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Prevalence of helminth parasites in some commercially important fish species of River Anambra, Nigeria

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Abstract

The demand for fish as a source of protein is on the increase. However, sustainable productivity by fish farmers is constrained by parasitic infections. Thus, an investigation was conducted on the prevalence of helminth parasites in some commercially important fish species of River Anambra, Nigeria. A total of 521 fishes belonging to 6 families (Claroteidae, Synodontidae, Mormyridae, Osteoglossidae, Bagridae, and Clariidae) and 20 species caught with hooks, nets, and local traps were examined using standard parasitological techniques. The overall prevalence was 23.80%. Fish samples belonging to 6 families had the following prevalence of infection: Bagridae (0.00%), Clariidae (2.11 %), Claroteidae (1.53%), Mormyridae (0.0%), Osteoglossidae (14.97%) and Synodontidae (5.18%). Helminth parasites recovered were: *Weyonia* species (4.65%), *Weyonia youdeowii* (15.97%), *Weyonia synodontis* (3.33%), *Sandonella sandoni* (37.41%), *Polyonchobothrium clarias* (17.98 %), Plerocercoid larva (13.33%) and unidentified cestode (35.47%) (Cestoda); *Emoleptalea* species (4.65%) (Trematoda); *Procamallanus laeviconchus* (2.72%), *Dujardinascaris* species (1.36%), *Spirocamallanus* species (3.99%) (Nematoda); *Neoechinorhynchus* species (24.61%), *Tenuisentis niloticus* (34.62%) and unidentified acanthocephalan (6.25%) (Acanthocephala). *Weyonia* species, *Weyonia youdeoweii,* and *W. synodontis* were recovered from synodontids only. Acanthocephalan, cestodes, nematodes and trematodes were found in decreasing order of abundance. The presence of trematode *Emoleptalea* sp in *Clarias gariepinus* is a new host record of the parasite for the geographical area.

Introduction

Parasites are a big concern for freshwater and marine fishes worldwide. They are especially prevalent in the tropics and are a key stumbling block to the development of farmed fish in Nigeria (Ejere *et al* 2014). Depending on the parasite species and load, the impacts of parasites on fish include nutritional devaluation, altered biology, and behaviour, lowered immune capability, induction of blindness, morbidity, mortality, growth, and low fecundity , and mechanical injuries (Ejere *et al* 2014). The possibility of disease transmission from fish to humans through fish consumption is a public health concern (Ekanem *et al* 2011). Kabata (1985) reported that *Clinostomum* (Acanthocephalan), when ingested with poorly cooked fish, can produce laryngopharyngitis, an unpleasant inflammatory condition.

River Anambra, Nigeria is a major tributary of the River Niger and is itself, fed by numerous tributaries, which together form an extensive drainage basin, whose contribution to the freshwater fishery in Anambra State, Nigeria is quite significant. The continued siting of many agricultural and fisheries projects, including the World Bank's Rice project in the Anambra Basin, is a clear indication of the great potential of the area. Major commercially oriented agricultural projects springing up in the river basin include Coscharis farms amongst others.

Commercially important fish species of River Anambra Basin as listed by Awachie and Ezenwaji (1981) are *Clarias* species, *Heterotis niloticus*, *Gymnarchus niloticus*, *Mormyrus* species, *Protopterus annectens*, *Citharinus* species (especially *C. citharinus*), *Synodontis* species, *Lates niloticus*, *Distichodus* species, *Bagrus* species, *Auchenoglanis* species, *Tilapia* species, *Channa obscura*, *Heterobranchus* species, *Alestes* species, *Labeo* species, *Eutropius niloticus* and *Schilbe mystus*.

Studies have been carried out on fish parasites from different bodies of water in Nigerian (Ekanem 2010; Obiekezie 1995; Ekanem and Obiekiezie 2000; Onwuliri and Mgbemena 1987; Anosike *et al* 1992; Ezenwaji and Ilozumba, 1992; Auta *et al* 1999; Okaka, 1999; Emere, 2000; Ibiwoye *et al* 2004; Olurin and Somorin 2006 and Akinsanya *et al* 2007). Despite the large diversity of its fish fauna and its important contribution to fish production in Nigeria, the investigation into the parasite fauna of River Anambra has been very scanty. The few reported studies include those of Azugo (1978), Ezenwaji and Ilozumba (1992), Ezenwaji *et al* (2005) and Ilozumba and Ezeife (2009). The present study aims at providing more information on the parasite fauna of some commercially important fish species of the River Anambra system.

