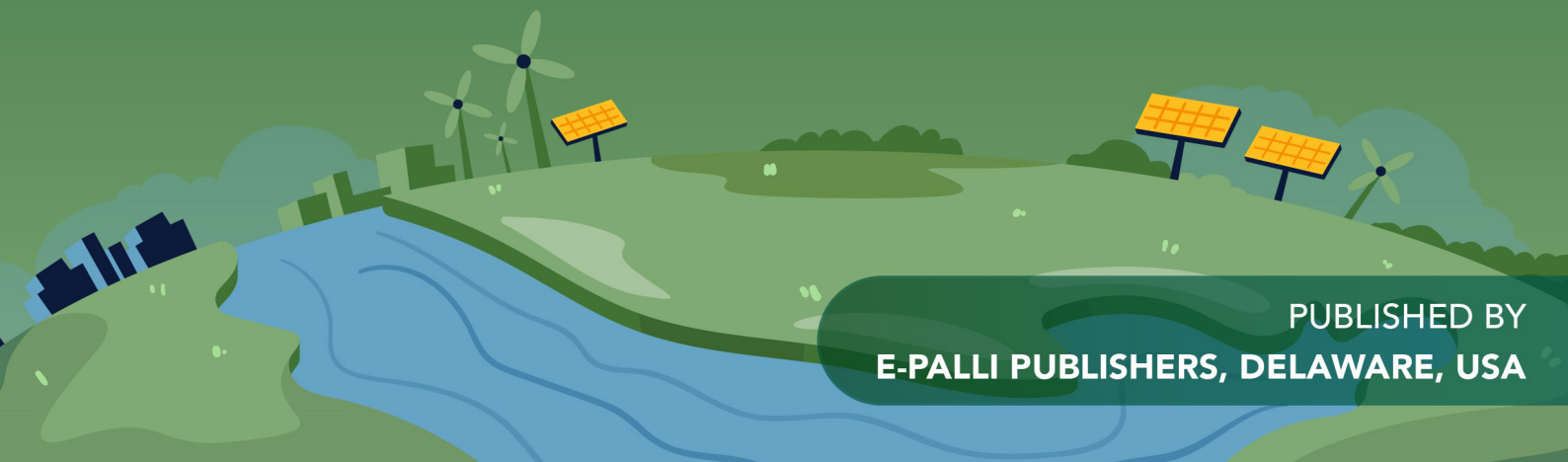




# AMERICAN JOURNAL OF ENVIRONMENT AND CLIMATE (AJEC)

ISSN: 2832-403X (ONLINE)

VOLUME 2 ISSUE 2(2023)



PUBLISHED BY  
E-PALLI PUBLISHERS, DELAWARE, USA

## Water Quality Index (NSFWQI) of the River Nun, Bayelsa State, Nigeria

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### Article Information

**Received:** May 27, 2023

**Accepted:** June 21, 2023

**Published:** July 13, 2023

### Keywords

*Comprehensive Pollution Index,  
Physicochemical and Biological  
Parameters, River Nun,  
Surface Water and Water Quality  
Index*

### ABSTRACT

Water remained the second most required and useful natural resource after air; but its usefulness is underscored through quality and quantity among various sources; of all sources of water, surface water occupied 70% of the earth's surface in various form at a given time in space. Despite the abundance, water quality remained a global burden such that hardly could there be any of such water bodies without questionable insignia in the Niger Delta. Therefore, it became pertinent to assess and characterized the water quality of the River Nun at various reaches. A six months (dry and wet season) sampling exercise was conducted following standards on Nine (9) physiochemical and biological parameters. Results in pH, Temperature, Biological Oxygen Demand, Total Phosphate, Turbidity and Total Dissolved Solids were within limits while concentrations for the fecal coliform count, Dissolved Oxygen and Nitrate were above limits. At 0.05% the differences among communities and seasons were insignificant while among parameters is significant. The Comprehensive Pollution Index range between slightly polluted – seriously polluted while the Water Quality Index for the River Nun is classified into Class 3 (C) literally described as Medium; which is unfit for drinking and for recreational activities without prior treatment. Therefore, information regarding water quality of the River Nun be transmitted to armed inhabitants of the status of the River Nun.

