Parasitic Fauna of *Clarias gariepinus a*nd *Clarias agboyiensis* in two Reservoirs on Owena River, Southwestern Nigeria.

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Abstract

Parasitic fauna of *Clarias gariepinus* and *Clarias agboyiensis* was examined between the months of May 2010 and April 2012 in the Old and New Reservoirs on Owena River. A total of three hundred and twenty fish (320) species comprising of one hundred and sixty (160) fish specimens each, from *Clarias gariepinus* and *Clarias agboyiensis* were examined. Twenty (20) of each fish species were collected and examined (per season) using standard methods. Observed parasites were collected, fixed and mounted for identification. The mean intensity, standard deviation, and prevalence of the data collected were determined. Differences in parasite prevalence, intensity or diversity among fish species were investigated using Student t-test at a p-value of 0.05. The results showed that 5 species of parasites, *Dactylogyrus spp* and *Gyrodactylus spp* (Monogenea) *Contracaecum spp* and *Capilaria spp* (Nematodes), and *Trichodina spp* (Protozoa) were observed. The t-test between the numbers of infected fish in the two reservoirs shows a significant difference ($P< 0.05$) between the rate of infection of *Clarias gariepinus* and *Clarias agboyiensis*. ($t = 0.00042$) in both OR and NR respectively. The highest Prevalence, intensity and abundance of infection was recorded for *Dactylogyrus spp* and *Capilaria spp* and the least was observed in *Gyrodactylus spp* and *Capilaria spp* respectively. The highest record of infection for each species was recorded in rainy season, and the lowest was in dry seasons. Multiple infections were recorded in several fish hosts, an indication of the rich parasitic fauna of the study sites. It is therefore recommended that proper processing method be put in place for fish caught in the wet season to reduce transmission of parasites to humans. More so *Clarias agboyiensis* is an endangered fish species and should be avoided from harvesting due to it endangered nature and its small size.

Keywords: Parasitic fauna, reservoirs, intensity, prevalence

Introduction.

Fish, like all living things in bound situations are subject to ill-health and diseases. Studies on the biology, nutrition, growth and management of most of the commercially vital fish species like Clarias agboyiensis and Clarias gariepinus, have been carried out (Ovie and Ovie, 2002). It had been apparent that the pathological conditions as a results of parasitic infections could lead on to serious consequences particularly the alimentary devaluation of the fish (Van Dan Brock 1979). Fish has a remarkable impact on the lives of the many people and communities in most continents of the planet, primarily as a major supply of comparatively low cost and cheap essential animal macromolecule. Several parasite faunas, like the monogenean, protozoans and nematodes, seem to be slightly or moderately unhealthful nonetheless destroy the aesthetic worth of fish (Ibrahim et al., 2008). Fish parasites are significant because they affect fish production particularly under culture system, by decreasing their yield aesthetic value,

marketability, palatability and reproductive potentials (Oniye et al., 2004; Ibrahim et al., 2008). The parasitic infections may lead to mass mortality of fish or emergence of zoonotic species if left un-curtailed (Oniye et al., 2004). The allergic responses to toxic waste products of the parasites may be evident to the consumers of the infected fish (Ukoli, 1990). The zoonotic diseases reported by Ko (1995) include opisthorchiasis, diphyllobothriasis, clonorchiasis, gnathosomiasis and anisakiasis were as a result ingestion of raw or under cooked fish.

Nigeria as other developing countries, her fish production is supported by the availability of widespread inland water systems made up of streams, rivers, and lakes which support a great number of fish species, many of which are of economic importance. These commercially vital fish species did well and have very great resistance to diseases through good management practices in absence of bad handling, unsuitable food, poor water quality, overcrowding, or other adverse influences which could not weaken them. (Eyo and Olatunde, 2001). Consequently, fish diseases can be kept under control when fish are in a good culture condition so that they can have a good resistance when any infection occurs. Most infections, however, can be avoided through good management practices (Oniye et al., 2004). A stocking density with high incidence of diseases will lead to slow growth of fish, unattractive fish appearance, gradual or sudden physical loss of fish by death, extra production cost to a farmer for treating such diseases and overall economic losses in production(Oniye et al., 2004).

