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Prevalence of Ecto and Endo Parasites in some Fresh Water Fishes from Jabi Lake, Abuja, (FCT), Nigeria

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A study on the prevalence of Ecto and Endo parasites in some fresh water fishes from Jabi Lake was carried out from July to September 2015. The fishes examined were *Clarias gariepinus*, *Chrysichthys nigrodigitatus, Tilapia zilli, Gnathonemus cyrinoides and Mormyrops deliciosus*. Ninety specimens each were examined in the laboratory for Ecto and Endo parasites using standard methods and equipment. The condition factors of all individual fishes were determined, and the following mean values were obtained: 1.29 ± 2.77 for *C.gariepinus,* 1.14 ± 2.38 for *C. nigrodigitatus* 1.52 ± 2.56 for *T. zilli,* 1.65 ± 1.82 for *G. cyprinoides*, and 0.59 ± 2.09 for *M. deliciosus*. Parasitic infections were lower for *Mormyrops deliciosus* (1.63) *and Chrysichtys nigrodigitatus* (2.33); low condition species, than *Tilapia zilli* (2.80) and *Clarias gariepinus* (2.67); high condition species. The mean weekly physicochemical parameters were: total alkalinity (139.5 ppm), biological oxygen demand (1.585 mg/l), dissolved oxygen (7.58 mg/l), pH (8.99), temperature (26.5°C), conductivity (106 µ/cm) and turbidity (2.73 m). Of the 450 fishes examined, for *C. gariepinus,* female and male parasitic prevalence was 55% and 45% respectively. For *Tilapia zilli*, female parasitism was 51% while male was 49%. For *C. nigrodigitatus*, female parasitism was 74% while male was 60%. For *G. cyprinoides,* female parasitic level was 37%, while male was 62%, and for *M. deliciosus*, female parasitic level was 36% while the male was 64%. Some of the Ecto parasites found were; *Flexibacter litoralis, Argulus japonicas, Diplostomulum flexicaudum, Saprolegnia ferax and Ichthyophthirius multifilis* and some of the Endo parasites found were; *Lingula anatina, Clinostomum marginatum, Diphyllobothrium latum and contraceacum spiculigerium.*

Keywords: Ecto and Endo parasites, fresh water fishes, Jabi Lake, Abuja

INTRODUCTION

Fish is very important to human populace in trade and economy; it is of importance in the diet of different countries, especially in the tropics and subtropics where malnutrition is a major problem (Alune and Andrew, 1996). Fish ranked high in the contribution of essential protein in Nigeria. As the human population inevitably increases, the demand for fish as source of protein also grows. In recent times, there has been tremendous increase in the development of fish farming and culture attributed to the increased need for affordable animal protein, especially in the tropics (Davies *et al.,* 2006). Therefore, catfishes of the family Clariidae are increasingly being used for freshwater aquaculture in Africa, owing to several favourable cultural characteristics. A parasite is an organism that lives in or on another larger organism of a different species (the host), upon which it depends for food. Although the parasite benefits from the association, the host is harmed. Depending on the species, the host/parasite relationship may be temporary or permanent. Bacteria and viruses are classified as parasites in some branches of biology. Fishes are subject to a wide variety of diseases including bacteria, fungi and miscellaneous parasites. Broken head disease with a symptom of skeletal deformities (lardosis and scoliosis) makes fish suddenly stop feeding, becomes lethargic and dies with

