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Seasonal Prevalence of Parasites of Clariids Fishes from the Lower Benue River, Nigeria

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ABSTRACT
The seasonal prevalence of parasites of Clariid fishes from the lower Benue River was conducted in this study. A total of six hundred (600) live fish, 300 each of *Clarias anguillaris* and *Clarias gariepinus* were examined for endo and ecto parasites, respectively. Different parasites belonging to different groups, namely protozoa (*I. multifiliis, Chilodonella sp,* and *Trichodina sp*), cestodes (*Diphillobothrium latum*), nematodes (*Procamallanus laevionchus, Capillaria sp* and *Eustrogylides sp*) and monogenean trematodes (*Dactylogyrus sp*) were found in different locations in the two Clariid fishes. There was no significant difference ($p>0.05$) in the prevalence of infection between *C. anguillaris* and *C. gariepinus*. Seasonal variations of parasitic infection in the fish species studied showed a significant difference ($p<0.05$). There was a higher parasite prevalence in *C. anguillaris* (27.33%) and *C. gariepinus* (29.33%) in the dry season than in the wet season (19.33%) for both species. Females of both fish species had more parasites load than the male in both seasons. There was a high percentage of parasite infestation (*C. anguillaris,* 67.8% and *C. gariepinus,* 41.09%) in the dry season compared with the wet season (*C. anguillaris,* 32.2% and *C. gariepinus* 49.00%). Fish between a total length group of (21 – 30 and 31 – 40 cm) were more parasitized than fish of other length classes. Variations in parasitic infestation were also observed among the different weight ranges in both seasons. The results are discussed in the context of fish parasite infestation and probable implication to fish productivity in lower River Benue Makurdi.

Key words: Ogun River, Seasonal Prevalence, Parasites, Clariids fishes, lower Benue River, Nigeria

INTRODUCTION

Fishes form a highly successful group of animals comprising of more than 40,000 species inhabiting all the seas, rivers, lakes, dams, muddy waters, brackish waters, estuaries and all places where there is water. A very wide distribution of fishes into a variety of habitat has resulted in numerous adaptations in their morphology, physiology and behaviour (Barber, 2000).

Clariid catfishes are among the most prominent and widespread of African freshwater fishes and they often form a large part of the catches in artisanal fisheries (Offem *et al*., 2010). The high rate of infection reduces the level of productivity and consequently low income to fish farmers. In Nigeria, the level of awareness of the impact of the disease to aquaculture is lacking as revealed by Berber and Wright (2006). In fish farming or aquaculture, some parasites may be highly pathogenic and contribute to a high fish mortalities and economic loss, while in natural systems they may threaten the abundance and diversity of indigenous fish species. The activities of the parasites secrete enzymes that destroy tissues, others secrete irritating substances and blood-feeding parasites may secrete anticoagulants (Marshall, 2011). This study was conducted to identify the parasites of *Clarias gariepinus* and *Clarias anguillaris* from the lower Benue River, compare the parasite loads in relation to length-weight and sex of the two Clariids fishes with reference to both dry and wet seasons.

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MATERIALS AND METHODS

Study area

The study was carried out in Makurdi the capital of Benue State, Nigeria located on Longitude 7°43′N and Latitude 8°32′E. The town is divided into the North and the South which is banked by the River Benue. River Benue exists year-round, the water volume fluctuates with the seasons and overflows its bank during the rainy season (May-October), but decreases drastically in volume leaving a tiny island in the middle of the River during the dry season (November-April). The river contains several species of fish which are of economic importance to the people of Benue State and Nigeria at large.

