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PREVALENCE OF ECTO AND ENDO PARASITES OF WHITE CATFISH (*AMEIURUS CATUS*) IN UKE RIVER, KARU LOCAL GOVERNMENT AREA OF NASARAWA STATE, NIGERIA

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ABSTRACT
In Uke River, Karu Local Government Area, Nasarawa State, Nigeria, a six-month research was carried out between January and June 2023 to examine the gills and intestinal helminth and protozoan parasites of White Catfish (*Ameiurus catus*). A total of 100 fresh *Ameiurus catus* fish samples of both sexes, were obtained from the fishermen and conveyed to the Zoology laboratory of Nasarawa State University for examination. The fishes were processed and examined using gills, oesophagus, intestine and rectum. Twenty-two (22) out of 100 fishes were found to be infected with helminth and protozoan parasites and a total of 31 parasites were isolated belonging to protozoa (*Eimeria spp*, *Hexamita spp*, *Protoopalina spp*), nematode (*Procamallanus spp*), trematode (*Dactylogyrus spp*), Cestode (*Diphyllobothrium latum*, *Bothriocephalus claviceps*) taxonomic groups. The findings indicated that *Ameiurus catus* intestine contained a greater quantity of fish parasites (96%). A nematode (*Procamallanus spp.*) was found to have the highest prevalence of 45.16%. Although the Chi square results showed no significant difference (p>0.05), the prevalence in *Ameiurus catus* was greater in female samples (63.64%) compared to male samples (36.36%). Fish weighing between 151-200 g (46.14%) and measuring between 21-30 cm (28.57%) had the highest percentage of parasite infection. Going forward, it is imperative to properly cook *Ameiurus catus* from the Uke River to prevent the spread of parasites to consumers. Additionally, it is advisable to steer clear of any potential actions that could contribute to the parasite predominance near the water body.

Keywords: White catfish, Helminths, Protozoa, Uke river, Karu

INTRODUCTION
Fishes are valued supply of aquatic food resources. They contain both macro and micro nutrients that are necessary for development and improvement of human health (Mishra, 2020). Fish is accessible to the average person in most nations and is an inexpensive source of animal protein. The Food and Agriculture Organisation (FAO) of the United Nations (2000) estimates that one billion people worldwide primarily obtain their animal protein from fish. The demand for fish is always rising, for a variety of reasons, including the growing number of people, the high price of alternative sources of animal protein and health risks associated with consuming other animal protein sources (Tavarez-Dias and Martins, 2017). Sub-Saharan Africa's status with regard to food security is becoming less favorable due to disruptions in the global economy, population expansion, and changes in consumer behavior (Wudil *et al*., 2022). Fish is considered as an affordable and nutritious animal protein and plays a significant role in the economic development of any nation that produces fish (Dauda *et al., 2016)*. Fish can meet the nutritional needs of a rural community because it has a higher digestible energy content and a nutrient profile than any terrestrial meat (Takon *et al*., 2020). In developing countries like Nigeria, fishing is a vital source of income, especially for families with modest income living in countryside with limited work prospects (Kigbu *et al*., 2014).

Helminth and protozoan diseases have a significant global influence on the fish business due to the zoonotic potential and the pathogenic effects of several species impacting productivity. Essentially, most human zoonotic parasite illnesses originating from fish are unintentional illnesses brought on by eating undercooked flesh that harbours live parasites (Acosta-Perez *et al*., 2022). Abdel-Gaber *et al.* (2015) claimed that many categories of adult helminth parasites infect fish from freshwater environments in Africa. Additionally, fish farmers face limitations because of the high mortality rates of fry and fingerlings, especially in culture systems where parasite invasion is occurring (Maikai and Maikai, 2018). Fish parasites frequently cause harm to their hosts by consuming their blood and bodily fluids, damaging the host tissues or serving as a venue for the emergence of secondary illnesses (Misganow and Getu, 2016).

