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A survey on endo-parasites of *Clarias gariepinus* in some selected fish farms in Owerri west local government area of Imo state, Nigeria

Okoye Uzodinma O, Ndupuh EE and Adeleye SA

Abstract
The present study was carried out in three different pond locations in Owerri West (namely Beliorck aquatic limited Obinze as Pond A, Eddvic integrated farm limited Ihiagwa as Pond B and Urban fish farm Avu as Pond C), to identify, determine and compare the prevalence of Endo-parasites of *Clarias gariepinus*. Of the 60 *Clarias gariepinus* samples analyzed and examined for Endo-parasites by taking a smear of their internal organs for examinations using staining method (Giemsa stain), 5 Endo-parasites were identified and isolated belonging to 3 taxas namely Nematode: *Contracaecum* sp (11.67%), *Camallanus* sp (48.33%), Protozoa: *Cryptobia iubilans* (40%), *Trypanosoma* sp (35%), Acanthocephalans: *Acanthocephalus* sp (21.67%). Pond C was found to harbour higher number of Endo-parasites than pond A and pond B. The intestine, stomach, liver and kidney were examined for Endo-parasites of which the stomach (with Pond A 60%, Pond B 40% and Pond C 80%) accounted as the organs with the most Endo-parasitic invasion. Bigger fishes were observed to harbor higher Endo-parasites than the smaller ones.

Keywords: Endo-parasites, selected ponds, *Clarias gariepinus*, parasites prevalence, invasion and infestation

1. Introduction
The African cat fish (*Clarias gariepinus*) belongs to the family Clariidae and has been known to be the most popular fish food in Nigeria (Froese *et al.,* 2014) [23]. It is found throughout Africa and in the Middle East and lives in freshwater rivers, lakes and as well as human-made habitat, such as the earthen pond or concrete ponds and was introduced all over the world in the early 1980's for aquaculture purposes (Froese, 2014) [23]. Its importance can never be over emphasized due to its high nutritive value, it is a good source of protein in the diet of different countries especially in the tropics and subtropics where malnutrition is a major problem (Alune and Andrew, 1996) [6]. Report shows that fish accounts for more than forty percent of protein diet of two-thirds of the global population (Eyo, 1992 and FAO, 1999) [20, 22]. According to Sadiku and Oladimeji (1991) [52], the average protein intake by an average Nigerian was estimated to be about 63.24g/caput/day, which happens to be below 70g/caput/day FAO minimum recommendation protein intake. The demand for fish has been found to be very high due to its oily flesh and low cholesterol level and; is a promising aspect of investment in Africa. Fish has a great wide geographical spread, high promise in growth rate, resistant to handling and as well as appreciated flesh (Akinsanya and Otubanjo, 2006) [4].
One of the major problems of the fishery sector which remains to be addressed as an important constraint in improving the productivity of the sector in both wild and cultured population are parasite and disease associated with fish (Subasinghe *et al.,* 2002) [54]. Parasites of fish are a concern since they often produce a weakening of the host's immune system thereby increasing their susceptibility to secondary infections that often result in the nutritive devaluation of fish and subsequent economic losses (Onyedineke *et al*., 2010) [45]. Parasitic diseases reduces fish production by affecting the normal physiology of the fish and if left uncontrolled could result to mass mortalities or in some cases could serve as source of infection for human and other vertebrates that consume it (Ayotunde *et al.,* 2007) [9]. These parasites could be Ecto-parasites or Endo-parasites. The protozoan and helminthes are reported to be the major group of parasites of fish involved in parasitism in Nigeria (Ndifon and Jimeta, 1990; Adikwu *et al*., 2004; Omeji, 2011) [37, 2, 41].

However, Endo-parasites reduce fish availability for consumption and also increase the danger of fish parasite occurring in our food, which serves as a threat to human health. The World Bank estimated that in 1997, global losses from aquaculture Endo-parasites were in the order of 3billion US Dollars per year (Subasinghe *et al.,* 2001) [53]. Economic impediment of fish parasites comes not only from mortality, but also from treatment expenses and growth reduction during and after outbreak of disease which militates against expansion of aquaculture. Therefore, understanding the etiology of parasitic diseases is of crucial importance as it determines the choice of potential treatment, hence, identification of parasites to its genus which is generally sufficient to implement an effective therapeutic or prophylactic strategy for combating the disease (Paperna, 1980) [50]. The study aims at investigating the Endo-parasites of fish from some selected ponds, therefore needs to identify the most common economically important Endo-parasites and to assess their prevalence in the pond.

