GESA
GLOCAL ENVIRONMENT & SOCIAL ASSOCIATION

International Journal of Biological Innovations
http://ijbi.org.in | http://www.gesa.org.in/journals.php
https://doi.org/10.46505/IJBI.2025.7105
IJBI 7(1): 36-40 **(2025)**
E-ISSN: 2582-1032

WATER QUALITY INDEX (WQI) OF AKASSA CREEK, SOUTHERN NIGERIA

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Article Info:
Research Article
Received
09.01.2025
Reviewed
20.02.2025
Accepted
05.03.2025

Abstract: Water quality index (WQI) is an important tool used to evaluate the status of a water body through a single value. In recent times, there have been serious concerns on the state of most coastal water of which Akassa creek is a portion. Water samples were collected from Akassa creek between June and December, 2024 from two stations. The water was analysed for Dissolved Oxygen, Biological Oxygen Demand, EC, nitrate, total hardness, zinc, cadmium, copper, lead using standard methods and the average taken using descriptive analysis. WQI values of 12.669 and 24.029 were recorded for both stations respectively. The result reveals that the study area had an excellent status. However, more detailed research work is recommended.

Keywords: Akassa creek, Impact assessment, Niger delta, Pristine, Water status, Water quality.

Cite this article as: Ogidìaka-Obende E., Anayeokwu S.N., Omoarebun E.O., Atadiose J. and Oyem I.M. (2025). Water Quality Index (WQI) of Akassa Creek, Southern Nigeria. *International Journal of Biological Innovations*. 7(1): 36-40. https://doi.org/10.46505/IJBI.2025.7105

INTRODUCTION

Water is an important resource that is essential for human existence, agriculture, industry etc. (Taiwo *et al.*, 2012; Kumar, 2018). Akassa creek has been a great livelihood support base for the residence of Burutu, as well as the neighbouring communities. The creek serves both for artisanal and aquaculture purposes. The usability and main productivity of surface water system is depended on its quality (Agbaire and Obi, 2009; Gupta *et al.*, 2013; Dwivedi, 2020; Goswami *et al.*, 2021; Kalal *et al.*, 2021). The assessment of water quality, usually carried out by determining its physico-chemical and biological properties or parameters against a set of standards, is used to determine whether the water is suitable for consumption or safe for the environment. Water quality assessment can be defined 'as the evaluation of physical, chemical and biological state of the water in relation with the natural state, anthropogenic effects and future uses (Chapman, 1996)'. The general norm for reporting water quality parameters by comparing the different analyzed parameters with their respective permissible limits and standards set by regulating bodies at local, regional, national or

international levels has been deduced to be ineffective in environmental monitoring program by both managers and the general public (Shweta *et al.,* 2013).

The WQI is based on the measurement of different water quality parameters thus providing a mechanism for presenting a cumulatively derived numerical expression for defining water quality index. Carlos *et al.* (2007) summarized the water quality data in a simple expressible format that describes the general health or status of a water body is more preferable to environmental managers and the general public rather than being asked to give a rather biased interpretation to complex and technical environmental data. WQI was first developed by Horton (1965), which presents a mathematical method of calculating a single value to represent water quality from multiple water quality parameters. The index represents the level of quality of a water body such as lake, river or stream by using some of the regularly used water parameters (BOD, temperature, turbidity, conductivity etc. (Kankal *et al.,* 2012). The objective of WQI is to turn complex water quality data into information that is understandable and usable by the public.

Several workers including Amadi *et al*. (2010), Ahaneku and Animashaun (2013), Iyama and Edori (2013), Ezeilo and Oba (2016), Ibiam *et al*. (2016), Aliyu *et al*. (2019), Aigberua *et al*. (2020), Uddin *et al*. (2021), Chakraborty *et al.* (2021), Sadiq *et al.* (2022) worked a lot on the related subject but there is a void of knowledge in this regards at the study sites, hence, authors took the opportunity to explore.

MATERIALS AND METHODS

Akassa creek is located in the Niger Delta, in Southern Nigeria in Burutu Local Government area and it is geographically located at latitude 5°19'25" N and longitudes 5°30'4" E of the Greenwich meridian. The climate of the study area is known by distinct wet and dry seasons. The two seasons are influenced by the tropical continental air mass, which brings the dry season (November to March) and the tropical maritime air mass that ushers in the wet season (April and ends in October). The main activity taking place in the study area is fishing and sand dredging.