Materials and methods

Study area

River Anambra is a major tributary of the River Niger (Figure 1). It is fed by numerous tributaries which together form an extensive drainage basin. It is about 207.4km in length and 14014m^2 in area (Awachie, 1976). Anambra River Basin lies between latitudes 5º55′2″N and 7º4′3″N and longitudes 6º42′15″E and 7º44′50″E. The basin has a rainfall of 150-200cm annually; and because of its low altitude of under 1000 above sea level, temperatures are uniformly high with a small annual range of 5-10ºC. The water emerges from a somewhat inaccessible point near Ankpa in Kogi State, Nigeria, crosses the Kogi/Anambra State boundary a bit north of Ogurugu, and then meanders through the Ogurugu station to Otuocha, from there it flows down to its confluence with the Niger at Onitsha (Azugo 1978).

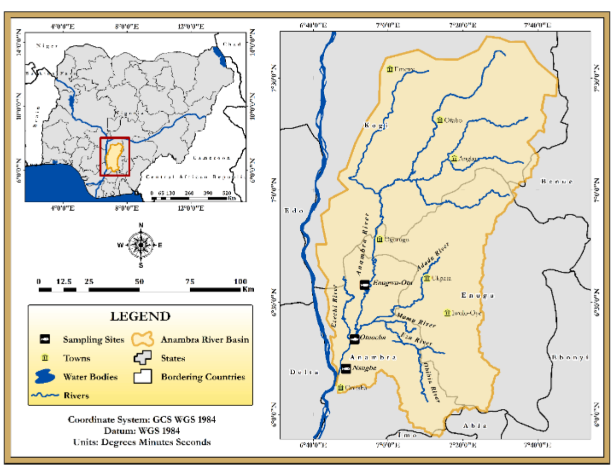

Figure 1. Map of Anambra River showing the sampling locations

Sample collection and identification

A total of 521 fish specimens belonging to 20 species were collected from the study area in a period of one year (January-December 2014). The fish were collected with the aid of fishers using gill and cast nets of various mesh sizes as well as hooks and lines, and local traps. Fresh dead fishes were immediately put into a plastic container with ice blocks to retard decomposition while live fish were transported in metallic fish tanks to the Zoology Laboratory, Nnamdi Azikiwe University for identification and examination. The following morphological structures/features were used for the identification, the mouth, teeth, nostrils, fins, scales, lateral line, and colour pattern using standard keys (with taxonomic descriptions and indices) of Holden and Reed (1972), Teugels *et al* (1992) and Idodo-Umeh (2003).

Killing and examination of the sample for helminth parasite

Live fish were killed by pithing. Thereafter, smears of the scrapings from the skin and fins, as well as the gills on clean microscope slides covered with coverslips were examined under a low-power light microscope. The alimentary canal of each fish specimen was excised from the buccal end of the oesophagus and the anal end and placed in receptacles that contained 3ml of normal saline. The associated mesenteries were thoroughly examined for parasites using a hand lens. Subsequently, each segment of the alimentary canal was meticulously searched for helminth parasites in a separate Petri dish which contained normal saline, utilizing a continuous slit approach to reduce the chances of severing long helminths, such as cestodes that may extend from one section of the alimentary canal into another.

Treatment and preservation of parasites

Parasites recovered were first shaken in normal saline to remove mucus and other host debris. Cestodes and acanthocephalans were relaxed in distilled water and later fixed in 4% formaldehyde. Live nematodes were killed by pouring hot 70% alcohol on them in Petri dishes and later preserved in cold 70% alcohol to which 2% glycerine was added to prevent brittleness. The number of parasites per fish was recorded along with the site/location where the parasites were found.

Identification of parasites

The parasites were identified using earlier established identification guides to species level (Yamaguti, 1961; 1963; Yorke and Mapplestone 1926; Markevich 1963; Cheng 1973; Soulsby 1982; Paperna, 1996, 1980).

