AGRICULTURAL AND BIOLOGICAL SCIENCES

MORPHOMETRIC INDICES AND PARASITES OF FROZEN *CLARIAS GARIEPINUS* AND *OREOCHROMIS NILOTICUS* SOLD IN JOS METROPOLIS, PLATEAU STATE

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ABSTRACT

The study on morphometric indices and parasites of frozen *Clarias gariepinus* and *Oreochromis niloticus* sold in Jos metropolis was carried out from January to April 2016. The indices measured were eye diameter, total length, standard length and weight. Twenty-two individuals of each species were measured. The mean of morphometric indices showed a very high significant difference (total length: $t = 49.085$, $df = 42$, $P < 0.0001$; standard length: $t = 34.466$, $df = 42$, $P < 0.0001$; eye diameter: $t = 18.139$, $df = 27.906$, $P < 0.0001$; weight: $t = 2.1402$, $df = 28.785$, $P < 0.04094$) between the two fish species. A total of eight parasites were recorded in this study, of which sporocyst of *diplostomatid*, *Pallisentis tetradontis*, *Acanthella* from Ostracod, Piscicolid leech were found in both fish species. However, *Allocreaduim ghanensis*, *Coracidium* and *Rhabdochonacon golensis* were found in only *Clarias gariepinus*, while *Spinitectus allaeri* was only found in *Oreochromis niloticus*. The prevalence of parasites in relation to internal organs was high in *Clarias gariepinus* and low in *Oreochromis niloticus*. However, there was no significant difference ($P > 0.05$) in prevalence rate of parasites in relation to internal organs of the two fish species. The parasites recorded are of medical importance. This study underscores the need for bio-surveillance of fish borne parasites being sold to the general public. The internal organs of fishes should be discarded before cooking the remaining parts.

INTRODUCTION

The definition of different stock of species is obtained from morphometric measurement of specific characteristics of an individual, or group of individuals which shows the degree of speciation induced by biotic and abiotic conditions (Bailey, 1997). Morphometric variation in relation to stocksgives a base for stock structure, which can be applied for short-term studies of environmentally induced variation geared towards successful fisheries management (Murta, 2002; Pinheiro *et al*., 2005). The difference between fish populations is identifiable from morphometric measurements (Tzeng, 2004; Cheng *et al*., 2005; Buj *et al*., 2008; Torres *et al*., 2010).

Fish has a remarkable impact on the lives of many individuals and communities in almost all constituents of the world being a major source of relatively cheap and affordable essential protein (Ashada *et al.*, 2013). The oil from fish is a source of minerals like omega-3 an essential fatty acid that is important for heart,brain and immune system functioning (Horn,1999). *Clarias gariepinus* is widely distributed in Africa and it occur mainly in quiet waters, lakes, pools and also in fast flowing rivers (Teugels,1986). It is highly priced in Nigeria whether smoked, dried, or fresh. *Tilapia* species are of major economic importance in tropical and sub-tropical countries throughout the world particularly in Africa (Fagbenro, 2002). *Oreochromis niloticus* has been described to be the best cultured species among the Tilapia family (Arignons,1998).

Many fish consumers prefer the delicate flavor and texture of uncooked fish and this can be a route of parasite transfer. Studies have shown that parasites whether ectoparasite or endoparasite affect the health, growth and survival of fish (Grabda, 1991; Auta *et al*., 1995; Oniye *et al.,* 2004). There is an appreciable documentation of parasite fauna of *C. gariepinus* in Nigeria (Awachie,1966; Ukoli,1969; Yakubu *et a*l., 2002;Oniye *et al.*, 2004; Ibiwoye *et al*., 2004; Akinsanya and Otunbajo, 2006).

All fishes are potential host to different species of parasites that are responsible for captive and wild fish stock mortality. Parasites and diseases are denying main adequate supply of fish resource. The issue of fish parasite and disease has posed serious challenge to fish biologists and agriculturists. It is an issue of both health and economic concern. The zoonotic disease that result from the consumption of raw material and uncooked fish include *clonorchiasis*, *opisthorchiasis*, *diphyllobothriasis, gnathosomiasis* and *anasakiasis* (WHO, 1995). To this end, the study onmorphometric indices and parasites of frozen *Clarias gariepinus* and *Oreochromis niloticus* sold in Jos metropolis, Plateau State was carried out.

