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ECOMORPHOLOGY AND HETEROGENEITY OF FISH SPECIES IN ASEJIRE DAM, OYO STATE, NIGERIA

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ABSTRACT

Understanding the morphological diversity of fish species within an ecosystem provides critical insights into the mechanisms of ecological interactions, adaptive strategies, and evolutionary processes. This study assessed the ecomorphological traits underlying fish assemblage in Asejire Reservoir. Random samples of fish were purchased from the landing sites of fishermen from Asejire Reservoir from November 2021 to April 2022. Fish species were identified, and counted, and morphological traits associated with allometric size, ecomorphology, swimming dynamic, and feeding habits were recorded. Data were subjected to descriptive statistics, diversity indices, and multiple-factor analysis. Thirteen species (n = 96) across 10 families were encountered at Asejire. Chrysichthys nigrodigitatus was the most prevalent species, comprising 22.92% of the assemblage, while Parachanna obscura was the least represented, constituting only 1.04%. The average Simpson dominance value of 0.21 (<1) suggests moderate species diversity, validated by the Shannon-Weiner index of 1.9. Multiple Factor Analysis (MFA) revealed 12 dimensions (Dim) explaining 100% variability in the dataset. Dimensions 1 (25.44%) and 2 (12.54) accounted for 47.89% inertia and identified feeding habits (herbivore, carnivore, and omnivore) as the most critical driver of species segregation, mediated by allometric size and swimming dynamics. The elongated-deep dichotomy provided a fundamental basis for the ecomorphological interpretation of these dimensions. This study provides a key aspect of understanding and preserving the complex interactions and diversity within Asejire ecosystems, ensuring their long-term sustainability and resilience

Keywords: ***Morphology, Ichthyofauna, Ecological niche, Biodiversity, Asejire dam***

INTRODUCTION

Fish are important indicators of an aquatic ecosystem, occupying a remarkable position from a socio-economic point of view (Bera *et al.*, 2014). An assessment of the stock and abundance provides information on size composition, rate of regeneration, level of exploitation, and the pattern of fishing which ultimately give guidelines for rational fisheries management. The authors affirm not only lakes but also reservoirs constitute the largest inland fishery resources in terms of size and production potential. However, freshwater ecosystems may well be the most endangered ecosystems in the world. Declines in biodiversity are far greater in fresh waters than in the most affected terrestrial ecosystems (Sala *et al.*, 2000).

There is a growing recognition of the importance of Ecological morphology (or ecomorphology), which is the study of the relationship between the morphology of the organism and its environment (Bock, 1994, Pessanha *et al.*, 2015) in the conservation and management of fish populations. Ecomorphology plays a crucial role in fisheries management and conservation strategies by providing insights into the relationship between morphological traits of fish species and their habitats; thus, aiding in the development of effective conservation measures. Studies like those by Anthi *et al*. (2018) highlighted how ecomorphological traits can be used to classify species based on their priority for protection, emphasizing the importance of considering such traits in conservation efforts. Additionally, research on the yellow-fin Mojarra, *Gerres cinereus* demonstrated how environmental variables influence the morphological variability of fish populations, showcasing the impact of environmental pressures on fish body shape and the need to account for these factors in conservation plans (Hernandez *et al.*, 2022).

By integrating ecomorphological analyses into fisheries management, conservation strategies can be tailored to better protect species and their habitats, ultimately contributing to sustainable resource exploitation and biodiversity conservation. Research in ecomorphology has concentrated on examining the connection between alterations in an individual's physical structure and ecological characteristics associated with resource utilization. This is grounded in the notion that the anatomical features of organisms are intricately linked to their behavioral patterns and ecological niche (Watson and Balon, 1984; Sampaio and Goulart, 2011). In the present study, we investigated the relationship between ecomorphological traits and species abundance within the fish community of Asejire Dam, southwestern Nigeria, consistent with a paradigm shift from the age-based and length-composition default stock assessment method for sustainable fish management and conservation. A thorough understanding of the economic characteristics of these fish species, especially within Asejire ecosystems, will play a significant role in unraveling the processes of adaptive radiation and resource partitioning.