Data collection techniques

Water samples were collected between October and December, 2024 from two (2) stations within Akassa creek at Burutu town and analysed as described in Standard Methods for the Examination of Water and Wastewater (APHA, 1998).

The different water quality parameters analyzed were: pH, biochemical oxygen demand (BOD), electrical conductivity (EC), total alkalinity (TA), total hardness (TH), calcium (Ca^{++}), nitrate (NO_3^-), iron (Fe), cadmium (Cd), copper (Cu), and zinc (Zn). The measurements were conducted using various methods; pH, EC and dissolved oxygen (DO) were measured using a calibrated HANNA HI model meter. BOD was determined titrimetrically after fixation with Winkler solutions on days 1 and 5. The difference between DO on days 1 and 5 was calculated to obtain the BOD concentration in mg/L. TA, TH, and Ca concentrations were determined titrimetrically. NO_3^- was determined calorimetrically. Fe, Cd, Cu, and Zn concentrations were determined using atomic absorption spectroscopy (AAS) after wet digestion with nitric acid.

Water Quality Index Calculation

The water quality index was evaluated using the equation as defined by Cude (2001).

$$WQI = \frac{\sum QiWi}{\sum Wi}$$

Where,

$$\text{Qi = Quality rating of each parameter} = \frac{\text{V actual} - \text{V ideal}}{\text{V standard} - \text{V ideal}} \times 100.$$

V actual = Actual value of the water quality parameter obtained from laboratory analysis

V ideal for pH = 7 and for other parameters it is said to be zero.

V standard = Represents the recommended WHO standard of the water quality parameter.

Wi = Unit weight = 1/ Si

Si= WHO Standard permissible value for nth parameter.

Qi = Quality rating of ith parameter for a total of n water quality parameters.

WQI values were categorized into five according to Ramakrishniah *et al*. (2009) as shown in the table 1.

Table 1: Water quality index categorization.

Category	Description
< 50	Excellent
50-100	Good water
100-200	Poor water
200-300	Very poor (bad) water
>300	Unsuitable (unfit for drinking)

RESULTS

WQI values of 12.669 and 24.029 were obtained for both stations respectively indicating that the

Table 2: Water quality index for station 1 for the entire study period.

Parameter	Observed values	Standard limits (Sn)	Unit Weight (Wn)	Quality Rating (Qn)	WnQn
Water temperature (^{O}C)	22.22	28	0.036	0.794	79.4
pH	6.96	8.5	0.117	-0.027	-2.7
Conductivity (µScm-1)	1890	40	0.025	47.25	4725
DO (mgO_2/l)	8.6	10	0.1	0.86	86
BOD (mgO_2/l)	3.82	4	0.25	0.955	95.5
Alkalinity (mg/l)	44.2	200	0.005	0.221	22.1
Phosphate (mg/l)	0.03	0.1	10	0.3	30
Nitrate Nitrogen (mg/l)	0.19	50	0.02	0.004	0.4
Total Hardness	1219	250	0.004	4.876	487.6
Zinc (mg/l)	0.003	3	0.0333	0.001	0.1
Copper (mg/l)	0.12	2	0.5	0.01	1
Cadmium (mg/l)	0.33	0.003	333.333	0.06	6
Lead (mg/l)	0.01	0.01	100	1	100
		∑Wn=444.4233		∑WnQn=5630.4 WQI=12.669	

DISCUSSION

WQI is used to classify water relatives to their chemical, biological, physical characteristics, which define their possible uses and applications. The indices are one of the most simplified methods of communicating water quality classification to the general public or those in authority.