2. Materials and Methods

2.1 Study area

This research study was carried out in Owerri West Local Government Area of Imo State. It is located in the southern part of the State within latitude 060 52' E and 070 05' E, longitude 050, 15' N and 050 34'N of the South East Zone of Nigeria. It comprises about 16 autonomous communities and share common boundary with villages like Ohaji/Egbema, Owerri North and Owerri Municipal etc with a total land mass of about 3,787 square kilometers and a population of about 250,000 people (Ministry of lands and survey Imo State, 2003) [37]. It has Otamiri and Nworie River. It has mean annual rainfall of about 2250-3000mm that begins from the month of March to October and the temperature ranges from 35 °C – 37 ºC

2.2 Experimental design

One pond was marked out from each fish farm selected (namely Beliorck Aquatic limited, Obinze as Pond A; Eddvic Integrated farm limited, Ihiagwa as Pond B and Urban fish farm Avu as Pond C) all in Owerri West Local Government Area. Each sampled fish was assigned a reference number to ensure proper documentation of records and transported alive immediately to the laboratory for examinations. The specimens were identified using both the meristic features provided by Willoughby (1974) [59]. The sexes of the fish were determined by examination of genital pore (Martinez-Aquino *et al*., 2004) [33]. The standard length of each fish was measured in centimeters (cm) using a meter rule while the weight measurement was taken in grams using an electronic meter balance (King 1996) [30].

2.3 Laboratory methods

The fish was immobilized to prevent it from struggling during dissection, and placed on a dissecting board. The fish was dissected to bring out the various organs that were examined for Endo-parasites which includes; liver, kidney, stomach and intestine. The excised gastrointestinal tract was carefully sectioned into portions such as the intestine, stomach, kidney, liver, and each portion was then cut open, washed in Petri dish with 0.1% sodium chloride solution and further rinsed with 0.1% sodium bicarbonate to enhance parasite search (Paperna, 1996; Marcogliese, 2011) [46, 32]. Each drop of the residue or smear was placed on the slide, stained with Giemsa stain and then viewed under x10 and x40 objective light microscope to check for parasites. The observed parasites were compared with the keys of freshwater fish parasites pictorial guide by Deborah *et al*, (2005) [16] for identification.

Simple descriptive statistical analysis such as mode, mean, percentages, frequency, histogram, pie chart and bar chart were employed in summarizing the data obtained with aid of excel 2013.

3. Results

Of the 60 samples of *Clarias gariepinus* examined for Endo-parasites, 68.33% was infected from selected fish farms (Pond A, Pond B and Pond C) in Owerri West Local Government Area. The result (fig 1) shows that *Camallanus sp* dominated the Endo-parasitism of *Clarias gariepinus* as it infected 29(48.33%) out of the 60 samples examined, followed by *Cryptobia iubilans* 24(40%), *Trypanosoma sp* 21(35%), *Acanthocephalus sp* 13(21.67%) and *Contracaecum sp* 7(11.67%) as the least parasitic infection.

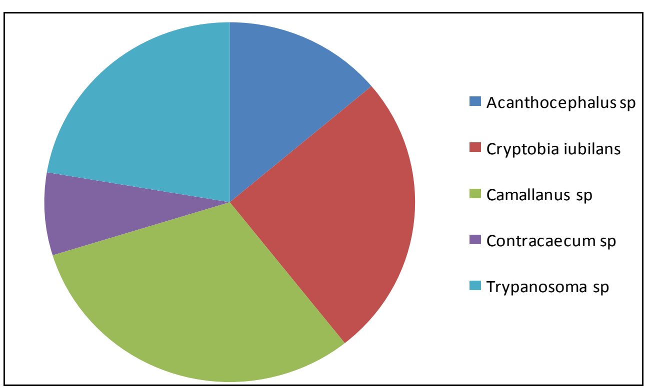

Fig 1: Pie chart showing the rate of Endo-para septic infection of *clarias gariepinus* form selected fish ponds in Owerri West

The weekly examination and identification of Endo-parasitism of *Clarias gariepinus* with respect to their sexes (table 1) shows that more of female fishes were examined 39(65%) and were also infected 28(71.79%) more than the male fishes 21(35%) and 13(61.90%) as a result of the random sampling of the fish. Similarly, week three recorded more number of Endo-parasites on the females singularly than any other week. *Acanthocephalus sp* was found to infest the male throughout the weekly examination. *Camallanus sp* (60%) was found to be more prevalent followed by *Cryptobia iubilans* (50%), *Acanthocephalus sp* (40%), *Trypanosoma sp* (40%) and finally *Contracaecum sp* (30%) as the least prevalent at all the weekly examination and identification.

Table 1: Prevalence of Infection of *Clarias Gariepinus* With Respect to Sex

Week	Sex	No of fish Examined	No (%) of fish infected	Total no of parasites	Endoparasites					(%) Prevalence of infection	(%) Prevalence of parasites
					Contracaecumsp	***Acanthocephalus sp***	***Trypanosoma sp***	***Cryptobia iubilans***	***Camallanus sp***		
Wk1	M	4	2(4.87)	3	+	-	-	+	+	3.33	5.00
	F	8	7(17.07)	2	-	+	+	-	-	11.66	3.33
Wk2	M	7	5(12.19)	2	-	-	-	+	+	10.00	3.33
	F	5	2(4.87)	3	-	+	-	+	+	1.66	5.00
Wk3	M	2	1(2.43)	1	-	-	+	-	-	1.66	1.67
	F	10	7(17.07)	4	+	+	-	+	+	11.66	1.67
Wk4	M	3	3(7.31)	1	-	-	-	+	-	5.00	1.67
	F	9	6(14.63)	2	-	+	+	-	-	10.00	3.33
Wk5	M	5	2(4.87)	1	-	-	-	-	+	5.00	1.67
	F	7	6(14.63)	3	+	-	+	-	+	8.33	5.00
Total		60	41(68.33)		30%	40%	40%	50%	60%	68.34	31.67
M		21	13(61.90)		10%	-	10%	30%	30%	100	100
F		39	28(71.79)		20%	40%	30%	20%	30%		

$$\text{\% Prevalence of infection} = \frac{\text{Number of fish infected x 100}}{\text{Total number of fish examined}}$$

$$\text{No (\%) of fish infected} = \frac{\text{Number of fish of the same sex infected per week x 100}}{\text{Total number of fish infected}}$$

$$\text{\% Prevalence of parasites} = \frac{\text{Number of fish infected x 100}}{\text{Total number of fish examined}}$$

