International Journal of Sustainable Applied Sciences (IJSAS)
Vol. 3, No. 10, 2025: 651-658

# Assessment of Fish Species Composition and Abundance in Sabiyal Lake, Aliero, Kebbi State

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A R T I C L E I N F O

*Keywords: Fish Species Composition, Abundance, Sabiyal Lake*

*Received: 19, August*
*Revised: 20, September*
*Accepted: 30, October*



A B S T R A C T

This study investigates the fish species composition and abundance in Sabiyal Lake, Aliero. Three (3) sampling sites, Sabiyal, Tari, and Kashinzama, were selected for six (6) six-month periods from March to August 2024. A total of nine (9) species were identified from Sabiyal Lake. The species richness remained constant across all locations (9 species), and the Shannon and Simpson indices revealed differences in community structure. Sabiyal exhibited the highest Shannon (2.015) and Simpson (0.855) values. There is a need for proper regulation to ensure the sustainability of the fish resources in the lake.

DOI: https://doi.org/10.59890/ijsas.v3i10.164
ISSN-E: 2988-2133
https://dmimultitechpublisher.my.id/index.php/ijsas

## INTRODUCTION

Aquatic ecosystems, particularly freshwater bodies such as lakes, play a crucial role in biodiversity conservation and provide valuable resources, including fish, which serve as a major source of protein and livelihood in many rural communities (Akinrotimi et al., 2011). Fish diversity and abundance are key indicators of the health and sustainability of freshwater ecosystems (Welcomme, 2001). In Nigeria, inland water bodies such as Sabiyal Lake in Aliero, Kebbi State, support artisanal fisheries and contribute significantly to food security and economic development (Ita, 1993).

Sabiyal Lake is an important water body in Kebbi State, supporting local fishers and contributing to the nutritional needs of nearby communities. However, there is limited documented information on the species composition and abundance of fish in this lake. Understanding the diversity and population structure of fish in the lake is crucial for proper fisheries management, conservation planning, and sustainable exploitation of its resources.

Despite the ecological and economic importance of Sabiyal Lake, there is a noticeable gap in scientific data regarding the composition and abundance of its fish species. This lack of baseline information impedes the development of effective management strategies. Moreover, increasing anthropogenic pressures such as overfishing, pollution, and habitat degradation may be altering the fish community structure (Ayoola, 2010). Without current data, it is challenging to assess the extent of these impacts or to propose conservation actions. Thus, there is a need for a comprehensive study to assess the present state of fish biodiversity in the lake.

## LITERATURE REVIEW

Fish species diversity and abundance assessments provide fundamental data necessary for the sustainable management of fisheries resources (FAO, 2020). Conducting this study in Sabiyal Lake is vital due to its role in supporting the local economy and food systems. The findings will not only fill existing knowledge gaps but also inform policymakers, fisheries managers, and local communities on the best practices for resource conservation. Additionally, it could serve as a reference for future ecological and fisheries research in Kebbi State and beyond.

## METHODOLOGY

### Study Area

Sabiyal Lake is an eutrophic, perennial standing freshwater body, located between latitude 13º6´ North and longitude 12º 27' East. The lake is at the center of Sabiyal, Kashinzama, Laga, Tari, Kambaza, Bami Mairuwa, and Kyara villages, 13 km away from Aliero town, Aliero Local Government Area, Kebbi State, Nigeria. It covers a length of 9 km between the one extreme and to extremes of the lake (Jega et al., 2015). It is almost covered by emergent plants, dominantly cat tail. Sabiyal Lake is one of the moderate lakes in the state and serves as an essential water body for the local communities and ecosystems. The lake covers a significant area, although specific management may vary depending on the seasons and water levels. Sabiyal Lake holds considerable

ecological and socio-economic significance for the region. It provides water for irrigation, fishing activities, and supports local biodiversity. The lake is a vital source and sustains the livelihood of many communities in the surrounding areas.

**Research Design**

The entire lake was divided into three strata, where the beginning of the lake at the southern end is named stratum 1, the middle is named stratum 2, and the northern end is named stratum 3. Each of these strata has a neighboring village, such as Sabiyal for Stratum 1, Tari for Stratum 2, and Kashenzama for Stratum 3. Fish sampling was done by recording all fish landings between 8.00 am to 2.00 pm in the first week of every month, starting from March 2025 to August 2025. In this case, each stratum will be sampled for 2 consecutive days of the said sampling week.

