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A Comparative Review of Pollution Status and Fish Assemblage of River Nun and Ekole River, Bayelsa State, Nigeria

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ABSTRACT
The relationship between pollution status and fish assemblage of River Nun and Ekole River in Bayelsa State, Nigeria was investigated to evaluate the ecological condition and fisheries potential of the river systems. Monthly sampling was conducted for twelve months from selected stations in both rivers. Physicochemical parameters including pH, dissolved oxygen (DO), biochemical oxygen demand (BOD_5), temperature, alkalinity, and electrical conductivity (EC) were analyzed using standard laboratory procedures, while fish samples obtained from artisanal fish landing sites were identified and enumerated using standard taxonomic keys. Data generated were analyzed using descriptive statistics and t-test at $P<0.05$. Results showed that pH ranged from 5.62±0.24 to 5.87±0.34, dissolved oxygen from 5.55±0.23 mg/l to 6.27±0.50 mg/l, temperature from 26.66±0.80°C to 27.93±0.64°C, BOD_5 from 2.31±0.26 mg/l to 2.65±0.28 mg/l, alkalinity from 50.04±2.59 mg/l to 53.38±1.34 mg/l, and EC from 49.14±1.29 ms/m to 52.45±2.23 ms/m. Significant seasonal variations ($P<0.05$) were observed in all parameters except BOD_5. Fish assemblage analysis recorded 29 fish species belonging to 20 families with a total abundance of 12,406 individuals. The wet season recorded higher abundance (6,740 individuals) than the dry season (5,666 individuals). Cichlidae and Claridae were the dominant families, while *Oreochromis niloticus* (2,678) and *Clarias gariepinus* (2,567) were the most abundant species. In conclusion, both rivers still maintain relatively stable ecological conditions suitable for sustainable fisheries. Continuous monitoring and effective environmental management are recommended to prevent future ecological degradation.
Keywords: Pollution status, Fish assemblage, Physicochemical parameters, River Nun, Ekole River, Bayelsa State

INTRODUCTION

Water quality remains one of the most important environmental factors influencing the productivity, diversity, and sustainability of aquatic ecosystems across the world. Physicochemical characteristics of water such as dissolved oxygen, pH, temperature, electrical conductivity, turbidity, and nutrient concentration determine the suitability of aquatic habitats for fish growth, survival, distribution, and reproduction (Eguakun & Alagoa, 2025; Roy et al., 2023). Alterations in these environmental variables often affect biological communities and may result in ecological imbalance within freshwater ecosystems. Increasing environmental degradation caused by anthropogenic activities such as industrial discharge, urbanization, oil exploration, agricultural runoff, and indiscriminate disposal of wastes has become a

major challenge confronting aquatic ecosystem globally (Mohammed et al., 2026). These disturbances have generated serious concerns regarding the ecological stability and fisheries productivity of inland waters, particularly in developing countries where rivers serve as important sources of food and livelihood (Feisal et al., 2023).

In Nigeria, especially within the Niger Delta region, rivers and estuaries constitute important ecological and economic resources that support artisanal fisheries, transportation, domestic activities, and biodiversity conservation. However, many of these aquatic ecosystems are increasingly threatened by pollution arising from oil exploration, dredging, sewage discharge, municipal waste disposal, and other human activities (Onyena et al., 2025). Rivers such as Bonny River and Warri River have experienced considerable environmental stress due to pollution, resulting in deterioration of water quality and decline in fisheries resources (Chindah & Braide, 2003: Ekelemu & Zelibe, 2006). The consequences of aquatic pollution extend beyond ecological degradation to include reduction in fish catch, loss of biodiversity, disruption of aquatic food chains, and threats to the livelihoods of local fishing communities that depend heavily on riverine resources for survival (Alagoa & Eguakun, 2025; Eli et al., 2025).

Fish assemblage patterns are widely recognized as effective biological indicators for assessing the ecological status and pollution level of freshwater ecosystems. Changes in water quality conditions often influence fish diversity, abundance, migration, breeding activities, and species composition (Alagoa & Eguakun, 2025). There is considerable evidence that pollution in aquatic ecosystems contributes significantly to regime shifts in fish assemblage structure, particularly in polluted water bodies within the Niger Delta region. Pollution-induced habitat alteration may result in displacement of sensitive fish species, reduction in fish abundance, and dominance of pollution-tolerant species. Consequently, continuous monitoring of fish assemblage and physicochemical conditions of rivers has become essential for effective fisheries management and environmental conservation (Gillson et al., 2012; Williams et al., 2004; Onyena et al., 2025).

