TITLE PAGE

GASTROINTESTINAL HELMINTH PARASITES OF SOME COMMERCIALLY IMPORTANT FISH SPECIES OF ANAMBRA RIVER, NIGERIA.

BY

NWADIKE, CHIDIOGO COMFORT
NAU/PG/Ph.D/2010597005P

A DISSERTATION SUBMITTED TO THE DEPARTMENT OF ZOOLOGY, FACULTY OF BIOSCIENCES, NNAMDI AZIKIWE UNIVERSITY, AWKA IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF THE DEGREE OF DOCTOR OF PHILOSOPHY (Ph .D) IN ZOOLOGY.

SEPTEMBER, 2018

CERTIFICATION

This is to certify that I am responsible for work, Gastrointestinal Helminth Parasites of some commercially important Fish Species of Anambra River, Nigeria submitted in this thesis under the supervision of Dr. P.C.O Ilozumba. I also certify that the original work is mine, except as specified in acknowledgement and references and that this thesis has not been submitted to this university or any other institution for award of degree.

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Nwadike, Chidiogo Comfort Date
NAU/PG/Ph.D/2010597005P

APPROVAL PAGE

This dissertation has been approved by the undersigned as meeting the requirement for the award of the Degree of Doctor of Philosophy of the Department of Zoology, Faculty of Biosciences, Nnamdi Azikiwe University, Awka.

______________________ ______________
Dr. P. C. O. Ilozumba Date
(Supervisor)

______________________ ______________
Prof. Mrs. C. I. Nsofor Date
(Head of Department)

______________________ ______________
Prof. C.A. Ekwunife Date
(PG Sub-Dean BioSciences)

______________________ ______________
Prof. M.U. Orji Date
(Dean, Faculty of BioSciences)

______________________ ______________
Prof. Odumegwu H. I. Date
(Dean, School of Postgraduate Studies)

______________________ ______________
Date

(External Examiner)

DEDICATION

This project is dedicated to the Most Blessed Trinity, Father, Son and Holy Spirit, the giver of life, wisdom, grace and strength.

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ABSTRACT

The increase in demand for protein especially to combat the incidence of protein deficiency disease (kwashiorkor) in Nigeria has led to studies aimed at tapping of all avenues of protein production of which fisheries is an important one. An investigation was conducted on the gastrointestinal helminth parasites of some commercially important fish species of Anambra River, Nigeria, between August, 2012 and August, 2014. The sample comprised one thousand and twenty five fishes belonging to 20 families and 43 species. The fishes were purchased from fishermen and fish mongers at Otuocha, Nsugbe and Enugwu-otu, transported to the laboratory and identified based on morphological structures/features. Routine body measurements for fish such as standard length, total length, weight, and sex were determined, after which the fishes were carefully and thoroughly examined for helminth parasites by opening the alimentary canal from the cloacal end to the anterior limit of the oesophagus. Parasites seen were picked with a small paint brush and placed in normal saline. Nematodes were fixed in 70 % alcohol while cestodes and acanthocephalans were fixed in 4 % formaldehyde. Parasite abundance and their preferred sites, seasonal variation and physico-chemical parameters of the river were recorded. Thirteen fish species were found to be infected by helminth parasites namely *Clarias gariepinus* (9.67 %), *C. anguillaris* (26.67 %), *C. lazera* (16.67 %), *Heterobranchus longifilis* (16.67 %) (Family; Clariidae); *Synodontis eupterus* (30.23 %), *S. batensoda* (23.33 %) (Family; Mochokidae); *Channa obscura* (28.77 %) (Family: Channidae); *Auchinoglannis occidentalis* (25.00 %) (Family: Bagridae); *Chrysichtys nigrodigitatus* (5.13 %) (Family: Claroteidae); *Protopterus annectens* (4.55 %) (Family: Protopteridae); *Schilbe mystus* (5.26 %) (Family: Schilbeidae); *Heterotis niloticus* (53.06 %) (Family: Osteoglossidae/Arapaimidae) and *Malapterurus electricus* (56.25 %) (Family: Malapteruridae). Nineteen species of helminth parasites were isolated comprising nine cestodes, Unidentified *Weyonia* species, *Weyonia youdeoweii*, *W. synodontis*, *Plerocercoid* larva, *Polyonchobothrium clarias, Sandonella sandoni, Electrotaenia malapteruri* and 2 unidentified; trematode, *Emoleptalea* species, three nematodes, *Procamallanus laeviconchus*, *Dujardinascaris* species and *Spirocamallanus* species and six acanthocephalans, *Neoechinorhynchus* species, *Tenuisentis niloticus* and 4 unidentified acanthocephalans. Unidentified *Weyonia* species were recovered from *S. eupterus* (4.65 %), *W. youdeoweii* from *S. eupterus* (9.30 %) and *S. batensoda* (6.67 %), *W. synodontis* from *S. batensoda* (3.33 %), *Plerocercoid* larva from *C. anguillaris* (13.33 %), *P. clarias* from *C. anguillaris* (13.33 %) and *C. lazera* (16.67 %), *S. sandoni* from *H. niloticus* (37.41 %) and *E. malapteruri* from *M. electricus* (50.00 %). *Emoleptalea* species were recovered from *C. gariepinus* (6.45 %). *Procamallanus laeviconchus* was recovered from *C. obscura* (28.77 %) and *H. niloticus* (2.72 %), *Dujardinascaris* species from *H. niloticus* (1.36 %) and *Spirocamallanus* species from *S. batensoda* (1.67 %) and *C. gariepinus* (3.22 %). *Neoechinorhynchus* species were recovered from *S. eupterus* (16.28 %) and *S. batensoda* (8.33 %), *T.niloticus* from *H. niloticus* (31.29 %), *S. batensoda* (3.33 %) and *M. electricus* (6.30 %). *Synodontis batensoda* is reported as a new host record for *T. niloticus*. *Heterotis niloticus* is reported as a new host record for *P. laeviconchus*. *Emoleptalea* species is reported as a new geographical record/ new parasite record in Nigeria. Correlation analysis revealed that there was a significant relationship between the weight of *A. occidentalis*, *C. anguillaris* and *C. obscura* at $P<0.05$ while *S. batensoda*, *H. longifilis* and *C. gariepinus* had an inverse significant relationship. For the fish length, correlation analysis revealed that there was a significant relationship between the length of

S.eupterus,*M. electricus* and *C. obscura* and helminth infection at P<0.05 while an inverse significant relationship was seen in *S. batensoda*, *C. anguillaris*, *H. longifilis* and *C. gariepinus*. All cestodes were recovered from the intestine of their host, likewise the trematode, *Emoleptalea* species. *Procamallanus laeviconchus*, *Dujardinascaris* species and *Spirocamallanus* species were recovered from intestine, rectum of their host. *Neoechinorhynchus* species were recovered from intestine and rectum while *Tenuisentis niloticus* were recovered from intestine. Mixed infections involving different species of helminth parasites occurred in *H. niloticus* and *S. batensoda*. The mochokids infection by cestode parasites recorded a higher prevalence in the dry season than in the rainy season. On the contrary, all three species of nematode parasites, *P. laeviconchus*, *Dujardinascaris* species and *Spirocamallanus* species recorded a higher prevalence in the rainy season than in the dry season in all their respective fish hosts. The values of water parameters determined in the dry season, pH (6.63), temperature (28.60) and dissolved oxygen (5.35) were slightly higher than in the wet season [pH (6.36), temperature (26.40) and dissolved oxygen (4.0)], although they were all within the stipulated limit. Additional studies will be required before the component community of helminths infecting the fishes of Anambra river can be ascertained especially as it relates to zoonotic infections.

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CHAPTER ONE

1.1 INTRODUCTION

Increase in human population and the attendant increase in demand for animal protein has continued to raise the demand for and consumption of fish and fish products worldwide. Freshwater fishery has an important bearing on the lives of many African communities primarily as an important source of dietary protein and secondarily as a source of subsistence income. Fish provides a good source of high quality protein and contains many vitamins and minerals. It may be classed as either whitefish, oily or shellfish. Whitefish, such as haddock (*Melanogrammus aeglefinus*) and seer (*Scomberomorus commersoni*), contain very little fat (usually less than 1%) whereas oily fish, such as sardines (*Sardina pilchardus*), contain between 10 – 25% (Fellows and Hampton, 1992). The latter, as a result of its high fat contents, contains a range of fat-soluble vitamins (A, D, E and K) and essential fatty acids, all of which are vital for the healthy functioning of the body (Fellows and Hampton, 1992).

Fish are intensively cultured and this culture system has created a need for more information on fish parasites. All species of fish are vulnerable to invasion by parasites depending on the species, size of fish and type of habitat where they live (Obano *et al*., 2010). Parasites in fish have been a great concern since they often produce disease condition in fish, increase their susceptibility to other diseases and cause nutritive devaluation of fish and fish loss (Obano *et al.*, 2010).

Common fish parasites include cestodes, acanthocephalans and nematodes which parasitize the skin, muscle, and viscera of fish, of which fish are the intermediate or final hosts. Nematodes commonly cause cysts in fish tissue.

Helminth parasites that infect vertebrates belong to two phyla, the Platyhelminthes (flatworms) and the Nemathelminthes (roundworms) (Roberts and Janovy, 2000). Flatworms of the Class Monogenea are ubiquitous in the fresh water environment and are found on the body surface of the host such as the gills and skin of fish while the flukes (Trematoda: Digenea), the tapeworms (Cestoidea) and the nematodes infect the internal organs, with their intermediate stages sometimes encysting in various host tissues (Roberts and Janovy, 2000). Helminth parasites can also cause damages such as compression and disruption of the vital organs including the gonads leading to sterility, eyes leading to blindness, poor growth rate and unthrifteness especially in young fish when they are found in large numbers in their body cavity and sometimes cause human diseases (Paperna, 1980; Roberts, 1989). The larval helminthes belonging to the genera *Clinostomum*, *Euclinostomum*, *Amplicaenum* and *Contracecum* species are known to occur in most African freshwater fishes (Paperna, 1980; Shibru and Tadesse, 1979).

The life cycles of most helminth parasites are so complex, involving more than one intermediate host, including fish, that their study enables one to better understand the dynamics of aquatic ecosystems as a whole (Hoffman and Bauer, 1971). Other aquatic animals, such as planktonic copepods and mollusks, play important role in the development of parasitic helminths as intermediate hosts. In general, endoparasitic helminths have a heteroxenous life cycle, that is, one in which the parasite passes through at least one intermediate stage before developing into the adult. The latter stage, in some cases, usually develops in higher vertebrates that feed on fish (eg piscivorous birds, mammals, man) in which case the larval stages in fish exhibit morphological and/or physiological adaptations that will enable them to survive in order to reach the adult stage and propagate (Dawes, 1946).

African rivers and flood plains contain more than 2000 species of fish representing several families (Khalil, 1971). However, not all are economically valuable. Three factors which broadly determine the economic importance of fish include size, edibility and abundance (Awachie *et al*., 1977).

The prevalence and intensity of helminth parasites on fish depend on many factors like parasite species and its lifecycle, host and its feeding habits and the physical factors of water body where fish inhabit (Hafiz *et al*., 2006). It also depends upon the presence of intermediate host such as snails and piscivorous birds for the onward transmission of parasite (like cestodes) infection to other hosts. The hygienic conditions of the water body are also very important in keeping aquatic environment free from introduction of any parasitic contamination from where fish are used for human consumption (Hafiz *et al.,* 2006).

Freshwater fish can serve as definitive, intermediate or paratenic (transport) hosts in the life cycles of many species of protozoan, metazoan and crustacean parasites. The parasites usually affect the marketability of commercially produced fish, thus raising public health concerns especially in areas where raw or smoked fish is eaten (Hoffman and Bauer, 1971; Paperna, 1996). In fish farming or aquaculture, some parasites may be highly pathogenic and contribute to high fish mortality and economic loss, while in natural systems they may threaten the abundance and diversity of indigenous fish species (Hoffman and Bauer, 1971). Some other factors that enhance parasitic infection in fishes include reduced oxygen content of water, increase in organic matter in the water, poor environmental conditions (Hoffman and Bauer, 1971; Paperna, 1996).

Infected fish can transmit disease to man resulting to poor public health (Nwuba *et al.*, 1999). While not all fish are of economic importance, a good number are utilized for different purposes by different communities, depending on their size, abundance and edibility. Efforts to develop and manage freshwater fisheries for increased productivity will understandably be concentrated on the economically important species. The increased number of natural and man-made lakes on the floodplains may lead to the development of new parasite levels with direct implications for the quality, quantity and even acceptability of the fish produced (Awachie *etal.*, 1977).

Most of the human impacts/activities on the aquatic environment affect the health of the resident fish fauna, eventually causing disease and associated mortalities (Poulin, 1992). Parasitic diseases of fish are very common all over the world, and are of particular importance in the tropics (Roberts and Janovy, 2000). Endoparasitic infections often give an indication of the quality of the water since they generally increase in abundance and diversity in more polluted water (Poulin 1992; Avenant- Oldewage, 2001). Fish parasitology is thus an indispensable tool in aquatic health studies and a basic understanding of the biology of the parasites is essential for instituting mechanisms of control.

Anambra River Basin habours one of the most important floodplain fisheries in Nigeria and is home to many commercially important fish families (Ilozumba and Ezeife, 2009). It is also an important source of fish seedlings/fingerlings for intensive fish culture which thrives in numerous permanent and semi-permanent floodplain lakes and ponds that add to the fish output of the basin (Ilozumba and Ezeife, 2009). The River Basin also harbours different schemes of intensive aquaculture. Profitability of the different types of aquaculture can be enhanced by sound management strategies which include knowledge of the parasitofauna of the different fish species in the wild.

The success of the aquaculture programme as it relates to fish farming depends to a significant extent on the ability of the management personnel to keep parasites under control in the fish farms. To be able to do this, comprehensive information on the parasite-fauna of the fish species should be available to them. It is in cognizance of the importance of such information and the need to improve on the status of knowledge of the parasite-fauna of freshwater fish in Nigeria that a study of parasites of the fish of Anambra River, particularly parasites of the commercially important fish species was undertaken.

1.2 Justification for the Study

The increase in demand for protein especially fish to combat the incidence of protein deficiency disease (kwashiokor) in Nigeria has led to studies aimed at tapping of all avenues of protein production of which fisheries is an important one. It is therefore necessary to be aware of the parasitofauna for possible zoonotic disease. However, although some works have been done in the direction of documenting the parasitofauna of freshwater fishes in Nigeria and in Anambra River Basin (Ilozumba and Ezenwaji, 1985; Ezenwaji, 1992; 1993; 2002; Ezenwaji and Ilozumba, 1992;

Ezenwaji and Inyang, 1999; Ezenwaji *et al*., 2005), detailed studies of whole fish communities of such water bodies would seem not to have been given due attention. Documentation of fish fauna of River Anambra Basin and its parasitofauna has also become something of urgent necessity, because the River Basin is the base of a newly incorporated Orient Petroleum Resources Plc and the company has begun to lay its operational infrastructure in the trough of the River Basin and also drill oil at the site. The notoriety of the petroleum industry in Nigeria for ecological devastation as a result of oil spillage and pollution makes a programme monitoring of the aquafauna and aquaflora of the basin an urgent necessity (Ilozumba and Ezeife, 2009). This study is geared towards this documentation so as to provideinformation on the parasites of commercially important fish of this basin and their helminth parasites, so that subsequent changes with time could be tracked.

1.3 Aim of the Study

The aim of the study was to provide data on gastrointestinal helminth parasites of some commercially important fish species of Anambra River.

1.4 Objectives of the Study

The objectives of the study were to determine:

1. the commercially important fishes obtained from River Anambra.
2. the prevalence and abundance of helminth endoparasites of some commercially important fish species obtained fromRiver Anambra.
3. the relationship between fish size (weight and length) and helminth infection.
4. the prevalence of helminth infections in the microhabitats ofthe fishes.
5. mixed infections involving different species of helminth parasites in fishes.

6. seasonal variation in the prevalence of helminth infections in the fishes.
7. the physicochemical factors of River Anambra in relation to helminth endoparasite infection.

CHAPTER TWO

LITERATURE REVIEW

2.1 Helminth Parasites of Freshwater Fish from other African countries

Several studies have been conducted on parasites of commercially important fishes from other African countries. Mansour *et al.* (2003) reported a prevalence of 87.25 % from different fish species at El- Mansoura, Egypt. The fishes examined were *Bagrus bayad*, *Bagrus docmac*, *Synodontis schall, Synodontis serratus, Mormyrus caschive*, *Barbus bynmi*, *Lates niloticus* and *Labeo niloticus*. The infestation rate was highest in *B. bayad* (97.70 %) followed by *B. docmac* (93.33 %), while the lowest rate was recorded in *Barbus buyni* (69.70 %). *Acamthodtomum absconditum* and *H. cahirinus* were recovered from the stomach and intestine of *B.bajad* and *B. docmac*, *P.aegyptiacus* from the testes and ovaries of *B. bajad*, *B. docmac*, *S. schall*, *S. serratus* and *Lates niloticus*. The metacercariae of both *Diplostomum* and *Neodiplostomum* were recovered from the eyeball of all the examined fishes, while the metacercariae species of *Posthodiplostomum* species were recovered from other organs than the eyes of *B.bynni* and *L. niloticus*. The nematode parasites, *C. yamagutii* were recovered from the intestine of *B. bajad, M. caschive* and *L. niloticus* while *S. moraveci* were recovered from the stomach of *B. bajad*, *B. docmac*, *S. schall*. *S. serratus* and *L. niloticus*. A significant correlation was found between the host length and infection prevalence, between the host weight and prevalence and between the host sex and intensity of infection, while insignificant relation was recorded between the host length or weight and intensity; and between host sex and prevalence of infection.

In a study carried out by Barson (2004) recorded a prevalence of 42.60 % in *C. gariepinus* from Lake Chivero, Zimbabwe, and the third-stage larva of *Contracaecum* species was found in the body cavity. Seasonal variation in the prevalence of the parasite was not obvious and there was no significant difference in the prevalence of infection between male and female fish.

Barson and Avenant-Oldewage (2006) recovered two species of nematodes namely *Procamallanus laeviconchus* in the stomach and *Contracaecum* specieslarva in the abdominal cavity of *Clarias gariepinus* from the Rretvlei Dam, South Africa.

Moyo *et al*. (2009) in their study examined different species of fish in Insukamini Dam, Zimbabwe namely *Clarias gariepinus* (n=10), *Orechromis macrochir* (n-12), *Orechromis mossambicus* (n=18) and *Serranochromis robustus* (n-10). Nematodes recovered were *Paracamallanus cyathopharynr, Capillaria, Contracecum* species larva and *Eustrongylides* species larva. *Paracamallanus cyathopharynr* had the highest prevalence of 80.00 %. Three cestodes, *Bothriocephalus acheilognathi, Polyonchobothrium claria* and *Preteocephalus glanduliger* were recovered. A digenean trematode, *Glossidium pedalum* was also recovered from all the fish specimens. The acanthocephalan, *Acanthogyrus* was recovered from all four fish specimens examined.

A study on gastrointestinal helminth parasites of catfish was undertaken by Hussen *et al*. (2012) in their study of *Clarias gariepinus* in Lake Hawassa, Ethiopia. They recorded a prevalence of 76.04 %. They also recovered *Capillaria* and *Contraceacum* species (both nematodes) with prevalence of 39.84 % and 27.60 % respectively and cestode (52.80 %).

Madanire-Moyo and Avenant-Oldewage (2013) recorded a prevalence of 70.00 % and 51.10 % for *Tetracamposciliotheca* and *Proteocephalus glanduligerus* respectively in *C. gariepinus* from Vaal Dam, South Africa.

Abdel- Gaber *et al*. (2015) recorded a prevalence of 65.00 % in *Clarias gariepinus* from lake Manzala, Egypt. Parasites recovered were *Orientocreadium batrachoides* (Digenea), *Polyonchobothrium clariae* (Cestoda), *Procamallanus laeviconchus* and *Camallanus polypteri* (Nematoda). Majority of the recovered parasites were found in the intestine. Female fishes had higher prevalence of 72 (90.00 %) than males, 58 (48.33%) and there was no significant difference ($P > 0.05$) in infestation rate between the two sexes. The relationship of host size (weight/length) and parasite infection showed that there was no significant difference in the parasitic infection, although fish of larger sizes had more infections.

Mavuti *et al*. (2017) recorded a prevalence of 67.80 % and 32.20 % for *Tilapia* and catfish respectively in Nyeri County, Kenya. They recovered *Clinostomum* species from the muscles and *Diplostomum* species from the eye. Also, *Dactylogyrus* species and *Gyrodactylus* species were recovered from the gill and skin respectively.

2.2 Helminth Parasites of Fish from other States in Nigeria

Awachie *et al.* (1977) listed commercially important fish species in Nigerian rivers to include: *Tilapia* species, *Citharinus* species, *Mormyrus* species, *Distichodus* species, *Bagrus* species, *Alestes* species, *Clarias* species, *Lates niloticus, Gymnarchus niloticus, Heterotis niloticus* and *Hepsetus odoe*.

Several studies have been conducted on parasites of commercially important fishes from states in Nigeria. Ugwuzor (1985) recovered *Procamallanus laeviconchus, Procamallanus* species*, Spironoura confolence, Spironoura* species, *Cucullanus* speciesand *Serradacnitis serrata* from Imo River.

Omoregie *et al*. (1995) in their study of *Oreochromis niloticus* from Panyam fish farm and petroleum polluted freshwater in Kaduna recovered the following parasites; *Diplostomulium*, *Cleidodiscus*, *Clinostomum tilapiae*, *Euclinostomum heterostomum, Procamallanuslaeviconchus*, *Capillaria*, *Eubothrium tragenna* and *Polyonchobothrium* species. They were recovered from the intestine, stomach, liver and brain.

Olurin *et al*. (2002) recovered *Clinostomum tilapiae* (metacercaria) and *Neoechinorhynchus rutili* (acantocephalan) from *Sarotherodon galileus* at a prevalence of 21.30 % and 10.22 % respectively and from *Tilapia zilli* at a prevalence of 10.00 % and 26.70 % respectively from River Oshun, Southwest Nigeria. No sex-related differences ($p > 0.05$) were found in parasite burden, and there was no relationship between parasite burden and fish size (length and weight).

Oniye *et al.* (2004) reported in *Clarias gariepinus* in Zaria a prevalence of 2.50 % for *Amonotaenia* species, 13.33 % for *Monobothrium* species and 1.67 % for *Polyonchobothrium clarias*. *Procamallanus laeviconchus* and *Neoechinorhychus rutili* both recorded a prevalence of 0.83 %. Majority of the parasites were found in the intestine and fish specimens that were lighter in weight were free of infection.

In Cross River, Ekanem *et al*.(2014) recovered the nematode, *Camallanus kirandensis* from the intestine and stomach of infected fish. They reported a prevalence of 60.00 % for *Bathygobius soporato*, 15.00 % for C*hrysichthys nigrodigitatus*, 10.00 % for *Clarias gariepinus* and 25.00 % for *Synodontis clarias*. The preferred organs for parasite infection were the stomach and intestine.

Adikwu and Ibrahim (2004) reported a prevalence of 40.82 % for *Procamallanus* species (Nematoda) in the intestine, 2.21 % for *Monobothroids* species in the intestine, 18.73 % for *Polyonchobothrium* (Cestoda) in the stomach, intestine, rectum, gall bladder and bile duct and 19.02 % for metacercaria (cysts) in studies on the endoparasites of gastrointestinal tract of *C. gariepinus* in Wuse Dam, Kano State. Prevalence was lowest in juvenile fish. They also had a high correlation between weight and length of fish ($P<0.05$, $r=+0.98$, length and infection ($r=+0.84$), weight and infection ($r=+0.80$).

Akinsanya and Otubanjo (2006) reported in *Clarias gariepinus* (Clariidae) from Lekki Lagoon, Lagos, a prevalence of 4.72 % and the parasites recovered were *Paracamallanus cyathopharynx* (Nematoda), *Polyonchobothrium clarias, Stocksia pujehuni* and *Wenyonia acuminata* (Cestoda). It was also reported that smaller fishes recorded higher infection than bigger fishes.

In Ekiti, Olofintoye (2006) recovered *P. laeviconchus* (14.40 %) from the intestine and *Cucullanus* species (18.20 %) from the stomach and intestine of *Tilapia zilli*. In *Clarias anguillaris, P. laeviconchus* (10.40 %) was recovered from the stomach and intestine while *Cucullanus* species (52.10 %) was recovered from the stomach, intestine and gills. *Procamallanus laeviconchus* and *Cucullanus* species recorded a prevalence of 14.20 % and 47.10 % respectively in the stomach and intestine of *C. gariepinus*. *Monobothrium* species (Cestoda) recorded prevalence of

1.70 %, 4.30 % and 3.10 % for *T. zilli*, *C. anguillaris* and *C. gariepinus* respectively. Another cestode, *Polyonchobothrium clarias* recorded a prevalence of 9.40 %, 0.90 % and 5.30 % in *T. zilli*, *C. anguillaris* and *C. gariepinus* respectively. *Neoechinorhynchus rutili* (acanthocephalan) recorded a prevalence of 1.70 % and 1.80 % in *T. zilli* and *C. gariepinus* respectively. Prevalence varied with the standard length and also increased with the body weight of the fish species examined.

Olurin and Somorin (2006) in their study of fishes of Owa stream reported a prevalence of 89.52 %, 71.43 % and 96.65 % for *Clinostomum tilapiae* (metacercariae) in *Chromidotilapia guntheri*, *Tilapia mariae* and *Hemichromis fasciatus* respectively. Also prevalence of 62.90 % and 85.71 % for *N. rutili* was recorded in *C. guntheri* and *T. mariae* respectively.

Akisanya *et al.* (2007a) in their comparative study of *Gymnarchus niloticus* and *H. nilotics* from Lekki Lagoon, Lagos reported an overall prevalence of 34.20 %. The nematode, *Raphidascaroides* species and the Philometrids, *Nilonema gymnarchi* were recovered from the stomach and intestine of *G. niloticus* respectively. The trematode, *Brevimulticalcum heterotis* was recovered from the liver while *T. niloticus* and *Sandonella sandoni* were recovered from the intestine of *H. niloticus*.

In another study carried out by Akinsanya *et al*. (2007b) on *Malapterurus electricus* from Lekki Lagoon Lagos, recorded a prevalence of 37.00 % and two species of cestode, a Proteocephalid cestode and *Electrotaenia malapteruri*; a nematode, *Nilonema* species and an acanthocephalan parasite, *Tenuisentis niloticus* were recovered. The overall worm burden was independent of sex and size of the fish species.

Musa *et al.* (2007) in their study on *Oreochromis niloticus* in Jos reported a prevalence of 49.07 %, 49.69 % and 1.24 % for *Clinostomum tilapiae*, *Enterogyrus cichlidarum* and an unnamed cestode respectively.

Edema *et al*. (2008) recovered *Procamallanus* species (50.00 %), *Cucullanus barbi* (33.30 %) and S*pinitectus* species (19.70 %) in fish species from Okhuo River, Benin city, namely, Notopteridae (*Papynocranus afer*), Characidae (*Brycinus longipinnis, B. nurse*), Malapteruridae (*Malapterurus electricus*), Channidae (*Parachanna obscura*) Cichlidae (*Chromidoptilapia guetheri*, *Hemichromis fasciatus*, *Orechromis aureus, Tilapia mariae*) and Anabantidae (*Ctenopoma kingsleyae*). *Procamallanus* species and *Cucullanus barbi* recorded a prevalence of 40.00 % in *C. guntheri* while *Spinitetus* species recorded a prevalence of 10.00 % in *P. obscura* examined. All the parasites were recovered from the intestine.

Ayanda (2008) recovered *ProcamaIlanus* speciesand *P. laeviconchus* from *C. gariepinus* in Asa dam Ilorin, Kwara State. Infection rate was higher in sub adults than in juveniles.

Akinsanya *et al.* (2008), in their study of *Synodontis clarias* (Siluriformes: Mochokidae) from Lekki Lagoon Lagos, reported a prevalence of 38.70 %. A nematode, *Raphidascaroides* species and two cestodes, *Proteocephalus* species and *Wenyonia accuminata* were recovered. The overall worm burden was high (678) and was independent of sex and size.

Owolabi (2008) reported a prevalence of 36.25 % in *Synodontis membranaceus* from Jebba Lake. Two species of nematodes, *Procamallanuslaeviconchus* and *Cucullanus* species and a cestode, *Polyonchobothrium* species were recovered. Nematodes had higher prevalence (27.81%) than cestode (8.44%). Prevalence of endoparasites was highest in the intestine, while the oesophagus recorded the lowest. Infestation of endoparasites was more prevalent in the dry season than in the rainy season.

Ayanda (2009) recovered *Procamallanus* species, *P. leaviconchus* (Nematoda); *Amonotaenia* species, *Polyonchobothrium clarias* and *N.rutilli* (acanthocephala) from both male and female *C. gariepinus* in Asa dam Ilorin, Kwara State.

Onyedineke *et al.* (2010) in their study on the freshwater fish from river Niger at Illushi, Edo State reported a prevalence of 60.60 %. Cestodes recovered were *Diphyllobothrium and Proteocephalus* species. *Diphyllobothrium* species was only found in the stomach and gills of *Chrysichthys nigrodigitatus* whereas *Proteocephalus* species was found in *Ctenopoma kingsleye* and was the only parasite infecting *T. galilaeus*. *Paramphistomum* species was the only trematode found in the gills of fishes. Another cestode, *Bucephalous* species was found in *S. eupterus and D. aegycephalus.* Acanthocephalans recovered were *Pomporhynchus, Quadrigyidae and Neoechinorhynchus. Neoechinorhynchus* was found only in the intestine of *Lates niloticus.*

Obano *et al.* (2010) in their study on fishes from Okhauihe River, Benin City reported 20.00 %, 40.00 %, 37.04 % and 33.33 % prevalence for *P. laeviconchus* in

H. biscutatus, Barbus callipterus, C. gariepinus and Malapterus electricus respectively. The cestode, *Lytocetus* species recorded a prevalence of 20.00 % in *H. biscutatus*, 18.19 % in *Hemichronis fasciatus*, 16.67 % in *Bagrus filamentous* while *Caryophyllaeides* had a prevalence of 20.00 % in *B. callipterus*. *Crescentovitus* species was recovered from *C. gariepinus* at a prevalence of 37.04 % and 68.97 % in *C. anguillaris*. The main location of the parasites was the intestine. They also reported that size of the fish influenced the degree of parasite infection and the recovering of *Lytocetus* species and *Crescentovitus* species was a new geographical record.

Hassan *et al.* (2010) in their study on *Clarias gariepinus* and *Synodontis clarias* from Lekki Lagoon, Lagos, recorded a prevalence of 68.70 % and 69.70 % in *S. clarias* and *C. gariepinus* respectively. Two species of nematode namely; *Procamallanus* and *Raphidascaroides* species were recovered. Cestode parasites recovered were *Wenyonia* species and a Pseudophyllideancestode. Concurrent infections of *Raphidascaroides* and *Wenyonia* species were common. Intestinal inflammation around the worm attachment surface and necrosis (cell death) were common in infected fish.

Akinsanya and Hassan (2011) recovered *Procamallanus* species (*Spirocamallanus*) and *Contraceacum* species (Nematoda) and a trematode, *Clinostomum metacercaria* from *Parachanna obscura*. Male specimens (299) recorded a lower prevalence (5.2 %) than the females (111) which recorded a prevalence of 7.2 %. The overall worm burden was low and independent of sex and size of the fish.

Ekanem *et al*. (2011) in Calabar reported a percentage incidence of 50.00 % for *C. nigrodigitatus*, 16.67 % for *H. niloticus*, 16.67 % for *Clarias gariepinus* and 16.67 % for *T. galileaus*. Parasite infections were found in the stomach and intestine and no parasites were found on the fins, skins and gills. *Diphyllobothrium* species was found in the intestine of *C. nigrodigitatus; Camallanus* species was found in the intestine of *H.niloticus* and *T. galileaus* while protozoan cysts were found in intestine of *C. gariepinus.* Parasites were more prevalent in fish of 30 to 39.9cm total length size range.

Omeji (2012) reported a prevalence of 58.33 % and 72.50 % in *Auchenoglanis occidentalis* and *Synodontis clarias* respectively from lower River Benue, Makurdi. Two species of nematode; *Camallanus* species and *Capillaria* species, and one species of cestode, *Diphyllobothrium latum* were recovered. Bigger fish of both species had more prevalence than the smaller ones.

Aliyu and Solomon (2012) reported a prevalence of 59.38 % in *Clarias gariepinus* from lower Usman Dam, Abuja. The nematode, *Procamallanus laeviconchus* was the only nematode recovered. Two cestodes namely, *Monobothrium* species and *Polyonchobothrium clarias* were recovered, and so also was the acanthocephalan, *Neoechinorhynchus rutili*. Majority of the parasites were found in the intestine. Infection was limited to fish ranging from 30-36cm standard length. Fish specimens that were lighter in weight (200-250g) were free from infection, but those found with high number of parasites weighed between 300g-350g.

Biu and Akorede (2013) in their study of *Clarias gariepinus* from Maiduguri, Borno State recorded a prevalence of 38.00 %. Parasites recovered were *Diphyllobothrium latum* (31.60 %), *Gnathostoma spinigerum* (44.70 %) and *Trypanosoma* spp (23.70 %). There was a significant difference ($p \leq 0.05$) between prevalence of infection and standard length and body weigth, whereas there was no significant difference ($p \geq 0.05$) between the sexes of the fishes.

Idris *et al*. (2013) recorded a prevalence of 41.67 % in *C.gariepinus* from Jeremiah Usein River, Gwagwalada Abuja and recovered *Polyonchobothrium clarias* and *Procamallanus laeviconchus* respectively from the intestine. In *C.gariepinus*, higher infection rate was observed in females (42.86 %) compared to their male counterpart (40.00 %) and adults had the highest age-specific rate (53.13%).

Dan-Kishiya *et al.* (2013) carried out a study on the prevalence of helminth parasites in the gastrointestinal tract of wild African sharp tooth catfish, *Clarias gariepinus* (Siluriformes: Clariidae) in Gwagwalada, Nigeria. A total of 110 specimens were examined which included forty two (42) males and sixty-eight (68) females. Forty eight (48) (43.64%) of the fishes were infected with various species of helminths of which the nematode, *P. laeviconchus* had a prevalence of 11.82 % and was recovered from the stomach and intestine. The relationship between sex and rate of infection revealed that out of 42 males examined, 17 (15.46 %) males were infected while 31(45.59 %) females were infected at a prevalence of 28.18 %. Thirty-one fishes were infected with *Wenyonia* specieswith *a* prevalence of 28.18 % while the trematode *E. heterostomum* infected 4 (3.64 %) of the fishes. Female fishes had a higher prevalence (28.18 %) than males which had 15.46 % prevalence. Most of the parasites were recovered from the intestinal lumen. The relationship between length, weight and rate of infection showed that infestation increased with age of fish as juvenile fish had no parasite while the sub-adults and adults were infected.

Eyo *et al*. (2013) recorded a prevalence of 72.60 % in *Synodontis batensoda* at Rivers Niger-Benue Confluence, Nigeria. Nematode parasites recovered were *P. laeviconchus* (9.52 %), *R. congolensis* (3.57%) ,*S. guntheri* (15.48 %),*O. equi* (17.86 %),*C. microcephalum* (8.33 %), larval nematode (2.38 %) and *Strongylides* species (3.57 %). Cestodes recovered were *Monobothrioides woodland* with a prevalence of 2.38 %, *Bothriocephalus acheilognathii* 2.38 %, *Proteocephalus largoploglotis* 1.19% and *Caryophyleus* species 3.57 %. Digeneans recovered were *Allocreadim ghanensis* with a prevalence of 1.19 % and metacercariae of *Pygidiopsis genata* which had a prevalence of 16.67 %. Acanthocephalans recovered were *Acanthoicephalus* species (35.71 %) and *Neoechinorhynchus prolixum* (16.67 %). The *acanthella* (immature stages) had a prevalence of 15.48 %. Acanthocephalans had the highest prevalence among the parasites recovered and all parasites were recovered from the intestine of the infected fishes, except Trichodinids which were recovered from the gills and skin of fish hosts. The relationship of host weight and parasite infection showed infection was highly significant ($P \leq 0.01$) in fish of larger weight of 76 to 100g and above. There was no significance ($P \geq 0.01$) in prevalence of parasites between the male and female fish hosts. Multiple infections were recorded in several fish hosts, an indication of the rich parasitic fauna of the localities.

