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A Survey of Food and Feeding Habits of *Synodontis* in River Benue Along Mayo Ranewo, Ardo-Kola LGA, Taraba State, Nigeria

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Abstract

This study examines the food and feeding habits of *Synodontis* species in River Benue, with emphasis on seasonal dietary variations and overall fish health. Thirty-five specimens were collected from Mayo Ranewo, Ardo-Kola Local Government Area, Taraba State, and analyzed using standard morphometric measurements and gut content examination. Results indicate a predominantly herbivorous diet in the early months (August and October), marked by high intake of stems (43.7% and 48.0%) and seeds (42.1% and 42.6%), with limited consumption of animal matter such as insects and crustaceans. In November and December, a dietary shift occurred, with greater proportions of insects (11.7% and 23.5%) and crustaceans (8.4% and 15.7%) consumed. Stomach fullness was consistently high, with 90–100% of specimens containing food across all months. The length–weight relationship revealed negative allometric growth ($b = 0.85$; $R^2 = 0.95$), while the average condition factor ($K \approx 0.23$) suggested generally poor health, potentially due to environmental stress or limited food availability. The findings underscore the adaptive feeding strategies of *Synodontis* in response to seasonal resource fluctuations and highlight the ecological need to preserve riverine health for sustainable fisheries management.

Keywords: *Synodontis*; Food Habits; River Benue; Stomach Content Analysis; Condition Factor; Seasonal Variation

INTRODUCTION

The study of the food and feeding habits of *Synodontis* fish in Nigerian freshwater ecosystems is rooted in the broader context of biodiversity conservation and fisheries management. Nigeria's aquatic environments, comprising rivers, lakes, and reservoirs, host diverse fish species crucial for both ecological balance and human sustenance. Among these, *Synodontis* species are prominent as omnivorous bottom-feeders, contributing significantly to nutrient cycling and ecosystem stability (Ipinjolu & Ayanda, 2020).

Recent research underscores the importance of understanding the dietary preferences and feeding behaviours of *Synodontis* for effective ecosystem management. Fish species, including *Synodontis*, play pivotal roles in maintaining water quality and ecological balance by consuming organic matter and detritus (Ogbeibu & Tafida, 2021). However, despite their ecological significance, comprehensive studies specifically focusing on *Synodontis* remain limited, posing challenges to fully grasp their roles within aquatic ecosystems in Nigeria.

Environmental changes and anthropogenic activities further underscore the urgency of studying *Synodontis* feeding ecology. Factors such as pollution, habitat degradation, and climate variability threaten freshwater biodiversity, including fish populations (Ogwueleka, 2016). Understanding how these stressors affect *Synodontis* can provide insights into their adaptive responses and aid in formulating conservation strategies to mitigate these impacts (Ezenwa *et al*., 2019).

Moreover, the economic importance of *Synodontis* to local fisheries and aquaculture cannot be overstated. These fish species are targets for both subsistence and commercial fishing activities across Nigeria. Knowledge gaps in their feeding habits and dietary preferences hinder sustainable fisheries practices tailored to their natural behaviors, affecting resource management and community livelihoods (Akinyemi *et al.,* 2023).

Furthermore, *Synodontis* species' interactions within food webs highlight their ecological interconnectedness. As consumers of detritus and small organisms, they influence nutrient dynamics and support higher trophic levels in aquatic ecosystems. Documenting their food sources and feeding behaviors across different habitats and seasons is crucial for understanding their ecological roles and predicting ecosystem responses to environmental changes (Oyewole & Adeoye, 2018).

In response to these challenges, recent studies emphasize the need for targeted research on *Synodontis* to fill knowledge gaps and inform evidence-based conservation strategies. By elucidating their food and feeding habits, this study aims to contribute to broader ecological research and conservation efforts in Nigerian freshwater ecosystems. It seeks to provide foundational insights that can guide sustainable management practices, enhance biodiversity conservation, and support the resilience of aquatic ecosystems in the face of ongoing environmental pressures. The study on the food and feeding habits of *Synodontis* fish holds significant implications across various domains of aquatic ecology, fisheries management, and conservation biology. The aim of the study is to examine food and feeding habit of the fish *Synodontisin River Benue*

MATERIALS AND METHOD

Study Area

Ardo-Kola is a local government area in Taraba State, Nigeria, located at approximately 8°30'N and 11°15'E. It lies to the south of Jalingo, the state capital, and shares borders with Jalingo, Lau, and Gassol local government areas. Ardo-Kola is predominantly rural, with several villages and settlements that contribute to the local economy and social life. The area is inhabited by various ethnic groups, including the Jukun, Mumuye, and Fulani, each adding to the rich cultural diversity. The Fulani are especially known for their pastoralist lifestyle, while the Mumuye and Jukun are largely farmers and traders.