swollen weak tissues on both sides of the head, usually observed on fish >10 cm, dead fish exhibit thick and curved skulls. Parasitic infection and diseases are some of the factors hindering high productivity in fish farming (Doglel *et al.,* 1961; Kayis *et al.,* 2009). The majority of the fish parasites which cause disease in fish include protozoan parasites. Typically, these parasites are present in large numbers either on the surface of the fish, within the gills, or both. When they are present in the gills, they cause problems with respiration, and death will commonly occur when additional stressors are present in the aquatic environment. Protozoan parasites on the skin, fins or scales only (i.e., not affecting the gills) usually do not result in death unless they are accompanied by a secondary bacterial infection. According to Klinger and Francis (2000), protozoa are a vast assemblage of eukaryotic organisms, and most of the commonly encountered fish parasites are protozoa, which with practice are the easiest to identify and easiest to control. In general, protozoa are one of the major fish parasites that have been long neglected because of the inherent difficulty in studying compared to other larger parasites. Among protozoa, Ecto and Endo parasitic protozoa occupy a very important sector as one of the hazardous threats to fish health. These parasites attack the fish, causing massive destruction of skin and gill epithelium. Even moderate infection of these organisms on small fish may prove a fatal disease, since the infection may cause the fish to stop feeding (Enayat, 1996). Some fish parasites would develop in humans if the fish is eaten raw, but none would be harmful if the fish is thoroughly cooked. All reports of people being infested with fish parasites were because of ingestion of raw fish or insufficiently cooked fish (Food Agricultural Organization, 1996). Most fish, especially in the wild population, are likely to be infested with parasites, but in the great majority of cases, no significant harm to the host may be encountered or identified; thus, there are only few reports of parasites causing mortality or serious damage to the fish populations, but this may be largely because such effects go unnoticed (Roberts, 2001). Fishermen or consumers often observe parasites in wild fish only when they are so obvious as to lead to rejection of fish (Roberts, 1995). In culture fish population, on the other hand, parasites often cause serious outbreak of diseases. The presence of dense populations of fish kept in particular environmental conditions may favour certain parasites so that the parasite population increases to a very high level (Roberts *et al*., 2000). Parasites are the most diverse and common pathogens the aqua culturist may likely encounter, and parasitic diseases which are very common in fish all over the world, are of particular importance in the tropics. Parasite of fish can either be external or internal. Parasitic infections often give an indication of the quality of water, since parasites generally increase in abundance and diversity in more polluted waters (Poulin, 1992; Avenant-Oldewage, 2002).

Parasites are capable of causing harm to the fish host notwithstanding the sp., either through injury to the tissues or organs in the process of burrowing or consuming food or the removal of digested food in the gut of the fish as well as the secretion of proteolytic enzymes. Parasites generally don't kill their hosts (it is a dumb parasite that kills its free lunch), but some can severely stress fish populations to the point of becoming biological and economical concerns. Parasites have a stake in the survival of their host. Sometimes, when parasites are numerous or the fish is stressed from another cause, the fish will die. Parasites can weaken a fish by destroying tissue, removing blood and cellular fluids, diverting part of its nutrient supply and allowing secondary infections to develop. Fish parasites result in economic losses not only mortality, but also from treatment expenses, growth reduction during and after outbreak of disease and this militates against expansion of aquaculture. Protozoan parasites cause serious losses in fishponds and wild in Nigeria, and their lesions render the fish unmarketable. Fish carrying protozoa parasites are capable of passing on the infective disease to man after its consumption. Protozoa are common tropical freshwater fish parasites that affect public health and cause losses to fishes. One of the scientific importances of identifying a fish properly is to tell to some extent the health condition of the fish, and certain parasitic infections present with some symptoms that bear on the external treatment of the fish (Schmitt and Dethloff, 2000). This study was conducted to investigate the level of prevalence of Ecto and Endo parasites in some fresh water fishes from Jabi Lake Abuja, F.C.T.

MATERIALS AND METHODS

Study area

The study took place in Jabi Municipal Abuja Federal Capital Territory Nigeria, located at latitude 9.0647803 (7°5’ 0’ N) and longitude 7.4219122 (8° 38’ 0’ E) (Figure 1). According to Mabogunje, (1977), there are two weather conditions experienced in the year, the dry season which falls between November and February, and the rainy season which is between March and October.

The studied fish

Clarias gariepinus

It has an average adult length of 1–1.5 m. It reaches a maximum length of 1.7 m and can weigh up to 60 kg. These fish have slender bodies, flat bony heads, and broad terminal mouths with four pairs of barbells. They also have large accessory breathing organs composed of modified gill arches. It is a nocturnal fish like many catfish. It feeds on living as well as dead animal matter.