Biu and Nkechi (2013) in their study of *Tilapia zilli* in Maiduguri recovered *Caryophyllaeus* species (57.10 %), *Diphyllobothrium* species (plerocercoid) (14.30 %) (Cestodes) and *Cystacanthus* (28.60 %) (Acanthocephalan). Fish within the length categories of 16-20cm and 21-25cm recorded a significantly (p=0.012<0.05) higher prevalence of 25.00 %and 60.70% respectively. The lowest prevalence of 14.30 % was recorded in fish of 20 to 30cm categories. Smaller *Tilapia zilli* were more susceptible to parasitic infections than larger ones.

Nzeako *et al.* (2013) recorded 59.00 % in *Orechromis niloticus* from Calabar River, Port Harcourt. Male fish had a prevalence of 43.00 %, while prevalence for female fish was 16.00 %. Nematodes recovered were *Capillaria* species (21.00 %), *Eustrongyloides* species (15.00 %) and *G. sigalasi* (18.00 %). They also recovered a crustacean parasite, *Lernaeocera branchialis* which had a prevalence of 5.00 %.

Obaroh *et al*. (2013) in their study of *Synodontis clarias* from River Dukku in Birnin Kebbi recorded a prevalence of 68.00 %. They recovered *Camallanus* species, *Spirocamallanus* species (Nematoda), *Pterobothrium* species (Cestoda) and *Acanthcolpus* species, *Lecithocladium* species, *Clonorchi* species (Trematoda). Also, fishes with the highest total weight value of 8.60 – 10.90g were observed to have the higher prevalence of 75.00 % which was significantly different ($p < 0.05$), when compared to the other groups.

Salawu *et al.* (2013) in their comparative survey of helminth parasites of *Clarias gariepinus* (Burchell, 1822) and *Clarias pachynema* (Boulenger, 1903) from the Ogun River and Asejire Dam in South-West Nigeria recorded prevalence of 75.00 % and 45.10 % were recorded for *C. gariepinus* and *C. pachynema* from Ogun

River while prevalence for the two species from Asejire Dam was 25.90 % and 31.50 % respectively. Parasites recovered were *Wenyonia* species, *Polyonchobothrium* species and plerocercoid larva, one nematode namely, *Procamallanus* species and one digenean namely, *Clinostomum* species were recovered from the fish. Prevalence and mean intensity of parasitic infection were higher in specimens from the Ogun River than those from the Asejire Dam which they attributed to difference in pollution states- Ogun River was polluted while Asejire Dam was not polluted. Male *C.gariepinus* from the Ogun River had the highest prevalence of 76.50 %, while those from Asejire Dam had the lowest prevalence of 21.43 %. There was no significant difference in the prevalence of parasitic infection in relation to host size (P>0.05). However, largest size fishes had no parasitic infection. The helminth infections observed and recorded was restricted to the stomach, intestine and gill chamber. In Ogun River, *C. gariepinus* was infected by the cestodes in the stomach 42 (68.90 %) and intestine 141 (67.10%), nematodes in the stomach 19 (31.10 %) and intestine 34 (16.20 %), flukes were recovered from the gills 18 (100.00 %) while in *C. pachynema*, cestodes were recovered from stomach 27 (96.40 %), intestine 89 (90.80 %); nematodes from stomach 1(3.60 %) , intestine 9 (9.20 %) and flukes from the gills 9 (100.00 %). In Asejire Dam, cestodes were recovered from stomach 7 (63.60 %), intestine 76 (78.40 %) while nematodes were recovered from the stomach 4 (36.60 %) and intestine 21 (21.60 %) of *C. gariepinus*. For *C.pachynema*, cestodes were recovered from the stomach 7 (70.00 %), intestine 65 (91.50 %) while nematodes were recovered from stomach 3 (30.00 %) and intestine 6 (8.50 %). *Clinostomum* species was found only in *C. gariepinus* and *C. pachynema* from Ogun

River. Concurrent infections in intestine with *Procamallanus* species and *Polyonchobothrium* species were common.

Ekanem *et al.* (2014) in their study of fish species namely *Alestes nurse, Bathygobius soporator, Chrysichthys nigrodigitatus, C. citherus, C. gariepinus, Ethmalosa fimbriata, Hepsetus odoe, Monodactylus sebae, M. rume, Orechromis niloticus, Polydactylus quadrafilis, Pseudotolithus elongates, Sphyraena barracuda, Schilbe mystus and Synodontis clarias* from Calabar River recovered *Diphyllobothrium latum* (Eucestode) and *Clinostomum complanatum* (Trematode) and *Pomporhynchus laevis* (Acanthocephala). *C. complanatum* was recovered from the stomach and intestine of *B. soporato, D. latum* was recovered from the stomach of *C. nigrodigitatus while P. laevis* was recovered from the intestine of *B. soporato, S. clarias and C. nigrodigitatus* and from the stomach of *S. clarias.* No parasite was recovered from the other fish species.

Eyo and Iyaji (2014) recorded a prevalence of 60.30 % in *Clarotes laticeps* at Rivers Niger-Benue Confluence, Lokoja. Seven parasite species were recovered namely, *Trichodinid ciliates* (protozoan), *Monobothrioides woodlandii, Bothriocephalus acheilognathii, Proteocephalus largoproglotis* (cestodes) and *P. laeviconchus, Rhabdochona congolensis, Contracaecum microcephalum* (nematodes). The cestode and nematode parasites were recovered from the intestine while the protozoan parasite was recovered from the gills/skins. The relationship of host size (weight /length) and parasite infection showed there was no significant difference in the infection ($p > 0.5$) among size classes, although fish of larger sizes had infection rate. There was also no significant difference in the infection of the sexes.

Ejere *et al*. (2014) in their study of different fish species comprising 21 *Tilapia zilli*, 23 *Synodontis clarias*, 23 *Chrysichthys nigrodigitatus*, 16 *Hepsetus odoe* and 2 *Clarias anguillaris* recorded a prevalence of 32.90 % in Warri River. They also recovered *Neoechinorhynchus prolixim* (8.70 %) *Pomphorhynchus* species (21.70 %), *Acanthocephalus* species (13.0%), unidentified acanthocephalan (34.80 %), *Camallanus polypteri* (13.0%), *Capillaria pterophylli* (14.30%), *P.laeviconchus* (8.70 %)and *Railletenma synodontis (*4.30 %*)* from *S.clarias.* An unidentified acathocephalan (6.30 %), nematode, *C.polypteri* (25.00 %), *P.africanus* (12.50 %) and an unidentified crustacean (6.30%) were recovered from *H.odoe*

The nematodes, *P.laeviconchus,* (9.50 %), *C.cichlasomae* (4.80 %) and Hirudinea, *Pisciola geometra* (4.80 %*)* were recovered from *T. zilli. C. polypteri* (50.00 %) and *C. pterophylli* (50.00 %) (nematodes) were recovered from *C. anguillaris.* The nematodes, *C.polypteri* (21.70 %), *Camallanus pterophylli* (8.70 %), *P.laeviconchus* (4.30 %); trematode, *C. complanatum* (4.30 %) and Hirudinae, *P.geometra* (4.30 %) were recovered from *C.nigrodigitatus*. For the microhabitat of these parasites on the host, *N.prolixum, Pomphorhynchus* species were found in the intestine of *S. clarias* while an unidentified acanthocephalan was found in the stomach and intestine of *H.odoe.*

C.polypteri was found in the stomach and intestine of *T.zilli* and *H.odoe*, intestine of *S.clarias*, stomach, intestine and buccal cavity of *C.nigrodigitatus,* and *C.anguillaris. Capillaria cichlasomae* was found in the intestine of *T.zilli* while *C.*

pterophylli was found in the intestine of *S. clarias, C. nigrodigitatus, and C. anguillaris. Procamallanus laeviconchus* was found in the intestine and stomach of *S.clarias* and intestine of *C.nigrodigitatus. Railletnema synodontis* was found in the intestine and stomach of *S.clarias* while *P.africanus* was found in the stomach of *H.odoe. Clinostomum complanatum* was found in the muscle of *C.nigrodigitatus. Pisciola geometra* was found in the buccal cavity of *T.zilli* and *C. nigrodigitatus*. The crustacean parasite was found in the skin of *H.odoe.*

Although the acanthocephalans constituted 75.60 % and nematodes 22.20 % of the parasite recovered, the nematodes had the highest prevalence (23.5%). compared to the acanthocephalans (9.40 %). The highest prevalence (39.10 %) was observed in *S.clarias,* while the least (23.80 %) was observed in *T.zilli*. Generally, the prevalence of parasites was higher in females (35.70 %) than in the males (31.60 %), although the difference was not statistically significant (x^2 = 0.145, P = 0.8074).

lyaji and Eyo (2014) recorded 65.47% prevalence of infection in *Malapterurus electricus* at Rivers Niger-Benue Confluence. Parasites recovered comprised one protozoan ciliate (*Trichodinids*), three cestodes (*Monobothrioides woodlandi, Electrotaenia malapteruri* and *Proteocophalus largoploglotis*), three nematodes (*Procamallanus laeviconchus, Rhabdochona congolensis* and *Camallanus* species). *Electrotaenia malapteruri* had the highest prevalence (66.67%) among the parasites recovered. All parasites were recovered from the intestines except the *Trichodinids* which were recovered from the gills and skin of fish hosts. The relationship of host weight/length and parasite infection showed higher infection in fish of larger sizes and there was no significant difference between the infection of male and female fish hosts.

Ajala and Fawole (2014) recorded a prevalence of 46.34 % in *Clarias gariepinus* from Oba reservoir, Oyo State. Parasites recovered were *P. laeviconchus*, *Paracamallanus cyathopharynx* (nematodes), *Anomotaenia* species, *Monobothrium* species, *Polyochobothrium clarias* (cestodes) and *Neoechinorynchus rutili* (acanthocephalan). Infection varied significantly with season ($p = 0.05$), and females were more infected than males. *Monobothrium* species had the highest range of infection (0 - 32) and intensity (21.98± 2.08) while *Anomotaenia* species had the least (0 -1) and (1.00 ± 0.01) respectively. Fishes of small sizes (<10cm) and small weight (<20g) were not infected, but there was high prevalence in medium and large sized fish and a direct linear relationship existed between length and intensity. Body weight and sex were significant (K – S; $P = 0.05$) in relation to infection. Multiple infections were common, which showed a positive correlation between most of the parasites except *Anomotaenia* species which showed negative correlation with *P.clarias*

Biu *et al.* (2014a) in their study of *Clarias gariepinus* from the Lake Alau, Maiduguri, Borno State recovered *Hemogregarina* (61.00 %), *Babesiosoma* (9.70 %) and *Trypanosoma* (3.20 %) ($P < 0.05$). There was positive significance between the weight and length and parasite prevalence.

Ugbor *et al.* (2014) in their study of *C. gariepinus* and *C. anguillaris* recorded a prevalence of 41.10 %. Parasites recovered were protozoans (*Trichodina acuta* and *Epistylis* species), two cestodes (*P. clarias* and *Monobothriodewoodlandi*), and two nematodes (*Rhabdochona congolensis* and *P. laeviconchus*). Protozoan ciliateswhich were recovered from the gills and skin of fish hosts had the highest prevalence (25.55 %) among the parasites recovered. All other parasites were recovered from the intestine and the glandular stomach. The relationship of host size (weight and length) and parasite infection showed infection was significantly different ($p<0.05$) in fish of larger weight (126g+) and length (30cm +). There was significant ($p<0.05$) difference in the infection of sexes, with the males having more infections. Monthly / seasonal patterns of infection varied from one parasite to another.

Omeji *et al*. (2014) reported in their study on *Malapterurus electricus* from upper River Benue a prevalence of 47.00 %. They recovered *Camallanus* species, *Cappillaria* species, *Contracaecum* species, *Eustrogylides* species and *Caenorhabditis briggsae* (Nematoda), *Diphyllobothrium latum* and *B. aengypticus* (Cestoda), *Henneguya* species (Protozoa) and *Clinostomum* species (Trematoda). Female specimens recorded a higher rate of infections (57.57 %) than males (42.43%).

Usip *et al.* (2014) reported in their study on *Clarias gariepinus* from three fish farms in Uyo a prevalence of 19.50 %. Protozoan parasites recovered included, *Trichodina* species (18.57 %), *Chilodonella* species (12.86 %) and *Ichthyophthirius multifilis* (15.71 %). Nematode parasites recovered were *Paracamallanus* species (17.14 %) in the rectum and *Contraceacum* species (14.29 %) in the intestine while one trematode parasite, *Clinostomum* species (21.43 %) was recovered from the gills.

Biu *et al*. (2014b) in their study of *Orechromis niloticus* from Lake Alau, Maiduguri recorded a prevalence of 26.30 %.They recovered *Paracamallanus* species,*Plerocercoid*, *Contracaecum* with incidences of 42.90 %, 33.30 % and 23.80 % respectively and haemoparasites namely *Haemogregarina* species, *Babesioma* species and *Trypanosoma* species with incidences of 12 (57.10 %), 2 (9.50 %) and 1 (4.80 %) respectively. Parasitic infestations in the female were significantly higher 12 (26.70 %) than in the male 9 (25.70 %). There was a significant difference between incidence of infestation and standard length and body weight of *O. niloticus* while there was no significant difference ($p > 0.05$) between incidence of parasitism and total length of the fishes.

Okoye *et al.* (2014) in their study of different fish species collected from the Agulu lake namely Cichlidae (*T. zilli* (585), *T. mariae* (268), *T. guineensis* (74), *Chromidotilapia guntheri* (58); Bagridae (*Auchinoglannis occidentalis* (13) and *Chrysichthys auratus* (46); Hepsetidae *(H. fasciatus* and *H. odoe*) and Channidae (*P. obscura* (2), recorded eleven (11) species of parasites. *Clinostomoides* species were recovered from *T. zilli* (13.50 %) in the skin, fin, and opercula, *H. fasciatus* (0.70 %) in the skin and jaw, and *P. obscura* (50.00 %) in the intestine while *C. tilapiae* were recovered from the gills of *T. zilli* (0.70 %) and 2 *C. guntheri* (1.70 %).

Clinostomum species were recovered from intestinal wall of *T. zilli.* (1.54 %), *Proteocephalus* species were recovered from the intestine of *A. occidentalis* (7.70 %), *Camallanus* species 1 (17.40 %) were recovered from the stomach of *C. auratus*, *Camallanus* species 2 (1.70 %) from the intestine of *C. guntheri* and *C. auratus.* (8.70 %), *Camallanus* species 3 (68.80 %) were recovered from intestine of *H. fasciatus.* Oxyuroid (adult) were recovered from intestine of *H. odoe* (28.60 %)

while *Spironoura* species (28.60 %) were recovered from intestine of *T. zilli* (2.39 %) and *T. mariae* (24.60 %).

Neoechinorhynchus species 1 were recovered from intestine of *T. zilli* (53. 90 %) and *T.guineensis* (13.50 %). Prevalence, mean intensity and abundance of four (4) most frequent parasite species (*Clinostomoides* species, *Camallanus* species 3, *Neoechinorhynchus* species 1 and *Neoechinorhynchus* species 2) were higher in dry months of November to April than wet months of May to October.

Domo and Ester (2015) recorded a prevalence of 38.30 % and 41.60 % for *Oreochromis niloticus* and *Clarias gariepinus* respectively in Lake Geriyo Jimeta, Yola. Helminths isolated from *O. niloticus* were *Clinostomum* species (53.00 %), *P. laeviconchus* (35.70 %), *Serracdacnitis serrata* (44.40 %) and *Wenyonia* species (25.00 %). For *C. gariepinus*, the recovered helminths were *Clinostomum* species (46.10%), *Procamallanus* species (64.30%), *S. serrata* (55.6 %) and *Wenyonia* species (75.00 %).

Iyabo *et al*. (2015) in their study of *Chrysichthys nigrodigitatus* (Lacepede: 1803) in the Mid- Cross River Flood system recovered *Rhabdochoma congolensis*, *Procamallanus laeviconclus*, *Paracamallanus cyathopharynx* and *Capillaria* species (Nematoda) and *Diphyllobothrium latum* and Plerocercoid larva (Cestoda). Parasite burden was high and dependent on sex and age of fish as males (152) recorded a lower rate of infection (33.20 %), than females (248) which recorded 66.90 % prevalence.

Bamidele (2015) recorded 42.00 % prevalence in *Synodontis filamentosus* and zero prevalence for *Calamoichthys calabaricus* from Lekki Lagoon, Lagos. The

Caryophyllidaecestode, *Weyonia* species and a nematode, *Raphidascaroides* species were recovered from the intestine of *S.filamentosus.* Infection was more pronounced in the juvenile of *S.filamentosus* than in the adults.

Omeji *et al*. (2015) recorded a prevalence of 46.00 % for *Synodontis schall* and 54.00 % for *Synodontis ocellifer* from lower River Benue. They recovered *Eustrogylides* species, *Procamallanus* species, *Microsporidian* species and *Diphyllobotrium latum* from the stomach and intestine of sampled fish species.

Amaechi (2015) recorded a prevalence of 56.40 % in *Orechromis niloticus* and *Tilapia zilli* from Asa Dam, Ilorin. *Euclinostomium heterostomum* recorded a prevalence of 24.10 % in *O. niloticus* and 23.80 % in *T. zilli* while *C. tilapiae* had a prevalence of 35.90 % and 27.60 % in *O. niloticus* and *T. zilli* respectively. There was no relationship ($p > 0.05$) between parasite burden and fish size (length x weight). Male fish were more heavily infected than females and the overall health status of both fish species remained unaffected.

Bekele and Hussien (2015) reported a prevalence of 20.83 % in *Orechromis niloticus* and *Clarias gariepinus* in lake Ziway, Ethiopia. Parasites recovered were *Clinostomum* 31.25 % while the nematodes, *Contracaecum* and *Eustrongylides* had prevalence of 62.50 % and 6.25 % respectively. The nematode parasites were recorded from 8.60 % of *O. niloticus* and 19.02 % of *C. gariepinus* in the gastrointestinal tract of the fish. The second most prevalent parasite, *Clinostomum* was recovered from 16 (7.24 %) *O. niloticus* and 9 (5.52 %) *C. gariepinus* in the gill filaments and thoracic cavity, while the least encountered parasite

*Eustrongylides*were recovered from 2 (0.90 %) of *O. niloticus* and 3 (1.84 %) of *C. gariepinus* in the thoracic cavity.

Balogun and Solomon (2015) reported a prevalence of 70.00 % in *Clarias gariepinus* in Gwagwalada, Abuja and also recovered *Procamallanus* species (57.14 %) from the intestine and stomach, *P. clarias* (14.29 %) from the stomach and intestine, *D. latum* (7.14 %) from the gut, *Diphyllobothrium* plerocercoid (7.14 %) from the gut and trematode, *Diplostomum spathaceum* (7.14 %) from the intestine and stomach and acanthocephalan species (7.14%).The correlation between length and weight showed that there was a significant relationship between length/weight on parasite prevalence at P = 0.05. The presence of parasites in the intestine of fish did not show any visible adverse effects on the host.

Iboh and Ajang (2016) recorded a prevalence of 53.04 % in *Clarias gariepinus* from Great Kwa River, Cross River State. Parasites recovered were tapeworm species (9.84 %), *Anisakis simplex* (24.59 %), *Nippostrongylus brasilienses* (34.43 %), *Ascaris lumbricoides* (7.38 %), *Caenorhabditis elegans* (17.21 %) and *Ancyrocephalids monogeneans* (6.56 %). There was no significant difference (p> 0.05) in the infection rate of male and female fish. The highest fish organ infected was intestine (51.01 %), followed by the stomach (18.62 %), skin (12.15 %), liver (10.12 %) and gills (8.10 %).

Kawe *et al*. (2016) reported a prevalence of 67.50 % in their study of *Clarias gariepinus* in Abuja. They recovered *Procamallanus laeviconchus* (32.50 %), *Rhabdochona congolensis* (18.10 %) (Nematoda), *Polyonchobothrium clarias* (10.80 %) (Cestoda), *Allocreadium* species (3.60 %) (Trematoda) and *Heterophyid* fluke

(2.40 %) (Trematoda). The result of the study indicated that the association ($P < 0.05$) between the prevalence of infection, sex, length and weight of the host was not statistically significant.

Okoye *et al.* (2016) recorded a prevalence of 68.33 % in *C. gariepinus* in Owerri. They recovered *Contracaecum* species (11.67 %), *Camallanus* species (48.33 %) (Nematoda), *Cryptobia iubilans* (40.00 %), *Trypanosoma* species (35.00 %) (Protozoa), *Acanthocephalus* species (21.67 %) (Acanthocephala) from the intestine, stomach, liver and kidney.

Edeh and Solomon (2016) recorded a prevalence of 35.00 % and 23.33 % for *Clarias gariepinus* and *Orechromis niloticus* respectively from Utako, Abuja. Parasites recovered were *Procamallanus* species (6.67 %) (Nematoda), *Diphyllobothirum latum* (13.33 %) and *P. clarias* (16.67 %) (Cestoda) from *C. gariepinus* while *D. latum* (Cestoda) was recovered from *O. niloticus*. There was no significant difference between the prevalence of infection and sex, length and weight of fishes examined.

Uneke and Jonah (2017) recorded a prevalence of 48.33 % in *Tilapia zilli* from Ebonyi River and recovered *Diphyllobothrium* species (32.40 %) and *Hymnolepsis nana* (13.50 %), *Camallanus* species (16.20 %), *Capillaria* species (16.20 %), and *Procamallanus* species (10.80 %) while the trematode, *Trichostrongylus* species had a prevalence of 10.80 %. Correlation between weight of fish and number of parasites was highly significant. However, negative coefficient values for both length and weight indicated increase in length and weight with decrease in infection rate.

Absalom *et al*. (2018) reported a prevalence of 63.00 % in Clarias gariepinus from River Gudi, Nasarawa State, Nigeria. Parasites recovered were Camallanus (41.00 %), Diphyllobothrium latum (29.00 %) and Capillaaria (20.00 %). There was a significant difference (p>0.05) in the infection rate of male and female fish and also in the gastrointestinal helminth parasites of Clarias gariepinus in relation to body length. The microhabitats of the parasites were the intestine (36.00 %), stomach (33.30 %), oesophagus (23.30 %) and rectum (6.60 %).

2.3 Helminth Parasites of Commercially Important Fishes in Anambra River

Commercially important fish species of Anambra River 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*.

Several studies have been conducted on parasites of commercially important fishes from Anambra River. Ilozumba and Ezenwaji (1985) recorded a prevalence of 42.99 %, 15.78 % and 9.78 % for *T. niloticus*, *S. sandoni* and *Dujardinascaris* species respectively in *Heterotis niloticus*.

Ezenwaji and Ilozumba (1992) recorded a prevalence of 5.36 %, 4.96 %, 14.88 % for *Euclinostomum clarias*, *Procamallanus laevichonchus*, and larval spiruroid respectively in *C. ebriensis* and 17.83 %, 1.94 %, 10.08 % and 0.39 % for

Euclinostomum clarias, *Procamallanus laeviconchus,* larval spiruroid and the unidentified acanthocephalan respectively in *C. agboyiensis*. In *C. macromystax,* a prevalence of 27.44 %, 3.05 % and 6.10 % for *Euclinostomum clarias, Procamallanus laeviconchus* and larval spiruroid respectively was recorded while a prevalence of 12.35 %, 4.12 % and 1.77 % for *Euclinostomum, P. laevichonchus* and the larval spiruroid respectively was recorded in *C. buthopogon*.

Ezenwaji *et al.* (2005) reported a prevalence of 20.00 % and 10.00 % for *Sandonia sudanensis* and *Weyonia synodontis* respectively in the large and small intestine of *Hemisynodontis membranaceous*; 2.90 %, 5.80 %, 7.20 %, 5.80 % and 4.30 % for *S.sudanensis,W. synodontis, W. youdeoweii, W. kainji and P. laeviconchus* respectively in the small intestine of *Synodontis clarias*; a prevalence of 10.00 %, 33.30 % and 13.30 % for *S.sudanensis,W. synodontis* and *P. laeviconchus* respectively in the small intestine of *Synodontis schall*; 12.00 %, 6.00 %, 6.00 % and 6.00 % for *W. synodontis, W. youdeoweii, W. kainji and P. laeviconchus* respectively in the stomach, large intestine and small intestine. Also, a prevalence of 1.90 % was recorded in the small and large intestine of *Synodontis gobroni* for *W. synodontis*; 13.30 % for *W. synodontis* in the small intestine of *S. ocellifer*; 10.00 % for *W. youdeowii* in *S. budgetti* and 12.50 % for *W.kainji* in *S.sorex*. No parasite was recovered from *S. filamentous* while *P.laeviconchus* was recovered from the stomach of *S.nigrita* and *S.xiphias* at a prevalence of 3.80 % and 20.05 % respectively.In all, the prevalence of the endo-parasites was low (≤20 %). There were cases of mixed infection involving *S. sudanensis* and *P. laeviconchus* as well as *Weyonia* species and *P. laeviconchus* but never between *Weyonia congeners*. Prevalence, mean intensity and abundance of all the endoparasites were generally higher in the dry than in the rainy season. No visible damage or injury resulting from the endoparasites was evident on parasitized fish.

Nwuba *et al.* (2008) recovered nematodes, cestodes and trematodes at a prevalence of 26.70 %, 13.30 % and 60.00 % respectively. The nematodes were *Ascaris, Camallanus, Ichtyobrenema* and *Procamallanus* species. Cestodes included *Eubothrium* and *Phyllobothrium* species, while the trematodes were *Gyrodactylus* and *Clinostomum* species.

Nwani *et al.* (2008) recovered *Rhadinorhynchus horridus (*Acanthocephala) from the intestine of *H. bebe bebe* and *G. petersii*; *Procamallanus laevichonchus* from the stomach of *M. rume rume* and *C. tamandua*; *Spinitectus mormyri* from the stomach of *M.rume rume*; *Contracaecum* sp. from the coelom of *H. bebe bebe, G. petersii* and *C. tamandua,* whereas an unidentified cestode infected the intestine of all the mormyrids. *Gnathonemus petersii* constituted a new host record for *R. horridus; M. rume rume* for *S. mormyri* and *M. rume rume* and *C. tamandua* for *P. laeviconchus.* The overall prevalence of the endo-parasites in the fish hosts was 41.90 % which is within the range ($\leq$ 50 %) typical of Southern Nigerian freshwater lotic habitats. Prevalence, mean intensity and mean abundance of *R. horridus* in its host fishes were higher in the dry (October/ November- March) than the rainy season (April-Sept/ October).

Echi and Ezenwaji (2009) in their study on the Characids reported a prevalence of 14.20 % for *Caryophylleus* species (Cestoda) in *Brycinus macrolepidotus,* 8.10 % in *Alestes baremoze* while *Rhabdochoma* species (Nematoda) and *Myxobolus* species (protozoa) had a prevalence of 9.60 % and 7.80 % respectively in *Hydrocynus vittatus*. Also *Myxobolus* species had a prevalence of 2.00 % in *Brycinus leuciscus,* 1.90 % of

Diplozoonghanense in *B. macrolepidotus* and 1.90 % of *Neodipolzoon polycotyleus* (Monogeneans) in *A. baremoze* was recorded. Dissolved oxygen (0.8 – 14.0) mgl^{-1} and pH (5.5 – 7.0) influenced the occurrence of the parasites whereas temperature (20.1 – 27.5 DC) showed no much effect.

Ilozumba and Ezeife (2009) recorded a prevalence of 14.20 % for *Heterorchis protopteri*, a digenean in *Protopterus annectens.*

Okpasuo *et al*. (2016) recovered *Procamallanus* species (25 %), *Camallanus* species (25 %), *Capillaria* species (25%), *Weyonia* species (3%), *Gyrodactylus* species (9.4%), copepods (53.1 %), *Branchiura* (53.1%), unidentified leech (3%) and *Polymorphus* species (6.3%) from *Bagrus bayad*. *Procamallanus* species (15.8%), *Weyonia* species (10.5%), *Dactylogyrus* species (10.5%), copepods (47.4 %), *Branchiuara* (47.4%) and *Neoechinorhynchus* species (15.8%) were recovered from *B.docmac*. *Cucullanus* species (7.10 %), *Clinostomum* species (7.10 %), copepods (14.30 %), unidentified leech (7.10 %) and *Neoechinorhychus* species (64.30 %) were recovered from *A.monkei.* In *A.occidentalis*, *Cucullanus* spp (38.50 %), *Ligula* species (23.10 %) and copepods (38.50 %) were recovered. *Capillaria* species, *Procamallanus* species, *Camallanus* species, *Philomena* species (embryo) (32.40 %), *Ligula* species, unidentified cestode (18.80 %), *Clinostomum* species (5.90 %), copepods (29.40 %), *Echinorhynchus* spp (14.70 %) and *Neoechinorhynchus* spp (14.70 %) were recovered from *A.biscutatus. Capillaria* species (16.70 %), *Cystacanthus* (5.60 %), copepods *Branchiura* (33.30%), unidentified leech (16.70 %) and *Neoechinorhynchus* species (27.80 %) were recovered from *C.auratus. Procamallanus* species (25.00 %), copepods (50.00%), and unidentified leech (25.00 %) were recovered from *C.laticeps.* The skin, fin, gills, intestine and stomach were infected with parasites.

CHAPTER THREE

MATERIALS AND METHODS

3.1 THE STUDY AREA

River Anambra is a major tributary of the River Niger (Fig 1).It is fed by numerous tributaries which together form an extensive drainage basin. It is about 207.4km in length and 14014 km^2 in area (Awachie, 1976). Anambra River Basin lies between latitudes $6^0 10^1$ and $7^0 8^1$ N and longitudes $6^0 30^1$ and $7^0$15E (https://www.mapcarta.com). The basin has a rainfall of 150cm-200cm annually; and because of its low altitude of under 1000 above sea level, temperatures are uniformly high with a small annual range of 5-10^{o}C. The water emerges from a somewhat inaccessible point near Ankpa in the Kogi State of 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).

The normal rainy season occurs between May and October, a short break between late July and early August. During the rains, water levels increase in the main river channel. There is also a rise in the levels of the natural depression, lakes and ponds in the extensive floodplain that lie mainly on the western side of the Anambra River. The rise in the water levels of the river channels is brought about by direct precipitation within the catchment area as well as by inflow from the Niger floodplains.

The period November to April is usually that of the dry season. This season witnesses maximum production of phytoplankton and zooplankton. High phytoplankton production is known to be located mainly in the lakes and ponds, many of which occur in this river basin (Awachie, 1973).

It is one of the richest areas for agricultural and fishery production in Nigerian lower Niger (Mutter, 1973). Principal crop products include a wide variety of large yams (*Dioscorea* species), Sweet potatoes (*Ipomoea batatas*), cassava (*Manihot esculenta*), and rice (*Oryza sativa*), while fish production is dominated by clariids, *Gymnarchus* and mormyrids which are available throughout the year (Awachie and Ezenwaji, 1981).Agriculture and fishing thus form the dominant occupations of the local people, and these two major economic activities are closely geared to the two seasons of the year.

The continuing siting of many agricultural and fishery projects, including the World Bank's Rice project in the Anambra basin, is a clear indication of the great potentials of the area inspite of the adverse effects of Kainji on the extent of its rich alluvial farm lands and natural floodplain production systems. Major commercially oriented agricultural projects are springing up in the river basin such as Coscharis farms amongst others.

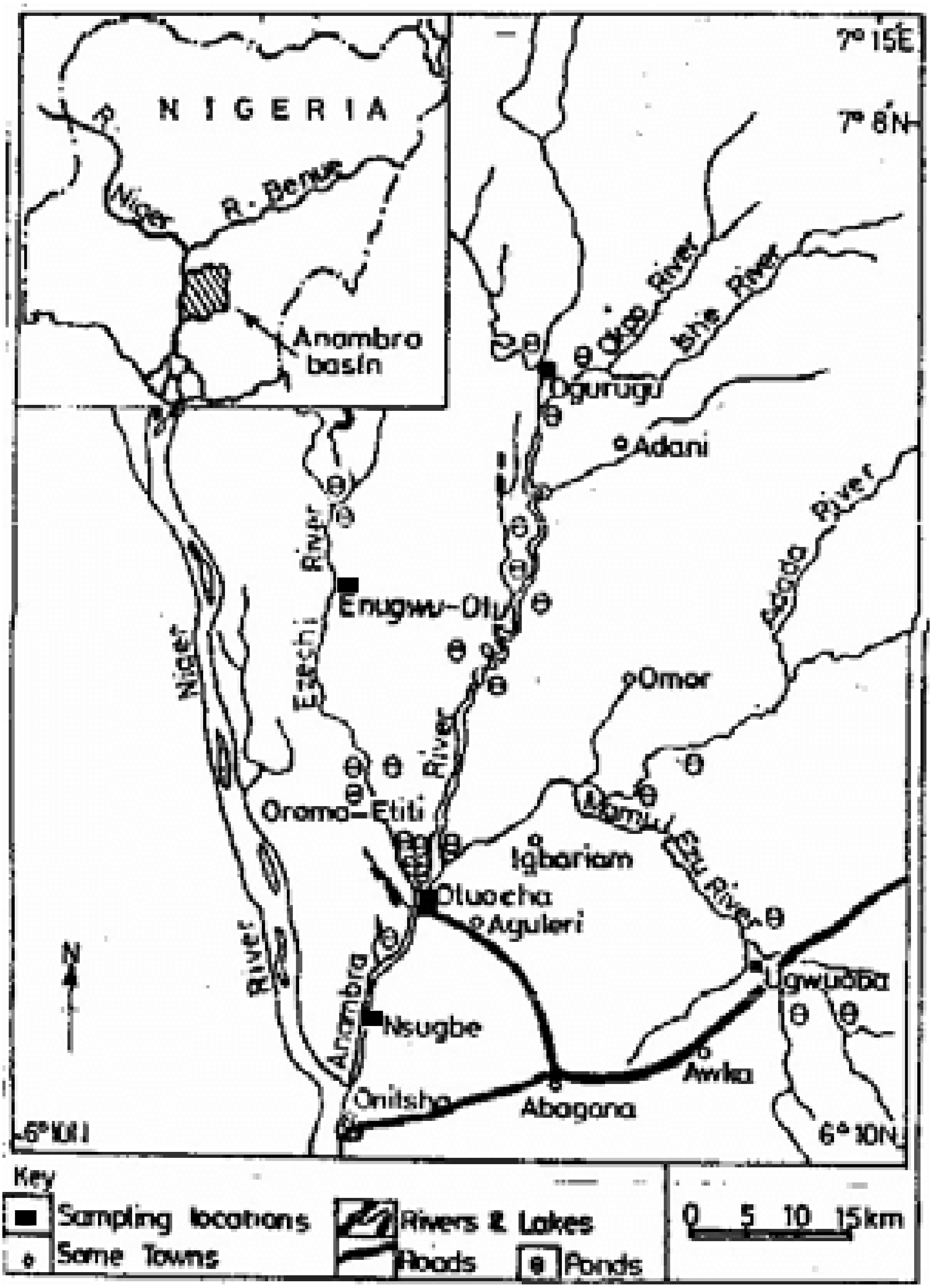


Fig 1: Map showing the study area: Anambra River Basin
Source: https://www.mapcarta.com

3.2 COLLECTION OF FISH SAMPLES

Different fish species were collected from three different stations or landing points namely, Nsugbe, Otuocha and Enugwu-Otu from August 2012 to August 2014, using nets of various sizes (25 mm – 100 mm), hooks and line, caste nets, gill nets as well as local traps. Some fishermen were engaged to catch and deliver the fishes but in cases where the fishermen failed to catch enough fish, the deficiencies were made up by purchase of live or fresh dead samples from market women or fish mongers at the different sampling stations. Fresh dead fishes were immediately put into a plastic container with ice block to retard decomposition before examination.

3.3 IDENTIFICATION OF THE FISH SPECIES

Identification of fishes to species level was done in the Zoology laboratory of Nnamdi Azikiwe University, Awka and some were done insitu in the field. The following morphological structures/ features were used for the identification, the mouth, teeth, nostrils, fins, scales, lateral line and colour pattern using the standard keys with taxonomic descriptions and indices as in Holden and Reed (1972), Teugels *et al*. (1992) and Idodo-Umeh (2003).

3.4 KILLING AND EXAMINATION OF SPECIMENS

Live fish were transported to the laboratory in fish tanks and were killed by pithing. In a situation where it was not possible to examine the fish on the day of purchase, live fish killed by pithing were stored in a deep freezer. Occasionally however, live fish were maintained in circular metallic fish tanks. Before examination, the fish were weighed to the nearest gram using Adams electronic weighing balance; model AQP 1600. The total and standard lengths of each fish were determined using a measuring board caliberated in centimetre. The alimentary canal was excised at the anterior limit of the oesophagus and the anal end of the cloaca and was placed in a clean dissecting dish containing clear tap water.

