International Journal of Innovative Research and Advanced Studies (IJIRAS)
Volume 5 Issue 8, August 2018

ISSN: 2394-4404

Water Quality Of Kolo Creek In Bayelsa State By Means Of Water Quality Index For Missing Parameters

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Abstract: *The Kolo Creek is one of the inland water bodies in the Niger Delta receiving organic and chemical wastes arising from anthropogenic activities within the catchment area. This study was therefore carried out to investigate the impact of human activities on the quality of surface water along the Kolo Creek between 2016-2017 using Water Quality Index for missing parameters method in bide of finding a descriptive definition to the water quality status of the Kolo Creek. Water samples were collected for ten (10) months each during the dry and wet seasons and assessed from six sampling points (A-F) for seven (7) physico-chemical parameters and total coliform counts. All data were analyzed using Water Quality Index. The water status from the Kolo Creek is scientifically ranked as medium (Class III), relatively moderate, but not good for consumption without further purification. Hence, poor ecological ethics and culture should be discouraged to keep the Kolo Creek water under check for safe domestic water use.*

Keywords: *Kolo Creek; Water Quality Index for Missing parameter; Weighted values*

I. INTRODUCTION

Water is a dynamic medium containing living, non – living components, organic, inorganic soluble as well as insoluble substances that constitute a support system (Al-Mashagbah, 2015). Water stands to be the second most important natural resource for all forms of life after air and is a valuable natural asset which forms the major constituent of the ecosystem (Balan, Shivakumar & Kumar, 2012; Bariweni, 2017). Despite its abundance, the quality and accessibility of potable water remains a global challenge especially in the rural and semi-rural communities in the developing countries (Ohwo & Abotutu, 2014; Izonfuo & Bariweni, 2001).

The availability of fresh water through surface and groundwater resources has become critical as the only freshwater that is available for drinking, agricultural and domestic purposes is exposed to arrays of contamination among leading causes is uncontrolled activities of man (Bariweni, 2013; Oribhabor, 2015). The type and severity of water contamination often is directly related to human activity, which can be quantified in terms of the intensity and type of land use in the source areas of water. poor water quality continuous to pose major threats to human health, and according to the World Health Organisation (2011A); contaminated water kill more people than cancer, AIDS, war or accident. diarrhoeal diseases alone accounted an estimated 4/1% of the daily global diseases burden and are responsible for the death of 1.8million people yearly; 88% of this burden is attributed to unsafe water supply, poor sanitation and hygiene (Udousoro & Umoren, 2014; WHO, 2004).

It may interest you to know that in Nigeria, only 58% of inhabitants of the Urban and semi-urban areas and only 39 of the rural areas have access to potable water supply; the rest population depends on ground (well, and borehole) and surface (Lake, streams, and River) for their domestic water supply (Udousoro & Umoren, 2014; FGN, 2012). With a growing human population, urbanisation, pollution, atmospheric input from fossil fuel burning and environmental degradations, lakes, streams and rivers if any; are now in a natural conditions; increasing the threats on water supplies from chemical and biological concentration. The Kolo Creek is one of the inland water bodies in the Niger Delta receiving organic and chemical wastes arising from anthropogenic activities within the catchment area**.** This study aimed at determining the water qualities of the Kolo creek from the source to the mouth of the Kolo Creek using Water Quality Index for missing parameters.

Numerous studies were conducted to asses surface water quality and to establish the extent of surface water contamination due to increasing human activities in the high risk Kolo Creek in Niger Delta region of Nigeria. Research studies conducted in the Kolo Creek were NEDECO (1961) centred on general water quality in the Niger Delta; Causes and problems of water pollution by Chima and Obiene (2009); Heavy metals survey in sediment of the Kolo Creek by Ogamba, Ebere and Izah (2017), Inegite, Oforka and Osuji (2010); Microphyte load for water Hyacinth by Gobo, Amangabara and Etiga (2013); Assessment of physicochemical characteristics of lower Kolo Creek by Aghoghovulia and Ohimain (2014); water quality phytochemistry and proximate constituents of water hyacinth by Ogamba, Seiyaboh, Izah, Ogbugo and Demedonha (2015); Assessment of hydrocarbon level in surface water by Seiyabor and Ayibaefie (2017); of all these studies, none has scientifically classified generally the water quality from the Kolo Creek ; as the indices used are either from the physico-chemical or biological parameters. Hence, this study is to assess water quality of the Kolo Creek using Water Quality Index for missing parameters.