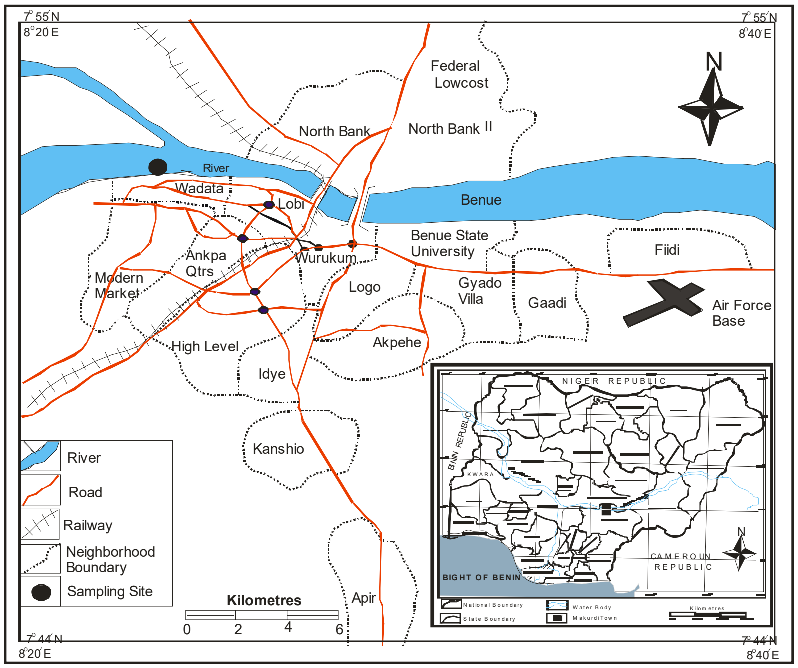

Figure 1. Map of Makurdi showing the sampling site.

Fish collection and identification

A total of six hundred (600) fish samples of the two Clariids catfish were bought from fishermen at the lower Benue River Makurdi Benue State, Nigeria over a period of eight months from January – August 2016, covering the dry and wet seasons. Gross physical examination of the external features of the samples were undertaken for abnormalities at the main landing site. Samples were thereafter transported in a 25 litres plastic container to the Faculty of Science, Biology Laboratory, Benue State University Makurdi, for identification using the keys provided by Teugels (1986). The total and standard lengths (cm) were measured using a measuring board (Goselle *et al*., 2008). Weight (g) was measured using a top loading, weighing balances (Mettler Toledo).

The skin, gills and fins of the fish were brushed into a petri dish containing 0.9% normal saline and examined with a hand lens for the presence of ectoparasites. Skin scrapings were obtained using scalpel blade and prepared as a smear when mixed with drops of physiological saline solution and using a dropper placed on glass slides covered with a cover slip and examined under a light microscope (Olympus CX31 RTSF) for protozoan parasites and smaller metazoan parasites as describes by Ekanem *et al*. (2011). The gills were examined using the techniques of Omeji, *et al*. (2011). Fish were dissected to expose the alimentary canal using the techniques of Omeji *et al.* (2015) and parasites were identified to species level using the keys to describes by Yamaguti (1963), Paperna (1996) and Pouder *et al.* (2011). The parasites identified were counted and recorded. Samples from the fish's stomach, gills, skin, fins and intestine that could not be examined on the same day of collection were preserved in sample bottles containing 4% formalin and labelled appropriately with the reference number. The following were estimated using the formulae:

i. Prevalence (%) = Number of fish host infected/ Total number of fish host examined X 100

ii. Parasite load (%) on each location = Number of each parasite/ Total number of parasites examined X 100

iii. Mean intensity = Total number of parasite/ Number of fish infested X 100

iv. Abundance = Total number of individual parasites recovered in a sample of a host / Total no. of individual fish species sampled

Statistical analysis

Chi – square was used to investigate significant differences in prevalence rate. Correlation matrix was used to check the strength and direction of the relationship between weight and length. Descriptive statistic was used to show the parasitic loads of fish associated with sex using social science software (SPSS 22.0).

RESULTS

Table 1 show Prevalence of Parasites of *Clarias anguillaris* and *Clarias gariepinus* lower Benue River. A total of 134 (22.33%) of the fish species were infested in which *Clarias anguillaris* has more (70%) of infestation. There was no significant difference (P=0.623 >0.05) between the prevalence rates of parasitic infestation among *C. anguillaris* and *C. gariepinus*.

