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Prevalence and intensity of parasitic fauna infestation of the Nile perch, *Lates niloticus* (Linnaeus, 1758), caught from River Mu stretch, Makurdi, Nigeria

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Abstract

Parasitological examination of 80 fresh samples of the Nile perch (*Lates niloticus*) obtained from the fishermen's catches along the River Mu stretch, Makurdi, Benue State, Nigeria, was carried out to determine the prevalence and intensity of parasites on the host fish. Two nematodes (*Cuccullanus sp* and *Camallanus sp*), three cestodes (*Monobothrium latum, Diphylobothrium latum* and *Pleurocercoid sp*), one crustacean (*Argulus sp*) and one protozoa (*Henneguya sp*) were recovered during the examination. Out of the 80 fish samples examined, 49 (61.3%) were infested with a total of 169 parasites. The highest prevalence of infestation (18.8%) was recorded for *Camallanus sp.* while the least (2.5%) was recorded for *Argulus sp.* Among the parasite classes, nematodes had the highest prevalence (32.5%) while the least (2.5%) was recorded for the class Crustacean. Out of the 169 parasites recovered, class Nematoda accounted for the highest number/percentage parasite load (116/169 = 68.6%), while the least (3/169 = 1.8%) was recorded for Crustacea class. Highest intensity (4.46) of parasite infestation was recorded for the Nematode class, with *Cuccullanus sp* accounting for 5.36, while *Camallanus sp.* accounted for 3.80 intensity of infestation. The least intensity of parasite infestation (1.33) was recorded for the protozoan class (*Henneguya sp)*. Longer/bigger fish samples had more prevalence of infestation compared to the smaller sized counterparts. Higher prevalence of parasite infestation (67.4%), number/percentage parasite load (107/63.3%) and mean parasite intensity (3.69) were recorded for female *L. niloticus* compared to their male counterpart.

Keywords: Nile perch; *Lates niloticus*; Prevalence; Parasites; Intensity; River Mu, Makurdi, Nigeria.

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Introduction

Fish are a major source of animal protein consumed globally and are also important in trade and economy (Lesnierowski and Stangierski, 2018; Onyishi and Aguzie, 2018; Ezenwaka and Living-Jamala, 2024). The Nile perch, *Lates niloticus* (Linnuaeus 1758, Family: Centropomidae, Subfamily: Latidae) is a widespread fish species with high value throughout the world's rivers and in brackish water for commercial aquaculture (Namulawa *et al.,* 2015). It is of economic and food security importance in Africa (Chrétien and Chapman, 2016) but its population is threatened due to the excessive harvest and parasitic diseases (Katurole and Wadanya, 2012). Only few parasitological studies (ectoparasites and endoparasites) been reported on that species (Onyedineke *et al.,* 2010; El-Seify *et al.,* 2015).

Parasitic diseases restrict fish farmers' capacity to produce fish at a sustainable rate (Afoemezie *et al.,* 2023), despite the fact that the daily need for fish as a protein source is increasing. Depending on the type and number of infesting or infecting parasites, fish may experience a variety of negative effects, such as decline of the its immune system due to the pathogenic effects of secondary infections, altered biology and behavior, nutritional devaluation, blindness induction, poor growth, low fecundity and mechanical injuries attributable to the parasites (El-Seify *et al.,* 2015; Nguyen *et al.,* 2021). Studies in different regions have identified various parasites, with their prevalence and intensity varying, depending on factors like location, season and fish size (Rania, 2022). Some freshwater fish species are of public health significance because they are intermediate or final hosts of parasites that may be harmful to both human and animal health, even though they are a significant source of protein for humans and other animals (Onoja-Abutu *et al*., Ahtisham *et al.,* 2022).

