

Assessment of Mormyridae species diversity and abundance in Ikere Gorge Dam, Oyo State, Nigeria

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Abstract

*This study investigates the species composition, abundance, spatial distribution, seasonal variation, and diversity indices of the Mormyridae family in Ikere Gorge Dam, Oyo State, Nigeria. Field surveys were conducted across four major fishing sites; Spillway, Asamu, Agatu, and Irawote over a 24-month period. A total of 10 Mormyridae species belonging to seven genera were identified, with *Petrocephalus bovei* being the most numerically dominant (55.86%) and *Mormyrus rume* exhibiting the highest biomass contribution (43.68%). The Spillway station recorded the highest abundance and species richness, while Agatu had the lowest. Seasonal analysis revealed a clear pattern, with peak abundance occurring during the rainy season, particularly in September, which may be attributed to spawning migrations and increased availability of food resources. Diversity indices showed moderate species diversity, with a Shannon-Wiener index (H) ranging from 1.17 to 1.54 and an overall Simpson's diversity ($1-D$) of 0.74. Compared to other Nigerian inland waters, the Mormyridae diversity in Ikere Gorge Dam is relatively moderate, reflecting the ecological health and environmental dynamics of the reservoir. The findings underscore the importance of habitat-specific and seasonal management strategies to support the conservation of fish biodiversity and sustainable fisheries within the dam.*

1. Introduction

Fishes of the family *Mormyridae* are of considerable commercial and ecological importance and are widely distributed throughout tropical Africa. Commonly referred to as elephantfishes, Mormyrids are notable for their possession of electric organs that produce weak electric discharges. These discharges serve a variety of critical biological functions including communication, navigation, prey detection, species recognition, and mating behavior (Adjibade et al., 2019).

Tropical freshwater ecosystems, particularly rivers, support an immense diversity of fish species. However, this ichthyological richness remains insufficiently explored, especially in terms of taxonomy, ecology, and biology (Souley et al., 2024). The *Mormyridae* family, endemic to sub-Saharan Africa, comprises approximately 22 genera and 228 recognized species (Kisekelwa et al., 2016; Souley et al., 2024). In Nigerian inland waters, particularly in the Ikere Gorge, members of this family are among the most frequently encountered species. Despite their abundance, there is a critical gap in knowledge concerning their ecological roles, population dynamics, and response to environmental changes in this region.

Recent studies have emphasized the ecological relevance of Mormyrids, particularly their sensitivity to ecosystem alterations. Souley et al. (2024) reported that species within this family often exhibit early responses to environmental disturbances, thereby making them valuable bioindicators for ecological monitoring. Similarly, Kerckhove (2012) highlighted their usefulness in biodiversity assessments. Nonetheless, limited understanding of their distribution, population structure, and ecological interactions continues to challenge conservation efforts (Souley et al., 2024).

The economic importance of *Mormyridae* in Nigerian inland fisheries has been well documented. For instance, Ogidiaka and Davies (2019) reported that Mormyrid species are abundant and commercially significant in the Warri River at Agbarho. In the Ikere Gorge, Mormyrids play essential roles both ecologically and economically. Smaller individuals are often used as bait for larger predatory species such as *Lates niloticus*, while mature individuals have appreciable market value (Ajagbe and Ojo-Fakuade, 2020). Their trophic role within the aquatic food web also contributes to sustaining biodiversity and ecosystem functioning.

Several regional studies have reported significant diversity and abundance of Mormyrid species. Danba et al. (2019) recorded seven species of *Mormyridae* in the Taraba River, identifying it as the most diverse family in that ecosystem. Obaroh et al. (2019) noted *Mormyridae* as the most abundant family in the Argungu section of River Rima, with a recorded count of 2,257 individuals. Likewise, Okeke et al. (2023) documented seven species in the Onitsha axis of the River Niger, Anambra State, indicating significant species richness. Okogwu and Ugwumba (2010) also reported *Mormyridae* as one of the most diverse families in the Mid-Cross River, second only to *Mochokidae* in terms of species number.

In the Oni River, Ogun State, *Mormyridae* was found to be the most abundant family, with 163 individuals recorded (Obe and Jenyo-Oni, 2011). The authors attributed this success to the species' preference for structurally complex habitats such as submerged logs and areas with slow-moving water, which provide ample detritus and benthic prey (Holden and Reed, 1972).

