



Research Paper

Food and Feeding Habit of African Bagrid catfish, *Chrysichthys nigrodigitatus* in Kwakwalawa river, Sokoto State, Nigeria

Muhammad, U. ¹, Adeoye, R.L. ², Bala, G. ³, Ayokhai, O.J. ⁴, Ocheja, F.O. ⁵ and Jibrin, H. ⁶ 

¹Department of Agricultural Technology, Umaru Ali Shinkafi Polytechnic Sokoto, Sokoto State, Nigeria

²Department of Fisheries Resources, Nigerian Institute for oceanography and marine Research, Victoria Island, Lagos, Nigeria

³Department of Agricultural Technology, Niger State College of Agriculture, Mokwa, Nigeria

⁴Department of Biotechnology, Nigerian Institute for Oceanography and Marine Research, Victoria Island, Lagos, Nigeria

⁵Department of Agricultural Technology, Federal Polytechnic Idah, Kogi State, Nigeria

⁶Department of Fish Nutrition and Physiology, Nigerian Institute for oceanography and marine Research, V.I. Lagos, Nigeria

How to Cite

Muhammad, U., Adeoye, R.L., Bala, G., Ayokhai, O.J. and Ocheja, F.O. (2026). Food and Feeding Habit of African Bagrid catfish, *Chrysichthys nigrodigitatus* in Kwakwalawa river, Sokoto State, Nigeria. *Journal of Fisheries and Zoological Sciences*, 1(3), 34-38. <https://doi.org/10.65385/JFZS0018>

ISSN: 3108-1991 (online)

Article History

Received 08 June 2026

Accepted 14 July 2026

First Online 18 July 2026

Corresponding Author

E-mail: jibrinhaliru25@gmail.com

Keywords

C. nigrodigitatus

Feeding habit

Kwakwalawa river

Zooplankton

Stomach analysis

Abstract

A study was conducted to determine the feeding adaptations and dietary composition of *Chrysichthys nigrodigitatus* in Kwakwalawa river. A total of fifty (50) samples were collected weekly over twelve (12) weeks (October to December 2025) from artisanal fish landing sites. Specimens were captured using hand nets, clap nets, cast nets, and gill nets of varying mesh sizes. Samples were transported immediately to the Forestry and Fisheries Laboratory at Usmanu Danfodiyo University, Sokoto, for fresh examination. Stomach contents were analyzed using the frequency of occurrence and numerical methods. Results indicated that 86.0% of the stomachs contained insects, 68.0% contained millet, 12.0% contained grasses, and 6.0% contained fish parts. Identified food items included insects, fish fragments, millet, macrophytes (grasses), and unidentified organic matter. These findings suggest that *C. nigrodigitatus* is an omnivore with a diet primarily consisting of insects, plant materials, and fish. Fisheries management and local aquaculture developers should prioritize the preservation of insect-rich benthic habitats and the integration of locally available agricultural by-products, like millet, into feed formulations to ensure the sustainable growth and economic viability of *Chrysichthys nigrodigitatus* in the Sokoto region. Further research is recommended to establish a comprehensive nutritional profile for this species across other water bodies, such as the Kwakwalawa river.

1. Introduction

The silver catfish, *Chrysichthys nigrodigitatus* (family Claroteidae), is a high-value species in West African fisheries and aquaculture. Widely recognized for its adaptability, hardiness, and superior nutritional profile, it remains a cornerstone of regional food security (Eyo, 2001). In Nigeria, particularly within Rivers State and the wider Niger Delta, it is a commercially vital demersal species prized for its firm flesh and high protein content (Uneke, 2014). Physically, *C. nigrodigitatus* is characterized by a scaleless, silver-grey body with a white underside, a prominent dorsal spine, and a deeply forked caudal fin. Unlike many other catfishes, it possesses large eyes and relatively small barbels an evolutionary adaptation to clear-water habitats where sight is prioritized over touch for hunting (George and Atakpa, 2015). Despite the reduced size of these barbels, the species still retains four pairs of highly sensitive, taste-bud-lined filaments typical of the group. Ecologically, the silver catfish is potamodromous, inhabiting fine sand and shallow benthic layers across rivers, lakes, and estuaries.