Over, the past four (4) decades, Water Quality Index has been successfully applied in water quality assessment studies in various region of the world in various name such as Weighted Arithmetic Water Quality Index (WAWQI), National Sanitation Foundation Water Quality Index (NSFWQI), Canadian Council of Minister of the Environment Water Quality Index (CCMEWQI), Oregon Water Quality Index (OWQI) etc. (Cude, 2001; Chaturvedi & Bassin, 2010; Sing *et al.*, 2013; Fadaei & Gafari, 2015).

WQI was first developed by Horton in 1965 to calculate a single number that expresses the overall water quality at a certain location and time based on multiple water quality parameters into mathematical equation that rates the health status of water with a figure (Yogedra & Puttaiah, 2008; Sing, Tiwari, Panigarhy & Mahato, 2013; Boah, Twum & Pelig-Ba, 2015); multiple parameters such as DO, BOD, Total-coliform, pH, Phosphate, Nitrate, Temperature, Turbidity and TDS are substituted into the Water Quality Index formulae and read in a legend table (Balan, Shivakumar & Kumar, 2012; Fadaei & Gafari, 2015). The uniqueness of this technique is that it provides the composite influences of individual water quality parameter on the overall quality of water (Ramakrishnaiah, Sadashivaiah & Ranganna, 2009; Sing, Tiwari & Mahato, 2013). Information on the quality of surface water using water quality index in most streams and rivers in Nigeria is scanty; focus has been more on the use of physicochemical and biological parameters which information is still inadequate in explaining water quality status, hence the important of this study in assessing the water quality of the Kolo Creek using Water Quality Index for missing parameters.

II. MATERIAL AND METHODS

A. STUDY AREA

Kolo Creek lies within latitude $04^{0}24^{1}26.893^{11}$ and 04^{0} $59^{1}05.094^{11}$ North and longitude 06^{0} $14^{1}59.190^{11}$ and 06^{0} $20^{1}47.701^{11}$ East. The full length of the Kolo Creek is 85km, covering a total area of about 1,625 square kilometers (NEDECO, 1961; Eli, 2012). Kolo Creek is located at the central part of the Niger Delta and transverses about twenty-one (21) communities including Okarki; Otegue II, Ibelebiri, Oruma/Yibama, Otuasega, Imiringi, Emeyal 1 and 2, Kolo 1, 2 and 3, Otuegila, Otakeme, Otuabagi, Ewoma/Otuabi, Otuogidi, Ogbia Town, Otuabo/Abobiri, Ekpenkiri, Akakumama, and Bukiri (Eli, 2012; Gobo, Amangabara and Etiga, 2013) (Fig. 1.2).

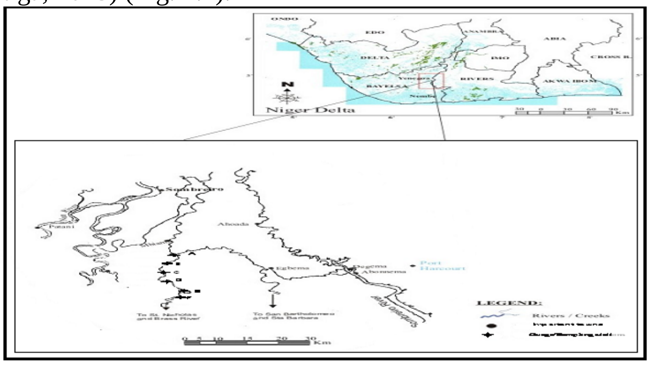

Figure 1.1: The Kolo Creek: The Niger Delta

B. WATER COLLECTION AND PRESERVATION

Operational purpose block design was used to divide the study area into six (6) unequal blocks according to the observed differences in anthropogenic activities as explained by Kothari (2012); Tekenah, Agi and Babatunde (2014). Each block was tested equally with eight (8) physico-chemical and biological parameters for a year, for the purpose of seasonal variation comparison.