Objective of the Study

Given the ecological and economic importance of *Mormyridae*, and the limited knowledge on their species composition, distribution, and ecological roles in the Ikere Gorge area, this study aims to:

1. Assess the species diversity and abundance of *Mormyridae* in Ikere Gorge;
2. Spatial and Seasonal Distribution of *Mormyridae* Species

2. Materials and Methods

Study Area

This study was conducted at the Ikere Gorge Dam, a multipurpose reservoir located in Ikere Village, approximately 28 kilometers northeast of Iseyin in Oyo State, southwestern Nigeria. Geographically, the dam lies between latitudes 8°10' and 8°20' N and longitudes 3°40' and 3°50' E (Figure 1). The reservoir serves various purposes, including irrigation, hydroelectric power generation, and fisheries.

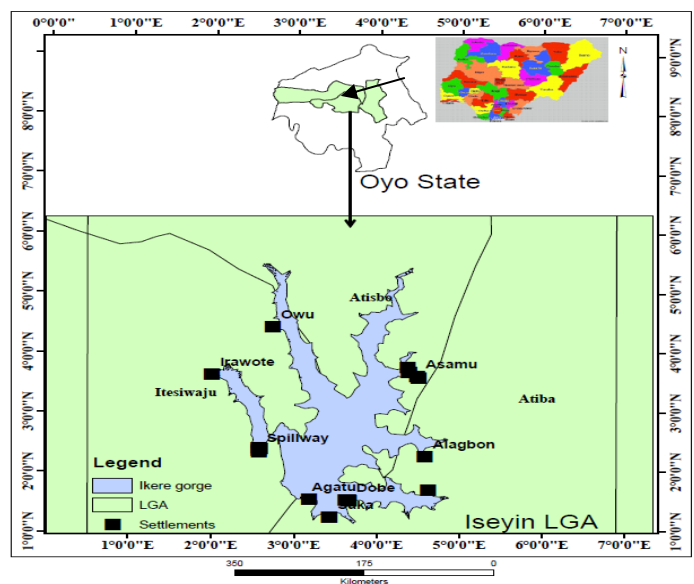


Figure 1: Map of Ikere-gorge dam Oyo State, Nigeria

There are twelve fishing settlements around the Ikere Gorge Dam. For this study, four fishing villages; Asamu, Agatu, Spillway, and Irawote, were randomly selected representing one-third of the fishing villages in Ikere-gorge. Monthly sampling was carried out in each of these locations over a continuous period of twenty-four months, from January 2021 to December 2022.

Fish Sampling and Identification

Fish specimens belonging to the family *Mormyridae* were obtained directly from fishermen's catches at each selected village during the study period. The sampling approach was random, based on the catch availability from artisanal fishing operations using traditional gears which involved gillnets, cast net, gura or trap and wire net with mesh sizes varied between 3.81 cm and 8.89 cm. For each sample, the number of individuals and their corresponding weights were recorded. Taxonomic identification of cichlid species was performed using established identification keys provided by Adesulu and Sydenham (2007) and Olaosebikan and Raji (2013).

Diversity Indices

To assess species composition and diversity, the following ecological indices were calculated:

- i. **Relative Species Abundance (%)**
This was determined to understand the proportional representation of each species in the total catch, using the formula:

$$\text{Relative Species Abundance} = \frac{n}{N} \times 100 \quad (1)$$

Where:

n = Number of individuals of a particular species

N = Total number of individuals of all species in the sample

- ii. **Shannon-Wiener Diversity Index** (Shannon and Wiener, 1963)

$$H = - \sum P_i \ln P_i \quad (2)$$

Where:

H = Shannon-Wiener diversity index

P_i = Proportion of individuals of a particular species (n_i/N)

n_i = Number of individuals of a given species

N = Total number of individuals in the sample

- iii. **Simpson's Index of Dominance** (Simpson, 1949)

$$\lambda = \frac{\sum n_i (n_i - 1)}{N(N - 1)} \quad (3)$$

- iv. **Simpson's Index of Diversity (Heterogeneity)**

$$D = 1 - \lambda \quad (4)$$

This value reflects the probability that two individuals randomly selected from a sample will belong to different species.

