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ORIGINAL RESEARCH

Indigenous Fish Diversity and Socioeconomic Importance in the Lower River Niger (Lokoja, Nigeria): Implications for Inland Fisheries Management and Aquaculture Development

Somdare, P. O.[1*], Abdullahi, M.[1], Fanwo, R. R.[2], Uchendu, C. N.[3]

[1]Department of Zoology, Federal University Lokoja, P M B 1154, Lokoja.
[2]Department of Animal Health and Production Technology, Kogi State Polytechnic, Nigeria.
[3]Department of Zoology and Environmental Biology, University of Nigeria, Nsukka

***Corresponding author's email:** peace.somdare@fulokoja.edu.ng

ABSTRACT

Inland capture fisheries play a vital role in food security and rural livelihoods in Nigeria and also provide a foundation for aquaculture development through the supply of indigenous species. This study assessed the diversity, spatial distribution, and socioeconomic importance of indigenous fish species in the Lower River Niger at two fishing locations: Kpata and Ganaja Ferry sites in Lokoja. Fish species data were collected over a six-week period through direct sampling of artisanal fish catches, while socioeconomic information was obtained through structured interviews with fishers and fish traders. Species identification was carried out using standard taxonomic keys, and ecological indices including species richness, relative abundance, and Shannon–Wiener diversity were calculated. Economic importance was evaluated based on local demand, market price, and utilization patterns. A total of 15 indigenous fish species were recorded across both sites. Kpata had higher species richness (13 species) and abundance, dominated by *Chrysichthys nigrodigitatus* (138 individuals) and *Oreochromis niloticus* (120 individuals). In contrast, Ganaja Ferry site showed lower diversity and was dominated by *Heterotis niloticus* (45 individuals) and *Clarias gariepinus (39 individuals)*. Spatial distribution analysis revealed site-specific species presence, with disturbance-tolerant species such as Silver Catfish and Nile Arowana dominating heavily trafficked areas. Shannon–Weiner diversity indices confirmed greater diversity and evenness at Kpata (H'=2.45, E=0.83) than at Ganaja Ferry (H'=1.58, E=0.63). Economic evaluation indicated that Nile Tilapia and African Catfish were of very high importance due to strong local demand and high market value (₦1500–7500/kg), whereas species such as Weather Loach and Grey Mullet were of minimal economic relevance. The results show that spatial variation in habitat characteristic strongly influence fish communities, and that resilient, economically valuable indigenous species continue to play a key role in food security and could support sustainable aquaculture development, providing baseline information for inland fisheries management in Nigeria.

Keywords: Inland fisheries; Indigenous fish species; River Niger; Artisanal fishing; Aquaculture relevance; Nigeria

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INTRODUCTION

Inland freshwater fisheries remain an essential component of global food systems, particularly in developing countries where they provide affordable animal protein, employment, and income for rural populations (Funge-Smith and Bennett, 2019). In sub-Saharan Africa, rivers and floodplains contribute substantially to fish production, supporting millions of small-scale fishers and traders (Muringai et al.,2022). Beyond capture fisheries, inland waters are increasingly recognized as important sources of indigenous fish species with potential for aquaculture development, especially under low-input production systems.

Nigeria is endowed with extensive inland water resources, including rivers, lakes, reservoirs, wetlands, and floodplains, which collectively support a diverse assemblage of freshwater fish species. The River Niger, the country's largest river system, is of particular ecological and socioeconomic importance (Ogilvie et al., 2013). Along its course, the river sustains artisanal fisheries that supply fish to urban and rural markets while supporting livelihoods across multiple states.

Lokoja, located at the confluence of the Rivers Niger and Benue, represents one of the most productive sections of the river system (Lawal and Omosanya, 2023). The confluence zone is characterized by complex hydrological interactions, seasonal flooding, and habitat heterogeneity, all of which influence fish distribution, breeding, and recruitment. Indigenous fish species such as tilapias (*Oreochromis* spp.), catfishes (*Clarias spp*, *Chrysichthys spp*, *Synodontis spp*.), and Nile arowana (*Heterotis niloticus*) dominate catches in this region and are central to local diets and trade.

Despite such significant ecological and economic value, inland fishery resources in Nigeria are under increasing pressure from anthropogenic activities including overfishing, pollution, sand dredging, shoreline modification, and intensified boat traffic (Awolumate and Fregene, 2025). These pressures can alter habitat quality, reduce species diversity, and affect the availability of

economically important fish species. Such changes have direct implications for food security, livelihoods, and the sustainability of both capture fisheries and aquaculture initiatives that rely on indigenous species.