Water samples were collected from six (6) purposive locations labelled A (Okarki); B (Otuasega); C (Imiringi); D (Kolo 2); E (Otuabagi) and F (Ogbia Town) (Table 2.1; Fig. 2.1) based on the asses variation in anthropogenic activities for the purpose of comparison and generally classified water quality of the Kolo using Water Quality Index technique. Samples were collected monthly for a year making a total of 72 samples. All sampling locations were geo-located using GARMIN 76 hand held GPS equipment (Table 2.1 and Fig 2.1)

Acronym	**Interpretation**	**Sampling Location**
A	Okarki	N $04^{o}59^{1}35.094^{11}$ E $006^{o}25^{1}47.701^{11}$
B	Otuasega	N $04^{o}54^{1}45.993^{11}$ E $006^{o}23^{1}12.326^{11}$
C	Imiringi	N $04^{0}52^{1}46.986^{11}$ E $006^{0}22^{1}31.926^{11}$

ISSN: 2394-4404

D	Kolo II	N $04^{0}48^{1}18.612^{11}$ E $006^{0}22^{1}36.954^{11}$
E	Otuabagi	N $04^{0}42^{1}35.736^{11}$ E $006^{0}21^{1}51.786$
F	Ogbia Town	N $04^{0}41^{1}26.893^{11}$ E $006^{0}18^{1}59.190^{11}$

Sources: Fieldwork, 2017.

Table 2.1: Distribution of samples Location

Sample A (Okarki) constitute the upstream sample where River Orashi bifurcated; serving as controlled point for the rest sample stations and samples.

Station B (Otuasega) is 3 kilometers away from the Bunkering spot (Otuegue II) where creek water is used as coolant during makeshift oil refining. It was observed that oil silks floats on the creek with a dredging point at the Ibelebiri axis of the Creek.

Station C (Imiringi) is 3 meters away from the SPDC Oilfield Base

Station D (Kolo) is where mini-industrial (Oil palm, wood sawmill and Cassava processes) activities are situated.

Station E (Otuabagi) another point for oil related activities; and

Station F (Ogbia Town) the confluence spot between the Kolo Creek and the Otuoke Creek.

All Winkler bottles and high density polyethylene screw-capped plastic containers (2litres) used for water sample collection in this work were thoroughly washed with detergent, vials pre-treated with 4M HNO3 and properly rinsed with de-ionized water followed by double distilled water before use as required by the American Public Health Association (APHA, 1995); Younos and Grady (2014).

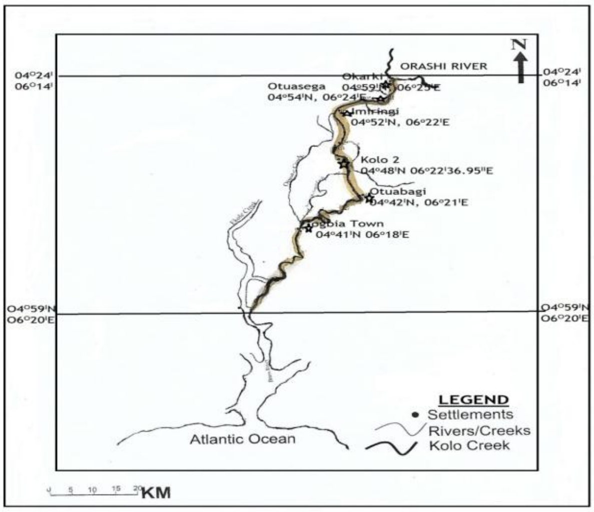

Fig. 3.1 The Kolo Creek, Its Tributaries and Sample Points
Source: Cartography Unit, Niger Delta University, Bayelsa State, 2017

Figure 3.1

The sample containers were labelled and doubled rinsed with clean water at the collection point and later lowered and opened at about 1.5 meters depth filled slowly into 2litres HDPE containers from one bank through midstream to the other bank using hand-paddled canoe to the brim, closed under water to avoid bubbles between the hours of 7am-11am of each day to analyzed for ten (10) parameters namely, pH, Temperature ^{o}C, Biochemical Oxygen Demand (BOD_5) (mg/l), Chemical Oxygen Demand (COD) (mg/l), Dissolved Oxygen (DO) (mg/l), Turbidity (NTU), Total Dissolved Solids (TDS) (mg/l), Nitrate (NO_3) (mg/l), Total Coliform Count (CFU/100ml) and Total Hydrocarbons Contents (THC) (mg/l).

