

Prevalence of Gastrointestinal Helminth Parasites of African Bony Tongue Fish (*Heterotis Niloticus*) in Sabiyel Lake, Kebbi State

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ABSTRACT

The parasites can cause disease in fish and affect human. This study investigated the prevalence of gastrointestinal helminth parasites in African bony tongue fish (*Heterotis niloticus*) from Sabiyel Lake, Kebbi State, Nigeria. A total of 270 specimens were examined between (February and July 2025) and transported to the laboratory for morphological and parasitological studies to determine infection rates in relation to host sex. Overall prevalence was 24.07%, comprising nematodes (*Capillaria* spp., 16.67%) and trematodes (*Clinostomum* spp., 7.41%). Males (24.53%) exhibited slightly higher infection rates than females (23.42%), though differences were not statistically significant ($\chi^2 = 0.044$; $P = 0.834$). The findings show an average but notable helminth burden in *Heterotis niloticus* influenced by host sex with implications for fisheries management, food safety and public health. Therefore, it is recommended that *Heterotis niloticus* from Sabiyel Lake should be cooked properly to protect consumers from ingesting fish infected with parasites. Regular parasitological investigation should be carried out on *H. niloticus* populations in the Lake to track trends in helminth infections

INTRODUCTION

In addition to being a reasonably priced and significant source of protein, fish also contains calcium, lipids, minerals, vitamins, and oils that have a profound effect on the lives of numerous people and communities (Ogbu et al., 2019). The growing demand for reasonably priced animal protein, particularly in the tropics, has led to a massive expansion in fish farming and culture. In addition to providing food for immediate use, people depend on fishing to generate income and jobs. Nigeria consumes more than 1.5 million tons of fish a year, making it one of the world's biggest consumers of fish. Because of its low cost and comparatively high nutritional value, fish protein is becoming more and more popular in Nigeria (Ogbu et al., 2019). Because of the ongoing population growth, the high expense of other animal protein sources like beef and eggs, environmental deterioration, overfishing, and water pollution, the demand for fish is continuously rising. One of the things preventing natural lakes, rivers, and reservoirs from having good fish output is parasitic diseases (Banyigy et al., 2023).

The huge fish known as the African Bony Tongue (*Heterotis niloticus*) is found in many tropical rivers and freshwater lakes in central and western Africa (Mustapha, 2010). It is found in Nigeria with numerous freshwater bodies. The freshwater of the Niger River can easily support this species of fish, which has a sizable population of both juveniles and adults. The river's abundance of feed kinds and adaptable feeding style, which are largely related to the type of alimentary canal and digestive processes, are responsible for this successful adaptation (Agbugui and Oniye, 2019). For the fishermen and locals living along the Niger River, *Heterotis niloticus* is a significant fish species. In the family Osteoglossidae and genus *Heterotis*, it is the sole species. Because of its high protein content and persistent freshness, this commercial fish is a highly favored food source and plays a significant role in the diets of many Nigerians. Because of its advantages and economical significance, it is highly regarded. It grows quickly and is available year-round in big sizes and numbers (Agbugui and Egbo, 2021).

The two phyla of helminths that infect vertebrates are the Nematelminthes (roundworms) and the Platyhelminthes (flatworms). While the flukes (Trematoda: Digenea), tapeworms (Cestoidea), and nematodes infect the internal organs, their intermediate stages can occasionally encyst in different host tissues, and flatworms of the Class Monogenea are common in freshwater environments and are found on the body surface of the host, such as the gills and skin of fish (Chidiogo, 2018). In addition to causing harm to the gonads, which can lead to sterility, the eyes, which can cause blindness, poor growth rate, and thriftiness, helminth parasites can also cause human diseases when they are found in large quantities in the body cavity of young fish. The majority of freshwater fish in Africa are known to harbor larval helminths from the genera *Clinostomum*, *Euclinostomum*, *Ampliccaenum*, and *Contracecum* (Omeji et al., 2018). Because most helminth parasites have extremely complicated life cycles that involve multiple intermediate hosts, including fish, studying them helps one better understand the dynamics of aquatic ecosystems overall. As intermediary

hosts, other aquatic creatures including mollusks and planktonic copepods are crucial to the development of parasitic helminths (Chidiogo, 2018).