Fish species diversity is a measure of the variability of fish species that co-habit and constitutes an important feature of aquatic biological communities. According to Awogbade (2004), it is a feature that puts into full use the various niches in an aquatic environment, thus ensuring the completion of its biological cycles. Fish are important indicators of an aquatic ecosystem, occupying a remarkable position from a socioeconomic point of view (Bera *et al.*, 2014). An assessment of the stock and abundance provides information on size composition, rate of regeneration, level of exploitation, and the pattern of fishing which ultimately give guidelines for rational fisheries management. According to Bera *et al.*, (2014), lakes and reservoirs are the single largest inland fishery resources in terms of size and production potential.

Biodiversity entails the study of the variety and variability of life that exists on Earth, which includes quantity, variety, and distribution, ranging from genetics to species, populations, communities, and ecosystems (Gowda *et al*., 2015). It starts with a measure of the number of species that make up a biological community and is considered one of the most significant aspects of the community organisation and structure (Ahmed *et al*., 2018). This provides a brief idea about species diversity and richness, which designates the key elements of biodiversity (Yadav and Mishra, 2013). Omoike (2021) also mentioned that relative abundance and species richness are the key elements of biodiversity in the aquatic system and have been recommended as a tool for ecological risk assessment. Biodiversity is the foundation of the vast array of ecosystem services that contribute significantly to human well-being (Rayal *et al*., 2021). It indicates the potential of any aquatic system and also depicts its trophic status (Kumar *et al*., 2011).

Ecomorphology on the other hand has been used to test hypotheses in community ecology based on the assumption that morphological traits that influence organism performance can reveal ecological patterns and insights into ecological processes. Ecomorphology has been used to infer factors influencing adaptive divergence of lineages (Arbour and L pez-FernÆndez, 2013), community assembly from local to regional scales (Halpern, 2005), and community response to environmental change (VillØger *et al*., 2010). Eco-morphology has to do with the study of the relationship that exists between the role of ecology on an organism and its morphology (Wiley, 2017). The study of species' ecomorphological traits encompasses a variation of ecological and morphological characteristics that is ecological morphospace (Tuset *et al*., 2014) and traits' linkage with species functions. Thus, species morphology is often used as a surrogate for species' functional roles in ecological assemblages (Dehling *et al*., 2016; VillØger *et al*., 2017).

It has been well demonstrated that morphological traits reflect adaptation to a particular environment in geographically and taxonomically disparate assemblages of fish species (Bridge *et al*., 2016). In fish, ecomorphological studies primarily focused on the relationship between body morphology and pattern of use of resources that contribute to understanding the realized niche of the fish species in a habitat (Wainwright *et al.,* 2002). Diversification of the adaptive morphology or morphological features can be linked to changes in the environment, whereby individual species can change their form due to complex associations involving other living organisms or as a result of restrictions caused by the environmental change or changing environment. Considering the fact that since the morphological traits of species are in a way associated with habitat use, environmental change may result in constraints in the activities of the existing species. These constraints may be linked to reproductive and or feeding patterns of the existing species, and their morphological features which may influence the selection of those better suited to colonize the new environment, and because fish species may be reduced in great numbers as a result of the continued stress or constraints placed on the aquatic environment (Boris, 2006). This, however, does not change the fact that the cause of the reduction in the number of a few species in an environment is a result of habitat destruction and or alteration (Warren *et al*., 2000). These ecomorphological traits, linked with fitness and performance, include prey capture, efficiency, diet, foraging methods, size, locomotion mode, reproduction, or habitat preference (Winemiller, 2005).

Freshwater ecosystems may well be the most endangered ecosystems in the world. Declines in biodiversity are far greater in fresh waters than in the most affected terrestrial ecosystems (Sala *et al.,* 2000). Eco-morphological studies have been carried out by many to predict habitat preferences. Santos *et al.,* (2011) worked on the "morphological patterns of five fish species (four characiforms, one perciform) in relation to feeding habits in a tropical reservoir in South-Eastern Brazil and used nine eco-morphological indices. Some ecomorphological indices used include relative height of mouth, compression index, relative length of head, relative length of the caudal peduncle, and mouth width. From their work, there were indications of divergence in the morphology of the fish used. Donald *et al*., (2001) used a fish ecomorphology study to predict habitat preferences of stream fishes using body shapes.

The eco-morphological traits and fish diversity in Asejire Dam, located in South Western Nigeria, have not been thoroughly studied. The outcome of this research would be valuable to lake fisheries management, as it would furnish detailed insights into the different fish species' abundance, variety, feeding habits, and ecomorphological traits. This information can aid in the management and preservation for sustainable fisheries. This study therefore determined the ecomorphological traits of fishes in Asejire Dam, Ibadan, Nigeria.

