Original Research Article

ASSESSMENT OF SOME HEAVY METALS AND PHYSICO-CHEMICAL PARAMETERS OF SURFACE WATER OF MATARA-UKU WETLANDS

ABSTRACT

The study assessed the levels of Nitrogen, Phosphorous and some heavy metals in Matara-Uku wetland. Twenty water samples were collected from surface water of Matara-Uku using polyethene plastic container, the physicochemical parameters of the samples were measured and the samples were analyzed for Nitrogen, Phosphorous and heavy metals. Results from physicochemical analysis are obtained as; pH (7.6 – 8.0), total dissolve solid (70.82 - 84.26mg/l), electric conductivity (105.0 – 163.0 µs/cm) and temperature (24.4 – 25.4 ºC). All the results are in line with World Health Organization standard of 6.5-8.5, <600mg/l, 400µs/cm and ambient temperature respectively. The Nitrogen and phosphorous were analyzed using UV- Visible spectrophotometer. From the results, it was found that all the samples had Nitrogen level below the World Health Organization maximum contaminant level of 10mg/L with a mean concentration range (0.2293±0.0057)mg/L to (2.2455±0.0216)mg/L. Phosphorus was also analyzed and the results indicated that all the sampling sites had phosphorus level above the WHO maximum contaminant level of 0.03 mg/L with a mean concentration range (3.8208±0.4109)mg/L to (4.56±0.1325)mg/L. The water samples were digested using concentrated HCl and HNO_3, in which the digested samples were used for heavy metals analysis using Atomic Absorption Spectrophotometer (AAS). The mean concentrations of the heavy metals analyzed were between the ranges Pb (0.1272±0.0445)mg/L to (0.2727±0.1285)mg/L, Cd (0.0026±0.0024)mg/L to (0.0053±0.0054)mg/L and Ni (0.0705±0.0235)mg/L to (0.1411±0.0819)mg/L respectively. Concentrations of Cd and Ni are generally below the maximum permissible limit of 0.03 mg/L and 0.2 mg/L, whereas concentrations of Pb exceeded the maximum permissible limit of 0.01mg/L for surface water. It was concluded that the surface water of Matara-Uku is polluted with respect to Pb, which is known to bio-accumulate and even undergo bio-magnification in organisms such as fishes and even plants with serious health implications to human being.

Keywords: *Heavy metals, Nitrogen, Phosphorus, physicochemical parameters, Surface water, Matara-Uku*

1. INTRODUCTION

Metals have the potential to be toxic to living organisms if present above threshold levels. The toxic heavy metals entering the ecosystem may lead to geo-accumulation, bioaccumulation and biomagnifications. Food chain contamination by heavy metals has become a burning issue in recent years because of their accumulation in bio-systems through contaminated water. The toxicity of these metals affect humans and animals health, few of these metals (lead, cadmium, mercury, and chromium), have been a major concern to researchers, because water pollution of local or distant origin may contribute significantly to the load of metals on natural ecosystem. Environmental contamination and exposure to heavy metals such as cadmium and lead is a serious growing problem throughout the world. Aloke *et al.* [1] determine the level of some heavy metals and the result showed significantly (P<0 .05) high level of As, Cd and Pb which also exceeded the World Health Organization (WHO) recommended maximum limits specification for drinking water. Chika and Prince [2] examine the level Pb, Cd, Cu, Fe, Cr, Zn, Na, Ni, Mg and Ca from Lagos and Ikorodu using Atomic Absorption Spectrophotometer. The result showed that Pb, Ni and Mg values exceeded the permissible limits set by WHO, NAFDAC and NIS. Gajere and Okegye [3] reported that the heavy metal concentrations in surface and ground water resources around Udege Mbeki mining district, North-Central

Nigeria ranged as: Cd (0.000-0.110 mg/L), Cr (0.003-0.146 mg/L), Co (0.110-1.260 mg/L), Cu (0.000-0.260 mg/L), Fe (0.015-8.398 mg/L), Pb (0.0001-1.853 mg/L) and Ni (0.001.112 mg/L). Concentrations of Cr, Cu and Ni are generally within the maximum permissible limit of the WHO guideline, whereas concentrations of Fe, Co, Pb and Cd are above the maximum permissible limit. Similarly, AbdulHameed *et al*. [4] examine the concentrations of eight heavy metals, namely: Cadmium, Chromium, Copper, Iron, Lead, Manganese, Nickel and Zinc. The observed levels for Cd, Cr, and Pb are well above the recommended value for rivers, while Cd, Cr, Cu and Pb exhibit higher values than the guidelines limit for protection of aquatic life.

