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BASELINE SURVEY ON ENDOPARASITIC FAUNNA OF THE SILVER CATFISH (*Chrysichthys nigrodigitatus*) FROM ESCRAVOS ESTUARY, DELTA STATE NIGERIA, AND ITS ZOONOTIC IMPLICATION FOR FISH CONSUMER'S HEALTH

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ABSTRACT

The Silver Catfish (*Chrysichthys nigrodigitatus*) is one of the important food fishes for the inhabitants of the Escravos Estuary. Due to lack of information on the parasites of fish species in the Escarvos Estuary, including *C. nigrodigitatus*, fish eaters from the Escravos Estuary are at grave danger of contracting zoonotic diseases. The purpose of this study was to determine the prevalence of endoparasites in the Silver Catfish (*Chrysichthys nigrodigitatus*) from the Escravos Estuary, Nigeria. A total of 180 samples of *C. nigrodigitatus* were collected from September 2023 to February 2024 from fish landing sites in Okerenkoko community. The fish samples were transported to Fisheries and Aquaculture Laboratory, Nigeria Maritime University, Okerenkoko for examination and endoparasites identification. Two genera of endoparasites were found that infect *C. nigrodigitatus* from the Escravos Estuary, namely *Procamallanus laevionchus* and *Pomphorhynchus laevis* belonging to nematode and acanthocephalan. Only 6 samples were infected with 12 endoparasites with a total prevalence of 3.33 %. More hosts were infested with more parasites in the rainy season than dry season with a rainy season prevalence of 4.17 % and 1.17 % for dry season. Prevalence (6.25 %) of endoparasites was higher in 40.0 – 49.9 cm size class than other length classes with 20.0 – 29.9 cm size class recording the least prevalence (1.67%). More female hosts (66.67%) were infested than male hosts (33.33 %). Parasites were only found in the intestine and stomach of *C. nigrodigitatus* with no parasite in the fillet, liver, heart, and kidney. In conclusion, fish consumers in the area are not at high risk of contracting zoonotic disease because of the extremely low prevalence and severity of endoparasites in *C. nigrodigitatus*. Additionally, residents of the Escravos Estuary must be made aware of the importance of eating cleanly prepared and cooked fish to prevent the spread of zoonotic parasites.

Keywords: Endoparasites, Escravos Estuary, Zoonosis, *Chrysichthys nigrodigitatus,* Prevalence, Intensity