Its ability to thrive across varying salinity gradients makes it an ideal candidate for both freshwater and brackish water culture systems (Ekanem et al., 2011).

Biologically robust, it withstands the stresses of handling and transportation, further enhancing its suitability for commercial farming (Adewolu et al., 2008).

As an opportunistic omnivore, *C. nigrodigitatus* exploits a diverse range of autochthonous and allochthonous food sources, including seeds, insects, bivalves, and detritus (Reed et al., 1967; George and Atakpa, 2015). Its feeding habits become increasingly specialized with age; while juveniles have a broad diet, larger individuals often transition to preying on decapods and smaller fish (Laleye, 1995). Understanding these natural dietary requirements is fundamental to developing cost-effective feed formulations and maximizing production yields in aquaculture (Malami et al., 2004; Fregene & Obasa, 2010). While various studies have explored the dietary patterns of *C. nigrodigitatus* across Nigeria, there remains a lack of site-specific data on the natural feeding ecology of populations in certain regions. This gap hinders the development of precision feeding strategies, often leading to suboptimal growth and increased overhead costs.

Consequently, a systematic investigation is required to bridge the gap between natural ecology and intensive culture. Previous studies across Nigeria highlight the opportunistic and diverse dietary range of *C. nigrodigitatus*, which varies significantly by habitat. In the Epe Lagoon, Lawal et al. (2010) identified a diet consisting of phytoplankton, crustaceans, molluscs, and plant materials. Similarly, in the Aiba Reservoir, the primary food items included insects, crustaceans, arachnids, and rotifers, with detritus and sand appearing as secondary components (Atobatele and Ugwumba, 2011).

In riverine systems such as the Ebonyi River, stomachs contained a broad mix of zooplankton (Cladocerans, copepods, rotifers), diatoms, and benthic organisms like clams and worms (Uneke, 2014). Investigations in estuarine environments further demonstrate this variety; in the Qua Iboe River Estuary, the species was described as a non-piscivorous predator favoring crustaceans and molluscs (Ekpo et al., 2014). Conversely, in the Cross-River estuary, its diet expanded to include small fish, fish bones, and prawns alongside typical amphipods and diatoms (George and Atakpa, 2015). This dietary plasticity is supported by the high mobility of these fishes, which move extensively through the water column and across longitudinal gradients to exploit available resources.

The presence of such diverse food items in the stomach of *C. nigrodigitatus* reflects its trophic flexibility and role as an opportunistic feeder (Warren, 1993). This characteristic allows the species to shift its diet based on the seasonal or spatial availability of prey within the ecosystem. Consequently, stomach content analysis remains a fundamental method in fish ecology. It provides a reliable means of investigating trophic relationships and understanding the complex interactions within aquatic communities (Fagbenro et al., 2008). Therefore, this study aims to evaluate the food and feeding habits of *C. nigrodigitatus* in the Kwakwalawa River, Sokoto State.

2. Materials and Methods

2.1 Study Area

The study was conducted at kwakwalawa village in Dundaye district of wamakko local government area of Sokoto state, Nigeria. Kwakwalawa village is located along the road leading to the main campus of the Usmanu Danfodiyo University, at the northern bank of river the Rima, Sokoto. The entire Sokoto state is located within latitudes 12° 00' - 13° 05' N and longitudes 4° 08' - 6° 04' E, in the North-West geo-political zone of Nigeria (Cronje, 1990). The state has an estimated land area of about 25,973 km² and human population was about 4.2 million people mainly of Hausa and Fulani ethnic groups (Mamman et al., 2000). Sokoto state falls within the Sudan savanna vegetation zone and two distinct seasons are recognized: the dry and wet (rainy) seasons. The rainy season covers normally a short period of 3-4 months (June/July – Sept.) with range of 400 - 800mm per annum. The dry season covers the remaining periods of 8 – 9 months of the year (Oct.-May/June). The

mean monthly temperature ranges from a minimum of 14°C during December/January and a maximum of 40°C in April/May with annual average of 28.3°C.

2.2 Collection of samples

A total number of seventy (50) samples of *Chrysichthys nigrodigitatus*, were collected from the artisanal fishermen of the kwakwalawa river fish landing site in batches weekly for the period of twelve (12) weeks. The fish were caught using various types of fishing gears which include hand nets, clap nets, cast nets and gill nets of various mesh sizes. The samples were taken to the Forestry and Fisheries Laboratory of Usmanu Danfodiyo University, Sokoto immediately after collection and were examined in fresh condition.