Phosphorus is present in natural waters either as orthophosphate or organic phosphate. In water, the combined form of the element is continually changing due to the process of decomposition and synthesis between organically bound forms and oxidized inorganic forms. Phosphorus gets into the water through various sources including leached or weathered soils from igneous rocks and domestic sewage containing human excrement. Other sources are phosphates from detergents in industrial effluents and run offs from fertilized farm lands. Phosphorus is very important for plant growth including algal growth in water. Elevated level of phosphorus in surface water is one of the most serious environmental problems because of its contribution to the eutrophication process and impairment of water quality.

Nitrogen found in natural waters is one of the common pollutants in surface water. Forms of nitrogen present in natural waters include molecular nitrogen (N_2) in solution, ammonia as NH_3, ammonium and ammonia hydroxides (NH_4 and NH_4OH). Surface waters rarely contain as much as 5 mg/L and often less than 1 mg/L of nitrogen. However where inorganic fertilizers are been used, ground waters may contain up to 1000 mg/L. Major sources of nitrogen pollution vary from agrochemicals, human and animal wastes, sewage leaks, landfills, application of waste water for irrigation, industrial wastes, etc. Contamination in drinking water has been implicated to be the causes of major health problems e.g. blue baby syndrome, when present at higher levels; World Health Organization prescribes a maximum permissible limit of 10 mg/L for nitrogen in drinking water.

2.0 MATERIALS AND METHODS

2.1 Study Area

The Matara-Uku in Hadejia-Nguru wetlands (Figure 1) is located between latitudes 12°15'North and 12°55'North, and between longitudes 10°East and 11°East in the Sudan savanna of Nigeria. Some of the economic activities carried out at Hadejia-Nguru wetlands include fishing, farming of different types of cash crops and tourism activities. Majority of the people living around the area are cultivating crops such as, cassava, beans, rice and maize etc, the lake around the land is used for irrigation in both dry and wet season for vegetables and rice production.