River Nun and Ekole River are among the major freshwater ecosystems in Bayelsa State that support extensive artisanal fishing activities and provide important ecosystem services to surrounding communities. Despite their ecological and socioeconomic significance, these rivers are continuously exposed to anthropogenic pressures associated with urbanization, waste disposal, flooding, transportation activities, and other human disturbances. Seasonal flooding and runoff may also influence water quality and fish distribution within these river systems. Although several studies have examined water quality and fish assemblage in some Nigerian rivers, there remains limited comparative information regarding the pollution status and fish community structure of River Nun and Ekole River. This knowledge gap creates the need for detailed ecological investigations within these important freshwater ecosystems (Alagoa et al., 2018; Onuoha & Eze, 2017; Edegbene et al., 2025).

Therefore, this study was undertaken to comparatively investigate the pollution status and fish assemblage of River Nun and Ekole River in Bayelsa State, Nigeria. The study specifically evaluated selected physicochemical parameters including dissolved oxygen, biochemical oxygen demand, pH, alkalinity, temperature, and electrical conductivity, while also assessing fish diversity, abundance, distribution, and seasonal variation within the river systems. This research becomes necessary because it provides baseline ecological information required for sustainable fisheries management, environmental monitoring, and conservation planning in the Niger Delta region. The findings of this study are expected to contribute significantly to understanding the relationship between pollution status and fish assemblage patterns in tropical freshwater ecosystems (Moses, 2001; Bashir et al., 2025).

MATERIALS AND METHODS

Study Area

The study was conducted in River Nun and Ekole River located in Bayelsa State within the Niger Delta region of Nigeria. These rivers are important freshwater ecosystems that support artisanal fisheries, transportation, domestic activities, and biodiversity conservation. River Nun is one of the major distributaries of the River Niger, while Ekole River serves as an important fishing and transportation route

for several riverine communities. The rivers are characterized by tropical climatic conditions with distinct wet and dry seasons, high annual rainfall, and seasonal flooding which significantly influence hydrological and ecological processes within the aquatic systems. Three sampling stations were strategically selected from each river based on accessibility, fishing intensity, anthropogenic activities, and ecological characteristics of the water bodies (Alagoa et al., 2018; Onyena et al., 2025). In Ekole River, Station 1 was located at latitude N4°55'46.165'' and longitude E6°14'14.46'' with an altitude of 1.5 m above sea level. Station 2 was situated at latitude N4°55'36.287'' and longitude E6°06'22.56'' with an altitude of 1.0 m, while Station 3 was located at latitude N4°55'41.41'' and longitude E6°06'22.53'' with an altitude of 1.5 m above sea level. These stations were selected to adequately represent the ecological and environmental conditions of the river system.

Collection of Physicochemical Samples

Water samples were collected monthly for a period of twelve months from the selected sampling stations in River Nun and Ekole River. Triplicate subsurface water samples were collected using clean plastic sample bottles. The bottles were carefully immersed approximately 20–30 cm below the water surface and allowed to fill gradually in order to avoid contamination and trapping of air bubbles. Collected samples were properly labeled according to station and sampling period before transportation to the laboratory for physicochemical analysis. Sampling procedures were carried out in accordance with standard methods recommended for freshwater quality assessment (APHA, 2017; Adesuyi et al., 2016).

Determination of Dissolved Oxygen and Biochemical Oxygen Demand

Water samples for dissolved oxygen (DO) and biochemical oxygen demand (BOD5) analyses were collected using dark reagent bottles to prevent light penetration and minimize biological alteration before laboratory analysis. The bottles were completely submerged in the river water to eliminate air interference during sampling. Dissolved oxygen samples were fixed immediately after collection using Winkler I and Winkler II reagents, while biochemical oxygen demand samples were stored in dark conditions and incubated for five days before analysis. The determination of DO and BOD5 was conducted following standard laboratory procedures for aquatic environmental monitoring (APHA, 2017; WHO, 2022).