There are several freshwater bodies in Nigeria, but the two main rivers that run across the country from North to South are the Rivers Niger and Benue. Throughout Nigeria, a large number of studies on parasites of freshwater fish have been conducted (Ezenwaka and Living-Jamala, 2004; Okita *et al.,* 2020; Amos *et al.,* 2018; Atalabi *et al.,* 2018) but given the dearth of research on the parasites of *Lates niloticus* as one of the most economic and cherished fish species that is consumed in Benue State, Nigeria, and owing to the fact that the parasites are known to reduce the profitability of this fish species, reduce the growth and can also lead to zoonotic diseases, the present study examined the prevalence, intensity and influence of size and sex on parasitic fauna of *Lates niloticus* caught from River Mu stretch, Makurdi, Nigeria.

Materials and Methods

Study Area: The study area was River Mu, a stretch of River Benue located in Makurdi town, the capital city of Benue State, Nigeria, with the earthly coordinates of 8̊21 0̈ North and 8˚30 0̈ East (Iwar *et al.,* 2021).

Sample Collection: A total of eighty fresh samples of *Lates niloticus* from the fishermen's catches along the River Mu stretch, Makurdi, Benue State Nigeria were bought from the fishermen across a period of four months (December, 2024 to March, 2025) and each time transported immediately after purchase in a 50 litres jerry can half filled with clean water to the Biological Science Laboratory, Joseph Sarwuan Tarka University, Makurdi for morphometric measurement and parasitological examination. Samples were identified using identification key as described by Fischer *et al.* (1981). The sample size for the study was determined using the formula for estimating prevalence in epidemiological studies, as described by Thrusfield and Christley (2018).

Morphometric measurement and sexing of the fish samples: The weight (g) and total length (cm) of each fish was recorded using a top-loading electronic weighing scale and fish measuring board, respectively. The sex of the fish samples was established by the detection of the female's ovaries and the male's testes at dissection. Every sampling process was carried out using the procedure described by Marcogliese (2002).

External Assessment of parasites of the fish samples: Macroscopic observation of fish samples was done to check for obvious lesions, cysts and other clinical signs of parasite infestation/infection; this process was facilitated by the use of a hand lens (Emere, 2000). The skin and gills were subjected to detailed external parasitological evaluation.

Examination of skin parasites: A scalpel blade was used to take mucous scrapes from the whole skin surface area, paying attention to sites of lacerations, hemorrhages, and abrasions (Oscar *et al.,* 2015). The mucus obtained was transferred onto grease-free glass slides containing a drop of saline solution and Lugol's iodine, covered with a cover slip, and viewed immediately for parasite movements.

Examination of gill parasites: Using a pair of scissors, the gills were removed from the dissected fish and put in a petri dish with 0.9% saline solution. A scalpel was used to take gill mucus scrapings. Rakers, patches with pigmentation, and the gill arcs were sites of particular attention. Objective lenses ×10 and ×40 magnification were used to observe the mucus on grease-free slides covered with coverslips and a drop of saline solution and iodine (Omeji *et al.,* 2011; Ayawei *et al.,* 2018). The parasites were identified using the parasites identification keys developed by Pouder *et al.* (2005) and Kawe *et al.* (2016).

Internal parasite assessment of the fish samples: Using scissors, the abdomen of the fish were sliced open from the anal hole to the pectoral region immediately after they were placed on the dissecting board (Iboh and Ajang, 2016). The stomach and digestive system were carefully removed and then put on Petri dishes with 0.9% saline solution. The gastrointestinal tract and stomach were cut open, the contents placed in saline solution-filled Petri dishes, and the emergence of parasitic worms was closely monitored. The observed parasites were identified using the parasite identification key developed Pouder *et al.* (2005) and Kawe *et al.* (2016).

Calculation of prevalence and mean intensity: Prevalence was calculated by dividing the number of fish infected with the number of fish examined and multiplying with 100, while the mean intensity was calculated by dividing the total number of parasites by the number of fishes infested (Oscar *et al*., 2015).

Statistical Analysis: Data obtained from the study were subjected to descriptive statistics and Chi square analysis with the aid of the SPSS software. Significance was accepted at $p < 0.05$.