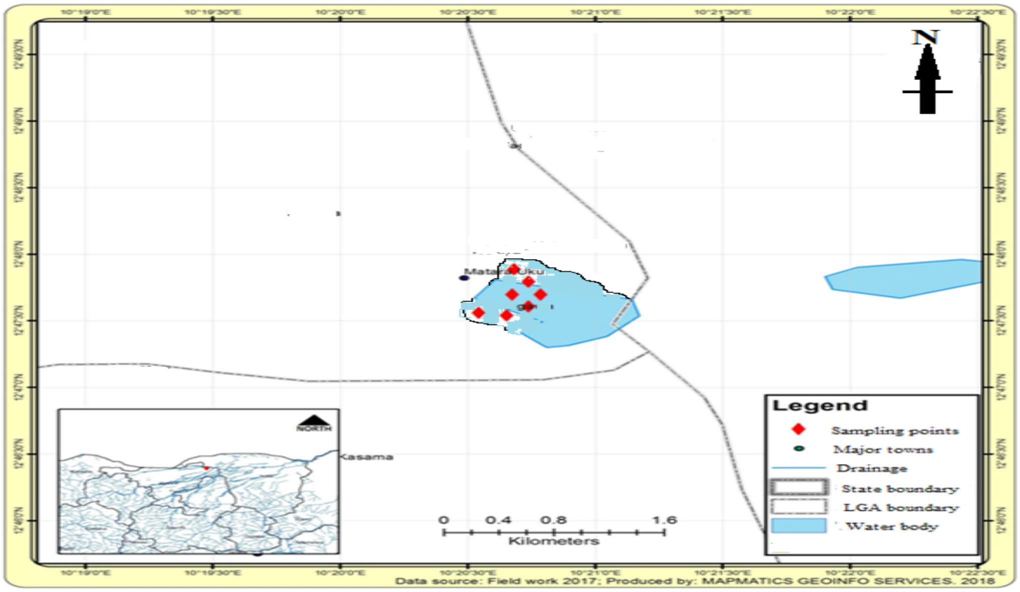

Figure 1: Matara-Uku wetland along Hadejia-Nguru wetlands

2.2 Sampling

Twenty surface water samples were collected from four different sites (A, B, C, D), five samples for each during the dry season. Sample bottles were preconditioned with 5% nitric acid and later rinsed thoroughly with distilled deionized water. At each sampling site, the polythene sampling bottles were rinsed at least three times before sampling was done. Pre-cleaned sampling bottles were immersed about 10 cm below the water surface. The pH of the water samples was measured at the sampling sites with a digital pH meter (pH 107). And the temperature was also measured using thermometer (glass thermometer).The water samples were then filtered using a filter paper.

2.3 Reagents

5.5M H_2SO_4, 2.5M H_2SO_4, concentrated nitric acid (HNO_3), concentrated HCl, 0.00324M ammoniummolybdate, 0.1M ascorbic acid, 0.008214M potassium antimony tartrate, reducing agent, 0.0581M acidic sulphanilamide, N(1-Naphthyl) ethylenediamminedihyhrochloride, reducing agent.

2.4 Preparation of Standard Solution

<u>2.4.1 Preparation of Cd Stock Solution</u>

Exactly 2.1032g of $Cd(NO_3)_2$ was weighed to prepared stock solution of 1g of Cd per 1 dm^3. 2 1032g of anhydrous $Cd(NO_3)_2$was dissolves in 250cm^3 of de-ionised water in a beaker and then transferred to a 1 dm^3 volumetric flask and filled up to the mark with de-ionised water. By means of pipette, 10cm^3 of the Cd stock solution was transferred to a 100cm^3 volumetric flask and make up to the mark with de-ionised water to produce an intermediate standard solution with concentration of 100mg/dm^3.

Cadmium standard solution for AAS calibration was prepared by pipetting, 1cm^3, 2cm^3, 4cm^3, 6cm^3, 8cm^3, and 10cm^3 aliquot portion of the intermediate solution into 100cm^3 volumetric flask respectively and diluted to the mark with de-ionised water. These standard solutions have the following concentrations 1mg, 2mg, 4mg, 6mg, 8mg, and 10mg per liter respectively.

<u>2.4.2 Preparation of Pb Stock Solution</u>

Exactly 1.5985g of $Pb(NO_3)_2$ was weighed and dissolved in 250cm^3 of de-ionised water in a beaker and then transferred to a 1 dm^3 volumetric flask and filled up to the mark with de-ionised water. By means of pipette, 10cm^3 of the Pb stock solution was transferred to a 100cm^3 volumetric flask and make up to the mark with de-ionised water to produce an intermediate standard solution with concentration of 100mg/dm^3.

2.4.3 Preparation of Ni standard solutions

Exactly 4.9544g of $Ni(NO_3)_2.6H_2O$ was weighed and dissolved in 250cm^3 of de-ionised water in a beaker and then transferred to a 1 dm^3 volumetric flask and filled up to the mark with de-ionised water. By means of pipette, 10cm^3 of the Ni stock solution was transferred to a 100cm^3 volumetric flask and make up to the mark with de-ionised water to produce an intermediate standard solution with concentration of 100mg/dm^3.

2.5 Experimental Procedure

2.5.1 Measurement of Physico- Chemical Parameters

Conductivity, Salt and Total dissolved solid of water were determined using *DDSJ-308A* conductivity/salt/total dissolved solid meter. The instrument was calibrated and the cell was rinsed with deionized water. The cell was immersed in 50 ml of sample and allowed to attain a stable value before the reading was taking. The mode key was pressed from the meter to give conductivity of the sample directly, which was also pressed again to give salt and finally total dissolved solid. Between each sample measurement, the cell was rinsed with deionized water and wiped.