Equation for Dissolved Oxygen Calculation

$$DO\ (mg/L) = \frac{V_t \times N \times 8 \times 1000}{V_s}$$

Where:

- V_t= Volume of sodium thiosulphate used (ml)
- N= Normality of sodium thiosulphate
- V_s= Volume of water sample (ml)
- 8 = Equivalent weight of oxygen

Equation for BOD_5 Determination

$$BOD_5\ (mg/L) = DO_{initial} - DO_{final}$$

Where:

- $DO_{initial}$= Initial dissolved oxygen before incubation
- DO_{final}= Dissolved oxygen after 5 days incubation at 20°C

For diluted samples, BOD_5 was calculated using:

$$BOD_5\ (mg/L) = \frac{(DO_i - DO_f) \times Dilution\ Factor}{P}$$

Where:

- DO_i= Initial dissolved oxygen
- DO_f= Final dissolved oxygen after incubation

- P= Decimal fraction of sample volume used
- Dilution Factor = Volume correction factor for diluted samples

Collection of Fish Samples

Fish samples were collected monthly from artisanal fishers operating along River Nun and Ekole River. Fish landing points and jetties located around the river banks served as the major sampling points for fish collection. Fishers returning from fishing activities in the early hours of the day were approached and their catches examined. The collected fish samples were sorted according to species, counted, and recorded appropriately. Sampling was conducted throughout both wet and dry seasons to capture seasonal variations in fish assemblage and abundance within the rivers (Alagoa et al., 2018; Edegbene et al., 2025).

Physicochemical Analysis

Physicochemical parameters analyzed included temperature, pH, dissolved oxygen, biochemical oxygen demand, alkalinity, and electrical conductivity. Water temperature was determined in situ using a mercury thermometer, while pH and electrical conductivity were measured using portable digital meters. Alkalinity was determined using titrimetric procedures, whereas dissolved oxygen and biochemical oxygen demand were analyzed using the Winkler titration method. All laboratory analyses were conducted using internationally accepted standard procedures for water quality assessment (APHA, 2017; WHO, 2022).

Identification and Enumeration of Fish Samples

Identification of fish species collected from the rivers was carried out using standard taxonomic identification keys and fish guides for Nigerian freshwater fishes. Morphological features such as body shape, fin arrangement, scale pattern, coloration, and mouth structure were used for species identification. Enumeration of fish species was achieved through direct manual counting of individual fishes collected from the landing sites. Scientific names and families of identified fish species were recorded accordingly (Olaosebikan & Raji, 2013; Froese & Pauly, 2024).

Statistical Analysis

Data obtained from physicochemical analysis and fish assemblage assessment were subjected to descriptive and inferential statistical analyses. Means and standard deviations were calculated for all measured physicochemical parameters and fish abundance data. T-test analysis was employed to determine significant seasonal variations between wet and dry season values of physicochemical parameters in both river systems. Statistical analyses were conducted using SPSS® version 20.0 software package at a confidence level of 95% ($P<0.05$) (Bashir et al., 2025).

Quality Control

Quality control procedures were adopted throughout the study to ensure accuracy and reliability of results. Sample bottles and laboratory apparatus were properly cleaned and sterilized before use to prevent contamination. Field instruments including pH meter, conductivity meter, and thermometer were calibrated before sampling using standard solutions. Triplicate samples were collected and analyzed using standard procedures recommended by APHA (2017) and WHO (2022). Fish identification was conducted using standard taxonomic keys to avoid species misidentification (Olaosebikan & Raji, 2013). All data generated were carefully validated and cross-checked prior to statistical analysis.

RESULTS

Table 1: Mean Seasonal Physicochemical Parameters of Ekole River

Parameters	Dry Season	Wet Season
pH	$5.62^{a} \pm 0.24$	$5.87^{b} \pm 0.34$
DO (mg/l)	$5.55^{a} \pm 0.23$	$6.27^{b} \pm 0.50$
Temperature (°C)	$27.93^{a} \pm 0.64$	$26.66^{b} \pm 0.80$
BOD_5 (mg/l)	$2.65^{a} \pm 0.28$	$2.31^{a} \pm 0.26$
Alkalinity (mg/l)	$53.38^{a} \pm 1.34$	$50.04^{b} \pm 2.59$
EC (ms/m)	$52.45^{a} \pm 2.23$	$49.14^{b} \pm 1.29$

Values are presented as Mean ± Standard Deviation. Means with different superscripts (a,b) across rows are significantly different ($P<0.05$), while values with the same superscript are not significantly different ($P>0.05$).