Although Lokoja is a major inland fisheries hub, recent site-specific assessments of fish diversity and socioeconomic importance are limited. Updated baseline data are needed to understand current fish assemblages, identify economically important species, and inform management strategies. This study therefore investigated the diversity, spatial distribution, and socioeconomic importance of indigenous fish species at Kpata and Ganaja Ferry sites along the Lower River Niger, with emphasis on their relevance to inland fisheries management and aquaculture development.

MATERIALS AND METHODS

Study Area

The study was conducted in Lokoja, Kogi State, Nigeria, located at the confluence of the Rivers Niger and Benue.

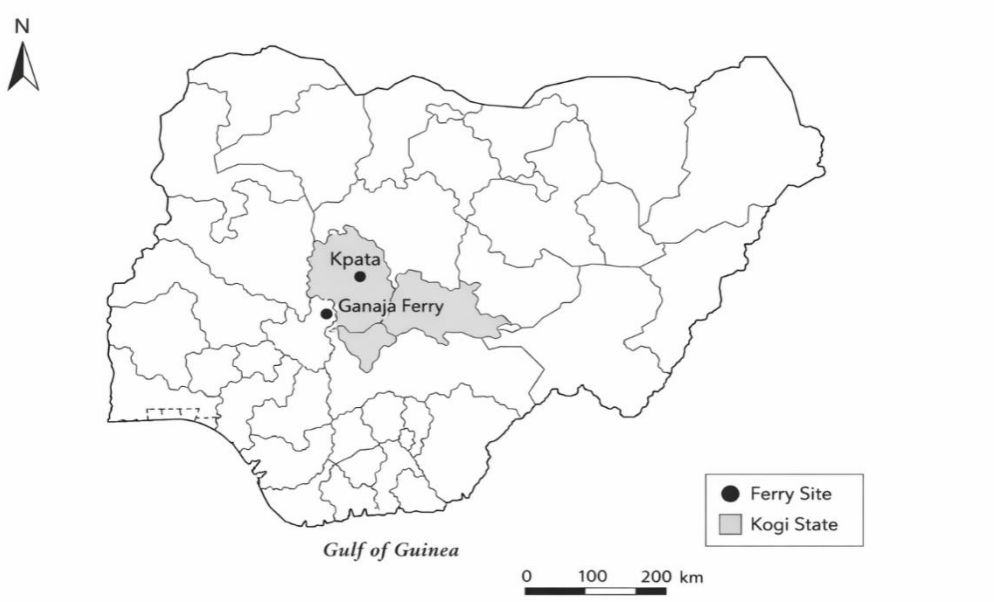

Figure 1: Study area showing Kpata and Ganaja Ferry Sites, Kogi State Nigeria Source: Authors' map generated using approximate geographic coordinates (WGS 84) based on field descriptions and publicly available location data

The region experiences a tropical wet-and-dry climate, with a rainy season from April to October and a dry season from November to March. Annual rainfall ranges from approximately 1100 to 1300 mm, while mean temperatures range between 25 and 32 °C. Seasonal flooding during the rainy season expands aquatic habitats and enhances fish productivity.

Two fishing locations were selected for the study:

1. **Kpata**, characterized by relatively calm water flow, wider floodplain connectivity, submerged macrophytes, and moderate fishing pressure.
2. **Ganaja Ferry Site**, characterized by intensive ferry operations, frequent boat movement, shoreline disturbance, and comparatively higher turbidity.

Sampling Design and Fish Collection

Species compositions were determined through direct observation and enumeration of artisanal fish catches. Sampling was conducted once a week over a six-week period during early morning when fishing activity was highest. Common fishing gears used by local fishers included cast nets, gill nets, hooks, and traps. Fish were identified using taxonomic keys and counted, and the frequency of each species was recorded.

Species Identification and Taxonomic Standardization

Fish species were identified using external morphological characteristics such as body shape, fin configuration, scale pattern, and coloration, following standard taxonomic guides (Idodo-Umeh, 2003). Scientific names and family classifications were verified and standardized using FishBase to ensure taxonomic consistency.

Socioeconomic Survey

Socioeconomic data were collected through structured interviews with artisanal fishers and fish traders using snowball sampling. A total of 30 respondents were interviewed at each site.