INTRODUCTION

Fish can serve as possible hosts for a variety of parasites, making parasites a common occurrence in both commercial and recreational fishing. Fish-attacking parasites are typically linked to unfavorable environmental conditions including salinity and temperature fluctuations (Yusni et al. 2022). Khalid et al. (2021) claim that fish parasites cause significant economic losses to fish populations. In addition to their potential zoonotic hazard, fish parasites are among the most prevalent infectious agents influencing aquaculture output globally (Abd-ELrahman et al. 2023). Fish parasites are classified as either ectoparasites or endoparasites (Tessema, 2020). Endoparasites are internal parasites that are widespread in both wild and cultivated fish and are easily spread to people, particularly when the fish are improperly prepared or handled in an unsanitary manner. Endoparasites can deform the body structure of fish and have negative effects that prevent the affected organs from functioning normally (Shaheen et al. 2014). Fish endoparasites have a wide range of consequences on their hosts, including the ability to hinder host development, survival, and reproduction as well as the marketability of fishery products (Bouwmeester et al. 2020; Koepper et al. 2022). According to Rahmati et al. (2020), human anisakidosis is a very painful inflammation of the gastrointestinal tract which is caused by ingesting third-stage larvae (L3) in fish that has not been cooked enough. The endoparasites of fish, such as Anisakis, Contracaecum, Pseudoterranova, and Phocascaris, belong to the Anisakinae family. The abiotic and biotic characteristics of the environment may have an impact on the differences in the mechanisms of parasite infections directed towards fish (Ucang et al. 2019). In addition to zoonosis, parasite infection in fish can have a detrimental effect on fish species' acceptance value and flesh quality. Fish infections have directly endangered the health and growth of the fishes and have indirectly endangered human physiology and morphology Khalid et al. (2021). Because of its superior nutritional value, fish is essential to human nutrition. For humans and other livestock, fish is a great source of protein (Abidemi-Iromini & Adelegan, 2019; Onoja-Abutu et al. 2021; Asuquo & Eyo, 2023). In addition to protein, fish are a good source of minerals, fats, and vitamins that help maintain food and nutrition security. However, eating fish has its own set of public health problems even if it is an important dietary source (Idowu et al. 2023). The Silver Catfish (*Chrysichthys nigrodigitatus*) is a significant food fish that the people living in the Escravos River eat because of its solid flesh, pleasant flavor, notable size, and nutritious makeup. The Nigeria Maritime University has two campuses in Kurutie and Okerenkoko, two island towns in Warri South-West Local Government Area of Delta State that are part of the Escravos Estuary (Eyo et al. 2023). By implication, animal protein from the fisheries resources of the Escravos Estuary, including Silver Catfish, are extremely important to the University community, which includes staff, students, and the native inhabitants of the island. Several researchers have examined the parasites of various fish species in Nigerian water bodies and culture systems, according to literature search (Ekanem et al. 2011; Ekanem et al. 2014; Effanga and Eyo, 2018; Eyo & Effanga, 2018; Osimen & Anagha, 2020; Asuquo & Eyo, 2023). However, there is no information available regarding the parasites of fish species in the Escarvos Estuary, including *C. nigrodigitatus*, indicating that fish eaters from the Escravos Estuary are at grave danger of contracting zoonotic diseases. Thus, the purpose of this work was to investigate the endoparasites of *C. nigrodigitatus* from the Escravos Estuary, and its implications on the health of fish consumers from a zoonotic perspective.

MATERIALS AND METHODS

Study Area description

This study was carried out in the Escravos Estuary, Warri South-West Local Government Area of Delta State (Figure 1). Situated in the southern region of Nigeria, the Escravos Estuary is geographically located between latitude 5.6º N and longitude 5.3º E. Fish samples were collected at Okerenkoko fish landing sites.