### INTRODUCTION

Water is the second most abundant and most required natural resource after air. It plays an important role in social, economic development, human health, welfare and inhabitants in contingent with availability and quality; such that too little or too much causes misery, displacement, hunger and death in a similar form with poor quality. Currently, water is now a commodity of strategic importance because of increasing demands, rising costs and diminishing supplies which has returned rural dwellers into high dependency on surface water sources. Regrettably; due to its openness, surface water is treated with contempt and regularly abused inhumanly were it is naturally available through the uncontrollable activities of man in the quest for improving life standards. According to Ebuete et.al. (2019) ignorance, carelessness and the quest for fast profits has rendered most if not all surface natural water bodies in the Niger Delta Region into waste sink; a waste management system best described as “*Out of Sight Syndrome*” as the call for Not In My Backyard (NIMB) waste management practices intensifies. Pathetically, it is theoretically believed that surface water sources has unlimited capabilities to process itself from raw waste and pollutants irrespective of the degree and amount of discharged waste provided it is flowing; a repugnant act that has exposed both ecological resources and human to high risk of extinction, varied sickness and death. Interestingly, about 70%-80 % of the burden of the disease globally is waterborne; caused from the drinking of contaminated water in developing countries (Khan *et al.* 2013) and about 3.1% deaths occur

due to the unhygienic and poor water quality (Pawari & Gawande, 2015; Raimi, Adedotun, Emmanuel & Anu, 2019). Records has showed that the priority accorded domestic water supply by the Colonial administration had not been sustained by the post-Independence government in Nigeria and so, water available for used by an individual has declined from 18.9litres in 1986 to less than 5litres per day in 2008 among 50% urban dwellers (Ekong, Jacob and Ebong, 2012) and its worst devastated states is among rural dwellers with a larger blame burden on poor government policies.

In reality, the hardnosed towards surface water did not stop most locals from attaching domestic, religious, economic and social importance to surface water; among which are the inhabiting locals along its flowing conduit (catchment) and others lacking better alternative water sources. It is philosophical that “*Dirty No Dey Kill Africa Man*” literally meaning “*Africans are immune to dirt*” and as such inferences regarding water quality is drawn on the premise of colour, taste and smell which are quite misleading and nebulous.

Another factor that encourages poor surface water protection and user culture is the lack of right information. Scientific information guiding users are lacking, complex, confusing and are temporal due to the variances in presentation/reporting of physiochemical and biological parameters within the available studies particularly in the Nun River. Interestingly, physiochemical and biological parameters are always dynamic pending on the prevailing activities of man at various reaches; whose information regarding such be keenly observed and not to be hastily

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concluded. In as much as I reckoned the efforts of such studies Nyananyo, Gijo and Ogamba (2007); Agedah, Ineyougha, Izah and Orutugu (2015); Seiyaboh, Ogamba and Utibe (2018); Aghoghovwia, Nkwa and Obomunu (2022); Silas-Olu and Alagoa (2022); none has been able to characterized the River Nunon the basis of quality. Therefore, this study aimed at characterizing the Upper River Nun, around Odi, Sampou, Agbede, Tombia and Okoloba in Bayelsa State using the National Sanitation Foundation Water Quality Index (NSFWQI). Further information regarding NSFWQI and importance is well documented in Kachroud, Trolard, Kefi, Jebari & Bourri  (2019); Adelagun, Etim and Godwin (2021).

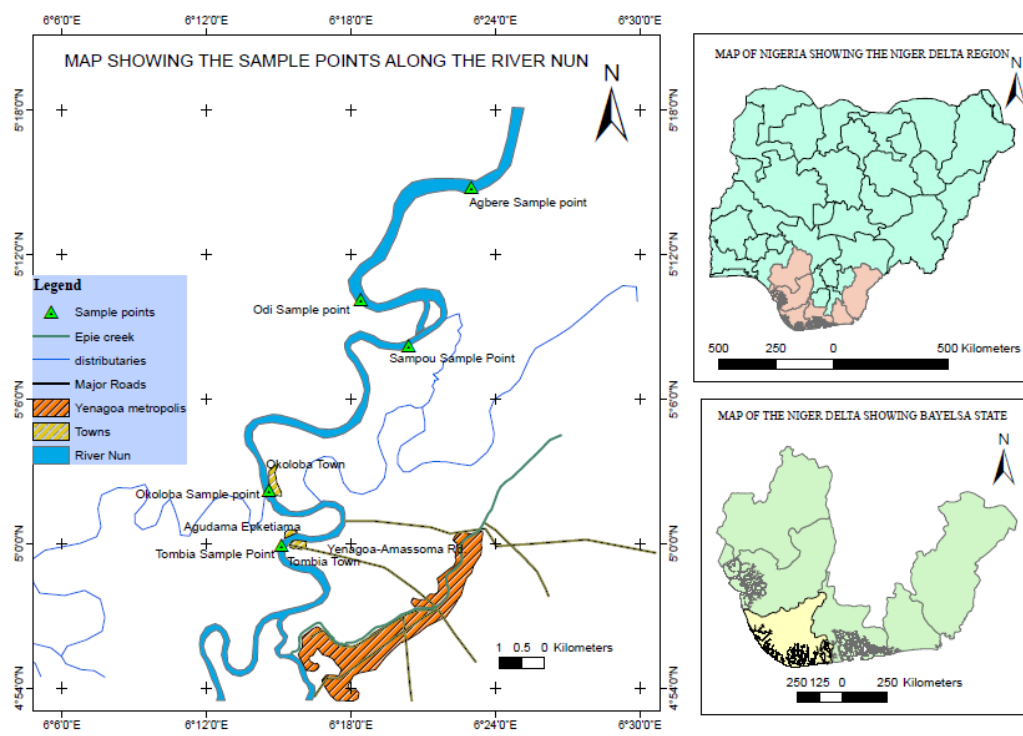
The Water Quality Index (NSFWQI) is a 100-point scale that summarizes results from a total of nine different water parameters (Oram, 2020). The index consider nine (9) water parameters (Temperature ( $^{\circ}\text{C}$ ), Phosphate(mg/l), Nitrate(mg/l), Dissolved Oxygen(mg/l), Total Dissolved Solids(mg/l), Biological Oxygen Demand(mg/l), pH, Turbidity(NTU) and Fecal Coliform bacteria (CFU/100ml); transfer recorded values into useful Q-Values and multiply with respective assigned weighted values each to arrive at single value that logically expressed (placing an identity) on the water quality (Equ 2; Table. 3-4). One interesting aspect in the use of NSFWQI is that temporal variations regarding concentrations of parameters do not influence results unlike the rudimentary reporting system; as higher