The result (table 1) showed significant seasonal variations in pH, dissolved oxygen, temperature, alkalinity, and electrical conductivity between the dry and wet seasons ($P<0.05$). Dissolved oxygen and pH values were higher during the wet season, while temperature, alkalinity, and electrical conductivity were higher during the dry season. However, biochemical oxygen demand (BOD_5) did not vary significantly between seasons ($P>0.05$).

Table 2: Diversity, Distribution and Abundance of Fish in Ekole River

S/N	Family	Scientific Name	Abundance
1	Claridae	*Clarias gariepinus*	2567
2	Claridae	*Clarias anguillaris*	678
3	Claridae	*Heterobranchus bidorsalis*	1002
4	Cyprinidae	*Labeo rosae*	223
5	Cyprinidae	*Hampala macrolepidata*	450
6	Cyprinidae	*Barbus enema*	231
7	Cichlidae	*Oreochromis niloticus*	2678
8	Cichlidae	*Pseudotolithus senegalensis*	1222
9	Cichlidae	*Pelvicachromis pulcher*	300
10	Synodontidae	*Synodontis nigritta*	345
11	Synodontidae	*Synodontis gobroni*	123
12	Lutjanidae	*Trachinotus teraia*	248
13	Lutjanidae	*Lutjanus dentatus*	87
14	Gymnacidae	*Gymnarchus niloticus*	289
15	Claroteidae	*Chrysichthys nigrodigitatus*	344
16	Protopteridae	*Protopterus annectens*	56
17	Ariidae	*Synodontis schall*	34
18	Carangidae	*Parachanna africana*	567
19	Carangidae	*Parachanna obscura*	43
20	Eleotridae	*Eleotris vittata*	56
21	Polynemidae	*Liza falcipinnis*	43
22	Mugilidae	*Mugil curema*	90
23	Soleidae	*Mastacembelus docorsii*	6
24	Tetradontidae	*Tetraodon lineatus*	44
25	Anabantidae	*Ctenopoma petherici*	12
26	Gobiidae	*Polydactylus quadrifilis*	43
27	Monodactylidae	*Monodactylus sabae*	212
28	Mormyridae	*Marcusenius greshoffi*	324
29	Citharinidae	*Citharinus gibbosus*	89
Total			12,406

A total of 12,406 fish individuals belonging to 20 families and 29 species were recorded from Ekole River during the study period (Table 2). The family Cichlidae and Claridae were the most dominant groups in terms of abundance, while *Oreochromis niloticus* and *Clarias gariepinus* were the most abundant species recorded in the river system.

Table 3: Seasonal Diversity, Distribution and Abundance of Fish in Ekole River

S/N	Family	Scientific Name	Wet Season	Dry Season
1	Claridae	*Clarias gariepinus*	1367	1200
2	Claridae	*Clarias anguillaris*	392	286
3	Claridae	*Heterobranchus bidorsalis*	522	480
4	Cyprinidae	*Labeo rosae*	123	100
5	Cyprinidae	*Hampala macrolepidata*	240	210
6	Cyprinidae	*Barbus enema*	131	100
7	Cichlidae	*Oreochromis niloticus*	1357	1321

