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A Comparative Study of the Gastro-Intestinal Helminth Parasites Infection of Fresh and Brackish Water Fishes from Warri River, Southern Nigeria

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Abstract

A comparative study of the gastro-intestinal helminth parasites infection of fresh and brackish water fishes from Warri river, Southern Nigeria, was undertaken. Eight hundred (800) fishes examined during the investigation belong to 30 families, 45 genera and 56 species. The study revealed a highly significant relationship (P < 0.001) between water type and gastro-intestinal helminth parasites infection of fish. Fresh water fishes recorded a higher infection rate of 38.11% than their brackish water counterparts with 17.85% rate of infection, suggesting a strong limiting influence of water type on gastro-intestinal helminth parasites infection of fish. However, in some other selected criteria, there were similarities in the pattern of infection of fish. On

feeding habits, omnivorous fishes had the highest prevalence of helminth infection (49.55%) compared to predators, planktivores, herbivores and mud/silt feeders, in that descending order. Although euryhaline fishes were more susceptible to intestinal helminth infection than stenohaline fishes, the difference was not significant (P > 0.05). A seasonal pattern of helminth infection of fish was observed, with a high infection rate of 70.1% recorded during the dry season months of November to February and at low infection rate of 29.9% in the rainy season months of March to October.

Key words: gastro-intestinal, helminth parasites, fishes, Warri river.

Introduction

Although some encouraging studies have been done on the helminth parasites of freshwater fishes of Africa (see Khalil, 1971; Paperna, 1996), the same cannot be said about brackish water fishes. There are serious deficiencies in present knowledge with regard to helminth parasites of brackish water fishes.

Brackish water regions cause stress to organisms because of their fluctuating environmental conditions. Factors change in response to tidal, diel and seasonal cycles as well as to sporadic variation caused by storms and mankind's intervention (Akpan *et al.*, 2003).

In Nigeria, there are reports of helminth parasites infections in fresh water fishes from several rivers and lakes. These include: Niger (Ukoli, 1969); Lake Kainji (Akinpelu, 1983); Jos, Plateau (Onwuliri and Mgbemena, 1987); Zaria (Shotter and Madaiyedu, 1977); Asa river and its dam at Ilorin (Okaka, 1991), and Imo (Ugwuzor, 1987).However, similar investigations on helminth parasites of brackish water fishes are not only scanty but also limited to Lagos lagoon (Akinsanya *et al.*, 2007) and the estuary of Cross River (Obiekezie, 1983).

Warri river is an important coastal river in Southern Nigeria with a strong tidal influence from the Atlantic Ocean. Salt-laden marine and brackish water influence the water quality and vegetation significantly along 50 kilometers of its length from the Atlantic Ocean (Egborge, 1994).

The present study was aimed at investigating, on the one hand, the effect, if any, of water quality, namely fresh and brackish water, on the intestinal helminth parasites infection of fishes from two different zones of the same river. On the other hand, to assess the general pattern of helminth parasites

infection of fish, using some selected criteria such as the feeding habits, distribution behavior of fish and season of the year, if any.

Materials and methods

The study area

Warri river located in Delta State, Southern Nigeria, stretches within latitudes $5^0 21'$ to 6^0N and longitudes $5^0 24`$ to $6^0 21'$E. From its source near Utagba-Uno, it joins the Forcados estuary which empties into the Atlantic ocean (Fig 1). It has a length of about 150km (NEDECO, 1961).

The climate of the study area is tropical with two recognizable annual seasons of variable durations: the dry and the rainy seasons. The rainy season lasts for 11 months in Forcados (close to the Atlantic Ocean), 7-9 months at Warri (about 66 kilometers from Forcados), and 6-7 months at Utagba-Uno (Egborge, 1994).

The fringing vegetation of Warri river changes from freshwater evergreen forest at its source to mangrove swamp forest at the lower reaches.

Data collection

Two sampling stations were selected. Station A, located in the freshwater zone is about 10 kilometers away from station B located in the brackish water zone of Warri river.

Fishes used in the present study were captured at the two sampling stations with the assistance of hired fishermen from April 2007 to September 2008. The fishing gears used were gill nets, cast nets and basket traps. The fishes were identified according to Holden and Reed (1972), Laosebikan and Raji (1998), Edema and Osagiede (2000) and Idodo-Umeh (2003). For each fish, the weight (gm), standard length (cm), sex and condition factor, were recorded in the laboratory.

The gastro-intestinal tract of each fish was carefully removed, and cut into three sections corresponding to the stomach, small intestine and rectum. Each section was examined for presence or otherwise of intestinal helminth parasites under a dissecting microscope using protocols and procedures described in the National Fish Health Survey (2005).

The helminth parasites recorded from fish were fixed in 4% formalin and cleared with glycerine for examination. Thereafter, the specimen was stored in 70% alcohol.

Using appropriate keys as provided by Yamaguti (1958 and 1961), Khalil *et al.,* (1994) and Amin (1987), the parasites were identified and classified into their various helminth taxa.

The analysis of the stomach contents of each fish for food items was carried out according to the methods of Windell and Bowen (1978).