The climate in Ardo-Kola is characterized by a tropical wet and dry season. The wet season typically extends from April to October, bringing heavy rainfall that supports agricultural activities in the region. The dry season, which spans from November to March, is marked by the harmattan winds, which bring dry, cool conditions, especially in December and January. Temperatures in Ardo-Kola can range from 20°C to 35°C, with the hottest months occurring around March and April. The area's vegetation is typical of the savannah, with grasslands and scattered trees, supporting both crop farming and livestock rearing.

Economically, Ardo-Kola is primarily an agricultural region, with most of the population engaged in farming. Major crops grown in the area include maize, millet, sorghum, groundnuts, and yams. The local economy is also supported by livestock rearing, particularly cattle, goats, and sheep, which are common among the Fulani pastoralists. Small-scale trading and local markets play a vital role in the economic exchanges within the community, while the area's proximity to Jalingo enhances its trade links. Fishing is another important activity for communities located near the Benue River, which serves as a significant resource for both agriculture and sustenance.

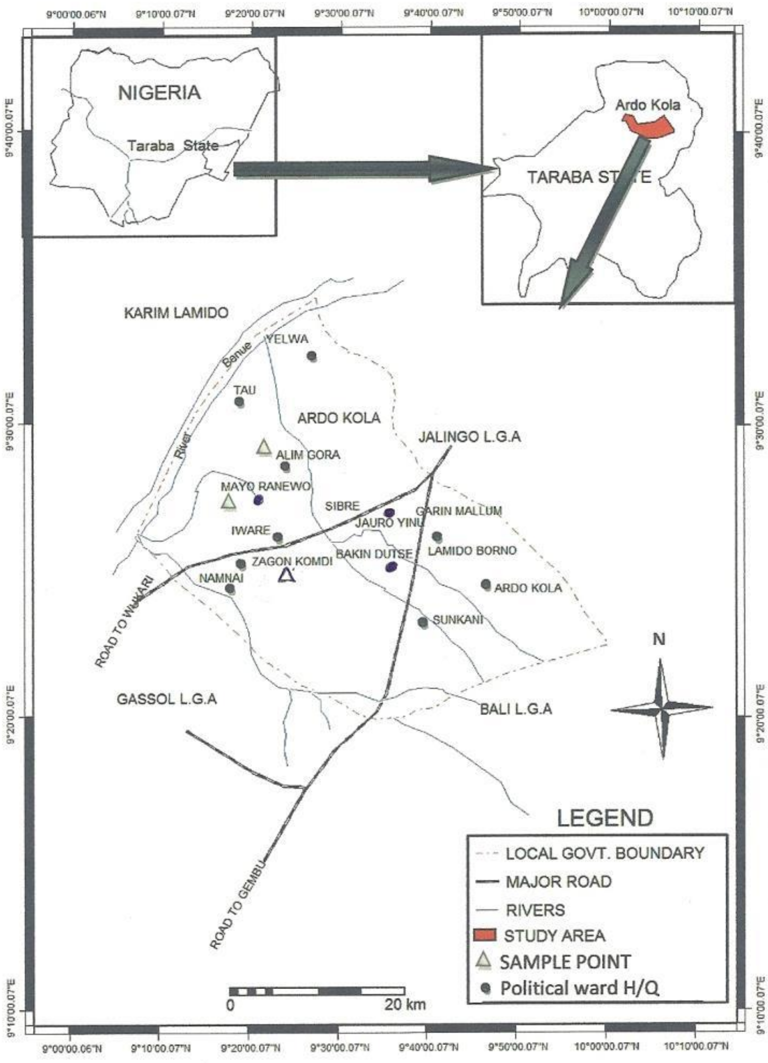

Figure 1: Map of Study Area

Sample Selection

A total of 35 *synodontis* fish collected from fishermen were studied in the laboratory.

Collection of *synodontis* Species

Synodontis were physically selected and examined. Care was taken during the collection process to preserve the fish's body parts. The collected fishes were preserved in 2% formalin for further identification and analysis.