If left unchecked, parasitic diseases can cause large-scale deaths, decrease fish productivity and in certain situations, spread infections to people and other animals that eat diseased fish. One of the commercial fish in River Uke is *Ameiurus catus* and its utilisation will be affected by parasitic infections and diseases. The major aim of this study is to establish the prevalence of gills and intestinal helminth and protozoan parasites of *Ameiurus catus* in Uke River, Karu Local Government Area of Nasarawa State, Nigeria. The objectives of the investigation are to determine the presence of gills and intestinal parasites of *Ameiurus catus* in River Uke, to verify the comparative loads of parasites in gills and intestine of *Ameiurus catus* in relation to their weight, to verify the comparative loads of parasites in gills and intestine of *Ameiurus catus* in relation to their total length and to find out gills and intestinal parasite of *Ameiurus catus* in relation to their sexes.

MATERIALS AND METHODS
Study Area
This investigation was carried out in River Uke, Karu Local Government Area, Nasarawa State. The area, which has two separate seasons—the wet and dry season—is located in the North-Central region of Nigeria. Karu is situated on longitude

8°32'N 8°18'E and latitude 8.533°N 8.300°E. It is known for its tropical sub-humid climate. The range of monthly temperatures varies between 20°C to 34°C, while the yearly precipitation varies from 1100 mm to around 2000 mm. Uke is situated around 26 kilometers South-East of Abuja. Being close to the Federal Capital Territory of Nigeria, it is regarded as an Abuja suburb (Ihuma *et al*., 2016).

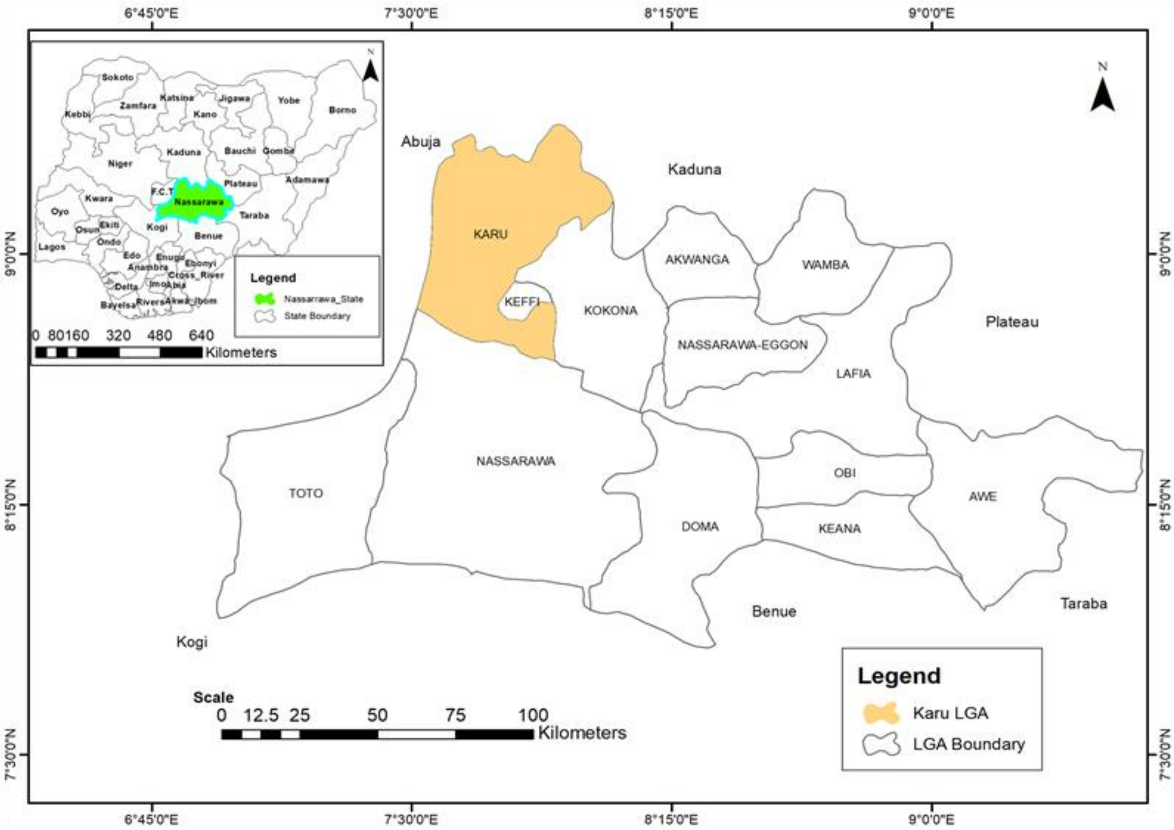

Figure 1: Map of Nasarawa State indicating the Location of Karu Local Government Area.
Source: (Kanayochukwu and Dogo, 2019)