Data Analysis

Descriptive statistical analyses were conducted using SPSS software (Version 20.0) to determine species abundance and composition. Fish species diversity indices were computed using the Palaeontological Statistics software (PAST) Version 2.12 (Hammer, 2011; Odulate et al., 2017).

3. Results and Discussion

The present study documented the species composition of the family *Mormyridae* in the Ikere Gorge Dam, Oyo State, Nigeria (Table 1). A total of ten species belonging to seven genera were identified, indicating a relatively high diversity of mormyrid fishes in the study area. This richness surpasses the findings of Olopade (2013), who reported six species of *Mormyridae* in the same reservoir, thereby demonstrating an apparent increase in the observed species diversity.

Comparatively, Souley et al. (2024) recorded fifteen *Mormyridae* species in the Niger River, highlighting the broader species pool in larger riverine ecosystems. These findings emphasize the ecological significance of *Mormyridae* species as indicators of aquatic biodiversity and ecosystem health. Their presence and diversity are often reflective of the integrity and productivity of freshwater environments, particularly in West African inland water bodies.

In the current study, the ten species recorded represent approximately one-third of the 32 species from 11 genera documented in Nigerian freshwater systems (Olaosebikan and Raji, 2013). This supports earlier findings by Adesulu and Sydenham (2007), who noted that up to 29 *Mormyridae* species have been described in Nigerian inland waters. The relatively high number of species observed in Ikere Gorge Dam underscores the ecological richness of the area and the habitat suitability for mormyrids.

Ajagbe et al. (2021) also previously reported that mormyrids are well diversified in the Ikere Gorge ecosystem, corroborating the present findings. Similarly, Adjibade et al. (2019) reported eleven species from nine genera of *Mormyridae* in the Niger River in northern Benin, further indicating that West African freshwater systems generally support a high diversity of this family.

The current species composition, therefore, contributes valuable baseline information for the conservation and management of mormyrid fishes in Ikere Gorge and similar aquatic habitats. It also reinforces the role of *Mormyridae* as a crucial group for biodiversity monitoring and fisheries development in tropical Africa.

Table 1: Composition of Mormyridae Species Identified in Ikere Gorge Dam, Oyo State, Nigeria

S/N	Genus	Species Name
1	Mormyrus	Mormyrus rume (Valenciennes, 1847)
2	Hyperopisus	Hyperopisus bebe (Lacepède, 1803)
3	Petrocephalus	Petrocephalus bovei (Valenciennes, 1847)
4	Mormyrops	Mormyrops anguilloides (Linnaeus, 1758)
		Mormyrops oudoti (Daget, 1954)
5	Brienomyrus	Brienomyrus brachyistius (Gill, 1862)
		Brienomyrus niger (Günther, 1866)
6	Marcusenius	Marcusenius senegalensis (Steindachner, 1870)
		Marcusenius brucii (Boulenger, 1910)

7	Pollimyrus	Pollimyrus isidori (Valenciennes, 1847)
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Relative Abundance and Biomass of Mormyridae Species

The relative abundance and biomass distribution of *Mormyridae* species in Ikere Gorge Dam are presented in Table 2. The results reveal that *Petrocephalus bovei* was the most abundant species, comprising 55.86% of the total mormyrid population sampled. The dominance and widespread occurrence of *P. bovei* in Ikere Gorge may be attributed to its efficient utilization of available habitat resources, which enhances its adaptability and persistence within the ecosystem. The second most abundant mormyrid was *Hyperopisus bebe* (19.50%) and *Mormyrus rume* (16.39%). In contrast, the least abundant species were *Marcusenius brucii* (0.10%), *Brienomyrus brachyistius* (0.14%), and *Pollimyrus isidori* (0.14%). *Marcusenius brucii* has previously been classified as a vulnerable species; however, more recent assessments indicate that it is currently listed as data deficient (DD), reflecting limited available information on its population status (FishBase).

Despite its numerical dominance, *Petrocephalus bovei* contributed only 5.46% to the overall biomass (weight), indicating a relatively smaller body size compared to other species. On the other hand, *Mormyrus rume* contributed the highest biomass at 43.68%, followed by *Hyperopisus bebe* (32.52%) and *Mormyrops delicious* (14.63%). The lowest biomass contributions were recorded for *Pollimyrus isidori* (0.01%) and *Brienomyrus brachyistius* (0.02%).