Under current circumstances, losses from these parasites are at high densities and could reach catastrophic proportions if unchecked. Fish that are heavily infested with parasites have an impact on their normal growth (Abbas et al., 2020). Parasites not only effect the survival of fish directly by reduced condition (fish size), changing the behavior, further susceptible to infection, but also lowered swimming ability, decrease their growth rate and increase mortalities (Salawu et al., 2013). Different parasitic worms affect aquatic species, including African bony tongue fish (*H. niloticus*). While some of these worms act as definitive hosts for a number of parasites, others act as intermediate hosts for a variety of digeneans and cestodes. Compared to other areas of aquatic parasitology and fish biology, fish helminthology is not as well investigated. This could be as a result of the fact that parasitic worms are mainly internal illnesses that impact internal organs, particularly the abdominal region. Many people do not view fish as being particularly dangerous because, to them, the stomach and intestine region do not include the edible section of the fish (Ali et al., 2020).

According to Bashar and Jega (2023), the prevalence of parasites belonging to the Cichlidae family in Sabiyel Lake varies. The frequency and variety of gastrointestinal helminths that impact *H. niloticus*, one of the primary fish species that frequently inhabit Sabiyel Lake and an essential resource for artisanal fishermen, are not well understood. Sustainable fisheries and efficient management of fish health are hampered by the lack of such data. Additionally, little is known about ecological and environmental factors that can affect parasite infections in this area, such as fish size, sex, and season, as well as environmental factors including pollution, host density, and water quality. It is clear from the available literature that there is limited study on helminth parasites of *H. niloticus* in the Sabiyel Lake, thus it needs further study.

Additionally, parasites are implicated in serious pathological conditions that devalue the fish's nutritional value and economic worth. The fishing resources in Kebbi State are steadily declining due to these diseases and other factors. In light of the aforementioned, this study will look into the prevalence of gastrointestinal helminth parasites and how they affect *H. niloticus* in Sabiyel Lake, Aliero, Kebbi State. The goal is to gather pertinent data that may help reduce the amount of money lost due to parasitic infestations. Examining the gastrointestinal helminth parasite that affects *H. niloticus* in Sabiyel Lake is the goal of this study. This study will focus on *H. niloticus* by analyzing helminth parasite prevalence, abundance and distribution in the study area. The study will be limited to gastrointestinal helminths affecting *H. niloticus*.

LITERATURE REVIEW

Study Area

The study was conducted in Sabiyel Lake, which is located in Kebbi State, Nigeria's Aliero Local Government Area. Situated between latitudes 13° 6" to 4° 15" North and longitudes 12° 27" to 47" East, Sabiyel Lake is a freshwater lake. About 13 kilometers from Aliero town in Kebbi State, the lake is situated in the

middle of the villages of Sabiyel, Kashinzama, Laga, Tari, Kambaza, Bami, Mairuwa, and Kyara. According to Jega et al. (2015), emergent vegetation, primarily cattail, covers the 9-kilometer-long lake from one end to the other.

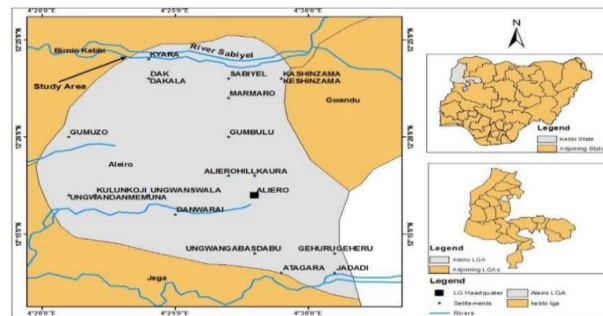


Fig 1. Map of Aliero Showing Study Area (Source: AFUSTA Forestry Lab)

Sample Size

The sample size of (270) fishes were used for this study and it was determined using the formula below.

$$n = \frac{Z^2 Pq}{d^2}$$

Where: n = sample size

Z = statistic level of confidence interval at 95% = 1.96

P = previous prevalence from other study (22.4%)

d = allowable error of 5% (0.05)

q = complementary proportion of p = 1 - P

Sample Collection

Every month for six months (February 2025 to July 2025), 45 samples of *H. niloticus* of various weights and sizes were collected directly from the local fisherman in the study region. For additional analysis, the samples were brought to Abdullahi Fodio University of Science and Technology Aliero's Fisheries Laboratory, which is part of the Department of Forestry and Fisheries.