MATERIALS AND METHODS

The research was carried out within Jos metropolis. The city is located on the Jos Plateau at an elevation of about 1,238 metres or 4,062 feet above sea level. Jos city is divided into 3 Local Government Areas, Jos North, Jos East and Jos South.

The frozen fishes sold within the Jos metropolis are of different species and usually undergo proper inspection before being certified for human consumption.

Samples of the two frozen fish species sold at the Jos metropolis of Plateau State were obtained for this study. The fish specimens were transported to the laboratory and preserved under refrigeration prior to identification and analysis. The procedure for examining fish for parasites by Marcogliese (2002) was used.

The Total Length (TL), Standard Length (SL) and Eye Diameter were measured to the nearest 0.1cm using a meter rule on a measuring board. The weights of the fish were measured to the nearest 0.10g using a top loading meter PC 2000 electronic weighing balance.

The internal organs i.e. oesophagus, large intestine, small intestine, stomach, liver, spleen and heart were dissected and searched for endo-parasites. The organs were then placed in normal saline in different petri-dishes including parasites isolated from those regions.

The fixation and preservation of parasites followed the procedure employed by Ash and Orihel (1991). The worms isolated, were placed in normal saline to clear mucus and other debris. The parasites were mounted on a glass slide using cover slip. The parasites were identified under the light microscope (x10 and x40 objectives).

Data obtained was analyzed using R Console software version 3.2.2. Two sample t-test was used to compare between the two fish species mean of morphometric measurements (total length, standard length, eye diameter and body weight respectively). Chi-square was used to compare the proportion of the prevalence rate of parasites in some internal organs between the two fish species. The P-value <0.05 were considered statistically significant.

RESULTS AND DISCUSSION

Comparison of the mean of morphometric measurements between *Clarias gariepinus* and *Oreochromis niloticus*

Total length

The mean total length between *Clarias gariepinus*and *Oreochromis niloticus* showed a very high significant difference ($t = 49.085$, $df = 42$, $P < 0.0001$, Figure 1).

Standard length

The mean SL between *Clariasgariepinus*and *Oreochromis niloticus* showed a very high significant difference (t = 34.466, df = 42, P < 0.0001, Figure 2).

Eye diameter

The mean Eye D between *Clariasgariepinus* and *Oreochromis niloticus* showed a very high significant difference (t = -18.139, df = 27.906, P < 0.0001, Figure 3).

Weight

The mean weight between *Clarias gariepinus* and *Oreochromis niloticus* showed a significant difference (t = 2.1402, df = 28.785, P = 0.04094, Figure 4).

Checklist of Parasites Found in the Two Fish Species

A total of eight parasites were recorded in this study (Table 1). Sporocyst of diplostomatid, *Pallisentistetradontis Acanthella* from Ostracod, Piscicolid leech were found in both fish species. On the other hand, *Allocreadiumghanensis*, *Coracidum* and *Rhabdochonaalleari* were found in only *Clarias gariepinus* while *Spinitectusallaeri* was found in only *Oreochromis niloticus*.

Comparison of the Prevalence Rate of Parasites in Relation to Internal Organs of the Two Species of Fish

a). **Oesophagus:** no parasite was found in the oesophagus organ in both fishes (Table 2).

b). **Stomach:** there was no significant difference in the prevalence rate of parasites between the stomach of the two fishes ($\chi^2 = 0$, df = 1, P = 1,Table 2).

c). **Large intestine:** there was no significant difference in the prevalence rate of parasites between the large intestine of the two fishes ($\chi^2 = 1.7368$, df = 1, P = 0.1875,Table 2).

d). **Small intestine:** there was no significant difference in the prevalence rate of parasites between the small intestine of the two fishes ($\chi^2= 0$, df = 1, P = 1,Table 2).

e). **Liver:** there was no significant difference in the prevalence rate of parasites between the liver of the two fishes ($\chi^2 = 0.15278$, df = 1, P = 0.6959,Table 2).

f). **Spleen:** there was no significant difference in the prevalence rate of parasites between the spleen of the two fishes ($\chi^2 = 0.15278$, df = 1, P = 0.6959,Table 2).

g). **Heart:** there was no significant difference in the prevalence rate of parasites between the heart of the two fishes ($\chi^2 = 0.52381$, df = 1, P = 0.4692,Table 2).