Table 1: Prevalence of Parasites of Clariids fishes examined from the lower Benue River

Fish Specie	**No. of fish Examined**	**No. (%) infected**
Clarias anguillaris	300	70(23.33)
Clarias gariepinus	300	64(21.33)
Total	600	134(22.33)
χ^2=0.242	Df =1	P = 0.623 (p>0.05)

χ^2= Chi square, p>0.05 no significance difference

Table 2 shows the prevalence of parasites based on species, intensity and abundance infection by protozoa was significantly higher than other parasites. *Ichthyophthirius multifiliis* recorded the highest infection in 40 of the fish species (*C. anguillaris* N=16 and *C. gariepinus* N=14), with a prevalence of 5.33%, mean intensity of 2.31 and abundance of 0.12 recorded for *C. anguillaris* and 4.66%, 2.23, 0.31 for *C. gariepinus*, respectively. Other parasites in recorded were *Procamallanus laevionchus* which had 5.33% in the *C. gariepinus* and 3.67% in *C. anguillaris*, *Capillaria* had 2.33% and 3.67, *Trichodina* with 4.00% for each. *Eustrogylides* was 1.67% and 2.00%, *Chilodonella sp* 0% and 1%, *D. latum* with 1.6% and 2.67% and *Dactylogyrus* with 1.67% and 1.00%, respectively.

Table 2: Prevalence of Parasites Based on their Species, Intensity and Abundance.

Parasite species	***C. anguillaris* (n = 300)**					***C. gariepinus* (n = 300)**				
	A	**B**	**C**	**D**	**E**	**A**	**B**	**C**	**D**	**E**
I. multifiliis	16	37	5.33	2.31	0.12	14	28	4.66	2.00	0.09
Chilodonella sp	3	9	1.00	3.00	0.03	-	-	-	-	-
Trichodina sp	12	26	4.00	2.17	0.08	12	29	4.00	2.42	0.09
P. laevionchus	11	15	3.67	1.36	0.05	16	31	5.33	1.94	0.10
Capillaria sp	11	19	3.67	1.73	0.06	7	9	2.33	1.29	0.02
Eustrongylides	6	7	2.00	1.17	0.02	5	5	1.67	1.00	0.02
D. latum	8	14	2.67	1.75	0.05	5	5	1.67	1.00	0.02
Dactylogyrus sp	3	6	1.00	2.00	0.02	5	12	1.67	2.40	0.04

A=Number of hosts infected, B=Number of parasites recovered, C= %prevalence of parasites, D=Mean intensity of parasites, E=parasite abundance, n=Total number of fish species sampled.

The seasonal distribution of parasites is shown in fig. 2. There was a significance difference (p<0.05) in parasitic infestation between the fish species based on seasons. In dry season, *C. anguillaris* had the highest prevalence of 41 (27.33%) compared to wet season with 29 (19.33%), Similarly, *C. gariepinus* had the highest parasitic prevalence (23.33%) during the dry season, compared to the wet season (19.33%).