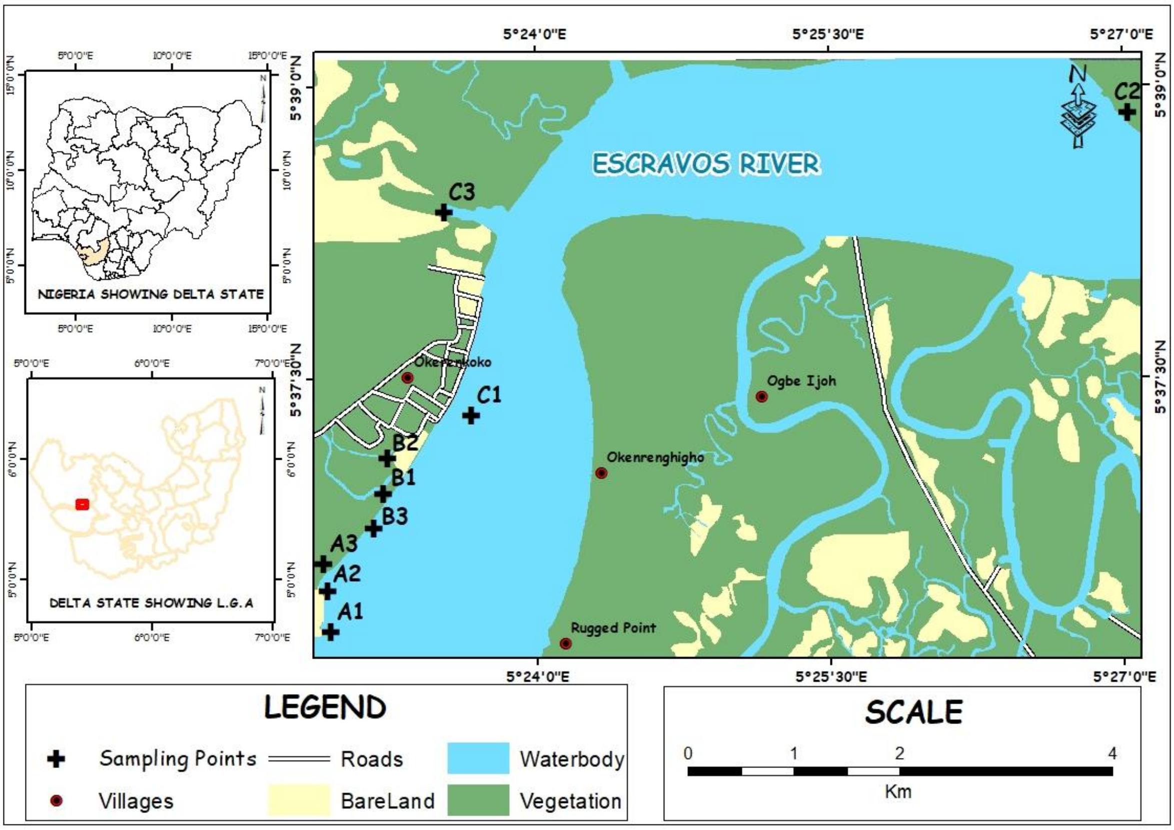

Figure 1: Map of Study showing sampling points

Sample collection and identification

A total 180 sample of *C. nigrodigitatus* of were collected from fish landing sites in Okerenkoko fishing community between September 2023 to February 2024.

Plate 1: The Silver Catfish (*Chrysichthys nigrodigitatus*)

Sample preservation, transportation and identification

Following collecting, the fresh fish specimens were quickly transported in an ice chest to the Fisheries and Aquaculture Laboratory at Nigeria Maritime University, Okerenkoko Campus. Fish identification guide by Idodo-Umeh (2003) was used to identify the fish species that were collected.

Measurement of morphometric parameters

Morphometric data of each *C. nigrodigitatus* including total length (TL – cm) and body weight (BW – g) of each fish were measured following Asuquo & Eyo (2023). Total length was measured from the tip of the snout to the tip of the caudal fin to the nearest 0.1 cm using a measuring board with calibration in centimeter. A digital scale (OHAUS SPX622) was used to measure the total weight to the closest 0.1g.

Determination of fish sex

The sexes of *C. nigrodigitatus* were determined by dissecting the fish to examine for the absence or presence of ovaries or testes (Osimen & Anagha, 2020).

Parasitological examination

Following the methods Koepper et al. (2022), the body cavity of the fish was cut-opened with a sharp scissor, and the intestine, heart, liver, kidney, stomach and fillets were removed and examined for endoparasites. After being removed from the host tissue, the endoparasites were collected in 70% ethanol and preserved in glycerin (Koepper et al. 2021). Subsequently, the parasites were preserved on tiny slides and later identified using original descriptions and key given by Parpena (1995).

Assessment of Parasitological indices

The formulas provided by Upadhyay et al. (2012) were used to calculate the parasitological indices, which were as follows:

$$\text{Abundance}=\frac{\text{Total number of parasite recovered}}{\text{Total number of fish examined}}$$

$$\text{Intensity}=\frac{\text{number of collected parasites}}{\text{number of infested fish}}$$

$$\text{Prevalence}=\frac{\text{No of fish infected}}{\text{Total number of fish examined}}\times\frac{100}{1}$$

Statistical Analysis

Predictive Analytical Software (PASW) version 20 was used for statistical analysis after all parasitological data were processed in Microsoft Excel (version 13.0).

