FUDMA Journal of Agriculture and Agricultural Technology
ISSN: 2504-9496
Vol. 8 No. 1, June 2022: Pp.123-130

https://doi.org/10.33003/jaat.2022.0801.080

PREVALENCE OF GASTROINTESTINAL HELMINTHS OF AFRICAN CATFISH (*Clarias gariepinus* BURCHELL 1822) IN ZOBE RESERVOIR, KATSINA STATE, NIGERIA

MUSTAPHA AMADU SADAUKI, AKEEM BABATUNDE DAUDA* MOHAMMAD AWWAL YUSUF
Department of Fisheries and Aquaculture, Federal University Dutsin-Ma, PMB 5001, Dutsin-Ma, Katsina State, Nigeria
*Corresponding author email: tdabak@gmail.com; +2348062085120

ABSTRACT

A six months study was carried out to examine the gastrointestinal helminth of wild *Clarias gariepinus* from Zobe reservoir, Dutsin-Ma, Katsina State, Nigeria. A total of 162 pieces of *Clarias gariepinus* were purchased from fishermen at three (Raddawa, Tabobi and Makera) of the landing sites on Zobe reservoir between March and August 2021. Fish samples were identified at each of the three landing sites. The fish were transported alive to the fish biology laboratory, Federal University Dutsin-Ma, for the helminths examination. Experimental fish samples were measured for length and weighed. Stomach and intestinal parasites were, identified and counted. The helminths recovered include, one Cestode, *Monibothrium* sp, four nematodes, *Procamallanus* sp, *Contracaecum* sp, *Capilaria* sp and *Camallanus* sp and one *Metacercariae of* Trematode, with the Nematodes as the dominant helminths. The result showed higher number of the fish parasites in the intestine of *C. gariepinus*. The prevalence in female specimens of *C. gariepinus* 77 (88.50%) was higher than that of the males (84.00%). The Chi-square result was not significant showing there is no association between the sex and prevalence of helminths. It is not significant also for length and weight, but the sampling station had a P-value of 0.001, showing that there is a relationship between the sampling station and the prevalence of helminths in the sampled *C. gariepinus* from Zobe reservoir. The highest prevalence was from the Makera sampling station. African catfish from the Zobe reservoir were highly infested with gastrointernal parasites, and this cut across the sexes, ages and landing sites. Hence, *Clarias gariepinus* from the reservoir should be cooked properly to avoid the transfer of the parasites to the consumers. It is strongly advised that more studies should be carried out to examine parasites from other fish species from the reservoir, to ascertain the safety of consumers that relied on the reservoir for fish. It may also be important to put up regulations such as restrictions on waste disposal and grazing, that will limit potential activities that may encourage an increase in parasites around the water body.

Keywords: *Clarias gariepinus*, helminths, gastrointestinal, Nematode, Zobe reservoir