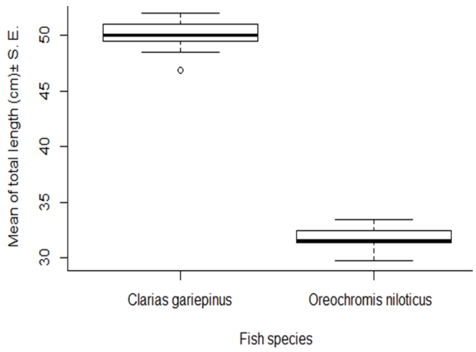

Figure 1: The Mean of Total Length of the two Fish Species

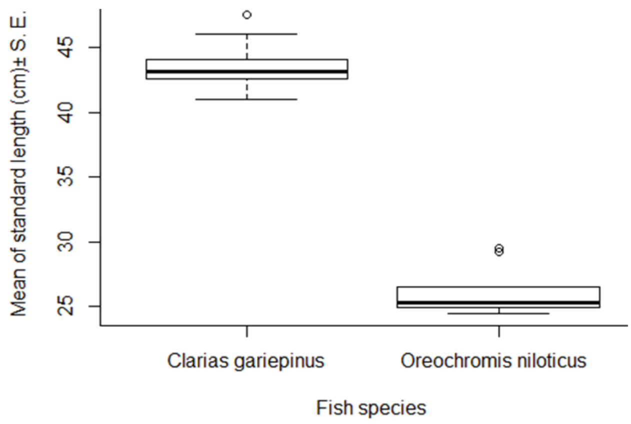

Figure2: The Mean of Standard Length of the Two Fish Species

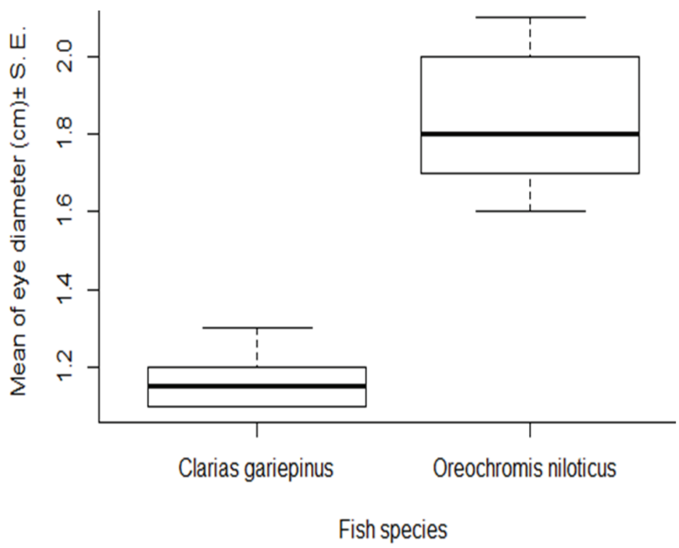

Figure 3: The Mean of eye Diameter of the Two Fish Species

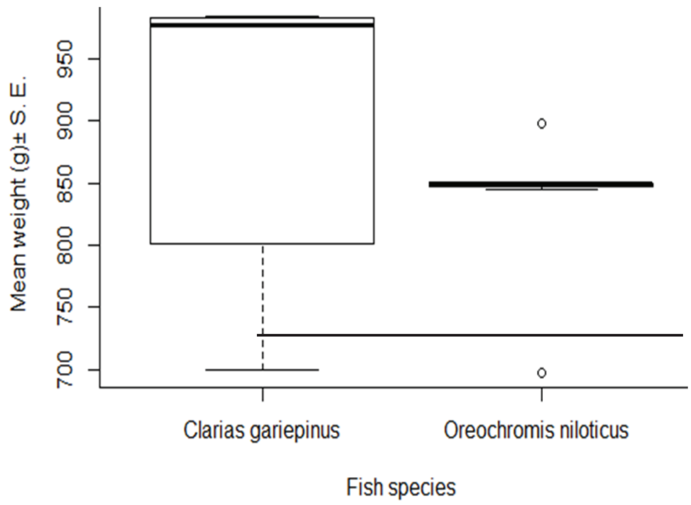

Figure 4: Mean Weight of the Two Fish Species

Table 1: Checklist of Parasites Recorded in the Two Fish Species

	Fish species	
Parasites	*Clarias gariepinus*	*Oreochromis niloticus*
Allocreadiunghanensis	+	_
Sporocyst of Diplostomatid	+	+
Coracidium	+	_
Pallisentistetradontis	+	+
Acanthellafromostracod	+	+
Piscicolid leech	+	+
Rhabdochonacongolensis	+	_
Spinitectusallaeri	_	+

+ Present

- Absent

Table 2: Prevalence Rate of Parasites in Relation to Internal Organs of the two Fish Species

Organ	*Clarias gariepinus*		*Oreochromis niloticus*	
	No. infected (%)	No. uninfected (%)	No. infected (%)	No. uninfected (%)
Oesophagus	0 (0.0)	22 (100)	0 (0.0)	22 (100)
Stomach	4 (18.2)	18 (81.8)	4 (18.2)	18 (81.8)
Large intestine	5 (22.7)	17 (77.3)	1 (4.5)	21 (95.5)
Small intestine	3 (13.6)	19 (86.4)	3 (13.6)	19 (86.4)
Liver	5 (22.7)	17 (77.3)	3 (13.6)	19 (86.4)
Spleen	5 (22.7)	17 (77.3)	3 (13.6)	19 (86.4)
Heart	2 (9.1)	20 (90.9)	0 (0.0)	22 (100)

Morphormetric measurements in relation to Clarias gariepinus and Oreochromis niloticus

Total length

The observed variation in the total length between the two fish species is possibly due to the position of straight bone of *Clarias gariepinus* while *Oreochromis niloticus* have numerous bones all over the body, thus accounting for the longer total length of the former. Also the variation in relation to zones of the two fish species within fresh water habitat possibly accounts for difference in their total length. *Oreochromis niloticus* are found in the pelagic zone of fresh waters while *Clarias gariepinus* are found in the bentic zone. This is in consonance with the study by Mattson and Belk (2013) who found that morphomentric characteristics of even two common intra specific marine fish species from South Africa varied with differences in benthic-pelagic zones within habitat.

Standard Length