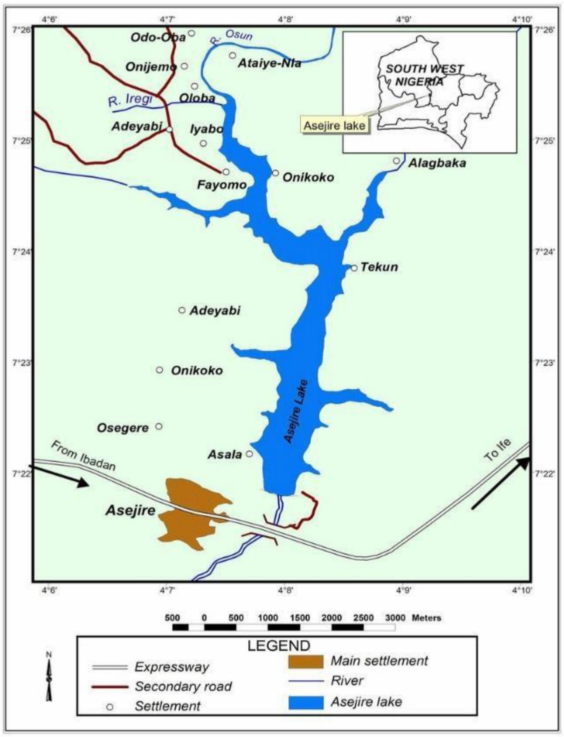

Figure 1. Asejire Dam.

Collection of fish samples

Over a period of six months, from November 2021 to April 2022, random samples of fish species inhabiting Asejire Dam were collected from the catch of local fishermen using basically gill nets and traps. The collected samples were transported in plastic containers with ice blocks to the Laboratory of the Department of Aquaculture and Fisheries Management, University of Ibadan, Nigeria. The samples were preserved by deep freezing in the laboratory for subsequent analysis.

MATERIALS AND METHODS

The Study area

The study was carried out in Asekire Dam in SouthWestern Nigeria. Asejire Dam lies 30km east of Ibadan and has its source from River Oshun. It is located on Latitude 07 21'- 07 26'N 0 0 and longitude 04 06'04 10'E at an altitude of 137 m above sea level (Figure 1)

Collection of biological data The preserved specimens were allowed to thaw and identified using the standard guide Idodo-Umeh, (2003)

Morphometric and a meristic measurement

Sixteen morphometric characters namely (Table 1) were measured, and nine meristic traits (Table 2) were counted and measured on the identified individuals across species

Feeding habits

The feeding habits of the species were classified as herbivorous, carnivorous, and omnivorous based on Relative Gut Length (RGL), calculated as the ratio of full unstretched gut length after dissection to the total length of the fish: RLG < 1 = carnivore; RLG > 1: 1.4 = Omnivore and RLG > 1.5 Herbivore) (Al-Husaaini, 1949)

Ecomorphological indices Ten ecomorphological traits were measured and recorded (Table 3)

Swimming dynamics

Thirteen traits that explain fish swimming dynamics were measured in centimeters (cm) for each identified sample obtained. Pectoral fin length (PFL), pectoral fin width (PFW), Pelvic fin length (PelFL), pelvic fin width (PelFW), anal fin length (AFL), anal fin width (AFW), Dorsal fin length (DFL), dorsal fin width (DFW), caudal fin length (CFL), caudal fin width (CDW), caudal peduncle length (CPL), caudal peduncle width (CPW) and adipose fin (present/absent).

Table 1: Morphometric measurements

Morphometric indices	Code	Description
Total Length	TL	Distance from the tip of the snout to the end tip of the caudal fin
Standard Length	SL	Distance from the mouth tip to the mid-point of the caudal fin origin
Head Length	HL	Distance from the tip of the snout to the bony posterior margin of the operculum
Body Height	BH	Distance between the anterior base of the dorsal fin and origin of the pelvic fin
Body Width	BW	Distance from the anterior of the anterior of the dorsal fin to the middle of the dorsal fin
Head Height	HH	Distance from the anterior of the dorsal fin to then origin of the pelvic fin
Eye Relative Height	ERH	Distance from the base of the lower jaw, to vertically just below the eye.
Pectoral Fin Height	PFH	Distance from the base of the tip of the pectoral fin
Pectoral Fin Width	PFW	Vertical distance between the top to the end of the pectoral fin
Caudal fin length	CFL	Distance from the tail base to the tip of the caudal fin
Caudal fin width	CFW	Distance from the posterior end of the caudal peduncle to the end of the caudal fin
Caudal Peduncle length	CPL	Distance from the horizontal distance between the most posterior points of the caudal fin articulation
Caudal Peduncle height	CPH	Vertical distance from the upper peduncle to it base
Caudal Peduncle width	CPW	Horizontal distance between the anterior to posterior end of the caudal peduncle
Mouth Height	MH	Distance from upper base of the lower jaw to the tip of the upper jaw
Mouth Width	MW	Distance from the beginning of mouth opening horizontally to the end on both jaws.