**Fish Sampling**

Sampling was done using a combination of gill nets, cast nets, and local fish traps. Sampling was carried out in the morning and evening hours to coincide with peak fish activity. Captured fish were sorted, counted, and weighed bulk-wise using an ordinary "20 kg weighing balance". Fish species and abundance in the lake were reported as the total number of fish species in a monthly repeated sampling in order to account for a possible variation between dry and wet seasons, as well as patterns of occurrence.

**Identification of Fish**

Fish caught were sorted and identified into species using guides by Olaosebikan and Raji (2013), and counted.

**Fish Ecological Diversity**

The ecological diversity of fish species in the lake was determined using the formula by Pielou (1966):

Simpson's Index of Diversity = $1/\Sigma$ pi2

Shannosn-Weiner index (H) = $-\Sigma$ piInpi

Where: pi=n/N = the number of individuals within a species (n) divided by the total number of individuals (N) present in the entire sample, ln = natural Log Evenness (E)= eHS

Where: H=Shannon-Weiner's index; S=Number of species in sample.

**Data Analysis**

The data was summarized using simple descriptive statistics such as means and percentages. Analysis of Variance (ANOVA) was used to compare the means on Microsoft Excel 2010, and SPSS 23.0 was used for graphing and statistical analysis, respectively.

## RESULT AND DISCUSSION

**Diversity Indices of Fish Species during the Period of Study in Sabiyal Lake**

Table 1 presents the fish diversity indices recorded across the three sampling sites, Sabiyal, Tari, and Kashinzama, within Sabiyal Lake. The indices included are species richness, Shannon diversity index, and Simpson diversity index, which together offer a comprehensive picture of fish community structure and ecological balance in the lake. Across all three locations, species

richness is recorded at nine (9), indicating that each site harbored the same number of fish species during the study period. This suggests a uniform presence or availability of fish species in terms of count, possibly influenced by similar habitat conditions or connectivity within the lake. However, despite this uniform richness, the Shannon diversity index, which accounts for both abundance and evenness, shows slight variations among the locations. The highest Shannon index was recorded at the Sabiyal site (2.015), followed closely by Tari (1.991), and the lowest at Kashinzama (1.934). A higher Shannon value at Sabiyal implies that not only are the fish species present, but they are also more evenly distributed and less dominated by a single species, reflecting a relatively balanced ecosystem. A similar trend is observed in the Simpson's diversity index, where Sabiyal (0.8548) again leads, followed by Tari (0.8533) and Kashinzama (0.8373). The Simpson index measures the probability that two individuals randomly selected from a sample belong to different species. Values closer to 1 suggest higher diversity and evenness. Thus, Sabiyal demonstrates the highest ecological evenness, and Kashinzama, while still diverse, exhibits a slightly higher dominance by certain species.

Table 1. Diversity Indices of Fish Species during the Period of Study in Sabiyal Lake

| Location | Richness | Shannon | Simpson |
|---|---|---|---|
| **Sabiyal** | 9 | 2.014927 | 0.8547563 |
| **Tari** | 9 | 1.991279 | 0.8532954 |
| **Kashinzama** | 9 | 1.934298 | 0.8372586 |

**Fish Species Abundance in Sabiyal Lake**

The figure below illustrates the overall abundance of different fish species sampled throughout Sabiyal Lake during the study period. It likely uses a bar chart or similar plot to represent the number of individuals per species. It is possible to identify dominant and subordinate fish species. The most abundant species are likely generalist species capable of adapting to diverse environmental conditions, while species with low abundance may indicate habitat specificity, intolerance to disturbances, or competition from dominant species. The visual distribution highlights ecological dominance, where one or two species may constitute a significant portion of the fish population. Such dominance can affect trophic interactions and resource availability for other species in the lake. This supports the inference from Table 1 that despite similar species richness, relative abundance varies, indicating differences in ecological pressures or habitat preferences.