The variation observed in standard length between *Clarias gariepinus* and *Oreochromis niloticus* may also be linked with the skeletal bone structure of two species. *Clarias gariepinus* has few bones and possesses a straight bone giving it a slender shape with a long body length while *Oreochromis niloticus* has many bones all over the body making it to be more robust and shorter. The superiority exhibited by *Clarias gariepinus* over *Oreochromis niloticus* may be as a result of genetic attributes. In a similar study Turan (2004) reported that phenotypic and genetic differentiation may occur among fish populations, which may be recognizable as a basis for separation and management of distinct population.

Eye Diameter

Variation in the eye diameter in the two fish species was evident and this may be due to the anatomical characteristics of the head of the fishes.*Clarias gariepinus* which has a flat head was observed to have a smaller eye diameter while *Oreochromis niloticus* has a higher eye diameter on the pointed head. In addition, *Oreochromis niloticusis* predominantly found in the pelagic zone of fresh water making it vulnerable to predatory attack from above water surface. De Busserolles *et al*., (2013) obtained a great variability in relative eye size within the Myctophidae at all taxonomic levels (from subfamily to genus), suggesting that this character may have evolved several times. The bigger eye could be anadaptive way to vigilance in detecting predators unlike *Clarias gariepinus* that is predominantly in the benthic zone. The visual capabilities of an eye are influenced by its size (Walls, 1942). Malcolm *et al*., (2012) explained that a larger eye would provide an advantage for fishes in the pelagic zone as it will increase the chance of photon capture, since the larger the eye, the more energetically costly it will be. Smaller eyes are less energetic and can act as a distance filter by reducing the visibility of a bioluminescent signal against a completely dark background especially in the bentic zone (Warrant *et al.,* 2003). This could explain why *Oreochromis niloticus* has a larger eye because a smaller eye would be a disadvantage as the higher column of water habitat has high levels of background illumination needing an increased sensitivity. The smaller eye diameter of *Clarias gariepinus* on the other hand is well adapted for its zone.