concentration values amount to lower Q-values; of such is Fecal Coli(>10, Q 2.0); TDS (>500, Q 20.0); DO (>140 =Q 50); pH (<2 >12 =Q 0.0); Turb (>100 =Q 2.0); Nitra (>10 =Q 2.0).

## MATERIALS AND METHODS

### Study Area

The experimental study was conducted on the Upper Nun River, along Tombia (4.999318, 6.252248), Okoloba (5.036262, 6.243479), Odi (5.169808, 6.3065529), Sampou (5.137430, 6.340031) and Agbere (5.246776, 6.383667) in Bayelsa State (Fig. 1). Tombia is a community in Southern Ijaw Local Government Area; Odi, Okoloba and Sampou are communities in Kolokuma/Opukuma Local Government Area (LGA) while Agbere is in Sagbama Local Government Area. The River Nun is a tributary of the River Niger, located between latitude, 5.137311 and longitude 6.1713881 with wide meander whose outer concave bank is relatively shallow with minimum and maximum widths of 200 and 250m respectively (Ifelebuegu, *et. al.* 2017). River Nun serve many purposes to the locals; include fishing, dredging, gravel mining, farming along the River bank, water transportation, laundry activities and refuse dump site. The river is subjected to tidal influence in the dry season. Water flows rapidly in one direction during the flood (May – October). At the peak of the dry season, the direction of flow is slightly reversed by the rising tide (Seiyaboh, Ogamba & Utibe, 2013).



**Figure 1:** River Nun showing Sample Points

Sources: Researcher, 2023

### Water Sampling Techniques

Water samples were collected bimonthly in Triplicate at five (5) communities at a depth of about 1.5-2.0cm below

surface, corked (stoppered) under water for a period of six (6) months (September- November, 2022 and December-February, 2023). Parameter such as pH and

Turbidity was measured Insitu using respective meters by SCHOTT while mercury-in-glass bulb thermometer is used for Temperature. The sampling bottles/containers for laboratory analysis were rinsed three times with the water at the specific sampling spots before the collection of samples, fixed and preserved on the site, stored in ice-cold containers and transported to the laboratory. Total Dissolved Solids was done following procedures outline by Silas\_Olu and Alagoa (2022). Dissolved Oxygen (DO), Biological Oxygen Demand (BOD<sub>5</sub>), Total Phosphate and Nitrates were done as described by Wokoma and Njoku (2017). Bacteriological analysis is done using Serial Dilution Method and pour plate techniques while the Characterization and Isolation of Enterobacteriaceae using membrane filtration method as explained by Adesakin *et. al.*, (2020).

### Data Analysis

Field and Laboratory data were presented in range and percentages; where necessary a test of statistical differences was performed using Two-Ways Anova (r) at (P<0.05). Comprehensive Pollution Index (CPI) was determine using the single factor pollution index (PI) as described by Iwegbue *et.al.*, (2022) in equation 1. The

Water Quality Index (WQI) was also evaluated using the National Sanitation Foundation Water Quality Index (NSFWQI) method described by Wu, Wang, Chen, Cai and Deng, (2018); Ebuete and Bariweni (2019), Ebuete *et. al.*, (2019) in equation 2.

$PI = C_i / S_i$  ..... Equ 1. (Iwegbue *et. al.*, 2022).