In opening the alimentary canal, a continuous longitudinal slit, starting from the cloacal end was employed in order to reduce the chances of cutting long helminths such as cestodes which may extend from one section into another (Ilozumba, 1980). As the alimentary canal is been opened, the content of each section of the gut (oesophagus, stomach, intestine and rectum) were emptied into separate petri dishes which contained normal saline and searched thoroughly for helminth parasites. The gut wall in each section was also carefully scraped with scapel unto microscope slide and thoroughly searched for attached or adhering helminths.

3.5 COLLECTION, PRESERVATION AND TREATMENT OF PARASITES

Parasites seen were picked up with a small paint brush and placed in specimen vials which contained normal saline. The vial was shaken vigorously for a while to remove mucus and adhering debris from the worms and also to cause fatique in the parasites to minimize contraction on contact with the fixative (Lucky, 1977). However, greater care was taken in the recovery of attached parasites like the cestodes, some camallanid nematodes and the acanthocephalans. By pulling them out, they might lose their proboscis, and so it was better to leave them undisturbed in saline, until their organs of attachment becomes visible after which they were collected. Live nematodes were killed by pouring hot 70% alcohol on them in petri dishes and were preserved in cold 70% alcohol to which 2% glycerin was added to prevent brittleness or in Alcohol formol Acetic acid (AFA). Trematodes and acanthocephalans were shaken vigorously in cold 4% formaldehyde until they died. They were also preserved in cold 4% formaldehyde. The number of parasites per fish was recorded along with the site/location from which each parasite was collected. Note was taken of any histopathological effects of recovered parasites on the fish.

3.6 IDENTIFICATION OF PARASITES

The identification of helminth parasites recovered relied on the comparison of distinctive body shapes/morphological features of the collected specimen and those described in literature using identification guide by Yorke and Mapplestone (1926), Yamaguti (1961), Markevich (1963), Cheng (1973), Soulsby (1982), Williams and Jones (1994) and Paperna (1980; 1996).

3.7 PHYSICO-CHEMICAL PARAMETERS OF THE RIVER BASIN

During the study, the physicochemical characteristics of the river water were undertaken for the dry (November – March) and rainy (May – October) seasons respectively. Samples of river were collected in scrupulously cleaned black plastic container and sent to Springboard Research Laboratories, Awka for analysis.The physicochemical parameters determined/measured were, pH, temperature, conductivity, turbidity, dissolved oxygen (DO), nitrate and free chlorine.

3.7.1 Hydrogen ion Concentration (pH)

This was measured by Electrometric method using laboratory pH Meter Hanna model H1991300 (APHA, 1998). The electrodes were rinsed with distilled water and blotted dry. Sufficient amount of the river water sample was poured into a small beaker to allow the tips of the electrodes to be immersed to a depth of about 2cm. The temperature adjustment dial was adjusted accordingly. The pH meter was turned on and the pH of sample recorded.

3.7.2 Nitrate

This was determined using PD303 UV spectrophotometer (APHA, 1998) by pipetting 50 cm^3 of the river water sample into a porcelain dish to which 2cm^3 phenol disulphonic acid was added to dissolve the residue, enhanced by constant stirring with a glass rod. Concentrated solution of sodium hydroxide and distilled water were added while stirring to make it alkaline. The mixture was filtered into a Nesslers tube and made up to 50cm^3 with distilled water; the absorbance was read at 410 nm using a spectrophotometer after the development of colour. The standard graph was plotted by taking concentration along X- axis and the spectrophotometric readings (absorbance) along Y- axis. The value of nitrate was found by comparing absorbance of sample with the standard curve and expressed in mg/L.

$$\text{Conc. of sample} = \frac{\text{Absorbance of sample} \times \text{Concentration of standard}}{\text{Absorbance of standard}}$$

3.7.3 Temperature

Temperature was determined by using ordinary mercury in glass thermometer tied to a thread and dipping it into the river at a dept of 1 meter for two minutes, after which the thermometer was pulled out and the temperature read off immediately.

3.7.4 Dissolved Oxygen

Dissolved oxygen (DO) was determined by titration method (APHA, 1998). The stopper was carefully removed from the sample bottle and 1 cm^3 manganous sulphate solution was added followed by 1 cm^3 alkaline- iodide – azide solution. The tips of the pipettes were below the surface of the liquid when introducing various reagents into the full bottle of sample. The stopper was carefully replaced after each addition so as to avoid inclusion of air bubbles. The contents were thoroughly mixed by inversion and rotation until a clear supernatant water was obtained. Addition of 1 cm^3 concentrated sulphuric acid with the tip of the pipette was done and the stopper immediately replaced. The contents were mixed well by rotation until the precipitation was completely dissolved. Pipette into a 250cm^3 conical flask 100cm^3 of the solution and immediately titrate it against standard sodium thiosulphate (0.025 mol dm^3) using freshly prepared starch solution as the indicator (add when solution becomes pale yellow). The titration was carried out in duplicate.

3.7.5 Turbidity

This was determined by selecting 'EPA 180' as the measurement mode. The sample was placed in a clean, dry turbidity vial with secured cap. Excess liquid was wiped off with a soft cloth and the sample placed into AQ4500 sample chamber. The result was displayed on the instrument. If the result is less than 40 NTU (Nepillow Turbidity Meter), repeat procedure for the next sample. If the result is greater than 40 NTU, dilute the sample with one or more volumes of turbidity-free water until the turbidity falls below 40 units. The turbidity of the original sample is then computed from the turbidity of the diluted sample and the dilution factor.

Calculation:

$$\text{Nephelometric Turbidity units (NTU)} = \frac{A \times (B + C)}{C}$$

A: NTU found in diluted sample

B: Volume of dilution water

MI C: Sample volume taken for dilution, ml interpretation of results.

3.7.6 Chloride

This was determined according to Amercan Public Association standard method (APHA, 1998). A 100 cm^3 of the clear river water sample was pipetted into an Erlenmeyer flask and the pH adjusted to 7-10 with either H_2SO_4 or NaOH solution. Then 100 cm^3 of K_2CrO_4 indicator solution was added with standard solution of AgNO3 in a permanent reddish brown colouration. The $AgNO_3$ titrant was standardized and a reagent blank established. A blank of 0.2-0.3 cm^3 is usual for the method.

Chloride conc= Titre value (x) x 10= 10xmg/l

A selected national and international water quality standard guideline is shown on Appendix 9.

3.8 STATISTICAL TEST ANALYSIS

Statistical analysis was performed using Statistical Product and Service Solution (SPSS) version 21. Results were presented using means, percentages and frequencies and expressed in figures and chats.Variables were further analysed using Chi Square to test for the association between Fish hosts and prevalence of infection at 0.05 level of significance. In addition to this, Pearson correlation analysis was used to assess the relationship between the weight and length of fish and the prevalence of infestation among these fish.Differences, associations and relationships were considered significant if $P<0.05$.

Terminology of infection statistics as defined by Bush *et al*. (1997) was also employed in the analysis of the data which includes,

1. **Abundance** – Is the number of individuals of a particular parasite in/on a single host regardless of whether or not the host is infected.
2. **Mean Abundance** – Is the total number of individuals of a particular parasite species in a sample of a particular host species divided by the total number of hosts of that species examined (including both infected and uninfected hosts).

3. **Mean Intensity** – Is the average intensity of a particular species of parasite among the infected members of a particular host species. In otherwords, it is the total number of parasites of a particular species found in a sample divided by the number of host infected with that parasite.

CHAPTER FOUR

RESULTS

4.1 Commercially Important Fishes of Anambra River Basin

Table 1 shows the commercially important fish species involved in the study, the number of each species examined, number infected and prevalence. A total of one thousand and twenty five (1,025) fish comprising twenty families, 26 genera and 43 species were examined for helminth infection during the study, and 169 (16.48 %) were found to be infected by helminth parasites. Fish species belonging to nine (9) families namely Bagridae, Channidae, Clariidae, Claroteidae, Mochokidae, Osteoglossidae, Malapteruridae,Protopteridae and Schilbeidae were found infected with helminth parasites while helminth parasites were not recovered from fish belonging to eleven (11) families namely, Alestidae, Ariidae, Characidae, Cichlidae, Citharinidae, Cyprinidae, Distichodontidae, Hepsetidae,Gymnarchidae, Mormyridae and Notopteridae.

However, out of the fourty three (43) species examined, only thirteen (13) species were infected by helminth parasites and precentage prevalence of infection on sampled fishes are; *Clarias gariepinus* (9.67 %), *Clarias anguillaris* (26.67 %), *Clarias lazera* (16.67 %) and *Heterobranchus longifilis* (16.67 %) (Family: Clariidae); *Synodontis eupterus* (30.23 %), *Synodontis batensoda* (23.33 %) (Family: Mochokidae); *Channa obscura* (28.77 %) (Family: Channidae); *Auchinoglannis occidentalis* (25.00 %) (Family: Bagridae); *Chrysichthys nigrodigitatus* (5.13 %) (Family: Claroteidae); *Protopterus annectens* (4.55 %) (Family: Protopteridae); *Schilbe mystus* (5.26 %) (Family: Schilbeidae); *Heterotis niloticus* (53.06 %) (Family: Osteoglossidae) and *Malapterurus electricus* (56.25 %) (Family: Malapteruridae)

Table 1: Commercially Important Fishes obtained from Anambra River

S/N	Fish species	Native/local Name (Igbo)	N.E	N.I	Prevalence (%)
	FAMILY ALESTIDAE				
1	*Alestes macrolepidotus* (valenciennes, 1840)		8	-	-
2	*Alestes nurise* (Rupple, 1832)	"Ikpo"	40	-	-
	FAMILY BAGRIDAE				
3	*Achinoglanis biscutatus* (Cuvier & Valenciennes, 1840)		7	-	-
4	*Achinoglanis occidentalis* (Valenciennes, 1840)	"Okpo nkita"	32	8	25.00
5	*Bagrus bayad macropterus* (Boulenger, 1875)		49	-	-
6	*Bagrus docmac niger* (Daget, 1954)		2	-	-
	FAMILY CHANNIDAE				
7	*Channa obscura* (Gunther, 1861)	"Evi"	73	21	28.77
	FAMILY CHARACIDAE				
8	*Hydrocynus brevis* (Gunther, 1964)		6	-	-
	FAMILY CICHLIDAE				
9	*Tilapia galilae* (Artedi, 1757)		2	-	-
10	*Tilapia zilli* (Gewais, 1848)		14	-	-
11	*Tilapia niloticus* (Linnaeus, 1757)		15	-	-
	FAMILY CITHARINIDAE				
12	*Citharinus citharus* (Geoffrey, 1809)	"Mpete"	70	-	-
	FAMILY CLARIIDAE				
13	*Clarias. anguillaris* (Linnaeus,1762)	"Alila"	15	4	26.67
14	*Clarias gariepinus* (Burchell,1822)	"Alila"	31	3	9.67
15	*Clarias lazera* (Cuvier & Valencinnes, 1840)	"Alila"	12	2	16.67
16	*Clarias submarginatus* (W.K.H. Peters, 1882)	"Alila"	14	-	-
17	*Heterobranchus longifilis* (Valenciennes, 1840)	"Echim"	12	2	16.67
	FAMILY CLAROTEIDAE				
18	*Chrysichthys auratus longifilis* (Geoffroy Saint-Hilaire, 1809)		4	-	-
19	*Chrysichthys nigrodigitatus* (Lacerede, 1802)	"Ọkpọ ọcha"	39	2	5.13
20	*Clarotes laticeps*	"Ọkpọ uwo"	20	-	-
	FAMILY CYPRINIDAE				
21	*Barbus occidentalis* (Boulenger, 1911)		8	-	-
22	*Labeo cubeo* (Rupple, 1832)		14	-	-
	FAMILY ARIIDAE				
23	*Arius heudelotii* (Valenciennes, 1840)	"Ọkpọ kwaraakwa rueuno"	2	-	-

	FAMILY DISTICHODONTIDAE				
24	*Distichodus brevipinnis* (Gunther, 1864)	"Ejo"	44	-	-
25	*Distichodus rostratus* (Gunther, 1864)		8	-	-
	FAMILY GYMNARCHIDAE				
26	*Gymnarchus niloticus* (Cuvier, 1829)	"Asa"	21	-	-
	FAMILY HEPSETIDAE				
27	*Hepsetus odoe* (Bloch, 1794)		2	-	-
	FAMILY MALAPTERURIDAE				
28	*Malapterurus electricus* (Forskali, 1775)	"Elili"	32	18	56.25
	FAMILY MOCHOKIDAE				
29	*Synodontis batensoda* (Ruppel, 1832)	"Ọkpọ aba"	60	14	23.33
30	*Synodontis clarias* (Linnaues, 1758)		2	-	-
31	*Synodontis eupterus* (Boulenger, 1901)	"Ọkpọ ebunu"	43	13	30.23
32	*Synodontis membranaceus* (Geoffroy, 1809)		15	-	-
33	*Synodontis nigrita* (Valenciennes, 1840)	"Ọkpọ efu"	24	-	-
34	*Synodontis schall* (Bloch & Schneider, 1801)		4	-	-
35	*Synodontis sorex* (Gunther, 1864)		10	-	-
	FAMILY MORMYRIDAE				
36	*Gnathonemus cyprinoides* (Linnaeus, 1758)		22	-	-
37	*Gnathonemus pictus* (Marcusen, 1864)		2	-	-
38	*Hyperopius bebe occidentalis* (Lacepede, 1803)		8	-	-
39	*Mormyrus rume* (Linnaeus, 1958)		2	-	-
	FAMILY NOTOPTERIDAE				
40	*Papyrocranus afer* (Gunther, 1868)	"Uvom"	8	-	-
	FAMILY OSTEOGLOSSIDAE				
41	*Heterotis niloticus* (Muller, 1843)	"Okpo"	147	78	53.06
	FAMILY PROTOPTERIDAE				
42	*Protopterus annectens* (Owen, 1839)	"Equum"	44	2	4.55
	FAMILY SCHILBEIDAE				
43	*Schilbe mystus* (Linnaues, 1958)	"Ọkpọ Adala"	38	2	5.26
	TOTAL		**1,025**	**169**	**16.49**

KEY = N.E – Number Examined
N.I. – Number Infected

4.2 PREVALENCE AND ABUNDANCE OF ENDOHELMINTH PARASITE IN FISHES OF ANAMBRA RIVER

The infection parameters of the helminth parasites in their respective fish hosts are shown on Table 2. It shows that the overall prevalence of the parasites in the infected fishes was 12.37 % and 889 helminth parasites were recovered. A total of thirteen helminth parasite species were recovered from the different parts of the fish species examined. The helminth fauna consisted of seven species of Cestoda and two unidentified cestodes namely: the caryophyllaeid tapeworm, Unidentified *Weyonia species, Weyonia youdeoweii* and *Weyonia synodontis;* the plerocercoid larva, the pseudophyllid tapeworm, *Polyonchobothrium clarias*; the proteocephalid tapeworm, *Sandonella sandoni* and the proteocephalid tapeworm, *Electrotaenia malapteruri.* One trematode, *Emoleptalae* species was also recovered. Three nematodes namely; the Camallanid roundworm, *Procamallanus laeviconchus* and *Spirocamallanus* species, the Ascaridoid roundworm, *Dujardinascaris* species and two acanthocephalans, *Neoechinorhyrchus* species, *Tenuisentis niloticus* and four unidentified ones.

Species belonging to the family Mochokidae, Clariidae, Bagridae, Osteoglossidae and Malapteruridae were infected by cestodes and acanthocephalans. Families Mochokidae and Osteoglossidae harboured all the different parasite taxa namely, cestodes, nematodes and acanthocephalan except the trematodes. Families Schilbeidae, Protopteridae and Claroteidae were found to be infected only by an unidentified acanthocephalan. It is noteworthy that only Clariids were found to be infected by the trematodes.

4.2.1 Cestoidea

Prevalence of cestode parasites in fish of Anambra River shows that out of 43 *S.eupterus* examined, 2 were infected by *Weyonia* species and a total of 10 parasites were recovered, giving a prevalence of 4.65 %, mean intensity of infestation (M.I.I) of 5.00 and mean abundance (M.A) of 0.23. Also of 43 *S. eupterus* examined, 4 were infected by *Weyonia youdeoweii* and a total of 6 parasites were recovered giving a prevalence of 9.30 %, mean intensity of infestation (M.I.I) of 1.50 and mean abundance of 0.14.

Of 60 *S. batensoda* examined, 4were infected by *Weyonia youdeoweii* and a total of 10 parasites were recovered, giving a prevalence of 6.67 %, mean intensity of 2.5 and mean abundance (M.A) of 0.20. Two (2) out of 60 *S.batensoda* examined were also infected by *Weyonia synodontis* and 14 parasites were recovered giving a prevalence of 3.33 %, mean intensity of infestation (M.I.I) of 7.0 and M.A of 0.23.

Of 15 *C. anguillaris* examined, 2 each were infected by plerocercoid larva and *Polynchonbothrium clarias* and 2 parasites each were recovered, giving a prevalence of 13. 33 %, mean intensity of infestation (M.I.I) of 1.00 and mean abundance (M.A) of 0.13. Also of 12 *C.lazera* examined, 2 were also infected by *P.clarias* and a total of 6 parasites were recovered giving a prevalence of 16.67 %, mean intensity of infestation (M.I.I) of 3.00 and mean abundance of 0.50.

Of 32 *Auchinoglannis occidentalis* examined, 6 were infected by an unidentified cestode and a total of 32 parasites were recovered, giving a prevalence of 18.80 %, mean intensity of infestation (M.I.I) of 5.33 and mean abundance of 1.00. Also of 12 *Heterobranchus longifilis* examined, 2 were infected by an unidentified cestode, giving a prevalence of 16.67 %, mean intensity of infestation (M.I.I) of 1.00 and mean abundance of 0.20.

Of 147 *Heterotis niloticus* examined, 55 were infected by *Sandonella sandoni* and a total of 159 parasites were recovered giving a prevalence of 37.41 %, mean intensity of infestation (M.I.I) of 2.90 and mean abundance of 1.10.

Of 32 *Malapterurus electricus* examined, 16 were infected by *Electrotaenia malapteruri* and a total of 110 parasites were recovered, giving a prevalence of 50.00 %, mean intensity of infestation (M.I.I) of 6.90 and mean abundance (M.A) of 3.44.

4.2.2 Trematoda

Thirty one (31) *Clarias gariepinus*was examined out of which 2 were infected by *Emoleptalea* species, and a total of 8 parasites were recovered, giving a prevalence of 6.45 %, M.I.I of 4.00 and M.A of 0.30.

4.2.3 Nematoda

Procamallanus laeviconchus was recovered from 21 out of 73 *C.obscura* examined. A total of 119 parasites were recovered, giving a prevalence of 28.77 %, M.I.I of 5.70 and M.A of 1.63. Of 147 *H. niloticus* examined 4 were infected by *P. laeviconchus* and a total of 20 parasites were recovered, giving a prevalence of 2.72 %, M.I.I of 5.00 and M.A of 0.14. The same specimen of *H.niloticus* examined also harboured 18 *P.laeviconchus* taken from 2 out of 147 examined giving a prevalence of 1.36 %, M.I.I of 9.00 and M.A of 0.12.

Of 60 specimen of *S.batensoda* examined one (1) was infected by *Spirocamallanus* speciesand a total of one (1) parasite was recovered, giving a prevalence of 1.67 %, M.I.I of 1.00 and M.A of 0.02. Likewise, of 31 *C.gariepinus* examined, one (1) was also infected by *Spirocamallanus* speciesand a total of 2 parasite were recovered, giving a prevalence of 3.22 %, M.I.I of 2.00 and M.A of 0.06.

4.2.4 Acanthocephala

Neoechinorhynchus species was recovered from *S.eupterus* and *S.batensoda*. Of 43 *S.eupterus* examined, 7 were infected and a total of 41 parasites were recovered, giving a prevalence of 16.28 %, M.I.I of 5.86 and M.A of 0.95. Also, of 60 *S.batensoda* examined 5 were infected and a total of 44 parasites were recovered, giving a prevalence of 8.33%, M.I.I of 8.80 and M.A of 0.73.

Tenuisentis niloticus were recovered from *H.niloticus*, *S.batensoda* and *M. electricus.* Of 147 *H. niloticus* examined 46 were infected and a total of 255 parasites were recovered, giving a prevalence of 31.29 %, M.I.I of 5.54 and M.A of 1.73. Of 60 *S. batensoda* examined, 2 were infected and 2 parasites recovered giving a prevalence of 3.33 %, M.I.I of 1.00 and M.A of 0.03. Also, of 32 *M. electricus* examined, 2 were infected and 2 parasites recovered, giving a prevalence of 6.30 %, M.I.I of 1.00 and M.A of 0.10.

An unidentified acanthocephalan was recovered from *P.annectens, S. mystus, C.nigrodigitatus* and *A.occidentalis.* Of 44 *P.annectens* examined, 2 were infected and 4 parasites recovered, giving a prevalence of 4.55 %, M.I.I of 2.00 and M.A of 0.09. Of 38 *S.mystus* examined, 2 were infected and 2 parasites recovered, giving a prevalence of 5.26 %, M.I.I of 1.00 and M.A of 0.05.

Of 39 *C.nigrodigitatus* examined, 2 were infected and 2 parasites recovered, giving a prevalence of 51.30 %, M.I.I of 1.00 and M.A of 0.05. Finally, of 32 *A. occidentalis* examined, 2 were infected and 16 parasites recovered, giving a prevalence of 6.25 %, M.I.I of 8.00 and M.A of 0.50.

A test of association between the hosts of those parasites with more than one host (*W.youdeoweii, P.clarias, P.laeviconchus, Spirocamallanus species, Neoechinorynchus species* and *T.niloticus*) and the prevalence of the infection was done. The result showed that for *Weyonia youdeoweii*, the two fish hosts namely *S.eupterus* and *S.batensoda* did not show any significant association (P = 0.622, x^2 = 0.243) with the prevalence of infection while *Procamallanus laeviconchus* showed a significant association (P = 0.000, x^2 = 32.85) between the fish hosts and prevalence of infection. This implies that the parasite infection is a function of the hosts in that *Channa obscura* has a higher prevalence than *H.niloticus.*

For *Spirocamallanus* species, the test of association shows that there was no significant association (P = 0.640, x^2 = 0.219) between the fish hosts (*S. batensoda* and *C.gariepinus*) and prevalence of infection. This means that the infection is not based on the hosts. Similarly, the test of association for *Neoechinorynchus* species showed that there was no significant association (P = 0.215, x^2 = 1.536) between the fish hosts (*S.eupterus* and *S.batensoda*) and prevalence of infection. This means that the infection is not based on the hosts. As for the parasite *T.niloticus*, there was a significant association (x^2 = 42.100, P = 0.0000) between the four hosts and the prevalence of infection. This implies that the infection was significantly based on the hosts as *H.niloticus* had a higher prevalence than the other three species.

For the unidentified *Acanthocephalan*, there was no significant association (x^2 = 0.110, P = 0.991) between the fish hosts and prevalence of infection.

Some of the endoparasites are shown in plates 16 – 22.

Table 2: Prevalence and abundance of Endohelminth parasites In Fishes of River Anambra.

Parasite taxa	Parasite species	Fish Hosts	N.E	N.I	N.P.R	P (%)	M.I.I	M.A
Cestoda	Unidentified *Weyonia* species	*Synodontis eupterus*	43	2	10	4.65	5.00	0.23
	Weyonia youdeoweii	*S. eupterus*	43	4	6	9.30	1.50	0.14
		S.batensoda	60	4	10	6.67	2.50	0.20
	Weyonia synodontis	*S. batensoda*	60	2	14	3.33	7.00	0.23
	Plerocerciod larva	*Clarias anguillaris*	15	2	2	13.33	1.00	0.13
	Polyonchobothrium clarias	*C.anguillaris*	15	2	2	13.33	1.00	0.13
	Polyonchobothrium clarias	*C. lazera*	12	2	6	16.67	3.00	0.50
	Unidentified cestode	*Auchinoglannis occidentalis*	32	6	32	18.80	5.33	1.00
	Unidentified cestode	*Heterobranchus longifilis*	12	2	2	16.67	1.00	0.20
	Sandonella sandoni	*Heterotis niloticus*	147	55	159	37.41	2.90	1.10
	Electrotaenia malapteruri	*Malapterurus electricus*	32	16	110	50.00	6.90	3.44
Trematoda (Digenetic Trematoda)	*Emoleptalea* species	*Clarias gariepinus*	31	2	8	6.45	4.00	0.30
Nematoda	*Procamallanus laeviconchus*	*Channa obscura*	73	21	119	28.77	5.70	1.63
		Heterotis niloticus	147	4	20	2.72	5.00	0.14
	Dujardinascaris species	*H. niloticus*	147	2	18	1.36	9.00	0.12
	Spirocamallanus species	*S. batensoda*	60	1	1	1.67	1.00	0.02
		C. gariepinus	31	1	2	3.22	2.00	0.06
Acanthocephalan	*Neoechinorynchus* species	*S. eupterus*	43	7	41	16.28	5.86	0.95
		S. batensoda	60	5	44	8.33	8.80	0.73
	Tenuisentis niloticus	*H. niloticus*	147	46	255	31.29	5.54	1.73
		S. batensoda	60	2	2	3.33	1.00	0.03
		M. electricus	32	2	2	6.30	1.00	0.10
	Unidentified Acanthocephala	*P.annectens*	44	2	4	4.55	2.00	0.09
		Schilbe mystus	38	2	2	5.26	1.00	0.05
		C. nigrodigitatus	39	2	2	5.13	1.00	0.05
		A.occidentalis	32	2	16	6.25	8.00	0.50
Total			**1,455**	**180**	**889**	**12.37**	**4.9**	**0.6**

KEY = N.E – Number Examined ; N.I. – Number Infected; NPR – Number of Parasite Recovered;

P – Prevalence; MII – Mean Intensity of Infection, MA – Mean Abundance

4.3 Relationship between Fish Weight and Helminth Infection

The relationship between infection parameters and weight of fish is shown on Table 3. It can be said that generally, the relationship between parasite prevalence and weight of fish hosts seemed to vary with species of fish.

In *A. occidentalis,* 2 out of the 24 fishes examined in the weight group 0 – 99g were infected and 16 worms were recovered, giving a prevalence of 8.33 %, M.I.I of 8.00 and M.A. of 0.70. Six (6) out of the 8 fishes examined in the weight group 100 – 199g were infected and 32 worms were recovered, giving a prevalence of 75.00 %, M.I.I of 5.33 and M.A of 4.00. Correlation analysis showed that there was a significant relationship (0.994, $P < 0.05$) (Appendix 3) between fish weight and helminth infection in *A. occidentalis.* This also shows that prevalence of infection increased with increasing weight. Similarly, correlation analysis revealed that there was a significant relationship (1.000, $p = 0.05$) between weight of *A. occidentalis* and mean intensity of infection and mean abudnance ($r = 1.000$, $p = 0.05$) (Appendix 4). This implies that mean intensity of infection and mean abundance increased with weight of fish.

In *Clarias anguillaris*, 2 out of the 6 fishes examined in the weight group 100 – 199gwere infected and 2 worms recovered, giving a prevalence of 33.33 %, M.I.I of 1.00 and M.A of 0.33. Two (2) out of the 5 fishes examined in the weight group 200 – 299g were infected and 2 worms were recovered, giving a prevalence of 40.00 %, M.I.I of 0.10 and M.A of 0.40. Correlation analysis showed that there was a significant relationship (0.993, $P < 0.05$) (Appendix 3) between fish weight and helminth infection in *C.anguillaris.* This implies that prevalence of infection increased with increasing weight.

In *C.gariepinus*, 1 out of 4 fishes examined in weight group 200 – 299g were infected and 3 worms were recovered, giving a prevalence of 25.00 %, M.I.I of 3.00 and M.A of 0.75. On the other hand, 2 out of the 6 fishes examined in the weight group 400 – 499 g were infected and 7 worms were recovered, giving a prevalence of 33.33 %, M.I.I of 3.50 and M.A of 1.20. All the other weight groups (500-599g, 600-699g, 1000-1099g) examined were not infected. However, result of correlation analysis showed that there was an inverse significant relationship (- 0.501, P < 0.05) (Appendix 3) between fish weight and helminth infection implying that heavier fishes tended to have low prevalence. Likewise, the result of correlation analysis showed that there was no significant relationship (r = -.501, p = .311) (Appendix 4) between weight of *C. gariepinus* and mean intensity of infection.

In *C. obscura,* 2 out of the 10 fishes examined in the weight group 0- 99g were infected and 4 worms were recovered, giving a prevalence of 20.00 %, M.I.I. of 2.00 and M.A of 0.40. Two (2) out of the 18 fishes examined in the weight group 100- 199g were infected and 6 worms were recovered, giving a prevalence of 11.11 %, M.I.I of 3.00 and M.A of 0.33. Also 2 out of the 19 fishes examined in the weight group 200 – 299g were infected and 8 worms were recovered, giving a prevalence of 10.53 %, M.I.Iof 4.00 and M.A of 0.42. Seven (7) out of the 10 fishes examined in the weight group 300 – 399g were infected and 29 worms were recovered, giving a prevalence of 70.00 %, M.I.I.of 4.14 and M.A. of 2.90. Four (4) out of the 11 fishes examined in the weight group 400 – 499g were infected and 30 worms were recovered, giving a prevalence of 36. 36 %, M. I. I.of 7.50 and M.A of 2.72. Two (2) out of the 3 fishes examined in the weight group 500 – 599g were infected and 8 worms were recovered, giving a prevalence of 66.67 %, M.I.I.of 4.00 and M.A of 2.70. All 2 fishes examined in the weight group 600 – 699g were infected and 34 worms were recovered, giving a prevalence of 100.00 %, M.I.I.of 17.00 and M.A of 17.00. It can be seen that the prevalence of infection rises and drops as the weight increases. However, the result of correlation analysis showed that there was significant relationship (0. 842, P< 0.05) (Appendix 3) in the weight and prevalence of infection in *C. obsura.* This implies that prevalence of infection increased with increasing fish weight.

In *H. longifilis*, only the lowest weight groups (400-499g) was found to be infected as all two fishes examined were infected giving a prevalence of 100.00 %, M.I.Iof 1.00 and M.A of 1.00. An inverse significant relationship (-0.775, P < 0.05) (Appendix 3) was observed in the correlation analysis. This implies that fish with less weight had higher prevalence. Correlation analysis between weight of *H. longifilis* and mean intensity of infection and mean abundance showed an inverse relationship, although it is not significant.

In *H.niloticus*, 8 out of 22 fishes examined in the weight group 0 – 99g were infected and 16 worms were recovered, giving a prevalence of 36.36 %, M.I.I of 2.00 and M.A of 0.73. Twenty – two (22) out of the 50 fishes examined in the weight group 200 – 299g were infected and 41 worms were recovered, giving a prevalence of 44.00 %, M.I.I of 1.90 and M.A of 0.82. Ten (10) out of the 24 fishes examined in the weight group 200 – 299g were infected and 41 worms recovered giving a prevalence of 41.67%, M.I.I of 4.10 and M.A of 1.71. Eight (8) out of the 15 fishes examined in the weight group 300 – 399g were infected and 13 worms were recovered giving a prevalence of 53.33 %, M.I.I of 1.63 and M.A of 0.90. Five (5) out of the 8 fishes examined in the weight group 400 – 499g were infected and 57 worms were recovered giving a prevalence of 62.50 %, M.I.I of 11.40 and M.A of 7.13. All four fishes examined in the weight group 500-599g were infected giving a prevalence of 100.00 %, M.I.I. of 8.30 and M.A of 8.30. Seventeen (17) out of the 18 fishes examined in the weight group 600 – 699g were infected and 220 worms were recovered giving a prevalence of 94.45 %, M.I.I of 12.94 and M.A. of 12.22. All two fishes examined in weight group 1000 – 1099g and 1100- 1199g were all infected giving a prevalence of 100.00% each. The prevalence of helminth infection increased with increasing host weight although it declined in weight group 200- 299g and 600- 699g. However, correlation analysis revealed that there was no significant relationship (0.144, $P < 0.05$) (Appendix 3) between fish weight and prevalence of infection. This implied that prevalence of helminth infection in *H.niloticus* had nothing to do with weight of the fish. Similarly, correlation analysis revealed that there was no significant relationship between weight of *H. niloticus* and mean intensity of infection and mean abundance.

In *M.electricus*, 4 out of the 6 fishes examined in the weight group 0 – 99g were infected and 24 worms were recovered, giving a prevalence of 66.67 %, M.I.I of 6.00 and M.A of 4.00. All four fishes examined in the weight group 100 – 199g were infected and 8 worms were recovered, giving a prevalence of 100.00 %, M.I.I of 2.00 and M.A of 2.00. Two (2) out of the 12 fishes examined in the weight group 200 – 299g were infected and 16 worms were recovered, giving a prevalence of 16.67 %, M.I.I of 8.00 and M.A of 1.33. Six (6) out of the 8 fishes examined in the weight group 300 – 399g were infected and 27 worms were recovered, giving a prevalence of 75.00 %, M.I.I of 4.50 and M.A of 3.38. All two fishes examined in the weight group 400 – 499g were infected and 37 worms were recovered, giving a prevalence of 100.00 %, M.I.I) of 18.50 and M.A of 18.50. Result of correlation analysis showed that there was no significant relationship (0.193, $P < 0.05$) between fish weight and helminth infection in *M.electricus.* Similarly, correlation analysis showed that there was no significant relationship ($r = 0.660$, $p = 0.225$) between fish weight and mean intensity of infection and between fish weight and mean abundance (0.653, $p = 0.232$) (Appendix 4).

In *Synodontis batensoda,* prevalence of infection also increased with increasing host weight (0-99g and 100-199g) upto a certain limit after which it decreased as seen in weight group 200 – 299g and 300-399g, although the number of parasites/helminths recovered increased with increasing host weight. The highest prevalence of infection (66.67 %) occurred in weight group 100 – 199g. Correlation analysis revealed that there was an inverse significant relationship (- 0.434, $P < 0.05$) (Appendix 3) between fish weight and helminth infection in *S.batensoda*. This implies that fish with less weight had higher prevalence of infection. Also, correlation analysis revealed that there was no significant relationship between weight of *S. batensoda* and mean intensity of infection ($r = -0.775$, $p = 0.225$) and mean abundance ($r = -0.183$, $p = 0.817$) (Appendix 4) but the nature of the relationship that exists is an inverse one.

In *Synodontis eupterus*, 2 fishes in weight group 0 – 99g were infected with 4 worms recovered, giving a prevalence of 100.00 %, M.I.I of 2.00 and M.A of 2.00. Two (2) out of 18 fishes examined in weight group 100 – 199g were infected with 2 worms recovered, giving a prevalence of 11.11 %, M.I.I of 1.00 and M.A of 0.11. The other weight groups examined namely 300-399g, 400 – 499g and 500 – 599g had a prevalence of 37.50 %, 25.00 % and 100.00 % respectively except weight group 200-

299g which was not infected. It can be seen that prevalence of infection increased with increasing fish weight up to a certain limit, after which it decreased (table 3), although the helminths recovered were seen to increase as the host weight increased apart from weight group 0-99g. Correlation analysis also revealed that there was no significant relationship ($r = 0.096$, $p < 0.05$) (Appendix 3) between fish weight and helminth infection in *S. eupterus*, although there was a significant relationship ($r = 0.822$, $p = 0.01$) (Appendix 4) between weight of *S. eupterus* and mean intensity of infection but none between weight of *S. eupterus* and mean abundance. This implies that the mean intensity of infection increased with increasing weight.

In *C. lazera*, *P. annectens*, *S. mystus* and *C. nigrodigitatus*, only one weight classin each species was found to be infected. For *C lazera*, all 2 fishes examined in the weight group 200 – 299g were infected and 6 worms were recovered, giving a prevalence of 100.00 %, M.I.I of 3.00 and M.A.of 3.00. Two (2) out of 15 *P. annectens* examined in the weight group 200 – 299g were infected and 4 worms were recovered giving a prevalence of 13.33 %, M.I.I.of 2.00 and M.A.of 0.30. For *S. mystus*, 2 out of the 38 fishes examined in the weight group 0 – 99g were infected and 2 worms recovered, giving a prevalence of 5.26 %, M.I.I of 1.00 and M.A of 0.10. Likewise 2 out of the 6 *C. nigrodigitatus* examined in the weight group 0-99g were infected and 2 worms were recovered, giving a prevalence of 33.33 %, M.I.I.of 1 and M.A. of 0.3. Correlation analysis was not done because only one weight group on each of the fish species was infected.

Table 3: Relationship between fish weight and helminth infection.