To fully develop and manage these diverse and rich fish resources in these inland water bodies, there is a need for adequate knowledge of parasites that infect them with a view to adopting preventive and control measure to improve fish yield. Parasitism in fish has been a great concern since these parasites produce disease condition in fish thereby increasing their susceptibility to other diseases, causing nutritive devaluation of fish and fish loss (Majidah and Khan, 1998). Incidence of heavy parasitic infection in fish has been reported globally because fish serves as reservoir and intermediate host to most stages of parasites ranging from protozoans to metazoans (Pal and Ghesh, 1985).

In Nigeria, some studies have been carried out by many researchers on common parasitic fauna of commercially important fishes. Eyo et al. (2012) reported on parasitic infestation of Synodontis batensoda in rivers Niger-Benue confluence. Okoye et al. (2014) worked on prevalence and seasonality of parasites of fish in Agulu Lake in South Eastern Nigeria, However, not much research on parasitic fauna of commercially important fishes has been done and documented in freshwater rivers in South Western Nigeria.

This limited studies in Nigeria confirmed that much more research needed to be carried out on tropical freshwaters and these have great potential to contribute to maintaining the populations of commercially important fish species through well-informed management of aqua cultural development in Nigeria. This study will present data on the parasitic fauna of two important fish species, namely Clarias agboyiensis and Clarias gariepinus, inhabiting two reservoirs on Owena River

Materials and Method

Study site

The study were carried out on the old and the New Reservoirs (NR) located on Owena River, about 7.1 km to Igbara-Oke town off Ilesa - Akure Road. NR is located in Ifedore Local Government Area of Ondo State Nigeria and was established in 2006 with central coordinates of 07.34272 N and 004.9996 E. NR is about 300 m long and 9 m in the deepest parts with a capacity of 600,000 m^3. The Old Reservoir

(OR) was established over 46 years ago along Ondo-Akure road for domestic purposes within Akure and Ondo metropolis. It has a central coordinate of 07.19866 N and 005.01849 E. Two major seasons are experienced in the reservoir: dry and wet seasons. Heavy rains bimodal characterizes the wet season (March–October). The rainfall regime is characterized by double peaks (June and October); 1005 mm in June and a little above 1800 mm in October (Lasisi (2002). The dry season is between November and February, while the peak of the dry season is in January. The sun shines throughout the year and the average temperature is between 29.40 ºC and 31.26 ºC. (Lasisi (2002). At present, fish production from NR and OR in Owena river form a significant proportion of Akure metropolitan inland fisheries supply. It is one of the largest rivers in the area with its reservoir under construction by the government to supply water to the local communities, for small scale farming, industries, and general house hold use.