Where:

PI= Pollution Index of Pollutants

C<sub>i</sub> = Parameters concentrated levels of

S<sub>i</sub> = Standard Limits Guide of the parameters (NIS, 2015 and Oram, 2020)

$NSFWQI = \sum Q_i QX$  ..... Equ 2. (Ebuete *et. al.*, 2019)

Where:

Σ = Summation sign

Q<sub>i</sub> = Sub-index for ith water quality parameter

QX= Weight associated with ith water quality

### RESULTS AND DISCUSSION

Water quality monitoring is vital especially in the River Nun to safeguard the public health (dwellers along it catchments), to protect the water resources and explore fundamental tools necessary for the management of surface water been the main sources of drinking water in

**Table 1:** Mean Physiochemical and Biological Parameters of the River Nun

| Parameters             | Seasons | Odi   | Sampou | Agbere | Tombia | Okoloba | NIS, 2015                      |
|------------------------|---------|-------|--------|--------|--------|---------|--------------------------------|
| DO                     | Dry     | 5.35  | 5.27   | 5.67   | 5.38   | 5.75    | 3.7mg/l                        |
|                        | Wet     | 4.75  | 3.71   | 3.68   | 3.32   | 3.87    |                                |
| F. Coli                | Dry     | 16.13 | 16.48  | 15.94  | 16.40  | 16.55   | 10 cfu/ml (1cfu/ml Oram, 2020) |
|                        | Wet     | 18.41 | 18.63  | 18.64  | 18.81  | 19.53   |                                |
| pH                     | Dry     | 7.18  | 7.68   | 8.31   | 7.97   | 8.43    | 6.5-8.9                        |
|                        | Wet     | 7.57  | 7.69   | 7.78   | 7.66   | 7.84    |                                |
| BOD <sub>5</sub>       | Dry     | 8.53  | 9.18   | 10.42  | 11.31  | 12.03   | 6mg                            |
|                        | Wet     | 3.23  | 3.14   | 3.54   | 3.78   | 3.72    |                                |
| T°C                    | Dry     | 27.70 | 27.59  | 28.47  | 28.53  | 28.24   | 20-30°C                        |
|                        | Wet     | 27.44 | 27.37  | 27.22  | 27.69  | 27.81   |                                |
| Total Phosphate        | Dry     | 3.95  | 4.57   | 4.49   | 5.38   | 5.77    | 0.5mg/l                        |
|                        | Wet     | 5.33  | 5.73   | 5.79   | 6.83   | 6.89    |                                |
| Nitrates               | Dry     | 0.45  | 1.88   | 2.34   | 1.75   | 0.96    | 50mg                           |
|                        | Wet     | 3.48  | 3.94   | 4.89   | 4.59   | 4.93    |                                |
| Turbidity              | Dry     | 31.27 | 32.21  | 31.95  | 34.78  | 35.46   | 5NTU                           |
|                        | Wet     | 57.36 | 63.66  | 63.94  | 64.54  | 65.18   |                                |
| Total Dissolved Solids | Dry     | 44.47 | 45.03  | 45.76  | 45.82  | 45.96   | 50mg/l                         |
|                        | Wet     | 32.14 | 32.21  | 32.42  | 32.51  | 32.64   |                                |

Sources: Researcher, 2023. NIS (2015) and Oram (2020)

the rural and some urban areas.

The mean Dissolved Oxygen (DO mg/l) from the five communities range from 5.27-5.75mg/l in the dry season and 3.32-4.75mg/l in the wet season (table 1.); which is within the recommended limits of 7mg/l by Nigerian Industrial Standard (NIS, 2015). Seiyaboh, Ogamba and Utibe (2013) reported 2.1-6.5mg/l; Ifelebuegu,

*et.al.*, (2017) (2.3-6.81mg/l); Aghoghovwia, Nkwa and Obomunu (2022) (6.27-6.81mg/l) for the Nun River; Iwegbue *et.al.*, (2022) (3.07–6.53mg/l) for Bomadi Creek. The mean coliform count (Fecal Coliform cfu/ml) ranged between 15.94-16.55cfu/ml for the dry season and 18.41-19.53cfu/ml during the wet season (table 1). The values were far above recommended standard of