Results

The prevalence of each parasite species found on the sampled *L. niloticus* caught from River Mu is presented in Table 1. Seven species of parasites were found on the fishes sampled, which included two nematode species (*Cuccullanus sp* and *Camallanus sp*), three cestode species (*Monobothrium latum, Diphylobothrium latum* and *Pleurocercoid sp*), one crustacean (*Argulus sp*), and one protozoan (*Henneguya sp*). The highest prevalence of infestation (18.8%) was recorded for *Camallanus sp.,* while the least (2.5%) was recorded for *Argulus sp.* (Table 1) *Cuccullanus sp, Monobothrium sp., D. latum, Pleurocercoid sp., Henneguya sp.* had parasites prevalence of 13.8%, 10.0%, 7.5%, 5.0% and 3.8%, respectively (Table 1). Among the parasite classes, nematodes had the highest prevalence (32.5%), followed by cestodes

(22.5%) and protozoans (3.8%), while the least prevalence (2.5%) was recorded for crustaceans (Table 1).

Out of the 80 fish sampled, 49 (61.3%) were infested with a total of 169 parasites (Tables 1 and 2). Out of the 169 parasites recovered from *L. niloticus,* class Nematoda accounted for the highest parasite load (116/169 = 68.6%) while the least (3/169 = 1.8%) parasite load was recorded for Crustacean class (Table 2). Class Cestoda and Protozoan recorded 46/169 = 27.2% and 4/169 = 2.4% parasite loads, respectively (Table 2).

The highest intensity of parasite infestation (4.46) was recorded for the nematode class, followed by class Cestoda (2.56), Crustaceans (1.50) and Protozoa (1.33) (Table 2), At the parasite species level, the intensity of *Cuccullanus sp infestation was* 5.36, followed by *Camallanus sp.* infestation (3.80), with *Henneguya* sp. having the lowest intensity (1.33) (Table 2).

Table 1. Prevalence of various parasite classes and species on 80 Nile perch (*Lates niloticus*) caught from River Mu stretch, Makurdi Nigeria.

Parasite class	No. of fish infested with parasite class, with % in brackets	Parasite species	No. of fish infested with parasite species, with % in brackets
Nematoda	26 (32.5%)	*Cuccullanus sp*	11 (13.8%)
		Camallanus sp.	15 (18.8%)
Cestoda	18 (22.5%)	*Monobothrium sp*	8 (10.0%)
		D. latumn	6 (7.5%)
		Pleurocercoid sp	4 (5.0%)
Crustaceans	2 (2.5%)	*Argulus sp.*	2 (2.5%)
Protozoa	3 (3.8%)	*Henneguya sp*	3 (3.8%)
Total	**49 (61.3%)**		**49 (61.3%)**

Table 2. Parasite load and intensity of various parasite classes and species on 80 Nile perch (*Lates niloticus*) caught from River Mu stretch, Makurdi Nigeria.

Parasite class	No. of parasite class, with % parasite load in brackets	Intensity of infestation for each parasite class	Parasite species	No. of parasite species, with % parasite load in brackets	Intensity of infestation for each parasite species
Nematoda	116 (68.6%)	4.46	*Cuccullanus sp*	59 (34.9%)	5.36
			Camallanus sp.	57 (33.7%)	3.80
Cestoda	46 (27.2%)	2.56	*Monobothrium sp*	23 (13.6%)	2.88
			D. latumn	14 (8.3%)	2.33
			Pleurocercoid sp	9 (5.3%)	2.25
Crustaceans	3 (1.8%)	1.50	*Argulus sp.*	3 (1.8%)	1.50
Protozoa	4 (2.4%)	1.33	*Henneguya sp*	4 (2.4%)	1.33
Total	**169 (100%)**	**3.45**		**169 (100%)**	**3.45**

Based on location on which the parasites were found, 90 out of the 169 parasites (53.3%) were found in the intestines, while 72 (42.6%) were found in the stomach, and only 7 (4.1%) were found in the gills (Table 3). No parasite was found on the skin.