2.3 Identification of food items

Identification of food items was done using fish identification guide by Oso, et al., (2006) and FAO (1992). The weight of each specimen was taken using a top loading balance (model PN1200) to the nearest 0.1g after draining excess water with a pile of filter paper while standard length was measured in centimeter using a measuring board. Specimen were dissected and the gut taken out to remove the stomach. The contents were emptied into a petri dish for analysis.

2.4 Stomach analysis

The gutted weight and the stomach were determined after the visceral organs were removed by making longitudinal incision along the mid ventral line from the anus to the mouth to exposed the visceral organs, the guts were removed carefully by detaching it from other internal organs and fatty tissues.

2.5 Stomach fullness

The stomach was scored 0, 25, 50, 75 and 100% according to its stomach fullness as described by Shinkafi, et al. (2010).

2.6 Statistical Analysis

Analysis was done using frequency of occurrence and numerical methods as described by Hyslop (1980) and Costal et al. (1992). In the frequency of occurrence method, the occurrence of food items was expressed as the percentage of the total number of stomachs containing food.

3. Results

3.1 Stomach fullness

Table 1 showed the stomach fullness of (50) *Chrysichthys nigrodigitatus* examined of which 86.0% has insects in their stomach content, 68.0% has millet in their stomach, 12.0 percent had grasses in their stomach content and only 6.0 percent has fish parts in theirs stomach content.

Table 1: Frequency of occurrence of *Chrysichthys nigrodigitatus*

Food Items	NO	Present	Percentage (%)	Absent	Percentage (%)
Insects	50	43	86.0	7	14.0
Millet	50	34	68.0	16	32.0
Fish parts	50	3	6.0	47	94.0
Grasses	50	6	12.0	44	88.0
Empty Stomach	0	0	0	0	0

Table 2: T-test analysis of stomach content of *Chrysichthys nigrodigitatus*

Items	Test Value = 0					
	T	Df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Insect	17.349	49	0.000	0.860	0.76	.96
Millet	10.204	49	0.000	0.680	0.55	.81
fish part	1.769	49	0.083	0.060	0.01	.13
Grass	2.585	49	0.013	0.120	0.03	.21
Rice	1.000	49	0.322	0.020	0.02	.06

Table 3: Descriptive statistics of the relationship between the variables

Food items	N	Range	Minimum	Maximum	Mean	Std. Error
Weight of fish	50	33.14	8.06	41.20	21.69	1.06
TL (CM)	50	18.4	9.0	27.4	16.928	.6855
Weight of food	50	90	0	90	40.62	3.138

The Table 2 showing T-test analysis shows that the stomach contents of *Chrysichthys nigrodigitatus* consist predominantly of insects and millet, which are statistically significant and primary components of its diet. Grass also contributes significantly, but to a lesser extent. Fish parts and rice are present but not in significant quantities. This indicates that the species primarily feeds on insects and millet, with some variability in its diet. The data highlights variability in the weight and length of *Chrysichthys nigrodigitatus*, as well as the weight of food found in their stomachs. On average, the fish sampled were moderately sized (21.69 g and 16.93 cm), and the stomach contents varied significantly, reflecting differences in feeding habits or availability of food resources. Weight of Fish, Sample Size (N), 50. Range 33.14 (difference between the maximum and minimum weight). The fish sampled varied widely in weight, with an average weight around 21.69 g. The fish length also showed considerable variation, with an average length of approximately 16.93 cm.

The amount of food in the stomachs of the fish varied widely, with an average food weight of 40.62 g.

4. Discussion

The dietary analysis of *Chrysichthys nigrodigitatus* in the Kwakwalawa River reveals a highly opportunistic feeding strategy, dominated by insects ($t = 17.349$, $p < 0.001$) and millet ($t = 10.204$, $p < 0.001$). The significant reliance on insects aligns with the findings of Atobatele and Ugwumba (2011) in the Aiba Reservoir, who identified insects as a primary food item. Furthermore, the consumption of millet an allochthonous food source demonstrates the species' trophic flexibility, as it exploits agricultural runoff typical of the Sokoto region. This supports the observation by George and Atakpa (2015) [3] that *C. nigrodigitatus* adapts its diet based on the specific availability of resources within its immediate habitat.

