



OCCURRENCE AND PREVALENCE OF ECTO AND ENDO-PARASITES IN *Oreochromis niloticus* and *Tilapia zillii* FROM CALABAR RIVER, NIGERIA

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ABSTRACT

This study investigated the occurrence and prevalence of fish parasites in *Oreochromis niloticus* and *Tilapia zillii* from Calabar River, Nigeria. Fish samples (n=38; consisting of *Oreochromis niloticus* n=21 and *Tilapia zillii* n=17) were collected from Calabar River with the aid of local artisanal fishermen and prevalence of endo and ecto trematode fish parasites investigated using standard methods. The overall prevalence of *Clinostomum* species in the study was 79% with a higher prevalence in *O. niloticus* (55.3%) compared with *T. zillii* (44.7%). Two (2) *Clinostomum* species were encountered in this study with *C. cutaneum* (60%) as the dominant species, while *C. tilapiae* was the least prevalent species (40%). Overall, *C. cutaneum* was prevalent in the skin (83.3%) compared with the intestine (27.7%), while on the other hand *C. tilapiae* was prevalent on the intestine (75%) compared with the skin (25%). Results presented herein indicate a significant occurrence and prevalence of trematode parasites in food fish species from the Calabar River with potential wildlife, environmental and human health concern mostly for humans who depends on fish from Calabar River as a cheap source of protein.

KEYWORDS: Ecto and Endo parasites, *O. niloticus*, *T. zillii*, Calabar River, Nigeria

INTRODUCTION

Fin and shell fishery constitute a significant source of economic development and food safety in Nigeria and many other developing countries where about 35 million people have been reported to depend on its fisheries for livelihood (FAO, 1996; Ekanem et al., 2011). This is because, fish provides a cheap source of protein for the local populace and majority of the fish supply comes from surrounding rivers that are contaminated with several environmental pollutants (Adeyemo et al., 2003). The presence of parasites in fish have been reported to produced immune system effects, pathological damages with increased infections in host fish species and resulting effect on nutritional value and fish parasites include a vast range of parasitic organisms ranging from protozoans, round worms, flat worms that find their way into the system of fishes (Hoffman, 2019), belonging to the phylum Platyhelminthes, nematodes, and protozoans (Hoffman, 2019).

Also, the presence of parasites in the host organisms have been implicated in eliciting deficiency in fish physiological, health and the overall performance (Maraganga, 2023). A previous study showed that pathological effects caused by parasites in fishes was more deleterious in polluted water than in clean water (Kiprono, 2017). This was partly due to the fact that pollutants acted as catalysts and irritants, thus, stressing the fish physiology and causing a decrease in the fish resistance to diseases. Biotic factors such as host age, weight, maturity, sex and parasite lifecycle also affect the resistance of the fish and reduces its immune system (Pouder, 2005). Fish parasites have the ability to be passed from fish to vertebrates especially humans and have been implicated the transfer of many zoonotic diseases (Kiprono, 2017). Climate change and its associated changes in the ecological balance and systems have given a wide range of favourable conditions for parasites to thrive in the depleted environment.

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These changes in ecological balance provides a platform within which parasites breed, thus developing pathogenic problems to the organisms inhabiting that habitat (Horwitz et al., 2005). While there are reports on the occurrence of fish parasites from selected fish farms (Mowang et al., 2025; Gboeloh et al., 2016), Great Kwa River (Ekanem et al., 2011) and Calabar River (Ekanem et al., 2018). The paucity of information on the occurrence of endo and ectoparasites in *Tilapia* species from the Calabar River. Hence, it is important to investigate the occurrence and prevalence of parasites in the scales, gills and intestine of *Tilapia* species which are important ecological and economical food fish species in Calabar. This study is therefore aim at investigating the occurrence of endo and ecto parasites in commercially important food fish species (*Oreochromis niloticus* and *Tilapia zillii*) from the Calabar River, Nigeria. This scientific data is very crucial and needed to towards providing bases line information that is targeted towards food safety and security.