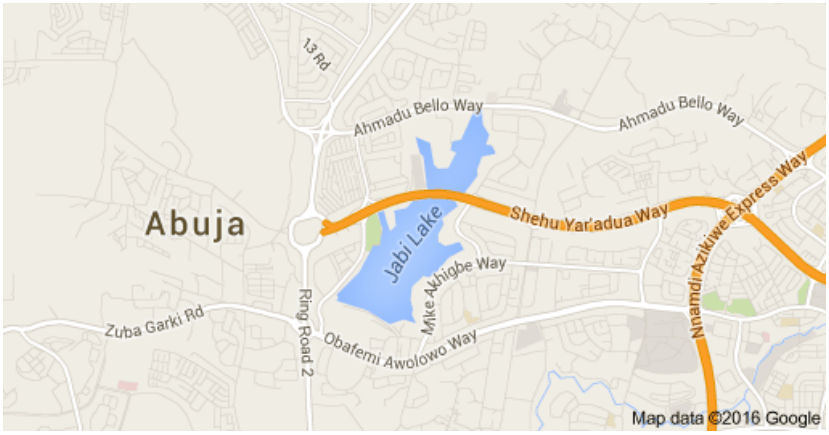

Figure 1. Map showing the study area.

Because of its wide mouth, it is able to swallow relatively large prey whole. It is also able to crawl on dry ground to escape drying pools. Further, it is able to survive in shallow mud for long periods of time between rainy seasons (Plate 1).

Plate 1. *Clarias gariepinus.*

Chrysichthys nigrodigitatus

It is also known as silver cat fish, found in Africa, including Nigeria. They belong to the family Bagridae. The fish is common in the Niger Delta where it is a valued source of protein and constitutes the dominant commercial catch of artisanal fishermen (Plate 2).

Plate 2. *Crysichthys nigrodigitatus.*

Tilapia zilli

It has a maximum length of 40 cm and a maximum published weight of 300 grams with a total of 13-16 dorsal spines. The non-breeding coloration of *T. zilli* is dark olive on top and light olive to yellow-brown on the sides. Lips are bright green and chest is pinkish (Plate 3).

Plate 3. *Tilapia zilli.*

Mormyrups deliciosus

They are widespread in Afro-tropical river systems and very abundant in West Africa. Roberts, (1975) attributed their success primarily to two adaptations, namely, their electric organs, which are non-visual sense organs important in nocturnal movement and communication and diversification of feeding habits (Plate 4).

Plate 4. *Mormyrups deliciosus.*

Gnathonemus cyprinoides

It is a genus of elephant fish in the family Mormyridae,

they exhibit two structural, sexually dimorphic characters; anal fin ray bone expansion and indentation of the posterior ventral body wall (formally described as anal fin indentation) (Plate 5).

Plate 5. *Gnathonemus. Cyprinoides.*

Sample collection

Fish samples were collected on weekly basis between July and September from the ponds using randomised sampling method through the help of a local fish farmer. A total of 450 fishes were examined, 90 fishes per species. The length and weight of each fish were measured to the nearest 1 cm and 0.1 g with the aid of a tape rule and a top loading meter balance respectively. The sexes of the fish were also determined by examining the papillae. Pond water samples were collected in sterilized glass bottles (250 ml) 15 to 20 cm below the water surface from three different locations in the pond in every sampling. This is in order to see a true picture of the general pond condition.