Table 2: Meristic count of fish species from Asejire Reservoir

Meristic Characters	Code
Dorsal fin soft ray	DFSR

Dorsal fin hard ray (Spine)	DFH
Pectoral fin soft ray	PFSR
Pectoral fin Hard ray (Spine)	PFHR
Caudal fin soft ray	CFSR
Pelvic fin soft ray	PelFSR
Meristic Characters	**Code**
Pelvic Fin Hard ray (Spine)	PelFHR
Anal Fin Soft Ray	AFSR
Anal Fin hard Ray (Spine)	AFHR

Table 3: Ecomorphological traits measured on fish species from Asejire dam

Ecomorphological index	Code	Formula	Description
Compression Index	CI	MBH/MBW	High values indicate lateral compression of the fish which is expected when they occupy habitats with low water velocity
Relative Height	RH	BH/SL	Directly related to the capacity for making vertical turns; Low values indicate an elongated fish.
Relative Peduncle Length	RPL	CPL/SL	Long peduncles indicate fishes with good swimming ability
Caudal Peduncle Compression Index	CPCI	CPH/CPW	High values are typical of less active swimmers
Aspect of Pectoral Fin Ratio	APFR	PFL/PFW	Higher values indicate long and narrow fins
Index of Ventral Flatering	IVF	MHB/BH	Low values indicate fishes inhabiting waters with high hydro-dynamism
Relative Head Length	RHL	HL/SL	Relatively larger heads indicate that the fish is able to handle larger prey
Relative Mouth Width	RMW	WM/SL	Indicate Particle size of food and prey size
Relative Mouth Height	RMH	HM/SL	Indicate Particle size of food and prey size, hydrodynamic morphology
Mouth Aspect Ratio	MAR	HM/WM	Is related to the shape of the food; high values indicate narrow mouths, but the large aperture

Univariate alpha diversity indices Species diversity was analyzed using two univariate diversity indices namely Simpson Dominance (D) and Shannon-Weiner indices.

Dominance index (d)

The dominance index (Harper DAT., 1999) was measured to determine whether a particular fisheries species dominates in a particular aquatic system and can be a useful index of resource monopolization by a superior competitor, particularly in communities that have been invaded by exotic species. This index was determined using the formula,

$$D = \Sigma \left(\frac{nini}{n\ n} \right)^2$$

Where; Σ = summation of values ni = number of individuals of species n = total number of individuals.

Shannon-Weiner (H')

The Shannon-Weiner Species diversity index was calculated by taking the number of each species, the proportion of each species of the total number of individuals, and summing the proportion times the natural log of the proportion for each species as shown:

$(H^{'})$: $(H') = -\sum (pi)(Inpi)$ where p = proportion of species and ln = natural logarithms.

Statistical analysis

Morphometric data were subjected to descriptive statistics. Ichthyofauna compositions of Asejire reservoir were described by univariate diversity indices namely Shannon-Weiner and Dominance index, computed monthly smples using the PAST statistics software version 4.0.3. The data matrix of species morphometric/ecomorphological traits was Multiple Factor Analysis (MFA) with FactoMineR and Factoshiny R packages based on sixteen morphometric measurements, thirteen swimming dynamics, ten ecomorphological indices and feeding habits (Herbivore, Carnivore and Omnivore based on Relative Gut Length: RLG < 1 = carnivore; RLG > 1: 1.4 = Omnivore and RLG > 1.5 Herbivore) The morphometric measurements were log-transformed prior to analysis. Multivariate analyses namely (MFA) were performed in R

RESULT

Fish species abundance and distribution

Thirteen fish species (n = 96) belonging to 10 families were encountered and collected between November 2021 and April 2022 from Asejire Dam. Family Bagridae

