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Contemporary Fish Species Diversity in Yankari Game Reserve, Bauchi, Nigeria.

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Abstract

Fish species diversity within Yankari Game Reserve was investigated to determine the morphological diversity, species richness, and distribution of fishes occurring in different water bodies across the Reserve between November and December 2024. Fish specimens were collected from 13 sampling locations within Yankari Game Reserve using cast nets, gill nets, frame nets, and fish traps. The selection of fishing gear at each location was based on the size, accessibility, and physical conditions of the respective sampling sites to ensure effective collection of representative specimens. All collected fish specimens were subjected to morphological examination and identified to species level using standard taxonomic identification methods. Species diversity and richness across the sampled water bodies were quantitatively evaluated using the Shannon-Wiener and Simpson diversity indices. A total of 28 fish species belonging to 14 families were identified from the 13 sampling locations, demonstrating considerable taxonomic and morphological diversity of the ichthyofauna within the Reserve. The overall Shannon-Wiener diversity index was 2.41, while the Simpson diversity index was 0.11. These diversity indices, together with the number of species and families recorded, indicate the presence of a diverse fish assemblage within the aquatic ecosystems of Yankari Game Reserve. The findings provide important baseline information on fish species composition, morphological diversity, and richness that can support future ecological monitoring and management of aquatic biodiversity within the Reserve. Considering the diversity of fish resources documented during the study, strict conservation measures are recommended to protect fish populations and their aquatic habitats and ensure the long-term preservation and sustainable management of the diverse fish resources available within Yankari Game Reserve.

Keywords

Conservation,
Yankari,
Diversity,
Nigeria,
Fish



Introduction

Conservation of biological resources is an important phenomenon which protects and maintain the values of the resource in question. There is a serious problem of biodiversity loss in the freshwater ecosystem (Albert *et. al.* (2021). Over the last century, habitat loss and degradation have occurred due to the intense human interventions and the consequence of this is that, many fish species have been highly endangered (Okeke *et. al.* 2023).

A key step towards effective biodiversity conservation is regular evaluation of existing species in an environment. According to Syafrialdi and Amrullah (2025), fish diversity research is fundamental because it not only knows and understands the status of its population, but also plays a crucial role in efforts to protect resources and ecosystem. Yankari Game Reserve is an important diversity hotspot and is blessed with many streams within its catchment areas which supports and sustain the diverse species of aquatic organisms including the fish species. Assessment of species richness and abundance is an important step in understanding population drifts, monitoring and designing conservation plans particularly in a protected area like Yankari Game Reserve.

In their study, Nayaya *et. al.* (2012) studied the diversity and distribution of fishes of Gaji river, the major source of water for the diverse wild fauna in and around Yankari Game Reserve and identified a total of 13 species of fish. Furthermore, despite the protection

status of Yankari Game Reserve, Nayaya and Ibrahim (2015) discovered that the major threats to conservation of *Clarias gariepinus* in Yankari Game Reserve are overexploitation, habitat degradation and competition among others. Generally, there is paucity of information on diversity of fish species in the reserve. In view of the importance of biodiversity conservation and in the absence of adequate information on the status of fish species of Yankari Game, this work was carried out to complement the existing information on diversity of the fish species in the Game Reserve with a view to providing an insight into their conservation status.

Materials and Methods

The Study Area

Yankari Game Reserve (formerly National Park) is a large wildlife park located in the south-central part of Bauchi State, in northeastern Nigeria. It is located on Latitude 9° 45' 16" and Longitude 10° 30' 37" and covers an area of about 2,244 km² (870 mi²) and is home to several natural warm water springs, as well as a wide variety of flora and fauna. Its location in the heartland of the West African savanna makes it a unique way for tourists and holidaymakers to watch wildlife in its natural habitat (Nayaya *et. al.* (2012). The area experiences wet and dry (hot and cold) season. It has an annual average rainfall of 900 to 1000 mm. The two dominant habitat types are Sudan savannah (and woodlands) and riparian vegetation. The YGR is famous for supporting a diversity of animals and plants.