MATERIALS AND METHODS

Description of study area: The Calabar River flows from the Northern part of the Calabar city and joins with the south region at about eight kilometres. The Calabar River is deep enough to carry vessels. It drains from part of the Oban hills in the cross river national with a longitude of 8° 18'E and latitude 4° 58'3N (Figure 1). Studies shows that the basin of the river is 43 kilometers wide and 62 kilometer long, having an area of 1,514 square kilometres (Eze and Effiong, 2010). The basin of the river has 223 streams with a total of 516 kilometres. The drainage system of the river in Calabar is poor and so the basin is subjected to gully erosion, flooding and landslides (Eze and Effiong, 2010).

Collection of samples

For this study, a total of 38 *Tilapia* species consisting of 21 *O. niloticus* and 17 *T. zillii* were collected along the entire length of the Calabar River with the aid of local artisanal fishermen. The fish samples were collected at about 08:00 hrs, preserved on ice and transported to Zoology and Environmental Biology Departmental Laboratory, University of Calabar, Calabar, where they were sorted into sexes and then the length and weight of individual fishes were taken.

Fish morphometric measurements and condition factor estimation

In the laboratory, the fish total length (cm), body weight and gonad weight (g) were determined using digital Vernier Caliper (Tresna Instruments) and an Ohaun digital weighing balance (Metler Instruments) respectively, while fish condition factor was estimated using the equation $k=100W/L^3$ (Fulton, 1902).

Parasite analysis

In the laboratory, all collected fish were sacrificed, weighed (total weight in grams), measured (total and standard lengths in centimeters), identified, and fixed in 4% formalin. The identity of fish samples was confirmed and sorted into different species based on external body features described (Idodo-Umeh, 2003). For a collection of parasites, fishes were placed in containers of 4% formalin, shaken and the sediments examined for the presence of *Clinostomum* species.

Ectoparasites analysis

The fish scrapings from the scales, fins, skin and gills of the fish specimen were smeared on clean glass slides, covered with cover slides and examined under light microscopes for ectoparasites. Some parasites were collected and fixed in 4% phosphate buffered formalin (PBF) for further processing and species identification (Paperna, 1980; 1996). Each sample was examined independently for parasites according to the protocol outlined in Obiekezie and Ekanem (1995). Skin scrapings and wet mounts from fins, skin and gills were examined for abundance and distribution of ectoparasites. Identification of parasites was carried out according to Yamaguti (1961), Roberts (2000), Obiekezie and Enyenihi (1988) and Obiekezie and Ekanem (1995).

Endoparasites analysis

The stomach of each fish was cut opened ventrally with a pair of scissors and the internal organs removed for examination. Organ squash of the organs and intestine were made and examined as wet mounts under the microscope while other parts were fixed in PBF for isolation, and identification of parasites (Paperna, 1980, 1996).

Determination of percentage incidence of fish parasites

The percent incidence of both ecto- and endoparasite were calculated according to Tombi and Bilong (2004). Percentage incidence (%) = $(n/N) \times 100$

Where, n is the number of individual parasites species isolated, N is the total numbers of parasites isolated from individual fish.