Sample collection

Fish samples were collected on weekly basis between January and June 2023 from River Uke, Karu Local Government Area, Nasarawa State using randomized sampling method through the help of local fishermen at the landing sites of the river. A total of One hundred (100) *Ameiurus catus* samples of different weight, length and sexes were purchased and transported in large plastic containers filled with water of same source to the laboratory of Department of Zoology at Nasarawa State University for examination. The fish species used for this study were identified by a fishery expert (Banyigyi, A. H., Nasarawa State University, Keffi). Identification was done in the laboratory based on the following diagnostic characters that differentiate white catfish from other icaturids: a moderately forked caudal fin with rounded edges, short and rounded anal fin, 22 anal fin rays, white ventral barbels and adipose fin not fused to caudal fin (Page and Burr, 2011; Rider and Powell, 2018).

Sex determination

The urogenital papillae behind the anus, which are lengthy in male fish and circular and reddish in mature female fish, were used to physically distinguish the sexes of fish. These were then verified through visual examination of the female ovaries and the male testes after dissection (Afolabi *et al.,* 2020).

Measurements of Length

Each fish sample was measured for total length in centimeters by arranging it laterally on the dissecting board and measuring from the mouth to the end of the tail using the meter rule. The standard length, on the other hand, is measured from the tip of the mouth to the end of the caudal fin (Nwokocha *et al*., 2019).

Measurements of Weight

Weight were measured using top loading sensitive weighing balance (GT4100). The weights of all the fishes used for the study were measured to the closest 0.1g (Akorede, 2013).

Formation of Normal Saline

The materials used for the preparation of the normal saline were Sodium chloride (9 grams), distilled water (1 litre), sterile container, stirring rod, weighing balance and Autoclave for sterilization. 9 grams of Sodium chloride was poured into a container and 1 litre of distilled water was added. The solution was stirred using stirring rod until all the sodium chloride was completely dissolved. The entire container was autoclaved to ensure sterility and stored in a closed container at room temperature.

Laboratory Examination of Fish Samples

Examination for ecto parasite

Using a scapel blade, the head of *Ameiurus catus* was sliced open, exposing the gills, which were then placed in a different Petri dish and examined through the use of a dissecting microscope and hand lens (Obi *et al.*, 2017). The mucus in the gills was washed using a brush and 4 mls of normal saline solution. The mucus was smeared on a slide and covered with a cover slip for examination under a light compound microscope with the magnification of 4x, 10x, 40x objectives.

Examination for intestinal (endo) parasites

The fish was dissected and gut extracted according to the procedure of Absalom *et al.*, 2018. The fish were immobilized by cervical dislocation for easy handling prior to dissection on a dissecting board. The fish were dissected through the abdomen by making a longitudinal slit on the ventral surface from the anus to a point level with the pectoral fins using a surgical blade. The gut was detached and cut into various parts; stomach, intestine and rectum. The gut was utilized for parasitic assessment since the population of the parasites is likely to be abundant here due to the availability of food materials. Every portion was put on a separate Petri dishes filled with normal saline, slit longitudinally and was viewed under a light compound microscope with the magnification of 4x, 10x, 40x objectives. Under a microscope, the writhing motion of any worm in the saline solution made its appearance obvious (Akinsanya *et al*., 2007).

Identification of Parasite

The parasites recovered were identified by comparing microscopic characteristics with the keys of the freshwater fish parasites graphical reference. The detected parasites were recognized morphologically (Pouder *et al*., 2013).

Statistical Analysis

The percentage (%) distribution was used to determine the prevalence and severity of infection. Analysis was done on length range frequencies in relation to sample prevalence. Chi-square test was used to determine the differences among the different variables studied and P-values ≤ 0.05 was considered significant.