1cfu/ml by (Oram, 2020) and 10 cfu/ml by NIS (2015). This is closely linked to the unmanned discharge of human waste, channeling of human excreta from pie toilets into the river at various reach due to the lack of sanitary rest room. The differences between the dry and wet season concentration account for about 8% which can be attributed exposure of the river to storm water runoff and other inland activities during the wet seasons. Human activities like bathing, farming, washing, and human/animal feces seepage run-offs resulted to the higher values which are capable of transmitting a large number of infectious diseases like meningitis, pneumonia and urinary tract infections in consumers (Adesakin *et. al.*,2020). Aghoghovwia, Nkwa and Obomunu (2022) made similar report for the River Nun; Silas-Olu and Alagoa, (2022) also recorded 153.33-165.33 cfu/ml at Okoloba and Tombia in the Nun River; Ebuete *et.al.* (2019) recorded 9.9-15.6cfu/ml for the Epie Creek; Ebuete and Bariweni (2019) recorded 32-39.83 cfu/ml for the Kolo Creek; Ifelebuegu, *et.al.*(2017) recorded 0.57-1.16x10<sup>5</sup> for the River Nun. However lower values were reported by Ben-Eledo, Kigigha, Izah and Eledo (2017a) 1.55-2.22log MPN/100ml on the Epie Creek.

The mean concentration of pH ranged between 7.18 – 8.43 for the dry seasons and 7.57-7.84, which are within the recommended limits of 6.5-8.9 by NIS (2015). However, the concentration different between the dry and wet seasons sample account for only 1%. Similarly, Nyananyo, Gijo and Ogamba (2007) reported (5.92NTU); 5.50-8.72NTU by Seiyaboh, Ogamba and Utibe, (2013); 6.27-6.81 by Aghoghovwia, Nkwa and Obomunu (2022) for the River Nun. The mean Biological Oxygen Demand (BOD<sub>5</sub>) range between 8.53-12.03mg/l for the dry season and 3.14-3.78mg/l for the wet seasons, which account for 49.4% differences owing to the increasing human activities during the dry seasons.

The BOD concentration is within the recommended limits of 6mg/l by NIS (2015). Nyananyo, Gijo and Ogamba (2007) reported 5.52mg/l for the River Nun; Iwegbue *et.al.* (2022) reported 3.07–6.53mg/l for Bomadi Creek; while Seiyaboh, Ogamba and Utibe, (2013) for River Nun reported 0.7-12.7mg/l. The mean temperature range between the dry seasons is 27.70-28.53°C and 27.22-29.64°C for the wet season, which is within the recommended limits of 20-30°C by the

Nigerian Industrial Standard (2015). The differences between the dry and wet seasons is insignificant (1%). Similar report were made by Silas-Olu and Alagoa (2022) (27.41-27.30°C); Seiyaboh, Ogamba and Utibe (2018) 27.84-28.25 on the River Nun.

The mean concentration of Total phosphate range between 3.95-5.77mg/l and 5.33-6.89mg/l for the dry and wet season respectively; which accounted for about 12% as it worsen during the wet season when surface erosion and surface flow is at its picks. The values were above the recommend limits of 0.5mg/l due to intensive agricultural practices using agrochemical, fertilizers and chemical fishing. Similarly, it align with the reports of Nyananyo, Gijo and Ogamba (2007) 13.76mg/l; 1.60-5.60mg/l by Ifelebuegu, *et.al.*(2017) for the River Nun. The mean nitrate concentration from the five sampled communities range between 0.54-2.34mg/l and 3.48-4.93mg/l for dry and wet season respectively and accounted for about 49% differences; higher during the wet season due to increasing agricultural activities and increasing storm surface runoff during the season; however, the values are within the recommended limits of 50mg/l by NIS (2015). Similar range of 1.0-0.56mg/l was reported by Ifelebuegu, *et.al.*, (2017); 0.025-0.550mg/l by Seiyaboh, Ogamba and Utibe (2013); 0.126-0.24mg/l by Aghoghovwia, Nkwa and Obomunu (2022) on the Nun River.

The mean Turbidity recorded range between 31.24-35.46NTU and 57.36-65.18NTU during the dry and wet season respectively and accounted for 31% difference; higher during the wet season. The values were above the limits of 5NTU recommended by NIS (2015); occasioned by intense human activities like sand dredging at various reach. Similar report in the River Nun was made by Ifelebuegu, *et.al.*, (2017) 1-32NTU; Silas-Olu and Alagoa (2022) 30.72-32.79NTU; Aghoghovwia, Nkwa and Obomunu (2022) 18.72-28.36NTU and Iwegbue *et.al.* (2022) 20.5–42.3NTU for Bomadi Creek.

The mean Total Dissolved Solids (TDS) range between 44.47-45.95mg/l and 32.14-32.64mg/l for dry and wet season with a percentage difference of about 17% in favor of the dry season sample due higher in stream used, fishing activities and agricultural cultivation during the dry season. Aghoghovwia, Nkwa and Obomunu (2022) reported 4.123 – 26.917mg/l; Iwegbue, (2022) reported 27.5–44.7 for the Nun River.