Information obtained included species preference, market demand, price per kilogram, utilization methods (e.g., fresh consumption, smoking, drying), and perceived economic importance of each species.

Data Analysis

Species richness and relative abundance were calculated for each site. Fish diversity was assessed using the Shannon–Wiener diversity index (H′). Socioeconomic data were summarized using descriptive statistics, including frequencies and percentages. Data analysis was conducted using Microsoft Excel Package.

RESULTS

Fish Species Composition and Abundance

A total of 15 indigenous fish species were recorded across the two study sites along the Lower River Niger. Species composition varied between Kpata and Ganaja Ferry, with Kpata exhibiting greater richness (13 species) compared to Ganaja Ferry (6 species).

At Kpata, Silver Catfish (*Chrysichthys nigrodigitatus*) and Nile Tilapia (*Oreochromis niloticus*) dominated the catch, with 138 and 120 individuals, respectively. Other relatively abundant species included Mandi Catfish (*Synodontis clarias*), Mozambique Tilapia (*Oreochromis mossambicus*), and Nile Arowana (*Heterotis niloticus*), were 43, 39, and 38 individuals, respectively. Low-abundance species included Weather Loach (*Misgurnus anguillicaudatus*), Grey Mullet (*Mugil cephalus*), and Pelteobagrus Catfish (*Tachysurus fulvidraco*).

At Ganaja Ferry, Nile Arowana (*Heterotis niloticus*) and African Catfish (*Clarias gariepinus*) were the most abundant species, with 45 and 39 individuals, respectively. Other species were recorded at much lower frequencies, such as *Pangasius* Catfish (*Pangasius brama*), Red Belly Tilapia (*Tilapia zilli*), and Common Brama (*Abramis brama*), each represented by only two individuals. While Nile Tilapia (*O. niloticus*) was abundant at Kpata, the species was

conspicuously absent from Ganaja Ferry sampling site.

Spatial Distribution Patterns

Comparison of relative abundances revealed distinct spatial patterns (Table 4.3). Species such as Silver Catfish and Nile Arowana were present at both sites, but abundance was significantly higher at Kpata (31.01% and 8.54%, respectively. Conversely, Pangasius Catfish, Red Belly Tilapia, and Common Brama were restricted to Ganaja Ferry, whereas Nile Tilapia, Mandi Catfish, and Hilsa Fish (*Tenualosa ilisha*) were found only at Kpata.

Species Richness, Abundance, and Diversity Indices

Analysis of species richness (S) and abundance revealed that Kpata had a higher Shannon–Weiner diversity index (H' = 2.45) compared to Ganaja Ferry (H' = 1.58). Evenness (E) was similarly higher at Kpata (0.83), indicating a relatively balanced distribution among species, whereas Ganaja Ferry had lower evenness (0.63), reflecting dominance by a few resilient species.

Economic Importance of Fish Species

Economic assessment revealed that Nile Tilapia and African Catfish are of very high economic importance, with local demand and market prices ranging from ₦1500–7500 per kg. Silver Catfish and Mozambique Tilapia were moderately high in value, while species such as Weather Loach, Grey Mullet, and Rohu Fish had very low economic relevance due to rarity or limited market appeal. High-value species were primarily concentrated at Kpata whereas Ganaja Ferry offered fewer commercially important species.

Table 1: Fish Species in Lower River Niger (Kpata)

S/N	Common Name	Family	Species	Frequency	Percentage (%)
1	Silver Catfish	Claroteidae	*Chrysichthys nigrodigitatus*	138	31.01
2	Nile Tilapia	Cichlidae	*Oreochromis niloticus*	120	26.97
3	Mandi Catfish	Mockomidae idae	*Synodontis clarias*	43	9.66
4	Mozambique Tilapia	Cichlidae	*Mossambicus niloticus*	39	8.76
5	Nile Arowana	Arapaimidae	*Heterotis niloticus*	38	8.54
6	Hilsa Fish	Clupeidae	*Tenualosa Ilisha*	25	5.62

7	African Catfish	Clariidae	*Clarias gariepinus*	23	5.17
8	Sea Catfish	Ariidae	*Arius Catfish*	10	2.25
9	Pelteobagrus Catfish	Bagridae	*Tachysurus fulvidraco*	3	0.67
10	Rohu Fish	Cyprinidae	*Labeo rohita*	3	0.67
11	Grey Mullet Fish	Mugilidae	*Mugil cephalus*	2	0.45
12	Weather Loach	Cobitidae	*Misgurnus anguillicaudatus*	1	0.22