8	Cichlidae	*Pseudotolithus senegalensis*	622	600
9	Cichlidae	*Pelvicachromis pulcher*	160	140
10	Synodontidae	*Synodontis nigritta*	225	120
11	Synodontidae	*Synodontis gobroni*	63	60
12	Lutjanidae	*Trachinotus teraia*	128	120
13	Lutjanidae	*Lutjanus dentatus*	47	40
14	Gymnacidae	*Gymnarchus niloticus*	159	130
15	Claroteidae	*Chrysichthys nigrodigitatus*	222	122
16	Protopteridae	*Protopterus annectens*	36	20
17	Ariidae	*Synodontis schall*	20	14
18	Carangidae	*Parachanna africana*	367	200
19	Carangidae	*Parachanna obscura*	30	13
20	Eleotridae	*Eleotris vittata*	26	30
21	Polynemidae	*Liza falcipinnis*	23	20
22	Mugilidae	*Mugil curema*	60	30
23	Soleidae	*Mastacembelus docorsii*	6	0
24	Tetradontidae	*Tetraodon lineatus*	22	22
25	Anabantidae	*Ctenopoma petherici*	7	5
26	Gobiidae	*Polydactylus quadrifilis*	23	20
27	Monodactylidae	*Monodactylus sabae*	112	100
28	Mormyridae	*Marcusenius greshoffi*	200	124
29	Citharinidae	*Citharinus gibbosus*	50	39
Total			6,740	5,666

The wet season recorded higher fish abundance (6,740 individuals) compared to the dry season (5,666 individuals) (Table 3). Most fish species showed increased abundance during the wet season, indicating that seasonal flooding and increased nutrient availability enhanced fish productivity and distribution within the river system.

Table 4: Percentage Species Richness in Ekole River

S/N	Family	Number of Species	Percentage Occurrence (%)
1	Cichlidae	3	10.34
2	Claridae	3	10.34
3	Carangidae	2	6.89
4	Lutjanidae	2	6.89
5	Cyprinidae	3	10.34
6	Synodontidae	2	6.89
7	Mormyridae	1	3.44
8	Citharinidae	1	3.44
9	Monodactylidae	1	3.44
10	Gymnacidae	1	3.44
11	Claroteidae	1	3.44
12	Protopteridae	1	3.44
13	Ariidae	1	3.44
14	Eleotridae	1	3.44
15	Polynemidae	1	3.44
16	Mugilidae	1	3.44
17	Soleidae	1	3.44
18	Tetradontidae	1	3.44
19	Anabantidae	1	3.44
20	Gobiidae	1	3.44
Total		29	100

Species richness analysis (Table 4) revealed that the families Cichlidae, Claridae, and Cyprinidae had the highest occurrence (10.34%) in Ekole River. Most other families recorded lower species richness values of 3.44%, indicating moderate diversity and distribution of fish families within the river ecosystem.

Table 5: Percentage Abundance of Fish Families in Ekole River

S/N	Family	Total Abundance	Percentage Abundance (%)
1	Claridae	4247	34.23
2	Cichlidae	4200	33.85
3	Cyprinidae	904	7.28
4	Carangidae	610	4.91
5	Synodontidae	468	3.77
6	Claroteidae	344	2.77
7	Lutjanidae	335	2.70
8	Mormyridae	324	2.61
9	Gymnacidae	289	2.32
10	Monodactylidae	212	1.71
11	Mugilidae	90	0.73
12	Citharinidae	89	0.72
13	Eleotridae	56	0.45
14	Protopteridae	56	0.45
15	Tetradontidae	44	0.35
16	Polynemidae	43	0.35
17	Gobiidae	43	0.35
18	Ariidae	34	0.27
19	Anabantidae	12	0.10
20	Soleidae	6	0.05
Total		12,406	100

The percentage abundance analysis (Table 5) showed that the family Claridae was the most dominant fish family in Ekole River with 34.23% abundance, closely followed by Cichlidae with 33.85%. Cyprinidae recorded moderate abundance (7.28%), while Soleidae had the least abundance (0.05%). The dominance of Claridae and Cichlidae suggests favorable ecological conditions for commercially important freshwater fish species within the river system.

Table 6: Seasonal Comparison of Fish Abundance in Ekole River

Season	Total Fish Abundance	Percentage (%)
Wet Season	6,740	54.33
Dry Season	5,666	45.67
Total	12,406	100

Seasonal comparison of fish abundance (Table 6) indicated that the wet season contributed 54.33% of the total fish abundance recorded during the study, while the dry season accounted for 45.67%. This result demonstrates that the wet season provided more favorable environmental conditions for fish survival, breeding, migration, and recruitment within the river ecosystem.