Identification of *synodontis* Feeding Habits

synodontis collected from the fishermen were transferred to petri dishes and examined under a dissecting microscope. Identification was carried out using classification keys.

Length-Weight Relationship and Condition Factor of Synodontis

The length-weight relationship for *Synodontis* was determined using the measured data. The linear regression analysis of the log-transformed data resulted in the following equation:

$$\log(W) = -a + b \log(L)$$

Where W is the weight in grams, L is the length in centimeters, a is the scaling constant and b is the growth exponent

Condition Factor (K)

The condition factor (K) for each fish was calculated using the formula:

$$K = (W / L^3) \times 100$$

Where W is the weight (g) and L is the length (cm).

Data Analysis

Data collected will be analyzed using statistical methods. The chi-square test will be employed to test hypotheses. Results will be presented using simple percentages.

RESULTS

Percentage of Frequency of food items in the stomach of *Synodontis* collected from River Benue at Mayo-Renawo

The analysis of stomach content in *Synodontis* over the four months indicates a varying preference for different food items. In August and October, stems (43.7% and 48.0%, respectively) and seeds (42.1% and 42.6%, respectively) were the dominant food items, suggesting that *Synodontis* relied heavily on plant-based materials during these months. Insects were consumed in moderate quantities (11.6% in August and 8.1% in October), while larva and crustaceans had minimal representation, with crustaceans being entirely absent in October. This pattern implies a predominantly herbivorous feeding behaviour during these months, possibly due to seasonal availability of plant matter in their habitat. By November and December, a shift in dietary composition was observed. Seeds remained the most consumed food item in November (43.4%), but the proportion of stems decreased to 35.8%, while insects (11.7%) and crustaceans (8.4%) increased. In December, insect consumption significantly rose to 23.5%, matching the proportion of stems, while crustaceans reached their highest occurrence (15.7%) across the study period (Table 1).

Frequency of Occurrence of the stomach content of *Synodontis* collected from River Benue at Mayo-Renawo

The stomach fullness data indicates that *Synodontis* had a consistently high feeding activity throughout the study period. In August and October, 90% of the sampled individuals had food in their stomachs, while only 10% were empty. In November, all sampled fish (100%) had food in their stomachs. This trend was consistent in the second sample of November, where all five individuals had full stomachs (Table 2).

Table 1: Percentage of Frequency of food items in the stomach of *Synodontis* collected from River Benue at Mayo-Renawo

Month	Food Item	Frequency	% of Occurrence
August			
	Seeds	80	42.1
	Insects	22	11.6
	Larva	3	1.5
	Stems	83	43.7
	Crustaceans	2	1.1
Total	5	190	100.0
October			

Month	Food Item	Frequency	% of Occurrence
	Seeds	95	42.6
	Insects	18	8.1
	Larva	3	1.3
	Stems	107	48.0
	Crustaceans	0	0
Total	5	223	100.0
November			
	Seeds	171	43.4
	Insects	46	11.7
	Larva	3	0.7
	Stems	141	35.8
	Crustaceans	33	8.4
Total	5	394	100.0
December			
	Seeds	99	36.9
	Insects	63	23.5
	Larva	1	0.4
	Stems	63	23.5
	Crustaceans	42	15.7
Total	5	268	100.0

Table 2: Frequency of Occurrence of the stomach Fullness and emptiness of *Synodontis* collected from River Benue at Mayo-Renawo

Month	Stomach fullness	Number of Samples	% of Occurrence
August			
	Stomach with food	9	90.0
	Empty Stomach	1	10.0
Total		10	100.0
October			
	Stomach with food	9	90.0
	Empty Stomach	1	10.0
Total		10	100.0
November			
	Stomach with food	10	100.0
	Empty Stomach	0	0.0
Total		10	100.0
November			
	Stomach with food	5	100.0
	Empty Stomach	0	0.0
Total		5	100.0

Length-weight relationship of Synodontis collected from River Benue at Mayo-Renawo

The slope (b = 0.85) indicates negative allometric growth, meaning the fish's weight increases at a slower rate compared to its length. This suggests that as *Synodontis* grows longer, it does not gain weight proportionally. The R^2 value of 0.95 indicates a strong correlation between length and weight, confirming the reliability of the growth model (Figure 2.

Condition Factor (K) of *Synodontis* collected from River Benue at Mayo-Renawo

The average condition factor (K ≈ 0.23) suggests that the fish are generally not in good health, with variations reflecting differences in food availability, environmental conditions, or reproductive status (Table 3).