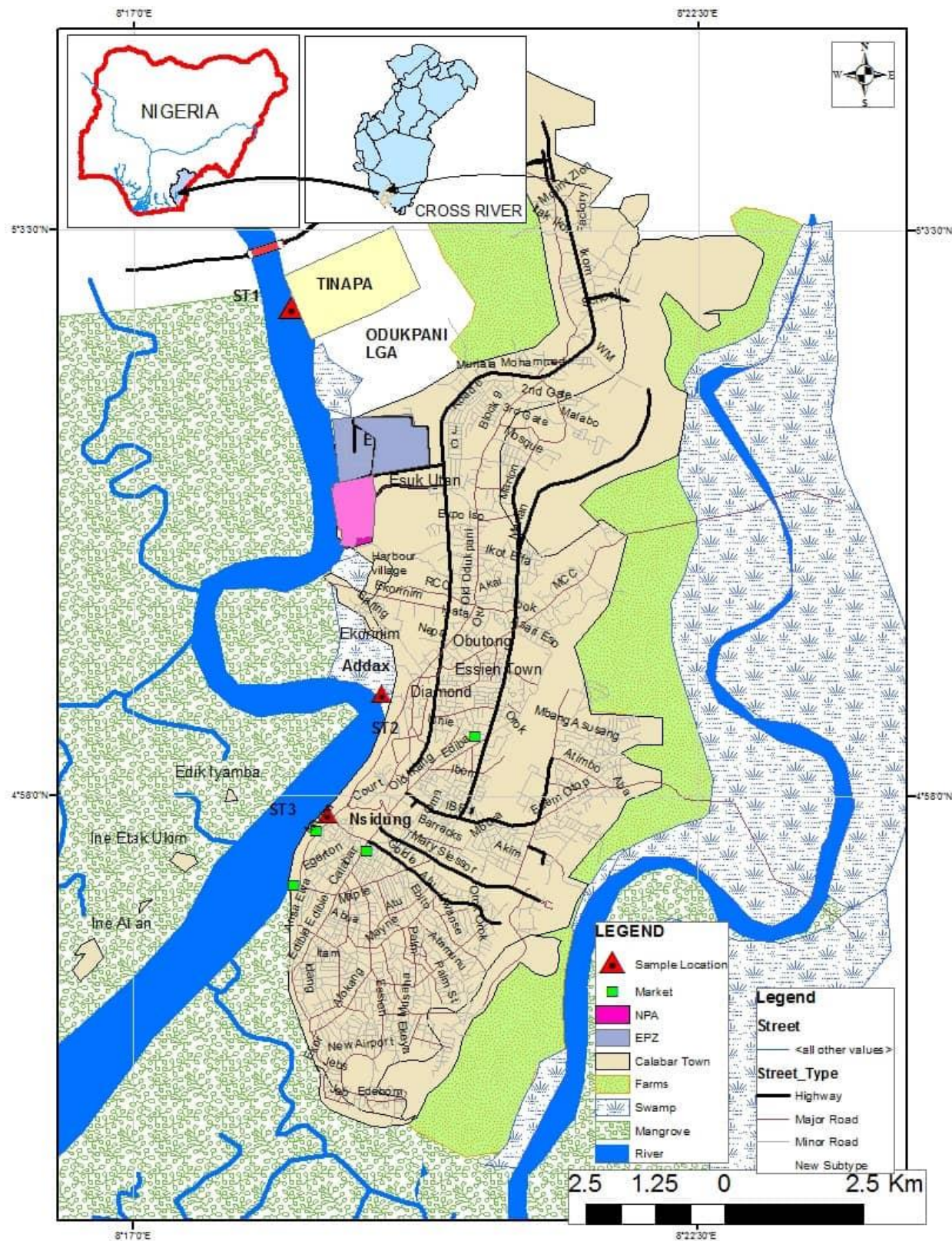


Fig 1: Map of the study area showing the two sampling stations Along the Calabar River.

RESULTS

Abundance of Tilapia species from Calabar River

A total of thirty-eight (38) samples of Tilapia species consisting of twenty (21, 55.3%) samples of *O. niloticus* and seventeen (17, 44.7%) of *T. zillii* were encountered in this study (Figure 2A). The 38 fish species encountered during this study belong to two main species, *O. niloticus* and *T. zillii*. The *O. niloticus* commonly called the Nile tilapia with a deep-body characterized with a truncated caudal fin that has many thin bands, while *T. zillii* on the other hand has a uniform colour (Figure 2B). The weight of fish samples collected in this study ranged from 90-316.9g.

Prevalence of helminths parasites in Tilapia species.