Table 7: Summary of Seasonal Statistical Significance of Physicochemical Parameters in Ekole River

Parameter	t-value	P-value	Level of Significance
pH	2.41	0.03	Significant
Dissolved Oxygen	3.56	0.01	Significant
Temperature	2.87	0.02	Significant
BOD_5	1.12	0.28	Not Significant
Alkalinity	2.64	0.02	Significant
Electrical Conductivity	3.11	0.01	Significant

The statistical comparison (Table 7) showed that pH, dissolved oxygen, temperature, alkalinity, and electrical conductivity varied significantly between wet and dry seasons ($P<0.05$). However, biochemical

oxygen demand (BOD_5) showed no significant seasonal variation ($P>0.05$). This suggests that seasonal hydrological changes strongly influenced most physicochemical properties of the river ecosystem.

DISCUSSION

The present study comparatively evaluated the pollution status and fish assemblage structure of Ekole River and River Nun through the assessment of selected physicochemical parameters and fish diversity indices. The physicochemical variables assessed included pH, dissolved oxygen (DO), biochemical oxygen demand (BOD_5), alkalinity, electrical conductivity (EC), and temperature. The findings of the study demonstrated significant seasonal variations in most physicochemical parameters measured in the river systems. Similar observations have been reported in tropical freshwater ecosystems where seasonal rainfall and hydrological fluctuations significantly influence water quality characteristics (Alagoa & Aleleye-Wokoma, 2012).

The pH values recorded in Ekole River ranged from 5.62 during the dry season to 5.87 during the wet season. The result revealed that wet season pH values were significantly higher than dry season values. This finding may be attributed to dilution effects caused by increased rainfall and floodwater inflow during the wet season, which reduced acidity within the river system. The result is comparable to the findings of Onyena et al. (2025), who observed seasonal pH fluctuations in tropical freshwater ecosystems associated with rainfall intensity and runoff patterns. However, the result disagrees with the observations of Alagoa and Aleleye-Wokoma (2012), who reported lower pH values during the wet season in Taylor Creek, Bayelsa State. The acidic nature of the rivers observed in this study may be associated with organic decomposition, runoff from surrounding wetlands, and the nature of the Niger Delta soil environment.

Dissolved oxygen values ranged from 5.55 mg/l during the dry season to 6.27 mg/l during the wet season. The significantly higher dissolved oxygen concentration recorded during the wet season may have resulted from increased water turbulence, atmospheric re-aeration, rainfall input, and enhanced mixing processes within the river systems. Adequate dissolved oxygen is essential for aquatic life, especially fish survival, growth, and reproduction. The values recorded in this study fall within acceptable ecological limits for freshwater organisms and indicate relatively stable aquatic conditions. Similar results were obtained by Edegbene et al. (2025), who reported elevated dissolved oxygen concentrations during periods of increased rainfall and flooding in freshwater ecosystems.

Temperature values varied significantly between seasons, with higher temperatures recorded during the dry season (27.93°C) compared to the wet season (26.66°C). Seasonal variation in temperature is common in tropical freshwater systems and is largely influenced by solar radiation intensity, atmospheric conditions, and rainfall distribution. The elevated dry season temperature observed in this study may have increased metabolic activities of aquatic organisms and enhanced evaporation within the river systems. Similar observations were reported by Abdul (2009), who noted that dry season periods in Nigerian freshwater ecosystems are generally characterized by increased water temperature due to intense solar heating.

Biochemical oxygen demand (BOD_5) values ranged from 2.31 mg/l during the wet season to 2.65 mg/l during the dry season, with no significant seasonal variation observed. The relatively low BOD_5 values recorded indicate low levels of organic pollution and microbial decomposition within the river systems. This suggests that the rivers are still ecologically stable and not heavily impacted by organic waste pollution. The result agrees with the findings of Edegbene & Muller (2024), who reported relatively low BOD levels in less polluted freshwater systems within the Niger Delta region. However, the result contrasts with observations from highly polluted river systems where elevated BOD values have been associated with sewage discharge and anthropogenic disturbances (Onuoha & Eze, 2017).

Alkalinity values were significantly higher during the dry season (53.38 mg/l) than during the wet season (50.04 mg/l). The decrease in alkalinity during the wet season may be due to dilution effects caused by increased rainfall and floodwater input into the river systems. Electrical conductivity also showed similar seasonal variation, with higher values recorded during the dry season. Increased conductivity during the

dry season may result from higher concentrations of dissolved ions caused by evaporation and reduced water volume. Similar findings have been documented by Alagoa and Aleleye-Wokoma (2012), who observed that conductivity and alkalinity values in Niger Delta rivers often increase during the dry season due to reduced dilution effects.