INTRODUCTION

Fish is one of the inexpensive and significant sources of protein and also has calcium, lipids, minerals, vitamins and oils. The by-product of fish can be incorporated into the feed of livestock and poultry. Among the most common fish available in Nigeria water is the catfish species of *Clarias gariepinus* (Dauda *et al.*, 2018). They occur mainly in still water, lakes and pools but may similarly be found in fast-moving water such as rivers, creeks and streams (Ayanda and Egbamuno, 2012). The fish is sourced from both natural water and aquaculture (Komatsu and Kitanishi, 2015). Until recently, the major sources of fish in Nigeria were streams, rivers and importation. Although the first attempt to practice fish farming started in Onikan, Lagos in 1951 (Dauda *et al.*, 2018), catfish farming was not commercially viable until the period between 1991 and 2001 (Hassan *et al.*, 2010). African catfish (*Clarias gariepinus)* belonging to the family clariidae is popular fish food, that is considered to be one of the most significant tropical fish for aquaculture in Nigeria (Froese and Pouly, 2014). The African catfish is considered one of the most lucrative candidates for fisheries and aquaculture in Africa (Froese and Pouly, 2014). *Clarias gariepinus*, a scale-less teleost displays wide-ranging ecological distribution in freshwater (such as reservoirs, rivers, creeks and pools) and brackish (such as estuaries and lagoon) water environments in Africa, from rivers, freshwater streams to lakes and rarely drying waterways (Enas *et al.*, 2013). African catfish are known to be omnivorous (they consume both plants and animals) and live in a wide range of aquatic environments, from pure to muddy, cloudy, highly polluted water bodies. It is highly valued in Nigeria both as smoked, dried or fresh. It is commonly categorized as an omnivore, feeding largely on aquatic insects, fish and higher plant debris as stated for catfishes in the River Ubangi, Central African Republic (Ahmad, 2014). According to Tripathi (2014), these characteristics render the *Clarias gariepinus* likely to be attacked by a diversity of parasitic animals. Freshwater fishes such as *Clarias gariepinus* and *Tilapia Zilli* function as definitive, intermediate hosts in the life cycle of numerous species of protozoan, metazoan and crustaceans parasites. In fisheries and aquaculture, some parasites may be highly pathogenic and contribute to high fish deaths and financial losses while in natural systems they may threaten the abundance and variety of native fish species e.g. *Clarias gariepinus* (Ogonna *et al.*, 2017). Abdel-Gaber *et al.* (2015) stated that fish species from freshwater streams such as rivers and creeks in Africa were infested by a diversity of adult helminth parasites such as *monogeneans, digeneans, cestodes, nematodes, acanthocephalans* and *aspidogastrean*. The contact between hosts (*Clarias gariepinus*) and parasites is a difficult relationship usually favouring one or the other depending on several factors (Khan, 2012). Parasite infections in some fishes have been reported to massively disrupt fish farming or aquaculture production and its profitable viability. The incidence and prevalence rate of parasite infections are closely associated with the ecological conditions of the water body and also the general well-being of the fishes (Ahmad *et al.,* 2016). The age of fish, the behaviour of the fish, physiological and immunological condition of the fish, the position of fish in the water column, and feeding habits of *Clarias gariepinus* can affect its contact with parasites (Sogbesan *et al.*, 2018). The parasite will mimic its host's (*Clarias gariepinus*) protein composition hence, influencing susceptibility and infectivity. In general, the amount of parasites required to cause injury to any host varies considerably with the size of the host and its well-being status (Khan, 2012). Parasitic infections in fishes enormously disturb fisheries' production and their profitable viability (Rameshkumar and Ravichandran, 2010). According to Okoye *et al.* (2014), these species of parasites usually affect the commercial value of produced fish and at the same time raise community health concerns, especially in zones where raw or smoked fish is eaten. Certain animal diseases can be transmitted to humans through the ingestion of raw or undercooked fish such as *opisthorchiasis, diphyllobothriasis, clonorchiasis, gnathostomiasis and anisakiasis*. Various adult and larval forms of different helminth parasites species were recovered from the gills, stomach and intestine of freshwater fishes and infection with these helminths can cause a severe loss in fish production (Shafi *et al.*, 2015). Parasites frequently damage their hosts (fish) by destroying host tissues, this may lead to secondary infection or providing a site for the development of secondary infestation or taking blood and cellular fluids from the host (MSG, 2017).This study investigated the gastrointestinal helminths of the African catfish (*Clarias gariepinus*) from Zobe reservoir, Nigeria.

Materials and methods

Study Area

Dutsin-Ma LGA is located in Katsina Central Senatorial district and lies on latitude 12̊ 27̍ 18''N and longitude 7̊ 29̍ 29''E with headquarters at Dutsin-Ma town. It covers a total land area of about 527km² (Dauda *et al.,* 2013). Zobe reservoir is an earth-filled structure located in the southern part of Dutsin-Ma LGA on the coordinates of 12°23'18"N and 7°28'29"E. It is one of the biggest dams in the state with a base of 2,750 m, a length of 360 m height of 48 m and a storage capacity of 179 million cubic metres (Dasuki *et al.,* 2014). The primary purpose of the dam was for domestic water supply and irrigation activities, while it has over time served as a source of fish, providing a livelihood for fishermen and cheap quality protein for the consumers.