The high numerical abundance but low biomass of *P. bovei* may be explained by the predominance of juvenile individuals and the relatively small adult body size characteristic of the species within this ecosystem. Olaosebikan and Raji (2013) reported a maximum standard length of approximately 10 cm for *P. bovei*. In contrast, species such as *M. rume* and *H. bebe* attain larger body sizes and therefore contribute more substantially to total biomass despite their lower numerical abundance. This pattern highlights the need to consider both abundance and biomass when evaluating species dominance and patterns of resource utilization in freshwater ecosystems.

Interestingly, while *Pollimyrus isidori* was among the least abundant in Ikere Gorge, Ogidiaka and Davies (2019) reported it as a common species in the Warri River at Agbarho, Delta State, suggesting possible habitat preferences or localized population differences. Similarly, Souley et al. (2024) identified *Mormyrus rume* and *Pollimyrus isidori* as dominant species in the Niger River, contrasting with the findings in the current study.

In Oyan Dam, *Mormyrus rume* was previously reported as the most dominant *Mormyridae* species (Olopade, 2013), a pattern consistent with earlier findings by Olopade (2010), who also documented it as the most abundant species in Oyan Lake. This recurring trend across multiple inland water bodies underscores the ecological adaptability and significance of *M. rume* in Nigerian freshwater systems.

In a broader West African context, Adjibade et al. (2019) observed that *Marcusenius senegalensis* was the most abundant *Mormyridae* species in the Niger River, Northern Benin. In terms of biomass, *M. senegalensis* again ranked highest, followed by *Mormyrus rume* and *Hyperopisus bebe*, indicating variability in species dominance across geographic regions and aquatic ecosystems.

These variations underscore the importance of localized ecological studies for fisheries assessment and management, as species composition, abundance, and biomass can significantly differ due to environmental factors, fishing pressure, and habitat structure.

Table 2: Relative Abundance and Biomass of Mormyridae Species in Ikere Gorge Dam, Oyo State, Nigeria

S/N	Species Name	AB	%RA	Wt (Kg)	%Wt
1	Mormyrus rume	485	16.39	145.10	43.68
2	Hyperopisus bebe	577	19.50	108.00	32.52
3	Petrocephalus bovei	1653	55.86	18.13	5.46
4	Mormyrops anguilloides	143	4.83	48.60	14.63
5	Mormyrops oudoti	38	1.28	9.85	2.96
6	Brienomyrus brachyistius	4	0.14	0.08	0.02
7	Pollimyrus isidori	4	0.14	0.03	0.01
8	Brienomyrus niger	36	1.22	0.88	0.26
9	Marcusenius senegalensis	16	0.54	1.13	0.34
10	Marcusenius brucii	3	0.10	0.38	0.11
	Total	2959	100.00	332.20	100.00

Key: AB – Abundance; %RA – Percentage Relative Abundance; Wt – Weight (Kg); %Wt – Percentage Weight Contribution

Spatial and Seasonal Distribution of Mormyridae Species

The spatial distribution of *Mormyridae* species across the four fishing villages sampled within Ikere Gorge Dam is presented in Figure 2. Among these locations, the Spillway area recorded the highest abundance of *Mormyridae* species, indicating it may serve as a preferred habitat or feeding ground for these fishes. Conversely, Agatu village recorded the lowest abundance, suggesting possible habitat differences, fishing pressure, or environmental constraints affecting species distribution in that location.

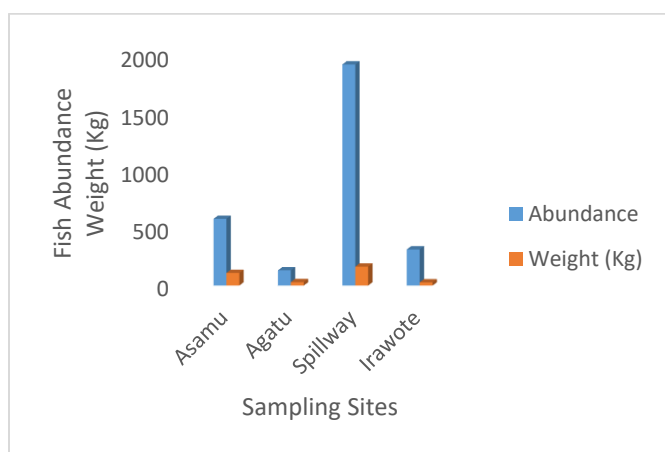


Figure 2: Spatial Distribution of Mormyridae Family in Ikere Gorge Dam, Oyo State, Nigeria