Results

Fish samples totaling one hundred (100) were screened for intestinal and gill parasites. Of the fish samples examined, 22 (22.0%) were infected by different parasite species, while the remaining 78 (78.0%) were not infected. The taxonomic groups of protozoa, nematodes, trematodes, and cestodes comprised the isolates of parasites from the fish samples examined. The protozoa parasites identified were *Eimeria Spp*, *Hexamita spp, Protopalima spp* while nematode seen was *Procamallanus Spp.* The cestodes parasites isolated were *Diphyllobothrium latum*, *Bothriocephalus claviceps* while Dactylogyrus spp was the only trematode parasite recovered.

Prevalence of parasite infestation on *Ameiurus catus* in relation to sex of the fish

Table 1 shows the incidence of parasite infection on *Ameiurus catus* in relation to sex of the fish. Forty-five (45) of the fish examined were males while fifty-five (55) of the fish examined were females. Prevalence of 8 (36.36%) was observed in male *Ameiurus catus* compare to female with prevalence of 14 (63.64%). There was no significant difference (p>0.05) in the parasitic infection in both sexes of the fish.

Table 1: Prevalence of Parasite Infection of *Ameiurus catus* in Relation to Sex of the Fish

Sex	No. Examined	No. Infected	Prevalence (%)
Male	45	8	36.36
Female	55	14	63.64
Total	100	22	100

χ^2 = 1.636, P-value= 0.201 at degree of freedom = 1 and 0.05 confidence level

Frequency and distribution of both gills and intestinal parasite infection on *Ameiurus catus*

Table 2 shows frequency and distribution of parasite infection of *Ameiurus catus*. The *Procamallanus spp* recorded the highest prevalence 14 (45.16%) while *Eimeria spp* 1(3.23%) and *D. latum* 1(3.23%) were the least prevalent parasites. Others were *Hexamita spp* 6(19.35%), *Dactylogyrus spp* 4(12.90%), *B.claviceps* 3(9.68%), *Protopalima spp* 2(6.45%).

Table 2: Frequency and Distribution of Parasites of *Ameiurus catus* with respect to Species and Location

Parasite species	Taxonomic group	Location of parasites	Frequency	Prevalence (%)
Procamallanus spp	Nematode	Intestine	14	45.16
Dactylogyrus spp	Trematoda	Gill	4	12.9
Hexamita spp	Protozoan	Intestine	6	19.35
Protopalima spp	Protozoan	Intestine	2	6.45
Eimeria spp	Protozoan	Intestine	1	3.23
D. latum	Cestode	Intestine	1	3.23
B. claviceps	Cestode	Intestine	3	9.68
Total			31	100%

χ^2 = 20.290, P-value= 0.001 at degree of freedom = 5 and 0.05 confidence level

Prevalence of parasitic infection of *Ameiurus catus* in relation to the body weight of the fish at River Uke

Table 3 presents the prevalence of parasite infection in *Ameiurus catus* fish with respect to fish body weight. Fishes weighing between 151-200g had the highest prevalence of infection 46.14% followed by fishes weighing 251-300g (42.86%). However, no infection was recorded in fishes less than 50g body weight (0.00%). There was no significant difference (P>0.05) in the infestation with the body weight of the fishes.

Table 3: Prevalence of Parasitic Infection of *Ameiurus catus* in Relation to the Body Weight of the Fish at River Uke

Weight (g)	No. Examined	No. Infected	No of parasites recovered	Prevalence (%)
Less than 50	17	0	0	0
51 – 100	12	5	7	41.67
101 – 150	12	3	5	25
151 – 200	13	6	8	46.14
201 – 250	26	4	6	15.38
251 – 300	7	3	4	42.86
301 and above	13	1	1	7.69
Total	100	22	31	22

χ^2 = 3.909, P-value= 0.418 at degree of freedom = 4 and 0.05 confidence level

Prevalence of parasites infection of *Ameiurus catus* in relation to standard length of the fish at River Uke

Table 4 shows prevalence of parasites infection of *Ameiurus catus* in relation to standard length. Fish with standard length of 21-30cm had the highest prevalence of infection 54.55% followed by fishes with standard length less than 10cm (22.72%). The least prevalence was recorded in standard length of 31cm and above (9.09%). There was a significant difference ($P<0.05$) in parasitic infestation in relation to Standard length.

Table 4: Prevalence of Parasites Infection of *Ameiurus catus* in Relation to Standard Length of the Fish at River Uke.