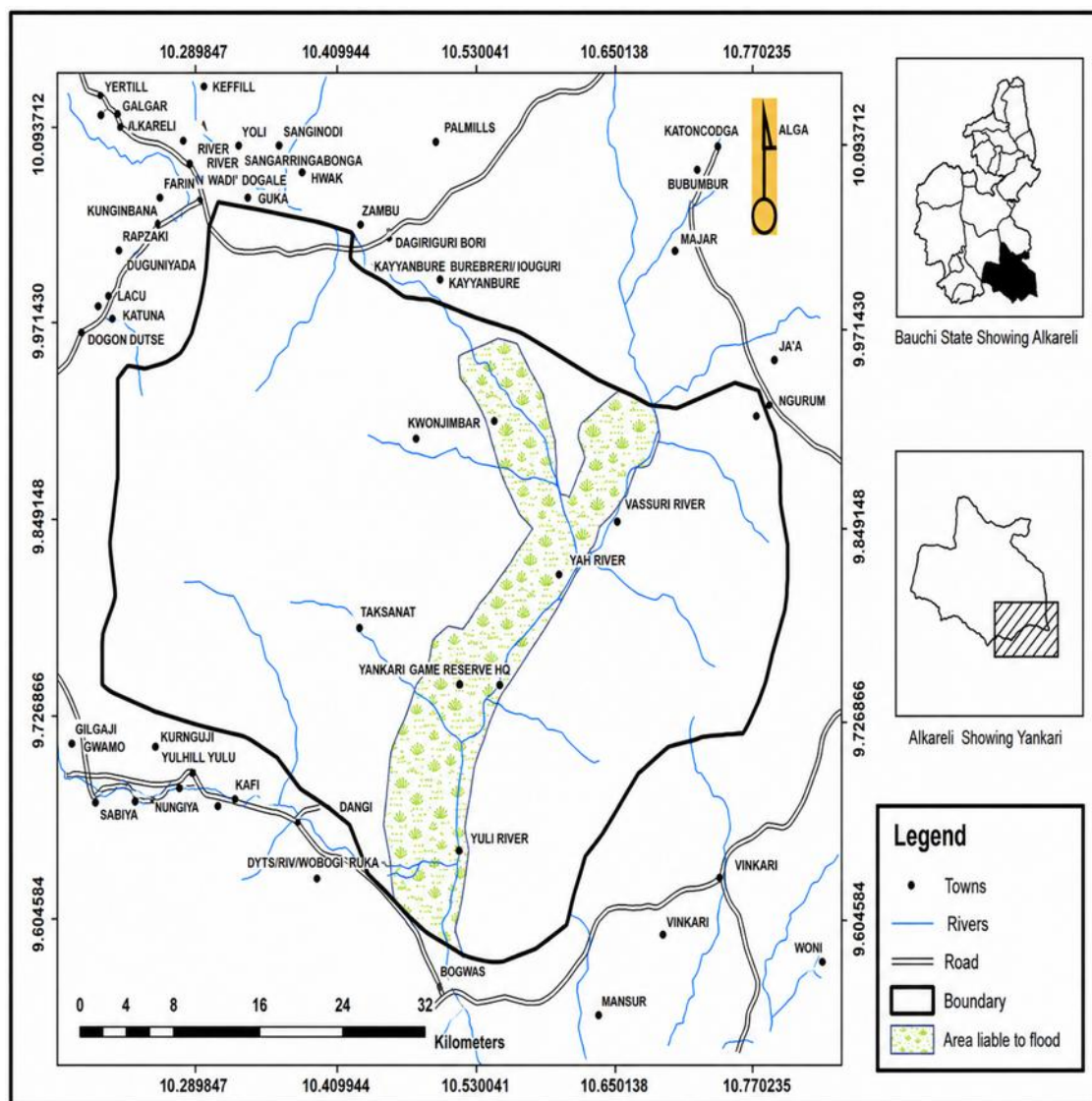


Figure 1: Map of Yankari Game Reserve, Bauchi State, Nigeria

Fish sampling, treatment and identification

Fish sampling was carried out in November and December 2024. Sampling sites were selected based on accessibility following a reconnaissance visit. Throughout the period of the work different fishing gears were used. The different fishing gears used included cast nets, gill nets, entrance traps, hooks and line. A total of fifteen (15) sites were sampled using the different fishing gears. All the species were identified into species level using standard taxonomic references of Idodo-Umeh, (2003) and Olaosebikan and Raji (2013). Voucher specimens were collected and fixed in 10% formalin. Later, the fish samples were washed under running

water and transferred to a 70% alcohol solution for permanent storage.

Fish species composition, abundance and diversity

The composition and abundance of encountered fish species by site was documented. The Species diversity was also evaluated using the Shannon-Weiner index to assess the overall species diversity according to Okeke et. al. (2023) and Syafrialdi and Amrullah (2025).

$$H' = - \sum_{i=1}^n (p_i)(\log_2 p_i)$$

where: H' is the Shannon-Wiener diversity index, p_i is the proportion of individual found in the i th fish

species with the total number of fish relative to the number of individual fish ($p_i = n_i/N$). This index accounts for both the richness of the species and their relative abundance, which gives higher value in ecosystems with many evenly distributed species.

