gastropoda and Polychaeta. Four species Crustacea were collected namely *Seserma sp, Nymphula sp*, *penaeus*, *Exocirolana* and while Insecta was reperesented by *Belostoma sp.* Two species of Gastropoda were collected namely *Turritella sp.*and *Littorina sp.* one species of polychaeta namely *Nereis sp.* Ecological indices were computed and the results shown in Table 4 with the number and classification of the fauna collected. The most abundant organism found in all stations was species of *Exocirolana sp.*

TABLE 1: OVERALL PERCENTAGE COMPOSITION

PHYLUM	NO OF INDIVIDUALS	CLASSES	FAMILIES	TOTAL NO OF INDIVIDUALS	OVERALL COMPOSITION
ARTHROPODA	138	2	4	175	79%
MOLLUSCA	30	1	2	175	17%
ANNELIDA	7	1	1	175	4%

DISCUSSION

The laboratory result and values of water quality parameters reported in this investigation are obvious reflection of a degraded aquatic system, and these have direct influence on the structure of the benthic phytomacrofauna.

The water chemistry of an aquatic ecosystem is dependent on the physical and geological features of its drainage basin (18, 19). The present information on the seasonality of hydrological characteristics of this tidal creek confirms earlier observations similarly observed in the adjoining Lagos lagoon. The regime of ecological factors operating in the Lagos lagoon has been documented by several investigators over the years (20; 21; 22, 23; 24). Further to this higher salinity in the dry season in the Lagos lagoon has been associated to increased tidal seawater incursion, coupled with reduced flood, water inflow from associated rivers, creeks and freshwater lagoons. The interstation comparison of parameters using Anova test indicated that water level, flow velocity, transparency and dissolved oxygen were significantly different ($P<0.05$).

Air temperature varied between 24-34 (29.065±2.348) °C and water temperature ranged from 27.2-32(28.3±2.2837) °C, these values were within the acceptable levels for survival, metabolism and physiology. Water temperature has some positive and negative effects on plant growth. The most suitable water temperature for plant growth is 20-35°C, Temperature over 30°C can cause regression in growth and decay in plants (25).

The rainfall recorded in this study was 7.8-317.4mm (135.64±137.33) mm. Water level of an aquatic ecosystem is usually influenced by the rainfall pattern of the drainage basin (25). The highest water level was recorded during the rainy month of June. Rainfall greatly affects the dynamics of the environments, transports nutrients and allochthonous materials and alters the water's visual, physical and chemical characteristics. Rainfall regimen according to (27) in shallow systems is a major activity which affects the concentration and distribution of inorganic and dissolved nutrients, heat throughout the water column and suspended materials and consequently, transparency and depth. Rainfall and salinity are known to be the more important ecological factors influencing the environmental characteristics of Nigerian coastal waters. For instance (20, 21 23 and 28) reported the importance of rainfall and salinity in determining biota in Lagos lagoon and adjacent creeks.

The surface water pH values in the Abule-Eledu creek move from neutral to alkaline in all the months this alkaline pH may be due to the buffering effects of the seawater. The pH values of between 7.14 and 7.97 (7.629± 0.265) recorded in the study fell within ranges reported for rivers flowing through areas with thick vegetation (29, 30). The highest pH value of 7.97 mg/L was recorded for station 2 while the least value of 7.14 mg/L was also recorded for station 4. This pH range (7.14-7.97) was similar to those reported earlier for Lagos lagoon. (31) recorded a very similar pH range (7.2-8.2) at an adjacent creek to the Lagos lagoon. There was no significant difference in the pH values at the study stations. pH has direct or indirect effects on photosynthesis and growth of water plants. (32) observed that organic acids resulting from decaying vegetation might be responsible for the low pH in most aquatic ecosystems.

Our drinking water pH level varies between 6.5 and 9.5. The safest pH level of drinking water would be 7 which is the pH level of pure water. Based on this, water from the mangrove swamps of Lagos lagoon is not suitable for drinking.

Alkalinity values ranged from a minimum of 13.3 to a maximum of 152.2 mg/L (80.84 ± 48.98mg/L). The highest alkalinity value of mg/L was recorded for station 3 (April) while the least value of 13.3mgkg^{-1} was also recorded for station 1 (January). Concentrations less than 100 ppm are desirable for domestic water supplies. The recommended range for drinking water is 30 to 400 ppm. A minimum level of alkalinity is desirable because it is considered a "buffer" that prevents large variations in pH.