Sample Collection and Identification

A total of one hundred and sixty-two (162) life fish samples of individual *Clarias gariepinus* of different sizes were randomly collected from artisanal fishermen using various fishing gears (long line, traps, and nets) from three major landing sites of Zobe reservoir (Tabobi, Makera and Raddawa) for a period of six months (March-August 2021) cutting across the end of the dry season and the beginning of the wet season. Immediately on the field, fish were identified using the freshwater fish identification guide by Olaosebikan and Raji, (2013). They were later transported live to the fish biology laboratory of the Department of Fisheries and Aquaculture, Federal University Dutsin-Ma, Katsina State.

Sexing of Experimental Fish

The sexes of the fishes were determined by physical examination of the external features of the fish samples (urogenital system), where males were characterized by protruded and elongated genital papilla and the female with round opening papilla as described by Sogbesan *et al.* (2018).

Measurement of Experimental Fish

The standard lengths (cm) were measured using a meter rule while the weight was measured using top loading sensitive weighing balance using standard techniques described by Sogbesan *et al.* (2018)

Examination of Gastrointestinal Helminths

The individual fish samples were dissected to expose the gastrointestinal tract. The gastrointestinal tract was removed and split into two portions stomach and intestine. The gastrointestinal tract was used for the parasitic examination because this is where food is most abundant for the parasites. Each section was placed separately in Petri dishes containing 0.9% normal saline. Each section was slit longitudinally and examined for parasites under a dissecting microscope between 10 and 30X magnification. The appearance of any worm or larva was simply detected by its wriggling movement in the normal saline solution under a microscope, then the helminths were separated into different groups using the morphological examination. Fish parasites recovered were counted and after that fixed and preserved in 5% formalin. Representative parasites were stained overnight with a weak solution of Erlich's haematoxylin for proper identification (Sogbesan *et al.*, 2018).

Identification of Parasite

The parasites were identified to a species level morphologically using standard identification keys and pictorial guides (Scholz *et al.*, 2004; Pouder *et al.*, 2005).

Parasite Prevalence and Intensity Estimation

Prevalence of parasites infection

The prevalence of parasites infection was calculated for sex, location, length and weight using the model described by Sogbesan *et al.* (2018):

Prevalence (%) = $\frac{No\ of\ fish\ hosts\ infected x100}{\text{Total no.of fish hosts Examined}}$

$$\%\ of\ \ infection = \frac{Number\ of\ a\ specific\ parasite\ in\ the\ samples}{total\ number\ of\ parasites\ in\ the\ samples}\ x100$$

Data Analyses

Data were presented using descriptive statistics, a simple percentage was used to present the prevalence and distributions of parasites. The Chi-square test of independence was used to examine the association between infection and the risk parameters for the prevalence.