M= male; F= female; + = present; - = absent

Note: % infestation of fish sex (male and female) were calculated with respect to the number sampled respectively

The rate of Endo-parasites invasion of different organs (intestine, stomach, liver and kidney) of *Clarias gariepinus* in the selected Ponds (see fig 2) shows that five parasites were identified in Pond C (as the most infected farm) namely *Contracaecum sp, Camallanus sp, Trypanosoma sp* and *Cryptobia iubilans* with the intestine (80%) as most invaded than the other organs. None of the identified parasites were found to be present in the kidney in all the Ponds examined. Then followed by Pond A, identified with four parasites namely *Contracaecum sp, Camallanus sp, Trypanosoma sp,* and *Acanthocephalus sp*, with the intestine (60%) as the most invaded than the other organs. Then Pond B which had the least infection identified four parasites namely *Contracaecum sp, Camallanus sp, Trypanosoma sp* and *Cryptobia iubilans* with the intestine and liver with 40% prevalence as the most invaded organ in the pond.

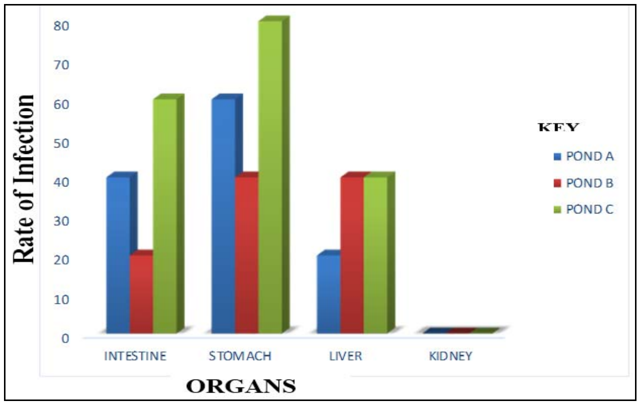

Fig 2: multiple bar chart showing the rate of invasion of different organs of *Clarias gariepinus* by Endo-parasites in selected Ponds in Owerri West.

Table 2 shows weight distribution and parasitic infestation of *Clarias gariepinus* from the selected Fish Ponds while Fig 3 shows the rate of Endo-parasitic infection of *Clarias gariepinus* with respect to size (length) distribution. The length classes of 18.00-20.99(Pond A), 27.00-32.99(Pond B) and 18.00-20.99 (Pond C) examined, was found to harbour no Endo-parasitic infection, where Pond C recorded the highest number of fish infestation and Endo-parasitic invasion.

Table 2: Weight Distribution and Parasitic Infestation of *Clarias gariepinus* in selected Fish Ponds in Owerri West L.G.A

Pond	Body weight	No (%) of fish Examined	No (%) of fish infected	No of parasites present	Intensity of infection
	150-199	-	-(-)	-	-
	200-249	-	-(-)	-	-
	250-299	-	-(-)	-	-
	300-349	-	-(-)	-	-
	350-399	2(10.00)	1(50.00)	2	0.50
POND A	400-449	3(15.00)	2(66.67)	1	0.67
	450-499	2(10.00)	1(50.00)	2	0.50
	500-549	4(20.00)	2(50.00)	3	0.50
	550-599	7(35.00)	5(71.42)	3	0.63
	600-650	2(10.00)	2(100)	3	1.00
					Total: 3.80
	150-199	3(15.00)	2(66.67)	2	0.67
	200-249	3(15.00)	-(-)	-	-
	250-299	4(20.00)	2(50.00)	2	0.50
	300-349	2(10.00)	2(100)	1	1.00
POND B	350-399	5(25.00)	3(60.00)	3	0.67
	400-449	3(15.00)	2(66.67)	3	0.67
	450-499	-	-(-)	-	-
	500-549	-	-(-)	-	-
	550-599	-	-(-)	-	-
	600-650	-	-(-)	-	-
					Total: 3.51
	150-199	-	-(-)	-	-
	200-249	1(5.00)	-(-)	-	-
	250-299	1(5.00)	19(100)	2	1.00
	300-349	-	-(-)	-	-
POND C	350-399	2(10.00)	2(100)	3	1.00
	400-449	1(5.00)	1(100)	2	1.00
	450-499	3(15.00)	2(66.67)	2	0.67
	500-549	4(20.00)	4(100)	3	1.00
	550-599	3(15.00)	2(66.67)	4	0.67
	600-650	5(25.00)	5(100)	4	1.00
					Total: 6.34

$$\text{No (\%) of fish examined} = \frac{\text{Number of fish examined} \times 100}{\text{Total number of fish in Pond (A, B, C)}}$$

$$\text{No (\%) of fish infected} = \frac{\text{Number of fish infected} \times 100}{\text{Number examined}}$$

$$\text{Intensity of infection} = \frac{\text{Number of fish infected}}{\text{Number of fish examined}}$$