Sample analysis

Upon arrival at the laboratory, physicochemical parameters were analysed for the three water samples separately and averaged. External examination of each of the fish for parasites was carried out using the technique of Emere and Egbe, (2006) on the gills, fins and skin. The skin, gills and fins of each of the fish were also examined for ectoparasites using hand lens. The fish samples were filleted using scalpel blade. The tissue was placed in a petri-dish and 3 ml of 0.9% saline solution were added and stirred using a mounted pin. Some drops of the mixed solution were collected using dropper, placed on a slide, and then covered with a cover slip after which, observation on a light binocular microscope was made. Later, the gills of each of the fish were dissected using a dissecting kit, each of the gills was placed in 10 ml of normal saline in petri-dish, later, it was removed, place on a slide on which 1-2 drops of saline solution were added and observed on a binocular microscope. The stomach and the intestine of each of the fish were cut opened, and contents washed into the petri-dish containing the saline solution. The lining of the gut lumen was also scrapped out and placed in the saline solution. One to two drops of the preparation was placed on slide covered with slips and observed using a light binocular microscope for endo parasites. Ecto parasitic data was collected on the gills, fins, and skins of the fish, while the Endo parasitic data were collected on the stomach and intestine of the fish using the techniques of Emere and Egbe (2000). The parasites were identified by making their sketches as observed on the binocular microscope and compared with the pictorial guide on fish parasites by Pouder *et al.* (2005). The number of parasites observed in the binocular microscope were counted and recorded.

Physicochemical parameters of the Jabi Lake

Alkalinity

The total alkalinity was determined using the methyl orange method. Two to three drops of methyl orange indicator were dropped into 100 ml of water to be tested. This was titrated slowly and carefully against N/50 sulphuric acid from a burette to the water sample until the faintest pink colour appeared. This was the end point which signifies the alkalinity level of the water and the volume of the titrant was recorded and calculated (U.S EPA, 2007a; Environmental Review, 2008).

Temperature

Temperature readings of the water were taken using the mercury in bulb thermometer. The readings were taken *in-situ*. Once between 8:00am to 12:00pm and was repeated at each visit of the site (U.S EPA, 2007a).

Dissolved oxygen

The modified Winkler method (Annes, 1966) was used. 300 ml BOD bottles labelled approximately were used in collecting water samples from the site. Water samples were collected in a way to avoid turbulence or bubbles which may interfere with the readings so, samples were taken at a depth of 0.5 m in such a way that the bottle could be capped while it was still submerged. The water was then allowed to fill the bottles gradually avoiding any turbulence. The bottle was slowly turned upright and filled completely after the water level in the bottle was stabilized. Eight drops of manganese sulphate solution and 8 drops of alkaline potassium iodide were added and were mixed gently and carefully by inverting the bottle several times. The stopper was immediately inserted, air was not trapped in the bottle and inverted several times to allow proper mix. An orange brown flocculent precipitate was formed if oxygen was present. Once the flocculent settled after a few minutes, the bottle was inverted several times to ensure complete reaction of the sample and reagent (Annes, 1966; U.S EPA, 2007a). The fixed sample was poured into graduated cylinder and transferred to a burette. The burette was filled with 0.025N of sodium thiosulphate to the zero mark. The plunger was pressed slowly until the yellow brown colour

was reduced to a faint yellow thereafter eight drops of starch indicator solution was added until the sample turned blue (U.S EPA, 2007a). Titration continued until the blue colour just disappeared (end-point). The initial and final burette readings were taken and the volume of reagent was noted. From these, volume of dissolved oxygen was calculated (Annes, 1996; U.S EPA, 2007b).

pH

The pH was measured using a pH meter model British Milwaukee Smart Meter S_2O_4. 50 ml of sample water was poured into a 100 ml beaker and part of the meter electrode was inserted into the water. Readings were taken after one minute (Globe, 2005).

Turbidity

Turbidity was taken *in-situ* using a Secchi disc. The Secchi disc inserted into the pond by the help of graduated string attached to it and the point at which the white part of the disc disappeared completely from site was taken as the measure of the turbidity of the water. This was repeated three times and the average reading taken (Robert, 2007; U.S EPA, 2007).

Biological oxygen demand

The methods for collecting samples for BOD were the same as described for dissolved oxygen. For BOD measurement, two samples were taken. One was tested immediately for dissolved oxygen and the second was incubated in the dark at 20 ± 1.25°C for 5 days and then tested for the amount of dissolved oxygen remaining using the method described in the method use dissolved oxygen. The difference in oxygen levels between the first test and the second test in milligrams per litre (mg/L) is the amount of BOD i.e. The amount of oxygen consumed by microorganisms to break down the organic matter present in the sample bottle during the incubation period (APHA, 1992).