Table 4 presents the prevalence distribution of parasite infestation based on the length categories of the fishes. The highest parasite prevalence was recorded among fish in the 55.0 – 65.9 cm length category, where 20 out of 28 fish (71.4%) were infested. This was followed by fish in the 22.0 – 32.9 cm category, with 12 out of 19 fish (63.2%) infested, and those in the 33.0 – 43.9 cm category, with 8 out of 13 fish (61.5%) infested. Fish within the 44.0 – 54.9 cm length category recorded a prevalence of 50.0%, with 5 out of 10 fish infested. The lowest prevalence was recorded among fish in the 11.0 – 21.9 cm category, where 4 out of 10 fish (40.0%) were infested. Fish of the highest length category recorded the highest prevalence, while the smallest length category recorded the lowest, though the pattern was not strictly consistent across from the highest to the lowest.

Table 3. Distribution of parasite load of various parasite species on the stomach, intestines and gills of 80 Nile perch (*Lates niloticus*) caught from River Mu stretch, Makurdi Nigeria.

Parasite species	No. of parasites infesting specific body parts, with % in brackets			Total no. of parasite species, with % total parasite load in brackets
	Stomach	Intestines	Gills	
Cuccullanus sp	26 (36.1%)	33 (36.7%)	0 (0.0%)	59 (34.9%)
Camallanus sp.	32 (44.4%)	25 (27.8%)	0 (0.0%)	57 (33.7%)
Monobothrium sp	9 (12.5%)	14 (15.6%)	0 (0.0%)	23 (13.6%)
Diphylobothrium latum	3 (4.2%)	11 (12.2%)	0 (0.0%)	14 (8.3%)
Pleurocercoid sp	2 (2.8%)	7 (7.8%)	0 (0.0%)	9 (5.3%)
Argulus sp.	0 (0.0%)	0 (0.0%)	3 (42.9%)	3 (1.8%)
Henneguya sp	0 (0.0%)	0 (0.0%)	4 (57.1%)	4 (2.4%)
Total	**72 (42.6%)**	**90 (53.3%)**	**7 (4.1%)**	**169 (100%)**

Table 4. Prevalence of parasite infestation based on fish length of 80 Nile perch (*Lates niloticus*) caught from River Mu stretch, Makurdi Nigeria.

Fish length range categories	No. of fish examined in the length category	No. of fish infested in the length category	Percentage of fish infested in the length category
11.0 – 21.9 cm	10	4	40.0%
22.0 – 32.9 cm	19	12	63.2%
33.0 – 43.9 cm	13	8	61.5%
44.0 – 54.9 cm	10	5	50.0%
55.0 – 65.9 cm	28	20	71.4%
Total	**80**	**49**	**61.3%**

Table 5. Prevalence of parasite infestation based on fish weight of 80 Nile perch (*Lates niloticus*) caught from River Mu stretch, Makurdi Nigeria.

Fish weight range categories	No. of fish examined in the weight category	No. of fish infested in the weight category	Percentage of fish infested in the weight category
65.0 – 125.9 g	14	6	42.9%
126.0 – 180.9 g	38	29	76.3%
181.0 – 241.9 g	12	7	58.3%
242.0 – 302.9 g	9	5	55.6%
303.0 – 363.9 g	7	2	28.6%
Total	**80**	**49**	**61.3%**

Table 6. Prevalence of parasite infestation based on sex of 80 Nile perch (*Lates niloticus*) caught from River Mu stretch, Makurdi Nigeria.

Fish sex	No. of fish examined in the sex category	No. of fish infested in the sex category	Percentage of fish infested in the sex category	Intensity of infestation in the sex category
Female	43	29	53.8%	3.69
Male	37	20	46.3%	3.10
Total	**80**	**49**	**100%**	**6.79**

The distribution of the prevalence of parasite infestation based on the fish weight categories is presented on Table 5. Fish of the 126.0 – 180.9 g weight category had the highest prevalence with 29 out of 38 fish (76.3%) being infested. They were followed by fish in the 181.0 – 241.9 g category, with 7 out of 12 fish (58.3%) infested, and those in the 242.0 – 302.9 g category, with 5 out of 9 fish (55.6%) infested. Fish in the 65.0 – 125.9 g category recorded a prevalence of 42.86%, with 6 out of 14 fish infested. The lowest prevalence occurred in the 303.0 – 363.9 g category, where only 2 out of 7 fish (28.6%) were infested.