Data analysis

Parasite prevalence, mean intensities and mean abundance was calculated as defined by Bush *et al* (1977).

$$\text{Prevalence (\%)} = \frac{number\ infected}{number\ examined} \times 100$$

$$\text{Mean intensity} = \frac{\text{total number of parasite species recovered in a host species}}{\text{number of the infected host}}$$

Chi-Square was used to test for association between parasites (with more than one host) and Fish hosts at a 0.05 level of significance was done.

Results

The commercially important fish species in the river system examined in this study belonged to six families and twenty-one species (Table 1).

Family Synodontidae, and Mormyridae represented by seven and four species, respectively had the highest number of fish species examined while Family Osteoglossidae represented by only *Heterotis niloticus* was the least.

A total of eight out of twenty-one species examined were infected by helminth parasites. In the Family Claroteidae, only one species (*A. occidentalis*) was infected by a parasite with a prevalence of 25.00%. Three species in the Family Claridae were parasitized and the prevalence was *C. anguillaris* (26.67%), *H. longifilis* (16.67%), and *Clarias gariepinus* (11.62%). Parasite infection was recorded in two species in the Family Synodontidae namely, *S. batensoda* with a prevalence of (23.33 %), and *S. eupterus* with a prevalence of 30.23%. The highest prevalence was recorded in the Family Osteoglossidae, when the lone species, *H. niloticus* had a prevalence of 53.06%. None of the species in the Family Mormyridae and Bagridae examined in the course of the study showed infection by helminth parasites.

Twelve (12) species of helminth parasites were recovered from infected fish (Table 2), all from the alimentary canal. The parasite community is comprised of seven species of Cestoda, three species of Acanthocephala, three species of Nematoda, and one species of Trematoda. Cestodes recovered included three species of *Weyonia*, all of which were recovered from *Synodontis* species, *Polyonchobothrium clarias*, which was recovered from the clariids, *Sandonella sandoni,* which was recovered from *Heterotis niloticus,* and, unidentified cestode species, recovered from *H. longifilis* and *A. occidentalis.* The three species of Acanthocephala recovered in the course of the study were *Tenuisentis niloticus* that infected *H. niloticus* and *S. batensoda. Neoechinorhynchus* species, which infected *S. eupterus* and *S. batensoda*, and unidentified acanthocephalan, recovered from *A. occidentalis*.

Among the Cestodes recovered, *Sandonella sandoni* (37.41%) in *Heterotis niloticus* had the highest prevalence while *S. batensoda* infected by *W. synodontis* had the least prevalence of 3.3%. The trematode, *Emoleptalea* species recovered only from *C. gariepinus* recorded a prevalence of 4.65%. For the Nematodes, *P. laeviconchus* (2.72%) in *H. niloticus* was most prevalent while *Dujardinascaris* species (1.36%) was the least prevalence also in *H. niloticus.* For the Acanthocephala, *T. niloticus* was most prevalent (31.29%) in *H. niloticus* and was the least prevalent (3.33%) in *S. batensoda* (Table 2).

Table 1: Commercially important fish species of River Anambra, Nigeria and prevalence of helminth parasite.

Fish species	**Number examined**	**Number infected**	**Prevalence (%)**	**Confidence Interval (95%)**	
				Upper	**Lower**
CLAROTEIDAE					
Auchenoglanis biscutatus	7	0	0.00	0.00	0.000
Auchenoglanis occidentalis	32	8	25.00	9.4	40.6
BAGRIDAE					
Bagrus bayad macroptreus	49	0	0.00	0	0
Bagrus docmac niger	2	0	0.00	0	0.0
CLARIIDAE					
Clarias anguillaris	15	4	26.67	6.7	46.7
C. gariepinus	43	5	11.62	2.3	23.3
C. submarginatus	14	0	0.00	0.0	0.0
Heterobranchus longifilis	12	2	16.67	0.0	41.7
SYNODONTIDAE					
Synodontis batensoda	60	14	23.33	13.3	35.0
S. clarias	2	0	0.00	0.0	0.0
S. eupterus	43	13	30.23	16.3	44.2
S. membranaceus	15	0	0.00	0.0	0.0
S. nigrita	24	0	0.00	0.0	0.0
S. schall	4	0	0.00	0.0	0.0
S. sorex	10	0	0.00	0.0	0.0
MORMYRIDAE					
Gnathonemus cyprinoides	22	0	0.00	0.0	0.0
G. pictus	2	0	0.00	0.0	0.0
Hyperopius bebe occidentalis	8	0	0.00	0.0	0.0
Mormyrus rume	2	0	0.00	0.0	0.0
OSTEOGLOSSIDAE					
Heterotis niloticus	147	78	53.06	44.9	61.2
	521	**124**	**23.80 %**	**20.3**	**27.4**