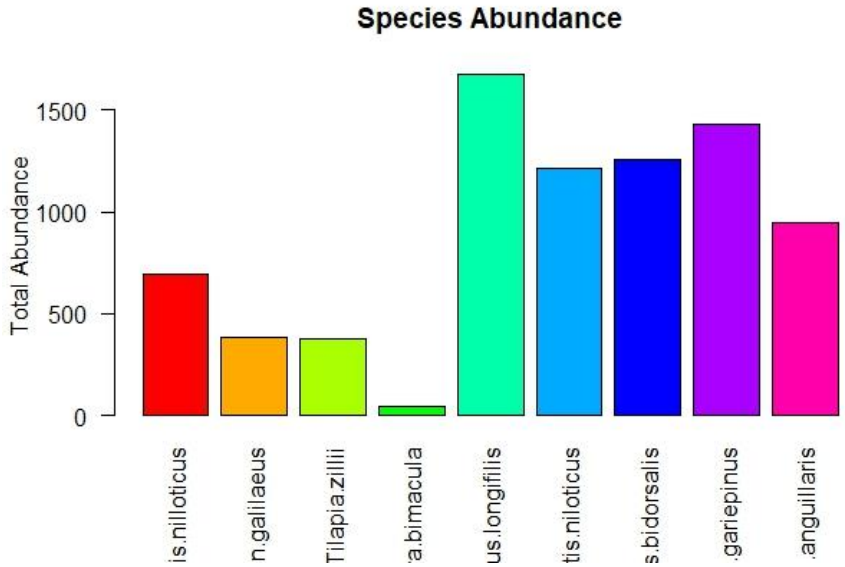


Figure 1. Fish Species Abundance in Sabiyal Lake

**Distribution of Fish Species in Three Sampling Sites**

Figure 2 presents a comparative view of how fish species are distributed across the three sampling sites: Sabiyal, Tari, and Kashinzama. This figure allows for an assessment of site-specific species occurrence and abundance. The distribution pattern shows that while some species are ubiquitous across all sites, others are site-specific, found only in one or two locations. Such patterns indicate the ecological heterogeneity of the lake. It suggests that such as water microhabitat characteristics depth, vegetation cover, or substrate type, may influence the habitat preference of certain fish species. The figure also provides insight into species turnover between locations. For instance, the presence of certain species in Sabiyal and their absence in Kashinzama could support earlier findings that Sabiyal harbors more ecologically balanced fish communities.

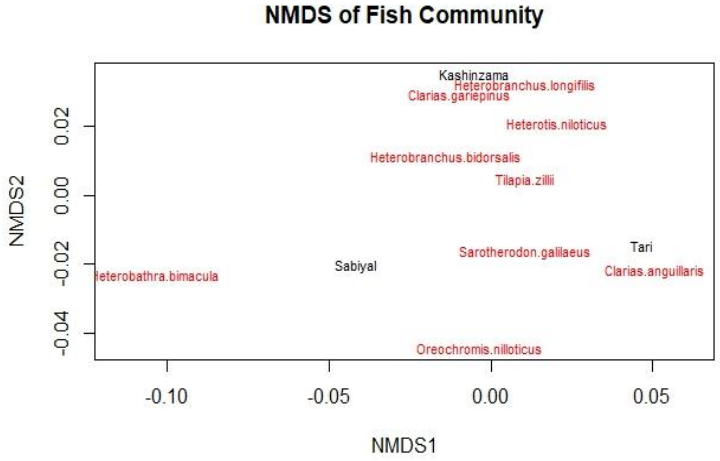


Figure 2. Distribution of Fish Species in Three Sampling Sites in Sabiyal Lake

**Taxonomic Abundance of Fish Species in the Study Area**

Figure 3 displays the taxonomic structure of the fish community in Sabiyal Lake, likely broken down by family or genus level. This helps to

understand not just the number of species, but also how they are distributed across taxonomic groups. The visual may reveal that specific families such as Cichlidae, dominate the fish population, possibly due to their adaptive traits, such as tolerance to low oxygen, wide feeding niches, or fast reproduction. A diverse taxonomic structure suggests a robust ecosystem with multiple trophic levels and interactions. Conversely, overrepresentation of a few families may indicate ecosystem simplification or anthropogenic impact.