The sampling stations analysed from Akassa creek situated in the Niger Delta region of southern Nigeria can be considered as clean indicating that the activities around the sampling stations are not negatively impacting the water body. This is in line with the reports of Iyama and Edori (2013) for River Isiodu. Reports from this study reflected a lower number when compared to reports of 122.46 to 203.65 from Imiringi River, by Aigberua *et al*.(2020), 174.49 for rivers Otamiri and Oramiriukwu in Rivers State, by Amadi *et al*. (2010), value of 105.77 and 126.34 during the dry and rainy periods respectively river Gamla, Zaria, in Northwestern Nigeria. In general, WQI gives an idea of the combined influence of several water quality indicators and reveal water quality concerns to the public and decision makers. Furthermore, WQI provides assurance on the safety of a water body to users such as habitat for aquatic life, irrigation water for agriculture and livestock, recreation and aesthetics, and drinking water supplies.

Table 3: Water quality index for station 2 for the entire study period.

Parameter	Observed values	Standard limits (Sn)	Unit Weight (Wn)	Quality Rating (Qn)	WnQn
Water temperature (^{O}C)	22.23	28	0.036	0.793	79.393
pH	5.27	8.5	0.117	-1.153	-115.3
Conductivity (µScm-1)	2072.42	40	0.025	51.811	5181.1
DO (mgO_2/l)	7.49	10	0.1	0.749	74.9
BOD (mgO_2/l)	3.73	4	0.25	0.933	93.25
Alkalinity (mg/l)	49.17	200	0.005	0.246	24.6
Phosphate (mg/l)	0.05	0.1	10	0.5	50
Nitrate Nitrogen (mg/l)	0.21	50	0.02	0.0042	0.42
Total Hardness	1375	250	0.004	5.5	550
Zinc (mg/l)	0.02	3	0.0333	0.00666	0.666
Copper (mg/l)	0.14	2	0.5	0.07	7
Cadmium (mg/l)	0.13	0.003	333.333	43.333	4333.333
Lead (mg/l)	0.04	0.01	100	4	400
		∑Wn=444.4233		∑WnQn=10679.362 WQI=24.029	

CONCLUSION

WQI is very effective for water quality monitoring. The single-value output of the index, derived from several parameters, provides important information about water quality that is easily interpretable by the general and non-technical populace. The result obtained from the study for the calculated water quality indicator is within the recommended range as indicated. A continuous monitoring of the Akassa creek is recommended as the activities within the region keeps skyrocketing.

REFERENCES

1. **Agbaire O. and Obi C.G.** (2009). Seasonal variation of some physicochemical properties of River Ethiope water in Abraka, Nigeria. *Journal of Applied Environmental Management*. 13(1): 55-57. 10.4314/jasem.v13i1.55265
2. **APHA** (1998). Standard Methods of the Examination of Water and Wastewater. 20th Edition, Washington DC.
3. **Ahaneku I.E. and Animashaun I.M.** (2013). Determination of water quality index of river Asa, Ilorin, Nigeria. *Advances in Applied Science Research*. 4(6): 277-284.
4. **Aigberua A., Tarawou T. and Erepamowei Y.** (2020). Environmental Assessment of Imiringi River in South-South Nigeria: the Water Quality Index Approach. *Current World Environment*. 15: (1): 59-67. http://dx.doi.org/10.12944/CWE.15.1.09
5. **Aliyu G.A., Jamil N.R.B., Adam M.B. and Zulkeflee Z.** (2019). Assessment of Guinea Savanna River System to evaluate water quality and water monitoring networks. *Global Journal of Environmental Science and Management*, 5(3): 345-356. https://doi.org/10.22034/GJESM.2019.03.07
6. **Amadi A.N., Olasehinde P.I., Okosun E. and Yisa J.** (2010). Assessment of Water Quality Index of Otamiri and Oramiriukwa Rivers. *Physics International*. 1(2): 116-123.
7. **Carlos M., Volpedo A.V., Ojeda C. and Cirelli A.F.** (2007). Water Quality Index as a Tool for River Assessment in Agricultural areas in the Pampean Plains of Argentina *Journal of Urban and Environmental Engineering*. 1(1):18-25. 10.4090/juee.2007.v1n1.018025

8. **Chakraborty B.K., Verma A.K. and Muniya S.** (2021). Present Status of Aquatic Resource and Its Catch of Mogra River in Bangladesh. *Sustainable Marine Structures.* 3 (2): 26-38. http://dx.doi.org/10.36956/sms.v3i2.436

9. **Chapman D.** (1996). Water Quality Assessments: A Guide to the Use of Biota, Sediments and Water. Environmental Monitoring. Second Edition. UNESCO, WHO, and UNEP. E & FN Spon, London UK.

