ASSOCIATION BETWEEN PARASITIC INFECTION AND FISH HABITAT

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Abstract

With the research objective being to relate parasitic infection to fish habitat and guided by the research question: "Is there any relationship between fish habitat and parasitic infection?" a total of 446 fish samples- 300 Clarias gariepinus and 146 Oreochromis niloticus, 184 from natural systems and 262 from culture systems, were examined for parasitic infections. Out of this number, 68 were fingerlings, 62 were juveniles, and 316 were adults. Adopting a strictly parasitological methodology, and applying apposite statistical testing, findings were that fish in natural sytems are more susceptible to parasitisation than those from culture systems. In comparative terms, samples from the natural water body recorded higher infection (74.5%) than those from culture system (31.7%).

Keywords: Parasites, habitat, infection, natural and cultural system

Introduction

Frances-Floyd (2002) defines fish disease as an abnormal condition characterized by a gradual degeneration of a fish's ability to maintain normal physiologic functions. It is a condition in which the fish is not "in balance" with itself or its environment. There are two broad categories of disease that affect fish, infectious and non-infectious diseases. Infectious diseases are caused by pathogenic organisms present in the environment or carried by other fish. They are contagious diseases, and some type of treatment may be necessary to control the disease outbreak. In contrast, non-infectious diseases are caused by environmental problems, nutritional deficiencies, or genetic anomalies; they are not contagious and usually cannot be cured by medications.

Infectious diseases are broadly categorized as parasitic, bacterial, viral, or fungal (Frances-Floyd, 2002). Like any animals, fish are susceptible to a range of problems such as tumours, heart and other organ disease, as well as metabolic disorders such as diabetes. However, the overwhelming majority of common health problems involve external parasites, fungus, gill and bacterial infections. According to Fish doc (2008), any body of water, be it a tank or pond will be teeming with millions of opportunistic bacterial and nearly all fish carry small populations of parasites.

The parasites are characterized by an activity of constantly probing and trying to occasion a breach of the immune system of the fish with the objective of gaining a strong foothold. Studies indicate that for them to gain a strong foothold as desired, there has to be an underlying predisposing factor such as poor environmental conditions, poor nutrition,

overcrowding, poor water quality, or a combination of these factors. The prevalence of these circumstances gives rise to a situation of stress, which has the effect of depressing the immune system of the fish and subsequently encourages increased numbers of opportunistic infections and pathogens (Fishdoc, 2007, Klinger and Francis-Floyd 2002).

A situation of serious parasitic infestation can cause severe secondary damage to skin, fins, and gills. This in turn may result in secondary infections such as ulcers or fin-rot, or excess mucus production and cell hyperplasic. Some pathogens in particular *Costia (Ichthyobodo)* are very quick to take advantage of sick and stressed individuals. This can cause additional stress and complications of which a typical example would be a serious infestation of gill flukes, *Dactylogyrus*. The irritating presence of these parasites could lead to excess mucus production.

The National Fish Pharmaceuticals (2006) has given a short list of parasitic disorders of fish. The list includes gill flukes *(Dactylogyrus),* anchor worn *(Lernaea)* fish lice *(Argulus)*, mites *(Hydrachnellae)* leeches *(Placobdella montifera),* skin flukes *(Gyrodactylidiasis*), *Trichodina, mitospora, capillaria* and tapeworm.

The mere mentioning of parasitic disorders of fish is only part of the solution to the fish disease burden and problem. Klinger and Francis Floyd (2002) have lamented the common mistake of fish culturists, of misdiagnosing disease problems and treatment with the wrong medication or chemical. As a response to this situation, they have sought to provide some description of common parasites affecting fresh water fishes, with a view to facilitating their isolation and identification.

The research objective pursued in this article is to relate parasitic infection to fish habitat. The guiding research question is *is there a relationship between fish habitat and parasite infection?*

Materials and methods

This study was carried out in Imo and Rivers States, of Nigeria. Nworie and Otamiri rivers, the natural habitats of fishes used in this study and Emekuku pond are located in Owerri, the capital city of Imo State. Other aquatic culture habitats of fishes used for this study were Okwuzi in Egbema L.G.A. and Aluu in Obio-Akpor L.G.A., both in Rivers State. These cover the culture and natural habitats from which fish samples were collected.