Table 2: Fish Species in Ganaja Ferry Site

S/N	Common Name	Family	Species	Frequency	Percentage (%)
1	Nile Arowana	Arapaimidae	*Heterotis niloticus*	45	40.54
2	African Catfish	Claridae	*Clarias gariepinus*	39	35.14
3	Silver Catfish	Claroteidae	*Chrysichthys nigrodigitatus*	21	18.92
4	Common Brama	Cyprinidae	*Abramis brama*	2	1.8
5	Pangasius Catfish	Pangasiidae	*Pangasius brama*	2	1.8
6	Red Belly Tilapia	Cichlidae	*Tilapia Zilli*	2	1.8

Table 3: Comparison of Relative Abundance and Distribution of Identified Fish Species in Ganaja Ferry Site and Lower River Niger (Kpata)

S/N	Common Name	Scientific Name	Site I	Site II	Frequency	Distribution Pattern
1	Silver Catfish	*Chrysichthys nigrodigitatus*	21	138	159	More in Site II
2	African Catfish	*Clarias gariepinus*	-	23	23	Only found in Site II
3	Pangasius Catfish	*Pangasius brama*	2	-	2	Only found in Site I
4	Common Brama	*Abramis brama*	2	-	2	Only found in Site I
5	Nile Arowana	*Heterotis niloticus*	45	38	83	Common to both sites
6	Red Belly Tilapia	*Tilapia zilli*	2	-	2	Only found in Site I
7	Nile Tilapia	*Oreochromis niloticus*	-	120	120	Only found in Site II
8	Rohu Fish	*Labeo rohita*	-	3	3	Only found in Site II
9	Hilsa Fish	*Tenualosa ilisha*	-	25	25	Only found in Site II
10	Grey Mullet	*Mugil cephalus*	-	2	2	Only found in Site II
11	Weather Loach	*Misgurnus anguillicaudatus*	-	1	1	Only found in Site II
12	Mozambique Tilapia	*Oreochromis mossambicus*	-	39	39	Only found in Site II
13	Mandi Catfish	*Synodontis clarias*	-	43	43	Only found in Site II
14	Pelteobagrus Catfish	*Tachysurus fulvidraco*	-	3	3	Only found in Site II
15	Sea Catfish	*Arius africanus*	-	10	10	Only found in Site II

Site I: Ganaja ferry site, Site II: Kpata

Table 4: Economic Importance of Indigenous Fish Species to Local Fishing Communities in Lokoja

S/N	Common Name	Species	Demand	Price (₦/kg)	Economic Use	Economic Importance
1	Nile Tilapia	*Oreochromis niloticus*	Very High	1500–2000	Consumption, trade, dried fish	Very High
2	African Catfish	*Clarias gariepinus*	Very High	2000–7500	Consumption, aquaculture	Very High
3	Silver Catfish	*Chrysichthys nigrodigitatus*	High	1800–2200	Fresh consumption, smoking	High
4	Nile Arowana	*Heterotis niloticus*	Moderate	1200–1800	Cooking, cultural dishes	Moderate
5	Mandi Catfish	*Synodontis clarias*	Moderate	1000–1500	Local soup recipes,	Moderate

					market trade	
6	Mozambique Tilapia	*Oreochromis mossambicus*	High	1200–1800	Grilled/fried fish, fish farming	High
7	Hilsa Fish	*Tenualosa ilisha*	High	2000–2800	Seasonal delicacy, ceremonial use	High
8	Rohu Fish	*Labeo rohita*	Low	1000–1300	Occasional market presence	Low
9	Common Brama	*Abramis brama*	Low	800–1000	Minimal local consumption	Low
10	Pangasius Catfish	*Pangasius brama*	Low	1200–1400	Rarely consumed	Low
11	Sea Catfish	*Arius africanus*	Low	900–1200	Smoked fish trade	Low
12	Weather Loach	*Misgurnus anguillicaudatus*	Very Low	Not sold	Rarely recognized/used	Very Low
13	Grey Mullet	*Mugil cephalus*	Low	1000–1300	Occasional market item	Low

DISCUSSION

The results of this study demonstrate a pronounced spatial variation in fish diversity between the Kpata and Ganaja Ferry sites along the Lower River Niger. Kpata exhibited higher species richness and greater overall abundance compared to Ganaja Ferry, indicating that habitat characteristics play a crucial role in shaping fish assemblages. The relatively stable hydrological conditions at Kpata, coupled with floodplain connectivity and the presence of aquatic vegetation, likely provide suitable conditions for a wider range of species. Floodplains are widely recognized as critical habitats for freshwater fish, offering shelter, abundant food resources, and spawning grounds, particularly for species that rely on submerged vegetation for breeding and juvenile development (Pander et al., 2018; Petsch et al., 2023). The presence of macrophytes and structured habitats in Kpata may also support higher densities of small-bodied and benthic fish species, which are less tolerant of high-flow, turbid, or disturbed waters.