2.5.2 pH Measurement

The pH was measured at the sampling sites using a portable wagtect international potatest pH meter. The meter was calibrated by dipping the tip of the electrode in a sample of pH 7.0 buffer (HI 7007P) at ambient temperature, the reading was allowed to stabilized and the pH 7.0 trimmer adjusted until the reading displayed 7.0. The electrode was rinsed with water and dipped into a sample of pH 10.01 buffer solution (HI 700IP), the reading allowed to stabilize and the pH 10 trimmer adjusted to a reading of 10.01. The standardized meter was switched on and allowed to warm for about 15 minutes. The electrode was then immersed into the water sample and the measurement was taken when a stable value was obtained. The electrode was rinsed with deionised water before taken each reading [5].

2.5.3 Procedure for Phosphate Determination

30 cm^3 of the sample was pipetted into a 50 cm^3 calibrated flask with the addition of 8 cm^3 of the mixed reagent and mixed thoroughly. The solution was allowed to stand for 20 minutes for optimum colour formation, thereafter, the absorbance of the sample was measured at 880 nm, using reagent blank as the reference solution.

2.5.4 Procedure for Nitrate Determination

5 cm^3 of the digested sample was pipetted into a 50 cm^3 volumetric flask and 10 cm^3 of 0.5 M NaOH solution and 10 cm^3 of the reducing reagent were added and heated for 15 minutes at 52 ^{0}C. 10 cm^3 of 0.0581 M acidic sulphanilamide solution was added, shaken thoroughly for 5 minutes for the diazotization reaction to go to completion. Thereafter, 10 cm^3 N-(1-Naphthyl) ethylenediaminedihydrochloride solution was added to form an azo dye and the contents were diluted to 50 cm^3 with water. The absorbance of the pink coloured dye solution was measured at 540 nm against the corresponding reagent blank.

2.6 Sample Digestion

100 ml of each sample were transferred into different beaker. 5 ml of concentrated HCl and 5 ml of HNO_3 were added to each beaker and the samples were cover with watch glass and digested for 2 hour 30 minutes on a heating mantle until the volume have been reduced to 15-20 ml. The sample was removed from the heating source. The digested sample was allowed to cool, then transferred into a 100 ml volumetric flask and made up to mark with deionized water. This solution was then used for the heavy metals analysis using Atomic Absorption Spectrophotometer (AAS).

2.7 Instrumental Analysis

2.7.1 Metal Determination

The absorbance values of Pb, Cd and Ni in the water samples were taken using Atomic Absorption Spectrophotometer at their individual absorption lines. Instrumental calibration was carried out prior to metal determinations by taking the absorbance values of the standard solutions prepared for the different metals. Calibration curves for the different metals were plotted using the results obtained. The water samples were aspirated into the spectrophotometer and the absorbance reading recorded. The same procedure was used for the blank and standard solutions. The concentrations of metals were extrapolated from the calibration curves.

2.7.2 Nitrate and Phosphate Determination

A755S UV-VIS spectrophotometer equipped with Deuterium Lamp and Halogen-Tungsten Lamp was used for the determination of Nitrate and Phosphate levels. Whereby, working standards were prepared by further dilution of 1000 ppm stock solution (of KNO_3 and KH_2PO_4) and a calibration curve was generated by plotting absorbance versus concentration. By interpolation, the concentrations of the Nitrate and Phosphate in samples were determined.

2.8 Data Analysis

All analyses were performed in triplicates and the results were expressed as means of ± SD.

The difference in metals concentrations among the different sites were treated by correlation coefficient, one-way analysis of variance method, (ANOVA) and Tukey's test were used to determine pair-wise differences among locations. In analysis where $P<0.05$, the comparisons were considered statistically significant. All statistical calculations were performed with SPSS 20.0 for windows.

3. RESULTS AND DISCUSSION

The results obtained for physical properties of the samples collected from the twenty sampling sites were presented in (Table 1). The variations of pH for all the water samples were between the ranges of 7.60 to 8.0 which are within the permissible limit recommended by WHO [6]. Statistical analysis showed that there is significance relationship in the pH from the sampling points at ($P<0.05$). And the pH in the sampling site B is positively correlated with site B and that of site D is positively correlated with sites B and C at a significance level of 0.05 (2-tailed) (Table 2). Similarly, Tukey test revealed that there no significance between the pH levels of sites A and C, but the values obtained in site A were significant lower than those of from observed in sites B and D (Table 3).