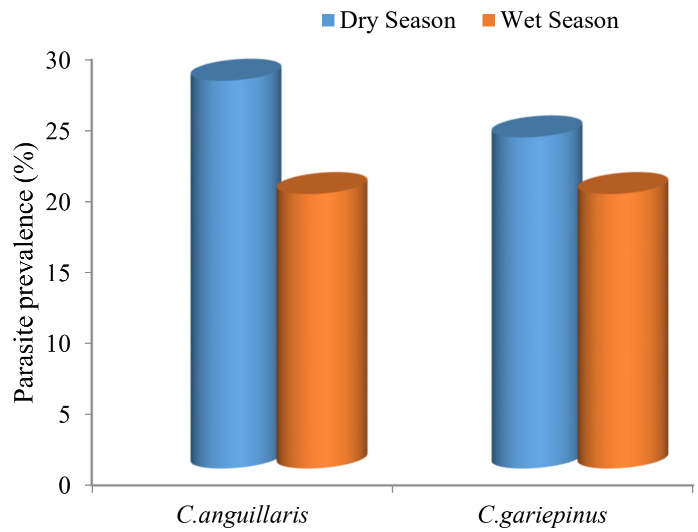

Fig 2. Prevalence of parasitic infestation of fish species based on season

The relationship between parasitic infection and sex of the fish species in the dry and wet seasons is shown in fig. 3. The study revealed a significant difference in parasite loads between male and female fishes at p<0.001. During the dry season, female *C. anguillaris* and *C. gariepinus* had the highest parasite load (63.50 and (630%, respectively) compared to the males *C. anguillaris* 27 (36.5%) and *C. gariepinus* 27 (37.0%), while in the wet season female fish also of *C. anguillaris* 40 (67.8%) and *C. gariepinus* 32 (62.7%) recorded higher prevalence than the males of *C. anguillaris* 19 (32.2%) and *C. gariepinus* 19 (19.3%).

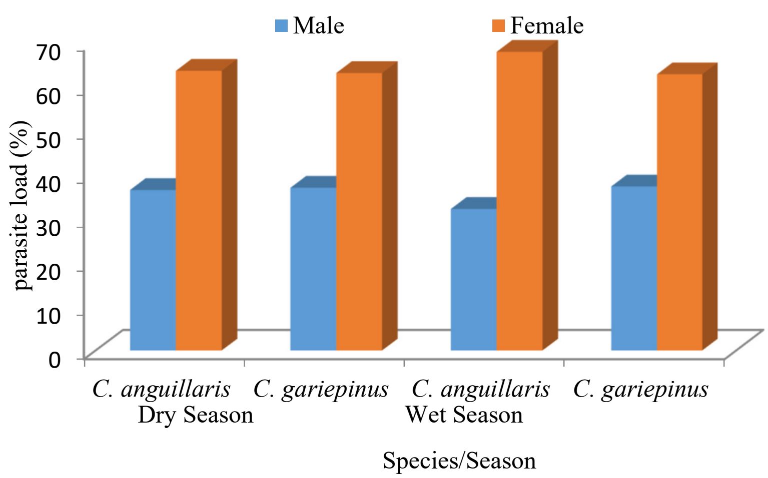

Fig 3: Relationship between parasite infestation and sex of the fish species in dry and wet seasons.

Figure 4 shows the relationship between Total Length (TL) and percentage parasite load in the fish species during the dry and wet seasons. During the dry season, *C. anguillaris* had the highest parasitic load for the TL range of 21-30cm with 29 (39.20%) and the least fish with total length greater 40cm with 9 (12.16%), while in dry season, the highest parasitic load was recorded in *C. gariepinus* with TL ranges between 31- 40cm with 30 (41.09%), The least were among the fish with TL greater 40cm with 8 (10.96%). During the wet season *C. anguillaris* with length between 21-30cm had the highest parasitic load 40 (67.8%) and least were recorded in fish with TL ranging between 31 to 40cm 19 (32.2%). *C. gariepinus* between the range of 31 to 40cm had the highest load of parasites (49.0%).