Weight

The observed differences in the weight of the two species of fish could be explained by the higher fluid content *Clarias gariepinus* than *Oreochromis niloticus* hence making the former heavier than the latter. Genetic variation in weights and body yields of fishes has also been reported by Diadatti *et al., (*2008). Usman *et al*. (2004) explained that *Clarias gariepinus* has a heavy weight of ovaries containing eggs than *Oreochromis* species thus significantly making them heavier. However, this observation is limited to the female species of frozen fish.

Parasite in the Two Fish Species

The overall prevalence of Parasite observed in *Orechromis niloticus* was 36.36%. This is in agreement with the result obtained by Bichi and Ibrahim (2009) and Olotintoye (2006) who recorded 43.3% and 60.23% respectively. All the five parasites recorded in this study from *Oreochromis niticus* were of medical importance with the *Acanthocephala* species having dominant (3 parasites) than *nematode* and *trematode* species having 1 species each. The dominance of *acanthocephalan* species over other species may mean that; physio-chemical factors present in the habitat of the fish support the survival of these parasites. This may also explain that *Oreochromis niloticus* is a good host for parasites survival. Akinsanya and Otubanjo (2006) also had similar observation that the most encountered parasites were that of *Acanthocephalans*.

The overall prevalence of parasites observed in *Clarias gariepinus* was 40.91%. This is relatively similar to 63.0% obtained by Owuliri and Mgbenena (1987) and 34.7% recorded by Anosike *et al*. (1992). This slight variation in the proportions recorded might be explained by the different management practices, environmental condition of the fish habitat, handling method by fish famers and sellers. Syndenhem (1974) stated that parasitism of fishes varies among farms, river, streams and lakes depending on several factors prevailing and the aquatic ecosystem. *Acanthocephala*, *Cestoda*, *Nematoda* and *Trematoda* species which are medically important parasites all encountered in the frozen *Clarias gariepinus* with *Acanthocephala* having a higher frequency of occurrence. On the contrary, Ayanda (2009) found nematodes to be the predominant parasites in *Clarias gariepinus*. This disagreement may be attributed to the type of intermediate host presents in the habitat of the fish as well as other environmental factors (Paperna, 1980).

It was discovered that all the frozen fishes used in this study harboured at least one species of parasites. This finding is in consonance with what was observed by Sieszko (1975) and Daniel (1978), that under natural condition this could indicate that parasitism is much more common diversified in farms, ponds and the wild.

Prevalence Rate of Parasites in the Internal Organs of the Two Fish Species

The lack of variation in the prevalence rates of the parasites in relation to internal organs of the two fish species may be possible due to the fact that they were harvested from the same habitat. The habitat may possess physiochemical parameters that are suitable for the survival of parasites in water bodies thereby infecting their fish host.

Majority of the parasites were found in the intestinal region which is possibly due to the fact that *Acanthocephala* and Cestodes lack digestive tract making them to depend on end product of digested food in their host (Hickman *et al.*, 2006).

Ayanda (2009) also agrees with this finding but however stated that the stomach of fishes harbours few parasites as a result of high concentration of acid being secreted in the stomach which is capable of killing them. In this study the oesophagus did not harbour parasites. This could be as a result of no food reserve concentration and chemotactic responses in these sites.

The heart of Clarias harboured parasites while that of Oreochromis did not.

All parasites obtained from the two fishes are of medical importance.

CONCLUSION

The morphometric measurements between *Clarias gariepinus* and *Oreochromis niloticus* vary. *Clarias gariepinus* was observed to have a higher total length, standard length and weight than *Oreochromis niloticus*. However, *Orechromis niloticus* had a higher eye diameter than *Clarias gariepinus.* Eight species of the parasites which spread across Acanthocephala, Cestoda, Trematoda and Nematoda phyla were recorded. Most parasites were more abundant in the liver, spleen and intestine of the frozen fish while the oesophagus and the heart were relatively parasites free.

The gastrointestinal tract of the fishes should be discarded before cooking. In order to prevent parasites infestation,the fish farmers should be educated on the need to maintain proper sanitary condition of the environment and regular introduction of fish antibiotic into the water body, pond and dam.

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