The Simpson diversity index (D) was also calculated to determine the fish species dominance using as follows:

$$D = \sum_{i=1}^s (p_i)^2$$

where: D is Simpson's dominance index, s is the number of fish species, p_i is the proportion of individuals of species-i to the total individuals in the community ($p_i = n_i/N$ with n_i being the number of individuals of species i and N being the total individuals of all species). Here values closer to 1 indicate lower dominance, which indicates greater evenness within the ecosystem. This index assessed whether certain species were particularly dominant or if there was a more balanced species distribution.

Results and discussion

A total of 28 species belonging to 14 Families were identified from 13 locations in the Game Reserve (Table 1). The table showed that the Family Cichlidae had the highest number of 5 species representing 19.23 % followed by the Families Mochokidae, Mormyridae, Clariidae and Cyprinidae with 15.38 %, 15.38%, 7.68% and 7.68% respectively. The remaining families Alestidae, Bagridae, Citharinidae, Claroteidae, Distichodontidae, Hepsetidae, Schilbeidae, Protopteridae and Polypteridae had 1 species each representing 3.85% in each case.

The moderate number of fish species identified and dominance of Cichlidae may be

due to the relatively low attention the fish species enjoy in the Reserve. Freshwater fishes are the most affected by human activities worldwide, yet freshwater fish diversity conservation has not received the same attention as other vertebrates. Furthermore, species diversity is central to biodiversity conservation and, therefore, accurately describing, measuring, and assessing species diversity are long-standing concerns in ecology and conservation biology as reported by He et. al. (2022). Maimunatu et. al. (2019) identified eighteen (18) fish species with the most dominant species being *Tilapia zilli*. *Tilapia zilli*. Okeke et. al. (2023) worked on fishes of river Niger and identified 31 species in 15 families with the Family Mormyridae in dominance followed by Bagridae. Syafraldi and Amrullah (2025) reported 13 families, 23 genera, and 26 species caught in their work with Cyprinidae being the family with the highest abundance.

Other studies have shown that Cyprinidae is the most dominant fish family in various waters (Hu et al 2019; Yagos et al 2022; Zare-Shahraki et al 2022). Iyiola (2025) reported *Oreochromis niloticus* and *Coptodon zilli* to be the most abundant fish species in the Owalla and Erinle reservoirs, respectively. He opined that the highest fish species abundance encountered in Owalla may be due to its location, which was upstream. He further reported that the activities in this area upstream will dictate the abundance downstream, as observed in Erinle. Oladipo et al. (2021) reported that natural waters flow by gravity, and obstructions, such as dams, created in the flow of natural waters can influence the abundance and diversity of fish in the lower regions of these waters.

Table 1: Composition of identified fish species by location in Yankari Game Reserve

S/N	Location	Species
1	Dallamiri	<i>Gymarchus niloticus</i> <i>Synodontis violacea</i> <i>Coptodon zillii</i> <i>Bagrus filamentosus</i> <i>Hemichromis bimaculatus</i>
2	Likalika	<i>Clarias gariepinus</i> <i>Mormyrus hasselquistii</i> <i>Coptodon zilli</i> <i>Synodontis batensoda</i> <i>Protopterus annectens</i> .
3.	Barkono	<i>Oreochromis niloticus</i> <i>Sarotherodon galilaeus</i> <i>Distichodus brevipinnis</i>
4.	Guruntun	<i>Oreochromis niloticus</i> <i>Sarotherodon galilaeus</i> <i>Clarias gariepinus</i> <i>Citharinus citharus</i>
5.	Magama	<i>Sarotherodon galilaeus</i> <i>Citharinus citharus</i>
7	Duhunwan Mata	<i>Schilbe mystus</i> <i>Synodontis batensoda</i> <i>Mormyrus hasselquitii</i> <i>Citharinus citharus</i> <i>Chelaethiops elongatus</i>
8	Gadan Baba Ilori	<i>Auchenoglanis occidentalis</i> <i>Alestes nurse</i> <i>Hetrobranchus bidorsalis</i>
9	Tabakare	<i>Hepsetus odoe</i> <i>Sarotherodon aureus</i>
10	Maisan Gora	<i>Polypterus bichir</i> <i>Mormyrus rume</i> <i>Synodontis ocellifer</i>
11	Ruwan sarki	<i>Synodontis batensoda</i> <i>Gnathonenus abadii</i> <i>Marcusenius senegalensis</i> <i>Coptodon zillii</i>
12	Twins Bridge B	<i>Coptodon zilli</i> <i>Synodontis eupterus</i> <i>Sarotherodon galilaeus</i> <i>Hepsetus odoe</i> <i>Alestes brevis</i> <i>Distichodus brevifinnis</i>
13	Salt lick B	<i>Labeo parvus</i> <i>Oreochromis niloticus</i>