(-) = Absent; **(+)** = Present

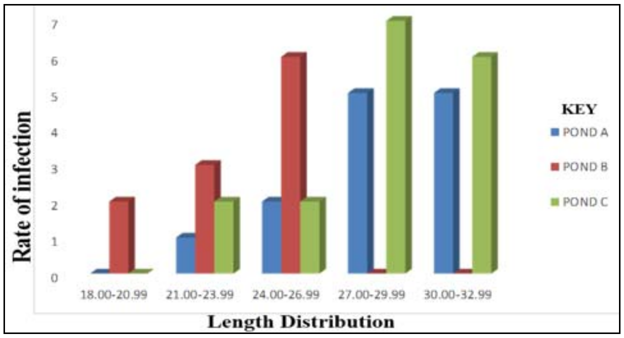

Fig 3: Multiple bar chart showing the rate of Endo-parasitic infection of *Clarias gariepinus* with respect to size distribution from selected fish Ponds in Owerri West.

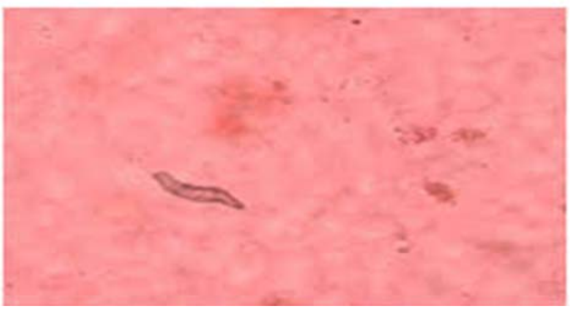

Plate 1: Photomicrograph of *Cryptobia iubilans* isolated from *Clarias gariepinus*

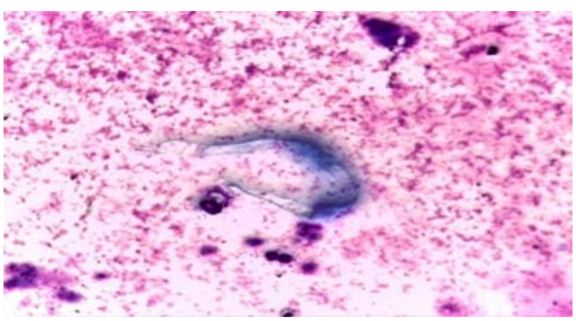

Plate 2: Photomicrograph of *Trypanosoma sp* isolated from *Clarias gariepinus.*

Plate 3: Photomicrograph of *Acanthocephalus sp* isolated from *Clarias gariepinus.*

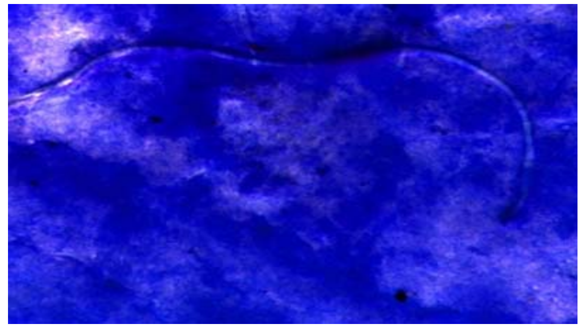

Plate 4: Photomicrograph of *Camallanus sp* isolated from *Clarias gariepinus*

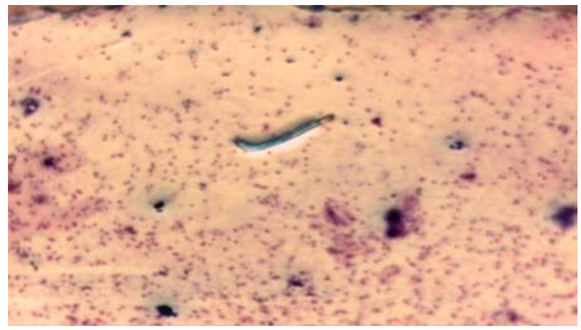

Plate 5: Photomicrograph of *Contrcacaecum sp.* isolated from *Clarias gariepinus.*