Analysis of variance, Chi-square statistics and Student's t-test were used in statistical analysis.

Results

A total of eight hundred fish specimens were examined during the study period. They belong to 30 families, 45 genera and 56 species. 391 fishes were caught in station A (freshwater) while 409 fishes were collected from station B (brackish water).

The intestinal helminth parasites of fish consisted of trematodes (Allocreadiidae, and Aspidogastridae), cestodes (Caryophyllaeidae and Lytocestidae), nematodes (Trichuridae, Cylicostongylidae, Atractidae, Oxyuridae, Kathlaniidae, Quimperidae, Heterocheilidae, Camallanidae, Cucullanidae and Rhabdochonidae) and acanthocephalans (Tenuisentidae, Quadrigyridae and Rhadinorhynchidae). The helminth parasite species are listed in Appendix 1.

Table 1 shows a summary of comparative data on 26 of the 56 species of fish found not only in both freshwater (Station A) and brackish water (Station B) of Warri river, but also were hosts to intestinal helminth parasites during the study period.

For the other selected criteria, namely: feeding habits, euryhaline and stenohaline behaviour of fishes and seasonality, with respect to prevalence of intestinal helminth parasites, the pattern of infection in host fishes was very similar in both fresh and brackish water. Hence, on the above criteria, the analysis focuses on a combined mean data for both fresh and brackish water fishes.

Using the stomach contents as strong indicators of the diet and dominant feeding habits, all fish specimens examined were placed into 5 broad groups. These were: predators or carnivores, omnivores, planktivores, herbivores and silt/mud (detritus) feeders. Table 2 shows a summary of the mean data on the

main feeding habits of fish from both fresh and brackish water infected by intestinal helminth parasites during the study period.

Stenohaline fishes were only found or restricted either to freshwater or brackish water Zone of Warri River. The euryhaline fishes occurred both in fresh and brackish water. Figure 2 shows the prevalence of intestinal helminth infection of euryhaline and stenohaline fishes.

More fishes in both fresh and brackish water were infected by intestinal helminth parasites during the dry season months of November to February than during the rainy season months of March to September.Figure 3 shows the prevalence of intestinal helminth parasites infection of fish and season of the year.

Discussion

This paper is the first part of our report on the investigations of the fish intestinal helminth fauna of Warri river with an upper freshwater zone and an extensive brackish water zone fringed by mangrove swamp forest on the lower reaches. The paper gives a comparative account and then focuses on broad patterns of parasites infection of fish collected from fresh and brackish water zones of the same river, using some selected criteria.

Table 1 shows the summary of data on 26 infected fish species found in the two zones of the river. For the 26 species, the prevalence of intestinal helminth parasite infection was 44.9% for fresh water fishes while their brackish water counterparts recorded 19.7% rate of infection. However, when the entire 800 fishes (56 species) examined are used in the computation, freshwater fishes recorded 38.11% rate of infection while brackish water fishes had 17.85% rate of infection.

Also, Table I shows that freshwater fishes had a higher abundance of intestinal helminth parasites in all taxa than their counterparts in brackish water.

The finding in this study of a significantly higher intestinal helminth infection in fresh water fishes than their brackish water counterparts suggests a strong limiting influence of water type on the intestinal helminth parasites infection of fish.

The reason for the difference in the rate of helminth infection could be attributed to variations in salinity tolerance of fish hosts. Besides, it could

also be related to the presence or absence of many freshwater intermediate hosts of the intestinal helminth parasites.

Table 2 shows a summary of the data on the association of fish feeding habits and intestinal helminth parasites infection. There was a highly significant relationship ($P<0.01$) between helminth infection and the feeding behavior of host fishes.

However, in this study, omnivores rather than predators recorded the highest rate of intestinal helminth infection while herbivores and detritus feeders had the least infection rate.

This finding could be attributable to the preponderance of omnivores in the fish fauna of Warri river. Besides, it could probably also be an indication of the difficulty of getting suitable prey by predatory fish.

Nevertheless, the pattern of high infection rate in omnivores and predators might be the inevitable outcome of these fishes being more exposed to helminth parasites larvae in their diet than other categories of fish.

According to Paperna (1996), the first intermediate hosts of piscine acanthosephalans and nematodes are amphipods, isopods, copepods or ostracods. Fishes become infected by ingesting these invertebrates.

Another area of focus in this study was the relationship between the distribution behaviour of fish and intestinal helminth infection. On the whole, 46.43% of the fishes infected by intestinal helminth parasites in Warri river were euryhaline fishes (Fig.2). Sterohaline fishes from fresh and brackish water recorded 37.5% and 16.07% rate of infection respectively.

The reason for this finding could be that fishes with a wider geographical distribution/movement harbour more intestinal helminth parasites simply as a result of the greater variety of food/prey they must feed on than those with a more restricted distribution.

Also, there was a highly significant association between intestinal helminth infection of fish and season of the year in this study (Fig.3). A seasonal pattern of parasite infection was recorded with a high infection rate (70.1%) in the dry season and a low infection rate (29.9%) in the rainy season.