The distribution of fish species by Family showed that the Family Cichlidae had the highest percentage of 19.3% followed by Mormyidae and Mochokidae each with 15.38, Clariidae and Cyprinidae with 7.69% each while the least percentage of 3.85% was encountered in the remaining fish Families (table 2). The highest abundance of Cichlids may be due to their wide spread in Nigerian

waters. According to Iyiola (2025), Cichlids were the most abundant in most reservoirs in Nigeria. Similar results were reported from reservoirs as in (Taiwo *et al.*, 2018), Aiba Reservoir (Iyiola *et al.*, 2019), and Gold Mine reservoirs (Komolafe *et al.*, 2016). The presence of cichlids is also reported to be abundant in Nigerian inland waters (Oguntade *et al.*, 2014; Oladipo *et al.*, 2018b).

Table 2: Composition of fish species in various families in Yankari Game Reserve

S/N	Family	Fish Species	Number of species	% composition
1	Alestidae	<i>Alestes nurse</i>	1	3.85
2	Bagridae	<i>Bagrus filamentosus</i>	1	3.85
3	Cichlidae	<i>Oreochromis niloticus</i> <i>Sarotherodon galilaeus</i> <i>Coptodon zilli</i> <i>Sarotherodon aureus</i> <i>Hemichromis bimaculatus</i>	5	19.23
4	Clariidae	<i>Hetrobranchus bidorsalis</i> <i>Clarias gariepinus</i>	2	7.69
5	Citharinidae	<i>Citharinus citharus</i>	1	3.85
6	Cyprinidae	<i>Labeo parvus</i> <i>Chelaethiops elongatus</i>	2	7.69
7	Claroteidae	<i>Auchenoglanis occidentalis</i>	1	3.85
8	Distichodontidae	<i>Distichodus brevipinnis</i>	1	3.85
9	Hepsetidae	<i>Hepsetus odoe</i>	1	3.85
10	Mormyridae	<i>Mormyrus hasselquistii</i> <i>Gnathonenus abadii</i> <i>Marcusenius senegalensis</i> <i>Mormyrus rume</i>	4	15.38
11	Mochokidae	<i>Synodontis batensoda</i> <i>Synodontis violacea</i> <i>Synodontis eupterus</i> <i>Synodontis ocellifer</i>	4	15.38
12	Schilbeidae	<i>Schilbe mystus</i>	1	3.85
13	Protopteridae	<i>Protopterus annectens</i>	1	3.85
14	Polypteridae	<i>Polypterus bichir</i>	1	3.85
Total			26	

The overall Shannon-Weiner and Simpson diversity indices were found to be 2.41 and 0.11 respectively.

Specimens of some fish species are shown on plate 1.