The presence of grass ($p = 0.013$) as a significant but less

prominent dietary component suggests it serves as supplemental roughage, similar to the "plant materials" reported by Lawal et al. (2010) in Epe Lagoon. In contrast, the lack of statistical significance for fish parts ($p = 0.083$) and rice ($p = 0.322$) indicates that these are incidental rather than staple items. This classifies the Kwakwalawa population as predominantly non-piscivorous, consistent with the findings of Ekpo et al. (2014) in the Qua Iboe River Estuary, where the species focused on invertebrates rather than fish prey.

The descriptive statistics for weight (8.06g – 41.20g) and length (9.0cm – 27.4cm) indicate a population of mostly juveniles and sub-adults. This demographic profile is common in riverine systems where younger fish utilize shallow, nutrient-rich benthic layers for growth (Reed et al., 1967). The wide range in food weight (0 to 90g) reflects a high variability in feeding intensity. As noted by Laleye (1995), feeding becomes more specialized as these fish grow; the higher food weights observed in larger individuals likely reflect the increased energy demands and expanded stomach capacity associated with maturation. Ultimately, the dietary plasticity observed switching between natural aquatic prey (insects) and terrestrial grains (millet) positions *C. nigrodigitatus* as an ecologically resilient species (Warren, 1993). This adaptability is a key factor in its commercial importance across Nigeria (Uneke, 2014). For sustainable fisheries management in the Kwakwalawa River, conservation efforts should prioritize the protection of insect-rich habitats and the monitoring of agricultural impacts, as these factors directly sustain the growth and productivity of the silver catfish population.

5. Conclusion

This study confirms that *Chrysichthys nigrodigitatus* in the Kwakwalawa River is a highly adaptable, omnivorous feeder with a diet primarily supported by insects and agricultural by-products like millet. The high statistical significance of these items highlights the species' reliance on both natural aquatic productivity and allochthonous inputs from surrounding farming activities. The presence of varied growth stages predominantly juveniles and sub-adults indicates that the river serves as a critical nursery and feeding ground. Ultimately, the trophic flexibility displayed by the silver catfish underscores its ecological resilience and continued potential for regional aquaculture. To ensure the sustainability of this economically vital fishery, management efforts must prioritize the preservation of insect-rich benthic habitats and the careful monitoring of agricultural runoffs. These results provide a necessary baseline for developing site-specific feeding strategies and conservation policies tailored to the Sokoto riverine ecosystem.

6. Statements and Declarations

Ethical Approval: Not applicable

Conflict of Interest: The authors in this article declare that they have no known competing financial interests, personal relationships that could have influenced the

work reported in this study.

Funding statement: No financial support.

ORCID:

Jibrin, H.: <https://orcid.org/0000-0003-2846-0765>

Acknowledgements: The authors express their sincere gratitude to the fishermen communities of the study area for their cooperation and valuable participation during the field work. The authors also acknowledge the support provided by the department of fisheries and aquaculture, Usmanu Danfodiyo University, Sokoto, Nigeria.