RESULTS

Overall and parasite wise abundance, intensity and prevalence of endoparasites in *C. nigrodigitatus* from the Escravos Estuary

A total of 180 *C. nigrodigitatus* as indicated in Table 1 were collected from the Escravos Estuary, and their endoparasite content was assessed. Six (6) of the one hundred and eighty (180) fish that were examined had 12 endoparasite infections, totaling 3.33 % in prevalence, 0.06 in abundance, and 2.00 in intensity. There were only two types of parasites found: *Procamallanus laevionchus*, a nematode, and *Pomphorhynchus laevis*, an acanthocephalan. *P. laevionchus* had an abundance of 0.02, intensity of 1.50, and prevalence of 1.11 %, while *P. laevis* had an abundance of 0.05, intensity of 2.25, and prevalence of 2.22 %.

Seasons wise Abundance, intensity and prevalence of parasites in *C. nigrodigitatus* from the Escravos Estuary

Table 2 illustrates that during the rainy season, five (5) hosts were contaminated with ten (10) parasites, compared to just one host (1) and two (2) parasites during the dry season. In comparison to the dry season, when parasite abundance (0.03) and prevalence (1.17%) were lower, the rainy season had increased parasite abundance (0.08) and prevalence (4.17%). The intensity of parasites was 2.00 in both seasons.

Table 1: Overall and parasite wise abundance, intensity and prevalence of endoparasites in *C. nigrodigitatus* from the Escravos Estuary

Parasites	Host examined (%)	Host infested (%)	No. of parasites collected	Abundance	Intensity	Prevalence (%)
Nematode (*Procamallanus laevionchus*)		2 (33.33)	3	0.02	1.50	1.11
Acanthocephalan (*Pomphorhynchus laevis*)		4 (66.67)	9	0.05	2.25	2.22
Total	180 (100.00)	6 (100.00)	12	0.06	2.00	3.33

Table 2: Seasons wise Abundance, intensity and prevalence of parasites in *C. nigrodigitatus* from the Escravos Estuary

Season	Host examined (%)	Host infested (%)	No. of parasites collected	Abundance	Intensity	Prevalence
Rainy	120 (66.67)	5 (83.33)	10	0.08	2.00	4.17
Dry	60 (33.33)	1 (16.67)	2	0.03	2.00	1.67
Total	180 (100.00)	6 (100.00)	12	0.06	2.00	3.33

Abundance, intensity and prevalence of parasites in *C. nigrodigitatus* from Escravos Estuary in relation to size class

The length of the host fish was found to increase with an increase in the number, intensity, and prevalence of endoparasites. According to Table 3, 40.0–49.9 cm size class (adult hosts) had higher endoparasite abundance, intensity, and prevalence (0.19, 3.00, and 6.25%) than other length classes, where the younger fish hosts in the 20.0–29.9 cm size class had the lowest endoparasite abundance, intensity, and prevalence (0.05, 1.50, and 1.67%).

Table 3: Abundance, intensity and prevalence of parasites in *C. nigrodigitatus* from Escravos Estuary in relation to size class

Size class (cm)	Host examined (%)	Host infested (%)	No. of parasites collected	Abundance	Intensity	Prevalence
20.0-29.9	60 (33.33)	1 (16.67)	3	0.05	1.50	1.67
30.0-39.9	104 (57.77)	4 (66.66)	6	0.06	2.00	3.85
40.0-49.9	16 (20.00)	1 (16.67)	3	0.19	3.00	6.25
Total	180 (100.00)	6 (100)	12	0.06	2.00	3.33

Sex-wise Abundance, intensity and prevalence of parasites in *C. nigrodigitatus* from Escravos Estuary

As shown in Table 4, more female hosts (4 – 66.67%) were infested with more parasites (9) than male hosts with only 2 host and 3 parasites. Sex wise abundance (0.07), intensity (2.25) and prevalence (3.23 %) of parasites in female hosts were higher than male hosts with abundance (0.05), intensity (1.15), and prevalence (2.57 %).