Samples for microbiology analysis were collected separately in capacity bottles (glassware 250ml) preserved with 2mL conc. HNO_3 per 2Litres not filled to the brim and stoppered. Samples for Total Hydrocarbons Contents (THC) (mg/l) were collected with a Winkler bottles but not filled to the brim. Three drops of HNO_3 was added into the samples and stoppered. Collected laboratory samples were transported to the Chemistry and Biology Departmental Laboratory of the Federal University of Technology, Otuoke Bayelsa State, Nigeria in an icebox at 4^{o}C for classic and automated instrumental method analysis.

Water samples for Dissolved Oxygen and Biological Oxygen Demand analysis were fixed with 1ml of Mn SO_4 solution together with 1ml of K I (Potassium Iodide) solution to the samples in the bottle and stoppered. The mixture was gently swirled to avoid entrapping air bubbles.

C. WATER AND DATA ANALYSES

All physicochemical parameters except for temperature were analysed *in-situ*; others were analysed in the laboratory within five (5) days.

a. PH (ASTM 1293B-95)

The pH of the surface water samples were measured electronically using handheld battery operated pH meters. The pH meter *(Hanna pH 19813 Grocheck Meter)*, was first standardized with appropriate buffer solutions before testing the samples.

b. TOTAL DISSOLVED SOLIDS (ASTM D 1888-78)

This was determined through evaporation. A known volume of water was used on a recorded weight of a clean and dried empty crucible. The water was added into the crucible and allowed to evaporate. When evaporation was completed, the dishes were placed in an oven for at least 30mins and then transferred into desiccators, cooled and re-weighed. The amount of total dissolved solids is the calculated difference.

c. NITRATE (APHA 4500)

Nitrates were determined by means of spectrophotometry. A known volume of water sample was measured into a curvette, ammonium chloride and EDTA solution was added, the mixture was stirred and allowed for contact time at 5mins for equilibration reaction. Nitrate concentration was extrapolated from the calibration curve.

d. TURBIDITY (PHOTOMETRIC METHOD) (APHA 2130-B)

Water turbidity depends on the quantity of solid matter present in the suspended state. It is a measure of light emitting properties of water revealing the quality of waste discharge in colloidal matter. A 25ml water sample was transferred into

25ml sample corvette and inserted into the cell holding compartment of the turbid meter. Readings were taken when appeared stable in NTU units.

e. DISSOLVED OXYGEN (DO)

Dissolved oxygen was determined by the popular classic Winkler method in the laboratory. 1ml of concentrated sulphuric acid was added to the sample and stoppered. The mixture was gently swirled to dissolve all the preformed precipitate in the bottle. 100ml of this solution was titrated against freshly prepared Sodium thiosulphate solution using starch as an indicator. The titrated value was equal to the concentration of DO in the samples.

f. BIOLOGICAL OXYGEN DEMAND (BOD_5)

The popular Winkler method was adopted in determining Biochemical Oxygen Demand. The water sample and blank were incubated for five days at 25^0C after subjecting to various Winkler reagents to determine the dissolved oxygen of individual solution and blank for the first day. After 5 days of incubation the DO was re-determined and the difference gave the BOD expected.

BOD_5 (mg/l) = $(S_1 - S_5) – (B_1 – B_5)$ X % Dilution ……. (Equ. 2.1)

Where: S_1 = DO for samples (Day 1);

S_5 = DO for day 5 after incubation (Day 5)

B_1 = DO for blank (Day 1);

B_5 = DO for blank after incubation (Day 5)

g. TOTAL-COLIFORM COUNTS (MOST PROBABLE NUMBER TECHNIQUE) (APHA 9216-B)

Ten-fold serial dilutions of the water samples from different sites were used for the enumeration of bacterial species. Samples prepared in MacConkey Broth with inverted Durham tubes were left to cool in labeled sterilized glassware. Samples were incubated for Faecal-coliform at temperature of 35^oC for 48 hours. Presumptive tests were made by comparing positive colour changers with the 5 test tube statistical table to enumerate the most probable number of micro-organisms present.

h. TEMPERATURE (^{O}C)