Standard length (cm)	No. Examined	No. Infected	Prevalence (%)
Less than 10	31	5	22.72
11 – 20	19	3	13.64
21 – 30	42	12	54.55
31 and above	8	2	9.09
Total	100	22	100

χ^2 = 11.09, P-value= 0.011 at degree of freedom = 3 and 0.05 confidence level

Discussion

The study of gills and intestinal parasites of *Ameiurus catus* reveals an overall prevalence of 22.0%. This is similar to 22.33% recorded in Clarid fish at Lower Benue River Nigeria (Uruku and Adikwu, 2017). It is however lower when compared with 48.63% in Upper Benue River by Omeji *et al.* (2015) and 30% in River Nasarawa by Banyigyi *et al.* (2013). The frequency of interaction between the fish and the parasites infectious stage can account for a considerable portion of the variation in prevalence. The abiotic and biotic factors of the study surroundings may also be responsible for variations in the parasite assemblage (Poulin, 2004). The location of the river relative to human residence, the number and kind of people that frequent the river for swimming, bathing, and laundry, as well as the general state of sanitation, may all contribute to the high infection rate in these fishes. Unhealthy human actions combined with unfavorable environmental conditions frequently expose fish to parasite infections and other illnesses (Sadauki *et al.,* 2022). This is notable in the discharge of domestic wastes and run-off from agricultural soil which introduce pollutants into the water body. The introduction of these pollutants into aquatic systems constitutes a major threat to hydro-chemical and fauna characteristics of the aquatic systems thereby exacerbating the incidence of fish diseases (Bukola *et al.*, 2015).

Numerous parasites from various taxonomic groups were found in various locations within the fish under study. Compared to cestodes, trematodes, and protozoans, nematodes were the most isolated intestinal parasite. Nematodes have been observed to penetrate subcutaneous tissue and are known to reside in body cavities where they derive energy for their metabolic processes (Akinsanya and Otubanjo 2006). As revealed in our work, several other studies have also reported the presence of ecto and intestinal parasites on or in various locations within the body of fishes ranging from skin, oesophagus, stomach, intestine, rectum etc. This study found that the intestinal tract contained more parasites than the gills. The higher number of parasites in the intestinal tract could be as a result of the presence of parasite ova and cysts in food particles ingested by the fish which are released during intestinal digesting activities (Omeji, 2012). There were no many parasites on the gills, which may be as a result of the water circulation flowing over the gills constantly preventing parasite reinforcement and existence. According to Marcogliese, (2011) majority of the parasites live in the intestine because of the way most parasites feed. In this study only *Dactylogyrus spp* was present on the gills with a prevalence rate of 12.5%.

The prevalence in *Ameiurus catus* did not differ significantly ($P>0.05$) when the male and female fishes were considered, however the female fish did carry more parasites (63.64%). The high level of food consumption by female fish which is necessary for egg development amplifies their risks of being infected. This finding is in one accord with Emere and Egbe, (2006) and Omeji *et al*., (2015).

Fish weighing between 151 and 200 grams had the highest risk of parasite infection. This implies that fish size play a crucial role in identifying the parasite burden. Fish that gain weight are more susceptible to parasitism. According to Poulin (2000), prevalence was observed to rise with fish size, which may have been caused by the larger fishes prolonged exposure to the environment. The length classes with the highest prevalence of parasite infection were those falling between 21 and 30 cm. The prevalence in relation to length class of fishes could be due to random selection during sampling (Akinsanya and Otubanjo, 2006).

CONCLUSION

The prevalence of gills and intestinal helminth and protozoan parasites in *Ameiurus catus* recorded in this study is significant and may be one of the limitations to optimum productivity of the fish in Uke River. It is certain that parasites possess the capacity to operate as severe infections, either directly killing the fish or making it more susceptible to predators. The number of nematodes identified was higher than that of cestodes, trematodes, and protozoans. Parasites isolated were *Eimeria spp*, *Hexamita spp*, *Protoopalina spp*, *Procamallanus spp*, *Dactylogyrus spp*, *Diphyllobothrium latum*, *Bothriocephalus claviceps* and were found to be existing in distinct regions of the fish analyzed. Consumers should avoid eating raw or undercooked fish and awareness of fish-born zoonotic parasites should be increased. To properly manage live fish habitat and lower environmental pollution, legislators, fish producers, and environmental health specialists should work closely together.

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