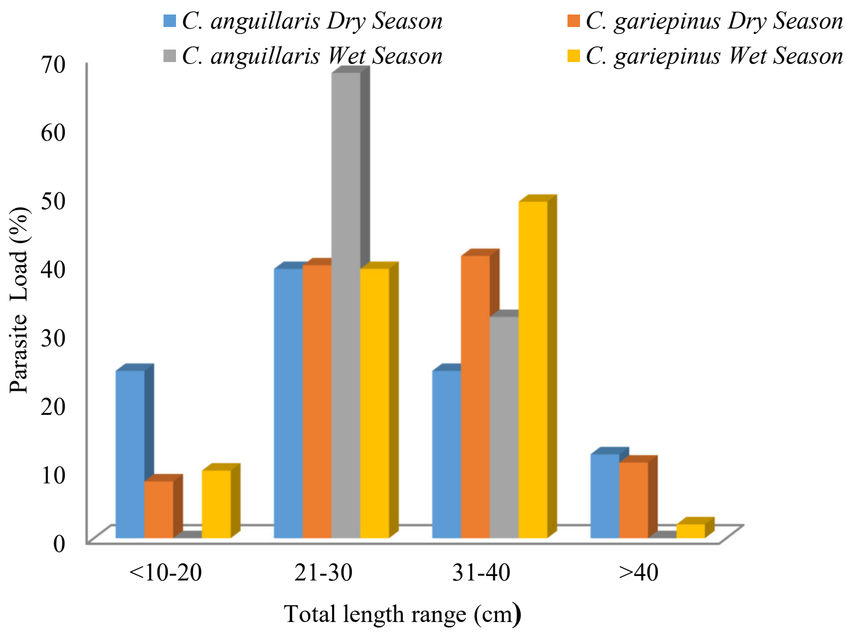

Fig 4: Relationship between TL and parasitic infestation of fish species in the dry and wet seasons

Figure 5 shows the relationship between weight (g) and percentage parasite loads of the fish species in the dry and wet seasons. During the dry season the highest parasitic load in the weight range of <40-150g, *C. anguillaris* 34 (45.95%) and *C. gariepinus* 28 (38.35%) was recorded while during the wet season *C. anguillaris* had the highest parasitic load in fish with weight ranges of 151-260g, 29 (49.20%) and the last in the range of 371-480g, 4 (6.80%) while in *C. gariepinus* the weight range of <40 – 150g had the highest parasitic load 19 (37.3%) while the range of 481 – 590g, 1 (2.0%) had the least.

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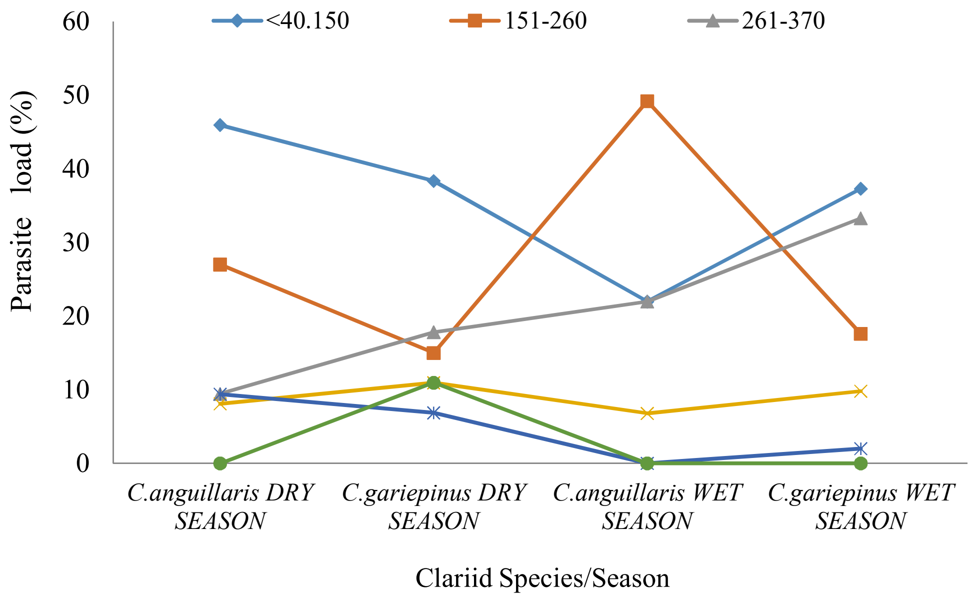

Fig 5: Relationship between weight (g) and parasite in two Clariids species in the dry and wet seasons.