4. Discussion

From this study, it is revealed that Out of the sixty *Clarias gariepinus* examined for parasitological investigation, a total of 41(68.33%) specimens were infected while 19(31.67%) were not infected. It further shows that out of the five parasites identified, *Camallanus sp* had the highest prevalence of 48.33% which was found to be present at the three ponds examined and at three organs out of four organs examined for Endo-parasitic infestation. This was followed by *Cryptobia iubilans* with prevalence of 40%, *Trypanosoma sp* with 35%, *Acanthocephalus sp* (21.67%) and *Contracaecum sp* (11.67%) as the least identified parasite present. This results agrees with Okoye *et al* (2014) [39] and Moravec and Jean-Lon (2006) [35], they identified *Camallanus sp* as the most prevalent Endo-parasitic organism but disagrees with Omeji *et al* (2013) [43], Amare *et al* (2014) [10], Moravec (2009) [36], Barson (2004) [12] and Eyo *et al* (2013) [18], they have reported *Eustrongylides*, *Contracaecum sp* and *Acanthocephalus sp* in their investigation as the most prevalent parasitic organism present in *Clarias gariepinus*. Okoye *et al* (2014) [39] have equally recorded *Acanthocephalus sp* as the least occurred parasites in fish. This result also agrees with the findings of Wengon (1908) [58], Dias (1952) [17], Baker (1960, 1961) [12, 13], Adikwu (2004) [2] and Omeji *et al* (2013) [43], they have reported the occurrence of *Trypanosoma sp* in *Clarias sp* in ponds and all major waters of Africa. High prevalence of *Cryptobia iubilans* which was recorded as most occurred Endo-parasite of the Protozoan class in freshwater fish (*Clarias gariepinus*) affects their health adversely.

This study equally reveals that Protozoan parasitic taxa (75%) make up the highest infestation rate of parasites found to be prevalent in the selected fish ponds followed by Nematode (60%) and Acanthocephalan (21.67%) which agrees with Alverez-Pellitero (2004) [7] and Omeji *et. al* (2010, 2011, 2013) [42, 41, 43]. This also disagrees with Ejere *et al* (2014) [20] and Usip *et al* (2014) [60] who recorded Acanthocephalan and

Nematode as the most prevalent Endo-parasite respectively. In this study, the commonest infection was caused by Nematode and of which many authors have recorded it as one of the most prevalent Endo-parasites of *Clarias gariepinus* and occurred mostly as primary Endo-parasitic infection of the host. They also are of great economic importance to the host in stabilizing and utilizing unwanted food particles in their body and become damaging when in excess and no check on them (Bakare and Imevbore, 1970) [25].

Out of the 41 specimens infected 13(61.90%) were males and 28(71.79%) were females which show that females were heavily infected more than the males (See table 1). This may be attributed to their quest for survival. Since males are believed to be stronger sex, they are able to explore available food resources better than the females. Females in their quest for survival might have fed on other food particles that it would normally not feed on were food very abundant thereby taking up these infective organisms in the process and their increased food intake to meet up to the food requirement for development of their egg might have exposed them to more contact with the parasites which subsequently increases their chance of being infected. According to Ibiwoye *et al.,* (2004) [24] and Mhaisen *et al.,* (1988) [34], female fish are more infested than their male counterpart while Biu, A.A *et al.,* (2013) [15] disagrees when he reported that variations in parasitic infection among the sexes of fish were by chance. Ibiwoye *et al.,* (2004) [24] have reported that female fishes are generally susceptible to infection with Acanthocephalans, Nematodes and Cestodes. This present work agrees with Omeji *et al* (2013) [43] who had more percentage parasitic infestation in females and disagree with Aliyu *et al.,* (2012) [8] who indicated that more males were infected to that of the females. The result showed that out of the five weeks of examination, week four recorded the highest prevalence, with males (5%) and females (10%) (See table 1). The result from this study further disagrees with Emere (2000) [19]; Onwuliri and Mgbemena (1987) [44] who reported differences in the incidence of infestation between male and female fish, which may be due to differential feeding either by quantity or quality of feed, or as a result of different degrees of resistance to infection.

It was observed in this study that the prevalence of infection in *Clarias gariepinus* increased with increasing size. Similar observations were reported by Ayanda (2009) [11] and Olurin and Samorin, (2006) [40] that the longer and heavier the fish, the greater the susceptibility to parasitic infection. This observation could be attributed to the fact that bigger fish provides larger surface area for infection to multiply in numbers than in smaller ones, and also as a result of changes in diet from Phytoplankton and Zooplankton to insects, larvae, snails, worms and crustaceans for food as smaller fishes grow into bigger ones (Obano *et al.,* 2010) [38]. The higher number of parasites and intensities recorded in bigger fish with the weight classes of 500-650g could be attributed to their quest for survival (Ayanda, 2009) [11].

The results further showed that out of the four organs examined for Endo-parasites, no parasite was identified at the kidney in the entire three farms undertaken, from this study. This work agrees with Omeji *et al* (2010) [42], Akinsanya *et al* (2008) [3], and Okoye *et al* (2014) [39] who reported that none of the identified parasite was recorded in the kidney. Endo-parasitic invasion on the stomach (Pond A 60%, Pond B 40%, Pond C 80%) was more than the other organs examined, followed by the intestine which had 40% prevalence in Pond A, 20% in Pond B and 60% in Pond C. High nutritional content of *Clarias gariepinus* in the stomach may possibly account for their abundance in them (Akinsanya, *et al.,* 2008) [3]. These variations in the rate of parasitism could be likened to abiotic and biotic conditions of the environments where the studies were carried out (Koskivaara, 1992; Thompson and Larson, 2004) [31, 56]. This is attributed to the saying that internal helminthes parasites depends on the presence of absorbable food materials in lumen of the gut. The availability of certain classes of nutrient and their different site of digestion and absorption will play a definite role in determining the kind of parasite and their distribution in the fish specimens (Onyedineke, 2010) [45]. *Cryptobia iubilans* was found to occur in most of the organs (stomach, intestine and liver) examined for Endo-parasites which agrees with Omeji *et al* (2010) [42] and Adam *et al* (2009) [1] who have reported heavy presence of *Cryptobia iubilans* in the stomach, intestine and liver respectively.