Sex based distribution of the prevalence of infestation, percentage parasite load and mean intensity is shown in Table 6. A higher prevalence of infestation (53.8%), number/percentage parasite load (107/169 = 63.3%) and mean intensity (3.69) were recorded for females, while lower prevalence of infestation (46.3%), number/percentage parasite load (62/169 = 36.7%) and mean intensity (3.10) were recorded for the males (Table 6).

Discussion

The 61.3% prevalence of parasite infestation recorded in this study is higher than the prevalence of 47.5% reported by Nnatuanya *et al.* (2023) for *C. gariepinus* in the wild, 56.4 % reported by Amaechi (2014) for fishes at Asa Dam, Ilorin, Nigeria, the 31.1% reported by Onojafe *et al.* (2021) for *Clarias gariepinus* at Abraka, Delta State, Nigeria, and the 53.3 – 55.5% reported for *Oreochromis niloticus* at Egbe, Ero and Ureje dams, Ekiti State, Nigeria (Olagbemide and Owolabi, 2022). The total

prevalence obtained in this study is also higher than the 57.3% reported by Abiyu *et al.* (2020) in the fish species caught from south west part of Lake Tana, Central Gondar, Ethiopia, and also the 29.0% and 47.8% reported by Omoniyi and Ojelade (2017) for *O. niloticus* in Abeokuta Nigeria. It is however lower than 100.00% reported by Mitiku *et al.* (2018) from Lake Koftu in central Ethiopia, 88.2 % reported for *Clarias gariepinus* and 91.2% for *Tilapia zillii* by Mgbemena *et al* (2020), and the 77.6% reported by Areda *et al* (2019) from selected fish farms in south west zone, Oromia region, Ethiopia. Similarly, related higher prevalence rates of parasite infestation have been reported by earlier studies in Nigeria and elsewhere by Kawe *et al.,* (2016) who reported 67.5 % and Salawu *et al.,* (2013) who reported 75.0 % prevalence.

The high occurrence of parasite infestation for *L. niloticus* in this study may be attributed to anthropogenic pollution of River Mu, given that (Omeji *et al* 2018) had reported the contamination of River Mu by activities such as agriculture, fishing, domestic and wastes disposal into the River. Abdel-Gaber *et al.* (2015) and Keke *et al.,* (2017) have earlier opined that activities from urban settlements are able to encourage pollution from various human sources, resulting to an increase in the prevalence of organisms, such as parasites. The high prevalence of parasite infestation recorded in this study may also be as a result of availability of the parasites' intermediate hosts (e.g. insects, molluscs and copepods) that inhabit the infective larval stages of parasites, and are eventually fed by the fish. Furthermore, climatic dynamics that prevail on biotic and abiotic factors of a locality might be responsible for variations in parasite infestation rates of different localities.

The occurrence of the seven identified parasites in *L. niloticus* in this current work is not surprising as these have been reported from same or different fish species from same or different water bodies. For example, *Cuccullanus sp.* and *Camallanus* sp. has been reported by Mgbemena *et al.* (2020) from *C. gariepinus* and *Tilapia zillii* in Chanchanga River, while *Monbothrium sp.*, *Camallanus* sp. and *Pleurocercoid sp.* have been reported by Sadauki *et al.* (2023) from *C. gariepinus* in Zobe, reservoir, Katsina State, Nigeria. *Henneguya sp.* has been reported by Bichi and Yelwa (2010) from the gills of C*larias gariepinus* (Teugels) at Bagauda fish farm, Kano, Nigeria, and *Argulus sp* has been reported by Omeji *et al.* (2024) from *Sarotherodon galilaeus* (Linnaeus, 1758) sampled along the Lower River Benue, Makurdi, Benue State, Nigeria.