The overall prevalence of trematode parasites in Tilapia species from Calabar River was 78.9% (Figure 3A). Two trematode species of the same general, identified as *Clinostonium cutaneum* and *Clinostonium tilapiae* were observed in this study. *C. cutaneum* was the most abundant trematode fish parasite in tilapia species from Calabar River consisting of 60% while *C. tilapiae* was the least abundant parasite consisting of 40% (Figure 3B). *C. cutaneum* was mostly found on the skin, while *C. tilapiae* was found both on the skin and in the intestine. The prevalence of *C. cutaneum* in the skin 83.3% and 27.7% in the intestine, while for *C. tilapiae* it was 25% prevalent in the skin and 75% prevalence in the intestine (Figure 4A). The occurrence of fish parasites was higher in *O. niloticus* (55.3%) compared with *T. zillii* (44.7%) (Figure 4B).

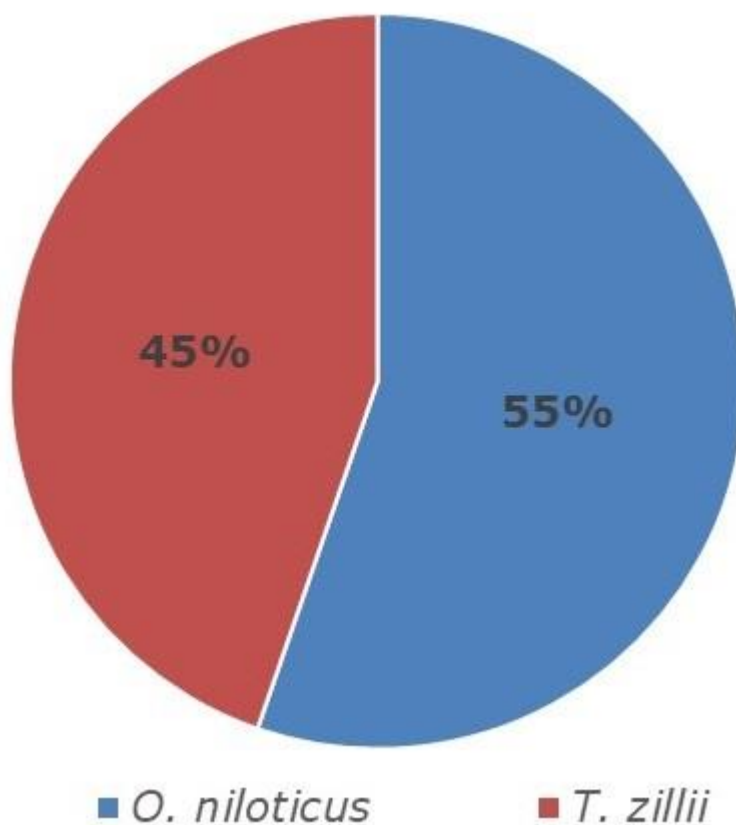


Figure 2A. Abundance of Tilapia species from Calabar River.