Alkalinity is not detrimental to humans. Moderately alkaline water (less than 350 mg/L); in combination with hardness, forms a layer of calcium or magnesium carbonate that tends to inhibit corrosion of metal piping. High alkalinity (above 500 mg/l) is usually associated with high pH values, hardness and high dissolved solids Water with low alkalinity (less than 75 mg/l), especially some surface waters and rainfall, is subject to changes in pH due to dissolved gasses that may be corrosive to metallic fittings. (33) recommended suitability of alkalinities between 20 and 50 mg/l for plankton production for fish culture. Total acidity values of 4.1-12.1(6.745 ± 2.465 mg/l). The highest acidity value of 12.1 mg/l was recorded for stations 2(January) and 3 (April) while the least value of 4.1 mg/l was also recorded for station 1 (January).

Acidity and alkalinity are related to pH, they should not be confused with pH, nor should the terms be used interchangeably. Acidity is a measure of a solution's capacity to react with a strong base (usually sodium hydroxide, NaOH) to a predetermined pH value. Alkalinity is the measure of a solution's capacity to react with a strong acid (usually sulphuric acid HSO) to a predetermined pH. The highest pH value of 402 mg/l was recorded for station 4 while the least value of 23 mg/l was also recorded for station 4

In this study the Total suspended solids (TSS) ranged from 23 to 402, the overall mean was (130.208 ± 106.5886 mg/l).. TSS is solid materials, including organic and inorganic, that are suspended in the water. These would include silt, plankton and industrial wastes. Source of total suspended solids include erosion from urban runoff and agricultural land, industrial wastes, bank erosion, bottom feeders, algae growth or wastewater discharges. The combination of warmer water, less light and less oxygen makes it impossible for some forms of life to exist. Suspended solids clog fish gills, reduce growth rates, decrease resistance to disease and prevent egg and larval development. Particles that settle as well as suffocate newly-hatched larvae. (34).

Total dissolved solids (TDS) varied between 8329 and 22620(mean 15701.63 ± 4202.408 mg/l). The highest pH value of 22620 mg/l was recorded for station 4 (February) while the least value of 8329 mg/l was also recorded for station 4 (June). The EPA Secondary Regulations advise a maximum contamination level (MCL) of 500mg/liter for TDS. When TDS levels exceed 1000mg/L it is generally considered unfit for human consumption. Water can be classified according to (35) by the amount of TDS per litre: fresh water < 1500 mg/L TDS, brackish water 1500 to 5000 mg/L TDS and

saline water > 5000 mg/L TDS. This is an indication that water in the mangrove swamps can switch between fresh and brackish waters.
A high level of TDS is an indicator of potential concerns and warrants further investigation. Most often, high levels of TDS are caused by the presence of potassium, chlorides and sodium. These ions have little or no short-term effects, but toxic ions (lead arsenic, cadmium, nitrate and others) may also be dissolved in the water. High TDS results in undesirable taste which could be salty, bitter, or metallic. It could also indicate the presence of toxic minerals. Some dissolved solids come from organic sources such as leaves, silt, plankton and industrial waste and sewage. Salinity regimes in the Lagos lagoon have been related to rainfall distribution.

According to (36),(23), salinity is an environmental barrier in the distribution of biota. Salinities 7.05-19.81 (13.942 ± 3.723‰) observed in this study were slightly brackish and fell within the range reported by (37 and 38). Higher salinities were recorded across the stations during the dry months (December -April) than wet months (May and June) this may be due to dilution of the water by the increase freshwater input during these wet months. This was in agreement with reports of (38) on the adjacent Ogbe creek that drains Lagos lagoon. Nutrients concentrations recorded were high especially sulphates. The high levels of nitrate-nitrogen and sulphide may be due to the effect of direct discharges of pollutants and other biodegradable wastes into the coastal waters coupled with the enrichment of adjoining wetlands, creek and subsequent run-offs for the coastal water of south-western Nigeria.

Similarly, (39) reported that the continuous activities of bacteria led to the release of nutrients into the water. The Dissolved oxygen values of 0.1 to 4.9 (3.695 ± 1.406mg/L) in this study and all the values fell within the 0.1–10 mg/l range for which slight adverse health effects can be expected in children and sensitive individuals (40,41). The low dissolved oxygen recorded in station 1 of the study area was as a result of its depletion by the micro-organisms in the sewage and other domestic wastes in station 1.
Sensitive phytomacrofauna species can be negatively impacted (42), and at Dissolved oxygen levels below 2.5 mg/L most aquatic organisms are negatively impacted (43). The generally low level of dissolved oxygen and high BOD recorded at the sampling stations indicated deteriorating water quality and probably resulted from the deposition and decomposition of organic waste from domestic sources at the study stations. (44) stated that high load of biodegradable wastes was the major cause of low dissolved oxygen.