Conductivity

Conductivity was measured using conductivity meter of model America Phillips Hanna HI9813-0. The water samples were transferred to the laboratory for testing (U.S EPA, 2007a). The conductivity meter was calibrated to give the greatest number of significant digits. A range for 2000 was set to measure in microhms (µs) and the calibrated knob was adjusted till the instrument reads 1,000 µs. The probe was placed into the water sample making sure that the slot at the end of the probe is totally immersed. The sample with the probe was agitated for 5-10 seconds to remove bubbles that might be trapped in the slot and the readings were taken (U.S EPA, 2007b).

Statistical analysis

The results of the experiment was statistically analyzed using chi square test, Student's Test at P - values equal to or less than 0.05, and, variation of the mean values and variables tested (Mahajan, 1997; Matur, 2008).

Condition factor K

The condition factor "K" i.e. the general well-being of the fish also known as the Ponderal index or the Fulton Coefficient of condition was calculated/computed using the formula below.

$$K = 100 \times \frac{W}{L^3}$$

Where K= Condition factor
W= Body weight of the fish (g)
L= Total or standard length of the fish (cm)
Condition factor was used as a base for grouping individuals into low conditions and high conditions status (Carlender, 1969).

Percentage prevalence of parasites

$$\text{Percentage prevalence} = \frac{\text{Number of fish infected}}{\text{Number of fish examined}} \times 100$$

RESULTS AND DISCUSSION

The total numbers of species examined were four hundred and fifty (450); 90 *C. gariepinus*, 90 *C. nigrodigitatus*, 90 *T. zilli*, 90 *M. deliciosus*, and 90 *G. cyprinoides*, with a total of 290 female and 160 male species. Among the male species, *Mormyrops deliciosus* had the highest percentage parasite prevalence, while *Tilapia zilli* had the lowest percentage parasite prevalence. Among the female species, *Chrysichthys nigrodigitatus* had the highest parasite prevalence while *Clarias gariepinus* had the lowest percentage parasite prevalence. In the overall, *Chrysichthys nigrodigitatus* had the highest prevalence of parasite while *Tilapia zilli* had the lowest prevalence of parasites (Tables 1-3).

List of ecto and endo parasites of the sampled fish

The Ecto parasites found were;

Flexibacter litoralis *Uvulifer ambloplitis*
Arulus japonicus *Salmincola*

Table 1. Condition factor of the sampled fish

Species	K -RANGE	K-MEAN
C. gariepinus	1.29 - 2.77	2.675
C. nigrodigitatus	1.14 - 2.38	2.330
T. zilli	1.52 - 2.56	2.800
G. cyprinoides	1.65 - 1.82	2.560
M. deliciosus	0.59 - 2.09	1.635

Table 2. Prevalence of Ecto and Endo parasites in males and females of the sampled fish from Jabi lake.

Species	Sex	Infected	Non Infected	Total	(% Prevalence)
Clarias gariepinus	Male	20	15	35	(57.14)
	Female	30	25	55	(54.54)
	Total	50	40	90	55.5%
C. nigrodigitatus	Male	15	10	25	(60.00)
	Female	48	17	65	(73.85)
	Total	63	27	90	70%
Tilapia zilli	Male	12	28	40	(30.00)
	Female	32	18	50	(64.00)
	Total	44	46	90	48.89%
G. cyprinoides	Male	14	10	24	(58.33)
	Female	42	24	66	(63.64)
	Total	56	34	90	62.22%
M. deliciosus	Male	22	14	36	(61.11)
	Female	36	18	54	(66.67)
	Total	58	32	90	64.44%

Table 3. The mean physicochemical parameters of the Jabi lake.