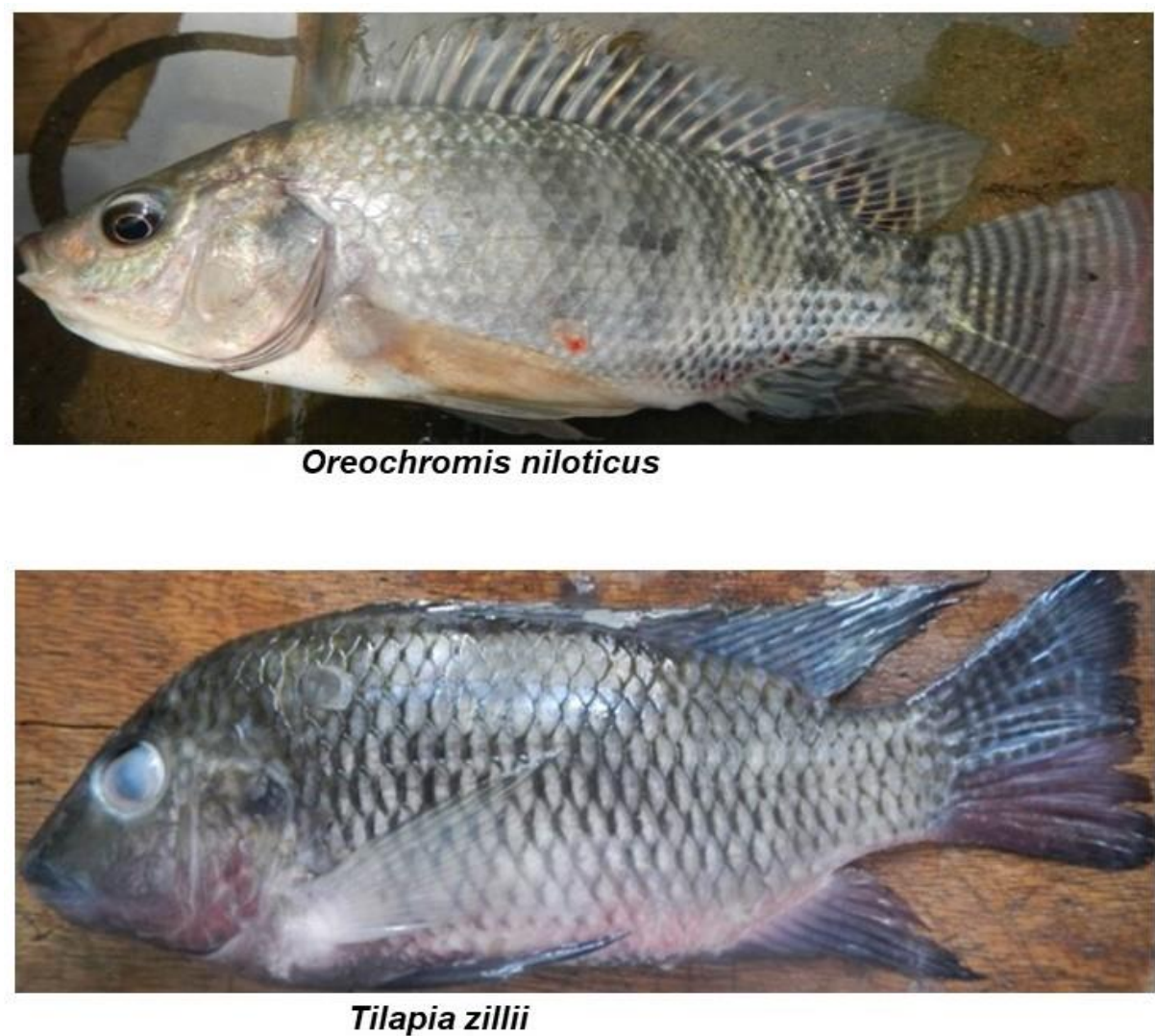


Figure 2B. Morphological images of *Oreochromis niloticus* (Linnaeus,1758) and *Tilapia zillii* (Linnaeus,1758) from Calabar River.

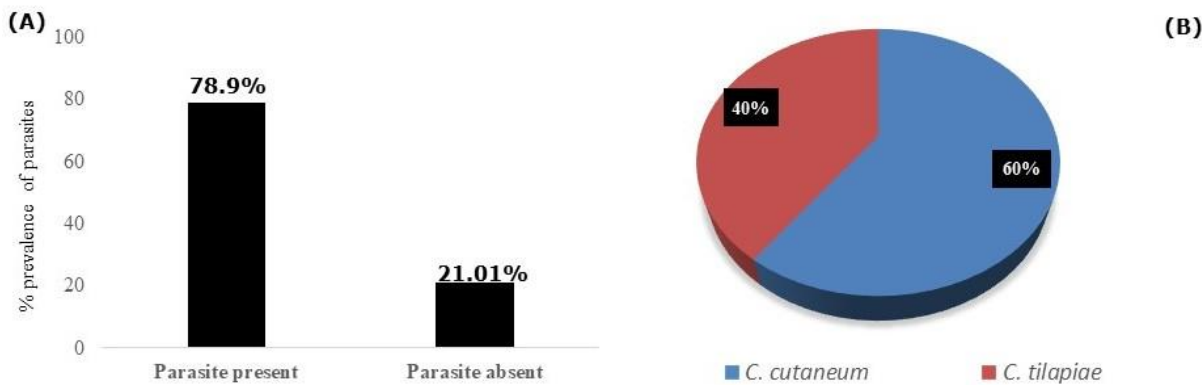


Figure 3: Prevalence of trematodes parasites in tilapia species from Calabar River.