Temperature of the water samples were measured *in situ* at different sites using mercury bulb thermometer. Temperature was read directly after the mercury bulb thermometer was lowered into each water samples for 20 seconds.

i. WATER QUALITY INDEX (WQI)

It is important to monitor water quality over a period of time in order to detect changes in the water's ecosystem. Water Quality Index is basically a mathematical means of calculating a single value from multiple test results which represents the level of water quality in a given water basin, such as a lake, river, or stream. Water Quality Index also indicate the health of the watershed at various points which can be used to keep track of and analyze changes over time. The WQI is one of the most widely used of all existing water quality procedures to determine the health of such water body considering the nine (9) physicochemical and biological parameters (Yisa & Jimoh, 2010; Alobaidy, Abid & Maulood, 2010; Mustapha & Aris, 2011; Robert & Pirro, 2013; Singh & Kamal, 2014; Pullanikkatil, Palamuleni & Ruhiiga, 2015). In this study a formula found by Srivastava and Kumar (2013) to calculate water quality index when the numerical value of some of its quality parameters are missing. The standard formula to calculate water quality index has nine water quality parameters- biochemical oxygen demand, dissolved oxygen, pH, nitrate, phosphate, total coliform, turbidity, total dissolve solids and temperature; but because of the difficulties to find out the values of phosphate due to testing failure; the formula with missing parameters below was used to classified water quality of the Kolo Creek.

$WQI_{MP} = \Sigma WYQY / WY$ …………………. (Equ. 2.1)

Where: WQI_{MP} = Water Quality Index for Missing parameters.

Σ = Summation sign

WY = Weighting Factors of Available Parameters.

Y = Available parameters

QY = Q-values of available parameters.

After completing the eight (8) tests, the results are recorded and transferred to a weighting curve chart where a numerical value is obtained. For each test, the numerical value or Q-value is multiplied by a "weighting factor." For example, dissolved oxygen has a relatively high weighting factor (0.17) because it is more significant in determining water quality than the other tests. The nine resulting values are then added to arrive at an overall water quality index (WQI). The highest score a body of water can receive is 100 which is read in a legend table. The Q-Value is an indication of how good or bad the water quality is relative to one parameter; having 100 as Very Good and 1as Very Bad (Srivastava & Kumar, 2013; Singh & Kamal, 2014). The Weighting Factor is the relative importance of the parameter to over all water quality.

D. WEIGHING FACTORS OF WATER QUALITY PARAMETERS

Parameters	**Weight Factor**
Dissolved Oxygen (DO)	0.17
Total Coliform	0.16
Potential d'Hydrogene (pH)	0.11
Biological Oxygen Demand	0.11
Temperature	0.11
Nitrates	0.10
Turbidity	0.08
Total Dissolved Solute (TDS)	0.07

Range	Class	Quality
90 – 100	I	Excellent
70 – 90	II	Good
50 – 70	III	Medium
25 – 50	IV	Bad
0 – 25	V	Very Bad

Source: Deepika & Sing, 2015

Table 2.3: Water Quality Index Legend

III. RESULTS AND DISCUSSION

A. WATER QUALITY OF THE KOLO CREEK

The quality of surface water is continuously changing as a result of the reaction of water with contact media and human activities. Water quality in an aquatic ecosystem is determined by many physical, chemical and biological parameters based on defined limits (Sargaonkar & Deshpande, 2003; Deeker, Abowei & Alfred-Ockiya, 2010). The values of these parameters are harmful to human health if they occur beyond defined limits (Bharti & Katyal, 2011; Akoteyon, Omotayo, Soladoye & Olaoye, 2011; Jena, Dixit & Gupta, 2013).

a. PHYSICOCHEMICAL AND BIOLOGICAL CHARACTERISTICS

In this study eight (8) physicochemical and biological parameters of the different sampling points in two seasons of the Kolo Creek were presented in table 3.1