Table 4: Species abundance of Asejire Dam (22.92%) was the most diverse with the highest number of species while Channidae (7.69%) constituted the least diverse family in the reservoir during the study period (Table 4). The smallest (11.5 cm) and largest (30.0) species were *Schilbe mystus* and *Chrysichthys nigrodigitatus* encountered in the dam during the present study (Table 5). Temporal variation in the values of the dominance index peaks in December 2021 (0.21) but lowest in April 2022 (0.2) (Table 6). The overall average dominance value of 0.21 suggests Asejire dam is rich in diversity. Cichlids were notably abundant in the present study. There was also temporal variability in Shannon-Weiner diversity (H^1) with the highest value recorded in March 2022. The average H^1 value of 1.9 reflects moderate fish species diversity in the dam (Table 6). Morphological traits of fish species in Asejire dam are summarized in Table 7.

Family	Species	Abundance	% Abundance	Richness	% Richness
Characidae	*Hydrocynus forskahlii*	4	4.17	1	7,69
Latidae	*Lates niloticus*	10	10.42	1	23.07
Mormyridae	*Mormyrus rume*	5	5.24	2	15.38
	Gnathonemus cyprinodes				
Cyprinidae	*Labeo senegalenisi*	12	12.5	1	7.69
Cichlidae	*Coptodon zillii*	21	21.875	3	23.07
	Orechromis niloticus				

Species	Total Length (cm)	
	Minimum	Maximum
Labeo senegalensis	15.8	23.2
Coptodon zilli	10.7	14.7
Oreochromis niloticus	13	24
Oreochromis aureus	10.1	26
Clarias gariepinus	15.8	29
Schilbe mystus	11.5	21.3
Chrysichthys nigrodigitatus	15	30
Gnathonemus cyprinodes	14	17
Polypterus senegalus	23.1	28.5
Parachanna_obscura	12.9	21

	Orechromis aureus				
Clariidae	*Clarias gariepinus*	6	6.25	1	7.69
Schilbeidae	*Schilbe uranoscopus*	12	12.5	1	7.69
Chrysichthys	*Chrysichthys nigrodigitatus*	22	22.92	1	7.69
Polypteridae	*Polypterus senegalus*	22	3.16	1	7.69
Channidae	*Parachanna obscura*		1.04	1	7.69
Total		96	100	13	100

Table 5: Body sizes of fish species from Asejire dam

Species	Total Length (cm)	
	Minimum	Maximum
Hydrocynus forskahlii	17	22
Lates niloticus	14.4	21.6
Mormyrus rume	23	24

Table 6: Biodiversity of fish from Asejire dam during the period of study

Index	NOV	DEC	JAN	FEB	MAR	APRIL
Dominance (D)	0.16	0.21	0.61	0.14	0.15	0.2
Shannon (H^1)	1.88	1.67	1.88	2.1	1.93	1.72

Table 7: Ecomorphological attributes of fish species from Asejire dam

Species	CI	RH	CPL	CPCI	IVF	APFR	RHL	RMW	RMH	MAR
C. nigrodigitatus	3.2–1.8	0.2–0	0.1–0	1.6–0.4	0.8–0.1	2.9–0.9	0.3–0	0.1–0	0–0	0.5–0.1226
C. gariepinnus	2.2–1.1	0.2–0	0.1–0.1	2.5–0.7	1–0.2	2.6–1.2	0.2–0.1	0.1–0	0.1–0	0.6–0.3263
S. uranoscopus	5.5–2.8	0.4–0.3	0.2–0.2	1.6–0.5	0.8–0.3	2.6–1.3	0.3–0.2	0.1–0.1	0.1–0.1	0.8–0.8309