Identification of Fish Species

The following morphological characteristics were used to identify *H. niloticus*: the mouth, teeth, nostrils, fins, scales, lateral line, and color pattern. Using the Olasibikan and Raji (2013) handbook, meristic traits included the number of spiny fins, sensory pits, and pelvic fin rays.

Sex Determination

Both internal and exterior examinations were used to determine the fish's sex. External Morphological Examination: During the mating season, when females are carrying eggs, the size and shape of adult females was somewhat larger or broader in the abdominal area than that of males. The vent was less prominent or narrower in male and more rounded or projecting in females. Internal Examination (Gonadal Inspection) The internal organs were made visible following the fish's mid-ventral incisional euthanasia. The granular, paired ovaries in females were frequently yellowish or orange in hue, particularly when fully developed. Males tended to have more elongated, streamlined testes that were smoother, smaller, and white or cream in color.

Parasite Examination

A dissecting blade was used to make the central incision on the sample's abdomen. Both the anal end of the cloaca and the anterior limit of the esophagus had their alimentary canals removed, and they were emptied into a petri dish filled with 10% Formalin solution. According to Ajala and Fawole (2014), a wet mount slide containing a few drops of a 0.9% physiological saline solution was made and examined under a microscope using ×40 and ×100 objectives lenses.

Identification of Parasite

Parasite identification was carried out by comparing the morphological features, including body shape, of the collected specimens with descriptions available in the literature, using the pictorial guide provided by Pouder et al. (2005).

METHODOLOGY

Determination of Parasitic Prevalence

The percentage prevalence (i.e rate of infection) of parasites was determined by using the formula below:

$$\text{Prevalence (\%)} = \frac{\text{Number of fish infected}}{\text{Number of fish examined}} \times 100$$

Data Analysis

Descriptive statistics was used to analyze the data obtained on the prevalence of parasitic infection and expressed in percentage. The variables were further analyzed using Chi Square to test level of significance at (P = 0.05). relationships were considered significant if P <0.05

RESULTS

Prevalence of Helminth in Heterotis Niloticus in Sabiyel Lake.

During the investigation, 270 Heterotis niloticus samples were analyzed, and 65 fish samples had an overall prevalence of gastrointestinal helminth parasites of 24.07% (Table 1). Nematoda and trematoda are members of two important classes of helminths. It was discovered that nematodes were the most common parasites in fish, with 45 fish (16.67%) infected with Capillaria spp. Next in frequency were trematodes, where 20 fish (7.41%) were found to be infected with Clinostomum spp.

Table 1. Prevalence of Helminths Parasites in Heterotis Niloticus in Sabiyel Lake

| Class (Taxa) | Parasites | NFI | NPR | Prevalence (%) |
|--------------|------------------------|-----------|-----------|----------------|
| Trematoda | <i>Clinostomum spp</i> | 20 | 25 | 7.41 |
| Nematoda | <i>Capillaria spp</i> | 45 | 51 | 16.67 |
| Total | 2 | 65 | 76 | 24.07 |

KEYS: NFI=Number of Fish Infected; NPR=Number of Parasite Recovered;

Relationship Between Helminths and Sex of *Heterotis Niloticus* in Sabiyel Lake

Helminths infection in relation to sex of *Heterotis niloticus* is represented in Table 2. A total of (270) fishes were examined and 159 were found to be males with 39(24.53%) being infected while 111 were females with 26(23.42%) being infected with helminths parasites. There was no significance difference statistically ($P>0.05$).