Seasonal trends in the abundance of *Mormyridae* species are illustrated in Figures 3 and 4. The data clearly indicate that *Mormyridae* were most abundant during the rainy season, with a peak observed in September. In contrast, the lowest abundance was recorded in January, corresponding to the dry season. This seasonal pattern aligns with findings by Olopade (2013), who observed higher catches of *Mormyridae* in the wet season compared to the dry season in Oyan Dam. Specifically, Olopade (2010) reported the presence of four species during the dry season and five species during the wet season, particularly in September. However, he also noted a decrease in relative abundance of *Mormyridae* with increasing water levels, suggesting that while wet seasons promote abundance, excessively high water levels may dilute fish concentrations or affect catchability.

Similar seasonal patterns were reported by Obaroh et al. (2019) in River Argungu, Northwestern Nigeria. Their findings showed the lowest number of fish species captured in April and May 2014 (eight and nine species respectively), while October recorded the highest with 26 species. These fluctuations reflect the ecological significance of seasonal cycles in shaping fish distribution and availability.

The observed seasonal abundance of *Mormyridae* in Ikere Gorge may be attributed to their spawning migrations and ecological responses to environmental changes associated with the rainy season. Olopade (2013) noted that rainy season spawning migrations are common among some mormyrid taxa, often moving from river mouths to upstream breeding areas. This behavior is not solely reproductive; it is also a response to changes in environmental conditions such as temperature, dissolved oxygen, and increased availability of food organisms during the rainy season (Moyle and Cech, 1988).

These findings emphasize the importance of considering seasonal and spatial dynamics in fisheries management. Understanding such ecological patterns can inform sustainable harvesting practices and conservation efforts, especially in inland water bodies where hydrological variability strongly influences fish community structure.

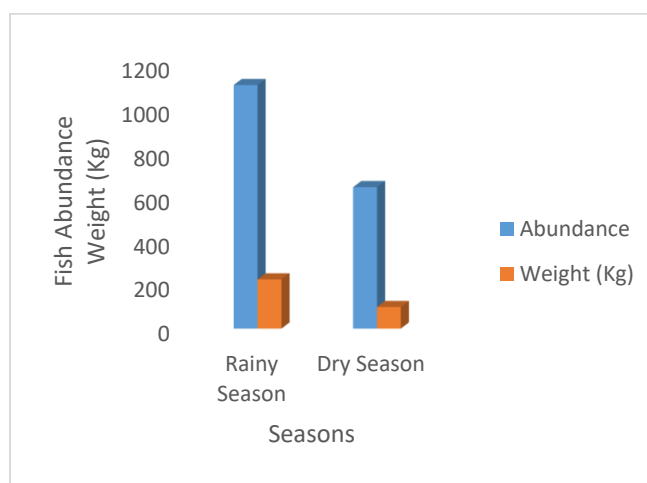


Figure 3: Seasonal variation of *Mormyridae* in Ikere-gorge dam, Oyo State.

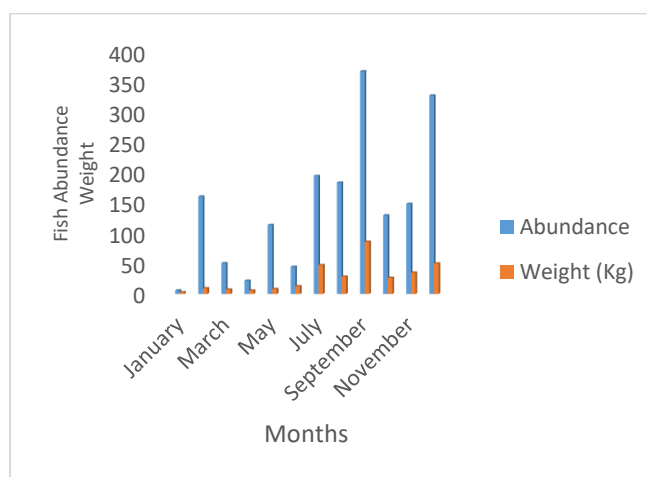


Figure 4: Monthly abundance of *Mormyridae* in Ikere-gorge dam, Oyo State, Nigeria