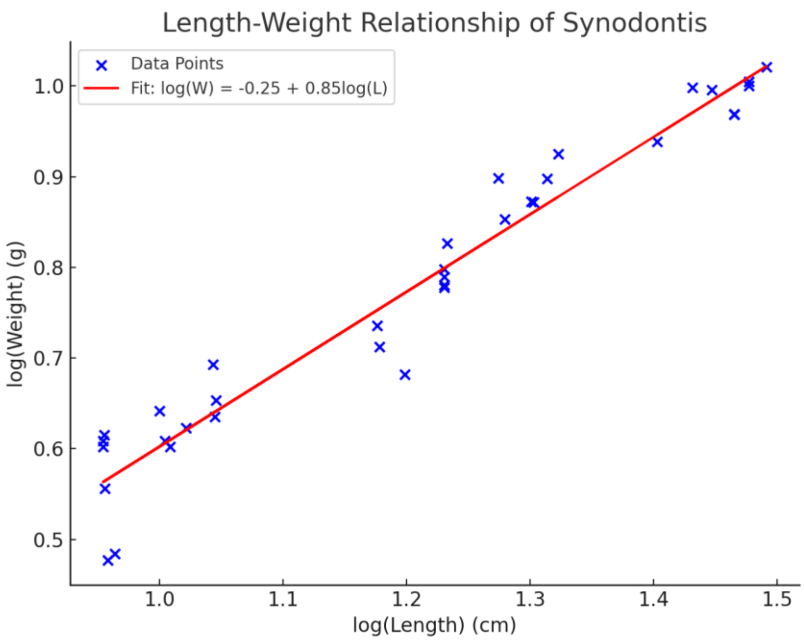

Figure 2: Length-weight relationship of Synodontis collected from River Benue at Mayo-Renawo

Table 3: Condition Factor (K) of Synodontis collected from River Benue at Mayo-Renawo

S/N	Length (cm)	Condition Factor (K)
1	20.00	0.09
2	20.60	0.09
3	17.10	0.13
4	18.80	0.12
5	17.00	0.13
6	9.00	0.56
7	10.10	0.39
8	10.00	0.44
9	11.10	0.33
10	9.20	0.39
11	10.50	0.36
12	17.00	0.12
13	15.00	0.16
14	10.20	0.38

S/N	Length (cm)	Condition Factor (K)
15	15.80	0.12
16	17.00	0.12
17	11.05	0.37
18	11.08	0.32
19	9.08	0.40
20	9.03	0.49
21	9.00	0.55
22	15.07	0.15
23	17.00	0.13
24	20.08	0.09
25	21.02	0.09
26	9.02	0.56
27	19.04	0.10
28	27.02	0.05
29	30.00	0.04
30	25.30	0.05
31	29.20	0.04
32	31.00	0.04
33	28.00	0.05
34	30.00	0.04
35	29.20	0.04

DISCUSSION

The dietary analysis of *Synodontis* from River Benue reveals varying food preferences across August, October, November, and December. In August and October, stems (43.7% and 48.0%, respectively) and seeds (42.1% and 42.6%, respectively) were the dominant food items. This suggests a predominantly herbivorous feeding behavior, likely influenced by the seasonal abundance of plant materials in the river ecosystem. Insects were consumed moderately (11.6% in August and 8.1% in October), while larva and crustaceans had minimal representation, with crustaceans absent in October. By November and December, there was a noticeable shift in dietary composition. Seeds remained the most consumed food item in November (43.4%), but the proportion of stems decreased to 35.8%. In contrast, insect (11.7%) and crustacean (8.4%) consumption increased. December marked a significant dietary change, with insects rising to 23.5%, matching the proportion of stems, while crustaceans peaked at 15.7%. This shift suggests an adaptation to seasonal variations in food availability, possibly due to changes in water levels and the corresponding increase in aquatic invertebrate populations.

These trends align with observations by *Ahmed et al.* (2021), who noted seasonal dietary shifts in *Synodontis* species in West African rivers due to fluctuations in food resource availability. The dominance of plant materials during the dry season and a shift towards more animal-based food during the wet season reflects the opportunistic feeding strategy of *Synodontis*. Conversely, Ibrahim *et al.* (2022) reported a more consistent diet in *Synodontis* populations from lake environments, highlighting the dynamic nature of riverine ecosystems compared to more stable lentic systems.