RESULTS

A hundred and sixty-two (162) pieces of wild *C. gariepinus* obtained from the Zobe reservoir were examined for fish parasites. Of the 162 fish examined, 142 were infected. The distribution of the gastro-intestinal helminths according to the Class is shown in table 1, there are three Classes namely, Nematode, Cestode and Trematode. The Nematode was the dominating Class with 50.33% of the percentage of infection. The three Classes had a total of six species, while the Nematode had four species, Cestode and Trematode had one species each (Table 2). Metacercarie stage of Trematode was the only Trematode found and it was 15.89% of the infection. *Monibothrium species* of Cestode was found and it was the highest single species of the helminths with 33.77%. Nematode had the highest number of species and the cumulative highest percentage of infection. The species were *Procamallanus* sp, *Contracaecum* sp, *Capilaria* sp and *Camallanus* sp. The distribution based on the site of infection (Table 3) showed a slightly higher infection (51.66%) in the intestine compared to the stomach (48.34). While trematode was equally shared between the two sites. Nematode had a higher percentage of infection (29.14) in the intestine than in the stomach (21.19). It was the other way round for Cestode with 19.20 in the stomach compared to 14.57% in the intestine. The prevalence of the gastrointestinal helminths in *C. gariepinus* from the Zobe reservoir showed an average of 86.42%. According to sex (Table 4), the females had a slightly higher prevalence (88.50%) than males (84.00%), the Chi-square result revealed no significant association between the sex and prevalence of the gastrointestinal helminths. The prevalence according to sampling locations (Table 5) showed that Makera had the highest prevalence of 90.74% while the least was observed in Raddawa with 74.07%. The results of the Chi-square (p=0.001) showed a significant association between the prevalence of gastrointestinal helminths and the sampling location. Prevalence in relation to size, length (Table 6) and weight (table 7) did not show any significant association according to the Chi-square test (p=0.700 and p=0.022 respectively). The length range of 15.1 – 20.0 cm had the highest prevalence of 88.05, while the least was recorded in the length range of 25.1 – 30.0 cm. The weight range of 10 – 20.9 g had the highest prevalence of 93.33% and the prevalence was decreasing with an increase in weight, with the least prevalence of 73.33 in the weight range of 73.33%.

Table 1: Class distribution of gastrointestinal helminths in *Clarias gariepinus* from Zobe reservoir.

Parasite	Number of parasites	% of infection
Nematode	76	50.33
Cestode	51	33.77
Trematode	24	15.89
TOTAL	151	(100)

Table 2: Species distribution of gastrointestinal helminths in *Clarias gariepinus* from Zobe reservoir.

Parasite	Number of parasites	% of infection
Procamallanus sp.	23	15.24
Contracaecum sp.	27	17.88
Capilaria sp.	16	10.60
Camallanus sp.	10	6.62
Monibothrium sp.	51	33.77
Metacercariae of trematode	24	15.89
TOTAL	**151**	**(100)**

Table 3: The distribution of the gastrointestinal helminths in *Clarias gariepinus* from Zobe reservoir based on site of infection

Parasite	% of infection	
	INTESTINE	**STOMACH**
Nematode	44 (29.14)	32 (21.19)
Cestode	22 (14.57)	29 (19.20)
Trematode	12 (7.95)	12 (7.95)
TOTAL	**78 (51.66)**	**73 (48.34)**

Table 4: Prevalence of Intestinal helminths of *Clarias gariepinus* in relation to sex in Zobe reservoir

SEX	No examined	No of infected	Prevalence of infection
Male	75	63	84.00
Female	87	77	88.50
Total	**162**	**140**	**86.42**

$\chi 2$ (1, n =162) =0.697, p=0.404

Table 5: Prevalence of Intestinal helminth of *Clarias gariepinus* in relation to sampling location in Zobe reservoir

Locations	No examined	No Infected	Prevalence of Infection
Raddawa	54	39	74.07
Tabobi	54	51	79.62
Makera	54	50	90.74
TOTAL	**162**	**140**	**86.42**

$\chi 2$ (2, n =162) =13.991 , p=0.001

Table 6: Prevalence of Intestinal helminth of *Clarias gariepinus* in relation to length in Zobe reservoir

Fish length (cm)	No examined	No infected	Prevalence of infection
10.0-15.0	48	41	85.41
15.1-20.0	67	59	88.05
20.1-25.0	24	21	87.50
25.1-30.0	10	8	80.00
30.1-35.0	13	11	84.61
TOTAL	**162**	**140**	**86.42**

$\chi 2$ (4, n =162) =2.194 , p=0.700

Table 7: Prevalence of Intestinal helminth of *Clarias gariepinus* in relation to weight in Zobe reservoir

Fish weight (g)	No examined	No of Infected	Prevalence of Infection
10-20.9	45	42	93.33
21-50.9	62	55	88.70
51-80.9	25	20	80.00
81-110.9	15	12	80.00
111-140.9	15	11	73.33
TOTAL	**162**	**140**	**86.42**