5. Conclusion

Pond C as the most infected Endo-parasites of *Clarias gariepinus* could be as a result of its higher nutrient load (more fertilized), pond area, and physico-chemical parameters of the water than pond A and pond B (See fig 2). Therefore the presence of these parasites might elicit some pathological effects on the fishes by retarding their growth performance, causing tissue disruption and even death. Unfavourable conditions may offset fish physiology, favouring parasite infestation and invasion. Some examples are Pollution of the pond and unfavourable temperature which may alter fish physiology aids Endo-parasitizing of fish organs significantly. Fish parasitism constitutes a major threat to fish productivity, and the increased demand on fish as a ready and safe source of protein to humans should trigger more studies on fish and its parasites. Also fish activities and time may have contributed to female *Clarias gariepinus* being more infected with parasites than the males. Though *Clarias gariepinus* as a hardy stock, may have high tolerance and resistance to parasitic infection, still parasitic infection is been recorded to be the main cause of loss in fish production which may results to mortality, treatment cost, quality and quantity reduction of the stock thereby causing a decrease in the value and price of fish. Adequate care should be taken in management of Aquaculture because this is where the infections spread without been noticed as a result of poor managerial condition.

6. Acknowledgement

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7. References

1. Adam HM, Samia H, Sayied AS. Protozoan parasites of two fish species (*Oreochromis niloticus* and *Clarias gariepinus*) in Khartoum State (Sudan). Sud. J. Vet. Sci. Anim. Husb. 2009; 48(1&2).
2. Adikwu IA, Ibrahim BA. Studies on the Endo-parasites In the Gastro-Intestinal Tract of *Clarias gariepinus* (Tugels) In Wase Dam Kano State, Nigeria. Afr. J App Zoo Env Bio. 2004, 6:35-40.