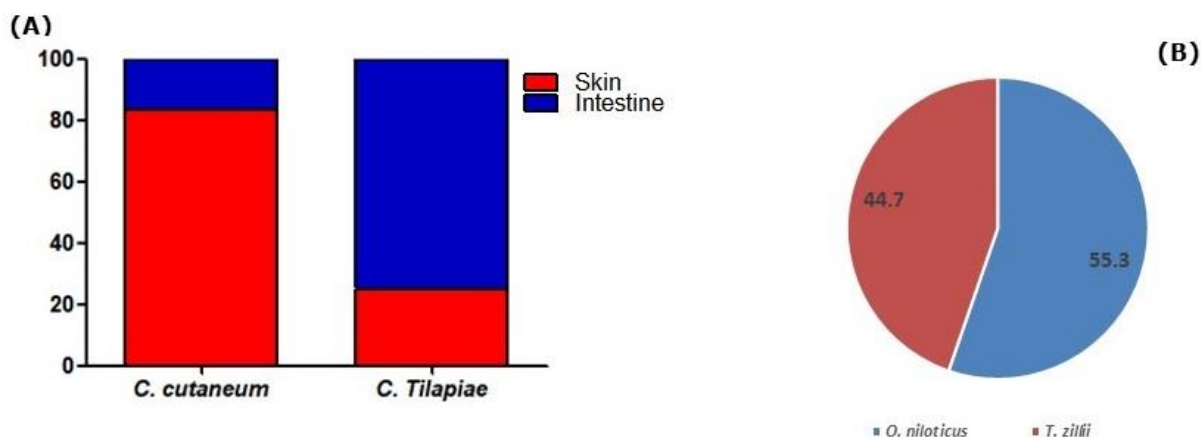


Figure 4 A and B. Species and site prevalence of trematodes parasites in fish samples from Calabar River.

DISCUSSION

The management and conservation of wild fish populations entails detailed and accurate scientific information concerning their biology and ecology (Gupta *et al.*, 2020). Therefore, freshwater fish parasites, particularly those that infect economically and ecologically important food fish species have attracted significant attention which in many cases devalues their aesthetic quality and palatability (Silva-Souza and Ludwig, 2005; Oso *et al.*, 2017). The infections of fish by parasites also bring about behavioral changes, reduced growth, changes in sexual characteristics, and fecundity and result in many other maladaptive alterations of the infected host. These changes could have significant consequences not only at individual levels but also population, community, and ecosystem levels (Shirakashi and El-Matbouli, 2009). In this study, the occurrence and prevalence of trematode parasite in economically and ecologically important food fish species from Calabar River, Nigeria was investigated. Results showed a 79% parasite prevalence in sampled fish from Calabar River with *C. cutaneum* dominating the fish skin and external surfaces, while *C. tilapiae* was dominant in the intestine. Also, the parasite species prevalence was high in *O. niloticus* than in *T. zillii*.

Fish parasites compete for food, thereby depriving fish of essential nutrients and inhibiting growth leading to morbidity and mortality with consequent economic losses (Khalil and Polling, 1997). They also inflict damage on the hosts, sometimes causing gross mortalities, which can lead to great losses in commercial fisheries and aquaculture (Roberts, 2001). Fish parasites have the potential to affect fish through loss of blood and nutrients as well as the invasion of biochemical and immunological processes in the host fish (Paperna, 1996).