Fish species	Fish Weight (g)	N.E	N.I	P (%)	N.P.R	M.I.I	M.A
A. Occidentalis	0 – 99	24	2	8.33	16	8.00	0.70
	100 – 199	8	6	75.00	32	5.33	4.00
C. anguillaris	0 – 99	4	0	0.00	0	0.00	0.00
	100 – 199	6	2	33.33	2	1.00	0.33
	200 – 299	5	2	40.00	2	1.00	0.40
C. gariepinus	200 – 299	4	1	25.00	3	3.00	0.75
	300 – 399	2	0	0.00	0	0.00	0.00
	400 – 499	6	2	33.33	7	3.50	1.20
	500 – 599	2	0	0.00	0	0.00	0.00
	600 - 699	2	0	0.00	0	0.00	0.00
	1000 - 1099	15	0	0.00	0	0.00	0.00
C.lazera	0 - 99	6	0	0.00	0	0.00	0.00
	100 - 199	2	0	0.00	0	0.00	0.00
	200 - 299	2	2	100.00	6	3.00	3.00
	300 - 399	-	-	-	-	-	-
	400 - 499	2	0	0.00	0	0.00	0.00
C. obscura	0 - 99	10	2	20.00	4	2.00	0.40
	100 - 199	18	2	11.11	6	3.00	0.33
	200 - 299	19	2	10.53	8	4.00	0.42
	300 - 399	10	7	70.00	29	4.14	2.90
	400 - 499	11	4	36.36	30	7.50	2.72
	500 - 599	3	2	66.67	8	4.00	2.70
	600 - 699	2	2	100.00	34	17.00	17.00

C.nigrodigitatus	0 - 99	6	2	33.33	2	1.00	0.33
	100 - 199	0	0	0.00	0	0.00	0.00
	200 - 299	20	0	0.00	0	0.00	0.00
	300 - 399	3	0	0.00	0	0.00	0.00
	400 - 499	2	0	0.00	0	0.00	0.00
	500 - 599	3	0	0.00	0	0.00	0.00
	700- 799	2	0	0.00	0	0.00	0.00
	800 - 899	2	0	0.00	0	0.00	0.00
	1800 - 1899	1	0	0.00	0	0.00	0.00
H. longifilis	400 – 499	2	2	100.00	2	1.00	1.00
	500 – 599	-	-	-	-	-	-
	600 – 699	6	0	0.00	0	0.00	0.00
	900-999	4	0	0.00	0	0.00	0.00
H. niloticus	0 -99	22	8	36.36	16	2.00	0.73
	100 – 199	50	22	44.00	41	1.90	0.82
	200 – 299	24	10	41.67	41	4.10	1.71
	300 – 399	15	8	53.33	13	1.63	0.90
	400 – 499	8	5	62.50	57	11.40	7.13
	500 – 599	4	4	100.00	33	8.30	8.30
	600 – 699	18	17	94.45	220	12.94	12.22
	700 – 799	2	0	0	0	0.00	0.00
	800 – 899	-	-	-	-	-	-
	900 – 999	-	-	-	-	-	-
	1000 – 1099	2	2	100.00	4	2.00	2.00
	1100 – 1199	2	2	100.00	27	13.50	13.50
M. electricus	0 – 99	6	4	66.67	24	6.00	4.00
	100 – 199	4	4	100.00	8	2.00	2.00
	200 – 299	12	2	16.67	16	8.00	1.33

	300 – 399	8	6	75.00	27	4.50	3.38
	400 – 499	2	2	100.00	37	18.50	18.50
P. annectens	0 - 99	0	0	0.00	0	0.00	0.00
	100 - 199	16	0	0.00	0	0.00	0.00
	200 - 299	15	2	13.33	4	2.00	0.30
	300 - 399	3	0	0.00	0	0.00	0.00
	400 - 499	3	0	0.00	0	0.00	0.00
	500- 599	2	0	0.00	0	0.00	0.00
	600- 699	3	0	0.00	0	0.00	0.00
	700- 799	1	0	0.00	0	0.00	0.00
	1400- 1499	1	0	0.00	0	0.00	0.00
S. batensoda	0 – 99	18	3	16.67	16	5.33	0.90
	100 – 199	6	4	66.67	20	5.00	3.33
	200 – 299	34	7	20.59	35	5.00	1.03
	300 – 399	2	0	0.00	0	0.00	0.00
S. eupterus	0 – 99	2	2	100.00	4	2.00	2.00
	100 – 199	18	2	11.11	2	1.00	0.11
	200 – 299	3	0	0.00	0	0.00	0.00
	300 – 399	8	3	37.5	10	3.30	1.30
	400 – 499	8	2	25.00	10	5.00	1.30
	500 – 599	4	4	100.00	31	7.80	7.80
S. mystus	0- 99	38	2	5.26	2	1.00	0.10
	100- 199	0	0	0.00	0	0.00	0.00

KEY = N.E – Number Examined ; N.I. – Number Infected; NPR – Number of Parasite Recovered; P – Prevalence; MII – Mean Intensity of Infection, MA – Mean Abundance

4.4 Relationship between Fish Total Length and Helminth Infection

The relationship between infection parameters and length of fish is shown on Table 4.

In *A. occidentalis,* 2 out of the 26 fishes examined in the length group 10 – 19 cm were infected and 16 worms were recovered, giving a prevalence of 7.69 %, M.I. of 8.00 and M.A. of 0.62. All 6 fishes examined in the length group 20 – 29 cm were infected and 32 worms were recovered, giving a prevalence of 100.00 %, M.I.I of 5.33 and M.A. of 5.33. Correlation analysis showed that there was no significant relationship but the nature of the relationship that exists in the fish species is an inverse one.

In *C. anguillaris*, 2 out of the 4 fishes examined in the length group 20 – 29cm were infected and 2 worms were recovered giving a prevalence of 25.00 %, M.I.I. of 1.00 and M.A.of 0.50. Two (2) out of the fishes examined in the length group 30- 39 cm were infected and 2 worms were recovered, giving a prevalence of 16.67%, M.I.I. of 1.00 and M.A.of 0.33. Correlation analysis showed that there was an inverse significant relationship (0. 982, $P < 0.05$) (Appendix 3) between length of C. *anguillaris* and prevalence of infection.

In *C. gariepinus,* 1 out of the 6 fishes examined in the length group 30 – 39 cmwas infected and 3 worms were recovered, giving a prevalence of 16.67 %, M.I.I. of 3.00 and M.A. of 0.50. Two (2) out of the 8 fishes examined in the length group 40 – 49 cm were infected and 7 worms were recovered, giving a prevalence of 25.00 %, M.I.I. of 3.50 and M.A. of 0.88. Correlation analysis showed that there was an inverse significant relationship (- 0.655, $P < 0.05$) (appendix 3) between fish length and helminth infection.

In *C. obscura,* 9 out of the 42 fishes examined in the length group 20 – 29 cm were infected and 22 worms were recovered, giving a prevalence of 21.43 %, M.I.I. of 2.44 and M.A. of 0.52. Ten (10) out of the 21 fishes examined in the length group 30 – 39 cm were infected and 63 worms were recovered, giving a prevalence of 47.62 %, M.I.I. of 6.30 and M.A. of 3.00. All 2 fishes examined in the length 40 – 49 cm were infected and 34 worms were recovered, giving a prevalence of 100.00 %, M.I.I. of 17.00 and M.A. of 17.00. Correlation analysis showed that there was a significant relationship (0.976, $P < 0.05$) (appendix 3) between fish length and infection.

In *H. longifilis,* only 1 fish was examined in the length group 30 – 39 cm and it was infected, giving a prevalence of 100.00 %, M.I.I of 1.00 and M.A. of 1.00. One (1) out of the 10 fishes examined in the length group 40 -49 cm was infected and 1 worm was recovered, giving a prevalence of 10.00 %, M.I.I. of 1.00 and M.A. of 0.10. Correlation analysis showed that there was an inverse significant relationship (- 0.908, $P<0.05$) (Appendix 3).

In *H. niloticus*, all four (4) fishes examined in the length group 10 – 19 cm were infected and 12 worms were recovered, giving a prevalence of 100.00 %, M.I.I. of 3.00 and M.A. of 3.00. Fourty (40) out of 98 fishes examined in the length group 20 – 29 cm were infected and 93 worms were recovered giving a prevalence of 40.82 %, M.I.I. of 2.33 and M.A. of 0.95. Nineteen (19) out of 31 fishes examined in the length group 30 – 39 cm were infected and 168 worms were recovered, giving a prevalence of 61.29 %, M.I.I. of 8.00 and M.A. of 5.42. Thirteen (13) out of 15 fishes examined in the length group 40 – 49 cm were infected and 179 worms were recovered giving a prevalence of 86.67 %, M.I.I. of 13.80 and M.A. of 11.93.

In *M. electricus,* 3 out of the 6 fishes examined in the length group 10 – 19 cm were infected and 24 worms were recovered, giving a prevalence of 50.00 %, M.I.I of 8.00 and M.A. of 4.00. Thirteen (13) out of the 24 fishes examined in the length group 20 – 29 cm were infected and 51 worms were recovered giving a prevalence of 54.17 %, M.I.I of 3.92 and M.A. of 2.13. All the 2 fishes examined in the length group 30 – 39 cm were infected and 37 worms were recovered giving a prevalence of 100.00 %, M.I.I of 18.50 and M.A. of 18.50. Correlation analysis showed that there was a significant relationship (0.866, $P < 0.05$) (appendix 3) between the fish length and prevalence of infection. This implies that increase in length results to increase in helminth infection.

In *S. batensoda*, 5 out of the 24 fishes examined in the length group 10 – 19 cm were infected and 16 worms were recovered, giving a prevalence of 12.50 %, M.I.I. of 5.33 and M.A. of 0.70. Eleven (11) out of the 34 fishes examined in the length group 20 – 29 cm were infected and 55 worms were recovered, giving a prevalence of 32.35 %, M.I.I. of 5.00 and M.A.of 1.62. The result of correlation analysis revealed that there was an inverse significant relationship (- 0. 518, $P < 0.05$) (Appendix 3) between the length of *S. batensoda* and prevalence of infection. This implies that longer fishes had lower prevalence.

In *S. eupterus*, 2 out of the 20 fishes examined in the length group 10 – 19cm were infected and 4 worms were recovered, giving a prevalence of 10.00 %, M.I.I. of 2.00 and M.A. of 0.20. Five (5) out of the 14 fishes examined in the length group 20 – 29 cm were infected and 12 worms were recovered, giving a prevalence of 35.71 %, M.I.I. of 2.40 and M.A.of 0.90. Six (6) out of the 9 fishes examined in the length group

30 – 39 cm were infected and 41 were worms recovered, giving a prevalence of 66.67 %, M.I.I. of 6.83 and M.A of 4.60. The result of correlation analysis shows that there was an increase in parasitic infection with increase in length.

In *C. lazera*, *P. annectens, S mystus* and *C nigrodigitatus*, only one length group was infected. For *C. lazera*, all the 2 fishes examined in the length group 30 – 39 cm were infected and 6 worms were recovered, giving a prevalence of 100.00 %, M.I.I. of 3.00 and M.A. of 3.00. Two (2) out of 26 *P. annectens* examined were infected and 4 worms were recovered, giving a prevalence of 7.70%, M.I.I. of 2.00 and M.A. of 0.20. For *S. mystus*, 2 out of the 32 fishes examined were infected and 2 worms were recovered, giving a prevalence of 6.30 %, M.A. of 1.00 and M.A. of 0.10. For *C. nigrodigitatus*, 2 out of the 17 fishes examined were infected and 2 worms were recovered, giving a prevalence of 11.76 %, M.A. of 1.00 and mean abundance of 0.12. Due to the fact that only one length group was infected in each of the fish species, there was no correlation analysis.

Table 4: Relationship between fish length and helminth infection.

Fish species	Fish Length (cm)	N.E	N.I	P (%)	N.P.R	M.I.I	M.A
A. occidentalis	10 – 19	26	2	7.69	16	8.00	0.62
	20 - 29	6	6	100.00	32	5.33	5.33
	30 - 39	-	-	-	-	-	-
C. anguillaris	20 - 29	4	2	25.00	2	1.00	0.50
	30 - 39	6	2	16.67	2	1.00	0.33
	40 - 49	5	0	00.00	0	0	0
C. gariepinus	30 - 39	6	1	16.67	3	3.00	0.50
	40 - 49	8	2	25.00	7	3.50	0.88
	50 - 59	17	0	0.00	0	0	0
C.lazera	10 - 19	6	0	0.00	0	0	0
	20 - 29	2	0	0.00	0	0	0
	30 - 39	2	2	100.00	6	3.00	3.00
	40 - 49	2	0	0.00	0	0	0
C.nigrodigitatus	10 - 19	2	0	0.00	0	0	0
	20 - 29	17	2	11.76	2	1.00	0.12
	30 - 39	10	0	0.00	0	0	0
	40 - 49	9	0	0.00	0	0	0
	50 - 59	1	0	0.00	0	0	0
C. obscura	10 - 19	8	0	0.00	0	0	0
	20 - 29	42	9	21.43	22	2.44	0.52
	30 - 39	21	10	47.62	63	6.30	3.00
	40 - 49	2	2	100.00	34	17.00	17.00
H. longifilis	30 - 39	1	1	100.00	1	1.00	1.00
	40 - 49	10	1	10.00	1	1.00	0.10
	50 - 59	1	0	0.00	0	0	0
H. niloticus	10 - 19	4	4	100.00	12	3.00	3.00
	20 - 29	98	40	40.82	93	2.33	0.95
	30 - 39	31	21	67.74	168	8.00	5.42
	40 - 49	15	13	86.67	179	13.80	11.93
M. electricus	10 - 19	6	3	50.00	24	8.00	4.00
	20 - 29	24	13	54.17	51	3.92	2.13
	30 - 39	2	2	100.00	37	18.50	18.50

S. batensoda	10 - 19	24	3	12.50	16	5.33	0.70
	20 - 29	34	11	32.35	55	5.00	1.62
	30 - 39	2	0	0.00	0	0	0
S. eupterus	10 – 19	20	2	10.00	4	2.00	0.20
	20 - 29	14	5	35.71	12	2.40	0.90
	30 - 39	9	6	66.67	41	6.83	4.60
S.mystus	10 – 19	32	2	6.30	2	1.00	0.10
	20 – 29	6	0	0.00	0.0	0	0
	30 - 39	0	0	0.00	0	0	0
P. annectens	10 - 19	0	0	0.00	0	0	0
	20 - 29	12	0	0.00	0	0	0
	30 - 39	26	2	7.70	4	2.00	0.20
	40- 49	4	0	0.00	0	0	0
	50- 59	1	0	0.00	0	0	0
	60- 69	1	0	0.00	0	0	0.00

KEY = N.E – Number Examined ; N.I. – Number Infected; NPR – Number of Parasite Recovered; P – Prevalence; MII – Mean Intensity of Infection, MA – Mean Abundance

4.5 Prevalence of Helminth Infections in the Microhabitats of Fish

The prevalence of helminth infection in the microhabitats of fish is shown on Table 5. As indicated earlier, all the main helminth taxa were represented in the parasite fauna of the fishes of the Anambra river. However, the specific composition of the parasites, the range of fish hosts parasitized and their location and distribution within the microhabitats in their fish hosts varied considerably. For clarity of understanding, it is necessary to examine separately and in some detail the features of the distribution of helminth species in each major parasite taxon.

4.5.1 Cestoidea

As indicated earlier, the cestodes recovered belonged to 3 families, viz, caryophyllaeidae, ptychobothriidthridae and proteocephalidae.

A total of 10 Unidentified *Weyonia* species were recovered from the *S. eupterus* and all the 10 (100.00 %) were recovered from the intestine. Similarly, *W. youdeoweii* were recovered from the intestine of *S. eupterus* and *S batensoda* at a prevalence of 100.00 %). The same goes with *S. batensoda* in which 14 *W. synodontis* were recovered from the intestine giving a prevalence of 100.00 %.

Two (2) *Plerocercoid* larva were recovered from *C. anguillaris* and all 2 (100.00 %) were recovered from the intestine. *P clarias* was recovered from *C anguillaris* and *C. lazera,* and a total of 2 and 6 *P. clarias* were recovered respectively from the intestine giving a prevalence of 100.00 %.

S sandoni was recovered only from *H. niloticus* and a total of 159 worms were recovered. Out of that number, 90 (56.60 %) were recovered from the posterior intestine while 69 (43.40 %) were recoved from the mid- intestine.

E. malapteruri was recovered only from *M. electricus* and a total of 110 worms were recovered. All the 110 (100.00 %) were recovered from the intestine of the fish. An unidentified cestode was also recovered from *A. occidentalis* and *H. longifilis.* A total of 32 and 2 unidentified cestode were recovered from *A. occidentalis* and *H. longifilis* respectively from the intestine.

4.5.2. Trematoda

The only species recovered was *Emoleptalea* species from *C. gariepinus* and a total of 8 *Emoleptalea* species were recovered from the intestine. It would therefore appear that the intestine was the preferred microhabitat for *Emoleptalea* species in *C. gariepinus*.

4.5.3. Nematoda

The nematodes recovered belonged to two families namely, Ascarididae and Camallanidae. The Camallanidae were the most prevalent, particularly *P. laeviconchus.P. laeviconchus* was recovered from *C. obscura* and *H. niloticus.* A total of 119 *P. laeviconchus* were recovered from *C.obscura*. Out of that number 6 (5.04 %) were recovered from the stomach, 100 (84.03 %) from the intestine and 13 (10.92 %) from the rectum.

Again, a total of 20 *P.laeviconchus* were recovered from *H.niloticus*. Out of that number, 6 (30.00 %) were recovered from the mid-intestine while 14 (70.00 %) were recovered from the rectum.

Dujardinascaris species was recovered only from *H.niloticus* and a total of 18 worms were recovered. Out of that number, 12 (66.67 %) were recovered from the rectum. Another Camallinidae, *Spirocamallanus* specieswas recovered from *S.batensoda* and *C.gariepinus.* One (1) worm was recovered from the rectum of *S.batensoda* and 2 worms from the intestine of *C.gariepinus.*

4.5.4 Acanthocephala

A total of 41 *Neoechinorhynchus* species were recovered from *S.eupterus.* Out of that number, 30 (73.17 %) worms were recovered from the intestine while 11 (26.83 %) were recovered from the rectum. It would therefore appear that the intestine is the preferred microhabitat of *Neochinorhynchus* species in *S. eupterus*. A total of 44 *Neoechinorhynchus* specieswere recovered from *S.batensoda.* Out of that number, 26 (59.09 %) were recovered from the intestine while 18 (40.91 %) were recovered from the rectum and this makes the intestine, the preferred microhabitat.

A total of 255 *T.niloticus* were recovered from *H.niloticus*. Of that number, 41(16.08 %) were recovered from the anterior intestine, 184 (72.16 %) mid-intestine, 18 (7.06%) post intestine and 12(4.71 %) from the pyloric caeca.

Two (2) each of *T.niloticus* were recovered from *S.batensoda* and *M.electricus* and all the 2 (100.00 %) were recovered from the intestine.

An unidentified acanthocephan was recovered from *P.annectens*, *S.mystus*, *C.nigrodigitatus* and *A.occidentalis.* All 4 worms recovered from *P.annectens* were found in the intestine. Two (2) of the recovered worms in *S.mystus* were found in the intestine.

Table 5: Prevalence of helminth infections in the microhabitats of fish

Parasite taxa	Parasite	Fish host	N.P.R	Oesophagus	Stomach	Intestine	Rectum	Caecum	Pyloric caeca
Cestoda	Unidentified *Weyonia* species	*S. eupterus*	10	0	0	10(100.00%)	0	0	0
	Weyonia youdeoweii	*S. eupterus*	6	0	0	6(100.00%)	0	0	0
		S. batensoda	4	0	0	4(100.00%)	0	0	0
	Weyonia synodontis	*S. batensoda*	14	0	0	14(100.00%)	0	0	0
	Plerocercoid larva	*C. anguillaris*	2	0	0	2(100.00%)	0	0	0
	Polyonchobotrium clarias	*C. anguillaris*	2	0	0	2(100.00%)	0	0	0
		C. lazera	6	0	0	6 (100.00 %)	0	0	0
	Sandonella sandoni	*H. niloticus*	159	0	0	90(56.60 %) Post- Int 69(43.40 %) Mid-Int	0	0	0
	Electrotenia malapteruri	*M. electricus*	110	0	0	110(100.00%)	0	0	0
	Unidentified cestode	*A. occidentalis*	32	0	0	32(100.00%)	0	0	0
		H. longifilis	2	0	0	2(100.00%)	0	0	0
Trematoda	*Emoleptalea* species	*C. gariepinus*	8	0	0	8(100.00%)	0	0	
Nematode	*P. laeviconchus*	*C. obscura*	119	0	6 (5.04%)	100(84.03%)	13(10.92%)	0	0
		H. niloticus	20	0	0	6(30.00%)	14(70.00%)	0	0
	Dujardinascaris species	*H. niloticus*	18	0	0	12(66.67%)	6(33.33%)	0	0
	Spirocamallanus species	*S. batensoda*	1	0	0	0	1(100.00%)	0	0
		C. gariepinus	2	0	0	2(100.00%)	0	0	0
Acanthocephalan	*Neoechinorhynchus* species	*S. eupterus*	41	0	0	30(73.17 %)	11(26.83%)	0	0
		S. batensoda	44	0	0	26(59.10 %)	0	18(400.91)	0
	Tenuisentis niloticus	*H. niloticus*	255	0	0	41(16.08 %) Ant- Int 184(72.16%) Mid- Int 18(7.06 %) Post- Int	0	0	12(4.71%)
		S. batensoda	2	0	0	2(100.00%)	0	0	0
		M. electricus	2	0	0	2(100.00%)	0	0	0
	Unidenified acanthocephalan	*P. annectens*	4	0	0	4(100.00%)	0	0	0
		S. mystus	2	0	2(100.00%)	0	0	0	0
		C. nigrodigitatus	2	0	0	2(100.00%)	0	0	0
		A. occidentalis	16	0	0	16(100.00%)	0	0	0

	889	0.0	0.9	79.53%	5.10	2.02	1.35

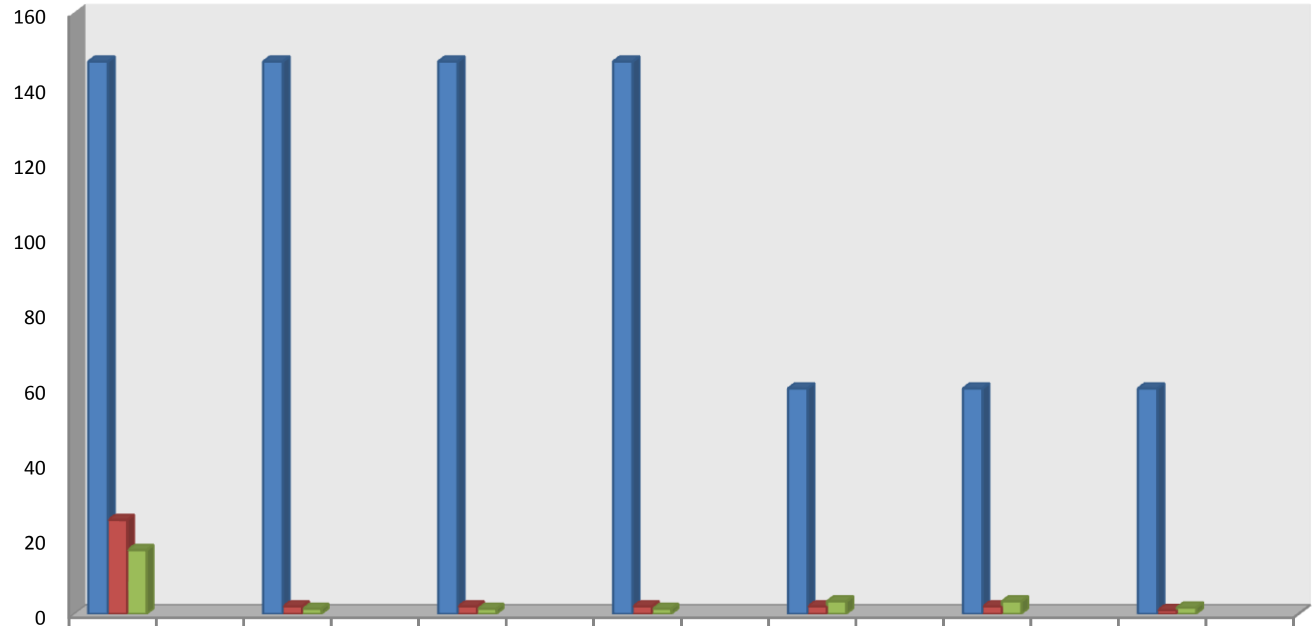
4.6 Mixed Infections involving different Species of Helminth Parasites in Fishes

Mixed infections involving different species of helminth parasites in fishes of River Anambra as recorded in the present study is shown on Fig 2.

It shows that only two (2) out of 43 different species of fish examined namely *H. niloticus* (147) and *S. batensoda* (60) had cases of mixed infections.

In *H.niloticus*, the highest incidence of mixed infection involved *T. niloticus* (acanthocephalan) and *S. sandoni* (Cestode) in the intestine at a frequency of 17.01. Mixed infection involving *S. sandoni* and *P. laeviconchus, T. niloticus, S. sandoni* and *P. laeviconchus* (Nematodes) both occurred at a frequency of 1.36.

In *S. batensoda*, infections involving two different species of acanthocephalan were recorded *Neoechinorhynchus* species and *T.niloticus* in the ceacum and intestine at a prevalence of 3.33 %. Mixed infection involving *Neoechinorhynchus* species and *W.youdeweoii* had a prevalence of 3.33 % while *Spirocamallanus* species and *Neoechinorhynchus* species occurred at a prevalence of 1.67 %.



	T. niloticus and *S. sandoni*		*S. sandoni* and *P. laeviconchus*		*T. niloticus* and *Dujardinascaris* species		*T. niloticus, S. sandoni* and *P. laeviconchus*		*Neoechinorhynchus* species and *T. niloticus*		*Neoechinorhynchus* species and *W. youdeoweii*		*Spirocamallanus* species And *Neoechinorhynchus* species	
	H. niloticus									*S. batensoda*				
No. Examined	147		147		147		147		60		60		60	
No. Infected	25		2		2		2		2		2		1	
Frequency	17		1.36		1.36		1.36		3.33		3.33		1.67	

Figure 2: Mixed Infection involving different species of helminth parasites in fishes of Anambra River

4.7 Seasonal Variation in the Prevalence of Helminth Parasites in Fish of Anambra River

The seasonal variation in the prevalence of helminth infections in fishes of River Anambra is shown in Fig. 3-7. For clarity of understanding, the table will be described under the parasite taxa.

4.7.1 Seasonal Variation in the Prevalence of Cestode Parasites in Fish of River Anambra.

Seventeen (17) *S.eupterus* were examined in the dry season out of which 2 were infected by an Unidentified *Weyonia* species and 10 parasites were recovered, giving a prevalence of 11.76 %, M.I.I of 5.00 and mean abundance of 0.60. None of the *S.eupterus* examined in the rainy season was infected by *Weyonia* species.

Weyonia youdeoweii was recovered from 3 out of 17 *S.eupterus* examined in the dry season and 5 parasites were recovered, giving a prevalence of 17.64 %, M.I.I of 1.67 and M.A of 0.30. In the rainy season, 1 out of 26 fishes examined was infected and only 1 parasite was recovered, giving a prevalence of 3.85 %, M.I.I of 1.00 and M.A. of 0.04. *Weyonia.youdeoweii* was recovered from 3 out of 36 *S.batensoda* examined in the dry season and 9 parasites were recovered, giving a prevalence of 8.33 %, M.I.I of 3.00 and M.A of 0.25. In the rainy season, 1 out of 24 fishes examined were found to be infected and 1 parasite was recovered, giving a prevalence of 4.12 %, M.I.I of 1.00 and M.A of 0.04.

Weyonia synodontis was recovered from only *S.batensoda* in the dry season. Two (2) out of 36 fishes examined in the dry season were infected and 14 worms were recovered, giving a prevalence of 5.56 %, M.I.I of 7.00 and M.A of 0.39. The parasite was not recovered from the fish in the rainy season.

Plerocercoid larva was recovered from *C.anguillaris* only in the dry season. Two (2) out of 10 fishes examined were found to be infected and 2 worms were recovered, giving a prevalence of 20.00 %, M.I.I. of 1.00 and M.A. of 0.20.

Polyonchobothrium clarias was recovered from *C.anguillaris* and *C.lazera*.The parasite was recovered from the two fish species in the dry season only. Two (2) out of 10 *C.anguillaris* examined were infected and 2 worms were recovered, giving a prevalence of 20.00 %, M.I.I of 1.00 and M.A. of 0.20. Two (2) out of 12 *C.lazera* examined were infected and 6 worms were recovered, giving a prevalence of 16.67 %, M.I.I of 3.00 and M.A of 0.50.

S.sandoni was recovered from *H.niloticus* in the dry and rainy season. In the dry season, 39 out of 106 fishes examined were infected and 135 worms were recovered, giving a prevalence of 36.79 %, M.I.I of 3.50 and M.A of 1.30. In the rainy season, 16 out of 41 fishes examined were infected and 24 worms were recovered, giving a prevalence of 39.02 %, M.I.I of 1.50 and M.A of 0.60.

E.malapteruri was recovered from 16 out of 30 *M.electricus* examined in the dry season, and 110 worms were recovered, giving a prevalence of 53.33 %, M.I.I of 6.90 and M.A of 3.70. No parasite was recovered from *M.electricus* in the rainy season.

Six (6) out of 18 *A.occidentalis* examined in the dry season were infected by an unidentified cestode and 32 worms were recovered giving a prevalence of 33.33 %, M.I.I of 5.33 and M.A of 1.80. None of the fishes examined in the rainy season were infected. Two (2) out of 10 *H.longifilis* examined in the rainy season were also infected by an unidentified cestode and 2 worms were recovered, giving a prevalence of 20.00 %, M.I.I of 1.00 and M.A of 0.20.

Figure 3a shows the prevalence of cestode parasites on the fish in dry season. It further shows that different species of cestode parasites were recovered from eleven (11) species of fish in the dry season. *Malapterurus electricus* had the highest prevalence of 53.33 %, followed by *H. niloticus* (36.79 %), *A. occidentalis* (33.33 %), *C. anguillaris* (20.00 %), *S. eupterus* (17.64 %; from which *W. youdeoweii* was recovered), *C. lazera* (16.67 %), *S. eupterus* (11.76 %; from which *Weyonia* species were recovered), *S. batensoda* (8.33 %; from which *W. youdeoweii* was recovered), and *S. batensoda* (5.56 %; from which *W. synodontis* was recovered). Although an unidentified Cestoda was recovered from *H. longifilis,* none was recovered in the dry season.

Fig. 3b shows the prevalence of the cestode parasites on the fish host in rainy season. It further shows that *H. niloticus* (39.02 %) had the highest prevalence of cestode parasite (*S. sandoni*) in the rainy season. This was followed by *H. longifilis* (20.00 %), *S. batensoda* (4.12 %) and finally *S. eupterus* (3.85 %). All other fishes (*M. electricus, A. occidentalis, C. lazera, C. anguillaris, S. batensoda* and *S. eupterus)* from which various species of cestode parasites were recovered had zero prevalence in rainy season.

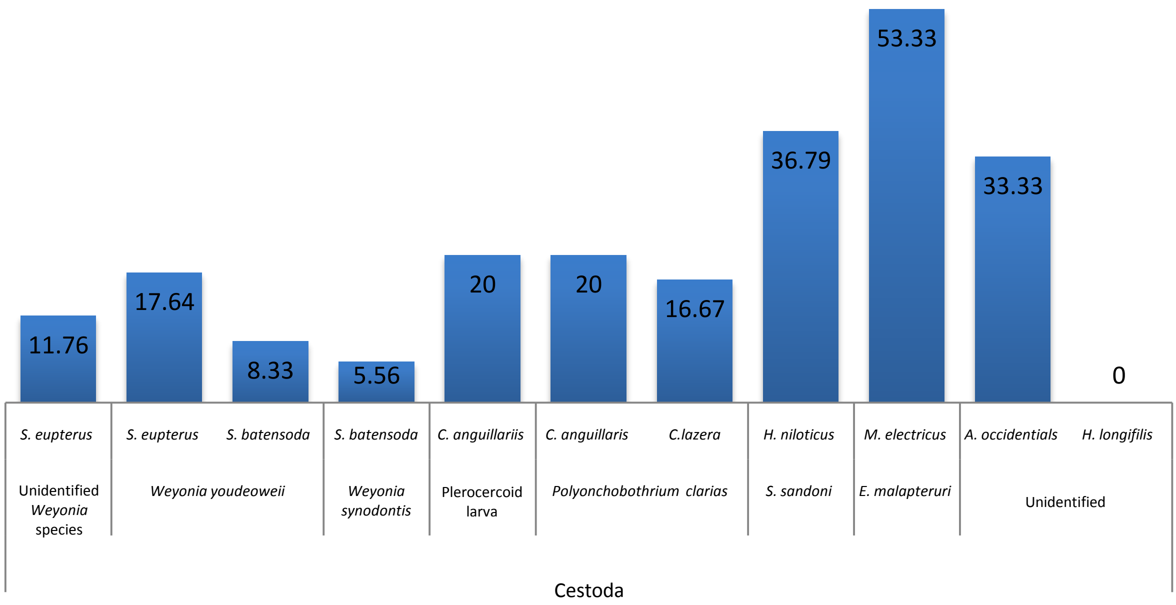


Figure 3a: Prevalence of Cestoda Parasites in their fish host in dry season in Anambra River

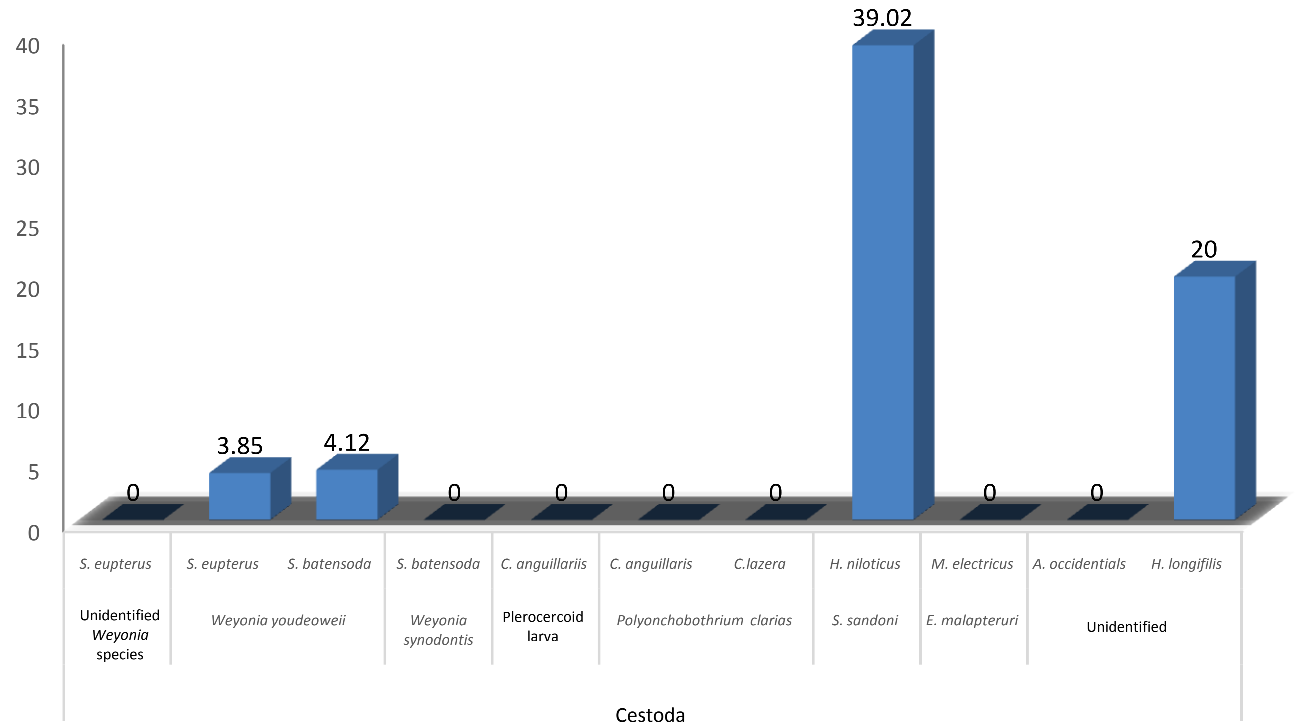


Figure 3b: Prevalence of Cestoda Parasites in their fish host in rainy season in Anambra River

4.7.2 Seasonal Variation in the Prevalence of Trematode Parasites in Fish

The only tremaode parasite recovered in the study *Emoleptalae* species was recovered from *C.gariepinus* only in the dry season. Two (2) out of 10 fishes examined were infected and 8 worms were recovered giving a prevalence of 5.00 %, M.I.I of 4.00 and M.A of 0.80.

Figure. 4(a) and (b) further show the prevalence of the trematode parasite in *C.gariepinus* represented in a bar chart.