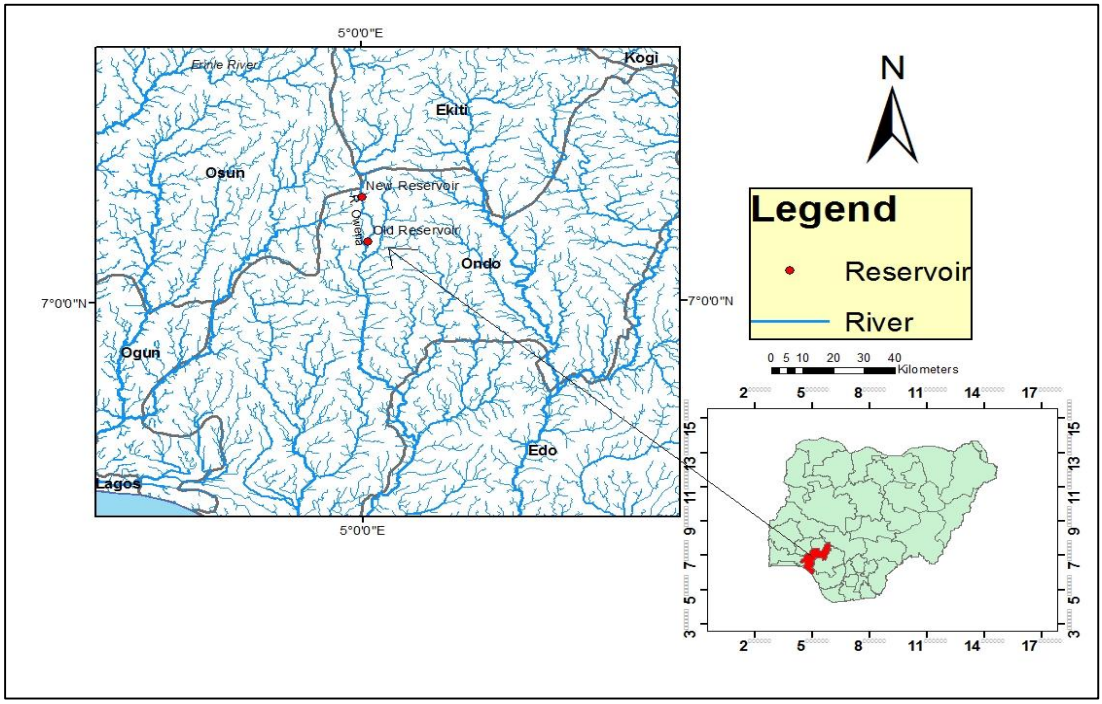

Figure 1: Map of the study areas showing the location of the reservoirs
Source: Field study 2015

Materials and Methods

Fish Sample Collection, identification, classification, and measurements

The seasonally collected fish samples were bought from the local fishermen in two Reservoirs between the months of May 2010 to the month of April 2012. The collected fish were identified as described (Olaosebikan and Raji, 2004) to species level in the field. The live fish samples (twenty for each fish species) were transported in a plastic bucket containing clean water from the river to the research laboratory of the Department of Fisheries and Aquaculture Technology, The Federal University of Technology, Akure. Prior to dissection, the standard length (from the tip of the snout to the end of the base of caudal peduncle) and the total length (from the tip of the snout to the extreme end of the caudal fin) were measured using a half

meter rule mounted on a dissecting board (Lowe McConnell, 1972). The weight of each fish samples was also measured to the nearest 0.1 g on a top loading Mettler balance (Model Mettled Toledo PB8001). The fish were sexed and the males were distinguished from the females by the examination of the urogenital area and external morphology gonads

Identification of parasites

The abdominal cavity of each fish was cut open by a small incision in the mid- ventral line, extending interiorly and passing laterally to the pelvic fins. The entire digestive system was removed and placed in a petri-dish with physiological saline solution and the gut was divided into sections. Examination of the fish specimen for parasites (skin, gills, gonads, livers and heart) were done with the aid of Binocular microscope at X100 and X400 magnification. Parasites recovered were washed free of debris in saline solution, fixed and preserved in 3% formal- saline. The number of parasites per fish and location was recorded (Author and Albert, 1994; Ash and Orihel, 1991) where the fish samples were examined for ectoparasites. Scraped mucus from the body surface of the fish was also examined under low power binocular microscopes for parasites.

Statistical Analysis.

For Statistical analysis, both parametric, as well as the nonparametric tests, were used for the analysis of the mean species richness. A computer program Excel and (SPSS 10.05 for windows) were used for data analysis. The descriptive data was used to determine mean ± standard deviation (SD). Student t-test and was used to analysis and determined the statistical significance in the prevalence of parasitic infections between different study sites.

Prevalence was calculated as

$$Prevalence(\%) = \frac{no\ infected}{no\ of\ fish\ examined} x100 \qquad \text{(Awharitoma, 2014)}$$

Intensity was calculated as

$$Intensity = \frac{no\ of\ parasite\ observed}{no\ of\ fish\ infecetd} \qquad \text{(Awharitoma, 2014)}$$

Parasite Abundance was calculated using the formular

$$Abundance = \frac{no\ of\ parasite\ observed}{no\ of\ fish\ examined} \qquad \text{(Awharitoma, 2014)}$$

Results.