**Table 2:** Two-Ways ANOVA

| Source          | SS       | D.F | MS      | F-ratio | Critical Table Value (%5) |
|-----------------|----------|-----|---------|---------|---------------------------|
| B/w Communities | -16.30   | 4   | -4.08   | 0.066   | 2.57                      |
| B/w Parameters  | 22238.55 | 8   | 2779.82 | 45.25   | 2.14                      |
| B/w Seasons     | 77.426   | 32  | 2.4196  | 0.039   | 1.45                      |
| Error           | 2825.64  | 46  | 61.427  |         |                           |

Sources: Researcher, 2023.

The differences concerning communities are insignificant (F-%5); so also between seasons while the difference

concerning parameters concentrations are significant (Table 2).

**Table 3:** Comprehensive Pollution Index (PI) of the River Nun

| Parameters       | NIS, 2015      | Dry   | PI    | Wet   | PI    | Remarks                |
|------------------|----------------|-------|-------|-------|-------|------------------------|
| DO               | 3-7            | 5.48  | 1.10  | 3.87  | 0.77  | Slightly/Mild Polluted |
| Fecal Coliform   | 1 (Oram, 2021) | 16.30 | 16.30 | 18.80 | 18.80 | Seriously polluted     |
| pH               | 6.5-8.9        | 7.92  | 1.03  | 7.71  | 1.00  | Medium pollution       |
| BOD <sub>5</sub> | 6              | 10.29 | 1.72  | 3.48  | 0.58  | Heavily/Mild Polluted  |
| T°C              | 20-30          | 28.11 | 1.12  | 27.90 | 1.12  | Heavily polluted       |
| Total Phosphate  | 0.5            | 4.83  | 9.66  | 10.95 | 21.9  | Non-Polluted           |
| Nitrates         | 50             | 1.48  | 0.03  | 4.36  | 0.09  | Seriously polluted     |
| Turbidity        | 5              | 33.13 | 6.63  | 62.94 | 12.59 | Seriously Polluted     |
| TDS              | 50             | 45.41 | 0.91  | 32.38 | 0.65  | Mild Polluted          |

Source: Researcher, 2023

The CPI values ranged between 0.03 – 12.98 in the dry season, and 0.09 – 21.99 in the wet season with a mean of 17.5 in both seasons. Thus, the water in the communities along the stretch of the River Nun is graded into “Mild

Pollution” (table 3) with regards to high concentration in faecal coliform count, Nitrates and turbidity. Similar report was made by Iwegbue, (2022) for Bomadi Creek.

**Table 4:** Q-Values Factors Extracted from Sampled Stations

| Parameters             | Weigh Factor | Seasons | Odi  | Sampou | Agbere | Tombia | Okoloba |
|------------------------|--------------|---------|------|--------|--------|--------|---------|
| Do                     | 0.17         | Dry     | 2.5  | 2.3    | 2.6    | 2.3    | 2.7     |
|                        |              | Wet     | 2.2  | 2.1    | 1.9    | 1.7    | 2.0     |
| F. Coli                | 0.16         | Dry     | 67   | 65     | 62     | 65     | 57      |
|                        |              | Wet     | 57   | 53     | 53     | 52     | 48      |
| pH                     | 0.11         | Dry     | 92.4 | 93.7   | 83.4   | 94.2   | 81.3    |
|                        |              | Wet     | 93.3 | 91.3   | 92.8   | 92.5   | 92.9    |
| BOD <sub>5</sub>       | 0.11         | Dry     | 40.1 | 34.3   | 30.8   | 30.4   | 29.8    |
|                        |              | Wet     | 95.6 | 95.8   | 94.9   | 93.7   | 93.5    |
| T°C                    | 0.11         | Dry     | 78.8 | 78.9   | 77.4   | 77.3   | 77.5    |
|                        |              | Wet     | 78.9 | 80.1   | 80.2   | 78.6   | 78.5    |
| Total Phosphate        | 0.10         | Dry     | 18.3 | 14.5   | 14.8   | 12.3   | 11.8    |
|                        |              | Wet     | 12.2 | 11.6   | 11.3   | 10.1   | 9.7     |
| Nitrates               | 0.10         | Dry     | 98.3 | 97.7   | 95.5   | 97.8   | 98.1    |
|                        |              | Wet     | 88.9 | 89.3   | 87.6   | 87.8   | 87.3    |
| Turbidity              | 0.08         | Dry     | 51.3 | 50.9   | 51.1   | 49.7   | 49.3    |
|                        |              | Wet     | 34.5 | 33.6   | 33.4   | 33.1   | 32.8    |
| Total Dissolved Solids | 0.07         | Dry     | 85.3 | 85.7   | 85.9   | 86.3   | 86.8    |
|                        |              | Wet     | 82.3 | 82.4   | 82.5   | 82.8   | 83.2    |

Source: Researcher, 2023.