Parameters	Sampling points											
	A		B		C		D		E		F	
	D	W	D	W	D	W	D	W	D	W	D	W
DO	6.0	4.0	7.0	9.1	7.5	10.38	7.8	10.72	8.4	10.73	8.8	10.81
E-Coli	6.0	40	59	38	46	41	48	45	16	38	17	37
PH	7.7	6.9	7.3	6.9	7.5	6.9	7.3	6.9	6.8	6.6	6.8	6.5
BOD	1.2	0.4	.95	.27	1.2	.26	.88	.23	.92	.15	.68	.08
Temperature	31.3	28.4	32	28.4	32	28.4	31.3	28.3	31	28.3	31	28.3
Nitrates	96	86	98	86	99	87	100	87	100	87	100	92
Turbidity	.40	2.5	.20	2.5	.10	2.4.	0	2.4	0	2.4	1.6	3.6
TDS	168	48.4	143	47.3	123	47.09	105	46.98	96	64.4	91	45.8

Source: Researcher, 2017; where: D = dry seasons, W = wet seasons

Table 3.1: Mean seasonal Physicochemical and biological parameters of the Kolo Creek

The mean temperature of the Kolo Creek were above WHO (2011) (30ºC) recommended standard during the dry season but were within the WHO (2011) and NIS (2007) limits during the wet season. However, both seasons temperature were within the range of National Guideline and standards for water quality (20-33 ºC) in Nigeria for aquatic life, industrial and agricultural uses NIS (2007). Aghoghovwia and Ohimain (2014) reported that seasonal fluctuation can be observed in water temperature values, lower during rainy season due to climatic conditions and the dilution effect of rain and flood cycles. Ogamba and Ebere (2017) (28-32 ^{O}C); Ogamba et. al. (2015) (28-31.4 ^{O}C) reported similar result.

The mean Hydrogen ions concentration (pH) in the dry season was 7.25±23 and 6.77±42 for the wet season along the Kolo Creek. The mean result obtained over the study period were within the range of 6.5-8.9 as recommended by NIS (2007) and WHO (2011) for drinking water. Digha et. al. (2009) (6.8-7.4); Inegite et. al. (2010) (6.90-7.30); Gobo, Amangabara and Etiga (2013) (6.08-7.38); Aghoghovwia and Ohimain (2014)

From the table above, the mean seasonal turbidity levels obtained during dry season sampled was 1.17NTU and 3.82NTU respectively. The observed values were below NIS (2007) and WHO (2011) permissible value of 5.00 NTU. The results were similar to the report of Seiyaboh *et.al.* (2016) (1.2-4.4) on the Kolo Creek.

The mean seasonal Total Dissolved Solids result were within the recommended value of (500 Mg/l) by the National guideline and standards for water quality in Nigeria (NIS, 2007) and the WHO (2011) specification limit for drinking water. The results were similar to the initial studies by Inengite *et.al.*(2010) (27.5-39.3); Aghoghovwia & Ohimain (2014) (41.5-51.3).

The seasonal mean Dissolved Oxygen result obtained were 7.58mg/l during the dry season sampled and 9.29mg/l during the wet season sampled which accounted for 10.14% seasonal differences. Both seasons Sampled except at station A, were above the recommended permissible limit by the Nigerian Standard for Drinking water (NIS, 2007) and WHO (2011) of 3.0-7.0mg/l (Table 4.6). The values obtained concord with the report of Inegite *et.al.*(2010); Aghoghovwia & Ohimain (2014) for the Kolo Creek; Willliams & Odokuma (2014); Daka *et.al.*(2014).

The mean Biochemical Oxygen Demand (BOD^5) recorded for the dry season was 0.96mg/l and 0.23mg/l for the wet season which accounted for 61.34% seasonal differences. Results fall within the NIS (2007) and WHO (2011) (6.0mg/l) permissible limit (Table 4.7). Comparatively, Ogamba & Ebere (2017) (0.2-1.1) for the Kolo Creek.

The result of the Total-Coliform count for both seasons were above NIS (2007) and WHO (2011) (10 CFU/100ml) permissible limit. The presence of coliform decreased downstream (A>B>C>D>E>F). The values obtained are similar to the findings of Anhwange, Agbaji and Gimba (2012) (26.0-576.0); Dami *et.al.*(2013) (1-20.0).

The seasonal mean nitrate results obtained from the six sampled stations for both seasons were within the NIS (2007) and WHO (2011) maximum permissible limits for drinking water. This study relate with the findings of Inengite et. al.(2014) (0.092-0.7) for the Kolo Creek.