Hence, studying parasites contributes to a better understanding of the ecology of a system and also helps to develop appropriate methods of controlling them (Barson and Avenant-Oldewage, 2006). Parasites render fish susceptible to secondary infection by disease-causing agents such as bacteria, fungi, and viruses (Poulin, 2000). In this study, there was a significant prevalence of fish parasites in *Tilapia* species from Calabar and this may be a direct reflection on the extent of fish infection by certain parasites which maybe as an early warning indicator of deteriorating water quality (MacKenzie *et al.*, 1995). This is because, fish parasitism has been previously used as an indicator for evaluating the risk of exposure, acting as early warning systems for environmental deterioration (Palm, 2011). Also, the overall prevalence of parasites in *Tilapia* species from Calabar River could be due to the increased contamination of the Calabar River with pollutants. Domestic, industrial and agricultural effluents of anthropogenic origin including the crude oil exploration and exploitation activities along the Calabar River may be responsible for this significant parasite prevalence and these pollutants could affect the physiology and immune response of the fish present in the water, thus making them susceptible to parasitic infections.

In this study, one trematode degenerative parasite *C. cutaneum* and *C. tilapiae* were detected and recorded in *Tilapia* species from Calabar suggesting that these are the most prevalent and abundant fish parasites from Calabar River. The *Clinostomidae* are digenetic trematodes with a heteroxenous life cycle, involving both vertebrate and invertebrate hosts. The basic life-cycle of clinostomes, as exemplified by *Clinostomum complanatum*, comprises snails as the first intermediate hosts, in which miracidia hatched from eggs laid by adult flukes develop to sporocysts and then rediae that produce brevifurcate cercariae.

These brevifurcate cercariae penetrate fish, the second intermediate hosts, developing into metacercariae that are infective for the definitive hosts (Bullard and Overstreet, 2008). The adult stage lives in the oral cavity, pharynx, or esophagus of fish-eating birds, reptiles, and occasionally mammals, including man. *Clinostomum* metacercariae, known as 'yellow grubs' due to the color of their gut contents, may encyst in different sites (e.g., dermis, muscles, gill-arch) or remain free in the body cavity. The family Clinostomidae has a widespread distribution and many fish species have been reported as second intermediate hosts (Bullard and Overstreet, 2008). Consistent with the current study, *Clinostomum metacercariae* have been reported in cichlids from different fish species in Nigerian water systems including lakes (Olurin and Somorin, 2006; Echi *et al.*, 2012; Okoye *et al.*, 2014; Caffara *et al.*, 2017). Also, the presence of *C. tilapiae* and *C. cutaneum* (metacercariae) suggests that the *Tilapia* species from Calabar River maybe intermediate hosts in the local trophic web. They are both known to use fish as an intermediate host, while the cattle egret is the definitive host (Ukoli, 1966). *Clinostomum cutaneum*, re-described herein, shows a unique morphological feature: a Y-shaped uterus in the metacercarial stage. It differs from all other species of *Clinostomum* in the shape of its uterus (Gustinelli *et al.*, 2010). Herein, it was observed that a higher parasite prevalence was recorded in *O. niloticus* compared with *T. zillii* and this was not surprising considering the fact that *O. niloticus* feeds mainly on benthic materials, including detritus, by picking up larval stages of parasites, with a higher susceptibility of harbouring more trematodes (*Clinostomum*) compared with *T. zillii*. The metacercariae of *Clinostomum* in the specimens of fish host suggested the presence of snails in the study area which are the first intermediate hosts of parasites (*Clinostomum*).

Conclusion: In this study, the occurrence and prevalence trematode fish parasites in *Oreochromis niloticus* and *Tilapia zillii* from Calabar River, Nigeria was investigated. Results showed a significant high (79%) prevalence in fish parasites on the sampled population. Also, higher species prevalence was recorded in *O. niloticus* compared with *T. zillii* with *C. cutaneum* being prevalent in the skin and external features of fish, while *C. tilapiae* was prevalent in the intestine of the sampled fish population from Calabar River. Therefore, information provided herein suggest a significant high prevalence of fish parasites in food fish species from Calabar. This represent significant and valuable scientific data towards sustainable wildlife, environmental, human health safety in Nigerian.

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