In contrast, the Ganaja Ferry site exhibited lower species richness and relative abundance, suggesting that anthropogenic activities have a significant impact on habitat suitability (Ogidi and Akpan, 2022). The area experiences heavy ferry operations and increased boat movement,

resulting in water turbulence, sediment resuspension, and periodic shoreline disturbance. Such conditions can negatively affect sensitive species that require calmer, shallow, or vegetated habitats for feeding, reproduction, or shelter. High turbidity levels and substrate disruption reduce light penetration and limit the growth of submerged plants (Guo et al., 2025), which in turn diminishes available microhabitats for juveniles and benthic species. Moreover, continuous disturbance favors only generalist or resilient species capable of tolerating fluctuating environmental conditions, such as *Clarias gariepinus* and *Heterotis niloticus*, which were observed to dominate the Ganaja site. Similar patterns have been reported in other Nigerian river systems, including the Ogun and Cross Rivers, where areas with intense human activity and shoreline modification supported lower species diversity compared to less disturbed sites (Allison et al., 2025; Ojelabi et al., 2025)

The observed spatial variation emphasizes the importance of habitat heterogeneity in maintaining fish diversity. Sites with intact floodplain connectivity and structurally complex habitats not only support more species but also contribute to ecological resilience by providing refuge during periods of environmental stress, such as high flows or dry seasons (Ochs et al., 2024). Conversely, areas subjected to high levels of anthropogenic disturbance may experience shifts in community composition, often resulting in dominance by a few tolerant species and a decline in rare or specialized taxa (Lake et al., 2000).

The study revealed that certain fish taxa, particularly catfishes (*Clarias gariepinus*, *Chrysichthys nigrodigitatus*, *Synodontis clarias*) and tilapias (*Oreochromis niloticus*, *O. mossambicus*, *Tilapia zilli*), dominated both abundance and economic relevance at the sampling sites. This pattern aligns with observations in many West African river systems, where these groups consistently form the bulk of artisanal catches (Offem et al., 2009).

Catfishes are known for their high tolerance to environmental stressors, including low dissolved oxygen, elevated turbidity, and variable water flows (Kasihmuddin et al., 2024). Their benthic

lifestyle allows them to exploit diverse food resources, ranging from detritus and invertebrates to small fish, making them highly adaptable to both disturbed and undisturbed habitats (Schmitt et al., 2019). The predominance of *Clarias gariepinus* and *Chrysichthys nigrodigitatus* at Ganaja Ferry, despite lower overall diversity, supports the idea that disturbance-tolerant species can thrive in habitats with continuous water turbulence caused by ferry traffic and boat operations. Similarly, *Synodontis clarias* was abundant at Kpata, likely due to the availability of submerged structures and floodplain microhabitats, which are critical for their shelter and breeding activities (Guedes & Araújo, 2022; Teugels, 1996).

Tilapias, particularly *Oreochromis niloticus* and *O. mossambicus*, dominated Kpata due to the prevalence of shallow, vegetated waters with stable substrates that favor spawning and juvenile development. These species exhibit rapid growth, high fecundity, and tolerance to moderate environmental fluctuations (Abd El-Hack et al., 2022), allowing them to maintain high population densities in suitable habitats. The absence of *O. niloticus* at Ganaja Ferry highlights the species' preference for calmer, vegetated, and low-energy environments, where turbidity and physical disturbance are minimal. *Tilapia zilli*, although less abundant, was recorded exclusively at Ganaja, possibly reflecting its ability to occupy marginal niches in open-water or slightly disturbed areas.

The dominance of these taxa is also influenced by their socio-economic importance. Fishers preferentially target large-bodied catfishes and tilapias due to their high market value, ease of capture, and widespread consumer preference. This selective fishing pressure can reinforce the relative abundance of these species in artisanal catches, particularly in communities that rely heavily on local fisheries for income and food security.