**Table 5:** Water Quality Index per Communities along the River Nun

| Parameters       | Seasons | Odi   | Sampou | Agbere | Tombia | Okoloba | Total |
|------------------|---------|-------|--------|--------|--------|---------|-------|
| DO               | Dry     | 0.43  | 0.39   | 0.44   | 0.39   | 0.46    | 2.11  |
|                  | Wet     | 0.37  | 0.36   | 0.32   | 0.32   | 0.34    | 1.71  |
| F. Coli          | Dry     | 10.72 | 10.4   | 9.92   | 10.4   | 9.12    | 50.56 |
|                  | Wet     | 9.12  | 8.48   | 8.48   | 8.32   | 7.68    | 42.08 |
| pH               | Dry     | 10.16 | 10.31  | 9.17   | 10.36  | 8.94    | 48.94 |
|                  | Wet     | 10.26 | 10.04  | 10.15  | 10.18  | 10.22   | 50.85 |
| BOD <sub>5</sub> | Dry     | 4.41  | 3.77   | 3.39   | 3.34   | 3.28    | 18.19 |
|                  | Wet     | 10.52 | 10.58  | 10.44  | 10.31  | 10.29   | 52.14 |

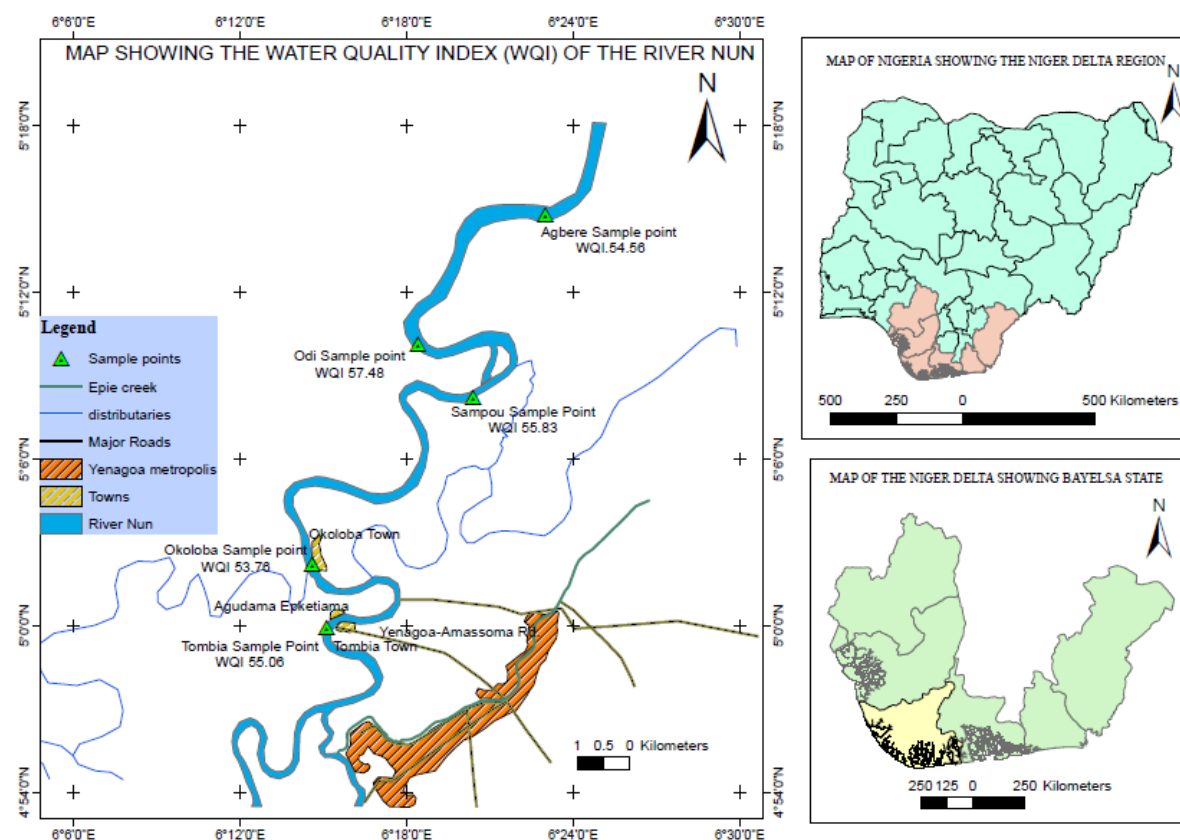
|                        |            |              |              |              |              |              |               |
|------------------------|------------|--------------|--------------|--------------|--------------|--------------|---------------|
| T°C                    | Dry        | 8.67         | 8.68         | 8.51         | 8.53         | 8.53         | 42.92         |
|                        | Wet        | 8.68         | 8.81         | 8.82         | 8.65         | 8.64         | 43.6          |
| Total phosphate        | Dry        | 1.83         | 1.45         | 1.48         | 1.23         | 1.18         | 7.17          |
|                        | Wet        | 1.22         | 1.16         | 1.13         | 1.01         | 0.97         | 5.49          |
| Nitrates               | Dry        | 9.83         | 9.77         | 9.55         | 9.78         | 9.81         | 48.74         |
|                        | Wet        | 8.89         | 8.93         | 8.76         | 8.78         | 8.73         | 44.09         |
| Turbidity              | Dry        | 4.10         | 4.07         | 4.09         | 3.98         | 3.94         | 20.18         |
|                        | Wet        | 2.76         | 2.69         | 2.67         | 2.65         | 2.62         | 13.39         |
| Total Dissolved Solids | Dry        | 5.97         | 6.0          | 6.01         | 6.04         | 6.94         | 30.96         |
|                        | Wet        | 6.58         | 5.77         | 5.78         | 5.80         | 5.82         | 29.75         |
| <b>Grand Total</b>     | <b>Dry</b> | <b>56.56</b> | <b>54.84</b> | <b>52.56</b> | <b>54.05</b> | <b>52.20</b> | <b>270.21</b> |
|                        | <b>Wet</b> | <b>58.40</b> | <b>56.82</b> | <b>56.55</b> | <b>56.02</b> | <b>55.31</b> | <b>282.85</b> |