H. forskahlii	3.8–0.5	0.2–0	0.1–0	2.5–0.6	1.1–0	1.3–0.5	0.2–0	0.1–0	0–0	0.6–0.2668
L. niloticus	2.4–1.1	0.3–0.1	0.1–0.1	1–0.2	0.9–0.2	2.4–1.1	0.2–0	0.1–0	0.1–0	0.9–0.2568
L. senegalens	3.8–1	0.3–0.1	0.2–0	1.6–0.5	0.9–0.4	2.3–1.1	0.2–0	0.1–0	0–0	0.5–0.1489
M. rume	1.1–0.2	0.2–0	0.1–0	1.3–0.1	1–0.2	4–0	0–0.2	0–0	0–0	0.5–0.2219
G. cyprinodes	6.9–2.4	0.4–0	0.1–0	1–0.1	0.9–0	1.8–0.2	0.2–0	0–0	0–0	0.8–0.2009
P.senegalus senegalus	3.9–2.3	0.2–0	0.1–0	5–5	1–0.2	0.6–0.3	0.2–0.1	0.1–0	0–o	0.5–0.00869
P. obscura	4.0–NA	0.1–NA	0.1–NA	0.5–NA	1.3–NA	1.0–NA	0.1–NA	0.1–NA	0.0–NA	0.5–NA
O. niloticus	2.7–0.9	0.4–0.1	0.2–0.1	1.2–0.8	1.2–0.3	4–2.4	0.2–0	0.1–0	0.1–0	1–0.3374
C. zilli	4.7–0.7	0.4–0	0.1–0	2.9–0.9	0.9–2.4	0.1–2.6	0.2–0	0.1–0	0.1–0	0.9–0.01
S.mystus	-	-	-	1.4–0.4	0.9–1.7	2.1–1.7	2.1–0.1	0.1–1.0	0.1–0	0.8–0.2427

NOTE: CI, Compression Index, RH, Relative Height; CPL, Caudal Peduncle Index, CPCI, Caudal Peduncle; RMH, Relative Mouth Height, RHL, Relative Head Length; IVF, Index of Ventral Flattening,
APFR, Aspect of Pectoral Fin Ratio, Compression Index; MAR, Mouth Aspect Ratio

Ecological dynamics of species assemblage

Multiple Factor Analysis (MFA) revealed 12 dimensions (Dim) explaining 100% of the total variation in the species composition, morphometrics, ecomorphology, and feeding habits. Dimensions 1 (25.44%) and 2 (12.54) accounted for 47.89%, and identified feeding habits as the most important determinant of species composition in Asejire reservoir (Figure 2), characterized by predominantly herbivores: *Oreochromis aureus, Oreochromis niloticus, Coptodon zilli, Schilbe mytstus*; and carnivores: *C. gariepinnus, S. uranoscopus, H. forskahlii, G. cyprinodes, P. senegalus senegalus*, *P. obscura* and sparse abundant of omnivore represented by *C. nigrodigitatus, L. niloticus, M. rume*. These feeding segregations are modulated by allometric size and swimming dynamics (Figure 3).

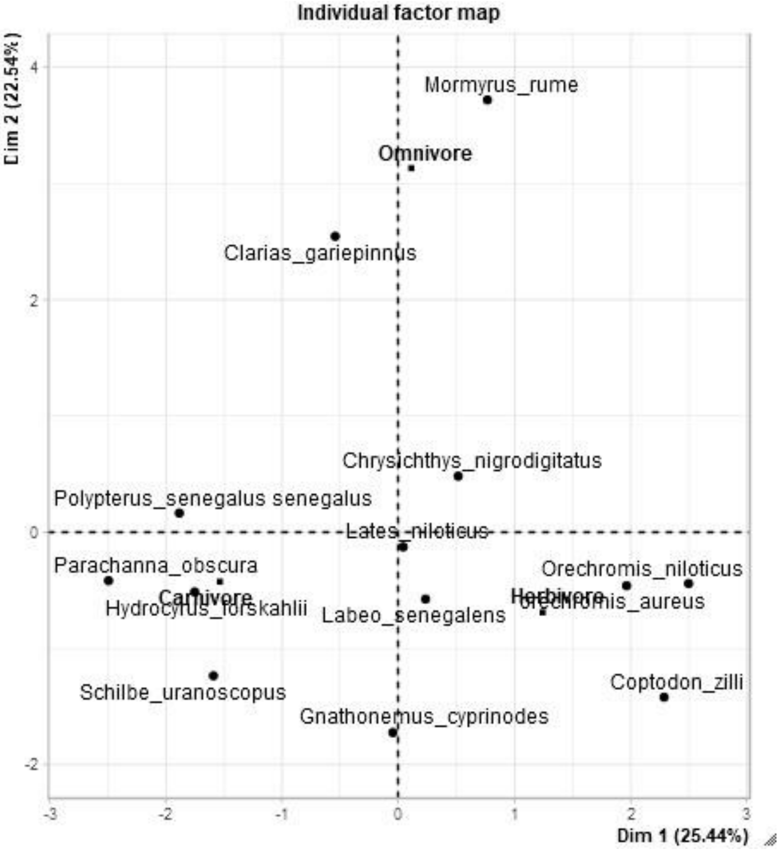

Figure 2: Multiple factor bi-plot of species interaction of fish assemblage in Asejire dam.