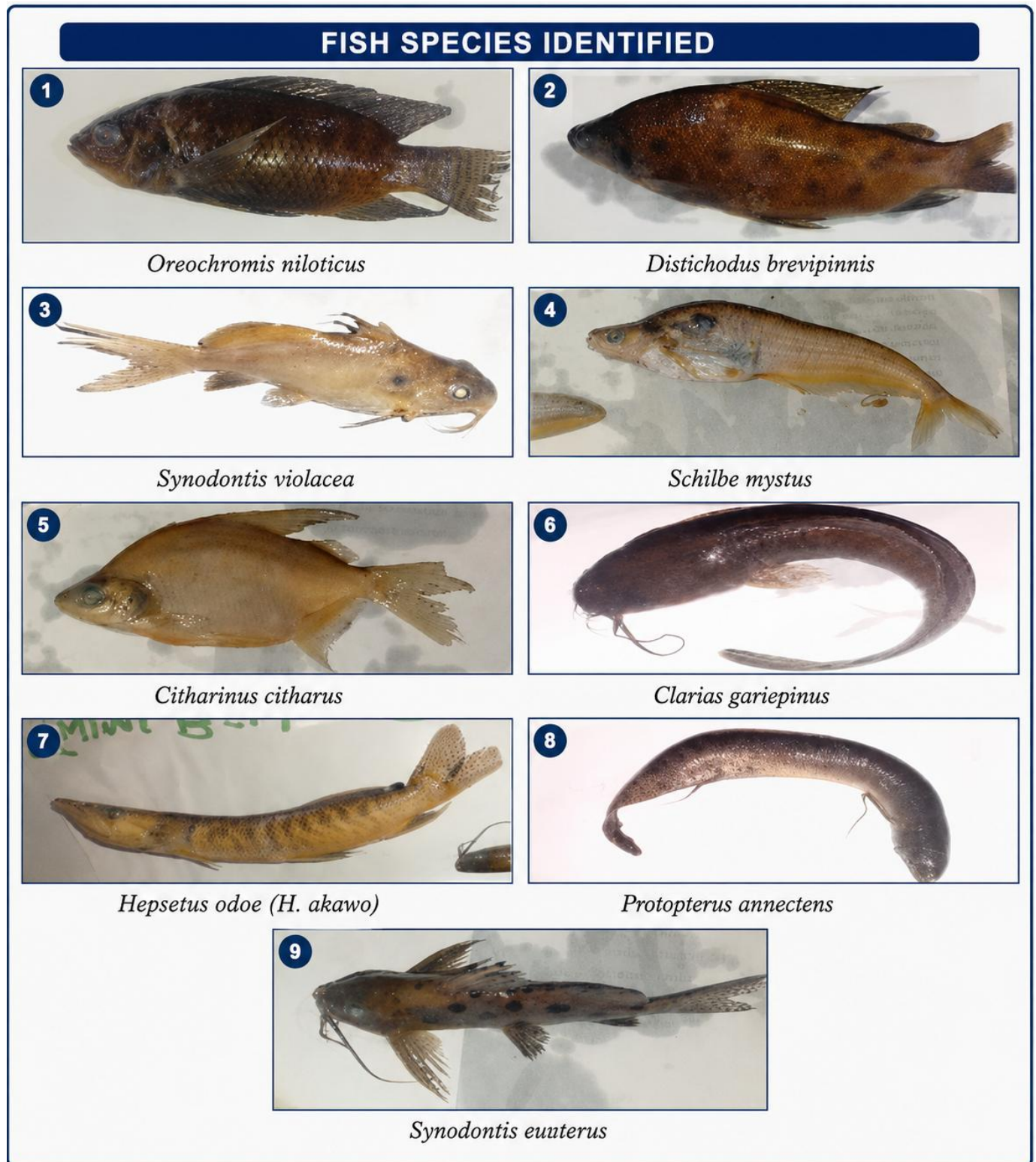


Plate 1: Some specimens of fish identified in Yankari Game Reserve

Conclusion and Recommendation

The aquatic ecosystems of Yankari Game Reserve support a rich and diverse assemblage of fish species, demonstrating the ecological importance of the Reserve's rivers, streams, pools, and other water bodies as habitats for freshwater biodiversity. The occurrence of numerous species representing several taxonomic families indicates substantial species richness and suggests that the aquatic environments within the Reserve provide a variety of ecological niches capable of supporting different fish communities. The diversity recorded across the sampled locations further highlights the importance of these water bodies for maintaining the ecological integrity and biological resources of Yankari Game Reserve.

The occurrence of several fish species across multiple sampling locations suggests a degree of ecological and hydrological connectivity among the water bodies within the Reserve. Such similarities in species composition may be influenced by seasonal water flow, drainage connectivity, habitat characteristics, availability of food resources, and the movement and dispersal of fish between interconnected aquatic environments. This connectivity is ecologically important because it facilitates population exchange and contributes to the long-term stability and resilience of fish communities. Consequently, alterations to water flow, habitat structure, water quality, or riparian vegetation could potentially affect fish distribution and overall aquatic biodiversity.

It is therefore recommended that appropriate conservation and management measures be strengthened to protect the aquatic habitats and fish resources of Yankari Game Reserve.

Particular attention should be given to maintaining natural hydrological connectivity, protecting critical fish habitats, preserving riparian vegetation, and preventing activities that may cause habitat degradation, water pollution, or excessive exploitation of fish resources.

Further comprehensive studies are strongly recommended to investigate the species diversity, abundance, spatial and seasonal distribution, population structure, habitat preferences, and conservation status of fish within the Reserve. Long-term monitoring across both wet and dry seasons would provide a more complete understanding of temporal changes in fish assemblages. Future investigations should also evaluate physicochemical water-quality parameters, habitat characteristics, anthropogenic pressures, and other environmental factors controlling fish distribution. Such information would provide a robust scientific basis for developing effective conservation strategies and ensuring the sustainable management of the diverse fish resources and aquatic ecosystems of Yankari Game Reserve.

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