WEEKS	ALK (ppm)	BOD (mg/l)	COND. (u/cm)	DO (mg/l)	pH	TEMP. (°C)	TURB. (meters)
1	126	1.16	120	7.56	10.11	25	3.1
2	142	2.01	108	7.00	8.56	28	2.2
3	154	1.89	100	8.26	7.55	26	3.2
4	136	1.28	96	7.48	9.74	27	2.4

lavaretus
Diplostomulum flexicaudum
Ichthyophthirius multifilis
Saprolegnia ferax Lernaea cyprinacea
Aeromonus hrdrophila
Naescus brevicaudatus

The Endo parasites found were;

Lingual anatina Acanthocephalus lucii
Clinostomum marginatum Diphyllobothrium latum
Contraceacum spiculigerium Eustrongylides tubifex
Wenyonia virilis Proteocephalas largoprosglotis

From this study, among the male species, *Mormyrops deliciosus* had the highest percentage prevalence of parasites and *Tilapia zilli* had the lowest percentage prevalence of parasites, while among the female species, *Chrysichthys nigrodigitatus* had the highest percentage prevalence of parasites and *Clarias gariepinus* had the lowest percentage parasite prevalence. Based on the total prevalence, *Chrysichthys nigrodigitatus* had the highest prevalence of parasite while *Tilapia zilli* had the

lowest prevalence of parasite. This implies that of all the studied fish samples, *Chrysichthys nigrodigitatus* is more susceptible to parasitic infections; this could be as a result of their omnivorous nature. Protozoans can be among the easiest to identify, and are usually among the easiest to control. Cestodes are parasitic and their life cycle varies, typically they live in the digestive tracts of vertebrates as adults and often in the bodies of other species of animals as juveniles. Trematodes are internal parasites with complex life cycle with at least two hosts. While nematodes occur within the intestine, they deprive their host of food and can feed on host tissues and blood causing emaciation and anaemia. Consequently, these parasites can build up to very high numbers when fish are crowded causing weight loss, debilitation, and mortality.

Individuals with low condition factors were found to be more susceptible to the infection. Apart from climate, other factors of considerable importance, which affect parasite prevalence, are the environment of host and the behaviour and life history of both the parasite and fish host. Stressors (Kadlec *et al.,* 2003) appear to have a moderating, sometimes overriding, influence on parasite prevalence.

Conclusion

In conclusion, a multitude of parasites have been reported in fish, but only a few species are capable of infecting humans. From the study, the mean weekly physicochemical parameters were: total alkalinity (139.5 ppm), biological oxygen demand (1.585 mg/l), dissolved oxygen (7.58 mg/l), pH (8.99), temperature (26.5°C), conductivity (106µ/cm) and turbidity (2.73 m). Of the 450 fishes examined, for *C. gariepinus,* female and male parasitic prevalence was 55% and 45% respectively.

For *Tilapia zilli*, female parasitism was 51% while male was 49%. For *C. nigrodigitatus*, female parasitism was 74% while male was 60%. For *G. cyprinoides,* female parasitic level was 37%, while male was 62%, and for *M. deliciosus*, female parasitic level was 36% while the male was 64%. Some of the Ecto parasites found were; *Flexibacter litoralis, Argulus japonicas, Diplostomulum flexicaudum, Saprolegnia ferax and Ichthyophthirius multifilis* and some of the Endo parasites found were; *Lingula anatina, Clinostomum marginatum, Diphyllobothrium latum and contraceacum spiculigerium.*

The method of capture, handling and storage of the catch can directly affect the quality of the fish with regard to the presence and numbers of parasites. The extent of processing - including heading and gutting, candling and trimming - and the type of product derived (fresh, frozen, salted or pickled) can all contribute to the control of the risks posed by fish parasites. The most effective means of killing the parasites are either freezing or heat inactivation.

Recommendation

The fish industry and government authorities can apply various programmes to reduce these risks, including good manufacturing practices (GMPs) and hazard analysis and critical control point (HACCP) systems. Such measures may include avoiding particular harvest areas, sizes of fish, or even particular species of fish. Measures can be taken during harvesting, processing or post-processing (e.g., by the consumer) to mitigate the risks of infection.

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