$\chi 2$ (4, n =162) =5.703 , p=0.222

DISCUSSION

Information has revealed that helminths are mostly found in all freshwater fishes, with their occurrence and intensity depending on the parasite species and their biology, host and its feeding habits, physical factors and cleanliness of the water body and presence of intermediate hosts where necessary (Hussen *et al.*, 2012). In this study, a total of five species of Helminths from three Classes were recovered. The dominant Class was Nematode with four species which was responsible for 50.33% of all the infection. Similar results were reported by Kawe *et al*. (2016) in *Clarias gariepinus* from different Council areas in Abuja, Nigeria. Kawe *et al*. reported two species of Nematode representing about 56% of the infection, a species of Cestode and two species of Trematode. Dan-Kishiya and Zakari (2007) also reported Nematode, Cestode and Trematode from wild *C. gariepinus* in Gwagwalada Abuja, While Salawu *et al*. (2013) reported Nematode Cestode from the digestive tracts of *C. gariepinus* from Ogun River and Asejire Dam in South-west, Nigeria. Abdel-Gaber *et al.*, (2015) and Khan, (2012) also reported similar results. However, Sogbesan et al. reported (2018) far higher in terms of number, species and Classes. Nine Classes, 16 species and 396 individual parasites were recovered from 60 adults and 60 juveniles of C. gariepinus from Lake Gerico, Yola, Adamawa State. Unlike our study which was limited to gastrointestinal, Sogbesan *et al*. (2018) recovered the parasites from the gill, skin, intestine and stomach. However intestine had the highest occurrence of the Helminths, a similar result was noted in the current study with more Helminths in the intestine than stomach.

Kawe *et al.* (2016) noted that parasitism varies in numerous aquatic environments and this is determined by the contact between biotic and abiotic factors. Fish species in healthy ecological conditions hardly come down with diseases (Kawe *et al.*, 2016). Abiotic factors such as augmented water temperature may change the immune/resistant status of fish favouring infection and setting up of parasites (Onyishi and Aguzie, 2018). The current study was carried out towards the end of the dry season to the early period of the rainy season in the study area. There is a high temperature and reduced volume of water during this period, and this might be responsible for the high prevalence of gastrointestinal helminths reported. Onyishi and Aguzie (2018) also had high gastro-intestinal helminths from fish sampled between February and July and they noted that the decrease in water capacity increased the rate of interaction of fish with parasites. The current research showed a higher prevalence of infection in smaller *C. gariepinus* compared to larger ones. This is in agreement with Biu *et al.* (2014) who stated that smaller fish were more infected compared to larger fish, maybe due to their nature of acquired immunity with age. The reason is that the immune system of the small fish is less developed and therefore, cannot resist parasites whereas the larger ones have fully developed immunity against parasitic infestations. Adebambo (2020) also stated that the lower incidence rate of adult fish to parasitic infection might be due to the fact that adult fish may have acquired resistance as a result of earlier exposure to parasites and other factors. In contrast, the current research disagrees with the results of Ashade *et al.* (2013) who reported that bigger fish and maybe matured fish have more parasitic infection compared to smaller fish because they feed more on different food sources thereby exposing them to more parasitic infestation. This study goes in tandem with the position of Kawe *et al*., (2016) who revealed that the environment is known to play a significant role in parasitic fauna prevalence. In this study, the prevalence varied from one location to the other, with Makera having a far higher prevalence, and unlike other parameters, there is a significant relationship between the prevalence of gastrointestinal helminths and the sampling location. This might be a result of activities and pollution status of the sites. Differences in the occurrence of infestation at different locations (sites) have been attributed to various factors such as endemicity, accessibility of intermediate hosts and weakness of the host to infection (Ogonna *et al.*, 2017). More so, the unhygienic practices among water users encourage the contamination of fish by helminths (Ani *et al.*, 2015; Ani *et al.*, 2016). Concerning the incidence of parasitic infestation in relation to the sex of *C. gariepinus*. The infestation rate was higher in females than that of male fish. This observation is similar to the finding documented by previous researchers (Dankishiya *et al.*, 2013; Amare *et al.*, 2014; Abdel-Gaber *et al.*, 2015), but disagrees with the finding of Ugbor *et al.* (2014) who stated more parasite infestation in males than in the female. Nevertheless, the female sex recorded more infections which could be due to differential nourishing either by quantity or quality of food consumed and as a result of different degrees of resistance to infection (Ogonna *et al.*, 2017).