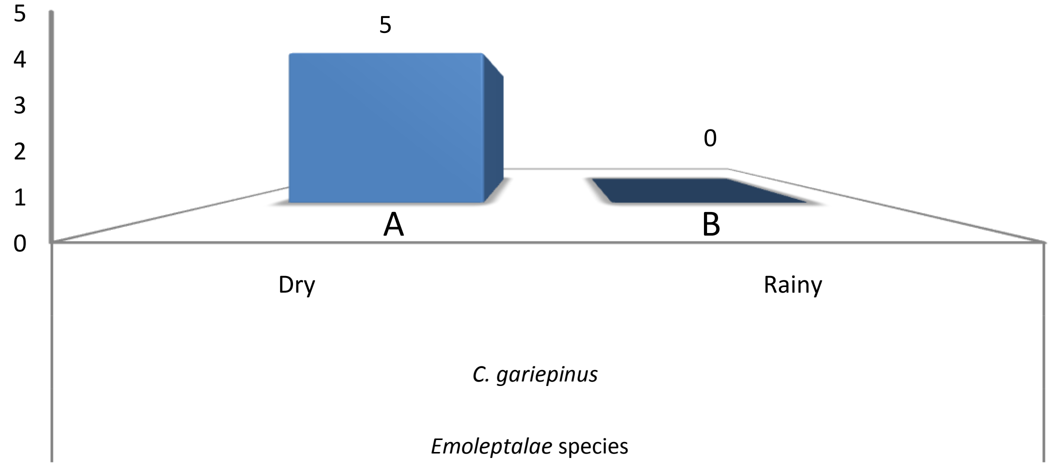


Figure 4(a) & (b): Prevalence of Trematode Parasites in their fish host in dry and rainy season in Anambra River

4.7.3 Seasonal Variation in the Prevalence of Nematode Parasites in Fish of Anambra River

Procamallanus laeviconchus was recovered from 10 out of the 39 *C.obscura* examined in the dry season and 60 worms were recovered, giving a prevalence of 25.64 %, M.I.I of 6.00 and M.A of 1.54. In the rainy season, 11 out of the 34 fishes examined were infected and 59 worms were recovered, giving a prevalence of 32.35%, mean intensity of infection (M.I.I) of 5.40 and mean abundance (M.A) of 1.74.

The other fish host being of *P.laeviconchus* was*H.niloticus*, 4 out of the 41 fishes examined in the rainy season were infected and 20 worms were recovered, giving a prevalence of 9.76 %, M.I.I of 5.00 and M.A of 0.50. None of the examined fishes were infected in the dry season.

Dujardinascaris specieswas recovered from 2 out of 41 *H.niloticus* examined in the rainy season and 28 worms were recovered, giving a prevalence of 4.88 %, M.I.I of 6.00 and M.A of 0.44. No parasite was recovered from H.niloticus in the dry season.*Spirocamallanus* species was recovered from 1 out of 24 *S.batensoda* examined in the rainy season and 1 worm was recovered giving a prevalence of 4.17 %, M.I.I of 1.00 and M.A of 0.04. In *C.gariepinus, Spirocamallanus* species was also recovered from1 out of 21 fishes examined in the rainy season and 2 worms were recovered, giving a prevalence of 4.76 %, M.I.I of 2.00 and M.A of 0.10. *Spirocamallanus* species was not recovered in the dry season in *S. batensoda* and *C. gariepinus.*

Fig. 5(a) shows prevalence of nemadtode parasites in fishes during the dry season. It futher shows that only the nematode, *P. leviconchus* recovered from *C. obscura* had a prevalence of 25.64 % in the dry season. No other nematode parasite was recovered from their various fish hosts in the dry season.

Figure 5b shows prevalence of nematode parasites in fishes during the rainy season. It further shows that *P. laeviconchus* in *C. obscura* had the highest prevalence of 32.35 % followed by *H. niloticus* (9.76 %) from which *P. laeviconchus* was also recovered, *Dujardinascaris* species in *H. niloticus* (4.88 %), *Spirocamallanus* species in *C. gariepinus* (4.76 %) and in *S. batensoda* (4.17 %).

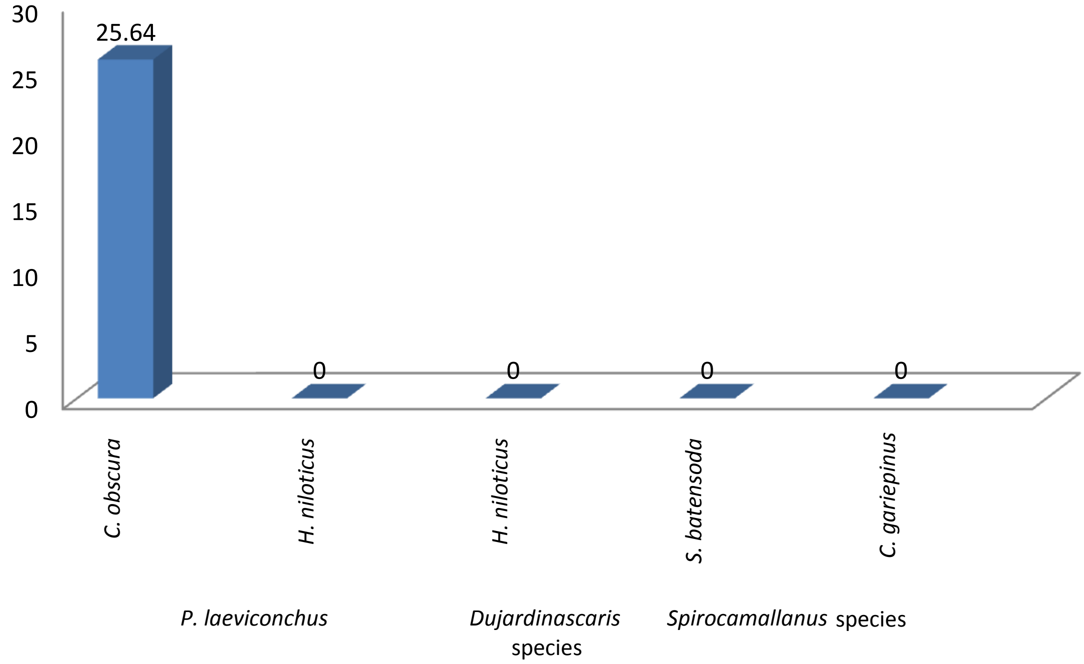


Figure 5a: Prevalence of Nematode Parasites in their fish host in dry season in Anambra River

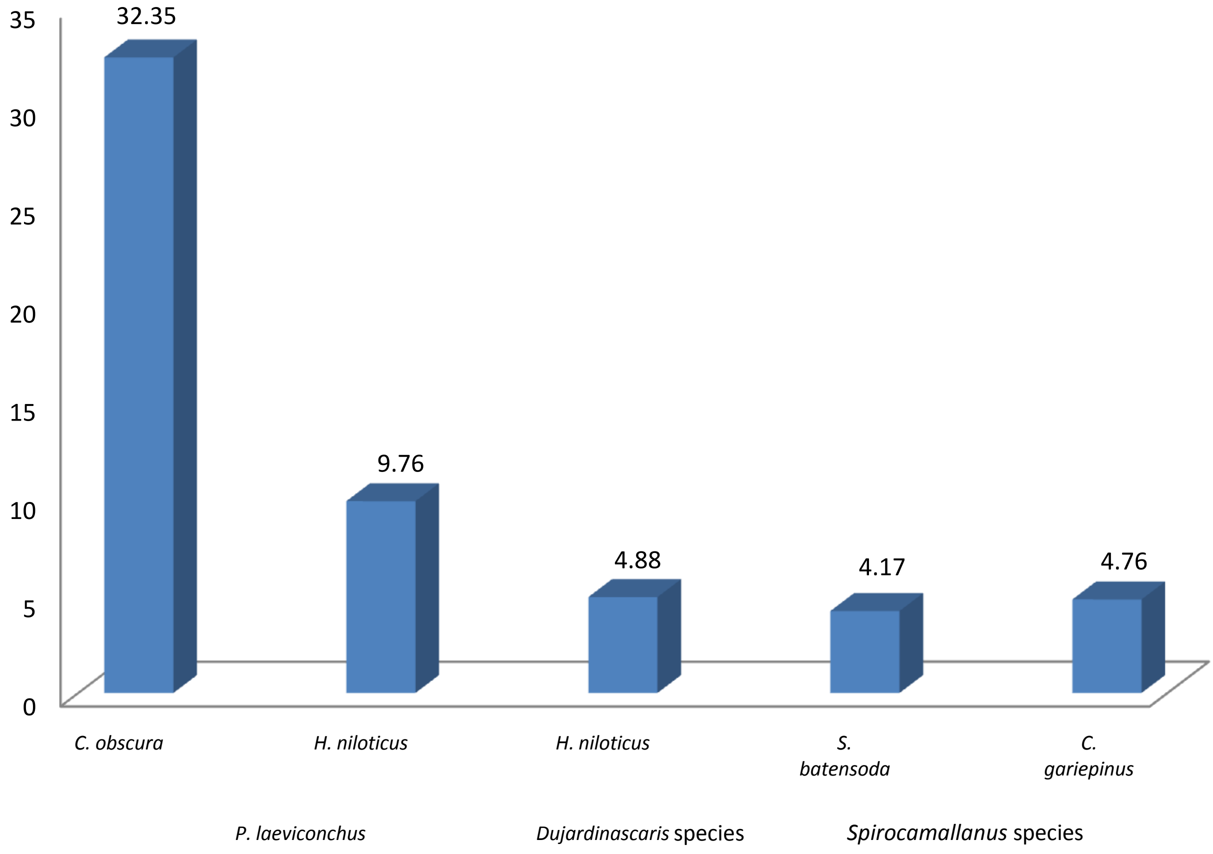


Figure 5b:Prevalence of Nematode Parasites in their fish host in rainy season in Anambra River

4.7.4 Seasonal Variation in the Prevalence of Acanthocephalan Parasites in Fish of Anambra River

Neoechinorynchus species was recovered from 2 out of the 17 *S.eupterus* examined in the dry season and 10 worms were recovered, giving a prevalence of 11.76 %, M.I.I of 5.00 and M.A of 0.60. In the rainy season, 5 out of 26 fishes examined were infected and 31 worms were recovered, giving a prevalence of 19.23 %, M.I.I of 6.20 and M.A of 1.20. For the other host, *S.batensoda*, 1 out of 36 fishes examined in the dry season was infected and 8 worms recovered, giving a prevalence of 2.78 %, M.I.I of 8.00 and M.A of 0.22. In the rainy season, 4 out of the 24 fishes examined were infected and 36 worms recovered, giving a prevalence of 16.67 %, M.I.I of 9.00 and M.A of 1.50.

T.niloticus was recovered from 43 out of 106 *H.niloticus* examinedand 249 worms were recovered, giving a prevalence of 40.57 %, M.I.I of 5.80 and M.A of 2.40. In the rainy season, 2 out of the 41 fishes examined were infected and 6 worms were recovered, giving a prevalence of 4.88 %, M.I.I of 3.00 and M.A of 0.12.

For *S.batensoda,* 2 out of the 24 fishes examined in the rainy season were infected and 2 worms were recovered, giving a prevalence of 8.33 %, M.I.I of 1.00 and M.A of 0.10. None of the fishes examined in the dry season were infected by *T.niloticus.*

In another fish host, *M.electricus,* 2 out of the 30 fishes examined in the dry season were infected and 2 worms were recovered, giving a prevalence of 6.67 %, M.I.I of 1.00 and M.A of 0.07. An unidentified acanthocephalan was recovered from *P.annectens, S.mystus* and *C.nigrodigitatus* only in the dry season at a prevalence of 8.33 %, 5.26 % and 6.89 % respectively.

Fig 6a shows prevalence of acanthocephalan parasite in fishes during the dry season. It further shows that the highest prevalence of acanthocephalan parasites in dry season among the fishes examined was recorded in *H. niloticus* (40.57 %). This was followed by *S. eupterus* (11.76 %), *A. occidentalis* (11.11 %), *P. annectens* (8.33 %), *C. nigrodigitatus* (6.89 %), *M. electricus* (6.67 %), *S. mystus* (5.26 %) and *S. batensoda* (2.78%).

Fig. 6b shows prevalence of acanthocephalan parasite in fishes during the rainy season. It further shows that the highest prevalence of acanthocephalan parasites in the rainy season among the fishes was recorded in *S. eupterus* (19.23%), this was followed by *S. batensoda* (16.67 %; from which *Neoechinorynchus* species was recovered), *S. batensoda* (8.33 %; from which *T. niloticus* was recovered) and *H. niloticus* (4.88 %).

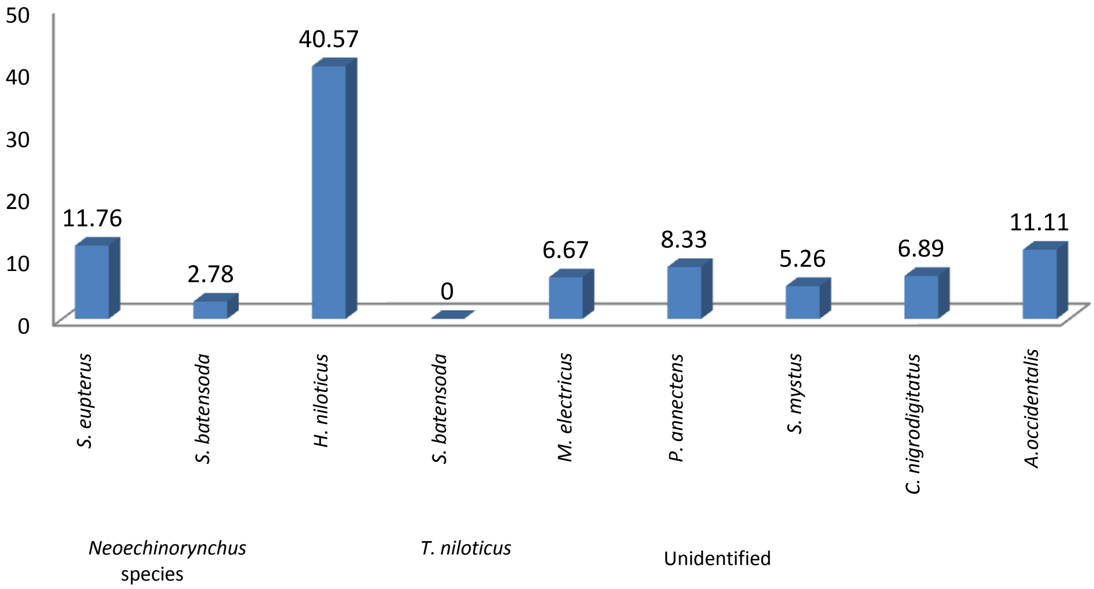


Figure 6a: Prevalence of Acanthocephalan Parasites in their Fish Host in dry season in Anambra River

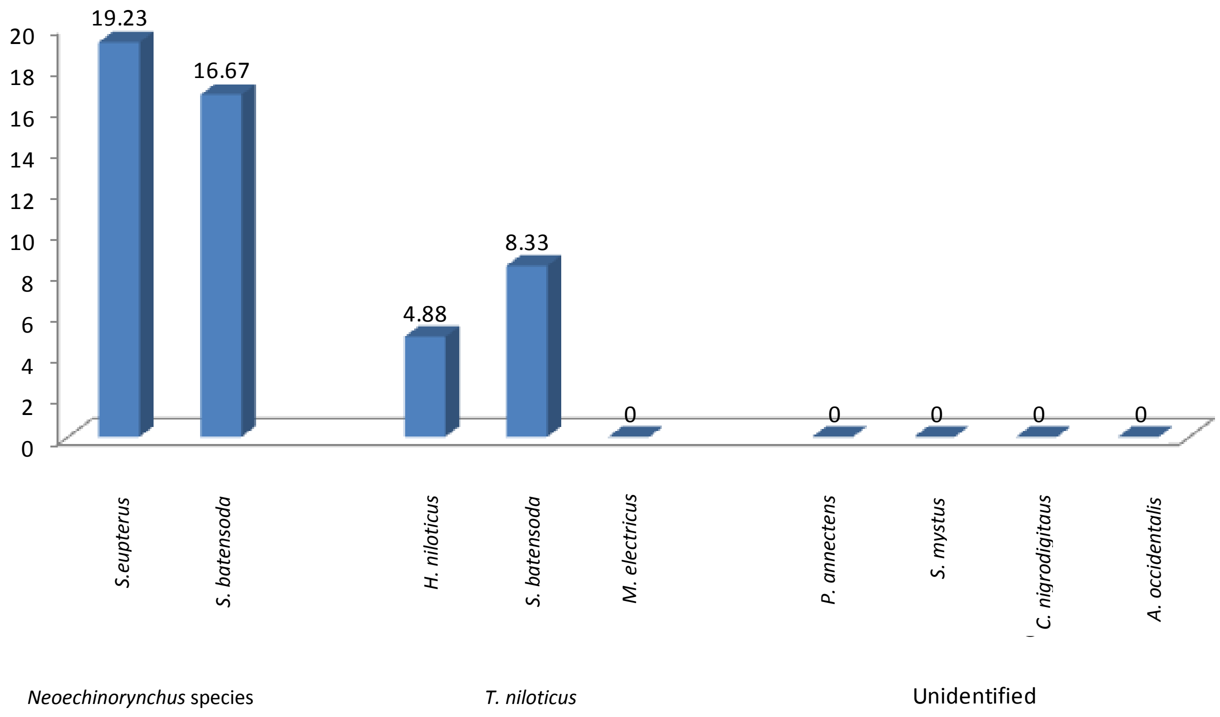


Figure 6b: Prevalence of Acanthocephalan Parasites in their Fish Host in rainy season in Anambra River

4.8 Physico-chemical Parameters of Anambra River

The physicochemical parameters of Anambra River for wet and dry season are shown in Figures 7a and b (See also appendix 7a and b). It shows that the mean value of the parameters for all the three locations in the wet season pH (6.36) temperature (26.40), chloride (133), nitrate (4.73), dissolved oxygen (4.30), conductivity (24.27) and turbidity (123.50) and in the dry season, pH (6.63), temperature (28.60), chloride (144), nitrate (2.90), dissolved oxygen (5.35), conductivity (28.58) and turbidity (107.37) were in line and agree with the standards of World Health Organization (WHO) for the development, growth and survival of the tropical fishes. The result in the table was plotted as figure 7a to show the variations.

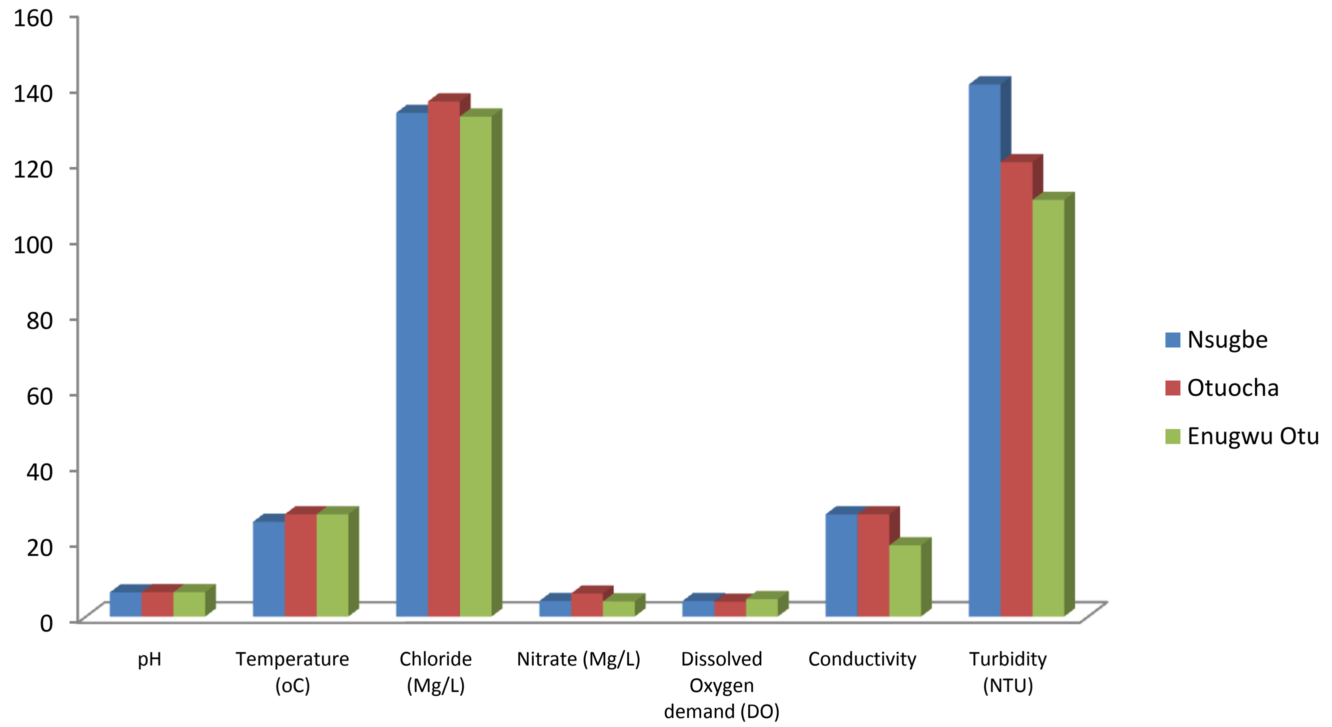


Figure 7a: Mean of Physicochemical Parameters of River Anambra in Wet Season

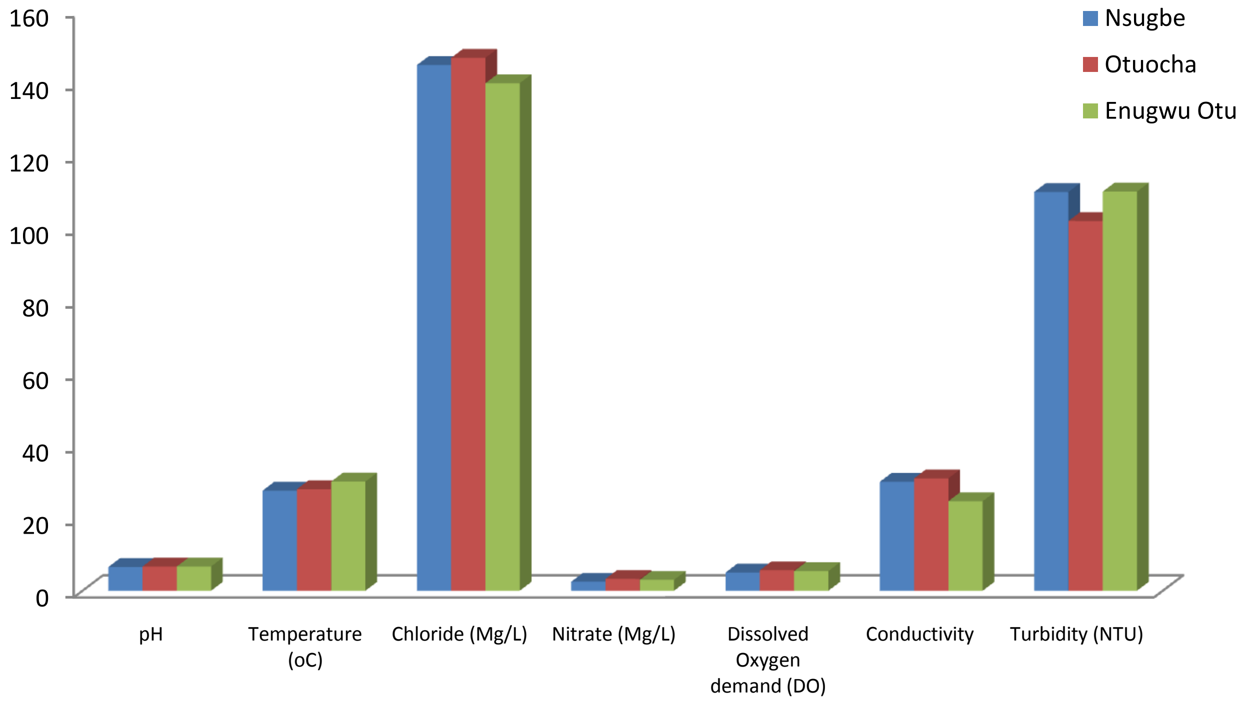


Figure 7b: Mean of Physicochemical Parameters of River Anambra in Dry Season

CHAPTER FIVE

DISCUSSION

A total of one thousand and twenty five specimens belonging to 20 familes and 43 species from River Anambra were examined as seen in Table 1 while Azugo (1978) examined five hundred and eighty one specimens belonging to 22 families and 57 species. Fish species belonging to the family Clupeidae, Pantedontidae, Ichthyoboridae, Pomadasydae, Anabantidae, Centropomidae and Tetradontidae examined by Azugo (1978) from Anambra River System were not examined in this study. Likewise, fish species belonging to the family Ariidae, Protopteridae, Hepsetidae, Cyprinidae and Alestidae recorded in the study were not examined by Azugo (1978). The reason for this disparity may be likened to fate or not having a chance of selection. Again, the issue of extinction may not be completely ignored because some of those species examined by Azugo (1978) were not also examined in the recent study.

The overall prevalence of infection in the 1,025 fish examined was found to be 12.37% which is lower than the 37.90 %, infection recorded by Azugo (1978), 59.50 % in Agulu Lake (Okoye *et al.* 2014) and 13.60 % in Imo River (Ugwuzor, 1987). The reason for this low prevalence may not be clearly defined but Nwani *et al*. (2008) recorded a prevalence of 41.90 % in their research on the endoparasitic helminths of four mormyrid species and stated that the prevalence was within the range (< 50%) typical of southern Nigerian freshwater lotic habitats. This also agrees with Ezenwaji *et al*. (2005) who noted that low prevalence of parasites in fish from lotic flood water systems has been widely reported (Ezenwaji, 2002 and Oniye *et al.* 2004). This is to be expected because the relatively fast flow of water in lotic habitats would inevitably reduce host-parasite contact frequency resulting in low prevalence. It is also worthy of note that infection rates vary greatly from one area to another and this may not be unconnected with the fact that a number of factors like availability of intermediate hosts, and susceptibility of definitive hosts, amongst others, determine to a large extent the rate of infection (Obano *et al*., 2010).

Findings in the present study showed that only one species of trematodes, 9 species of cestodes, 3 species of nematodes and 6 species of acanthocephalans were recovered.When compared with Azugo (1978) who recovered 6 species of trematodes, 16 species of cestode, 13 species of nematodes, 2 species of acanthocephalan and 1 hirudinea. The parasite fauna may be said to be poor and could be explained largely in terms of the frequency of contact between the fish and the infective stage of the parasite (Nwani *etal*. 2008). However, the nematode *Dujardinascaris* species and the acanthocepthalan, *Neoechinorhynchus* species were not part of the the parasites fauna recoreded by Azugo (1978).

Findings in the present study showed that the cestodes namely, unidentified *Weyonia* species was recovered from only *S. eupterus*, *Weyonia youdeoweii* from *S.eupterus* and *S.batensoda* while *W.synodontis* was recovered from only *S.batensoda.* It is noteworthy that these cestodes were not recovered from any other fish host examined in this study except from the mochokids. In other words, *Weyonia* species appear to show a marked preference for mochokids in which several of them have been recorded (Ukoli, 1965; Khali, 1971; Azugo, 1978). The infection of the mochokids with species of *Weyonia* suggests their importance in the fishery of the group. The stomach contents, mainly aquatic insect larvae, plant matter and mud with associated load of worms including Oligochaete worms of the mochokids especially *S. eupterus, S.schall, S.occellifer, S.sorex,* and *S.clarias* revealed the presence of intermediate hosts of caryophyllaeid tapeworm *Weyonia* species (Ezenwaji *et al*., 2005).

One of the cestodes (*Weyonia* species) reported in this study is common in Nigerian freshwater fishes. It has been recovered by Ukoli (1969) from River Niger, Ugwuzor (1987) from Imo River, Okaka (1991) from Asa River Ilorin; Domo and Ester (2015) from Lake Geriyo Jimeta Yola, Salawu*et al*. (2013) from Ogun River and Bamidele (2015) from Lekki Lagoon. The finding of *W.youdeoweii* in *S.eupterus* agrees with Ezenwaji *et al*. (2005) who also recovered the parasite from *S. eupterus* and *S.clarias* together with *W.synodontis* and *W.kainji. Weyonia synodontis* which was recovered in *S.batensoda* from this study was also recovered by Ezenwaji *et al.* (2005) from *Hemisynodontis membranaceous, S.clarias, S.eupterus, S.gobroni* and *S.ocellifer*. Other species of *Weyonia* however have been found in some *Synodontis* species*; W.longicauda* (Woodland, 1937) occurred in *S.gambiensis*, *W.nimuta* (Woodland, 1923) in *Chrysichthys, S.clarias* (Khalil and Polling, 1997), *W.accuminata* in *S.clarias, Weyonia* species in *C.gariepinus* (Dan-kishiya *et al*. 2013). *Weyonia* species are therefore been known to infect members of the family Mochokidae.

The presence of plerocercoid larva in *C.anguillaris* examined in the study is not new as Salawu *et al*. (2013) also recovered this plerocercoid larva from *C.gariepinus* and *C.pachynema* from Ogun River and Asejire Dam, South West Nigeria. Plerocercoids are larval stage of stages of Pseudophyllid tapeworms which include, *Diphyllobothrium* and *Spirometra* species. Fish eating mammals and man are the final hosts and it results in infection if eaten by the humans in improperly cooked fish. *Clarias anguillaris* was also seen as a host to *P.clarias*. Again, the presence of *P.clarias* in *Clarias* species is not new as it has been reported by Azugo (1978) in *C. anguillaris* from Anambra River, Akinsanya and Otubanjo (2006) in *C.gariepinus* from Lekki Lagoon. *Polyonchobothrium* species has also been reported by Olofintoye (2006), Kawa *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.

Auchinoglannis occidentalis and *H.longifilis* were found to be infected by unidentified cestode species. However, Omeji (2012) recovered the cestode *Diphyllobothrium latum* from *A.occidentalis* as the only parasite.

The presence of *S.sandoni* in *H.niloticus* is not new as Ilozumba and Ezenwaji (1985) recovered the same parasite from *H.niloticus* in River Anambra with prevalence of 15.78 % and intensity of infestation of 2.5. Similarly, Akinsanya *et al*. (2007a) also recovered *S.sandoni* in *H.niloticus* from Lekki lagoon, Lagos. It is noteworthy that this proteocephalid tapeworm was recovered fron only *H.niloticus* among the different species of fishes examined. This agrees with De Chambrier *et al*. (2008) who reported that *S.sandoni* is a relatively frequent parasite of *H.niloticus*. In the Sudan, this tapeworm was found in 12 of 19 (63.00 %) fish examined and with a mean intensity of 11.8 (abundance 7.4). In Senegal, 7 of 9 fishes (77.00 %) examined were infected with a mean intensity of 4.8 (range 1 – 13, abundance 3.7). *Sandonella sandoni* has been found in Benin, Chad, Nigeria, Senegal and the Sudan (Khalil, 1960; Lynsdale, 1960;

Ba and Marchand, 1994; Khalil and Polling, 1997; De Chambrier *et al*., 2008) respectively. It probably also occurs in other regions of the distribution area of *H.niloticus* which is native in all the basins of the Sahelo – Sudanese region (that is, Senegal, Gambia, Corubal, Volta, Queme, Niger, Benuoe, Chad, the Bile basins and lake Turkana) (Froese and Pauly, 2007).

Malapterurus electricus could be seen as an important host of *E.malapteruri* because it is infected only by *E.malapteruri* amongst the different species of fish examined in this study with a high prevalence of 50.00 %, mean intensity of 6.9 and mean abundance of 3.4. This parasite had also been reported by Iyaji and Eyo (2014) in Rivers Niger-Benue Confluene, Akinsanya *et al*. (2007b) in Lekki Lagoon and Azugo (1978) in *M. electricus* from Anambra River. According to the parasite checklist of Khalil and Polling (1997), it is only *E. malapteruri* that has been documented in *Malapterurus electricus*.Cestode (tapeworm) parasites have been reported to be widespread in all major freshwater systems of Africa infecting several species of fish and demonstrating high degree of host specificity (Iyaji *et al*. 2009).

According to Cheng (1999), infestation of fish hosts by proteocephalid cestode involves a complex life cycle of eggs with fully developed unciliated oncospheres, ingested by the first intermediate hosts which could be Copepoda (crustaceans), where they develop into procercoid larvae with three pairs of hooks. When the intermediate hosts are eaten by the right definitive hosts, they develop further in tissues into plerocercoid larvae with invaginated scolices and migrate to the lumen of the gut where they metamorphose into strobiliate adults. This complex life cycle could explain why *E.malapteruri* has been described as being host specific. In the host parasite checklist of

Khalil and Polling (1997), *E.malapteruri* was documented as parasite of *M.electricus*. Alain De Chambrier *et al*. (2004) also reported *E.malapterurus* as being specific to *M.electricus*.

Emoleptalea species was recovered from *C.gariepinus* at a prevalence of 6.45%. Similarly, 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 geographical record for the paraites.

The nematode, *Procamallanus laeviconchus* could be seen as an important parasite of *C.obsura* because it is the only parasite recovered from this species of fish in this study unlike others that harboured more than one parasite species. Its prevalence of 28.77 % is higher (P < 0.05) compared to 2.72 % in *H.niloticus.* The finding of *P.laeviconchus* in *C.obscura* is not new as Nwuba *et al*. (2008) also recovered *P.laeviconchus* from *C.obscura.*

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*Heterotis niloticus* may be seen as a new host record for this parasite. *Procamallanus laeviconchus* is widely distributed in several fish hosts in Russia, Europe and Africa (Markerich, 1963; Onwuliri and Mgbemena, 1987; Ugwuzor 1987; Auta *et al*. 1999). Likewise, Akinsanya and Hassan (2011) recovered *P.laeviconchus* from *Parachanna obscura* in Lagos*;* Barson and Avenant –Oldewage (2006) also recovered *P.laeviconchus* from *C.gariepinus* in South Africa. The recovery of *P.*

laeviconchus from studies within and outside the country (Barson and Avenant-Oldewage, 2006; Singh *et al*. 2013) shows it is a truly transafrican 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* agrees with the findings of Ilozumba and Ezenwaji (1985). *Spirocamallanus* species was recovered from *S.batensoda* and *C.gariepinus* at a prevalence of 1.67 % and 3.22 % respectively. *Spirocamallanus* speies had also been reported in *Parachanna obscura* by Akinsanya and Hassan (2007) in Lagos and Onyedineke *et al*. (2010) from River Niger at Unshi Edo State. Azugo (1978) also recovered *Spirocamallanus* species from *Synodontis clarias.*

Neoechinorhynchus species was recovered from only the mochokids, *S.eupterus* and *S.batensoda* at a prevalence of 16.28 % and 8.33 % respectively. The finding of this parasite in *S.batensoda* agrees with the report of Eyo *et al*. (2013) where acanthocephalan *(Neoechinorhynchus prolixum)* had the highest prevalence among the parasites of *S.batensoda.* The high prevalence of acanthocephalan worms in *S.batensoda* recorded in the study is in conformity with other findings in freshwater ecosystems in tropical Africa (Khalil, 1969; 1971; Troncy and Vassilides, 1973; Douellou, 1992a). Khalil (1969) reported unidentified acanthocephalan in 60% of *S.batensoda.*

The finding of *T. niloticus* in *H.niloticus* is not new as it has been earlier reported by Ilozumba and Ezenwaji (1985) from Anambra River and Akinsanya *et al*. (2007a) from Lekki Lagoon, Lagos. This parasite could be said to be an important parasite of

H.niloticus when compared with other parasites recovered from *H.niloticus*, in terms of fisheries management in the river system. The occurence of *T.niloticus* in *M.electricus* agrees with Akinsanya *et al*. (2007b). According to the host parasite checklist of Khalil and Polling (1997), it is only *Electrotaenia malapteruri* that has been documented in *M.electricus* but Akinsanya *et al.* (2007b) made the first scientific report of *T.niloticus* in *M.electricus*stating that the occurence of *T.niloticus* in *M. electricus* is also a confirmation of the feeding habits of *M.electricus.*All acanthocephalans develop via one or more intermediate hosts. The first intermediate hosts are amphipods, isopods, copepods or ostracods (Paperna, 1996). Fish can also serve as intermediate hosts. It is of interest to note that host specificity of acanthocephalans is variable (Akinsanya *et al.* 2007b). The finding of *T.niloticus* in *S.batensoda* in this study is a new host record for the parasite.