Diversity Indices of *Mormyridae* Species

The diversity indices of *Mormyridae* species across the four sampled locations within Ikere Gorge Dam are presented in Table 3. The analysis revealed varying levels of species richness and diversity across sites, with a total of 10 species recorded overall. The number of taxa ranged from six in Agatu and Irawote to ten in the Spillway area.

The overall species dominance index (Dominance_D) for the dam was 0.38, with values ranging from 0.26 to 0.49 across locations. This indicates a moderate level of dominance, suggesting that no single species overwhelmingly dominates the *Mormyridae* community in Ikere Gorge Dam. The Simpson's index of diversity (Simpson_1-D) was highest at Asamu (0.74) and lowest at Agatu and Irawote (0.65), with an overall value of 0.62. These values reflect moderate to high species diversity, implying a relatively balanced distribution of individuals among species.

The Shannon-Wiener diversity index (H'), a commonly used measure of ecological diversity, further supports this observation.

The index ranged from 1.05 at Spillway to 1.50 at Asamu, with an overall value of 1.25 for the dam. While these values reflect moderate diversity within the *Mormyridae* family, they are lower than those reported in broader studies encompassing entire fish communities. For example, Souley et al. (2024) reported a Shannon-Wiener index of 2.96 for *Mormyridae* in the Niger River, while Okeke et al. (2023) observed values ranging from 2.6 to 3.3 for the total fish fauna in the Onitsha axis of the River Niger. The relatively lower values observed in this study may be attributed to its focus on a single family rather than the entire ichthyofaunal assemblage.

Similarly, Adjibade et al. (2019) reported a moderate Shannon-Wiener diversity index ($H' = 2.54$) for *Mormyridae* species in the Niger River of Northern Benin, which is also higher than the values recorded in Ikere Gorge. These differences could reflect ecological variability among habitats, differences in sampling effort, or environmental conditions affecting species composition and distribution.

The evenness index (e^H/S), which indicates how evenly individuals are distributed among the recorded species, varied across sampling sites. It ranged from 0.29 in the Spillway (despite its high species richness) to 0.64 in Asamu, suggesting that although some areas host more species, others maintain a more equitable distribution of individuals.

Table 3: Diversity Indices of Mormyridae Species in Ikere Gorge Dam, Oyo State, Nigeria

Locations	Asamu	Agatu	Spillway	Irawote	Overall
Taxa_S	7	6	10	6	10
Individuals	582	133	1929	315	2959
Dominance_D	0.26	0.35	0.49	0.35	0.38
Simpson_1-D	0.74	0.65	0.51	0.65	0.62
Shannon_H	1.50	1.23	1.05	1.17	1.25
Evenness_e^H/S	0.64	0.57	0.29	0.54	0.35

Pairwise comparisons of fish diversity among sampling sites were conducted using Hutcheson’s *t*-test applied to the Shannon–Wiener diversity index (H') and the Simpson dominance index (D). Shannon diversity differed significantly between Site A and Site B ($H' = 1.4985$ vs. 1.2324 ; $t = 3.66$, $df = 180.26$, $p < 0.001$) and between Site B and Site C ($H' = 1.2324$ vs. 1.0524 ; $t = 2.51$, $df = 171.23$, $p = 0.013$). In addition, a significant increase in Shannon diversity was observed from Site C to Site D ($H' = 1.0524$ vs. 1.1738 ; $t = -2.70$, $df = 630.15$, $p = 0.007$).

Simpson dominance also showed significant variation across all site pairs. Dominance increased from Site A to Site B ($D = 0.2551$ vs. 0.3493 ; $t = -3.50$, $df = 153.68$, $p < 0.001$) and further increased from Site B to Site C ($D = 0.3493$ vs. 0.4938 ; $t = -5.04$, $df = 197.35$, $p < 0.001$). However, a significant decline in dominance was recorded between Site C and Site D ($D = 0.4938$ vs. 0.3524 ;

$t = 7.27$, $df = 797.79$, $p < 0.001$), reflecting pronounced spatial heterogeneity in fish community structure along Ikere Gorge.