Table 4: Sex-wise Abundance, intensity and prevalence of parasites in *C. nigrodigitatus* from Escravos Estuary

Sex	Host examined (%)	Host infested (%)	No. of parasites collected	Abundance	Intensity	Prevalence
Male	56 (31.11)	2 (33.33)	3	0.05	1.50	2.57
Female	124 (68.89)	4 (66.67)	9	0.07	2.25	3.23
Total	180 (100.00)	6 (100)	12	0.06	2.00	3.33

Organ wise Abundance, intensity and prevalence of parasites in *C. nigrodigitatus* from Escravos Estuary

Organ wise abundance, intensity and prevalence of parasites in *C. nigrodigitatus* from Escravos Estuary (Table 5) revealed that no parasites were detected in the fillet (muscle), liver, heart, or kidney; instead, parasites were only discovered in the intestine and stomach. A total of 10 nematodes (*P. laevionchus*) were recovered from the intestines of 5 different fish hosts with abundance (0.06), intensity (2.00) and prevalence (2.78 %). Out of a single host fish, only two acanthocephalans (*P. laevis*) with abundance (0.01), intensity (2.00), and prevalence (0.56 %) were found in the stomach.

Table 5: Organ wise Abundance, intensity and prevalence of parasites in *C. nigrodigitatus* from Escravos Estuary

Fish organ	Host examined (%)	Host infested (%)	No. of parasites collected	Type of parasites	Abundance	Intensity	Prevalence
Fillet	180 (100.00)	0 (0.00)	0	Nil	0.00	0.00	0
Liver	180 (100.00)	0 (0.00)	0	Nil	0.00	0.00	0
Heart	180 (100.00)	0 (0.00)	0	Nil	0.00	0.00	0
Kidney	180 (100.00)	0 (0.00)	0	Nil	0.00	0.00	0
Intestine	180 (100.00)	5 (83.33)	10	*P. laevis*	0.06	2.00	2.78
Stomach	180 (100.00)	1(16.67)	2	*P. laevionchus*	0.01	2.00	0.56

DISCUSSION

According to Abd-ELrahman et al. (2023), fish parasites are one of the most prevalent infectious agents that have an impact on fish output worldwide with a risk of zoonotic disease. In the current investigation, baseline data on endoparasite prevalence in Silver Catfish (*C. nigrodigitatus*) from the Escravos Estuary was collected, in addition to risk variables linked to infection and zoonosis. A total of 180 host fish specimens in all were sampled for this study and checked for the presence of endoparasites. Results showed that, with a total prevalence of 3.33%, only 6 fish hosts were infected with a total of 12 endoparasites. The 12 parasites that were found were from two different species: the nematode (*P. laevionchus*), which had 2 parasites, and the acanthocephalan (*P. laevis*), which had 10 parasites. The low prevalence of endoparasites (3.33%) found in this study is less than the 41% of trematodes, acanthocephala, nematodes, and protozoa for freshwater fish (Nile Tilapia) from Upper Egypt reported by Abd-ELrahman et al., (2023). The prevalence of endoparasites in this study is also lower than (32.9%) reported by Ejere et al. (2014) for fishes in Nigerian freshwater ecosystems and (38.5%) reported by and Gebreegziabher et al. (2020) fish in the Gilgel-Gibe River and three specific ponds in Ethiopia. Akinsanya et al. (2019) and Nzeako et al. (2014) showed a higher parasite prevalence (8.33% and 20.00%) in Lekki lagoon and the new Calabar river for the same species. The low endoparasite prevalence in *C. nigrodigitatus* from the Escravos Estuary may be related to the hygienic conditions of the estuary. The tidal impacts of estuaries, according to Nzeako et al. (2014), lowers the concentration of contaminants, which keeps estuaries clean. Furthermore, according to Wogu & Okaka (2012), estuarine proximity to the Atlantic Ocean may occasionally affect its salinity, making the river less conducive to the survival of freshwater parasites and the potadromous traits of *C. nigrodigitatus* may keep them from surviving in a habitat long enough to consume contaminated prey. Akinsanya et al. (2019) and Nzeako et al. (2014) showed a higher parasite prevalence (8.33% and 20.00%) in Lekki lagoon and the new Calabar river for the same species. The low endoparasite prevalence in *C. nigrodigitatus* from the Escravos Estuary may be related to the hygienic conditions of the estuary. The tidal impacts of estuaries, according to Nzeako et al. (2014), lowers the concentration of contaminants, which keeps estuaries clean. Furthermore, according to Wogu & Okaka (2012), estuarine proximity to the Atlantic Ocean may occasionally affect its salinity, making the river less conducive to the survival of freshwater parasites and the potadromous traits of *C. nigrodigitatus* may keep them from surviving in a habitat long enough to consume contaminated prey. In comparison to a lower size class with 20.0 – 29.9 cm size class having the least parasitological indices, *C.*