CONCLUSION

The results from the experiment established that *C. gariepinus* in the Zobe reservoir is highly infested by helminth parasites, considering the prevalent status. This infestation cut across sexes, ages and sizes of the fish. This also happens in all the landing sites examined. The parasites are more prevalent in smaller fish than the big ones, they are also more prevalent in the female fish than the males. Unlike, sex and size, the sampling station showed an association with the prevalence of the helminth parasites. It is therefore important to educate the consumers to avoid eating uncooked and poorly cooked *C. gariepinus* from the water body. Activities that have the potential of increasing the abundance of helminth parasites may be regulated by necessary government agencies that are responsible for the management of the water body. The parasites, if left unattended to, are capable of interfering with the growth and production of the fish which may result in low yield and poor productivity of the highly important *C. gariepinus* from the water body.

Disclosure: There are no competing interests to declare

Data Availability: All the data are available with the corresponding author and could be made available on request

REFERENCES

Abdel-Gaber, R. El Garhy, M. Morsy, K. (2015). Prevalence and Intensity of Helminth Parasites of African Catfish *Clarias gariepinus* in Lake Manzala, Egypt. *Advances in Bioscience and Biotechnology* 6, 464-469. Published Online July 2015 in SciRes. http://www.scirp.org/journal/abb http://dx.doi.org/10.4236/abb.2015.67048.

Adebambo, A. A. R. (2020). Fish Species Parasites: A Review In Nigerian Water Bodies. *Journal of Research in Forestry, Wildlife & Environment* 12(3), 223-234. ISBN: 2141 – 1778 http://www.ajol.info/index.php/jrfwe

Ahmad, M.T. (2014). Effect of Mangifera indica L. (Mango) Kernel on *Clarias gariepinus* (African catfish) Fingerlings Infected with *Aeromonas caviae* (Doctoral dissertation). Department of Veterinary Pharmacology and Toxicology, Ahmadu Bello University, Zaria, Nigeria. Pp. 1-12.

Ahmad, I. Afshan, K. Ramzan, M. Hayat Rizvi, S. S. R. Qayyum, M. (2016). Effect of Water Quality Parameters on Isopod Parasite Alitropustypus (Aegidae)of Ectotherms in Chashma Lake, Pakistan. *Pakistan Journal of Zoology* 48(3), 769-779.

Amare, A. Alemayehu, A. Aylate, A. (2014). Prevalence of Internal Parasitic Helminthes Infected *Oreochromis niloticus* (Nile Tilapia), *Clarias gariepinus* (African Catfish) and *Cyprinus carpio* (Common Carp) in Lake Lugo (Hawke), Northeast Ethiopia. *Journal Aquac Res Development* 5, 233 doi:10.4172/2155-9546.1000233

Ani, O. C. Nnamani, C. V. Nnamonu, E. I. Oduburu, C. J. Martins, P. E. (2016). Phylloplane Parasites on Common Edible Plants of Eastern Nigeria: Easy Link to Intestinal Parasites Transmission. *International Journal Tropic Disease & Health* 13(1), 1-5.

Ani, O. C. Nnamonu, E. I. Onwe, S. O. (2015). Helminthiasis among Rural School Children of Amofia-Ngbo Community in Ebonyi State, Nigeria. *Journal Pharma and Biologi Sci* 10(4), 69-72.