Overall, the results demonstrate that high abundance and species richness do not necessarily correspond to high diversity. Although Site C exhibited high species richness and numerical abundance, it was characterized by strong dominance and low evenness, likely associated with environmental stress, habitat simplification, or selective exploitation that favors tolerant species. In contrast, Site A supported a more stable and evenly structured fish community, suggesting comparatively better habitat conditions or reduced anthropogenic disturbance.

Table 4: Pairwise comparison of fish diversity indices across sites (Ikere-Gorge)

Index	Site pair	Site 1	Site 2	t	df	p-value
H'	A – B	1.50	1.23	3.66	180.26	0.001
	B – C	1.23	1.05	2.51	171.23	0.013
	C – D	1.05	1.17	-2.70	630.15	0.007
D	A – B	0.26	0.35	-3.50	153.68	0.001
	B – C	0.35	0.49	-5.04	197.35	0.001
	C – D	0.49	0.35	7.27	797.79	0.001

NB: **H'**: Shannon (H'); **D**: Simpson (D)

5. Conclusion

This study provides valuable insights into the composition, distribution, and ecological patterns of *Mormyridae* species in Ikere Gorge Dam, Oyo State, Nigeria. A total of ten species were recorded, with *Petrocephalus bovei* emerging as the most numerically dominant, while *Mormyrus rume* contributed the highest biomass. Spatial analysis revealed that the Spillway area harbored the highest species richness and abundance, indicating its ecological importance within the dam. Seasonal assessments highlighted significant fluctuations in abundance, with the peak occurring during the rainy season—particularly in September—suggesting the influence of seasonal hydrological dynamics on the life cycle and migration patterns of *Mormyridae*. The diversity indices indicate a moderate level of biodiversity within the family, with relatively low species evenness, suggesting a community structured around a few dominant taxa. These findings underscore the complex interplay between ecological variables such as habitat structure, water quality, and anthropogenic activities in shaping fish assemblages in the dam. From a conservation and management perspective, the results highlight the need for targeted efforts to protect rare species, preserve ecologically rich habitats, and ensure sustainable fishing practices. Management interventions such as seasonal fishing closures during spawning peaks, habitat protection in high-diversity zones, and ongoing biodiversity monitoring are recommended to support the long-term sustainability of fish populations in Ikere Gorge Dam. Overall, this research contributes to the understanding of fish biodiversity in Nigerian inland waters and offers a scientific basis for informed fisheries and aquatic ecosystem management. Continued studies that incorporate water quality assessments, trophic dynamics, and anthropogenic impact evaluations will

further strengthen the conservation framework for the dam and similar aquatic ecosystems in the region.