TABLE 1: Physico-chemical parameters of water samples

Water sample	Total dissolve solid (TDS)	Electrical conductivity EC (µS/cm)	pH	Temperature (ºc)
Sample A1	85.6	163.0	7.6	25.4
Sample A2	83.0	157.3	7.6	24.4
Sample A3	84.9	161.1	7.8	25.0
Sample A4	85.6	160.6	7.9	25.1
Sample A5	82.2	154.2	7.9	25.2
Sample B1	76.2	143.5	8.0	25..0
Sample B2	73.6	153.6	7.9	24.9
Sample B3	77.7	159.3	8.0	25.0
Sample B4	66.0	140.0	8.0	25.3
Sample B5	83.2	140.1	8.0	24.8
Sample C1	75.6	149.2	7.9	25.4
Sample C2	74.5	130.9	7.9	25.2
Sample C3	85.6	140.2	7.8	25.2
Sample C4	81.2	147.4	8.0	25.4
Sample C5	73.7	139.6	8.0	25.3
Sample D1	75.4	149.3	8.0	24.9

Sample D2	70.9	140.1	7.9	25.3
Sample D3	74.1	142.2	7.9	25.4
Sample D4	56.2	105.0	8.0	25.4
Sample D5	77.5	145.9	8.0	25.1

Table 2: Pearson correlation analysis of pH

	Site A	*Site B*	*Site C*	*Site D*
Site A	1			
Site B	0.589768	1		
Site C	0.472866	0.133631	1	
Site D	0.361158	0.612372	0.763763	1

Table 3: Tukey HSD Test for pH

Sample	N	Subset for alpha = 0.05	
		1	2
A	5	7.7600	
C	5	7.9200	7.9200
D	5		7.9600
B	5		7.9800
Sig.		.067	.744

Figure 2 showed the variations of Total Dissolved Solid (TDS). It was observed that the value varied from 70.82 to 84.26 mg/L, which is below the acceptable limits for surface water (300 mg/L). Based on statistical analysis, there is no significance difference between the concentration of total dissolve solid in sites B, C and D, however, the levels of TDS in site D is significantly lower than recorded at site A (Table 4) at significance level of 0.05 (2-tailed). TDS levels in sampling site C showed a positive correlation with those in site A and also TDS in sampling site D showed a strong positive correlation with those obtained in site B (Table 5).

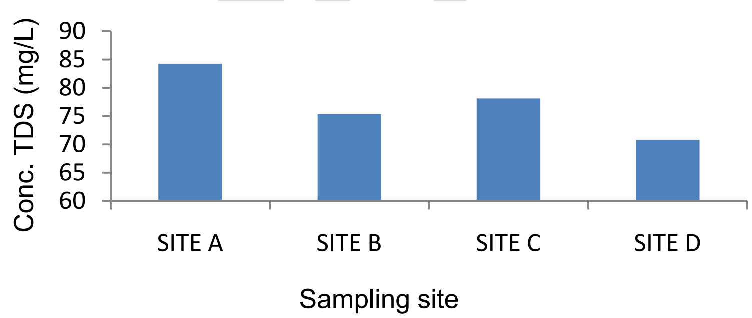

Figure 2: Mean concentration of total dissolve solid

Sample	N	Subset for alpha = 0.05	
		1	2
D	5	70.8200	
B	5	75.3400	75.3400
C	5	78.1200	78.1200
A	5		84.2600

Sig.	.249	.122

Table 4: Tukey HSD Test for TDS **Table 5: Pearson correlation analysis of TDS**

	Site A	*Site B*	*Site C*	*Site D*
Site A	1			
Site B	-0.60449	1		
Site C	0.599325	-0.32446	1	
Site D	-0.47215	0.935903	-0.35536	1