The fish assemblage assessment revealed that Ekole River recorded a total of 12,406 fish individuals distributed across 20 families and 29 species. The families Cichlidae, Claridae, and Cyprinidae were the most dominant groups within the river ecosystem. The dominance of Cichlidae and Claridae observed in this study is consistent with previous reports from Nigerian inland waters. Alagoa et al. (2018) similarly reported dominance of Cichlid and Clariid fishes in River Nun, Bayelsa State. The dominance of these fish groups may be due to their ecological adaptability, feeding flexibility, reproductive efficiency, and tolerance to environmental fluctuations.

The species *Oreochromis niloticus* and *Clarias gariepinus* recorded the highest abundance among all fish species encountered during the study. The abundance of these species may be attributed to their fast growth rate, high fecundity, ecological tolerance, and commercial importance in tropical freshwater ecosystems. Similar dominance of *Oreochromis niloticus* and *Clarias gariepinus* has been reported in several Nigerian freshwater systems including Zaria Reservoir (Balogun et al., 2000).

Seasonal fish abundance analysis showed that the wet season recorded a higher abundance (6,740 individuals) than the dry season (5,666 individuals). The higher fish abundance recorded during the wet season may be linked to increased food availability, flooding of marginal habitats, enhanced breeding conditions, and improved migration opportunities associated with rainy season hydrology. Floodplain inundation during the wet season provides breeding and nursery grounds for several freshwater fish species, thereby increasing fish recruitment and abundance. Similar findings were reported by Gillson et al. (2012) and Abdul (2009), who observed increased fish abundance during periods of flooding and high water levels in tropical freshwater ecosystems. However, the present result disagrees with the findings of Olufayo and Adebisi (2005), who reported higher fish abundance during the dry season in Kainji Lake, Nigeria.

Species richness analysis showed that the families Cichlidae, Claridae, and Cyprinidae recorded the highest percentage occurrence (10.34%) within the river systems, while several other families recorded lower richness values of 3.44%. The moderate fish diversity recorded in this study suggests that the rivers still maintain relatively stable ecological conditions capable of supporting diverse fish assemblages. Similar moderate diversity patterns have been reported in several Niger Delta freshwater ecosystems exposed to moderate anthropogenic pressure (Alagoa et al., 2018; Edegbene et al., 2025).

The percentage abundance analysis further revealed that Claridae (34.23%) and Cichlidae (33.85%) were the most dominant fish families in Ekole River. The ecological dominance of these fish groups in tropical freshwater systems has been attributed to their adaptive strategies, tolerance to environmental fluctuations, and ability to exploit diverse food resources. Similar dominance patterns have been documented in Nigerian inland waters by Balogun et al. (2000). The relatively low abundance recorded for Soleidae and Anabantidae may indicate habitat preference differences and lower ecological tolerance within the river systems.

The statistical analysis of seasonal physicochemical parameters showed significant seasonal differences in pH, dissolved oxygen, temperature, alkalinity, and electrical conductivity ($P<0.05$), while BOD_5 showed no significant variation ($P>0.05$). These findings indicate that seasonal hydrological processes strongly influenced the physicochemical characteristics of the river ecosystems. Rainfall intensity, flooding, runoff, and dilution effects may have contributed to the observed seasonal fluctuations. Similar seasonal patterns have been reported in several freshwater ecosystems across the Niger Delta region (Alagoa & Aleleye-Wokoma, 2012).

CONCLUSION

This study assessed the pollution status and fish assemblage of River Nun and Ekole River in Bayelsa State, Nigeria. The physicochemical parameters recorded were generally within internationally acceptable

limits, indicating relatively stable and unpolluted river systems. Significant seasonal variations were observed in most water quality parameters, while fish abundance was higher during the wet season. The rivers supported diverse fish species, with Cichlidae and Claridae being the dominant families. The findings suggest that both rivers still maintain healthy ecological conditions suitable for sustainable fisheries and aquatic biodiversity conservation. Continuous monitoring and proper environmental management are however recommended to prevent future ecological degradation.

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