Table 3: Correlation Matrix for TL, WT and TNP of the two Clariids fish species in both season

	***C. anguillaris* dry season**			***C. gariepinus* dry season**		
	TL	WT	TNP	TL	WT	TNP
TL	1.0	0.814*		1.0	0.882*	
WT	0.814*	1.0		0.882*	1.0	
TNP	0.143	0.167	1.0	0.022	0.192	1.0
	***C. anguillaris* DRY SEASON**			***C. gariepinus* DRY SEASON**		
	TL	WT	TNP	TL	WT	TNT
TL	1.0	0.628*		1.0	0.517*	
WT	0.628*	1.0	1.0	0.517*	1.0	
TNP	0.287	0.185	1.0	-0.167	0.030	1.0

*Correlation is Significant at p<0.05 level of significance. Key: TL=Total Length (cm), WT=Weight (g). TNP= Total Number of Parasites

Table 3 shows the correlation Matrix for TL and WT and total number of parasites (TNP) in dry and wet season of the two Clariids fish species. A significant difference (p<0.05) between the total length and total number of parasites and weight and total number of parasites in both species and season was recorded.

DISCUSSION

The prevalence of 22.33% recorded for fish parasites in this study was lower than 48.63% previously recorded for fishes in the upper and lower Benue River Nigeria (Omeji *et al*., 2014). It is, however, higher when compared with the prevalence of 18.5% in the Niger Delta tidal creek, 17.1% in Osse River, 6.9% in the Okhuo River and 3.3% in Great kwa River all in Nigeria (Okaka and Akhigbe, 1999; Edema *et al.,* 2008; Ekanem *et al*., 2011; Anthony *et al*., 2014). Differences in prevalence could be explained largely in terms of the frequency of contact between the fish and the infective stage of the parasites. Lower Benue River systems usually flow in very large volumes resulting in runoff from the systems catchment areas during the flood phase of the hydrological regime. During this period, the volume of water enables a wide dispersal of both the parasites and their hosts reducing the contact between them. The high flow of water further ensures minimal contact and therefore low prevalence

Omeji, *et al*. (2014). These variations in rate of parasitism could also be attributed to abiotic and biotic conditions of the environments where the studies were carried out (Thompson and Larsen, 2004; Eyo *et al*., 2013).

Different parasites belonging to different groups, namely protozoa (*I. multifiliis, Chilodonella sp,* and *Trichodina sp)*, Cestodes, (*Diphillobothrium latum*), Nematodes (*Procamallanus laevionchus, Capillaria sp* and *Eustrogylides sp*) and Monogenean trematodes (*Dactylogyrus sp*) were observed and identified to be present in different locations of the two cards fishes used for this study. The recovery of these parasites from different body parts of the fish species in this investigation is not surprising as they have been recorded previously from the species or related species elsewhere (Paperna, 1996; Omeji *et al*., 2014). However, it was observed in this study that the intestine had more parasites than the stomach, which could probably be due to the presence of digested food present there or due to greater surface area present in the intestines. Marcogliese (2002) reported that most parasites inhabit the intestines because of their general feeding habits. This also agrees with Omeji *et al*. (2011).

The higher number of protozoan parasites recorded from the skin and gills compared to the fins could be attributed to the fact that skin is easily accessible by these parasites due to their direct contact with the surrounding water or continuous movement of water over the skin and gills as a result of filter feeding and the sites of gaseous exchange. Similar observations by Ugbor *et al.* (2014).

The infection rate was higher in the dry season than the wet season. The factor responsible for this is eutrophication, which often raises parasitism because the associated increase in productivity will increase the abundance of the invertebrate intermediate hosts, mostly crustaceans (Lafferty and Kuris, 1999). Eutrophication leads to algal bloom at the peak of the rainy season, which results in increase in species variety and population of parasites, towards the end of the rainy season. This may result in the infection of fishes that fed on them, and thus probably bring about the maturity of the parasites in the fish towards the dry season, depending on the life cycle of the individual parasite.

Another factor that may be advanced is that during the dry season, (which roughly corresponds to the dry phase of the hydrological cycle) there is virtually no precipitation and the flow and volume of water is very much reduced, resulting in much higher contact between the parasites and fish leading to a relatively higher prevalence. This may account for the disparity in the prevalence of parasites during the drier than the wet seasons in this study. This observation also agrees with Omeji *et al*. (2014).