3.1 Phosphorus Concentration in Water Sample

The phosphorus levels in surface water samples obtained from various sampling sites in Matara-Uku is presented in Figure 3, with the mean value range (3.8208 ± 0.4109) mg/L to (4.56 ± 0.1325) mg/L .The results showed that all the sites had phosphorus concentration above the recommended level set for surface water by WHO [6] i.e. 0.03mg/L. Adesuyi *et al.* [7] reported high variation of phosphates and nitrates when compared to other creeks surface water in Niger Delta, Nigeria. Oniye *et al.* [8] also reported the lowest mean concentration of phosphate from Jakara river in Kano as 3.80mg/l in April and was significantly different (P<0.05) from the other months; higher values were obtained in July and August. The high concentration of phosphorus in surface water of Matara-Uku is due to the fact that agricultural activities is the major source of income in these communities and this activities are only possible through the application of both natural and synthetic fertilizers. The results obtained were subjected to statistical analysis using the analysis of variance (ANOVA). The analysis showed that the concentration of phosphorus in site D is significantly greater than those recorded at sites A and B (Table 7). Pearson correlation analysis shows that phosphorus in the four sampling point shows a strong positive correlation with each other at significance level of 0.01 (2-tailed) (Table 8). This confirmed that the source of pollution is the same.

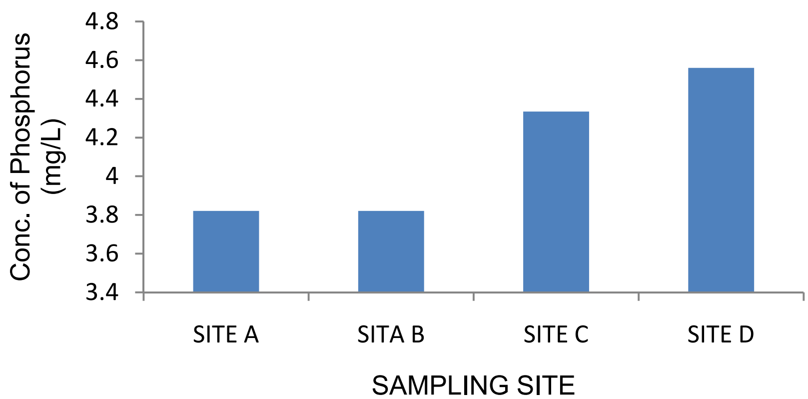

Figure 3: Mean concentration of Phosphorus

Table 6: Concentrations of Phosphate and Nitrate

Samples	Phosphate(mg/L)	Nitrate(mg/L)
Sample A1	3.096	0.2265

Sample A2	4.056	0.2306
Sample A3	4.08	0.2653
Sample A4	3.912	0.2725
Sample A5	3.96	0.2327
Sample B1	4.248	0.2143
Sample B2	4.224	0.2653
Sample B3	4.152	0.2306
Sample B4	4.2	0.2327
Sample B5	4.416	0.2367
Sample C1	4.08	0.2388
Sample C2	4.296	0.2245
Sample C3	4.344	0.2265
Sample C4	4.392	0.2306
Sample C5	4.56	0.2265
Sample D1	4.344	0.2388
Sample D2	4.68	0.2347
Sample D3	4.56	0.2449
Sample D4	4.56	0.2347
Sample D5	4.656	0.2449

Table 7: Tukey HSD test for Phosphorus

Sample	N	Subset for alpha = 0.05	
		1	2
A	5	3.8208	
B	5	3.8208	
C	5	4.3344	4.3344
D	5		4.5600
Sig.		.079	.666

Table 8: Pearson correlation analysis of phosphorus

	Site A	*Site B*	*Site C*	*Site D*
Site A	1			
Site B	1	1		
Site C	0.751825	0.751825	1	
Site D	0.909424	0.909424	0.782437	1

3.2 Nitrogen Concentration in Water Samples

The nitrogen level in sampling site of Matara-Uku is presented in Figure 4, with the mean concentration range (0.2293 ± 0.0057) mg/L to (2.2455 ± 0.0216) mg/L. The result clearly shows that all the sampling sites had nitrogen concentration below the permissible limit of 10 mg/L set by WHO [6]. Oniye *et al.* [8] reported from the level of nitrate from Jakara river in Kano State, that the lowest mean concentration (3.25mg/l) of nitrate was observed in March during dry season and the higher mean value of 11.46mg/l were observed in August and September respectively, both significantly different (P<0.05) from other months. However, the current results may not likely be a land mark for safety because the concentration of nitrogen may increased as a result of anthropogenic sources for instance the used of nitrogen-rich fertilizers and manure by the farmers near the wetland.