In discussing the specificity of some of the helminths in the host, it may be pertinent to mention the influence of environmental factors on this aspect of host parasite relationship. Wisniowski (1938) was first in indicating that the character of a body of water influences and determines its parasite fauna. This concept helped to understand the patterns of distribution of parasites in environments and on theoretical ground at least, should make it possible to forecast the species of parasites to be found in any given environment. These findings were further expanded by Bauer (1962) who noted that hydrobiological and hydrochemical factors have marked influences on the development, growth and abundance of freshwater fish parasite. The above findings were summarized by Chubb (1970) who stated that specificity exists not only for the parasite to its host, but also for the host to its environment. Therefore the specificity of a parasite to its host depends not only on the host alone but also on the ecological factors that operate in the hosts' environment. In the present investigation, cases of both narrow and wide specificity were noted among the helminths recorded. Among the caryophyllaeid cestodes, the specificity of the different species of catfishes, particularly the *Synodontis* is striking. As noted by Ukoli (1972) each species of the genus *Weyonia* was found to infest a particular family of catfish. Indeed, each of the different species of *Weyonia* taken in this study was found to infest a particular species of *Synodontis* except for *W.youdeoweii* that was recovered from *S.eupterus* and *S.batensoda.*

The relationship between fish weight and helminth infection varied among the different fish species examined. *Clarias angullaris, A.occidentalis* and *C.obscura* had a significant positive correlation between fish weight and helminth infection. This means that as the weight of the fish increased, the prevalence of helminth parasite tends to increase. This is in line with the findings of Adikwu and Ibrahim (2004), Aliyu and Solomon (2012), Olumuyinwa and Olatunde (2014) who observed that the rate of infection increases with increasing fish weight in *C.gariepinus*. Oniye *et al*. (2004) reported that the increase in fish size is a reflection of increase in length and weight, which is considered as a measure of age.

Similarly, Omeji (2012) reported that big fish specimen of *A.occidentalis* had more prevalence than the small ones. This suggests that food/diet is probably responsible for the parasite load as reported by Dogiel *et al*. (1985); Oniye (2000, 2004) and Emere (2000). Similarly, Ayanda (2008) observed that infection rate was higher in sub-adults than in juveniles and this could be attributed to changes in diet from weed seeds, phyto and zooplanktons as juveniles and fishes as adulthood is attained (Reed *et al*., 1967;

Anosike *et al*. 1992). This could also be due to the fact that big fish cover wider areas in search of food than the smaller ones and as a result, they take in more food than the smaller ones and this could expose them more to infestation by parasites. This agrees with the previous reports by Ayanda (2009), Omeji *et al*. (2012) but disagrees with Tasawar (2015), Kawe *et al*. (2016) who reported higher parasite load in smaller fish than the bigger counterparts.

In this study, *S.batensoda* and *C.gariepinus* were found to have an inverse significant relationship between fish weight and helminth infection. This implies that the lighter or less weight fishes of these species examined had a higher prevalence than the heavier ones. This agrees with the findings of Akinsanya (2015) who reported that infection was more pronounced in the juveniles than adults of *S.filamentous* but contradicts the findings of Eyo *et al*. (2013) who recorded that the relationship of host weight and parasite infection was highly significant ($P \leq 0.01$) in fish of larger weight and Akinsanya *et al*. (2008) who reported that the overall worm burden was independent of fish size.

The inverse relationship that was recorded in *H.longifilis* may be as a result of the least weight class (400 – 499) that was examined unlike other species thay had least weight class as 0 – 99g. However, this may be due to random selection of the specimen.

The relationship between fish length and helminth infection as shown in the findings of the present study revealed that helminth infection varied among the fish species. That is to say, some of the fish species had a significant relationship between the length and helminth infection while others either had an inverse significant relationship or no significance at all.

Synodontis eupterus, M.electricus and *C.obscura* had a significant relationship between fish length and helminth infection. The prevalence of helminth infection increased as the length of the fishes increased. This is in line with the findings of Iyaji and Eyo (2014) and Akinsanya *et al.* (2007b) who recorded a higher infection in *M.electricus* of larger sizes. Akinsanya *et al*. (2007a) recorded that worm burden and intensity of infection in *H.niloticus* was independent of age of fish and this agrees with the result of this study which found no significant relationship between fish length of *H.niloticus* and helminthinfection.

Furthermore, an inverse significant relationship was seen to exist between fish length and helminth infection of these species; *S. batensoda, C.anguillaris, H.longifilis* and *C. gariepinus*. This implies that the smaller sized fishes of these species had more helminth infection than the larger ones. Salawu *et al*. (2013) in a comparative survey of helminth parasites of *C. gariepinus* and *C. pachynema* from Ogun River and Asejire Dam in South-West Nigeria recorded that there was no significant difference in the prevalence of parasite infection in *C. gariepinus* in relation to the host sizes ($P > 0.05$). Akinsanya *et al*. (2007b) attributed this to low level of immunity in the smaller sized fish. Lagler *et al*. (1979) reported a correlation between parasite infection and fish length which also corresponds to fish age. Also several studies affirmed positive correlations between host age / size and increase in parasitism (Betterton, 1974; Madhavi and Rukmini, 1991; Chandler *et al*. 1995; Brickle *et al*. 2003)

Generally, standard length in fish is directly related to age (Shotter, 1973) and fish body size. Poulin (2000) argued that older fish have longer time to accumulate parasites than younger ones and may provide more internal and external space for parasite establishment and therefore tend to have heavier worm burden because they eat more parasitized prey and offer large surface area for skin – attaching parasites.

The result of the findings on the microhabitat of the parasite showed that the different cestodes species namely; *Weyonia* species, *W. youdeoweii. W. synodontis,* plerocercoid larva, *P. clarias, S. sandoni* and *E. malapteruri* were all recovered from the intestine of their respective hosts. This agrees with the findings of Ezenwaji *et al.* (2005), and Akinsanya *et al.* (2007a) who recovered *S. sandoni, Weyonia youdeoweii, W.synodontis, E. malapteruri and Weyonia* speciesfrom the intestine of *H. niloticus.*The findings are as would be expected since tapeworms lack digestive track and absorb nutrients which are usually more abundant in the intestine in vertebrate using the tegument.

Owolabi (2008) recorded that the prevalence of *Polyonchobothrium* species was highest in the intestine of *S. membranaceus* and lowest in the oesophagus. Similarly, Iyaji and Eyo (2014) recovered *E. malapteruri* from the intestine of *M. electricus.* Banhawy *et al.* (1975) also recovered *Weyonia virilis* from the intestine of *S. schall.* Akinsanya *et al.* (2008) also recovered *Weyonia acuminata* from the intestine of *S. clarias.*

In all, the recovery of cestode parasites from the intestine would be attributed to lack of digestive system in cesodes and so they obligatorily depend on end product of digested food in host which is absorbed through the body surfaces, hence they are localized in the host intestine where their nutritional requirements are satisfied.

The camallanid nematode, *Procamallamus laeviconchus* was recovered from the stomach, intestine and rectum of *C.obscura* at a prevalence of 5.04 %, 84.03 % and

10.92 % respectively, implying that the intestine is the preferred microhabitat of the parasite in *C.obsura.* This could be due to the conducive nutritional advantage presented by the host's intestine to the parasites and the availability of the intermediate host, mesocyclops (a copepod) in the environment as similar findings were reported by Khalil (1969); Ugwuzor (1987) and Emere (2000). Dan- Kishiya *et al.* (2013) also affirmed that *Procamallanus* species is an intestinal worm.

The finding of the acanthocephalan, *Neoechinorhynchus* species from the intestine (73.17 %) and rectum (26.83 %) of *S.eupterus* and intestine (59.10 %) and caecum (40.91 %) of *S. batensoda* shows that the intestine is the preferred microhabitat. This agrees with Eyo *et al.* (2013) who also recovered acanthocephalus species, *N. prolixum* and *Acanthella* species from the intestine of *S. batensoda.Tenuisentis niloticus* recovered from*H. niloticus* in the anterior (16.08 %), mid (72.16 %), posterior (7.06 %) and pyloric caeca (4.71 %) shows that the mid-intestine is the preferred microhabitat of *T. niloticus* which is a common parasite of *H.niloticus.*

All other fish species from which the different species of Acanthocephala were recovered showed the intestine to be the preferred microhabitat except for *S. mystus* where the unidentified acanthocephalan was recovered from the stomach. Generally, the acanthocephalan parasites were predominathy found in the intestine of the fish species parasitized which is in conformity with the findings of Awachie (1965), Onyedineke *et al.* (2010) and Olurin and Somorin (2006) in fishes from Kainji Lake, River Niger and Owa stream respectively. This would be attributed to lack of digestive system in acanthocephalans and so they depend on end product of digested food in the host. In all, no parasite was recovered from the gills. This could be as a result of the continuous movement of water current over the gills which may not encourage establishment and survival of parasites there (Ekanem *et al.* 2011).

Only two fish species namely,*H. niloticus* and *S. batensoda* had cases of mixed infections but mostly *H. niloticus.* Multiple infections with helminth parasites in *Synodontis* species inhabiting Nigeria inland water was reported by Owolabi (2008), and other fish hosts by Ezenwaji and Ilozumba (1992), Sowemimo and Asaolu (2004), Olumuyiwa and Olatunde (2014). Owolabi (2008) also recorded eight cases of mixed infections in *S. membranaceus,* with three each occurring between *P. laeviconchus* and *Cucullanus* species and *P. laeviconchus* and *Polyonchobothrium* species, while two cases occurred between *Cucullanus* species and *Polyonchobothrium* species.

In this study, the highest prevalence (17.00 %) of mixed infection was seen between *T. niloticus* and *S. sandoni* in *H. niloticus.* This agrees with Ilozumba and Ezenwaji (1985) who recovered *T. niloticus, S. sandoni* and *Dujardinascaris* species from *H. niloticus.*

Result of seasonal variation in the prevalence of helminth infections in fish, shows that seasonal patterns of infection varied from one parasite to another. While some parasites have their highest infection rates in the dry season, others have their highest infection rates during the rainy season.

The prevalence of the cestodes, *Weyonia* species in *S. eupterus* (11.76 %), *W.youdeoweii* in *S. eupterus* (17.64 %) and *S.batensoda* (8.33 %), *W. synodontis* in *S. batensoda* (5.56 %), plerocercoid larva in *C. anguillaris*, *P. clarias* in *C.anguillaris* (20.00 %) and *C. lazera* (16.67%) and *E.malapteruri* in *M.electrius* (53.33 %) was higher in the dry season than in the rainy season. This agrees with the findings of Ezenwaji *et al*. (2005) who recorded a higher prevalence in the mochokids in the dry season than the rainy season in the same river system. Ajala and Fawole (2014) also affirmed to this assertion.

Eutrophication which occurs in the rainy season often increases parasitism because the associated increase in productivity will increase the abundance of the invertebrate intermediate hosts, mostly freshwater crustaceans (Lafferty and Kuris, 1999).Eutrophication leads to algal bloom at the peak of rainy season, which results in increase in species variety and population of the parasites intermediate host, towards the end of the rainy season. This may result in the infection of fishes that feed on them, and thus probably bring about the maturity of the parasites in the fish towards the dry season depending on the life cycle of individual parasites. Another factor may be a drop in water level in the dry season exposing the invertebrates to their fish predators and also leading to an increase in host density and greater overlap of intermediate and definitive host. Fawole and Akinsanya (2000) reported a similar prevalence of infection in *S. galilaeus* by plerocercoid larva of pseudophyllidean cestode in Opa Reservoir in lle-ife, Nigeria, and higher prevalence of infection was also recorded in the dry season than the rainy season. Higher volume of water in the rainy season brings about greater dispersion of host and parasite resulting in reduced host-parasite contact and consequently reduced prevalence.

It is noteworthy that three different species of nematode parasites, *P. laeviconchus, Dujardinascaris* species and *Spirocamallanus* species had their highest prevalence in the rainy season in their respective host species. Higher abundance of parasites during the rainy season of the year has also been observed in other studies in the tropic (Granathy and Esch. 1983; Marcogliese and Esch, 1989). This could be as a result of some factors such as abundance of the intermediate host, availability of the parasite and pollution as a result of human activities. Copepods as intermediate hosts of some parasites have been reported to be a major food constituent of the family *Synodontis* species (Owolabi, 2008).

It was also argued that higher abundance of some parasites in the dry months before the rainy season in some tropical areas could be due to an increase in host density and greater overlap of intermediate and definitive host as water bodies shrink (Ezenwaji and Ilozumba, 1992) or due to pre-spawning congregation of hosts both of which facilitate transmission.

Acanthocephalan parasites in this study also exhibited some level of seasonal variation. *T. niloticus* recorded the highest prevalence in dry season in *H. niloticus* and *M. electricus* but recoded a higher prevalence in rainy season in *S. batensoda* than in the dry season. Similar seasonal variations have also been reported (Ezenwaji and Ilozumba, 1992; Ibiwoye *et al.* 1997; 2004).

Certain physico-chemical parameters which may affect the species abundance and prevalence of parasites were reported by Omeji (2012), Hassan *et al*. (2010) and Sosanya (2002) who attributed the high prevalence of helminth parasites to pollution by human wastes, physicochemical parameters in the water body and availability of the right fish host for the parasites.

From the findings of this study, the water parameters/values were in line with the fish breeding and survival in the tropics (Boyd, 1979) as seen in table 8a and b (Appendix 7a and b). This result also shows that in the life of Platyhelminthes, in which most of the intermediate hosts are crustaceans and molluscs, the water quality also agrees to the survival and existence of such animals and this enhances the distribution and infection of the disease.

Generally, water quality is a major factor in parasite infestation. This is so because many parasites use fish as intermediate hosts for completing their life cycle. Nematodes and trematodes are common groups, which generally infest the fish either in adult or larval form. Increase in parasitic infestation occurs as a result of elevated temperatures along with organic environment of the water bodies caused by pollution and agricultural runoff which cause increase in density of intermediate hosts. The effect of environmental and physicochemical characteristics of the River on helminth parasite fauna of the fish was not obvious in the present study.

Although there were no apparent effects on the condition of the fish examined, the intestine of one specimen of *H. niloticus* infected with the acanthocephalan, *T. niloticus* appeared very reddish and also another specimen of *H. niloticus* infected with the cestode, *S. sandoni* had its liver spotted unlike others. The presence of cestodes and nematodes could result to huge losses in fish productivity as they are reported to interfere with the absorption of nutrients in the intestine of fish and may reduce food intake. The metabolites produced by some of these parasites could adversely affect vital systems of the fish (Bichi and Yelwa, 2010). Also parasitic infection of fish does reduce their productivity, as shown by studies (Onwuliri *et al*. 1989; Anosike *et al*. 1992). However, the general absence of noticeable ill effects of the helminths on the fish of this river system may be at least partly due to their somewhat low intensity of infection.

Conclusion

The present study shows that while the parasite fauna of the fish of the Anambra River system is fairly rich, the number of fish with parasitic infection of any kind and stage was on the whole not high (12.37 %). The somewhat low prevalence of parasite should be expected in a natural situation particularly in a largely flowing water environment where the fish and relevant intermediate hosts would be expected to be widely separated therefore decreasing the chances of infestation. Indeed, it can be suggested that, but for the presence of a large number of natural flood plain lakes in the area, the overall parasite incidence could have been lower. The need for further study aimed at comparing the incidence of helminthes in the river channels and floodplain lakes is thus indicated.

The present investigation revealed parasitic helminth infection of some commercially important fishes of River Anambra, but additional studies will be required before the component community of helminths infecting the fishes of Anambra River can be ascertained. It can be concluded that *S. batensoda* and *H. niloticus* are new host records for *Tenuisentis niloticus* and *P. laeviconchus* respectively while *Emoleptalea* species, is a new parasite record in Nigeria. In addition, the increased demand on fish as a source of protein should trigger further studies on fish species and their parasites to determine if there is a risk to humans by feeding on them, and also the presence of orient petroleum company at the base of the river should be a concern to document the fish and parasite fauna of the river for subsequent resultant effect of oil spillage.

Recommendations

In view of the ever-increasing demand for fish as a source of high quality animal protein, it is necessary to constantly carry out a research to determine the parasite-fauna of the different fish species in Anambra River and also to determine if there is a risk to humans by feeding on them. It is therefore expedient that public enlightenment be embarked on to educate the public on the dangers of indiscriminate waste disposal and other unhealthy human activities on the aquatic environment which may affect the health of the fish fauna as endoparasitic infections often give an indication of the water quality.

Furthermore, with Anambra River basin harbouring different schemes of intensive aquaculture and the newly incorporated Orient Petroleum Resources in the area, documentation of fish fauna of River Anambra has become something of urgent necessity for subsequent resultant effect of oil spillage. The attention of the government should also be drawn to the effect of oil spillage on aquatic organisms which are also a source of subsistence income. Finally, the researcher recommends that additional studies should be carried out before the component community of helminths infecting the fishes of river Anambra can be ascertained.

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APPENDIX 1

NSUGBE LOCATION

S/No	Date of Collection	Fish Species	Sex	Method of Catch	Weight(g)	Total Length (cm)	Standard Length(cm)	Oeso	Sto	Sto content	Sto fullness	Int	Int. length	Pyloric Geca	Rectu
1	**April** 24/04/2012	*Channa obscura*	F		200.00	30.00	25.0				0				
2	4/24/2012	***Channa obscura***	F		300.00	33.30	29.0				0	4 Nematode			
3	4/24/2012	*Channa obscura*	F		200.00	30.50	27.3				0	1 Nematode			
4	4/24/2012	*Channa obscura*	F		300.00	31.50	26.6			Nothing	0	4 Nematode			
5	4/28/2012	*Chrysichthys nigrodigitatus*	F	Net 2.5inch	1820.00	55.50	43.0				0				
6	4/28/2012	*Protopterus annectens*	M	Net	580.00	44.50	37.0				0				
7	4/28/2012	*P. annectens*	M		620.00	45.50	41.0				0				
8	4/28/2012	*H. longiphylis*	M	Net	600.00	45.50	39.0			0	0	2 Nematode			
9	4/28/2012	*H. longiphylis*	F	Net	1000.00	53.00	45.5			0	0	5 ces			
10	**May** 23/05/2012	*Alestes macrolepidotus*	M	Net	800.00	50.00	39.2								
11	5/23/2012	*Alestes macrolepidotus*	M	Net	420.00	39.30	32.8								
12	5/23/2012	*Hydrocynus brevis*	F	Net	230.00	33.50	28.2								
13	5/23/2012	*Alestes nurise*	M	Net	210.00	29.00	26.0								
14	5/23/2012	*Tilapia galileae*	F	Net	200.00	22.70	18.5								
15	5/23/2012	*Tilapia niloticus*	M	Net	200.00	23.80	20.5								
16	5/23/2012	*Synodontis sohall*	M	Net	180.00	24.50	20.5								
17	5/23/2012	*Auchinoglanis biscutatus*	M	Net	300.00	36.20	29.3			phytoplanktons	1				
18	5/23/2012	*Auchinoglanis biscutatus*	M	Net	190.00	29.90	25.6								
19	5/23/2012	*S. eupterus*	M	Net	77	18.8	14.5				4				
20	5/23/2012	*S. eupterus*	M	Net	92.8	19.3	15.4				2	2Cestode			
21	5/23/2012	*S. eupterus*	M	Net	104	20.4	16.8				2	1cestode			
22	5/23/2012	*S. eupterus*	M	Net	94.4	19.6	16.2				4		26.5		

23		5/23/2012	S. eupterus	M	Net	98.8	19.4	16.7			2		24.5
24		5/23/2012	S. batensoda	M	Net	104	22.7	16.2	2Cestode		2	Nematode(2)	62.4
25		5/23/2012	*Heterotis niloticus*	M	Net	320.7	30.2	27.1			3		60.9
26		5/23/2012	*H. niloticus*	M	Net	201.7	25.5	21			3		47.2
27		5/23/2012	*H. niloticus*	M	Net	222.2	24.8	22.5			2		46.9
28		5/23/2012	*H. niloticus*	M	Net	220.3	26.4	24.2			3		47.2
29		5/23/2012	*H. niloticus*	M	Net	103.4	21.6	19.4			3		40.2
30		5/23/2012	*G. niloticus*	M	Net	203.2	45	30.2			0		36.4
31	**June**	23/06/2012	*Alestes nurse*	F	Net/River	200.00	30.70	24.5					
32		6/23/2012	*B. occideniatis*	M	Net/River	200.00	28.50	21.5					
33		6/23/2012	*C. obscura*	F	Net/River	180.00	27.50	24.0		phytoinspets	1		
34		6/23/2012	*Synodontis sohall*	M	Net/River	220.00	27.90	22.2		Diapited materials	0.5		
35		6/23/2012	*Synodontis sohall*	M	Net/River	200.00	29.50	24.3			0.5		
36		6/23/2012	*Auchinogianis biscultatus*	M	Net/River	220.00	35.50	25.7					
37		6/23/2012	*(Orowioji) B. occideniatis*	M	Net/River	210.00	23.90	20.2					
38		6/23/2012	*S. nigrita*	M	Net/River	400.00	34.50	24.9		Grasses	1		
39		6/23/2012	*S. nigrita*	M	Net/River	300.00	39.80	27.6		Hair like material	0.5		
40		6/23/2012	*A. nurse*	M	Net/River	400.00	37.20	28.5			0		
41		6/23/2012	*A. nurse*	M	Net/River	200.00	29.20	23.5			0		
42		6/23/2012	*S. nigrita*	M	Net/River	300.00	36.50	26.8			0		
43		6/23/2012	*Distichodus brevipinnis*	M	Net/River	1000.00	41.00	34.0			0		
44		6/23/2012	*P. annectens*	M	Net/River	400.00	50.00	44.5			0		
45		6/23/2012	*C. garicpinus*	F	Net/River	300.00	29.80	31.0			0		
46	**July**	25/07/2012	*Chrysichthy nigrodigithatus*	M		800.00	34.40	31.9			0		
47		7/25/2012	*Chrysichthy nigrodigithatus*	M		520.00	39.70	29.5			0		
48		7/25/2012	*Arius heudloti*	M		400.00	37.50	29.5			0		

49		7/25/2012	*S. eupterus*	M		400.00	34.50	27.2	0			
50		7/25/2012	*S. membranaceus*	M		220.00	32.00	22.5	0			
51		7/25/2012	*Chrysichthy nigrodigithatus*	M		200.00	30.10	27.2	0			
52		7/25/2012	*Barbus occidentalis*	M		200.00	28.60	22.5			32.8	
53		7/25/2012	*A. nurse*	M		200.00	23.20	19.5			28.2	
54		7/25/2012	*A. nurse*	M		350.00	26.00	22.8	0		33.2	
55		7/25/2012	*A. nurse*	M		200.00	25.30	20.3	0			
56		7/25/2012	*C. obscura*	M		166.6	24.7	21.1	4		19.5	
57		7/25/2012	*H. niloticus*	M		98.6	21.2	16.7	2		36.5	
58		7/25/2012	*H. niloticus*	M		85.3	20.5	16.4	1		32.4	
59		7/25/2012	*H. niloticus*	M		96.4	20.4	17.6	1		31.4	
60		7/25/2012	*C. citharus*	M		70.8	16.2	12.7	0		24.3	
61		7/25/2012	*A. nurise*	M		73	16	13.5	0		15	
62		7/25/2012	*A. nurise*	M		52.5	16.2	13.5	0		15.2	
63		7/25/2012	*H. brevis*	M		55.3	16.4	13.7	0		37.5	
64		7/25/2012	*H. brevis*	M		42.7	15.7	13.2	0		36	
65		7/25/2012	*A. nurise*	M		82	21.7	16.7	2		16.4	
66		7/25/2012	*H. niloticus*	F		219.7	27.7	24.3			34.6	
67	**August**	30/08/2012	*S. nigrita*	M	Net (Aka 3) Floodplain	400.00	35.70	29.4			33.4	
68		8/30/2012	*S. nigrita*	M	Net (Aka 3) Floodplain	350.00	38.50	30.6			34.8	
69		8/30/2012	*Gymnarchus niloticus*	M	Net (Aka 3) Floodplain	400.00	56.00	50.2			49.2	
70		8/30/2012	*S. batensoda*	M	Net (Aka 3) Floodplain	200.00	26.40	19.7		1 acan	94.4	4 Acar
71		8/30/2012	*S. batensoda*	M	Net (Aka 3) Floodplain	200.00	24.70	19.2			93.2	
72		8/30/2012	*H. niloticus*	M	Net (Aka 3) Floodplain	300.00	29.00	27.0	1		44.3	
73		8/30/2012	*H. niloticus*	F	Net (Aka 3) Floodplain	213	29.5	26.3	3			
74		8/30/2012	*H. niloticus*	F	Net (Aka 3) Floodplain	234.9	28	24.6	2		42.4	
75		8/30/2012	*H. niloticus*	M	Net (Aka 3) Floodplain	103.7	21.8	19.8	2		44.5	
76		8/30/2012	*H. niloticus*	M	Net (Aka 3) Floodplain	79.2	20.4	16.3	1		35.6	

77	8/30/2012	*S. eupterus*	M	Net (Aka 3) Floodplain	64	17.2	14				26.4
78	8/30/2012	*S. eupterus*	M	Net (Aka 3) Floodplain	50	17	13.6				
79	8/30/2012	*S. eupterus*	M	Net (Aka 3) Floodplain	54.2	17.2	13.7				
80	8/30/2012	*S. batensoda*	M	Net (Aka 3) Floodplain	340.8	33.9	23.8				106.4
81	8/30/2012	*S. batensoda*	M	Net (Aka 3) Floodplain	255.8	28.5	20.4				44.4
82	8/30/2012	*S. batensoda*	M	Net (Aka 3) Floodplain	163.2	26	19.2				60.5
83	8/30/2012	*S. batensoda*	M	Net (Aka 3) Floodplain	56.1	19.2	13.5				23.2
84	8/30/2012	*S. batensoda*	M	Net (Aka 3) Floodplain	44.5	17.4	12.4				21.6
85	8/30/2012	*S. batensoda*	M	Net (Aka 3) Floodplain	38.6	14.5	11.2				52.3
86	8/30/2012	*Schilbe mystus*	M	Net (Aka 3) Floodplain	53.9	19	16.7			3	27.2
87	8/30/2012	*S. mystus*	M	Net (Aka 3) Floodplain	74.6	19.2	17			2	45.3
88	8/30/2012	*S. mystus*	M	Net (Aka 3) Floodplain	47.3	16.3	13.5			4	35.2
89	8/30/2012	*S. mystus*	M	Net (Aka 3) Floodplain	35.5	16.5	14.2			1	18
	Sept										
90	06/09/2012	*S. nigrita*	M	Net (Aka 3) Floodplain	410.00	34.60	29.0	bones		1	32.3
91	9/6/2012	*S. nigrita*	M	Net (Aka 3) Floodplain	700.00	34.80	35.4	bones		1	30.8
92	9/6/2012	*S. nigrita*	M	Net (Aka 3) Floodplain	400.00	39.00	31.0			0	30
93	9/6/2012	*H. brevis*	F	Net (Aka 3) Floodplain	200.00	30.40	25.3				21.6
94	9/6/2012	*A. macrolepidotus*	M	Net (Aka 3) Floodplain	400.00	39.30	32.0				40.4
95	9/6/2012	*D. brevipinnis*	M	Net (Aka 3) Floodplain	200.00	23.00	19.0				28.2
96	9/6/2012	*S. batensoda*	M	Net (Aka 3) Floodplain	230.00	20.80	30.4				40.4
97	9/6/2012	*C. obscura*	M	Net (Aka 3) Floodplain	440.00	33.00	28.4				9.6
98	9/6/2012	*A. nurise*	M	Net (Aka 3) Floodplain	980.00	24.20	18.5				103
99	9/6/2012	*A. nurise*	M	Net (Aka 3) Floodplain	610.00	20.40	15.5				25.6
100	9/6/2012	*H. niloticus*	M	Net (Aka 3) Floodplain	740.00	39.60	38.4				45.1
101	9/6/2012	*S. membranaceus*	F	Net (Aka 3) Floodplain	250.00	20.20	16.5				30.2
102	9/6/2012	*S. mystus*		Net (Aka 3) Floodplain	59.6	17.6	15.2		2		27.4
103	9/6/2012	*S. mystus*		Net (Aka 3) Floodplain	31.1	14	12.4				16.5
104	9/6/2012	*S. mystus*		Net (Aka 3) Floodplain	52.5	17.4	15				45.2

105	**October**	26/10/2012	*H. niloticus*	M	Net(3 inch) Grassland	700.00	38.70	21.5				4 ces, 5 nem,2 acan	34.6	4 nem
106		10/26/2012	*H. niloticus*	M	Net(3 inch) Grassland	500.00	35.80	19.7			0.5	6 cestode	64.8	
107		10/26/2012	*H. niloticus*	M	Net(3 inch) Grassland	720.00	39.00	19.2			1	2 cestode	58	
108		10/26/2012	*H. niloticus*	M	Net(3 inch) Grassland	400.00	35.00	18.2			1	11 cestode	60.2	
109		10/26/2012	*S. eupterus*	M	Net(2 inch) Grassland	180.00	22.30	12.2			0		27.8	
110		10/26/2012	*S. eupterus*	M	Net(2 inch) Grassland	180.00	19.50	12.6			0		25.6	
111		10/26/2012	*C. gariepirius*	M	Net(3inch)	350.00	34.50	14.8					41	
112		10/26/2012	*G. niloticus*	M	Net(3inch)	200.00	49.50	21.3					40.2	
113		10/26/2012	*H. niloticus*	M	Net(3inch)	400.00	34.30	18.4					30.2	
114		10/26/2012	*S. mystus*	M	Net(3inch)	32.2	16.4	13.4					24.2	
115		10/26/2012	*S. mystus*	M	Net(3inch)	52	17.7	14.8					21.2	
116		10/26/2012	*M. electricus*	M	Net(3inch)	330.5	25.5	21.3		0			34.4	
117		10/26/2012	*M. electricus*	M	Net(3inch)	362.3	28.1	23.2					36.4	
118		10/26/2012	*M. electricus*	M	Net(3inch)	432.7	30.2	25.3					33.6	
119		10/26/2012	*M. electricus*	M	Net(3inch)	368.3	27	22.5					36.7	
120		10/26/2012	*M. electricus*	M	Net(3inch)	228.2	24.3	20.4					29.1	
121		10/26/2012	*M. electricus*	M	Net(3inch)	235	23.8	20		0			35.7	
122		10/26/2012	*M. electricus*	M	Net(3inch)	265.3	25.2	20					33.6	
123		10/26/2012	*C. citharus*	M	Net(3inch)	83.7	15.7	13	0	0			31.9	
124		10/26/2012	*C. citharus*	M	Net(3inch)	75.8	16.4	12.9	0	0			30.7	
125		10/26/2012	*C. nigrodigitatus*	M	Net(3inch)	240.9	28.8	20.5	0	3			26.2	
126		10/26/2012	*C. nigrodigitatus*	M	Net(3inch)	214.5	28.2	20.2	0	0			63.5	
127		10/26/2012	*C. nigrodigitatus*	M	Net(3inch)	297.3	31.6	22.3	0	0			75.3	
128		10/26/2012	*C. nigrodigitatus*	M	Net(3inch)	335.1	31.8	23.2	0				56.5	
129		10/26/2012	*C. nigrodigitatus*	M	Net(3inch)	95	20.7	15.8	0				27.8	
130		10/26/2012	*C. nigrodigitatus*	M	Net(3inch)	65.4	20.4	15	0				19.6	
131	**Jan**	17/1/2013	*C. gariepirius*	M	Net	300.00	33.50	13.4					40	

132	1/17/2013	*S. eupterus*	M	Net	150.00	20.30	10.2				25.8
133	1/17/2013	*B. Bayad macropeterus*	M	Net	300.00	33.60	27.8				30.8
134	1/17/2013	*B. Bayad macropeterus*	M	Net	300.00	36.50	29.1				26
135	1/17/2013	*S. eupterus*	M	Net	340.00	28.10	23.0				13.8
136	1/17/2013	*S. eupterus*	M	Net	380.00	30.20	25.0				29.2
137	1/17/2013	*S. eupterus*	M	Net	200.00	28.00	23.0				11
138	1/17/2013	*C. nigrodigitatus*	M	Net	270.3	30.9	23.5	0			63.4
139	1/17/2013	*C. nigrodigitatus*	M	Net	56.8	19.4	14.2	0			32.8
140	1/17/2013	*C. citharus*	M	Net	66.5	16.2	11.5	0	0	0	30.5
141	1/17/2013	*D. brevipinnis*	M	Net	171.8	23.7	18.6	0	0	0	37.8
142	1/17/2013	*D. brevipinnis*	M	Net	91.1	19.7	15.7	0	0	0	24.6
143	1/17/2013	*D. brevipinnis*	M	Net	143.9	23.6	18.4	0			36.6
144	1/17/2013	*Tilapia nilotica*	M	Net	81.9	15.3	12.6	0			
145	1/17/2013	*Tilapia nilotica*	M	Net	76.7	15.2	12.4	0			
146	1/17/2013	*S. mystus*	M	Net	76	19	15.5	0			24.2
147	1/17/2013	*Tilapia zilli*	F	Net	132	17.2	13.8	0			
148	1/17/2013	*Tilapia nilotica*	F	Net	51.4	13.5	10.6	0			
149	1/17/2013	*S. baterisoda*	M	Net	238.5	26.1	19.5	0		4	105.6
150	1/17/2013	*C. obscura*	F	Net	247.8	29.4	25.5	0		0	
151	1/17/2013	*S. sorex*	M	Net	123.4	24.2	16.7	0		0	34.8
152	1/17/2013	*S. sorex*	M	Net	115	24.6	15.7	0		0	49.3
153	1/17/2013	*A. occidentalis*	M	Net	56.3	17	14	0		0	24.2
154	1/17/2013	*A. occidentalis*	M	Net	79	19.2	15.4	0		0	26.7
155	1/17/2013	*A. occidentalis*	M	Net	36.7	14.9	12.2	0		0	19.2
156	1/17/2013	*C. submarginotus*	F	Net	46.9	41.6	38.2	0		0	34.6
157	1/17/2013	*S. batensoda*	F	Net	138.4	23.5	16.5	0		0	35.2
158	1/17/2013	*S. batensoda*	F	Net	65.3	19.7	13.2	0		0	36.1
159	1/17/2013	*S. batensoda*	M	Net	90.7	18.6	15.2	0		0	18.6
160	1/17/2013	*L. cubeo*	M	Net	163.7	24	18.5	0		0	

161		1/17/2013	*L. cubeo*	M	Net	155.4	24.5	17.8		0	0		
162		1/17/2013	*L. cubeo*	M	Net	214.1	28	20.4		0	0		
163		1/17/2013	*D. brevipinnis*	M	Net	103.1	20	16.7		0	0		19.6
164		1/17/2013	*D. brevipinnis*	M	Net	91.6	18.8	16		0			19.2
165		1/17/2013	*S. batensoda*	M	Net	72	19.4	14.2				1 Nematode	26.3
166		1/17/2013	*S. sorex*	M	Net	83.4	20.4	14.2					26.7
167		1/17/2013	*S. sorex*	M	Net	40.9	16.4	12		0			19.8
168		1/17/2013	*B. bayad M.*	M	Net	125.3	30.5	22					19.2
169		1/17/2013	*D. brevipinnis*	M	Net	67	17.5	14		0			18.4
170		1/17/2013	*S. sorex*	M	Net	45.6	17.5	12		0			34.6
171		1/17/2013	*D. brevipinnis*	M	Net	61.8	16.8	13.5		0			19
172		1/17/2013	*B. domac Nigis*	M	Net	42.8	19	14.1					15.1
173		1/17/2013	*C. anguillaris*	M	Net	219.4	30.9	28.1				1 cestode	30.8
174	**Feb**	12/02/2013	*C. gariepinus*	M	Net	200.00	30.00	27.1	11				
175		2/12/2013	*P. annectens*	M	Net	540.00	44.20	37.0	19				
176		2/12/2013	*P. annectens*	M	Net	500.00	44.10	36.0	18				
177		2/12/2013	*A. biscutatus*	M	Net	300.00	36.20	29.0	19				
178		2/12/2013	*C. obscura*	M	Net	300.00	31.50	26.6	14				
179		2/12/2013	*C. obscura*	M	Net	200.00	30.00	25.0	140				
180		2/12/2013	*C. obscura*	M	Net	300.00	33.30	29.0	15				
181		2/12/2013	*H. niloticus*	M	Net	520.00	40.80	31.3	34				
182		2/12/2013	*H. niloticus*	M	Net	400.00	39.20	29.0	28				
183		2/12/2013	*M. Electricus*	M	Net	400.00	29.80	24.2	28				
187		2/12/2013	*H. niloticus*	M	Net	228.3	28.6	25.6					43.4
188		2/12/2013	*H. niloticus*	M	Net	97.8	20.8	18.2					40.6
189		2/12/2013	*D. brevipinnis*	M	Net	108.1	20.4	16.3					46.4
190		2/12/2013	*D. brevipinnis*	M	Net	74.9	18.4	15					
191		2/12/2013	*A. nurise*	M	Net	98.5	24.2	18.5					