3.1.2 Water Quality Index (WQI**)**: The WQI is one of the most widely used of all existing water quality procedures which classified water quality according to the degree of purity by incorporating multiple water quality parameters into mathematical equation that rates the health status of water with a single number **(**Ayobahan, Ezenwa, Orogun, Uriri & Wemimo, 2014).

Parameters	Weight Factor	Q- Values For all Stations											
		A		B		C		D		E		F	
		D	W	D	W	D	W	D	W	D	W	D	W
DO	0.17	3	3	3.5	4	4	6	4.5	8	4.5	8	4.7	9
E-Coli	0.16	52	35	53	56	55	54	53	52	65	56	64	52
PH	0.11	90	75	92	75	94	75	92	75	89	70	88	68
BOD	0.11	97	95	100	96	97	96	100	97	99	97	100	99
Temperature	0.11	1.9	39	2.7	39	2.7	39	1.9	39	1.9	39	1.9	39
Nitrates	0.10	96	86	98	86	99	87	100	87	100	87	100	92
Turbidity	0.08	98	88	98	88	99	78	98	79	99	78	99	70
TDS	0.07	74	85	77	84	81	84	83	84	85	86	87	83

Sources: Weight Factors from Srivastava & Kumar, 2013; others were Fieldwork, 2017.

Table 3.2: Weighing Factors and Q-Values of Water Quality Parameters in Sampled Stations

WQI	Station											
	A		B		C		D		E		F	
	D	W	D	W	D	W	D	W	D	W	D	W
ΣQ_Y	55.9	53.9	57.2	54.3	57.9	53.6	57.9	53.8	59.6	53.9	59.6	53.12
ΣW_Y	0.91		0.91		0.91		0.91		0.91		0.91	
ΣWQI	61.4	59.2	62.8	59.7	63.7	58.9	63.6	59.1	65.5	59.3	65.5	58.22
$\bar{x}$	$\bar{x}\Sigma DQI_{mp}$ = 63.74 and $\bar{x}\Sigma WQI_{mp}$ = 58.22; $\bar{x}\Sigma WDQI_{mp}$ = ($\bar{x}\Sigma DQI_{mp}$ + $\bar{x}\Sigma WQI_{mp}$/ 2) = 60.97											

Table 3.3: Summary of Computed WQI across Stations for two seasons

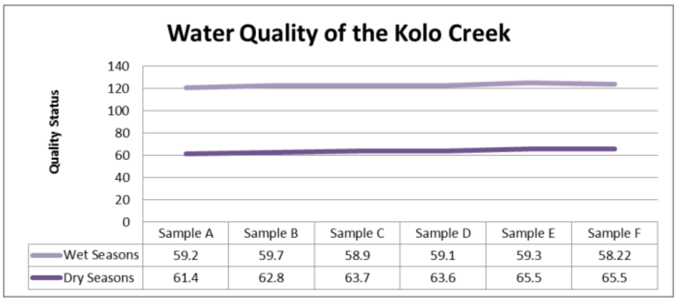

Figure 3.1: Water Quality Index of Kolo Creek

The Water Quality Index (WQI) used to determined water quality status of the Kolo creek classified water quality of the Kolo creek as Class III, scientifically described as "Medium" (Table 3.3). The water quality status from the computed water quality index revealed slight quality difference from source to mouth in an inverse variation order of dominancy as F>E>D>C>B>A during the dry season sample and contrary during the wet season sample (Table 3.3). Obviously, water quality of the Kolo Creek was practically determined by the types of anthropogenic activities operating within the set vicinity maintaining the fact that human activities in the study area changes with the seasons. The percentage differences between the dry seasons over the wet season samples account for 4.52% which was very minute compared to the differences in anthropogenic activities. Seiyaboh & Izah (2017); Olowe et.al. (2016); Rim-Rukeh & Agbozu (2013); Etim *et. al.* (2013); Etim, Odoh, Itodo, Umoh, Lawal (2013); Eli (2012); Mustapha & Aris (2011); Bariweni & Abowei (2011) had linked types and severity of water contamination to the human activities, which can be quantified in terms of the intensity and types of land use of the area

IV. CONCLUSION

The water from the Kolo Creek should be purified (treated) before use. It is therefore, important to note that WQI for missing parameters is an effective tool for understanding the dynamics between anthropogenic influences, natural dynamics and water quality status.

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