nigrodigitatus in a larger size class of 40.0 – 49.9 cm size class (adults' hosts) had the highest abundance (0.19), intensity (3.00), and prevalence (6.25%). These results are consistent with those of Ekanem et al. (2014), Iboh et al. (2016), Akinsanya et al. (2019), Effanga & Eyo (2018), and others who found that larger fish in comparable Nigerian water bodies had a higher prevalence than smaller fish. This can be because older fishes are exposed to the environment for longer periods of time than younger fishes, and these longer exposure periods might give the endoparasites more surface area and internal space in the gut and stomach to live (Effanga & Eyo, 2018). The results of the sex-wise parasitological evaluation showed that compared to male hosts (33.33%), more female hosts (66.67%) had higher parasite infestations (9) than male hosts. These results are consistent with research conducted on various fish species in comparable water bodies by Mwita and Lamtane (2014), Iboh et al. (2016), Effanga & Eyo (2018), and Akinsanya et al. (2019), but they differ from studies conducted by Ekanem et al. (2011), Idris et al. (2013), and Akinsanya et al. (2014). Emere (2000) suggests that the variance in parasite prevalence between sex may be associated with the level of resistance to infection. The explanation for the variation in prevalence between the sexes may be due to the physiological states of female and male hosts, particularly gravid hosts who have a lower tolerance to parasite infection (Effanga & Eyo, 2018). Additionally, because of the differences in their mating, feeding, and social activities, female fish may be more susceptible to parasites than male fish (Palm, 2011). The results of this investigation, which looked at six organs, revealed that the heart, kidney, liver, and fillet (muscle) in every sample of *C. nigrodigitatus* examined were clean and free from endoparasites. Only the intestine and stomach were discovered to have parasites; the intestine had the most number (10) and prevalence (2.78 %) of parasites, while the stomach had the lowest (2) and prevalence (0.56%). These results are consistent with those of Akinsanya et al. (2019) and Nzeako et al. (2014) for the identical species that was the subject of the current investigation. Nzeako et al. (2014) speculate that the higher number and frequency of endoparasites in the intestine may be caused by the vast amount of food that fish ingest.

CONCLUSION

The current study is a novel investigation of fish parasites in the Escravos Estuary and has provided baseline data on the endoparasites of the Silver Catfish (*C. nigrodigitatus*), which is one of the major food fish species consumed by the residents of Escravos Estuary. The investigation showed that fish consumers in the area are not at high risk of contracting zoonotic disease because to the extremely low prevalence and severity of endoparasites in *C. nigrodigitatus* from the Escravos Estuary. But because these endoparasites have the potential to spread to fish consumers in the Escravos Estuary, control measures must be considered in order to prevent zoonosis. Additionally, residents of the Escravos Estuary must be made aware of the importance of eating cleanly prepared and cooked fish in order to stop the spread of zoonotic parasites.

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