Table 1 shows the parasite distribution between *Clarias gariepinus* and *Clarias agboyiensis*. A total of 320 fish species were examined for parasite infection in both Old Reservoir (OR) and New Reservoir (NR) with 160 fish species of *Clarias gariepinus* and *Clarias agboyiensis* examined for parasite infection respectively. The result shows that 139 species of *Clarias gariepinus* were infected out of which 564 cases of parasitic infections were detected while 69 species of *Clarias agboyiensis* were infected out of which 102 infection cases identified. The prevalence, intensity and abundance of parasitic infection in *Clarias gariepinus* fishes were 93.13%, 3.79 and 3.53 respectively while that of *Clarias agboyiensis* were 43%, 1.49 and 0.64 respectively. The t-test between the numbers of infected fish in the two reservoirs shows that there is a significant difference ($P< 0.05$) between the rate of infection of *Clarias gariepinus* and *Clarias agboyiensis*. (t = 0.00042) in both OR and NR respectively

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Table 1: Parasite distribution between *Clarias agboyiensis* and *Clarias gariepinus*.

Fish Species	No Infected	No of Parasite Observed	Prevalence (%)	Intensity	Abundance
Clarias gariepinus	139	564	93.13	3.79	3.53
Clarias agboyiensis	69	102	43.13	1.49	0.64

No of fish Examined for each fish species= 160

The incidence of the parasitic fauna namely *Dactylogyrus spp* and *Gyrodactylus spp* (Monogenea) *Contracaecum spp* and *Capilaria spp* (Nematodes), and *Trichodina spp* (Protozoa) in the study areas is shown in Table 2. The result show that 68 species of *Clarias gariepinus* were infected with *Dactylogyrus spp,* 46 with *Trichodina spp*, 18 with *Gyrodactylus spp*, 9 with *Capilaria spp* and 8 with *Contracaecum spp.* The highest observation (189) of parasitic fauna was recorded for *Dactylogyrus spp* and *Capilaria spp* while the lowest (12) was recorded for *Contracaecum spp* in the study area. However, the highest parasitic abundance of 0.59 was recorded for Dactylogyrus spp and Capilaria spp, the highest prevalence of 21.25% was recorded for *Dactylogyrus spp*. While the lowest prevalence, intensity and abundance of 2.50%, 1.06 and 0.04 were for *Contracaecum spp, Gyrodactylus spp* and *Contracaecum spp respectively* in the study area. The highest parasitic intensity was recorded for *Capilaria spp* while the lowest was in *Gyrodactylus spp.* for *Clarias gariepinus* in the study area.

Also, 27 species of *Clarias agboyiensis* were infected with *Trichodina spp,* 21 with *Dactylogyrus spp,* 9 with *Contracaecum spp* and 6 each with *Gyrodactylus spp and Capilaria spp* respectively. The highest number of parasite observed (42) was recorded for *Trichodina sp* while the lowest (6) was recorded for both *Gyrodactylus spp and Capilaria spp* in the study area. However, the highest parasite prevalence of 8.44%, was recorded for *Trichodina spp,* and the highest intensity and abundance of 2.00 and 0.13 respectively were recorded for*, Dactylogyrus spp* in the study area. The lowest parasitic prevalence, intensity and abundance in *Clarias agboyiensis* were recorded for *Gyrodactylus spp and Capilaria spp* (1.88%), (1.00) and (0.02) respectively.

Table 2: Incidence of *Dactylogyrus spp Gyrodactylus spp*, *Trichodina spp*, *Capilaria spp*, *Contracaecum spp* in *Clarias gariepinus,* and *Clarias agboyiensis*.

Fish Species	Parasite species	No of fish Infected	No of Parasite Observed	Prevalence (%)	Intensity	Abundance
Clarias gariepinus	*Dactylogyrus spp*	68	189	21.25	2.78	0.59
	Gyrodactylus spp	18	19	5.63	1.06	0.06
	Trichodina spp	46	141	14.38	3.07	0.44
	Capilaria spp	9	189	2.81	21.00	0.59
	Contracaecum spp	8	12	2.50	1.50	0.04
Clarias agboyiensis	*Dactylogyrus spp*	21	42	6.56	2.00	0.13
	Gyrodactylus spp	6	6	1.88	1.00	0.02
	Trichodina spp	27	36	8.44	1.33	0.11
	Capilaria spp	6	6	1.88	1.00	0.02
	Contracaecum spp	9	12	2.81	1.33	0.04

No of fish Examined = 160

Table 3 compares the prevalence, intensity and abundance of parasites observer at New and Old reservoirs along Owena River. The result reveals that OR recorded the higher number of infected fishes (110), total number parasite observed (383) as against 98 and 283 recorded for NR. The prevalence, intensity and abundance were also high for OR at 68.75%, 3.48 and 2.39 respectively as against 61.25%, 2.89 and 1.77 respectively for NR.