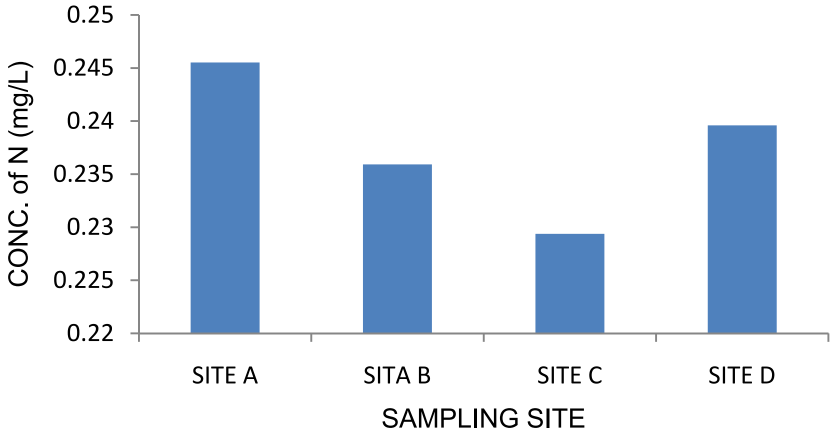

Figure 4: Mean concentration of Nitrogen

Statistical analysis shows that there is no significance difference in the concentration of Nitrogen between the sampling sites at (P<0.05). The concentration of Nitrogen among the sampling sites shows a negative correlation with each other at significance level of 0.05 (2-tailed) (Table 9). Similarly, there was correlation between the sites (Table 10). This confirmed that the source of pollution is different, as shown in the table below.

Table 9: Tukey HSD test for Nitrogen

Sample	N	Subset for alpha = 0.05
		1
C	5	.2294
B	5	.2359
D	5	.2396
A	5	.2455
Sig.		.340

Table 10: Pearson correlation analysis of Nitrogen

	Site A	*Site B*	*Site C*	*Site D*
Site A	1			
Site B	-0.14331	1		
Site C	-0.18926	-0.79875	1	
Site D	-0.0158	-0.3561	-0.17201	1

3.3 Levels of Heavy Metals in Water Samples

Result in Figure 5 and table 11 showed the concentrations of heavy metals in surface water of Matara-Uku from various sampling sites. The metals concentration were between the range Pb (0.1272 ± 0.0445) mg/L to (0.2727 ± 0.1285) mg/L, Cd (0.0026 ± 0.0024) mg/L to (0.0053 ± 0.0054) mg/L and Ni (0.0705 ± 0.0235) mg/L to (0.1411 ± 0.0819) mg/L respectively. Concentrations of Cd and Ni are generally below the permissible limit set by WHO [6] guidelines which are 0.03mg/L and 0.2mg/L, whereas the concentrations of Pb exceeded the maximum permissible limit of 0.01mg/L WHO [6] for surface water. Emoyan *et al.* [9] reported the level of heavy metals in river Ijana in Akpan Warri as Cd (0.010 ± 0.004 mg/L) and (0.100 ±0.014 mg/L); Cr (0.037 ± 0.006 mg/L) and (0.067 ± 0.020

mg/L), Cu (0.020 ± 0.004 mg/L) and (0.050 ± 0.029 mg/L); Fe (0.046 ± 0.007 mg/L) and (0.229 ± 0.008 mg/L); Ni (0.030 ± 0.004 mg/L) and (0.080 ± 0.010 mg/L); Pb (0.025 ± 0.006 mg/L) and (0.058 ± 0.008 mg/L) and Zn (0.088 ± 0.012 mg/L) and (0.122 ± 0.007 mg/L). Aderinola *et al.* [10] also reported high level of some heavy metals of surface water, sediments and fish from Lagos logoon as Cd (0.354±.297 mg/L), Cr (0.060±.028 mg/L), Pb (0.263±.118 mg/L) and Ni (0.140±.075 mg/L).