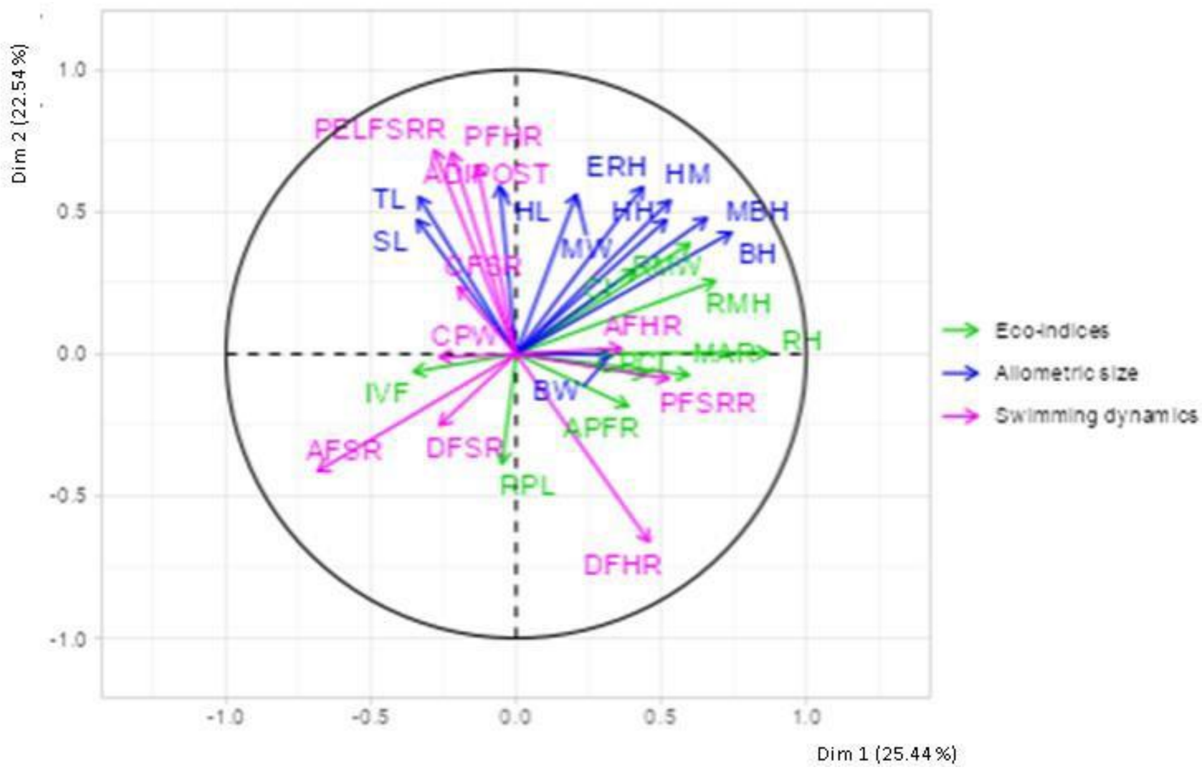

Figure 3: Multiple factor bi-plot of species interaction of fish assemblage in Asejire dam.

On the first dimension of Multiple Factor Analysis (MFA), two diametrical opposite fish.

Ecomorphology

High (positive) scores on D1 were associated with relative height (RH, directly related to the capacity for making vertical turns; low values indicate an elongated fish), body depth (BH), and relative mouth height (RMH, indicating particle size of food and prey size, hydrodynamic morphology) for herbivores but negative scores on D1 ecomorphological characterized carnivores by index of ventral flattering (IVF, indicating high swimming aerodynamics) with lateral elongated body (TL, SL). High scores on Dim2 were associated (RMW, indicating particle size of food and prey size), compression index (CI, high values indicate lateral compression of the fish which is expected when they occupy habitats with low water velocity), and adipose fin. These morphological patterns in relation to habitat partition and resource use could facilitate the co-existence of these fish when they are abundant in this tropical dam.

Above all, MFD showed the ecomorphological indices that most contributed to the discrimination among species relative body height (RH), encoding elongated vs deep body dichotomy.