Table 3: Comparison of the prevalence, intensity and abundance of parasites at New and Old Reservoirs

Location	No Infected	Total no of Parasite Observed	Prevalence (%)	Intensity	Abundance
New Reservoir	98	283	61.25	2.89	1.77
Old Reservoir	110	383	68.75	3.48	2.39

No of fish Examined = 160

The summary of all parasites recovered and their corresponding intensity prevalence and abundance are shown in Table 4. In NR, the most prevalent parasite was *Capilaria spp* (20.63%) while the least prevalent was *Contracaecum spp* (3.75%). Also, the highest intensity of 3.25 was recorded in *Dactylogyrus spp* and *Trichodina spp* with *Dactylogyrus spp* recorded as the most abundant parasite. Also, *Dactylogyrus spp* was the most prevalent (28.75%) parasite with *Gyrodactylus spp* was the least (3.13%). Also, the highest intensity of 5.44 was recorded for *Capilaria spp* while *Contracaecum spp* (2.78) was the least with *Dactylogyrus spp* was the most abundant of all the parasite in the OR

Table 4: The parasite distribution at New and Old Reservoirs in Owena River

Parasites	New Reservoir					Old Reservoir				
	NI	NPO	Prev.	Inten.	Abund.	NI	NPO	Prev.	Inten.	Abund.
Dactylogyrus spp	32	104	20.00	3.25	0.65	46	135	28.75	2.93	0.84
Gyrodactylus spp	7	11	4.38	1.57	0.07	5	16	3.13	3.20	0.10
Trichodina spp	20	65	12.50	3.25	0.41	32	109	20.00	3.41	0.68
Capilaria spp	33	90	20.63	2.73	0.56	18	98	11.25	5.44	0.61
Contracaecum spp	6	13	3.75	2.17	0.08	9	25	5.63	2.78	0.16

NI= No of fish infected, NPO = No of Parasite observed. Number of fish examined for each species = **160**

The number of Fishes infected at different seasons in the Study Area is presented in Table 5. In 2010, during the dry season, the total number of fish infected was 23 (11.06%) and 22 (10.58%) at NR and OR respectively while the number of fish infected during the wet season was 30 (14.42%) and 29 (13.94%) at NR and OR respectively. During the year 2011, the number of fish infected during the dry season was 20 (9.62%) and 19 (9.13%) at NR and OR respectively while the number of fish infected during the dry season at NR and OR was 25 (12.02%) and 40 (19.23%) respectively

Table 5: Number of Fishes Infected at Different Seasons in the Study Area.

	New Reservoir				Old Reservoir			
	2010 Dry	2010 Wet	2011 Dry	2011 Wet	2010 Dry	2010 Wet	2011 Dry	2011 Wet
No Of Fish Infected	23	30	20	25	22	29	19	40
% Of Fish Infected	11.06	14.42	9.62	12.02	10.58	13.94	9.13	19.23

Discussion

Changes in the fish feeding behavior and annual temperature regime have been considered as the principal factors responsible for the seasonal incidence and intensity pattern of parasites (Eure, 1976). The overall parasite prevalence of *Clarias gariepinus* obtained in this study was similar to that reported by Hamadia (1991) for *T. nilotica* in Lake Manzalah. The high percentage of *Clarias gariepinus* infection reported in this study was supported by Hassan (2006) but was lower than that reported by Biu and Akorede (2013). The relatively high parasite incidence in *Clarias gariepinus,* can be attributed to its large size as compared to the size of *Clarias agboyiensis. Clarias gariepinus* is omnivorous and can survive adverse conditions such as low oxygen concentrations (Mashego, 1989) thus is heavily parasitized. *Clarias gariepinus can* be found in all the trophic level feeding on plant materials, insect larvae, zooplanktons, mollusks, debris and smaller fish (Willoughby, 1974; Fagade, 1983) and also browse for food which may explain their heavy parasite infestation. On the other hand, the low parasite incidence in *Clarias agboyiensis* can be attributed to its resistance to parasite infection and its small size and hence only a small surface area is available for parasite attachment on its skin (Poulin, 2000). Munoz and Cribb (2005) also noted that in general, large hosts have more space, flux of energy (food), microhabitats for the parasites than for small fish.