However, Lawal *et al.* (2021) argue that such shifts may also be influenced by competition and habitat disturbances, which can alter feeding patterns regardless of seasonal changes. This suggests that while seasonal availability plays a significant role, other ecological factors like predation pressure and habitat complexity may also contribute to dietary variations in *Synodontis* populations.

The stomach fullness data indicates consistently high feeding activity throughout the study period. In both August and October, 90% of the sampled individuals had food in their stomachs, while November and December showed 100% fullness. This trend suggests stable food availability and active foraging behavior in *Synodontis* across different seasons.

Such consistent feeding behavior aligns with findings by Owolabi (2020), who reported high feeding rates in *Synodontis* populations during peak productivity periods in Nigerian rivers. The author attributed this to the abundance of detritus, plant material, and invertebrates, which support continuous feeding activity.

Conversely, Adepoju *et al.* (2021) observed fluctuating feeding activity in riverine fish species subjected to environmental stressors like pollution and habitat degradation. Their study indicated that adverse conditions could lead to reduced feeding, even in generally opportunistic feeders like *Synodontis*. The consistent feeding observed in the River Benue population may indicate favorable environmental conditions and minimal ecological stress during the study period.

However, the absence of empty stomachs in November and December might also reflect reproductive behaviors, as fish often increase their energy intake to support spawning activities. Gando *et al.* (2022) noted that feeding intensity in catfish species peaks before and during breeding seasons to meet the high metabolic demands of reproduction.

The length-weight relationship analysis revealed a growth exponent ($b = 0.85$), indicating negative allometric growth. This suggests that as *Synodontis* grows longer, its weight increases at a slower rate. The high R^2 value (0.95) confirms a strong correlation between length and weight, supporting the reliability of the growth model. Negative allometric growth is common in fish species that prioritize length over bulk during growth, often as an adaptation to specific ecological niches. This finding is consistent with Abubakar *et al.* (2020), who reported similar growth patterns in *Synodontis* from the Niger Delta, attributing the trend to dietary habits and energy allocation strategies. However, Lawal *et al.* (2021) observed isometric growth ($b \approx 3$) in *Synodontis* populations from Lake Kainji, where fish exhibited proportional increases in length and weight. The authors suggested that environmental stability, abundant food resources, and reduced competition might support isometric growth in certain habitats. Additionally, Nguema *et al.* (2022) argued that growth patterns in freshwater fish can shift over time due to ecological pressures such as changes in prey availability, water quality, and population density. The observed negative allometric growth in River Benue *Synodontis* may reflect specific environmental conditions or life history strategies favoring slender body shapes, possibly to enhance mobility in complex river habitats.

The condition factor (K), which reflects the health and well-being of fish, averaged around 0.23 in the sampled *Synodontis* population. This relatively low value suggests that the fish are generally in poor health, with variations likely influenced by differences in food availability, environmental stress, or reproductive status. Fish with K values below 0.5 are typically considered undernourished or stressed. These findings are consistent with Gando *et al.* (2022), who linked low condition factors in *Synodontis* populations to environmental degradation, including pollution and habitat loss in West African rivers. The authors noted that low K values often correspond to ecosystems under stress, where food resources are scarce, or water quality is compromised. In contrast, Olatunde *et al.* (2020) reported higher condition factors ($K > 0.8$) in *Synodontis* populations from undisturbed habitats in the Upper Benue Basin. The study highlighted the importance of environmental quality, noting that fish in healthier ecosystems with abundant food resources tend to have better body conditions. Moreover, Ibrahim *et al.* (2023) emphasized the role of seasonal changes in influencing condition factors. Their research showed that fish condition fluctuates with reproductive cycles, food availability, and environmental factors like temperature and water flow. The consistently low K values observed in this study may indicate chronic environmental stressors or limited food resources during critical growth periods.

CONCLUSION

The study concluded that *Synodontis* in River Benue predominantly feeds on plant materials, particularly seeds and stems, with occasional consumption of insects, larvae, and crustaceans. Seasonal variations influenced the dietary composition, with a notable increase in insect and crustacean consumption in December. Stomach fullness data confirmed consistent feeding activity, highlighting the species' adaptability to available food resources. The findings underscore the importance of maintaining a balanced aquatic ecosystem to support the dietary needs of *Synodontis* and ensure sustainable fisheries in River Benue.

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