Table 2: Prevalence of helminth parasites in commercially important fish species in River Anambra, Nigeria

Parasite species	Fish Hosts	N.E	N.I	N.P.R	P (%)	M.I.I	MA/SD
CESTODA							
Weyonia species	*Synodontis eupterus*	43	2	10	4.65	5.00	0.2
Weyonia youdeoweii	*S. eupterus*	43	4	6	9.30	1.50	0.1
	S.batensoda	60	4	10	6.67	2.50	0.2
Weyonia synodontis	*S. batensoda*	60	2	14	3.33	7.00	0.2
Plerocerciod larva	*Clarias anguillaris*	15	2	2	13.33	1.00	0.2
Polyonchobothrium clarias	*C.anguillaris*	15	2	2	13.33	1.00	0.1
Polyonchobothrium clarias	*C. gariepinus*	43	2	6	4.65	3.00	0.1
Unidentified cestode	*Auchinoglannis occidentalis*	32	6	32	18.80	5.33	0.1
Unidentified cestode	*Heterobranchus longifilis*	12	2	2	16.67	1.00	0.2
Sandonella sandoni	*Heterotis niloticus*	147	55	159	37.41	2.90	1.1
TREMATODA (DIGENETIC TREMATODA)							
Emoleptalea species	*Clarias gariepinus*	43	2	8	4.65	4.00	0.2
NEMATODA							
Procamallanus laeviconchus	*Heterotis niloticus*	147	4	20	2.72	5.00	1.6
Dujardinascaris species	*H. niloticus*	147	2	18	1.36	9.00	0.1
Spirocamallanus species	*S. batensoda*	60	1	1	1.67	1.00	0.02
	C. gariepinus	43	1	2	2.32	2.00	0.04
ACANTHOCEPHALAN							
Neoechinorynchus species	*S. eupterus*	43	7	41	16.28	5.86	0.9
	S. batensoda	60	5	44	8.33	8.80	0.7
Tenuisentis niloticus	*H. niloticus*	147	46	255	31.29	5.54	0.1
	S. batensoda	60	2	2	3.33	1.00	0.03
Unidentified acanthocephalan	*A.occidentalis*	32	2	16	6.25	8.00	0.7

KEY = N.E – Number Examined; N.I. – Number Infected; NPR – Number of Parasite Recovered; P – Prevalence; MII – Mean Intensity of Infection; MA/SD – Mean and Standard Deviation.

The result further showed that there was no significant association between *W. youdeowii,* and the two fish hosts namely *S. eupterus* and *S. batensoda* (p=0.62, χ^2=0.24). Likewise, *Neoechinorhynchus* species (p=0.22; χ^2=1.54) and *P. clarias* (p=0.81; χ^2=0.06) did not show any significant association with the fish hosts infected but *Tenuisentis niloticus* showed a significant association (p = 0.00; χ^2= 42.18) with the hosts, *H. niloticus* and *S. batensoda*.

Discussion

The overall prevalence of infection in the 521 fish examined was 23.80% which is lower than the 37.90% prevalence recorded by Azugo (1978) for the same river system. The reason for this low prevalence could be due in part to the unprecedented flooding, which affected the river system during part of the period covered by the present study. Again, this low prevalence should be expected in a natural situation, particularly in a largely lotic water environment where the fish and relevant intermediate hosts/infective stages of parasites would be expected to be widely separated therefore decreasing the chances of infestation. However, Ezenwaji *et al* (2005) observed that a low prevalence of parasites had been reported in fish from lotic water systems by several researchers (Ezenwaji 2002; Oniye *et al* 2004). Other factors which could influence the prevalence of parasite infection include the availability of intermediate hosts and susceptibility of the definitive host (Obano *et al* 2010).

The absence of infection among mormyrids in the present study does not lend itself to any feasible postulation, and more investigation needs to be conducted on the matter to enable a plausible opinion to be expressed on the issue. This is bearing in mind that Nwani *et al* (2008) reported infection of fish of the same family by different taxa of helminth parasites.