The nematodes (*Cuccullanus sp.* and *Camallanus sp.*) were the highest occurring parasites, followed by the cestodes (*Monobothrium sp., D. latum* and *Pleurocercoid sp*), with a low prevalence of crustacean (*Argulus sp*) and protozoan (*Henneguya sp.*). The relatively high prevalence or abundance of nematodes observed in the present study may be associated with the feeding ecology of the host fish and its exposure to infective stages of parasites through the food web. However, the feeding habits of Nile perch vary with fish size and prey availability. Agembe *et al* (2019) documented dietary shifts in Nile perch from zooplankton and other invertebrate prey towards larger prey, including fish, while Adeosun (2023) reported that fish remains and insects dominated the diet of Nile perch in Oyan Dam, Nigeria. Therefore, the observed nematode burden may reflect differences in dietary exposure and feeding ecology. The higher prevalence of nematodes recorded in the present study has also been reported by several other studies across Nigeria (Arimoro *et al.,* 2013; Iboh *et al.,* 2016; Kawe *et al.,* 2016; Omalu *et al.,* 2017; Omeji *et al.,* 2018; Mgbemena *et al.,* 2020).

The distribution of the prevalence of the parasite infestation based on size (total length and weight) of *L. niloticus* showed higher

prevalence in longer/bigger fishes compared to the smaller ones. The higher prevalence of infection recorded in bigger fishes relative to the smaller ones might plausibly be linked to differences exhibited in their feeding habit as a result of age and survival needs, where the older/bigger fishes feed more and as a result become more likely to pick up the parasites through feeding. In addition, the mere change of dietary contents as the fish grows from weeds, seeds, zooplankton to animal-based foods (e.g. snails, worms, insects which are intermediate hosts of infective larval stages of parasites) might be a possible reason for bigger fishes to have a higher prevalence that smaller ones. It is also possible that the younger fishes with supposedly better immunity were more resistant to infections than older fishes. These results of the present study are in agreement with the findings of Akinsanya and Otubanjo (2006) and Omeji *et al* (2018), but it contrasts with the reports of Ekanem *et al* (2011), which showed higher infection rate in smaller fish than the bigger ones.

The relatively higher prevalence of parasite infestation in females than males might be a result of their ultimate drive to survive. It could also mean that more females were available for parasitic infestation than males. Salawu *et al* (2013) and Abdel-Gaber *et al* (2015) also reported higher percentage infection in female fishes than the males and attributed it to physiological states of the female fishes with resultant decrease in their ability to resist parasitic infections. In contrast to this finding, Nnatuanya *et al* (2023) reported a higher prevalence of infestation in male *C. gariepinus* than the female where the males accounted for 50.0% while the females accounted for 33.3%. Also, Otor *et al.* (2016) reported a higher prevalence of parasite infestation in males (53.90%) than the female catfish (46.10%), and Ali *et al* (2020) recorded higher prevalence of infestation in males (26.67%) than the females (6.67%).

Conclusion and Recommendation: The study revealed a high prevalence of parasite infestation (61.3%) of Nile perch (*Lates niloticus)* caught at the River Mu stretch, Makurdi Nigeria, with seven species of parasites belonging to four classes. The findings of this study shall serve as baseline parasitological information for Nile perch and other fishes at River Mu, Makurdi Nigeria. It will predate future studies on how to protect and develop the ecological potential of River Mu.

It is recommended that the gastro-intestinal tract and gills of harvested fishes from the study area should not be consumed to prevent transmission to humans of some parasites and parasitic diseases that are known to be zoonotic. Human-induced actions and processes that impact the natural environment (industrial processes, urbanization, agriculture and waste disposal) which can enhance parasite proliferation in water bodies should be restricted.

Conflict of Interest

The authors declare no conflict of interest.

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