References

- Adewolu, M. A. (2008). Potentials of sweet potato (*Ipomoea batatas*) leaf meal as dietary ingredient for *Tilapia zilli* fingerlings. *Pakistan Journal of Nutrition*, 7(3), 444-449.
- Atobatele, O. E. and A. O. Ugwumba (2011). Condition factor and diet of *Chrysichthys nigrodigitatus* and *Chrysichthys auratus* (Siluriformes: Bagridae) from Aiba Reservoir, Iwo, Nigeria. *Rev. Biol. Trop.* 59(3):1233-1244.
- Costa, J. L., Almeida, P. R., Moreira, F. M., and Costa, M. J. (1992). "On the food of the European eel, *Anguilla anguilla* (L.), in the upper zone of the Tagus Estuary, Portugal." *Journal of Fish Biology*, 41(5), pp. 841-850.
- Cronje, H. P. (1990). "Veld management with specific reference to game ranching in the grassland and savanna areas of South Africa." *Koedoe*, 33(2), pp. 77-87.
- Ekanem, A. P., Obiekezie, A. I., Amazu, L. U., & Eyo, V. O. (2011). A comparative study of the parasites of *Chrysichthys nigrodigitatus* (Lacepede) from three water bodies in South Eastern Nigeria. *Journal of Fisheries and Aquatic Science*, 6(7), 785-791.
- Ekpo, I. E. M. A. Essien-Ibok and J. N. Nkwoji (2014). Food and feeding habits and condition factor of fish species in Qua-Iboe River estuary, Akwa Ibom State Southern Nigeria. *International Journal of Fisheries and Aquatic Studies* 2(2):38-46.
- Eyo, A. A. (2001). *Fish Processing Technology in the Tropics*. New Bussa, Nigeria: hNational Institute for Freshwater Fisheries Research (NIFFR)
- Fagbenro, O. A., Adeparusi, E. O., & Jimoh, W. A. (2008). Haematological profile of blood of African catfish *Clarias gariepinus* (Burchell, 1822) fed sunflower and sesame meal-based diet. *Journal of Fisheries and Aquatic Science*, 3(1), 1-7.
- FAO (1992). *The State of Food and Agriculture 1992*. FAO Agriculture Series, No. 25. Rome, Italy: Food and Agriculture Organization of the United Nations. 262pp
- Fregene, B. T., & Obasa, S. O. (2010). An assessment of the profitability of *Chrysichthys nigrodigitatus* (Lacepede) production in Epe Local Government Area, Lagos State, Nigeria. *Journal of Agricultural Science and Environment*, 10(1), 101-114.
- George U. U. and Atakpa, E. O. (2015), Food and feeding Ecology of *Chrysichthys nigrodigitatus* in the Cross-River estuary, South Eastern Nigeria. *New York Science Journal* 8(11):83-90.
- Hyslop, E. J. (1980). "Stomach contents analysis a review of methods and their application." *Journal of Fish Biology*, 17(4), pp. 411-429.
- Laleye, R. (1995). Climatic and anthropogenic effects on fish diversity and yields in the central Delta of the Niger River. *Aquat. Living Res.* 8:43-58.

- Lawal, M. O., O. J. Sangoleye, B. M. Seriki (2010). Morphometry and diet of *Chrysichthys nigrodigitatus* (Lac'epede) in Epe Lagoon, Nigeria. *African Journal of Biotechnology* 9(46):7955-7960.
- Malami, G. Z., Ipinjolu, J. K., Hassan, W. A. and Maga Wata, I. (2004) feeding adaptations often found in fish species in River Rima, North-Western Nigeria. A paper presented at the 2004 Annual Conference of Zoological Society of Nigeria held at the Institute of developmental Research, Ahmadu Bello University, Zaria.
- Mamman, A. B., Oyebanji, J. O., and Peters, S. W. (Eds.). (2000). *Nigeria: A People United, A Future Assured (Survey of States)*. Vol. 2. Calabar, Nigeria: Gabumo Publishing Co. Ltd.
- Oso, J. A., Ayodele, I. A., and Fagbuaro, O. (2006). "Food and feeding habits of *Oreochromis niloticus* (L.) and *Sarotherodon galilaeus* (L.) in a tropical reservoir." *World Journal of Zoology*, 1 (2), pp. 118–121.
- Reed, W. J. J. Burchard, A. J. Hopson and I Yaro (1967), *Fish and fisheries of Northern Nigeria* Ministry of Agriculture, Northern Nigeria, Zaria, Nigeria p.226.
- Shinkafi, B. A., and Ipinjolu, J. K. (2010). "Morphometric relationships and relative condition factor of *Auchenoglanis occidentalis* (Cuvier and Valenciennes) from River Rima, North-western Nigeria." *Journal of Fisheries and Aquatic Science*, 5(2), pp. 106–113.
- Uneke, B. I. (2014). Diet composition, feeding habits and condition factor of *Chrysichthys nigrodigitatus* in Ebonyi River (A Tropical Flood River system) Southeastern Nigeria. *Continental J. Agricultural Science*. 8(1):29-37.
- Warren, W.G. (1993). Changes in the within-survey special temporal structure of the northern cod (*Gadus morhua*) population. *Can. J. Fish Aquat. Sci.* 54(1) 139-148.