192		2/12/2013	*A. occidentalis*	M	Net	79.1	17.7	14.3			26.4	
193		2/12/2013	*B. bayad Macropterus*	M	Net	51.1	23	16.5			15	
194		2/12/2013	*Gnathonemus cyprinoides*	M	Net	29	13.9	13.3			13.3	
195		2/12/2013	*G. Cyprinoides*	M	Net	54.9	17.4	15.3			10.3	
196		2/12/2013	*A. macrolopidotus*	M	Net	36.2	14.7	12.4				
197		2/12/2013	*C. submarginotus*	M	Net	60.1	19.5	17.2			15.8	
198		2/12/2013	*H. bebe occidentalis*	M	Net	60.6	17.7	13.7	0		28.4	
199		2/12/2013	*H. bebe occidentalis*	M	Net	58.3	20.8	18.6	0		26.5	
200		2/12/2013	*G. cyprinoides*	M	Net	32	15	13.2	2		14	
201		2/12/2013	*G. cyprinoides*	M	Net	45.9	16.4	14	2		16.7	
202		2/12/2013	*S. mystus*	M	Net	30.3	14.4	13	0		17.3	
203		2/12/2013	*G. Cyprinoides*	M	Net	30.9	15.5	13.5	2		12.3	
204		2/12/2013	*C. citharus*	M	Net	34.8	13	10.3			14.1	
205		2/12/2013	*G. Cyprinoides*	M	Net	25.5	13.7	13.2	2		12.6	
206		2/12/2013	*G. pictus*	M	Net	19.9	12	11.5			12	
207		2/12/2013	*A. nurise*	M	Net	39.4	16	13	2			
208	**March**	15/03/2013	*H. niloticus*	M	Net(4inch)	1000	44.40	39.6	1	15 Acan	43.1	1 acan
209		3/15/2013	*H. niloticus*	M	Net(4inch)	920	43.00	38.5		6 acan	40.3	
210		3/15/2013	*H. niloticus*	M	Net(4inch)	600	39.40	35.2		17 acan	45.6	1 acan
211		3/15/2013	*A. biscutatus*	M	River hook no 10	520	40.90	31.5			33.8	
212		3/15/2013	*A. biscutatus*	M	River net (3inch)	400	39.20	29.0			32.6	
213		3/15/2013	*C. Obscura*	M	Draining (okwukwo method)	400	33.60	30.4		13 nem		
214		3/15/2013	*G. Cyprinoides*	M	River net (3inch)	20.4	13.5	12	0			
215		3/15/2013	*T. zilli*	M	River net (3inch)	15.1	9.7	8	0			
216		3/15/2013	*H. niloticus*	M	River net (3inch)	176.3	25.5	22.4	2		38.2	
217		3/15/2013	*H. niloticus*	M	River net (3inch)	133.4	23.1	20.5	2		37.9	
218		3/15/2013	*H. niloticus*	M	River net (3inch)	119.7	22.6	20.5	2		34.6	
219		3/15/2013	*H. niloticus*	M	River net (3inch)	129.9	23.6	21	2		34	

220		3/15/2013	*H. niloticus*	M	River net (3inch)	150	23.6	21	2		34.2
221		3/15/2013	*H. niloticus*	M	River net (3inch)	154.7	24.7	21.6	2		37.5
222		3/15/2013	*H. niloticus*	M	River net (3inch)	88.1	20.3	18.4	2		27.8
223		3/15/2013	*H. niloticus*	M	River net (3inch)	92	21.3	18.7	2		28.2
224		3/15/2013	*D. brevipinnis*	M	River net (3inch)	130.7	22.6	17.6	3		52.6
225		3/15/2013	*H. niloticus*	M	River net (3inch)	114.3	22.7	20.3	2		34.5
226		3/15/2013	*P. annectens*	M	River net (3inch)	170.4	36.2	30	1		13.5
227		3/15/2013	*P. annectens*	M	River net (3inch)	248.3	37	31.2	1		15.6
228		3/15/2013	*P. annectens*	M	River net (3inch)	212.5	37.8	32	1	2 nematode	16.8
229		3/15/2013	*P. annectens*	M	River net (3inch)	216.9	35.6	30.7	1	2 nematode	16.1
230		3/15/2013	*P. annectens*	M	River net (3inch)	209.6	36.8	31	0		15
231		3/15/2013	*C. obscura*	M	River net (3inch)	300.3	30.3	26.3	0		28.7
232		3/15/2013	*A. nurise*	M	River net (3inch)	82.3	22.4	17.4	0		17.2
233		3/15/2013	*P. annectens*	F	River net (3inch)	153	34.5	31	0		16.1
234		3/15/2013	*H. niloticus*	F	River net (3inch)	97.8	20.4	18.3	0		32.6
235		3/15/2013	*D. brevipinnis*	F	River net (3inch)	123.1	21.5	17.3	0		50.6
236		3/15/2013	*D. brevipinnis*	M	River net (3inch)	61.6	17.5	14	0		46.4
237											
238	**APRIL**	10/04/2013	*C. anguillaris*	M	River/Net	400	34.60	31.0			22
239		4/10/2013	*C. citharinus*	M	River/Net	200	17.50	15.0			34
240		4/10/2013	*I. niloticus*	M	River/Net	200	16.40	14.8			34
241		4/10/2013	*A.macrolepidotus*	M	River/Net	800	48.00	37.2			50
242		4/10/2013	*L. cubeo*	M	River/Net	210	29.00	26.0			18.4
243		4/10/2013	*A. Heudelotii*	M	River/Net	500	43.50	36.0			18
244		4/10/2013	*P. annectens*	M	River/Net	620	45.50	41.0			21
245	10/04/2013		*C.obscura*	M	River/Net	210	29.00	25.1			7.2
246		4/10/2013	*C.obscura*	M	River/Net	600	45.20	33.7			12.6
247		4/10/2013	*C.obscura*	M	River/Net	400	30.00	27.4			9.5
248		4/10/2013	*C.obscura*	M	River/Net	200	28.00	25.4			7.5

249	10/04/2013		*P. annectens*	M	River/Net	400	45.40	42.2			18.8
250		4/10/2013	*P. annectens*	M	River/Net	600	46.80	44.0			22
251		4/10/2013	*T.galilae*	M	River/Net	210	22.70	18.5			49.5
252		4/10/2013	*C. citharus*	M	River/Net	200	20.50	17.0			50.8
253	10/04/2013		*C. citharus*	M	River/Net	200	22.60	18.4			50.5
254	10/04/2013		*C. citharus*	M	River/Net	102.5	18.6	14.3		0	22.4
255	10/04/2013		*C. citharus*	M	River/Net	74.7	16.5	13.5		0	21.2
256	10/04/2013		*C. citharus*	M	River/Net	65.4	16.8	13.4		0	21.3
257	10/04/2013		*A. nurise*	M	River/Net	59.9	16.4	13.9		0	15.2
258	10/04/2013		*Claris lazera*	M	River/Net	470.6	42	37.2		0	45.5
259	10/04/2013		*Labeo coubie*	M	River/Net	129.1	24	18.5		0	
260	10/04/2013		*Labeo coubie*	M	River/Net	94.8	21.3	16		0	
261	10/04/2013		*A. occidentalis*	M	River/Net	87.6	19.4	15		2	23.6
262	10/04/2013		*A. occidentalis*	M	River/Net	60.1	18	14.5		2	23.1
263	10/04/2013		*A. occidentalis*	M	River/Net	16.5	14.1	23.2	2		49.7
264	10/04/2013		*S. baterisoda*	M	River/Net	17.4	12.2	55.8	0		54.8
265	10/04/2013		*D. brevipinnis*	M	River/Net	18.7	14.8				84
266	10/04/2013		*G. Cyprinoides*	M	River/Net	15.9	14.2	10.5	2		41.8
267	10/04/2013		*G. Cyprinoides*	M	River/Net	17.8	16	11.2	2		50.5
268	10/04/2013		*G. Cyprinoides*	M	River/Net	18.7	16.5	15.8	2		65.2
269	10/04/2013		*G. cyprinoides*	M	River/Net	14.2	12.2	13.1	1		33.9
270	10/04/2013		*Clarias anguillaris*	M	River/Net	20.5	18.8	12.5			62.1
271	10/04/2013		*Tilapia zilli*	M	River/Net	13	10.1				50.9

272		10/04/2013	*Hepetus odoe*	M	River/Net	21.1	16.9	14.6			60.8
273		10/04/2013	*S. clarias*	M	River/Net	17	12.2	23.6			51.9
274	**May**	01/05/2013	*S. membranaceus*	M	River Net (3inch)	400	25.80	22.5			
275		5/1/2013	*S. nigrita*	M	River Net (3inch)	720	48.20	37.7			
276		5/1/2013	*H. niloticus*	M	Engine & hand	400	32.80	31.2			
277		5/1/2013	*C. citharus*	M	River Net (3inch)	300	26.20	19.3			
278		5/1/2013	*I. niloticus*	M	River Net (2inch)	200	17.50	15.0			
279		5/1/2013	*C. nigrodigitatus*	M	River Net (3inch)	520	36.80	29.4			
280		5/1/2013	*H. longigilis*	M	Natural pond Engine/hnd	1000	53.20	47.2			
281		5/1/2013	*H. longigilis*	M	River Net (3inch)	380	39.40	34.3			
282		5/1/2013	*C. anguillaris*	M	River Net (3inch)	400	34.60	31.3			
283		5/1/2013	*Clarotes laticops*	M	River Net (3inch)	16.5	12.8		0	0	51.5
284		5/1/2013	*Tilapia nilotica*	M	River Net (3inch)	14.7	11.8	91.5	0	0	68.4
285		5/1/2013	*Tilapia nilotica*	F	River Net (3inch)	14.6	11.5	91	0	0	62.4
286		5/1/2013	*T. nilotica*	M	River Net (3inch)	15.4	12.3	110.4	0	0	85.6
287		5/1/2013	*C. citharus*	F	River Net (3inch)	16.7	14.2	112	0	0	83.6
288		5/1/2013	*C. citharus*	M	River Net (3inch)	22.4	17	118.4	0	0	158
289		5/1/2013	*C. citharus*	M	River Net (3inch)	14.3	10.6	78.4	0	0	48.5
290		5/1/2013	*C. citharus*	M	River Net (3inch)	22.1	16.6	110.6	0	0	153.3
291		5/1/2013	*C. citharus*	M	River Net (3inch)	20.2	15.3	112.7	0	0	105.3
292		5/1/2013	*C. citharus*	M	River Net (3inch)	16	12.3	95.4	0	0	54.6
293		5/1/2013	*C. citharus*	M	River Net (3inch)	14.4	10.6		0	0	36.9
294		5/1/2013	*C. citharus*	M	River Net (3inch)	17	12.5		0	0	74.4
295		5/1/2013	*C. citharus*	M	River Net (3inch)	13.4	9.6		0	0	39.7
296		5/1/2013	*C. citharus*	F	River Net (3inch)	11.5	9.5		0	0	30
297		5/1/2013	*C. citharus*	M	River Net (3inch)	14.6	11.5		0	0	38.4
298		5/1/2013	*C. citharus*	M	River Net (3inch)	15.8	12.3		0	0	45.9
299		5/1/2013	*H. niloticus*	M	River Net (3inch)	36.5	33.2	51.6	Sandgrains	3	522.4

300		5/1/2013	*H. niloticus*	M	River Net (3inch)	31.6	28.8	46.3		3		334.5
301		5/1/2013	*H. niloticus*	M	River Net (3inch)	34	30.4	53.7		3		420.5
302		5/1/2013	*H. niloticus*	M	River Net (3inch)	27.6	25.2	43.7		3		237.1
303		5/1/2013	*H. niloticus*	M	River Net (3inch)	25	22.5	33.5		3		156.1
304		5/1/2013	*H. niloticus*	M	River Net (3inch)	24	27.3	34.6		3		146.3
305		5/1/2013	*G. niloticus*	M	River Net (3inch)	43.2	36	24.3		3		183.5
306		5/1/2013	*G. niloticus*	M	River Net (3inch)	37	32.5	22		3		152.3
307		5/1/2013	*H. niloticus*	M	River Net (3inch)	24.6	22.3	38.2		3		151.4
308		5/1/2013	*H. niloticus*	M	River Net (3inch)	24.5	22	34.2		3		152.6
309		5/1/2013	*H. niloticus*	M	River Net (3inch)	22.4	19	33.6				112.8
310		5/1/2013	*H. niloticus*	M	River Net (3inch)	22.3	19.5	33.4		3		120.7
311		5/1/2013	*C. citharus*	F	River Net (3inch)	16.3	13.5	92.1	0	0		73.5
312		5/1/2013	*C. citharus*	F	River Net (3inch)	16.3	12.3	86.4	0	0		54.9
313		5/1/2013	*C. nigrodigitatus*	M		80	27.60	24.9			1 acan	38.4
314	**June**	06/06/2013	*C. citharus*	M	River Net(3inch)	200	24.90	19.3				23.6
315		6/6/2013	*C. citharus*	M	River Net(3inch)	200	23.50	18.5				
316		6/6/2013	*C. citharus*	M	River Net(3inch)	300	24.10	19.2				
317		6/6/2013	*C. citharus*	M	River Net(3inch)	200	22.00	17.6				
318		6/6/2013	*B. occidenlalis*	M	River Net(3inch)	230	26.00	21.1				
319		6/6/2013	*B. occidenlalis*	M	River Net(3inch)	200	26.60	20.9				
320		6/6/2013	*B. occidenlalis*	M	River Net(3inch)	200	24.50	19.5				
321		6/6/2013	*L. Cubeo*	M	River Net(3inch)	600	36.70	28.3				
322		6/6/2013		M	River Net(3inch)	200	25.60	17.6				45.5
323		6/6/2013	*S. eupterus*	M	River Net	200	23.90	18.7				
324		6/6/2013	*S. nigrita*	M	River Net	800	47.90	36.5				31.8
325		6/6/2013	*S. nigrita*	M	River/Net	400	39.00	31.8				30
326		6/6/2013	*C. nigrodigitatus*	M	River/Net	200	31.90	24.0				
327		6/6/2013	*C. nigrodigitatus*	M	River/Net	200	31.60	23.8				
328		6/6/2013	*C. nigrodigitatus*	M	River/Net	400	41.10	28.9				

329		6/6/2013	*C. anguillaris*	M	River/Net	200	31.20	27.5					20.5
330		6/6/2013	*D. brevipinnis*	M	River/Net	29	24	84.6	0	0			345.5
331		6/6/2013	*D. brevipinnis*	M	River/Net	22.4	17.3	72.5	0	0			135.1
332		6/6/2013	*D. rostratus*	M	River/Net	18.7	15.2		0	0			99.6
333		6/6/2013	*D. rostratus*	M	River/Net	19.2	15.5		0	0			94.4
334		6/6/2013	*D. brevipinnis*	M	River/Net	20	16.7	57.3	weeds	3			136
335		6/6/2013	*D. rostratus*	M	River/Net	24	19.7						200.3
336		6/6/2013	*D. brevipinnis*	M	River/Net	19.2	15.5						88.4
337		6/6/2013	*D. rostratus*	M	River/Net	15.8	13.8						45.5
338		6/6/2013	*Papyrocranus afer*	M	River/Net	25	24.2	8.2					90.4
339		6/6/2013	*Papyrocranus afer*	M	River/Net	22.7	21.4	7					58.8
340		6/6/2013	*S. baterisoda*	M	River/Net	21	15.2	62.4					94.2
341		6/6/2013	*S. mystus*	M	River/Net	14.4	12	8.7					29.6
342		6/6/2013	*C. obscura*	M	River/Net	25.2	21	17.9					203.4
343		6/6/2013	*C. citharus*	M	River/Net	13.5	11.4						34.3
344		6/6/2013	*Barbus occidentalis*	M	River/Net	25.2	19.4						157.1
345		6/6/2013	*S. nigrita*	M	River/Net	300	38.8	26.6					189.8
346		6/6/2013	*A. nurise*	M	River/Net	20.4	15.5	25.6					61.6
347		6/6/2013	*Barbus occidentalis*	M	River/Net	18.8	15.5						59.8
348		6/6/2013	*A. nurise*	M	River/Net	15.7	13.3	24					58.8
349		6/6/2013	*T. zilli*	M	River/Net	13.6	12.2						58
350		6/6/2013	*Clarias anguillaris*	M	River/Net	26.2	23	29.2				1 cestode	161.3
351		6/6/2013	*A. occidentalis*	M	River/Net	21	16.4	30.2				5 cestode	118.5
352		6/6/2013	*A. occidentalis*	M	River/Net	16.4	14.3	27.6		2			78.5
353		6/6/2013	*A. occidentalis*	M	River/Net	22.3	17.6	30.8		2			136.7
354		6/6/2013	*A. occidentalis*	M	River/Net	22.5	16.4	32.4		2			142
			JULY TO OCTOBER: PERIOD OF IJI										
355	**Nov**	13/11/2013	*S. batensoda*	F	River/Net	200	20.90	15.2			1		40.2
356		11/13/2013	*S. batensoda*	M	River/Net	200	22.30	16.8			1		26.3

357	11/13/2013	*S. batensoda*	M	River/Net	200	22.00	16.7		1		63.2
358	11/13/2013	*S. batensoda*	M	River/Net	200	17.50	23.4		1		50.5
359	11/13/2013	*S. batensoda*	F	River/Net	200	20.80	16.1		1		59.2
360	11/13/2013	*S. batensoda*	F	River/Net	200	21.20	15.5		1	6 nematode	53.2
361	11/13/2013	*S. batensoda*	M	River/Net	200	23.30	17.4		1		43.3
362	11/13/2013	*S. batensoda*	F	River/Net	200	22.40	15.5		1		66.2
363	11/13/2013	*S. batensoda*	M	River/Net	200	21.90	16.2		1		53.3
364	11/13/2013	*S. nigrita*	M	River/Net	200	40.40	26.5		1		28.2
365	11/14/2013	*S. eupterus*	M	River/Net 3inch	300	28.20	23.6		1		36.7
366	11/14/2013	*S. eupterus*	M	River/Net 3inch	380	30.50	25.8				29.2
367	11/14/2013	*S. eupterus*	M	River/Net 3inch	350	28.90	23.5				13.8
368	11/14/2013	*S. eupterus*	M	River/Net 3inch	200	28.00	23.0				12.9
369	11/14/2013	*A. occidentalis*	M	River/Net 3inch	19.5	15.7	28.1	2			102.8
370	11/14/2013	*C. citharus*	M	River/Net 3inch	20.4	16.2	34				130.4
371	11/14/2013	*C. citharus*	M	River/Net 3inch	16.7	13.7	31.6				115.9
372	11/14/2013	*D. brevipinnis*	M	River/Net 3inch	23.8	16.2	35.8				159.7
373	11/14/2013	*Mormyrus rume*	M	River/Net 3inch	27.2	24	18				136.9
374	11/14/2013	*Hyperopisus bebe occidentalis*	M	River/Net 3inch	26	23	18	3			121.2
375	11/14/2013	*H. bebe occidentalis*	M	River/Net 3inch	25.5	23.4	19.6				116.5
376	11/14/2013	*G. niloticus*	M	River/Net 3inch	33.2	27.2	16.3				71.7
377	11/14/2013	*H. niloticus*	M	River/Net 3inch	28.5	25.6	43.2				275.9
378	11/14/2013	*H. niloticus*	M	River/Net 3inch	25.4	23.2	40.1	3			224.9
379	11/14/2013	*H. niloticus*	M	River/Net 3inch	30.4	27	49.2	3			323.7
380	11/14/2013	*H. niloticus*	M	River/Net 3inch	28.8	25.3	41.6	3			256.6
381	11/14/2013	*H. niloticus*	M	River/Net 3inch	30.4	28.2	51.5	3			352.6
382	11/14/2013	*H. niloticus*	M	River/Net 3inch	23.4	20.2	38.7	3			144.3
383	11/14/2013	*H. niloticus*	M	River/Net 3inch	19.7	17	28.5	3			82.9
384	11/14/2013	*H. niloticus*	M	River/Net 3inch	29.4	26.4	43.6	3			248.6
385	11/14/2013	*H. niloticus*	M	River/Net 3inch	38	33.5	64.2	3			720.3

386		11/14/2013	*H. niloticus*	M	River/Net 3inch	43.4	39.5	69.8	3		1004
387		11/14/2013	*H. niloticus*	M	River/Net 3inch	21.4	18.8	34.5	3		106.3
388		11/14/2013	*H. niloticus*	M	River/Net 3inch	25.4	22.5	40.9	3		170.9
389	**Dec**	17/12/2013	*S. eupterus*	M	River/Net	300	28.00	23.6			36.7
390		12/17/2013	*S. batensoda*	M	River/Net	290	21.60	18.0		12	35
391		12/17/2013	*S. batensoda*	M	River/Net	280	21.00	16.7			34.6
392		12/17/2013	*C. obscura*	M	River/Net	200	29.40	25.0			7.5
393		12/17/2013	*C. obscura*	M	River/Net	350	33.00	28.4		5	9.6
394		12/17/2013	*C. nigrodigitatus*	M	River/Net	400	41.00	28.4			44
395		12/17/2013	*S. eupterus*	M	River/Net	200	23.50	18.6			20.4
396		12/17/2013	*C. obscura*	M	River/Net	400	29.00	23.5			6.3
397		12/17/2013	*C. nigrodigitatus*	M	River/Net	200	31.60	24.1			34
398		12/17/2013	*C. obscura*	M	River/Net	200	26.70	23.3			7.3
399		12/17/2013	*H. niloticus*	M	River/Net	23	21.2	35.6	3		162.8
400		12/17/2013	*H. niloticus*	M	River/Net	24.6	21.8	43.4	3		169.4
401		12/17/2013	*H. niloticus*	M	River/Net	24.9	22	40.5	3		177.8
402		12/17/2013	*H. niloticus*	M	River/Net	20.7	16.2	49.4	3		128.5
403		12/17/2013	*H. niloticus*	M	River/Net	24.6	21.6	30.5	3		176.6
404		12/17/2013	*H. niloticus*	M	River/Net	25.4	22.4	30.4	3		179.6
405		12/17/2013	*H. niloticus*	M	River/Net	29.3	26	42.8	3		317.1
406		12/17/2013	*P. annectens*	M	River/Net	41	40.6	20.5	3		338
407		12/17/2013	*G. niloticus*	M	River/Net	38.5	34.8				153.7
408		12/17/2013	*G. niloticus*	M	River/Net	47.4	40.2	30.2			312.1
409		12/17/2013	*G. niloticus*	M	River/Net	53	45.2	51.8			408.5
410		12/17/2013	*P. annectens*	M	River/Net	40.1	40	16.2			278.3
411		12/17/2013	*D. brevipinnis*	M	River/Net	23	16.5				146.2
412		12/17/2013	*H. niloticus*	M	River/Net	43	38	62.4			1147
413		12/17/2013	*Synodntis eupterus*	M	River/Net	11.9	9.5				25.2

414		12/17/2013	*Clarias lazera*	M	River/Net	17.5	16	8.5		33
415		12/17/2013	*C. lazera*	M	River/Net	19.6	18.8	10.2		42.4
416		12/17/2013	*P. annectens*	M	River/Net	31.2	29.4	14.2		174.3
417		12/17/2013	*P. annectens*	M	River/Net	37.4	35.2	16.5		197.4
418		12/17/2013	*P. annectens*	M	River/Net	37.8	34.1	16.5		200.8
419		12/17/2013	*P. annectens*	M	River/Net	30.4	27.2	13.5		107.6
420		12/17/2013	*P. annectens*	M	River/Net	28	27	11.8		100.6
421		12/17/2013	*S. nigrita*			400	35.50	25.6		
422		12/17/2013	*B. domac niger*			42	18.00	13.2		14.3
423	**Jan**	10/01/2014	*C. gariepinus*	M	River/Net	350	34.00	14.8		40
424		1/10/2014	*H. niloticus*	M	River/Net	400	36.00	33.2		64
425		1/10/2014	*P. afer*	M	River/Net	160	26.30	23.2		9.4
426		1/10/2014	*P. afer*	M	River/Net	160	26.50	23.6		8.2
427		1/10/2014	*C. auratus longifilis*	M	River/Net	300	30.40	27.0		
428		1/10/2014	*C. auratus longifilis*	M	River/Net	250	28.60	24.5		
429		1/10/2014	*P. annectens*	M	River/Net	32.4	29.7	13.4		152
430		1/10/2014	*D. brevipinnis*	M	River/Net	24.6	20.5	33.4	3	22.3
431		1/10/2014	*D. brevipinnis*	M	River/Net	24	20	32.1	0	20
432		1/10/2014	*D. brevipinnis*	M	River/Net	22.5	19.6	31.4		21.6
433		1/10/2014	*D. brevipinnis*	M	River/Net	23.5	19.5	31.4		15.4
434		1/10/2014	*D. brevipinnis*	M	River/Net	20.3	16.7	25.2		16
435		1/10/2014	*D. brevipinnis*	M	River/Net	16.4	13.3	15		
436		1/10/2014	*D. brevipinnis*	M	River/Net	16.2	13.2	17.2		
437		1/10/2014	*M. electricus*	M	River/Net	14.5	12.5	15.1		52.7
438		1/10/2014	*H. niloticus*	M	River/Net	19.7	17.2	21.8		99
439		1/10/2014	*H. niloticus*	M	River/Net	20.9	16.1	28.5		100
440		1/10/2014	*S. mystus*	M	River/Net	19.4	17.4	22.8		55.7
441		1/10/2014	*S. mystus*	M	River/Net	21.3	17.8	27.2		88.5

442		1/10/2014	*S. mystus*	M	River/Net	22.3	19.7	27.1	94.8
443		1/10/2014	*S. mystus*	M	River/Net	17.8	15.5	20.5	59.5
444		1/10/2014	*S. mystus*	M	River/Net	17.8	15.6	20.2	45.5
445		1/10/2014	*Clarotes laticeps*	M	River/Net	3	17.6	29.8	118.9
446		1/10/2014	*C. laticeps*	M	River/Net	14	11.6	20.5	34.7
447		1/10/2014	*C. laticeps*	M	River/Net	19	15	35.2	80
448		1/10/2014	*D. rostratus*		"	95.4	16.70	13.4	
449		1/10/2014	*D. rostratus*		"	94.2	19.00	15.1	
450		1/10/2014	*D. rostratus*		"	45.3	15.8	13.6	
451		1/10/2014	*D. rostratus*		"	200.2	24.00	19.0	
452		1/10/2014	*L. cubeo*			212.2	28.20	20.2	
453		1/10/2014	*L. cubeo*			500	35.70	28.0	
454	**Feb**	12/02/2014	*C. gariepinus*	M	River/Net	200	30.20	27.0	36
455		2/12/2014	*C. anguillaris*	M	River/Net	200	31.20	27.5	20.5
456		2/12/2014	*H. longifilis*	M	River/Net	600	45.30	39.0	24.5
457		2/12/2014	*A. biscutatus*	M	River/Net	300	36.20	29.0	20.5
458		2/12/2014	*C. obscura*	M	River/Net	520	28.50	24.0	7.2
459		2/12/2014	*C. obscura*	M	River/Net	410	30.00	25.0	10
460		2/12/2014	*H. longigilis*	M	River/Net	1000	53.00	46.2	34.1
461		2/12/2014	*G. niloticus*	M	River/Net	200	30.60	26.4	18
462		2/12/2014	*C. laticeps*	M	River/Net	18	14.2	28	60
463		2/12/2014	*C. laticeps*	M	River/Net	18.8	15.4	24.1	79.6
464		2/12/2014	*C. laticeps*	M	River/Net	12.4	10.2	18	22.5
465		2/12/2014	*B. bayad Macropterus*	M	River/Net	31.6	22.4	23.5	136.9
466		2/12/2014	*B. bayad Macropterus*	M	River/Net	32.4	24.6	23.4	178.7
467		2/12/2014	*B. bayad Macropterus*	M	River/Net	28	19.2	21	89.5
468		2/12/2014	*B. bayad Macropterus*	M	River/Net	30.5	21.8	20.8	147.6
469		2/12/2014	*B. bayad Macropterus*	M	River/Net	27.5	16.5	13	82
470		2/12/2014	*B. bayad macropterus*	M	River/Net	26	16	15.5	70.2

471		2/12/2014	*B. bayad macropterus*	M	River/Net	24.7	17.2	15.6		59.2
472		2/12/2014	*B. bayad Macropterus*	M	River/Net	28.5	20.4	15.8		108.9
473		2/12/2014	*B. bayad Macropterus*	M	River/Net	24.4	16.4	19.4		84.1
474		2/12/2014	*B. bayad Macropterus*	M	River/Net	22.6	16.2	14.2		56.9
475		2/12/2014	*S. mystus*	M	River/Net	21.5	17.8	20.1		96.3
476		2/12/2014	*S. mystus*	M	River/Net	10.8	10	13.3		15.1
477	**March**	25/03/2014	*B. bayad macropterus*	M	River/Hook	600	53.20	38.3	1	47.3
478		3/25/2014	*C. obscura*	M	Natural pond/draining	600	39.70	33.7	0	12.6
479		3/25/2014	*C. obscura*	M	Natural pond/draining	200	29.50	25.3	0	7.5
480		3/25/2014	*C. obscura*	F	Natural pond/draining	350	33.00	28.4	0	9.6
481		3/25/2014	*C. obscura*	F	Natural pond/draining	200	28.00	25.4	0	7.5
482		3/25/2014	*C. obscura*	M	Natural pond/draining	200	26.70	23.3	0	7.3
483		3/25/2014	*C. anguillaris*	M	River/1.5 net	400	40.70	35.8	0	11.2
484		3/25/2014	*C. obscura*	M	River/1.5 net	200	29.10	24.6	0	6.2
485		3/25/2014	*C. obscura*	M	River/1.5 net	200	28.50	23.5	0	6.3
486		3/25/2014	*P. annoctens*	F	Natural pond/draining	400	46.40	43.2	0	19.8
487		3/25/2014	*P. annectens*	F	Natural pond/draining	600	47.80	44.0	0.5	20.6
488		3/25/2014	*C. laticeps*	F	Natural pond/draining	14.6	11.5	15		31.1
489		3/25/2014	*C. laticeps*	F	Natural pond/draining	12.7	9.7	14.1		21.2
490		3/25/2014	*C. laticeps*	F	Natural pond/draining	12.6	9.4	14.2		19.4
491		3/25/2014	*B. bayad M.*	M	Natural pond/draining	20	14.5	16.2		37.3
492		3/25/2014	*H. niloticus*	M	River/1.5 net	29.1	26.2	39.4		334.9
493		3/25/2014	*H. niloticus*	M	River/1.5 net	20.4	17.6	26.4		97.9
494		3/25/2014	*P. afer*	M	River/1.5 net	25.5	24.6	10.5		81.4
495		3/25/2014	*A. occidentalis*	M	River/1.5 net	19.8	16	23.5		92.2
496		3/25/2014	*A. occidentalis*	M	River/1.5 net	16.2	13.5	24		65.7
497		3/25/2014	*P.afer*	M	River/1.5 net	25.5	24.7	10.4		82.1
498		3/25/2014	*Clarias submarginatus*	M	River/1.5 net	15.4	13.5	10.5		29.4

499		3/25/2014	*C. submarginatus*	M	River/1.5 net	20	18.2	16.6		74
500		3/25/2014	*C. submarginatus*	M	River/1.5 net	18.4	16.5	14.2		54.4
501		3/25/2014	*S. membranrus*	M	River/1.5 net	15.6	12.3	29.3		41.2
502		3/25/2014	*S. batensoda*	M	River/1.5 net	15.2	13	45.3		60.1
503		3/25/2014	*S. eupterus*	M	River/1.5 net	13	11.4	27.9		36.1
504		3/25/2014	*S. membranrus*	M	River/1.5 net	13	10	20.3		28
505		3/25/2014	*S. membranrus*	M	River/1.5 net	13.1	10	29.4		28.3
506		3/25/2014	*S. membranrus*	M	River/1.5 net	13	11	20.1		24.7
507		3/25/2014	*A. occidentalis*	M	River/1.5 net	14.8	13	24.5		48.6
508		3/25/2014	*C. obscura*	M	River/1.5 net	23.6	19.5	14.2		110.6
509		3/25/2014	*A. biscutatus*	M	Net/ River	200	35.20	25.4		
510		3/25/2014	*S.nigrita*		Net/ River	180	24.40	20.4		
511		3/25/2014	*G. cyprinoides*			28.6	13.80	13.3		
512		3/25/2014	*G. cyprinoides*			54	17.20	15.0		10.2
513		3/25/2014	*G. cyprinoides*			34.6	13.00	10.0		
514	**APRIL**	20/05/2014	*B. bayad macropterus*	M	River/Net (3inch)	300	34.90	28.0		31.8
515		5/20/2014	*B. bayad macropterus*	M	River/Net (3inch)	300	36.50	29.6		26.6
516		5/20/2014	*B. bayad macropterus*	F	River/Net (3inch)	300	35.60	28.2		26.4
517		5/20/2014	*S. batensoda*	M	River/Net	200	22.60	17.5		26.9
518		5/20/2014	*S. batensoda*	M	River/Net	200	26.60	18.5		79.6
519		5/20/2014	*S. batensoda*	M	River/Net	220	22.65	17.9		38.2
520		5/20/2014	*A. nurise*		River/Net	300	37.00	8.3		
521		5/20/2014	*S. membranaceus*	F	River/Net 3inch	210	26.40	20.8	0.5	31.8
522		5/20/2014	*S. membranaceus*	M	River/Net	200	30.80	26.4	0	27.6
523		5/20/2014	*C. nigrodigitatus*	M	River/Net	200	30.70	23.0	0	36.3
524		5/28/2014	*C. nigrodigitatus*	F	River/Net 3inch	220	28.40	3.4	0	34.8
525		5/28/2014	*C. nigrodigitatus*	F	River/Net	200	32.20	25.6	0	36.5
526		5/28/2014	*C. nigrodigitatus*	M	River/Net	190	29.30	3.0	0	38

527	5/28/2014	*C. nigrodigitatus*	M	River/Net	180	30.80	23.2	0	50.6
528	5/28/2014	*S. eupterus*	M	River/Net	400	37.00	29.6	0	49
529	5/28/2014	*S. nigrita*	M	River/Net	400	35.60	29.0		33.3
530	5/28/2014	*S. nigrita*	M	River/Net	350	38.10	30.6		34.7
531	5/28/2014	*S. nigrita*	M	River/Net	300	38.00	30.6		34.5
532	5/28/2014	*C. obscura*	M	River/Net	22.7	19	13		109
533	5/28/2014	*C. obscura*	M	River/Net	19.5	16.8	13.1		65.1
534	5/28/2014	*C. obscura*	M	River/Net	22.4	19.4	14.2		111.2
535	5/28/2014	*C. obscura*	M	River/Net	24.6	21.8	14.6		153.8
536	5/28/2014	*C. obscura*	M	River/Net	23	19.5	13.4		116.9
537	5/28/2014	*C. obscura*	M	River/Net	23.6	19.7	12.2		116.8
538	5/28/2014	*C. obscura*	M	River/Net	22.3	20	14		101
539	5/28/2014	*C. obscura*	M	River/Net	23	19.6	13.2		130.2
540	5/28/2014	*C. obscura*	M	River/Net	23	19.7	13		99.8
541	5/28/2014	*C. obscura*	M	River/Net	17.6	15.2	12.1		55.9
542	5/28/2014	*Clarias lazera*	M	River/Net	29.5	25.2	27.2		197.2
543	5/28/2014	*S.eupterus*	M	River/Net	400	29.2	24.7		37.7
544	5/28/2014	*C. citharus*	M	River/Net	27.1	21.7	28		444.8
545	5/28/2014	*D. brevipinnis*	M	River/Net	25.8	20.4	64.3		216.5
546	5/28/2014	*D. brevipinnis*	M	River/Net	25.4	20.7	60.1		205.1
547	5/28/2014	*B. bayad M.*	M	River/Net	30.4	23	26.7		152.6
548	5/28/2014	*B. bayad M.*	M	River/Net	23.5	16.4	16		72.8
549	5/28/2014	*B. bayad M.*	M	River/Net	21.7	14.5	14.1		39.3
550	5/28/2014	*B. bayad M.*	M	River/Net	24.3	17.2	14.8		48.5
551	5/28/2014	*B. bayad M.*	M	River/Net	27.4	16.7	18		76.5
552	5/28/2014	*B. bayad M.*	M	River/Net	25.5	19.2	18		74.4
553	5/28/2014	*C. auratus longigilis*	M	River/Net	19.4	14.2	27.5		56
554	5/28/2014	*C. nigrodigitatus*	M	River/Net	24	16.5	15		47.1
555	5/28/2014	*C. nigrodigitatus*	M	River/Net	21.3	15.4	14.1		63.2