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Fingerlings, juveniles and adult fishes, of the species *Clarias gariepinus* and *Oreochromis niloticus* were obtained from the sites mentioned above.

A total of four hundred and forty six (446) fish samples from both natural and culture systems were examined for parasitic infections. Out of this number, 68 were fingerlings, 62 were juveniles, and 316 were adults. Only the adult fish samples were sexed and the gender variation is male fish 151 (Clarias spp. 101,Oreochromis spp. 50); female fish 165 (Clarias spp. 119,Oreochromis spp. 46).The 446 fish samples examined were composed of 300 *Clarias gariepinus* and 146 *Oreochromis niloticus.* A total of 184 were from natural systems while 262 were from culture systems.

The samples were examined parasitologically using microscopic techniques (direct wet mounts using physiological saline, Lugol's iodine and methylene blue preparations as well as stained smears using Leishman and Giemsa staining methods) as in Arene (2006) and Obiajuru and Ozumba (2009).

Cysts and trophozoites of protozoa seen under the microscope were compared with micrographs on standard parasitological atlas for identification purposes as in Chiodini, Moody, and Manser (2003), with the aid of expert parasitologists.

The statistical analysis done in the work consisted of applying the paired t-test. The paired t-test is appropriate for testing the mean difference between paired observations when

the paired differences follow a normal distribution. It is applied in this study to test the statistical significance of the difference between mean protozoan and mean helminth infections in the selected fish species and between the different systems.

To maximize the mathematical precision of results, this analytical technique was done using the computational software known as *MINITAB 14* while results were presented using tables and charts produced from *Microsoft Excel 2007* version.

Results

Table 1: Fish samples by fish age and habitat

		Fingerlings		Juvenile		Adult		Total	
	Cite	Exam	Infec	Exam	Infec.	Exam	Infec	Exam	infec
Natural system	Otamiri	24	13	-	-	32	22	56	35
	Nworie	14	11	-	-	114	91	128	102
Culture system	Emekuku	20	9	-	-	54	13	74	22
	Aluu	-	-	32	19	40	22	72	41
	Okwu	10	-	30	-	76	20	116	20
	Total	68	33	62	19	316	168	446	220

Source: Field research

The fish samples used in this study were collected from both culture and natural systems. The culture systems from which fish samples were collected include Emekuku, Okwuzi and Aluu ponds. The total collection of 262 fish samples from culture systems is composed as follows: 74 from Emekuku, 116 from Okwuzi, and 72 from Aluu. Of these numbers, the total infections were 83 (31.7%), of which Emekuku pond had 22 (8.4%) , Okwuzi 20 (7.6%) and Aluu 41 (15.6%). Table 4.6 shows details while figure 4.6 provides a graphic summary of findings.

From the natural water sources a total of 184 fishes were sampled from rivers Nworie and Otamiri, with 137 (74.5%) infected. From Nworie a total of 102 (55.4%) were infected while from Otamiri 35(19.0%) infections was recorded.

Out of the 446 fish samples examined, 262 (58.7%) were from culture system, while 184 (41.3%) were from the natural water body. In comparative terms, samples from the natural water body recorded higher infection (74.5%) than those from culture system (31.7%). Fish samples categorized as adults were 316 (70.9%). The adult fish samples infected were 168 (53.16%). 146 adult fish samples were from natural water while 170 were from pond systems.