Ecologically, the dominance of catfishes and tilapias can influence community structure and ecosystem functioning. Their abundance affects prey populations and nutrient cycling within the river system (Shuai et al., 2023). At the same time, the relative scarcity of sensitive or

specialized species in disturbed areas may indicate early signs of habitat degradation and a shift toward homogenized fish assemblages dominated by resilient species.

From an aquaculture perspective, the abundance and economic importance of these species reinforce their suitability as priority candidates for culture. Their adaptability, high consumer acceptance, and established market demand make them central to current and future aquaculture development in Nigeria.

The findings of this study highlight the critical economic role of indigenous fish species to local communities along the Lower River Niger. Nile Tilapia (*Oreochromis niloticus*) and African Catfish (*Clarias gariepinus*) emerged as the most valuable species, followed by Silver Catfish (*Chrysichthys nigrodigitatus*) and Mozambique Tilapia (*Oreochromis mossambicus*). This trend mirrors observations in other Nigerian rivers, where these species constitute the primary target of artisanal fishers due to their size, palatability, and high market value (Offem et al., 2009; Orosun et al., 2023).

High local demand for these species can be attributed to multiple factors. First, they are preferred for consumption because of their taste, flesh quality, and adaptability to various cooking methods. Second, they support trade networks within and beyond Lokoja thereby providing a source of income for fishers, traders, and processors. Their contribution to livelihoods is particularly notable during periods of scarcity of other protein sources, emphasizing their role in food security (Lutfiani *e*et al., 2026; Oke et al., 2023). Furthermore, Nile Tilapia and African Catfish are frequently used in small-scale aquaculture initiatives due to their rapid growth and adaptability, enhancing both economic resilience and food supply in the region.

In contrast, species such as Weather Loach (*Misgurnus anguillicaudatus*), Grey Mullet (*Mugil cephalus*), and Rohu Fish (*Labeo rohita*) had limited economic importance, reflecting low market demand, small body size, or seasonal availability. Similar patterns have been

documented in West African rivers, where species abundance, size, and consumer preference directly influence economic relevance (Albaret et al., 2004).

Spatial differences in economic importance were evident between the two sites. Kpata, with higher species diversity, provides a more consistent supply of both high- and medium-value species thus, supporting diversified income streams for local fishers. On the other hand, Ganaja Ferry, with lower species richness and dominance of disturbance-tolerant species, offers fewer commercially valuable options. This pattern illustrates the link between ecological health and socio-economic outcomes: sites with intact habitats support higher-value species, benefiting both biodiversity conservation and local livelihoods (De Carvalho et al., 2025; Hong et al., 2009).

However, the reliance on a few dominant species poses potential risks. For instance, intense fishing pressure on Nile Tilapia and African Catfish could lead to over exploitation, population declines, and reduced ecosystem resilience if sustainable management practices are not enforced. Strategies such as seasonal closures, size limits, gear restrictions, and community-based monitoring are essential to ensure sustainable fisheries while maintaining the economic and nutritional benefits of these species.

The findings emphasize the need for location-specific fisheries management strategies in the Lower River Niger. Protecting relatively stable habitats such as Kpata could help sustain fish diversity, while regulating activities at heavily disturbed sites like Ganaja Ferry may reduce biodiversity loss. The dominance of aquaculture-relevant species suggests opportunities for strengthening linkages between capture fisheries and aquaculture development, particularly through the conservation and domestication of indigenous species.

CONCLUSION AND RECOMMENDATIONS

This study demonstrates that the Lower River Niger at Lokoja supports a diverse assemblage of indigenous fish species, with clear spatial variation influenced by habitat conditions and

anthropogenic activities. Kpata exhibited higher diversity and abundance, while Ganaja Ferry site showed reduced diversity associated with disturbance. Economically important species such as Nile Tilapia and African Catfish play a central role in local livelihoods and hold strong relevance for aquaculture development. Future studies should incorporate at least a year sampling and include water quality assessments to better understand environmental drivers of fish distribution.

AUTHOR'S CONTRIBUTION

Somdare, P. O.: Conceptualization, methodology, supervision, data analysis, original draft preparation, review and editing.; Abdullahi, M.: Data collection.; Fanwo, R.R.: Methodology, writing and editing.; Uchendu, C.N.: Data analysis, final review and editing.

CONFLICT OF INTEREST

The authors declare no competing interest

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