Source: Researcher, 2023.

**Table 6:** NSQWI Classification among Communities along the River Nun

| Class |     | Grading | Remark    | Odi       | Sampou | Agbere | Tombia | Okoloba |
|-------|-----|---------|-----------|-----------|--------|--------|--------|---------|
| 1     | (A) | 90-100  | Excellent |           |        |        |        |         |
| 2     | (B) | 70-89   | Good      |           |        |        |        |         |
| 3     | (C) | 50-69   | Medium    | Dry 56.56 | 54.84  | 52.56  | 54.05  | 52.20   |
|       |     |         |           | Wet 68.40 | 56.82  | 56.55  | 56.06  | 55.31   |
|       |     |         |           | ΣX: 57.48 | 55.83  | 54.56  | 55.06  | 53.76   |
| 4     | (D) | 25-49   | Bad       |           |        |        |        |         |
| 5     | (E) | 0-24    | Very Bad  |           |        |        |        |         |

Source: Researcher, 2023; Kachroud, Trolard, Kefi, Jebari & Bourrié (2019).



**Figure 2:** Water Quality Index (WQI) of the River Nun, Bayelsa State

Sources: Researcher, 2023

The Water Quality Index (NSWQI) at Odi, Sampou, Agbere, Tombia and Okoloba is categorized into Class 3 (C) “Medium” for both seasons (table 6). On the coronary, the water quality index is literally better during the wet seasons owing to the high volume of water during the seasons; which accounted for about 2.3% differences; however, the interaction difference between seasons is insignificant at %0.05 (table 2). In general, the River Nun is classified into Class 3(C) “Medium”. Similarly, Leizou, Nduka and Verla, (2017) reported poor quality for the Brass River; Aigberua (2019) also reported poor quality for the Taylor Creek; Ebuete and Bariweni (2019) also reported medium - poor for the Kolo Creek; Ebuete et.al. (2019) also recorded medium-poor quality with the Epie Creek; Ofuya and Asibor (2019) reported Medium for the Oji River, Warri; Ugochukwu, Onuorah and Onuora (2019) remarked good – Unsuitable for drinking during the dry seasons and Poor - Unsuitable for drinking in the wet season; Erhenhi and Omoigberale (2020) reported Poor - Medium quality for the Ethiopie River, Rivers State.

## CONCLUSION

It is on record that physicochemical and biological characteristics of the aquatic environment influences directly on the life inhabitant using such water bodies and the aquatic ecosystem; on that note, ascertaining the water quality and productivity is in the assessment of physicochemical and biological parameters. Information regarding sections of the River Nun (physicochemical and biological parameters) were assess and presented in consonants with recommended standards. The concentration of pH, Temperature, Biological Oxygen Demand, Total Phosphate, Turbidity and Total Dissolved Solids were within recommended standards while concentrations for fecal coliform count, Dissolved Oxygen and Nitrate were above recommended standards. The results from the Comprehensive pollution index range between slightly polluted – seriously polluted with regards to high concentrations in fecal coliform count, Dissolved oxygen and Nitrate. The Water Quality Index of the River Nun is classified into Class 3 (C) literally described as Medium; which is unfit for drinking and recreational activities without prior treatment. Therefore, information regarding water quality of the River Nun be transmitted to armed inhabitants of the status of the Nun River.

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