The prevalence of *Dactylogyrus spp* in this study was similar to that obtained by Adeogun *et al. (2014)* but Adeyemo and Falaye (2007) reported a low prevalence of *Dactylogyrus spp* in Clariid family. The intensity of *Capilaria spp* observed in this result was higher than that obtained by (Adeogun *et al.,* 2014. The prevalence of *Capilaria spp* in *Clarias gariepinus* in this study was supported by (Jihan, 2008) while prevalence of Trichodina *spp* in *Clarias agboyiensis* was lower than that obtained by Marzoik *et al.* (2013). Thilakaratine *et al.* (2003) reported that *Trichodina spp* is neither host nor site specific. Madsen *et al. (*2000); Martins *et al. (*2002); Khan, (2004) and Huh et al. (2005) explained that *Trichodina spp* lives normally in a few numbers in the mucous surface of skin and gills. However when host/parasite/environment relationship is broken by nutritional deficiency, poor water quality and infectious and or parasitic diseases, the trichodinids may proliferate rapidly and become responsible for severe epidermal lesions and disease outbreaks which may be the reason for the relatively high prevalence of *Trichodina spp*.

In this study, the high intensity of *Dactylogyrus spp* and *Capilaria spp* during the dry season could be attributed to the low water availability during the dry season during which some sections of the river are isolated by land barriers. This leads to concentrations of fishes in dry season for refuges resulting in higher densities and lower oxygen availability which contribute to higher levels of stress. This high densities of fish causes frequent host – to – host contact which significantly promotes the transmission of *Dactylogyrus spp*. As observed by Zuk, (1990), a higher frequency of occurrence of parasite during the dry season may result from relatively higher host susceptibility. Organisms under stress or in poor body condition are generally less resistant to parasites.

In seasonally flooding waters, dry season conditions lead to habitat contraction, lower oxygen availability, and higher fish densities, and in some cases lower fish condition and higher mortality is confirm by these researchers (; Chapman, et al, 1991; Chapman and Chapman, 1993). The high prevalence of the Protozoa, *Trichodina spp*, during the dry season could be attributed to its reproduction by binary fussion (Ogut and Palm, 2005) and the decrease in water volume during the dry season causing nutritional imbalance which results to less production of fish food organisms and moreover, fall in water temperature during cooler months reduced the immune response in fish and made them more vulnerable to disease

agents (Bhuiyan *et al.*, 2007).

Conclusion

The highest Prevalence, intensity and abundance of infection was recorded for *Dactylogyrus spp* and least was observed in *Gyrodactylus spp* and *Caplaria spp* respectively. The highest value of infection for each species was recorded in rainy season, and the lowest value was recorded in dry seasons. All parasites were recovered from the gills and stomach except the *Contracaecum spp* and *Trichodina spp* which were recovered from the intestine and skin of fish hosts and parasites observed were significantly difference in sites of infection. Multiple infections were recorded in several fish hosts, an indication of the rich parasitic fauna of the study sites.

There is seasonal variation of parasite infestation in fish species as reported in this study showed that the highest infestation of parasites in fish species were more in wet season than in dry season. It is therefore recommended that the local fishermen should fish in dry season rather than in wet season when fish will be loaded with high parasite infestation. Also, it is

Recommendations

recommended that proper processing method be put in place for fish caught in the wet season to reduce transmission of parasites to humans. More so *Clarias agboyiensis* is an endangered fish species according to IUCN Red List (2015). It is recommended that this species be avoided from harvesting due to it endangered nature and also its small size

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