3. Akinsanya B, Hassan AA, Adeogun AO. Gastrointestinal helminth parasites of the fish Synodontis *Clarias* (Siluriformes: Mochokidae) from Lekki lagoon, Lagos Nigeria. Pakistan J nutr. 2008; 5:359-362.
4. Akinsanya B, Otubanjo OA. Helminth parasites of *Clarias gariepinus* (clariidae) in Lekki lagoon, Lagos, Nigeria. Revista de Biologia Tropical. 2006; 54(1):93-99.
5. Al-Hamed MI, Hermiz L. Experiments on the control of anchor worm (*Lernaea Cyprinacea*). Aquaculture. 1973; 2:45-51.
6. Alune E, Andrew G. Fishes. Cambridge, University Press, London. 1996.
7. Alvarez-Pellitero P. Report about fish parasitic diseases. 2004. http:/cm.ciheam.org/article.php?IDPDF=4600222:Pp 103-130.
8. Aliyu MD, Solomaon JR. The intestinal parasite of *Clarias gariepinus* found at lower Usman Dam Abuja. Department of Biological Science, Faculty of Science, University of Abuja, Nigeria. 2012.
9. Ayotunde EO, Ochang SN, Okey IB. Parasitological examinations and food composition in the gut of feral African Carp, *Labeo coubie* in the Cross River, South eastern, Nigeria. Afr. J biotech. 2007; 6(5):625-630.
10. Amare A, Alemayehu A, Aylate A. Prevalence of Internal Parasitic Helminthes Infected *Oreochromis niloticus* (Nile Tilapia), *Clarias gariepinus* (African Catfish) and *Cyprinus carpio* (Common Carp) in Lake Hugo (Hayke), Northeast Ethiopia. School of Veterinary Medicine, Wono University, P.O. Box 1146, Dessie, Ethiopia. 2014.
11. Ayanda IO. Comparison of parasitic helminthes infection between sexes of *Clarias gariepinus* from Asa dam Ilorin, north central Nigeria. Scientific Res & Ess. 2009; 4(4):357-360.
12. Baker JR. *Trypanosomes* and *dactylosomes* from the blood of fresh-water fish in East Africa. Parasitology. 1960; 50, 515-526
13. Baker JR. Trypanosomes of Africa freshwater fish: an addendum. Parasitology. 1961, 51:263
14. Barson M, Marshall BE. First record of *Contrcaecum spp.* (Nematoda: Aniskadae) in fish-eating birds from Zimbabwe. J.S. Afr. Vet, Assoc. 2004; 75:1-5.
15. Bichi AH, Ibrahim AA. A survey of Ecto and intestinal parasites of *tilapia zillii* (gervias) in yiga lake, Kano, Northern Nigeria. Bayero J Pure App Sci. 2009; 2(1):79-82.
16. Bichi AH, Bizi AG. A survey of Ecto and Endoparasites fishes of Challawa George Dam. NISEB Journal. 2002; 2(3):219-222.
17. Biu AA, Akorede GJ. Prevalence of Endo-parasitized of *Clarias gariepinus* (Burchell 1822) in Maiduguri, Nigeria. Nigerian J Fis Aq. 2013; 1(1):1-6.
18. Deborah Pouder B, Eric Curtis W, Roy Yanoug PE. Common Freshwater Fish Parasites Pictorial Guide: Monogeneans. 2005.
19. Dias JAT. 8. Uma nova especie di tripanosoma, parasite do. *Clarias gariepinus* Gulf of Mexico. I. Fish. Dis. 1952; 2:469-479.
20. Ejere VC, Oscar IA, NjokuIvoke, Ekeh NE, Ezenwaji NE, Uwakwe SO, Eyo EF. ParasitoFauna of five freshwater fishes in Nigerian freshwater ecosystem. Croatian J fis. 2014; 72:17-24.
21. Emere MC. Parasitic infection of the Nile prech (*Lates niloticus*) in River Kaduna. J Aq Sci. 2000; 31:34-45.
22. Eyo AA. Utilization of freshwater fish species in Nigeria, proceedings of the 10th annual conference of fisheries society of Nigeria, Abeokuta, 1992, 32-38.
23. Eyo JE, Ejere VC, Aguzie OF, Njoku I, Ekeh FN, Ezenwaji NE, Onoja US. Parasitofauna of five freshwater fishes in a Nigerian ecosystem. Croatian J Fis. 2013; 72:17-24
24. FAO. World production of fish, crustaceans and mollusks by major fishing areas. Fisheries information Data and statistic unit (FIDI), Fisheries Department, F.A.O Rome. 1999.
25. Froese Ramer, Pauly Daniel. (eds) *Clarias gariepinus* in Fish Base. March 2014 version (Wikipedia search). 2014.
26. Ibiwoye TII, Balogun AM, Ogunsisi RA, Agbontale JJ. Determination of the infection densities of mud fish *Eustrongylides.* in *Clarias gariepinus and Clarias anguillaris* from Bida floodplain of Nigeria. J Appl Sci Environ Manage. 2004; 8(2):39-44.
27. Imevbore AMA, Bakare O. The food and feeding habits of non-cichlid fishes of the river Niger in Kainji Resevoir – A Nigerian Man-Made Lake, Kainji Lake Studies. Ecology, 1970; 7:87-98.
28. Kelly DW, Poulin R, Tompkins DM, Townsend CR. Synergistic effects of glyphosate formulation and parasite infections and survival. J app Eco. 2010; 47:498-504.
29. Kent ML, Andree KB, Bartholomew JL, El-matbouli M, Desser SS, Delvin RH *et al*. Recent advances in our knowledge of the myxozoans. 2001.
30. Keshar KJ. Aquaculture, Daya publishing house, Delhi-110035, India. 2010, 104-113.
31. Khali LF, polling K. Checklist of the African Freshwater fishes. University of the North Department of Zoology. Republic of South Africa, 1997, 23.
32. King RP. Length-Weight relationships of Nigerian freshwater fishes, Naga, ICLARM. Q. 1996; 19:44-52.
33. Koskivaara M. Environmental factors affecting affecting monogeneans parasite on freshwater fishes. Parasitology Today, 1992, 8, 10, 339-342.
34. Marcogliese DL. Parasitology module Steering committee PMSC. Protocols for measuring biodiversity: parasites of fishes in freshwater update. Protocols manual for water Quality Sample in Canada. Ecological Monitoring and Assessment Network EMAN, Canada. 2011.
35. Martinez-Aquino A, Salgado-Maldonado G, Aguilar-Aguilar R, Cabanas-Carranza G, Ortega-Olivares MP. Helminth parasites of *Chapalichthys encaustus* (Pisces: Goodeidae), and endemic freshwater fish from Lake Chapala, Jalisco, Mexico. J. Parasitilogy. 2004; 90(4):889-890.
36. Mhasisen FT, Al-Salim NK, Khamees NR. Occurrence of parasites of the freshwater mugilid fish *Liza abu* (Heckel) from Basrah, southern Iraq. J Fish Biol. 1988; 32:525-532.
37. Ministry of Lands and Survey Imo State (2003). Office of the commissioner for Lands and Urban Development; Block 7, State Secretariat, Port-harcourt Road, Owerri, Imo State, Nigeria.
38. Moravec Frantisek, Jean-lou Justine. *Camallanus cotti* (Nematode: Camallanidae), an introduced parasite of fishes in New Caledonia. Folia Parasitological. 2006; 53:287-296.
39. Moravec Frantisek. Experimental studies on the