Ashade, O.O. Osineye, O.M. Kumoye, E.A. (2013). Isolation, identification, and prevalence of parasites on *Oreochromis niloticus* from three selected River Systems. *Journal Fish Aquatic Sci* 1, 115-121.

Ayanda, O.I. and Egbamuno, E. (2012). A Histopathological examination of the liver and gills of *Clarias gariepinus* treated with glyphosate. *Environmental Research Journal* 6(3), 228-234.

Biu, A.A. Diyaware, M.Y. Yakaka, W. and Joseph, E. (2014). Survey of parasites infesting the Nile Tilapia (*Oreochromis niloticus* Linnaeus, 1758) from Lake Alau, Maiduguri, Nigeria. *Nigerian Journal of Fisheries and Aquaculture* 2(2), 6-12.

Dan-kishiya, A.S. and Zakari, M. (2007). Study on the gastrointestinal helminth parasites of *Clarias gariepinus* (Tuegels) in Gwagwalada, FCT, Nigeria. *BEST Journal.* **4**(2): 79-81.

Dan-kishiya, A. S. Oboh, A. and Ibrahim, U.B. (2013). The prevalence of Helminth parasites in the gastrointestinal tract of wild African sharp tooth catfish *Clarias gariepinus* (Siluriformes: Clariidae) in Gwagwalada, Nigeria. *UNED Research Journa*l 5, 83-87

Dauda, A.B. Natrah I. Karim, M. Kamarudin, M.S. and Bichi, A.H. (2018). African Catfish Aquaculture in Malaysia and Nigeria: Status, Trends and Prospects. *Fisheries and Aquaculture Journal* 2018, 9:1 DOI: 10.4172/2150-3508.1000237

Dauda, A.B. Yakubu, S.O. and Kabir I. (2013). Determinants of Fish Consumption in Dutsin-Ma LGA, Katsina State. In : J.A. Adediran, J.O. Saka, A.G. Ibrahim, V.A. Adeyemi, A.O. Atere and M.O. Adenekan (eds). Revamping Nigeria Agriculture through Transformation Agenda: The Way Forward. Proceedings of the 47th Annual Conference of the Agricultural Society of Nigeria held at the Federal College of Animal Health And Production Technology, Moor Plantation, Ibadan, Oyo State, Nigeria 4th – 8th November 2013. pp 1106-1109.

Dasuki, A., Dauda, A.B. Oshokem, J.O. Tiri, G.D. and Bichi, A.H. (2014). A Survey of Artisanal Fisheries of Makera Zone of Zobe Reservoir, Katsina State. In: Proceedings, 29th Annual Conference of Fisheries Society of Nigeria (Fison), held between 24th – 29th November 2014 at Royal Choice Inn Ltd, Gondo Aluor Road, Old GRA, Lobi Quarters, Makurdi, Benue State Nigeria. Pp 2-5

Enas, A. A. Doaa, M. Alaa Sayed, A. and Hassan A.H.S. (2013). Comparative Histomorphological Studies on Oesophagus of Catfish and Grass Carp. *Journal of Histology*, doi:10.1155/2013/858674.

Froese, R. and Pauly, D. (2014). *Clarias gariepinus* in Fish Base.

Hassan, A.A. Akinsanya, B. and Adegbaju, W.A.(2010). Impacts of Helminth parasites on *Clarias gariepinus* and *Synodontis Clarias* from Lekki Lagoon, Lagos, Nigeria" *Report and Opinion* Vol. 2, no . 11.

Hussen, A. Tefera, M. and Asrate, S. (2012). Gastrointestinal helminth parasites of Clarias gariepinus (Catfish) in Lake Hawassa Ethiopia. *Scientific Journal of Animal Science*, 1(4), 131-136.

Kawe, S.M. God'spower, R.O. Balarabe, M.R. and Akaniru R.I (2016). Prevalence of gastrointestinal helminth parasites of Clarias gariepinus in Abuja, Nigeria. *Sokoto Journal of Veterinary Sciences* 14(2), 26-33.