There was a significant difference ($p<0.05$) in prevalence between male and female *C. anguillaris and C. gariepinus.* The higher prevalence of infestation recorded on the female fish than the male could be due to the physiological state of the females, as most gravid females could have had reduced resistance to infestation by parasites. In addition, their increased rate of food intake to meet their food requirements for the development of their eggs might have exposed them to more contact with the parasites, which subsequently increased their chances of being infested. This observation agrees with Emere and Egbe (2006) and Omeji *et al*. (2015), but disagrees with Ugbor *et al.* (2014) who reported more parasite infestation in male fish than the female.

The higher number of parasite infestation obtained in bigger fishes (21.00 – 30.00cm and 31.00 – 40cm) of *C. anguillaris* and *C. gariepinus* is an indication that the size of the fish is important in determining the parasite load. Mohammed (1999) reported that prevalence was found to increase as the fish grew, and that could be attributed to the longer time of exposure to the environment by body size. The differences in parasite load could also be attributed to the random selection of the specimens and to the probable high level of immunity built up in the fish specimens (Akinsanya *et al*., 2008). The similar observation had been made by Ekanem *et al*. (2011) and Omeji *et al*. (2014).

The higher percentage of parasite load recorded in the weight class 40 - 150g (small fish) to that of 151- 260g (big fish) for both seasons could be attributed to the quest of the bigger fish for survival. The differences in parasite load between the small and big fish had been variously reported. Nyaku *et al*. (2007) and Tasawar *et al*. (2007) reported a higher parasite load in small fish than the bigger counterparts and attributed it to a random selection of the specimen and to probably high level of immunity built up in the fish specimens. However, this finding disagrees with Ugbor *et al*. (2014) who reported a higher parasite load in bigger fish than the smaller ones.

REFERENCES

Akinsanya, B., Hassan, A. A. and Adeogun, A. O. (2008). Gastrointestinal helminth parasites of the fish *Synodontis clarias* (Siluriformes: Mochokidae) from lekki Lagoon, Lagos, Nigeria. Revised Biology Tropic. *Int. J. Trop. Biol.* 56(4): 2021-2026.

Anthony, E. O., Christopher E. O. and Blessing J. O. (2014). Gastrointestinal Helminths parasites in a community of fish species in a Niger Delta Tidal Creek, Nigeria. *Journal of Ecosystems,* 10Pp.

Barber, I., Hoare, D. and Krause, J. (2000). *Effects of Parasites on Fish Behaviour*. Elsevier Academic Press San Diego. (10): 131-165.

Barber, I. and Wright, H. A. (2006). Effects of parasites on fish behaviour; Interactions Physiology., 110-149.

Edema, C. U, Okada, C. E, Oboh I. P. and Okogup, B. O. (2008). A preliminary study of parasitic infection of some fishes from Okhuo River, Benin City, Nigeria. *International Journal of Biomedical and Health Science* 4(3): 107 – 116.

Ekanem, A. P., Eyo, V. O. and Sampson, A. F. (2011). Parasites of landed fish from create Kwa River, Calabar, Cross River State, Nigeria. *International Journal of Fisheries and Aquaculture,* 3 (12): 225 – 230.

Emere, M. C. and Egbe, N. E. L. (2006). Protozoan parasites of *Synodontis clarias* (A fresh water fish) *Best Journal* 3(3):58-64.

Eyo, J. E., Iyaji, F. O. and Obiekezie, A. I. (2013). Parasitic Infestation of *Synodontis batensoda* (Ruppell 1832, Siluriformes, Mockokidae) at Rivers Niger-Benue Confluence, Nigeria. *Afr. J Biotechnol,* 12: 3029-3039.