development of *Contracaecum rudolphii* (Nematoda: Aniskadae) in copepod and fish paratenic hosts. Institute of parasitology, Biology Center of the Academy of Sciences of the Czech Republic, Branisovka 31, 370 05 Ceske Budejovice, Czech Republic. 2009.
40. Ndifon GT, Jimeta RS. Prelimary observation on the parasites of *Chryrichyes aurantus* (Geoffery) in Tigalake, Kano, Nigeria. J parasitology. 1990; 9(11):139-144.
41. Obano EE, Ezeri GNO, Aniye UK. Studies on the parasitic infections in fish in Ovia River at Ikoro, Ovia-south West Local Government Area of Edo State, Nigeria. Biosci. Res. Comm. 2010; 22(3):137.
42. Okoye Ikem C, Abu Simon J, Obiezue Ndunwanne NR, Ofoezie Ifeanyi E. Prevalence and seasonality of parasites of fish in Agulu Lake, Southeast, Nigeria. Academic journals. 2014; 13(3):502-508.
43. Olurin KB, Samorin CA. Intestinal helminthes of the fishes of Owa stream, South-west Nigeria. Res. J Fisheries and Hydrobiology. 2006; 1(1):6-9.
44. Omeji S, Solomon SG, Idoga ES. A Comparative Study of the Common Protozoan Parasites of *Clarias gariepinus* from the wild and cultured environments in Benue State, Nigeria. J Parasitol Res. 2011, 8.
45. Omeji S, Solomon SG, Obande RA. A Comparative study of the common protozoan parasites of *Hetrobranchus longifilis* from the wild and cultured environments in Benue State. Pakistan Journal of Nutrition. 2010; 9(9):865-872.
46. Omeji S, Solomon SG, Uloko C. Comparative study of Endo-parasitic infestation in *Clarias gariepinus* collected from Earthen ponds in Makurdi, Benue State, Nigeria. IOSR - J Agric Vet Sci. 2013; 2(1):45-49.
47. Onwuliri COE, Mgbemena MO. The parasitic fauna of some freshwater fish from Jos Plateau, Nigeria, Nigeria, Nigerian J Appl Fish Hydrobiol. 1987; 2:33-37.
48. Onyedineke NE, Obi U, Ofoegbu PU, Ukogo I. Helminth parasite of some Freshwater fish from River Niger at Illushi, Edo State, Nig. Am. Sci. 2010; 6(3):16-21.
49. Paperna I, Dzikowski R. Digenea (phylum: plathyhelmintes). In fish diseases and disorders. Protozoan and metazoans infections, (Ed: Woo, P.T.K.), CAB International, Wallingford, UK, 2006; 1:345-390.
50. Paperna I. *Amyloodinium ocellatum* (Brown 1931) (Dinoflagellida) infestation in cultured marine fish at Eilat red sea: Epizootiology and pathology. Journal of fish Diseases. 1980; 3, 363-372.
51. Paperna I. Parasites, infections and disease of fishes in Africa- an update. (IFA tech paper). 1996; 31:1-200.
52. Retrieved from Wikimedia: Aquarium tropical fish: Fish Disease and treatment. Animal World.
53. Retrieved from the ministry of lands and survey, Owerri Imo State. 2007.
54. Rohlenova K, Morand S, Hyrsl P, Tolarova S, Flajshans M, Sinkova A. Are fish immune systems really affected by parasites? An immunological study of common carp (*Cyprinus carpio*). Parasites and Vectors. 2011; 40:120-17-28.
55. Roberts LS, Janovy J. Gerald D. Schmidt and Larry S. Robert's Foundations of Parasitology, 6thEd, International Editions, Boston. 2000.
56. Sadiku SOE, Oladimeji AA. Relationship of proximate composition of *Lates niloticus* (L), synodontis schall (brich) and *Sarotherodon galilaeus* (Trewawas) from Zaria Dam, Nigeria. Biosci Res. Comm. 1991; 3:29-40.
57. Subasinghe RP, Bondad-Reantaso MG, McGladdery SE. Aquaculture development, health and wealth. In: R.P. Subasinghe, P. Bueno, M.J. Phillips, C. Hough, S.E. McGladdery and J.R. Arthur. (eds.) Aquaculture in the Third Millennium. Technical Proceedings of the Conference on Aquaculture in the Third Millennium, Bangkok, Thailand, 20-25 February 2000. NACA, Bangkok and FAO, Rome. (In press). 2001.
58. Subasinghe RP, Philips MJ. Aquatic Animal Health Management; Opportunities and Challenges for Rural, Small-Scale Aquaculture and Enhanced Fisheries Development; Workshop Introductory Remarks. In Primary Aquatic Animal Health Care in Rural, Small-Scale Aquaculture Development, ed. J.R. Arthur, M.J. Philips, Subasinghe, M.B. Reantaso, and I. H. MacRae, 1-5. FAO Fisheries Technical Paper 406, FAO, Rome. 2002.
59. Tachia MU, Omeji S, Odeh L. A survey of Ectoparasites of *Clarias Gariepinus* caught from the university of Agriculture research fish farm, Makurdi. J. Fores. Wildlife Environ. 2011; 4(2):30-37.
60. Thompson LC, Larsen R. Fish habitat in freshwater stream. Farm water Quality Planning FWQP: Reference Sheet 10.3, Publication 8112. University of California, California. 2004.
61. Usip LPE1, Udoidiong OM, Ekpo IE, Ukut II. Parasites of cultured *Clarias gariepinus* (burchell, 1822) from three farms, Uyo, Nigeria. Glo. Advance. J Food Sci Tech (ISSN: 2315-5098). 2014; (2):084-089.
62. Wengon CM. Report of travelling pathologist and zoologist, Welcome Res. Lab. Khartoum. 1908; (3):121-168.
63. Willoughby NG. The ecology of the genus *Synodontis* (Siluroidei) in Lake Kainji, Nigeria. PhD Thesis, University of Southampton. 1974.