The highest BOD value of 97 was recorded for station 1 (January) while the least value of 3 was also recorded for stations 2and 4(February). The high levels of BOD (3 – 97 mg/L) observed in this study is similar to the values (4.0 – 114 mg/L) reported for Epe lagoon (45) which is also infested with water hyacinth and also similar to values (12.0 – 259 mg/L) recorded for water courses receiving industrial and domestic wastes in Lagos state by (46). The elevated levels of BOD may be connected with the decomposition of detrital materials from dead and senescing water hyacinth parts common in water hyacinth infested aquatic systems. The generally low density of phytomacrofauna observed in this study is consistent with those of (37) and (38), who reported a poor representation of macroinvertebrates associated with the roots of *Eichorrnia crassipes* in similar environment.

Dissolved oxygen is an important characteristic of macrophyte beds that can alter nutrient cycling and the quality of beds as habitats for invertebrates (42, 45).

Fluctuations in the conductivity of water at the study stations were similar with slight spatial differences. Elevated values (> 100 μScm-1) were recorded at all four stations. Conductivity is the measure of the total ionic composition of water and in fact a good indicator of its overall chemical richness. The usual pattern in which conductivity rises during the dry season and falls during the wet season (47) was pronounced in this study. The principal sources are sewage, agricultural run-off, intensive stock rearing, industrial discharges and atmospheric inputs (46).

Although phosphate-phosphorus usually occurs in small amount in aquatic ecosystems (48) but the values reported in this study were high especially at station 2(may) compared to those reported for most Nigerian water bodies (49). The contribution from domestic effluents rich in detergents and other organic pollutants was responsible for the elevated values. The calcium content of the Abule-Eledu creek at the study stations was higher (mean >70 mgl-1) than those of many African waters in general (50) and Nigerian rivers in particular (51). While magnesium which varied between 187.7 to 859.2 (555.7083 ± 164.9705) throughout the duration of study and was relatively high and increased with the dry season.

The mean nitrate-N concentrations were significantly different ($P < 0.05$) among the stations. The high level in the creeks was likely due mainly to the leaching of allochthonous leaf litter that covers the bottom sediment at the creeks in addition to the contribution from human waste deposited directly into the creeks. Nitrate depletion by seasonal macrophytic blooms (52) maybe responsible for the low levels in the main channel.

Three major phytomacrofauna phyla were recorded in this study, which includes Arthropods, Molluscs and Annelids. Arthropods were the most abundant; they contributed 138 individuals, constituting 79% of the total population of phytomacrofauna. The taxa recorded in this study is lower than that reported by (37) for phytomacrofauna arthropod community in the same lagoon and for phytomacrofauna communities in a non – tidal creek in south-western Nigeria, respectively, and that recorded by (53). Phytpmacrofauna infaunal were collected at the study stations monthly within the Abule-Eledu creek (Lagos lagoon area) in south western part of Nigeria. A total of 175 individuals were obtained throughout the study period. They belong to three phyla: Mollusca, Arthropoda and Annelida and three classes: Crustacea, Insecta, Gastropoda and Polychaeta. Four species Crustacea were collected namely *Seserma sp, Nymphula sp*, *penaeus*, *Exocirolana* and while Insecta was reperesented by *Belostoma sp.* Two species of Gastropoda were collected namely *Turritella sp.*and *Littorina sp.* one species of polychaeta namely *Nereis sp.*. *Exocirolana sp, Penaeus sp* and *Littorina sp.* were more abundant species but their occurrence was affected by seasonal variation *Nereis sp.* was the only polychaete recorded

At all stations, arthropods, were the most abundant phyla associated with the roots of water hyacinth in the study stretch. This is an indication that the plant is either being used as habitat for epibenthic macroinvertebrates, (54, 55), Some of the dominant molluscs encountered during the study are endemic to West Africa and the total numbers of individuals are characteristic of plant morphology. Water hyacinth is a very good habitat for Molluscs, (56) and accounted for the observed population in the hyacinth mat. A class of annelids was recorded which confirms that the physical and chemical qualities of water and the immediate substrate for attachment, anthropogenic activities and food availability could have acted as important factors affecting the abundance of macrobenthic invertebrates, (57).

CONCLUSION

In conclusion, the study of water quality properties in terms of its physico-chemical parameters and phytomacrofauna communities associated with roots of water hyacinth from the tidal creek in south-western nigeria were assessed. Values and results recorded showed that the water was polluted and has effects on phytomacrofauna communities. This study was an additional data and information to already existed reviews on some Nigerian waters with high pollution rate and contaminants. The findings will assist our relevant agencies and also serve as guide for further investigation.

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