Khan, R.A. (2012). Host-parasite interactions in some fish species. *Journal of Parasitology Research*, Article ID 237280 | 7 pages https://doi.org/10.1155/2012/237280

Komatsu, K. and Kitanishi, K. (2015). Household Protein Intake and Distribution of Protein Sources in the Markets of Southern Ghana*:* A Preliminary Report. African Study Monographs, 51(3): 157-173.

MSG, (2017). Parasites Kill Fish. Minnesota Sea Grant (MSG) www.seagrant.umn.edu /fisheries/parasites Accessed 18 February 2017.

Ogonna, C. A. Emmanuel, I. N. and Cynthia, E. (2017). Prevalence of Intestinal Parasites of Fish Farmed and Harvested in Abakiliki, Nigeria: A Pointer to the Level of their Vulnerability. *International Journal of Research in Pharmacy and Biosciences* 4, 7-10.

Okoye, I.C. Abu, S. J. Obiezue, N. N. R. and Ofoezie, I. E. (2014). Prevalence and seasonality of parasites of fish in Agulu Lake, Southeast, Nigeria.*African Journal of Biotechnology* 13(3), 502-508. DOI:

10.5897/AJB2013.13384 Academic Journals http://www.academicjournals.org/AJB

Olaosebikan, B.D. and Raji A. (2013). A Field guide to Nigerian freshwater fishes Revised edition Federal College of Freshwater fisheries technology, New Bussa, Niger State. 144pp

Onyishi, G. C. and Aguzie I. O. N. (2018). Survey Of Helminth Parasites Of Fish In Ebonyi River At Ehaamufu, Enugu State, Nigeria. *Animal Research International* 15(3), 3112 – 3119

Pouder, D.B. Curtis, E.W. and Yanong, R.P.E. (2005). Common freshwater fish parasites pictorial guide. Digenean trematodes (FA112) and nematodes (FA113), 19.

Rameshkumar, G. and Ravichandran, S. (2010). Cymothoa indica (Isopoda; Cymothoidae) and Alitropus typus(Isopoda; Aegidae) on freshwater fish Tilapia mossambica (Cichlidae) in Vellar estuary, Southeast coast of India. *Biotemas*, 23: 67-70.

Salawu, M.T., Morenikeji, O.A., Sowunmi, A.A. and Odaibo, A.B. (2013). Comparative survey of helminth parasites of *Clarias gariepinus* and *Clarias pachynema* from the Ogun River and Asejire Dam in southwest Nigeria, *International Journal of Fisheries and Aquaculture*, 5(1): 7-11.

Scholz, T. Bray, R.A. Kuchta, R. and Řepová, R. (2004). Larvae of gryporhynchid cestodes (Cyclophyllidea) from fish. *Folia Parasitology* 51, 131-152.

Shafi, N. Ayub, J.and Akhtar, T. (2015). Physico - Chemical Variables and Fish Parasites of River Neelum Azad Jammu and Kashmir, Pakistan. *Journal of Bioresource Management* 2(2), 73-80.

Sogbesan, S.O. Eyiseh, T.E. Michael, E.T. (2018). Parasitic infection and prevalence in *Clarias Gariepinus* in Lake Gerio, Yola, Adamawa state. *MOJ Anat Physiol*. 5(6):376–381. DOI: 10.15406/mojap.2018.05.00229

Tripathi, A. (2014). The invasive potential of parasitic monogenoids (Platyhelminthes) via the aquarium fish trade: an appraisal with special reference to India. *Reviews in Aquaculture* 6, 147–161.

Ugbor, O.N. Odo, G.E. Nwani, C.D. Ochang, S.N. Somdare, P.O. and Agbakwuo C.A. (2014). Parasitic fauna of two dominant clariids (Siluriformes) catfish in a tropical freshwater ecosystem, Nigeria. *Nigeria Journal of Fisheries*11(1&2), 744-752.