10. **Cude G.C.** (2001). Oregon Water Quality Index: A Tool for Evaluating Water Quality Management Effectiveness. *Journal of the American Water Resources Association*. 37: 125-137. http://dx.doi.org/10.1111/j.1752-1688.2001.tb05480.x

11. **Dwivedi S.** (2020). Evaluation of Drinking Water Quality Status by Water Quality Index: A Case Study of Shikhar Water Fall, Dehradun (UK), India. *International Journal of Biological Innovations.* 2 (2): 214-219. https://doi.org/10.46505/IJBI.2020.2218

12. **Ezeilo F.E. and Oba K.M.** (2016). Evaluation of Water Quality Index of Orashi River, Rivers State, Nigeria. *International Journal of Environmental Issues.* 12(1-2): 60-75.

13. **Goswami D.N., Gautam Y.P. and Kumar A.** (2021). Evaluation of Ganges water quality and its suitability for Agriculture use from Rishikesh to Prayagraj, India. *International Journal of Biological Innovations*. 3(2):417-421. https://doi.org/10.46505/IJBI.2021.3225

14. **Gupta N., Yadav K.K., Kumar V. and Singh D.** (2013). Assessment of physicochemical properties of Yamuna River in Agra City. *International Journal of Chemical and Technology Research*. 5: 528-531.

15. **Horton R.K.** (1965). An index number for rating water quality. *Journal of Water Pollution Control Federation.* 37(3): 300-306.

16. **Ibiam N.A., Nwajei G.E., Agbaire P.O. and Verla A.W.** (2018). Determination of Water Quality Index of Selected Water Bodies in Warri, Delta State, Nigeria. *World News of Natural Sciences*.16: 42-52.

17. **Iyama W.A. and Edori O.S.** (2013). Water Quality Index Estimate for Isiodu River Water during Dredging in Niger Delta, Nigeria. *Global Journal of Pure and Applied Sciences.* 9(3):153-159. https://doi.org/10.3923/tasr.2014.153.159

18. **Kalal V., Giri M.J., Baskar S. and Kuba R.** (2021). Detection of Pollutants present in the surface water of Ayad River, Udaipur, Rajasthan. *International Journal of Biological Innovations.* 3 (1): 212-220. https://doi.org/10.46505/IJBI.2021.3123

19. **Kankal N.C., Indurkar M.M., Gudadhe D.J. and Wate S.R.** (2012). Water Quality Index of Surface Water Bodies of Gujarat, India. *Asian J. Exp. Sci.* 26(1): 39-48.

20. **Kumar A.V.** (2018). Unsustainable Agriculture, Environmental Ethics and Ecological Balance. *HortFlora Research Spectrum*. 7 (3): 239-241.

21. **Ramakrishnaiah C.R., Sadashivaiah C. and Ranganna G.** (2009). Assessment of Water Quality Index for the Groundwater in Tumkur Taluk, Karnataka State, India. *E-Journal of Chemistry*. 6(2): 523-530. http://dx.doi.org/10.1155/2009/757424

22. **Sadiq Q., Ezeamaka C.K., Daful M., Butu A.W., Adewuyi T.O., Ajibuah J. and Mustafa I.A.** (2022). Assessment of water quality in River Kaduna, Nigeria. *Journal of Research in Forestry, Wildlife & Environment.* 14(2): 154-165.

23. **Shweta T., Bhavtosh S., Prashant Singh and Rajendra D.** (2013). Water Quality Assessment in Terms of Water Quality Index. *American Journal of Water Resources.* 1 (3): 34-38. 10.12691/ajwr-1-3-3.

24. **Taiwo A.M., Olujimi O.O., Bamgbose O. and Arowolo T.A.** (2012). Surface Water Quality Monitoring in Nigeria: Situational Analysis and Future Management Strategy. *Water Quality Monitoring and Assessment*. 13: 301-322. 10.5772/33720

25. **Uddin M.G., Nash S. and Olbert A.I.** (2021). A review of water quality index models and their use for assessing surface water quality. *Ecological Indicators*. 122: 107218. https://doi.org/10.1016/j.ecolind.2020.107218