Table 2. Helminths Infection in Relation to Sex in *Heterotis Niloticus* in Sabiyel Lake

| Sex | NFE | NFI | Prevalence (%) | χ^2 | P-value |
|--------------|------------|-----------|----------------|----------|---------|
| Male | 159 | 39 | 24.53 | 0.044 | 0.834 |
| Female | 111 | 26 | 23.42 | | |
| Total | 270 | 65 | 24.07 | | |

KEY: NFE = Number of Fish Examined; NF I= Number Fish Infected

DISCUSSION

The study looked into how common *Heterotis niloticus* gastrointestinal helminths were in Sabiyel Lake, Kebbi State, Nigeria. The prevalence was 24.07% overall, with *Capillaria* spp. (16.67%) and *Clinostomum* spp. (7.41%) predominating. The moderate overall prevalence is in line with recent investigations conducted in Nigeria, which found that the prevalence of helminths in freshwater fishes varied from 20 to 40%, depending on the host and habitat (Nnatuanya et al., 2023). Nematode dominance is consistent with research by Aliyu & Abubakar (2024), who found that *Capillaria* spp. are common in fish that feed on sediment because of their life cycles and sediment-associated eggs. Because they need intermediate snail hosts and piscivorous birds, trematodes like *Clinostomum* spp. are less common in Sabiyel Lake, where snail numbers may be seasonally limited (Omeji et al., 2023). 65 of the 270 fish that were analyzed in this study were determined to be infested, containing 76 parasites overall. This number is less than that of Solomon et al. (2016), who found that carnivorous and omnivorous fish species typically harbor more diverse parasite communities than herbivorous species. They also analyzed 100 specimens of *Bagrus filamentosus* and *Chrysichthys citharus* from the River Benue, Makurdi, and recovered 198 parasites. The overall prevalence in this study was 24.07%, which is marginally higher than the 22.01% found in Danyaro et al.'s (2024) study on *Heterotis niloticus* helminth parasites. The results revealed two kinds of intestinal helminths: trematodes 20 (7.41%) and nematodes 45 (16.67%).

In a similar vein, Hadiza et al. (2024) found that silver catfish had a greater rate of nematode infection than trematodes. Given that trematodes and nematodes can interfere with the fish's intestinal absorption of nutrients, their presence in the current investigation raises the possibility of physiological effects. This is in line with Biu et al. (2014), who pointed out that this kind of interference might cause people to eat less. Males had a slightly greater prevalence of infection (24.53%) than females (23.42%), but the difference was not statistically significant

($P > 0.05$). This is consistent with recent findings by Omeji et al. (2023) indicating, unless behavior or hormonal immunity are at play, helminth prevalence rarely varies considerably between sexes.

By aggressive feeding or defending their area, males may show slightly greater exposure, but the diets of the sexes overlap, reducing the disparities. Males were more infected than females, as evidenced by the fact that 39 (24.53%) of the 65 infected specimens were male and 26 (23.42%) were female. In their study of *H. niloticus*, Danyaro et al. (2024) found that males had a higher infestation rate (60%) than females (40%) did. The incidence of parasites and host sex did not significantly correlate, with females having a higher infection rate (Goselle et al., 2013). According to several researchers, male fishes are frequently more highly parasitized than females due to the costs of sexual selection (Dan-kishiya et al., 2013; Omeji, 2014). Further, it has been suggested that males may be pushed closer to their physiological limits than females due to rivalry for mates (Omeji et al., 2013; Eyo & Iyaji, 2014), which would raise stress levels and impair immune function. Males are expected to suffer higher costs of sexual selection and the immunosuppressive effects of testosterone production, making them more vulnerable to parasitic infections than females. As a result, sex-biased parasitism is often associated with disparities in immune competence (Dan-kishiya et al., 2013; Esiest, 2013; Kurshid & Ahmad, 2013).

CONCLUSIONS AND RECOMMENDATIONS

The parasite prevalence in *H. niloticus* examined from Sabiyel Lake is 24.07%, according to the results obtained. Research on the parasite fauna of the various fish species in Sabiyel Lake and whether eating them poses a risk to people must be conducted continuously due to the growing demand for fish as a source of high-quality animal protein.

FURTHER STUDY

This study still has limitations, so further research is needed on the topic of Prevalence of Helminth Parasites (Ectoparasite) of African Bony Tongue Fish (*Heterotis niloticus*) in Sabiyel Lake, Kebbi State in order to perfect this study and increase insight for readers.

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