Goselle, N., Shir, G. I., Udeh, E. O., Abelau, M. and Imandeh, G. N. (2008). Helminth parasites of *Clarias gariepinus* and *Tilapia zilli* at Lamingo dam, Jos, Nigeria. *Science World Journal*, 3 (4):23-27.

Lafferty, K. D. and Kuris, A. M. (1999). How environmental stress affect the impacts of parasites. *Limnology Oceanography* 44:925-931.

Marshall, B. (2011). The fishery of Zimbabwe and their Biology. South Africa. Paarl Media, Paarl, South Africa Grahamstown, 31-103.

Marcogliese, D. J. (2002). Food web and the transmission of parasites to Marine Fish Parasitology. *Parasitology*, 124: S83-S99.

Mohamed, A. E. H. H. (1999). Trichodiniasis in farmed freshwater Tilapia in Eastern Saudi Arabia. *Journal of KAU: Marine Science*. 10: 157 – 168.

Nyaku, R. E., Okayi, R. G., Kolndadacha, O. D. and Abdulrahman, M. (2007). A Survey of Ectoparasites Associated with 3 Species of fish *Auchenoglanis Ocidentalis, Oreochromis niloticus* and *Bagrus bayad,* In River Benue, Makurdi, Benue State, Nigeria. *Proceedings of the 22nd Annual Conf. of FISON, Kebbi, Nigeria, Nov.* 10-14.

Offem, B. O., Samson, A. Y. and Omoniyi, T. I. (2010). Aspect of ecology of *Clarias anguillaris* (Teleostei: Clariidae) in the Cross River, Nigeria. *Turkish Journal of Fisheries and Aquatic Science.*10: 101 – 110.

Okaka, C. E. and Akhigbe, J. E. (1999). Helminth parasites of some tropical freshwater fish from Osse River in Benin, Southern Nigeria. *Tropical Freshwater Biology*, 8:41-48.

Omeji, S., Solomon, S. G. and Idoga E. S. (2011). A comparative study of the common protozoan parasites of *Clarias gariepinus* from the wild and cultured environments in Benue State, Nigeria: *Journal of Parasitology Research*, 8Pp.

Omeji, S., Tiamiyu, I.O., Annune, P.A and Solomon, S.G. (2014). Ecto and intestinal parasites of *Malapterurus electricus* from upper River Benue. *Journal of global Bioscience.* 3(6):895-903.

Omeji, S., Obande, R. A. and Member S. T. (2015). Prevalence of endoparasites of *Synodontis shcall* and *Synodontis ocellifer* (Upside-Down Cat Fish) from Lower River Benue, Nigeria. *International Journal of Animal Biology*, 5:176-181.

Paperna, I. (1996). Parasites Infections and Diseases of Fishes in Africa. An update. CIFA Technical Paper FAQ, Rome, (31):200Pp.

Pouder, D. B., Curtis, E. W. and Yanong, R. P. E. (2011). Common freshwater fish parasites pictorial guide: Sessile ciliates. *http:edis.ifas.ufl.edu/FA-107.* Accessed 15th November, 2015.

Tasawar, Z., Umer, K. and Hayat, C. S. (2007). Observations on lernaeid parasites of *Catla catla* from a fish hatchery in muzaffargarh, Pakistan. *Pakistan Veterinary Journal*. 27(1):17-19.

Teugels, G. G. (1986). A systematic revision of the African species of the genus *Clarias* (Pisces: Clariidae). *Annales Musee Royal de l' Afrique Centrate,* 247:1-199.

Thompson, L. C. and Larsen, R. (2004). *Fish habitat in freshwater stream. Farm Water Quality Planning FWQP*. Reference Sheet 10.3, Publication 8112. University of California, California.12.http:/anrcatalog.ucdavis.edu/merchant, 5-7.

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 clariid (Siluriformes) catfishes in a tropical freshwater ecosystem, Nigeria.*Nigerian Journal of Fisheries*, 11 (1&2):744-752.

Yamaguti, S. (1963). *Systema Helminthum*: The *Acanthocephala.* Inter-science publisher, New York. 142Pp.