References

- Adesulu E. A. and Sydenham D. H. J., 2007. The Freshwater Fishes and Fisheries of Nigeria, Macmillan Nigeria Publishers Ltd., Nigeria, 391.
- Adjibade, K. N., Adite, A., Arame, H., Imorou, R. S. and Sonon, S. P. 2019. Biodiversity and Community Structure of Mormyridae (Pisces: Teleostei: Osteoglossiformes) from Niger River in Northern Benin: Threats, Conservation and Valorization Perspectives. *International Journal of Science*, 8(5):106-116
- Ajagbe, S. O. and Ojo-Fakuade, F. F. 2020. Population dynamics of Mormyrus rume (Valenciennes, 1847; Osteoglossiformes; Mormyridae) of Ikere-gorge, Iseyin, Oyo State, Nigeria. *Global Journal of Agricultural Sciences* 19: 51-57. DOI <https://dx.doi.org/10.4314/gjass.v19i1.7> ISSN 1596-2903 www.globaljournalseries.com
- Ajagbe, S. O., Odulate, D. O., Akegbejo-Samsons, Y., Kehinde, A. S., Ajagbe, R. O and Ojbolamo, M. T. 2021. Species composition, abundance and diversity of Ichthyofauna of Ikere-Gorge, Oyo State, Nigeria. *ActaEcologicaSinica* 41(6): 575-583. <https://doi.org/10.1016/j.chnaes.2021.07.002>
- Danba, E.P., Ja'afaru, A., Abubarka, K.A., Zira, J.D., Kefas, M. and Baruw, B.W. 2019. Fish Biodiversity and Abundance in River Taraba state Nigeria. *Ethiopian journal of Environmental Studies & Management* 13: (5)535-544.
- Hammer, O., Harper, D. A. T. and Ryan, P. D. 2001. PAST: paleontological statistics software package for education and data analysis, *Palaeontol. Electron.* 1 (9) (2001). www.palaeo-electronica.org.
- Holden, M. and Reed, W. 1972. West African Freshwater Fish Longman London.
- Kerckhove O. 2012. Espèces ou association d'espèces de poissons en tant que bio indicateur de l'état de santé des récifs coralliens. Mémoire de maîtrise, *Fac. Sc. Université de Sherbrooke, Québec*.
- Kisekelwa T., Boden G., Snoeks J., Vreven E. 2016. Marcusenius kaninginii, a new species of elephant fish from the Loba River basin, Democratic Republic of the Congo (Osteoglossiformes: Mormyridae). *Ichthyological Exploration of Freshwaters*, 26: 341-352.
- Moritz, T., Engelmann, J., Linsenmair, K. E., Von DEReMDE, G. 2009. The electric organ discharges of the *Petrocephalus* species (Teleostei: Mormyridae) of the Upper Volta System. *Fish Biology*. <https://doi.org/10.1111/j.1095-8649.2008.02111.x>
- Moyle P. B. and Cech J. J. Jr., 1988. Fish: An Introduction to Ichthyology 2nd edn., Hall and Cliffs (eds), 559.
- Obaroh, I. O., Haruna, M. A. and Abubakar, U. 2019. Diversity of fish fauna in River Argungu, North Western, Nigeria. *Journal of Innovative Research in Life Sciences*. Oct. 2019, 1(2): 40-46 ISSN: 2705-3156
- Obe B. W. and Jenyo-Oni A. 2011. Assessment of Fish Biodiversity in Oni River, Ogun State, Nigeria. *International Journal of Agricultural Management & Development (IJAMAD)* Available online on: www.ijamad.com
- Odulate, D. O., Oladoye, A. O., Omoniyi, I. T., Edun, O. A., Busari, R. A. and Ajagbe, S. O. 2017. Diversity of Plankton Community and Water Quality in Lekan Aare Lake, Abeokuta, Nigeria. *Nigeria Journal of Fisheries* Vol. 14 <http://www.ajol.info/index.php/njf>
- Ogidiaka, E. and Davies, O. A. 2019. Growth characteristics of Pollimyrus isidori (Mormyridae) in Warri river at Agbarho, Delta state, Nigeria. *Asian J. Biol. Sci.*, 12: 804-807.
- Okogwu, O.I. And Ugwumba, O.A. 2010. The abundance and diversity of the fin and shell fish of mid-Cross River, South-east, Nigeria. *The Zoologist* Vol. 8 2010, pp. 19-24, ISSN 1596 972X.
- Olaosebikan, B. D. and Raji, A. 2013. Field Guide to Nigerian Freshwater Fishes. Federal College of Freshwater Fisheries Technology, New Bussa, Nigeria, 144p. Revised Edition.
- Olopade O. A., 2010 – Observations of fishing methods in Oyan Lake, *African Journal of Livestock Extension*, 8, 35-39.
- Olopade, O.A., 2013. Preliminary observations on the Family Mormyridae in Oyan dam lake (Nigeria). *Transylvanian Rev. Syst. Ecol. Res.*, 15: 33-48.
- Shannon CE and Weaver W. 1963. The mathematical theory of communication. University of Illinois Press, Urbana.
- Simpson, E. H. 1949. Measurement of diversity, *Nature* 163 (1949) 688.
- Souley, S. M. N., Mahaman, H., Ibrahim, A. M. and Issiaka, Y. 2024. First Assessment of Mormyridae diversity and abundance in the Niger River at Niamey, Niger. *Moroccan Journal of Agricultural Sciences* 5 (4): 225-231, <https://doi.org/10.5281/zenodo.1459736>