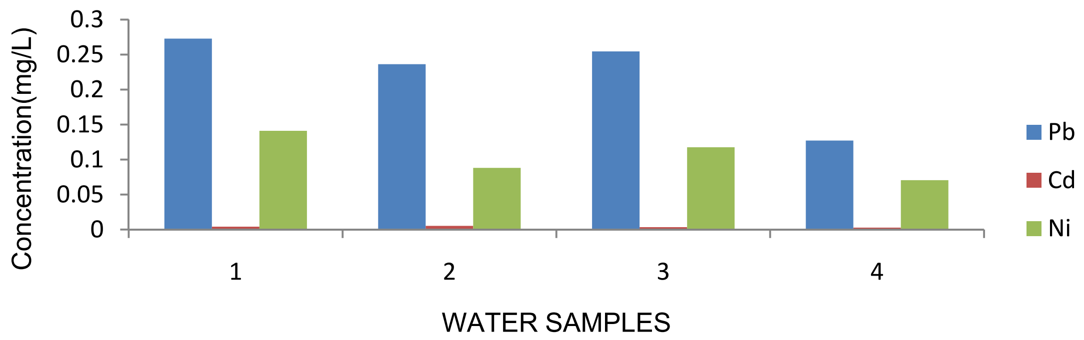

Figure 5: Mean concentration of Heavy metals

Table 11 .Heavy metal concentration (mg/l) in water samples

Water samples	Pb (mg/L)	Cd (mg/L)	Ni (mg/L)
Sample A1	0.454545	ND	0.088235
Sample A2	0.363636	0.01	0.029411
Sample A3	0.090909	0.006666	0.117647
Sample A4	0.272727	0.003333	0.235294
Sample A5	0.181818	ND	0.235294
Sample B1	0.272727	ND	0.088235
Sample B2	0.181818	0.013333	ND
Sample B3	0.181818	0.01	0.117647
Sample B4	0.272727	ND	0.029411
Sample B5	0.272727	0.003333	0.205882
Sample C1	0.090909	ND	0.117647
Sample C2	0.454545	0.003333	0.17647
Sample C3	0.272727	0.003333	0.117647
Sample C4	0.181818	0.006666	0.058823
Sample C5	0.272727	0.003333	0.117647
Sample D1	0.181818	0.003333	0.029411
Sample D2	0.181818	ND	0.088235

Sample D3	0.090909	0.006666	0.088235
Sample D4	0.090909	0.003333	0.088235
Sample D5	0.090909	ND	0.058823

N.D (Not detectable)

The statistical analysis showed that there is no significant relationship between the levels of metals in the sampling sites. Pearson correlation analysis was conducted between the heavy metals level in water samples to assess if there are similarities in the sources of these heavy metals as represented in Table 12. Cd shows negative correlations with Ni at a significance level of 0.01 (2-tailed). Similarly, Pb shows negative correlations with Cd at a significance level of 0.01 (2-tailed). And also Cd shows strongly negative correlation with Ni at a significance level of 0.01 (2-tailed). The sources of these heavy metals displaying negative correlations were considered to be different.

Table 12: Pearson correlation analysis of Heavy metals

	Pb	*Cd*	*Ni*
Pb	1		
Cd	-0.12122	1	
Ni	-0.45691	-0.60335	1

4. CONCLUSION

It is concluded that the surface water of Matara-Uku is polluted with respect to Pb. The high concentration of Pb in the water was due to the domestic effluent and other anthropogenic source which are discharged into the drains and subsequently into the wetland. Lead is well-known as cumulative poison that has several damaging effects on public health even at trace concentration in the body of humans and organisms. In addition Lead has carcinogenic properties, and it impairs both the respiratory and digestive systems. The water from this source may likely pose health hazard through bio - accumulation in fishes and other agricultural products. But, the concentration of Cd and Ni are below the NAFDAC [11] and WHO [6] guidelines for surface water which are 0.03mg/L and 0.2mg/L respectively.

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