Scarcity of zooplankton in the diluted flood waters of the rainy season months have been observed in Warri river by Gabriel (1986), Chigbu (1987)

and Egborge (1994). They reported zooplankton peak in the dry season. The abundance of zooplankton, comprising most invertebrate hosts of various helminth parasites during the dry season, could account largely for the high helminth parasites infection of fish during the season.

Some other studies that have reported seasonality of helminth infection of fish, include those of Awachie (1968), Okaka and Akhigbe (1999).

In conclusion, this study is the first comparative investigation of intestinal helminth parasites infection of fish from both fresh and brackish water zones of Warri river. It should provide baseline data on which future development and transformation of aquaculture in the Warri river basin would be based.

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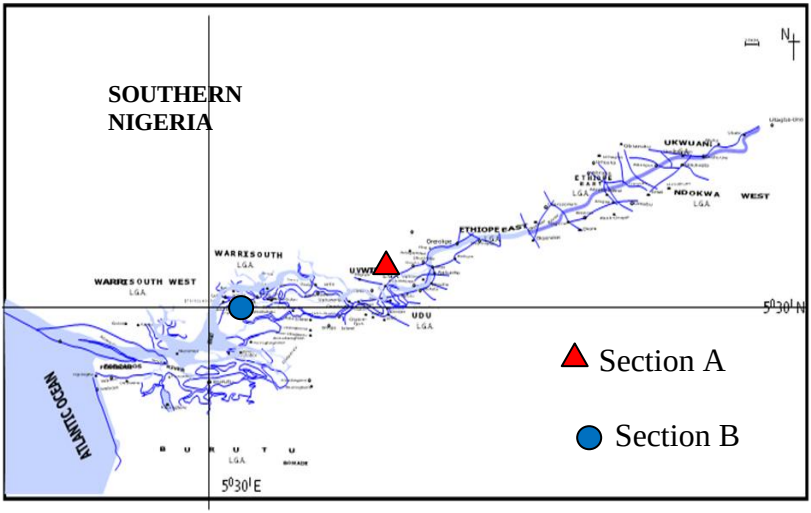
Appendix 1

The gastro-intestinal helminth parasites recovered from fish species included in the comparative analysis.

Allocreadium sp., *Aspidogaster* sp., *Lytocestoides* sp., *Orientocreadium* sp., and *Wenyonia* sp. (Phylum Platyhelminthes).*Camallanus* sp., *Capillaria* sp., *Cithariniella* sp., *Cucullanus* sp., *Cylicostrongylus* sp., *Paracamallanus cyathopharynx, Procamallanus laeviconchus, Quimperia* sp., *Raphidascaris* sp., *Rhabdochona* sp., *Rondonia* sp., *Spinitectus* sp., and *Spironoura* sp. (Phylum Nematoda).*Acanthogyrus tilapiae, Paragorgorhynchus* sp. and *Tenuisentis* sp. (Phylum Acanthocephala).



Source: Survey Dept. Asaba

Figure1: Map of Warri River (showing the sampling stations A and B)

Table 2: Summary of data on the relationship between the major feeding habits of fish and intestinal helminth infection

Fishes: major feeding behaviour	No. of fishes infected in fresh and brackish water	Percentage of intestinal helminth infection
Omnivores	110	49.5
Predators	77	34.7
Planktivores	22	9.9
Herbivores	07	3.2
Mud/silt feeders (detritus feeders)	06	2.7
Total	**222**	**100**

FIG. 2: The prevalence of intestinal helminth parasites infection in stenohaline and euryhaline fishes from Warri river during the study period.

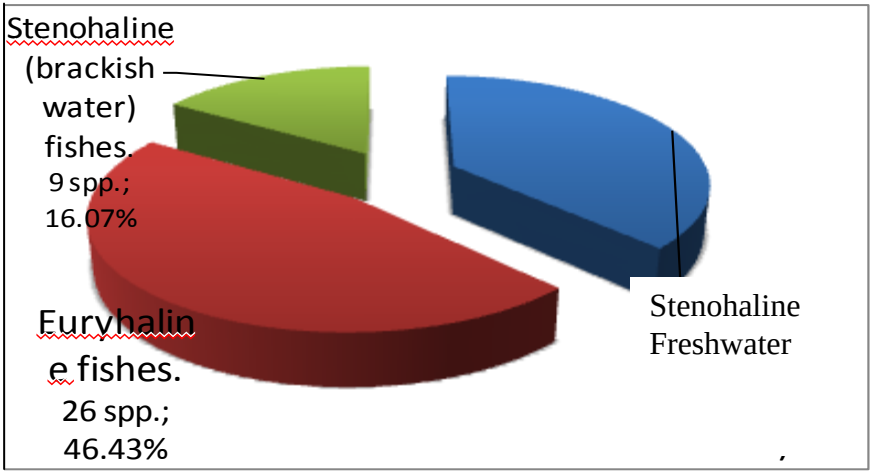


Fig. 3: The prevalence of intestinal helminth infection of fish and the season of the year