The infection of the mochokids with species of *Weyonia* suggests the importance of that group of helminths to that family of fish. The cestodes were not recovered from any other fish host examined in this study except mochokids. In other words, *Weyonia* species appear to show a marked preference for mochokids from which several of them have been recorded (Ukoli 1965, 1969; Khali, 1971; Azugo 1978; Ugwuzor 1987; Okaka 1991; Domo and Ester 2015; Bamidele 2015).

The presence of plerocercoid larva and *Polyonchobothrium clarias* in *C. anguillaris* and *C. gariepinus* corroborates the results of the studies of Salawu *et al* (2013), Azugo (1978), Olofintoye (2006), Kawe *et al* (2016) in Abuja, Nwuba *et al* (2008) in Anambra River and Olumuyiwa and Olatunde (2014) in Oyo State.

Polyonchobothrium magnum was recovered from *Clarias lazera* in Turkey (Soylu and Emre 2005), suggesting the genus *Polyonchobothrium* may be cosmopolitan. The recovery of plerocercoids in this study raises a potential health issue because *Diphyllobothrium latum*, the human broad tapeworm uses freshwater fish as the second intermediate host.

The proteocephalid tapeworm was recovered from *H. niloticus* only. The helminth species had earlier been recovered from the same fish host by De Chambrier *et al* (2008) who observed that *S. sandoni* is a relatively frequent parasite of *H. niloticus* as it has been reported from Benin, Chad, Nigeria, Senegal, and Sudan (Khalil 1960; Lynsdale 1960; Ba and Marchand 1994; Ilozumba and Ezenwaji 1985; Akinsanya *et al* 2007a; Khalil and Polling 1997; and De Chambrier *et al* 2008), respectively.

Emoleptalea species were recovered from *C. gariepinus* only in the present study. Vankara *et al* (2014) recovered *Emoleptalea proteropora* from *C. batrachus* at a prevalence of 1.85 % in India. The recovery of *Emoleptalea* species from *C. gariepinus* in this study is both a new host record and a geographical record for the parasites.

According to Akinsanya *et al* (2007a), the host specificity of nematodes is variable. Among the Camallinadae*, P. laeviconchus* had been reported from fish hosts of six different families. *Procamallanus laeviconchus* was also recovered from *H. niloticus* in this study and *H. niloticus* may be seen as a new host record for this parasite. The recovery of *P. laeviconchus* from studies within and outside the country (Barson and Avenant-Oldewage 2006; Singh *et al* 2013) show that, it is a truly trans-African species. This species occurs widely in *Synodontis* and other typical catfish, especially *Clarias* species (Khalil and Thurston, 1973; Ezenwaji and Ilozumba 1992; Paperna 1996; Oniye *et al* 2004).

Dujardinascaris species, which was recovered from *H. niloticus* was earlier recovered from the same fish species by Ilozumba and Ezenwaji (1985). Azugo (1978) also recovered *Spirocamallanus* species from *Synodontis clarias.* The finding of *Neoechinorhynchus* species in *S. batensoda* corroborates the report of Eyo *et al* (2013) who reported that *Neoechinorhynchus prolixum* had the highest prevalence among the parasites of *S. batensoda.* The high prevalence of acanthocephalan worms in *S. batensoda* recorded in the present study conforms with findings in other freshwater ecosystems in tropical Africa (Khalil 1969, 1971; Troncy and Vassilides, 1973; Douellou 1992a).

The significant association recorded between *T. niloticus* and the two hosts, *H. niloticus* and *S. batensoda* implies that the infection was significantly based on the hosts. *Heterotis niloticus* had a higher prevalence and mean intensity than the other species. *Tenuisentis niloticus* could be said to be a regular parasite of *H. niloticus* but the report of *T. niloticus* in *S. batensoda* in this study is a new host record for the parasite.

Conclusion

The somewhat low prevalence of parasites reported in the present study should be expected in a natural situation, particularly in a largely lotic water environment where the fish and relevant intermediate hosts/infective stages of parasites would be expected to be widely separated therefore decreasing the chances of infestation. Indeed, it would be suggested that, but for the presence of a large number of natural floodplain lakes and ponds in the area, which got inundated during the flood season, the overall parasite prevalence could have been lower. The need for a further study aimed at comparing the prevalence of helminths in the river channels and floodplain lakes is thus indicated.

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