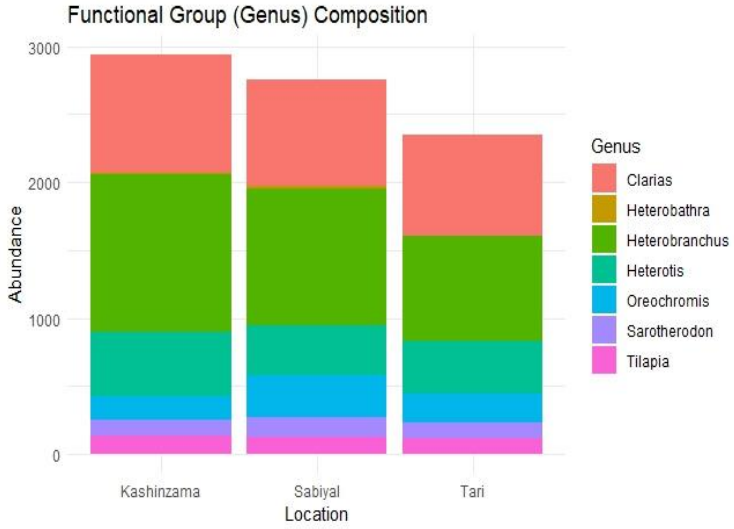


Figure 3. Taxonomic Abundance of Fish Species in Sabiyal Lake

The results from Table 1 show that although species richness was constant across all sites (9 species each), the Shannon and Simpson diversity indices varied. Sabiyal recorded the highest Shannon (2.015) and Simpson (0.855) values, indicating a more even and ecologically balanced fish community compared to Tari and Kashinzama. These findings are consistent with the work of Ovie and Adeniji (2007) on Nigerian inland water bodies, where it was reported that diversity indices are more sensitive indicators of community structure than mere species count. The high Shannon index in Sabiyal implies that fish populations are evenly distributed without dominance by a few species, which often suggests less ecological stress (Boyd, 2019). In contrast, the lower values in Kashinzama may indicate species dominance, potentially caused by anthropogenic pressures such as overfishing or water quality degradation. This aligns with findings by Ogunwenmo and Osuala (2012), who observed that declining diversity indices in Lagos Lagoon correlated with pollution and habitat disruption. The Simpson index, which reflects the probability that two individuals randomly selected from a sample belong to different species, further supports these observations. A higher Simpson value at Sabiyal denotes greater ecological resilience, while Kashinzama's lower value (0.837) may reflect competitive exclusion or niche limitation.

Species abundance and distribution is a common pattern in tropical freshwater ecosystems, where a small number of generalist or ecologically tolerant species tend to dominate due to their adaptability to varying conditions (Froese & Pauly, 2024; Boyd, 2019). Dominant species may include those with higher reproductive rates, broad feeding niches, or tolerance to low oxygen

levels. The presence of less abundant species, however, remains ecologically significant, as these species may play specialized roles in the ecosystem, such as bioindicators of water quality or contributors to trophic complexity. This pattern is consistent with the findings of Karr and Chu (1999), who emphasized that biodiversity includes not just dominant species but also rare and sensitive taxa that maintain ecological resilience.

From the visual analysis, some species are present in all three sites, while others are restricted to specific locations. This reflects ecological heterogeneity within the lake, where microhabitat variation, such as water depth, aquatic vegetation, substrate type, or water chemistry, may influence fish presence. Such spatial partitioning of species has also been observed in Nigerian lakes by Ovie and Adeniji (2007), who noted that certain cichlid and catfish species were closely associated with vegetated or oxygen-rich areas. This distribution pattern also confirms the importance of preserving habitat diversity within a water body, as it supports a wider range of ecological niches.

This figure classifies fish into taxonomic groups (likely family or genus level) and presents their relative abundance. The results indicate that one or two taxonomic families dominate the lake's fish fauna. This may include families such as Cichlidae, which are commonly reported as dominant in Nigerian freshwater systems (Ogunwenmo & Osuala, 2012; FishBase, 2024). According to Wetzel (2001), balanced taxonomic composition supports trophic diversity and food web stability. Hence, this figure helps identify keystone families and possible functional gaps in the fish community that may arise from disturbance.

## CONCLUSIONS AND RECOMMENDATIONS

This study provides crucial baseline assessment of the fish species composition and abundance in Sabiyal Lake, Kebbi State. The key finding is that while the lake supports consistent number of nine (9) fish species across the sampled sites (Sabiyal, Tari, and Kashinzama), the ecological structure of these fish communities varies. The Sabiyal site demonstrated the highest levels of diversity and evenness as indicated by the superior Shannon (2.015) and Simpson (0.855) indices, suggesting more balanced and resilient ecosystem at this location. In contrast, the lower diversity indices at the Kashinzama site point towards a community with greater species dominance, which can be an early indicator of ecological stress. Generally, the fish resources of Sabiyal Lake are vital asset for the local communities but the observed patterns highlight the need for immediate and strategic management to ensure their long-term sustainability.

## FURTHER STUDY

This research has limitations, so further research on this topic is still needed.

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