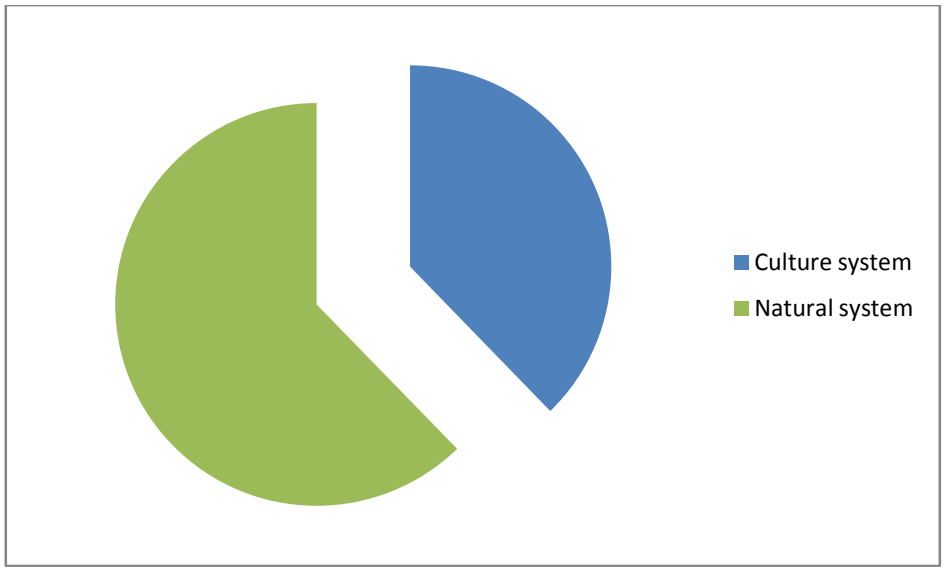

Figure 1: Parasitic infection-comparison between natural and culture system

A t-test of mean difference gave a t-value = 3.48 and a P-value = 0.073. This confirms that the difference is statistically significant, that is, fish from natural system are actually more susceptible to parasitic infection than those from culture systems.

Discussion and conclusion

Based on results obtained, the research question -*Is there any relationship between fish habitat and parasitic infection?* may now be answered unequivocally.

Yes, there is a relationship between fish habitat and parasitic infection. A t-test of mean difference confirms that fish from natural system are actually more susceptible to parasitic infection than those from culture systems.

The study objective focused on relating parasitic infection to fish habitat. The water quality of an aquatic body is very crucial because it determines the productivity and other parameters necessary for fish survival. The physical and chemical changes in the aqueous environment often cause some physiological changes in fish. A thin epithelial membrane separates fish blood from the water and any unfavorable change in the water body is reflected in the blood.

Olufayo (2009) found that there are many indigenous sources of botanical fish toxicants in Nigeria that are extremely toxic to a wide range of animals including fish. Some of these plants include :*Derris elliptica* , *Tephrosia vogelii* , *Acacia pennata* , *Tetraplera tetraptera* , *Mundulea sericea, Boerhavia coccinea*. The deliberate introduction of these plant extracts in the aquatic ecosystems could eventually lead to physiological stress inaquatic organisms and ultimately reduction in aquatic productivity (Olufayo, 2009; Warren, 1977).

The results indicate that those from natural systems were more infected than those from culture systems. This was statistically tested and the results proved the difference significant.

The findings are consistent with earlier studies. Francis-Floyd and Reed (2002); Klinger and Francis- Floyd (2002), Frances-Floyd (2002) and Obiajuru and Nnadi (2010) all converge to this. Frances-Floyd (2005) finds that freshwater fish infested with skin-inhabiting flukes become lethargic, swim near the surface, seek the sides of the pool or pond, and their appetite dwindles. They may be seen rubbing the bottom or sides of the holding

facility (flashing). The skin where the flukes are attached shows areas of scale loss and may ooze a pinkish fluid. Gills may be swollen and pale, respiration rate may be increased, and fish will be less tolerant of low oxygen conditions. "Piping", gulping air at the water surface, may be observed in severe respiratory distress.

Also, Lukacoric et al (2005) relate parasite abundance to salinity levels and conclude that low salinity levels in fresh water, like the natural sources investigated, are conducive to parsites. Studies conducted by Abraham (2009) also concur.

On the whole, it should be expected that the natural systems, being wild, should harbor more parasites than culture systems that are subject to expert regulation, monitoring and maintenance.

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