DISCUSSION

We found that morphological patterns associated with ecomorphological traits, allometric size, and swimming dynamics determine resource use, as reflected by feeding segregation in Asejire Dam. The thirteen fish species encountered during the present study were classified into three categories based on their apparatus for food capture and habitat use: (1) an herbivorous group with deep bodies but small gapes, (2) a carnivorous group with elongated bodies and strong caudal fins facilitating swimming, and (3) an omnivorous group with wide gapes and adipose fins. These findings on the associations between body shape and feeding habits, i.e., resource use, provide an effective tool for predicting patterns of environmental resource use by teleosts and understanding their realized niches. (Costa and Cataudella, 2007; Herler, 2007; Faye *et al*., 2012, Pessanha, 2015). The physical characteristics of fishes can effectively predict how they utilize resources, revealing the strategies they employ as adaptations to their environment (Peres-Neto, 2004). Various habitat features and environmental conditions have been identified as significant factors that can impact community composition and contribute to the distribution of species and organization of communities, often surpassing the influence of biotic factors. The coexistence of multiple fish species within a given habitat is often attributed to their distinct morphological characteristics and spatial segregation (Costa & Cataudella, 2007; Sampaio et al., 2013).

On the first dimension of Multiple Factor Analysis (MFA), two diametrical opposite fish assemblages were observed in morphospace, segregated as herbivores (positive scores) exhibiting small mouth gapes with deeper bodies and carnivores (negative scores) exhibiting elongated bodies equipped with larger caudal peduncle. This represents the major axis of species segregation, and MFD identified relative height (RH, positive scores) and index of ventral flattening (IVF), negative score)—encoding elongated–deep body dichotomy as the most discriminatory ecomorphological traits for species discrimination in Asejire dam. Carnivorous fish species require strong caudal peduncles for propulsion and to prevent the body from rolling over (Adriaens *et al*., 1993), facilitating active movement required to realize their trophic niche. For the second dimension of MFA, the species located in the upper and median morphospace distinguished by wide gape. Mouth size is strongly correlated with prey size such that species with larger mouths are able to ingest larger prey items and diverse food items.

During the study period, a total of 13 fish species were found to be endemic to the Asejire dam, indicating a robust and consistent aquatic ecosystem. These species play a crucial role in maintaining essential ecosystem processes like nutrient circulation and the creation of diverse habitats. However, this number of species differs from Omoike (2021), who reported 26 species, and Ipinmoroti (2013) who reported 27 species in the reservoir. The apparent dwindling number of species underscores the importance of ongoing monitoring and effective management practices to preserve aquatic biodiversity and ensure ecosystem sustainability. The variation in species abundance may be ascribed to either natural or human-induced factors, which have the potential to impact the diversity of fish species and their respective families (Molina *et al*., 2020). In the current study, *Chrysichthys nigrodigitatus* was observed to be the most abundant fish species while *Parachanna obscura.* The low abundance of *P. obscura* signals the need for targeted conservation efforts to prevent further decline and potential local extinction. Management strategies should focus on protecting habitats, reducing human-induced pressures, and possibly implementing breeding and reintroduction programs for this species.

Cichlids were notably abundant in the present study. Their high prolific rate, as suggested by Negi and Mamgain (2013), may account for their prevalence in tropical freshwater ecosystems. The abundance of fish species in reservoirs is influenced by various factors, including harvest intensity, the fishing gear employed, the availability of fish shelters and spawning grounds, downstream migration patterns, and commercial and domestic water usage (Bonjoru *et al*., 2019). Additionally, habitat morphology and hydrology, such as water retention and recession, as well as unethical fishing practices, like the use of small mesh-size nets (Omoike, 2021) or targeting of spawning biomass, particularly mega-spawners (Gebremedhin *et al*., 2021), can significantly alter the structure and composition of fish communities in reservoirs.

CONCLUSION

During the study period, Asejire Dam supported 13 species across ten families, organized into three feeding guilds influenced by allometric size and swimming dynamics. Ecomorphological traits, specifically the elongated-deep body dichotomy, explained these segregations. *Chrysichthys nigrodigitatus* emerged as the most common species, whereas *Parachanna obscura* was the least abundant. The low abundance of *P. obscura* indicates a need for targeted conservation efforts in Asejire Dam. Understanding the distribution and abundance of *Chrysichthys nigrodigitatus* and other common species can inform sustainable harvesting practices. Management can set appropriate fishing quotas and seasons to ensure these populations remain stable and productive.

RECOMMENDATION

The ecomorphological segregation based on body shape and swimming dynamics highlights the importance of diverse habitat structures. Management should prioritize the protection and restoration of various habitat types within the reservoir to support different feeding guilds and overall ecosystem health.

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