556	5/28/2014	*C. auratus longigilis*	M	River/Net	16	12.2	15.2	44.2
557	5/28/2014	*C. laticeps*	M	River/Net	16	12.7	10.4	36.2
558	5/28/2014	*C. citharus*	M	River/Net	15.5	12.3		56.9
559	5/28/2014	*C. citharus*	M	River/Net	17.2	13.2		70.1
560	5/28/2014	*A. nurise*	M	River/Net	19.8	15.6		49
561	5/28/2014	*A. nurise*	M	River/Net	20.5	16		50.2
562	5/28/2014	*L. cubeo*	M	River/Net	23.6	17.6		91.4
563	5/28/2014	*A. nurise*	M	River/Net	20.4	16		51.9
564	5/28/2014	*A. nurise*	M	River/Net	20.3	16.1		54.8
565	5/28/2014	*A. nurise*	M	River/Net	20.4	13.6		56.2
566	5/28/2014	*C. citharus*	M	River/Net	15	13.4		54.7
567	5/28/2014	*A. occidentalis*	M	River/Net	18.8	14.8		79.3
568	5/28/2014	*C. obscura*	M	River/Net	19.1	14		23.1
569	5/28/2014	*C. obscura*	M	River/Net	19	13		23
570	5/28/2014	*C. citharus*	M	River/Net	13	10.4		50.4
571	5/28/2014	*T. nilotica*	M	Net	200	23.4	20	
572	5/28/2014	*T. nilotica*	M	Net	200	22.4	18	

ENUGWU OTU LOCATION

S/No	Date of Collection	Fish Species	Sex	Method of Catch	Weight (g)	Total Length (cm)	Standard Length(cm)	Oeso	Sto	Sto content	Sto fullness	Int(Nem)	Int. length	Pyloric Caeca	Rec	Bev	Galls
1	**April 2012**	*S. eupterus*	M		77	18.8	14.5				4						
2		*S. eupterus*	M	24.5	98.8	19.4	16.7				2						
3		*C. citharus*	M	24.3	70.8	16.2	12.7				0						
4	**May 2012**	*C. gariepinus*	F	Net	180	31.4	27.2				0						
5		*C. gariepinus*	F	Net	180	32.4	28.3				0						
6		*C. gariepinus*	M	Net	190	29	24.3				0						
7		*A. macrolepidotus*	M		801	48.7	37										
8		*A. nurise*	M		400	37.2	28.5				0						
9		*A. nurise*	M		210	28.2	22.5				0						
10	**June 2012**	*T.zilli*	M	Net	200	17.3	14						49				
11		*A. nurise*	M	16.4	82	21.7	16.7				2						
12		*S. batensoda*	M	106.4	340.8	33.9	23.8										
13		*S. batensoda*	M	60.5	163.2	26	19.2										
14		*A. macrolepidotus*	m	Net	800	48.7	37.2										
15		*A. macrolepidotus*	M		700	47.8	36										
16		*A. nurise*	M		200	29	23.5										
17		*A. nurise*	M	Net	320	32.4	26.2										
18		*A. nurise*			200	30.7	24.2										
19	**July 2012**	*S.nigrita*	M	Net	190	17.3	12.8						58.1				
20		*S. batensoda*	M	21.6	44.5	17.4	12.4										
21		*C. citharus*		31.9	83.7	15.7	13		0	0							
22		*A. nurise*			420	38.8	32.8										
23		*A. nurise*	M		210	29.1	25.6										
24		*A. nurise*			200	29	26										
25	**Sept 2012**	*S.batensoda*	M	Net	200	18.4	14.2						77.2				
26		*S.batensoda*	M	Net	200	19.5	15.3						71				

27			*Tilapia nilotica*	M			81.9	15.3	12.6	0				
28			*Tilapia nilotica*	M			76.7	15.2	12.4	0				
29			*Tilapia zilli*	F			132	17.2	13.8	0				
	Feb													
30	**2013**		*C. citharus*			30.7	75.8	16.4	12.9	0	0			
31			*C. citharus*			14.1	34.8	13	10.3					
32			*H. niloticus*			27.8	88.1	20.3	18.4			2		
33			*C. citharus*	M		36.9	14.4	10.6		0	0			
34			*C. citharus*	M		74.4	17	12.5		0	0			
35	**March**	**2013**	*C. gariepinus*	M	Net		180	31.2	27				20.5	
36			*C. citharus*	M		39.7	13.4	9.6		0	0			
37			*C. citharus*	F		30	11.5	9.5		0	0			
38			*H. niloticus*			82.9	19.7	17	28.5		3	cestode-2; acan-1		
39			*P. annectens*			338	41	40.6	20.5		3			
40			*C. lazera*			42.4	19.6	18.8	10.2					
41			*Clarias submarginatus*			29.4	15.4	13.5	10.5					
41	**April**	**2013**	*S.batensoda*	M	Net		200	21.7	12.3				46.8	
42			*S. membranecus*			41.2	15.6	12.3	29.3					
43			*S. eupterus*			36.1	13	11.4	27.9					1 Nem
44			*C. citharus*			50.4	13	10.4						
45			*S. Sorex*	M		120.4	21.2	13.7	31.8					
46			*S. Sorex*	M		115	24.6	14.7	48.3					
47			*S. Sorex*	M		83.2	20.4	14.2	26					
48			*S. membranecus*			28.2	13.8	10	20.1					
49	**May**	**2013**	*S.membranaceus*	M			300	16.40	13.6				41.3	

50			*S.nigrita*	M		200	15.40	12.0				30.5
51			*T.zilli*	M		200	19.00	14.5				48
52			*C. gariepinus*	M		420	52.00	44.6				
53			*C. nigrodigitatus*	M		220.8	36.40	33.7				41.5
54			*C. nigrodigitatus*	M		242.6	38.00	28.4				39.5
55			*C. nigrodigitatus*	M		200	30.10	27.1				28
56	**June**	**2013**	*T.zilli*	M	River/Net	200	19.1	14.8		0	0	18
57			*T. zilli*	F	River/Net	200	15.9	12.4		0	0	46.4
58			*T. zilli*	F	River/Net	200	17.5	14		0	0	49
59			*T.zilli*	F	River/Net	200	15.7	12.3		0	0	46.8
60			*S. batensoda*	M	River/Net	200	18.9	14.6	decayed matters		1	77.5
61			*S. batensoda*	M	River/Net	200	19.5	15.3	decayed matters		1	71.3
62			*S. batensoda*	M	River/Net	190	18.2	13.5	decayed matters		0.5	60.3
63			*S. batensoda*	M	River/Net	190	18.5	13.3	decayed matters		0.5	65.2
64			*C. citharus*		River/Net	700	32.3	25.9		0	0	
65			*P. annectens*		River/Net	600	46	43.2		0	0	
66			*P. annectens*		River/Net	1200	60.5	57.3	decayed plants		0.5	27.6
67	**Feb**	**2014**	*C. gariepinus*	M		200	35.60	31.4				20
68			*C. citharus*		River/ Net	130.4	23.4	19				22.6
69			*C. citharus*		"	150.2	24.2	19				
70			*C. citharus*		"	34	13.5	11.4				
71			*C. citharus*		"	444.5	27.1	21.7				28.2
72			*C. citharus*		"	54.6	13.5	10.3				15.4
73			*C. citharus*		"	70	17	13				19.1

74			*B. bayad Macropterus*	M	River/Net	27.5	16.5	13		82
75			*B. bayad macropterus*	M	River/Net	26	16	15.5		70.2
76			*B. bayad macropterus*	M	River/Net	24.7	17.2	15.6		59.2
77			*B. bayad Macropterus*	M	River/Net	28.5	20.4	15.8		108.9
78			*S. nigrita*	M	River/Net	400	35.60	29.0		33.3
79			*S. nigrita*	M	River/Net	350	38.10	30.6		34.7
80			*S. nigrita*	M	River/Net	300	38.00	30.6		34.5
81			*L. cubeo*	M	River/Net	23.6	17.6			91.4
82			*A. nurise*	M	River/Net	20.4	16			51.9
83			*A. nurise*	M	River/Net	20.3	16.1			54.8
84			*A. nurise*	M	River/Net	20.4	13.6			56.2
85	**April**	**2014**	*S. batensoda*	M		200	18.90	14.6	Acan-1	75.5
86			*T. zilli*	F		130.1	15.2	12.8		
87			*S. batensoda*	M		64.3	18.7	12.2		35.1
88			*S. batensoda*	M		130.4	21.5	15.4		26.2
89			*S. batensoda*	M		200	17.4	23.2		50.5
90			*S. batensoda*	M		200	20.7	16		59.2

OTUOCHA LOCATION

S/No	Date of Collection	Fish Species	Sex	Method of Catch	Weight (g)	Total Length (cm)	Standard Length (cm)	Oeso	Sto	Sto content	Sto fullness	Intestine (Nem)	Int. length
1	**April 2012**	*P. annectens*			700	38	35						
2		*H. niloticus*	M		700	39.5	35				1	1 cestode	
3		*P. annectens*			250	44	37.2				0.25		
4		*H. niloticus*	M		600	41.1	36.6			stone Green grass	1	10 acan	
5		*H. niloticus*	M		620	41.4	37			Green grass	1	20 acan	
6		*G. niloticus*	M	Net	600	64.3	57.4			Green grass	0.5		
7		*Channa obscura*	M	Net	650	41.5	34.6		1 Nematode		0		
8		*C. gariepunus*	F	Net	400	43.2	38.8				0	3 unidentified	
9		*P. annectens*	M	Net	1400	65.8	61.1				0		
10	**May 2012**	*C. gariepinus*	M	Net	1400	55.4	49.3						
11		*C. gariepinus*	M	Net	1200.1	53.2	47.6						
12		*C. gariepinus*	M	Net	1180	53.2	48.2						
13		*C. gariepinus*	M	Net	1300	53	48.4						
14		*C. gariepinus*	M	Net	1400.2	55.6	49.8						
15		*C. gariepinus*	M	Net	1310	55.9	51						
16		*C. gariepinus*	M	Net	1450	56.8	49.9						
17		*C. gariepinus*	M	Net	1250	54.6	48.6						
18		*H. niloticus*	M	Net	800	44.8	39.5					9 acan	
19	**June 2012**	*C. Lazera*	M	Net	100	39	34						33
20		*H. longifilis*	M	Net	500	40.5	34.6						30.2
21		*C.nigrodigitatus*	M	Net	400	37.4	27.5						50
22		*C. nigrodigitatus*	M	Net	600	40	30.2						73

23			*S. eupterus*	M		92.8	19.3	15.4	2	2 Cestode	
24			*S. eupterus*	M		104	20.4	16.8	2	1 cestode	
25			*S. eupterus*	M		94.4	19.6	16.2	4		26.5
26			*S. Batensoda*	M		104	22.7	16.2	2	2 Cestode, 2nematode	62.4
27			*H. niloticus*	M		320.7	30.2	27.1	3		60.9
28			*H. niloticus*	M		201.7	25.5	21	3		47.2
29			*H. niloticus*	M		222.2	24.8	22.5	2		46.9
30			*H. niloticus*	M		220.3	26.4	24.2	3		47.2
31			*H. niloticus*	M		103.4	21.6	19.4	3		40.2
32			*G. niloticus*	M		203.2	45	30.2	0		36.4
33			*C. obscura*	M		166.6	24.7	21.1	4		19.5
34			*H. niloticus*	M		98.6	21.2	16.7	2		36.5
35	**July**	**2012**	*C. Submarginatus*	M	Net	200	34.6	30.5			17.3
36			*S. nigrita*	M	Net	190	25.2	20.9			22.7
37			*S.schall*	M	Net	200	26	21.9			23.7
38			*H. niloticus*	M		85.3	20.5	16.4	1		32.4
39			*H. niloticus*	M		96.4	20.4	17.6	1		31.4
40			*A. nurise*	M		73	16	13.5	0		15
41			*A. nurise*	M		52.5	16.2	13.5	0		15.2
42			*H. brevis*	M		55.3	16.4	13.7	0		37.5
43			*H. brevis*	M		42.7	15.7	13.2	0		36
44			*H. niloticus*	F		219.7	27.7	24.3			34.6
45			*H. niloticus*	F		213	29.5	26.3	3		42.4
46			*H. niloticus*	F		234.9	28	24.6	2		44.5
47			*H. niloticus*	M		103.7	21.8	19.8	2		35.6
48			*H. niloticus*	M		79.2	20.4	16.3	1		26.4
49			*S. eupterus*			64	17.2	14			

50			*S. eupterus*			50	17	13.6					
51			*S. eupterus*			54.2	17.2	13.7					
52			*S. batensoda*	M		340.8	33.9	23.8					106.4
53	**August**	**2012**	*C. nigrodigitatus*	M	Net/River	700	41.5	30.2			0		74
54			*S. eupterus*	M	Net/River	600	35.6	28.5			0	11 nematode	55
55			*S. eupterus*		Net/River	600	47.2	36.5			1		35.8
56			*S. eupterus*		Net/River	450	34.8	28.2			0		
57			*S. eupterus*	M	Net/River	400	32.4	27.5			1	5 nematode	49.3
58			*S. eupterus*	F	Net/River	400	31.9	26.7			1		36.2
59			*S. batensoda*	M	Net/River	200	27.2	20.5			1	5 nematode	70
60			*S. batensoda*	M	Net/River	200	27.6	21			1		72
61			*S. batensoda*	F	Net/River	200	28.4	21.6			1	8 acan	73.5
62			*S. Batensoda*	M		38.6	14.5	11.2					52.3
63			*Schilbe mystus*			53.9	19	16.7	nematode-1	3			27.2
64			*D. brevipinnis*			74.6	19.2	17		2			45.3
65			*S. mystus*			47.3	16.3	13.5		4			35.2
66			*S. mystus*			35.5	16.5	14.2		1			18
67			*S. mystus*			59.6	17.6	15.2		2			27.4
68			*S. mystus*			31.1	14	12.4					16.5
69			*S. mystus*			52.5	17.4	15	1 nematode				45.2
70			*S. mystus*			32.2	16.4	13.4					24.2
71			*S. mystus*			52	17.7	14.8					21.2
72			*M. electricus*			330.5	25.5	21.3		0		Acan-1	34.4
73			*M. electricus*			362.3	28.1	23.2				cestode-10	36.4
74			*M. electricus*			432.7	30.2	25.3				cestode-24	33.6
75			*M. electricus*			368.3	27	22.5				ceestode-2	36.7
76			*M. electricus*			228.2	24.3	20.4					29.1
77			*M. electricus*			235	23.8	20		0			35.7

78			*M. electricus*			265.3	25.2	20				cestode-4	33.6
79	**Dec**	**2012**	*H. niloticus*	M	Net River (4inch)	1000	44.4	40.7			0.5	1 nem; 10 acan	
80			*H. niloticus*	M	Net River (4inch)	940	44.2	40.7				18 acan	
81			*C. anguillaris*	M	Hook/River	800	43.9	39			1		
82			*C. anguillaris*	M	Hook/River	800	50.2	44.5					
83			*H. longiphylis*	M	Hook/River	620	46.5	41.5			0		
84			*H. longiphylis*	M	Hook/River	400	40	34.9			0	3 unidentified	
85	**Jan**	**2013**	*C. gariepinus*	M	Net River	300	29	26.6					20.5
86			*H. niloticus*	M		320	30.1	27					54.6
87			*C. nigrodigitatus*			335.1	31.8	23.2	0				56.5
88			*C. nigrodigitatus*			95	20.7	15.8	0			nematode-1	27.8
89			*C. nigrodigitatus*			65.4	20.4	15	0				19.6
90			*C. nigrodigitatus*			270.3	30.9	23.5	0				63.4
91			*C. nigrodigitatus*			56.8	19.4	14.2	0				32.8
92			*C. citharus*			66.5	16.2	11.5	0	0	0		30.5
93			*D. brevipinnis*			171.8	23.7	18.6	0	0	0		37.8
94			*D. brevipinnis*			91.1	19.7	15.7	0	0	0		24.6
95			*D. brevipinnis*			143.9	23.6	18.4	0				36.6
96	**Feb**	**2013**	*C. gariepinus*	M	Net River	1180	53.1	48.1					30
97			*D. brevipinnis*	M		76	19	15.5	0				24.2
98			*Tilapia nilotica*	F		51.4	13.5	10.6	0				
99			*S. batensoda*	M		238.5	26.1	19.5	0	4		nematode-4	105.6
100			*C. obscura*	F		247.8	29.4	25.5	0	0			
101			*S. sorex*	M		123.4	24.2	16.7	0	0			34.8
102			*S. sorex*	M		115	24.6	15.7	0	0			49.3
103			*A. occidentalis*	M		56.3	17	14	0	0			24.2

104			*A. occidentalis*	M		79	19.2	15.4	0	0			26.7
105			*A. occidentalis*	M		36.7	14.9	12.2	0	0			19.2
106			*C. submarginatus*	F		46.9	41.6	38.2	0	0			34.6
107			*S. batensoda*			138.4	23.5	16.5	0	0		cestode-3	35.2
108			*S. batensoda*			65.3	19.7	13.2	0	0			36.1
109			*S. batensoda*			90.7	18.6	15.2	0	0			18.6
110			*L. cubeo*			163.7	24	18.5	0	0			
111			*L. cubeo*			155.4	24.5	17.8	0	0			
112			*L. cubeo*			214.1	28	20.4	0	0			
113			*D. brevipinnis*			103.1	20	16.7	0	0			19.6
114	**March**	**2013**	*H. niloticus*	M	Natural pond used Engine	720	38.9	36.2		sand decayed matters	1	1 acan	43
115			*G. niloticus*	M	Natural pond used Engine	400	42.5	40.1		nothing	0		25.6
116			*C. obscura*	F	Natural pond used Engine	350	29	24.8	1Nem	decayed matters	0.5		
117			*C. gariepinus*		Natural pond used Engine	300	30	26.6		nothing	0		
118			*P. annectens*		Natural pond used Engine	300	38	36.3					
119			*C. nigrodigitatus*	M	River	400	37.4	27.5					
120			*C. citharus*		River	200	23.4	18					
121			*H. bebe occidentalis*			60.6	17.7	13.7		0			28.4
122			*H. bebe occidentalis*			58.3	20.8	18.6		0			26.5
123			*G. cyprinoides*			32	15	13.2		2			14
124			*G. cyprinoides*			45.9	16.4	14		2			16.7
125			*S. mystus*			30.3	14.4	13		0			17.3
126			*G. Cyprinoides*			30.9	15.5	13.5		2			12.3
127			*G. cyprinoides*			25.5	13.7	13.2		2			12.6
128			*G. pictus*			19.9	12	11.5					12
129			*A. nurise*			39.4	16	13		2			
130			*G. cyprinoides*			20.4	13.5	12		0			
131			*T. zilli*			15.1	9.7	8		0			

132			*H. niloticus*			176.3	25.5	22.4		2		38.2
133			*H. niloticus*			133.4	23.1	20.5		2	cestode-1	37.9
134			*H. niloticus*			119.7	22.6	20.5		2	cestode-1; Acan-1	34.6
135			*H. niloticus*			129.9	23.6	21		2		34
136			*H. niloticus*			150	23.6	21		2		34.2
137			*H. niloticus*			154.7	24.7	21.6		2		37.5
138			*H. niloticus*			88.1	20.3	18.4		2		27.8
139	**April**	**2013**	*S. batensoda*	M	River	200	27.6	21				72
140			*S. nigrita*	M	River	400	32.4	27				49.2
141			*S. batensoda*			17.4	12.2	55.8		0		54.8
142			*D. brevipinnis*			18.7	14.8					84
143			*G. cyprinoides*			15.9	14.2	10.5		2		41.8
144			*G. cyprinoides*			17.8	16	11.2		2		50.5
145			*G. cyprinoides*			18.7	16.5	15.8		2		65.2
146			*G. cyprinoides*			14.2	12.2	13.1		1		33.9
147			*Clarias anguillaris*			20.5	18.8	12.5				62.1
148			*Tilapia zilli*			13	10.1					50.9
149			*Hepetus odoe*			21.1	16.9	14.6				60.8
150			*S. clarias*			17	12.2	23.6				51.9
151			*Clarotes laticeps*			16.5	12.8		0	0		51.5
152			*Tilapia nilotica*	M		14.7	11.8	91.5	0	0		68.4
153			*Tilapia nilotica*	F		14.6	11.5	91	0	0		62.4
154			*T. nilotica*	M		15.4	12.3	110.4	0	0		85.6
155			*C. citharus*	F		16.7	14.2	112	0	0		83.6
156			*C. citharus*	M		22.4	17	118.4	0	0		158
157			*C. citharus*	M		14.3	10.6	78.4	0	0		48.5
158			*C. citharus*	M		22.1	16.6	110.6	0	0		153.3
159			*C. citharus*	M		20.2	15.3	112.7	0	0		105.3

160			*C. citharus*	M		16	12.3	95.4	0	0		54.6
161			*C. citharus*	M		14.4	10.6		0	0		36.9
162			*C. citharus*	M		17	12.5		0	0		74.4
163			*C. citharus*	M		13.4	9.6		0	0		39.7
164			*C. citharus*	F		11.5	9.5		0	0		30
165			*C. citharus*	M		14.6	11.5		0	0		38.4
166			*C. citharus*	M		15.8	12.3		0	0		45.9
167			*H. niloticus*			36.5	33.2	51.6		3	Acan-1; cestode-12	522.4
168			*H. niloticus*			31.6	28.8	46.3		3	cestode-1	334.5
169			*H. niloticus*			34	30.4	53.7		3	Acan-3; cestode-3	420.5
170			*H. niloticus*			27.6	25.2	43.7		3	Acan-6	237.1
171			*H. niloticus*			25	22.5	33.5		3	Acan-1; cestode-1	156.1
172			*H. niloticus*			24	27.3	34.6		3		146.3
173			*G. niloticus*			43.2	36	24.3		3		183.5
174			*G. niloticus*			37	32.5	22		3		152.3
175			*H. niloticus*			24.6	22.3	38.2		3	Acan-1	151.4
176			*H. niloticus*			24.5	22	34.2		3	Acan-2; cestode-2	152.6
177			*H. niloticus*			22.4	19	33.6				112.8
178			*H. niloticus*			22.3	19.5	33.4		3		120.7
179			*C. citharus*			16.3	13.5	92.1	0	0		73.5
180			*C. citharus*			16.3	12.3	86.4	0	0		54.9
181			*D. brevipinnis*			29	24	84.6	0	0		345.5
182	**May**	**2013**	*G. niloticus*	M	River	400	40	34.9				28.4
183			*S. nigrita*	M	River	600	34.6	28.5				54
184			*A. nurise*	M	River	830	20.4	15.4				15.2
185			*B. Bayad macropterus*	M	River	400	49.1	34.5				38.5

186			*A. occidentalis*			16.4	14.3	27.6		2			78.5
187			*A. occidentalis*			22.3	17.6	30.8		2		cestode-1	136.7
188			*A. occidentalis*			22.5	16.4	32.4		2		cestode-10	142
189			*A. occidentalis*			19.5	15.7	28.1		2			102.8
190			*C. citharus*			20.4	16.2	34					130.4
191			*C. citharus*			16.7	13.7	31.6					115.9
192			*D. brevipinnis*			23.8	16.2	35.8					159.7
193			*Mormyrus rume*			27.2	24	18					136.9
194			*Hyperopisus bebe occidentalis*			26	23	18		3			121.2
195			*H. bebe occidentalis*			25.5	23.4	19.6					116.5
196			*G. niloticus*			33.2	27.2	16.3					71.7
197			*H. niloticus*			28.5	25.6	43.2				cestode-2	275.9
198			*H. niloticus*			25.4	23.2	40.1		3		cestode-5	224.9
199			*H. niloticus*			30.4	27	49.2		3		cestode-2	323.7
200			*H. niloticus*			28.8	25.3	41.6		3			256.6
201			*H. niloticus*			30.4	28.2	51.5		3			352.6
202			*H. niloticus*			23.4	20.2	38.7		3		cestode-2	144.3
203													
204	**June**	**2013**	*C. anguillaris*		RiverNet (3inch)	600	44.9	38.8	decayed matters		0.5		35.8
205			*H. longiphylis*		River Net by putting grasses into river	600	42.5	36.4	fish bones		1		32.2
206			*H. longiphylis*		River Net by putting grasses into river	920	48.6	42.3	fish bones		0.5		33.4
207			*C. anguillaris*		RiverNet (3inch)	224.4	35.9	26.1			0	1 cestode	21.9
208			*C. obscura*	F	RiverNet (2inch)	400	30	26.2	fish bones		1		9.2
209			*C. obscura*	F	RiverNet(2inch)	200	29.5	23			0		14.4
210			*C. obscura*	F	River/Net	200	23.2	19.5			0	1Nem	16.4
211			*C. anguillaris*		RiverNet (3inch)	171.5	28.2	25			0	1 cestode	30.7
212			*C. lazera*		River/Net 3inch	1000	39.6	34.8			0		34.5
213			*B. bayad macropterus*	M	River/Net	400	32.3	27.3			0		20.5

214			*B. bayad macropterus*	M	River/Net	400	33.7	28.7		0		22.3
215			*B. bayad macropterus*	M	River/Net	200	24.5	21.7		0		21
216			*B. bayad macropterus*	F	River/Net	200	33.5	27.3		0		
217	**July**	**2013**	*S. nigrita*	M	Net	400	32.4	27				49.2
218			*C.nigrodigitatus*	M	Net	400	37.4	27.5				56.8
219			*H. niloticus*			29.4	26.4	43.6	3		cestode-10	248.6
220			*H. niloticus*			38	33.5	64.2	3			720.3
221			*H. niloticus*			43.4	39.5	69.8	3		cestode-1; Acan-2	1004.2
222			*H. niloticus*			21.4	18.8	34.5	3		cestode-4	106.3
223			*H. niloticus*			25.4	22.5	40.9	3			170.9
224			*H. niloticus*			23	21.2	35.6	3			162.8
225			*H. niloticus*			24.6	21.8	43.4	3		cestode-3	169.4
226			*H. niloticus*			24.9	22	40.5	3			177.8
227			*H. niloticus*			20.7	16.2	49.4	3		cestode-1	128.5
228			*H. niloticus*			24.6	21.6	30.5	3			176.6
229			*H. niloticus*			25.4	22.4	30.4	3			179.6
230	**August**	**2013**	*S. batensoda*	M	Net	200	28.4	21.6				73.5
231			*G. niloticus*			38.5	34.8					153.7
232			*G. niloticus*			47.4	40.2	30.2				312.1
233			*G. niloticus*			53	45.2	51.8				408.5
234			*B. bayad macropterus*			40.1	45.4	38.6				
235			*D. brevipinnis*			23	16.5					146.2
236			*H. niloticus*			43	38	62.4			cestode-15;Acan-1	1147.2
237			*Synodntis eupterus*			11.9	9.5					25.2
238			*Clarias lazera*			17.5	16	8.5				33
239			*C. lazera*			19.6	18.8	10.2				42.4

240			*P. annectens*	31.2	29.4	14.2			174.3
241			*P. annectens*	37.4	35.2	16.5			197.4
242			*P. annectens*	37.8	34.1	16.5			200.8
243			*P. annectens*	30.4	27.2	13.5			107.6
244			*P. annectens*	28	27	11.8			100.6
245			*C. Submarginatus*	46.1	41	38.2			34.2
246			*M. electricus*	24.6	20.5	33.4	3		330.3
247			*M. electricus*	24	20	32.1	0		207.3
248			*M. electricus*	22.5	19.6	31.4			208.5
249			*M. electricus*	23.5	19.5	31.4		cestode-1	193.2
250			*M. electricus*	20.3	16.7	25.2		cestode-3	140.1
251			*M. electricus*	16.4	13.3	15			78.6
252			*M. electricus*	16.2	13.2	17.2		cestode-6	70.4
253			*M. electricus*	14.5	12.5	15.1			52.7
254			*H. niloticus*	19.7	17.2	21.8		cestode-2	99
255			*H. niloticus*	20.9	16.1	28.5		cestode-1; Nem-1	100
256			*S. mystus*	19.4	17.4	22.8			55.7
257			*S. mystus*	21.3	17.8	27.2			88.5
258	**Sept**	**2013**	*S. mystus*	22.3	19.7	27.1			94.8
259			*S. mystus*	17.8	15.5	20.5			59.5
260			*S. mystus*	17.8	15.6	20.2			45.5
261			*Clarotes laticeps*	3	17.6	29.8			118.9
262			*C. laticeps*	14	11.6	20.5			34.7
263			*C. laticeps*	19	15	35.2			80
264			*C. laticeps*	18	14.2	28			60
265			*C. laticeps*	18.8	15.4	24.1			79.6
266			*C. laticeps*	12.4	10.2	18			22.5
267			*B. bayad M.*	31.6	22.4	23.5			136.9

268			*B. bayad M.*			32.4	24.6	23.4					178.7
269			*B. bayad M.*			28	19.2	21					89.5
270			*B. bayad M.*			30.5	21.8	20.8					147.6
271			*B. bayad M.*			27.5	16.5	13					82
272			*B. bayad M.*			26	16	15.5					70.2
273			*B. bayad M.*			24.7	17.2	15.6					59.2
274			*B. bayad M.*			28.5	20.4	15.8					108.9
275			*B. bayad M.*			24.4	16.4	19.4					84.1
276			*B. bayad M.*			22.6	16.2	14.2					56.9
277			*S. mystus*			21.5	17.8	20.1					96.3
278			*S. mystus*			10.8	10	13.3					15.1
279	**Oct**	**2013**	*H. niloticus*	M	Net	400	31.9	26.7					50.2
280			*M. electricus*	M		24.6	20.5	33.4		3			330.3
281			*M. electricus*	M		24	20	32.1		0			207.3
282			*M. electricus*	M		22.5	19.6	31.4					208.5
283			*M. electricus*	M		23.5	19.5	31.4				cestode-1	193.2
284			*M. electricus*	M		20.3	16.7	25.2				cestode-3	140.1
285			*M. electricus*	M		16.4	13.3	15					78.6
286			*M. electricus*	M		16.2	13.2	17.2				cestode-6	70.4
287			*B. bayad Macropterus*	M		24.4	16.4	19.4					84.1
288			*B. bayad Macropterus*	F		22.6	16.2	14.2					56.9
289			*S. mystus*	M		21.5	17.8	20.1					96.3
290			*S. mystus*	M		10.8	10	13.3					15.1
291	**Nov**	**2013**	*B. bayad Macropterus*	M	River/Hook 16	1200	62.8	48.6					
292			*Gymnarchus niloticus*	M	River/Net (2inch)	400	48.9	42.2			0		
293			*H. niloticus*	M	River/1ko	700	35.5	32.5	sand, seeds decayed matters		1		50.4

294			*H. niloticus*	M	River/3inch Net	450	32	27.6	sand, seeds	0.5	21 acan	44.6
295			*C. obscura*	M	River/Engine	400	29.3	26		0		16
296			*C. obscura*	M	River/Engine	400	30	26		0	11 Nem	16.2
297	**Jan**	**2014**	*C. gariepinus*	M	Net	500	42.2	37.8				28.5
298			*B. bayad Macropterus*	M		24	16	13.2				
299			*C. laticeps*	M		14.6	11.5	15				52.6
300			*C. laticeps*	M		12.7	9.7	14.1				31.1
301			*C. laticeps*	M		12.6	9.4	14.2				21.2
302			*B. bayad M.*	M		20	14.5	16.2				19.4
303			*H. niloticus*			29.1	26.2	39.4			Acan-2	37.3
304			*H. niloticus*			20.4	17.6	26.4			cestode-1	334.9
305			*P. afer*	M		25.5	24.6	10.5				97.9
306			*A. occidentalis*	M		19.8	16	23.5			8-unknown	81.4
307			*A. occidentalis*	M		16.2	13.5	24				92.2
308			*P.afer*	M		25.5	24.7	10.4				65.7
309			*C. submarginatus*	M		20	18.2	16.6				82.1
310			*C. submarginatus*	M		18.4	16.5	14.2				74
311			*S. membranaecus*	M		13	10	20.3				54.4
312			*S. membranaceus*	M		13.1	10	29.4				28
313			*S. membranaceus*	M		13	11	20.1				28.3
												24.7
314	**Feb**	**2014**	*C. gariepinus*	M	Net	400	44.7	39.7				27.8
315			*A. occidentalis*	M		14.8	13	24.5				48.6
316			*C. obscura*	M		23.6	19.5	14.2				110.6
317			*C. obscura*	M		22.7	19	13				109
318			*C. obscura*	M		19.5	16.8	13.1				65.1
319			*C. obscura*	M		22.4	19.4	14.2				111.2
320			*C. obscura*	M		24.6	21.8	14.6				153.8

321			*C. obscura*	M		23	19.5	13.4	nematode-3				116.9
322			*C. obscura*	M		23.6	19.7	12.2					116.8
323			*C. obscura*	M		22.3	20	14					101
324			*C. obscura*	M		23	19.6	13.2					130.2
325			*B. bayad macropterus*	M		23	19.7	13				2 nematode	99.8
326			*B. bayad macropterus*	M		17.6	15.2	12.1					55.9
327			*Clarias lazera*	M		39	25.2	27.2				3 cestode	297.2
328			*Clarias lazera*	M		33.5	29.2	17				cestode-3	299.4
329			*C. citharus*	M		27.1	21.7	28					444.8
330	**March**	**2014**	*B. bayad macropterus*	F	River/Net	500	50.1	35.5					39.5
331			*S. eupterus*	M	River/Net(3inch)	320	29	23.2		decayed plants	1		35.4
332			*S. eupterus*	M	River/Net(3inch)	190	25.2	20.9		decayed matters	0.5		22.7
333			*S. eupterus*	M	River/Net(3inch)	190	24.1	19.6			0		27
334			*C. obscura*	F	River/Net(3inch)	520	38.5	35.3			0	4Nem	24.8
335			*C. obscura*	M	River/Net (3)	300	33	27.3				4 Nematode	22
336			*C. gariepinus*	M	River/Net(3inch)	400	44.7	39.7				1 cestode	27.8
337			*C. gariepinus*	M	River/Net(3inch)	500	42.2	37.8			0		8.5
338			*C. gariepinus*	F	River/Net	400	41.5	37				5 cestode	19
339			*C. obscura*	M	River/Net	400	36.4	31.9			0		
340			*C. gariepinus*	F	River/Net	600	42.8	38.3			0		18.2
341			*C. submarginatus*	M	River/Net	200	34.6	30.5			0		17.3
342			*C. submarginatus*	M	River/Net	2200	32.4	28.6			0		17.8
343			*C. submarginatus*	F	River/Net	200	34.6	28			0		13.8
344			*C. gariepinus*	M	River/Net	200	34.6	30.8			0		12.9
345			*D.brevipinnis*	M	River/hook	200	23.5	19.5			0		29.8
346	**April**	**2014**	*H. longifilis*	M	Net	600	42.5	36.4					32.2

347	*A. nurise*	M	Net		820	20	15.6			15
348	*L. cubeo*			91.4	23.6	17.6				
349	*A. nurise*			51.9	20.4	16				
350	*A. nurise*			54.8	20.3	16.1				
351	*A. nurise*			56.2	20.4	13.6				
352	*C. citharus*			54.7	15	13.4				
353	*A. occidentalis*			79.3	18.8	14.8				
354	*C. obscura*			23.1	19.1	14				
355	*C. obscura*			23	19	13				
356	*A. occidentalis*			22.5	91.2	19.4	16		8 unknown	
357	*A. occidentalis*			27.6	76.6	14.4	25.7	decayed matter		
358	*A. occidentalis*			30.6	136.6	22.1	17.4	"	1 cestode	
359	*A.occidentalis*			30.2	141	21.5	16.4	"	10 cestode	
360	*A. occidentalis*				116.5	21	16		5 cestode	
361	*D. brevipinnis*	M			300	28.4	24			
362	*D. brevipinnis*	M			216	24.8	20.2			63.1
363	*D. brevipinnis*	M			201.1	21.4	20.7			60.1

APPENDIX 1B

Plate1*: Alestes nurse*

Plate 2*: Auchenoglanis occidentalis*

Plate 3: *Bagrus bayad macropterus*

Plate 4:*Channa obscura*

Plate 5: *Distichodus brevipinnis*

Plate 6:*Malapterurus electricus*

Plate 7:*Gymnarchus niloticus*

Plate 8:*Heterobranchus longifilis*


Plate 9:*Heterotis niloticus*


Plate 10:*Hydrocynus brevis*


Plate 11:*Synodontis batensoda*

Plate 12: *Protopterus annectens*

Plate 13:*Tilapia nilotica*

Plate 14: *Citharinus citharus*

Plate 15*: Mormyrus rume*

Plate 16: *Tenuisentis niloticus*

A – Anterior end
B – Posterior end

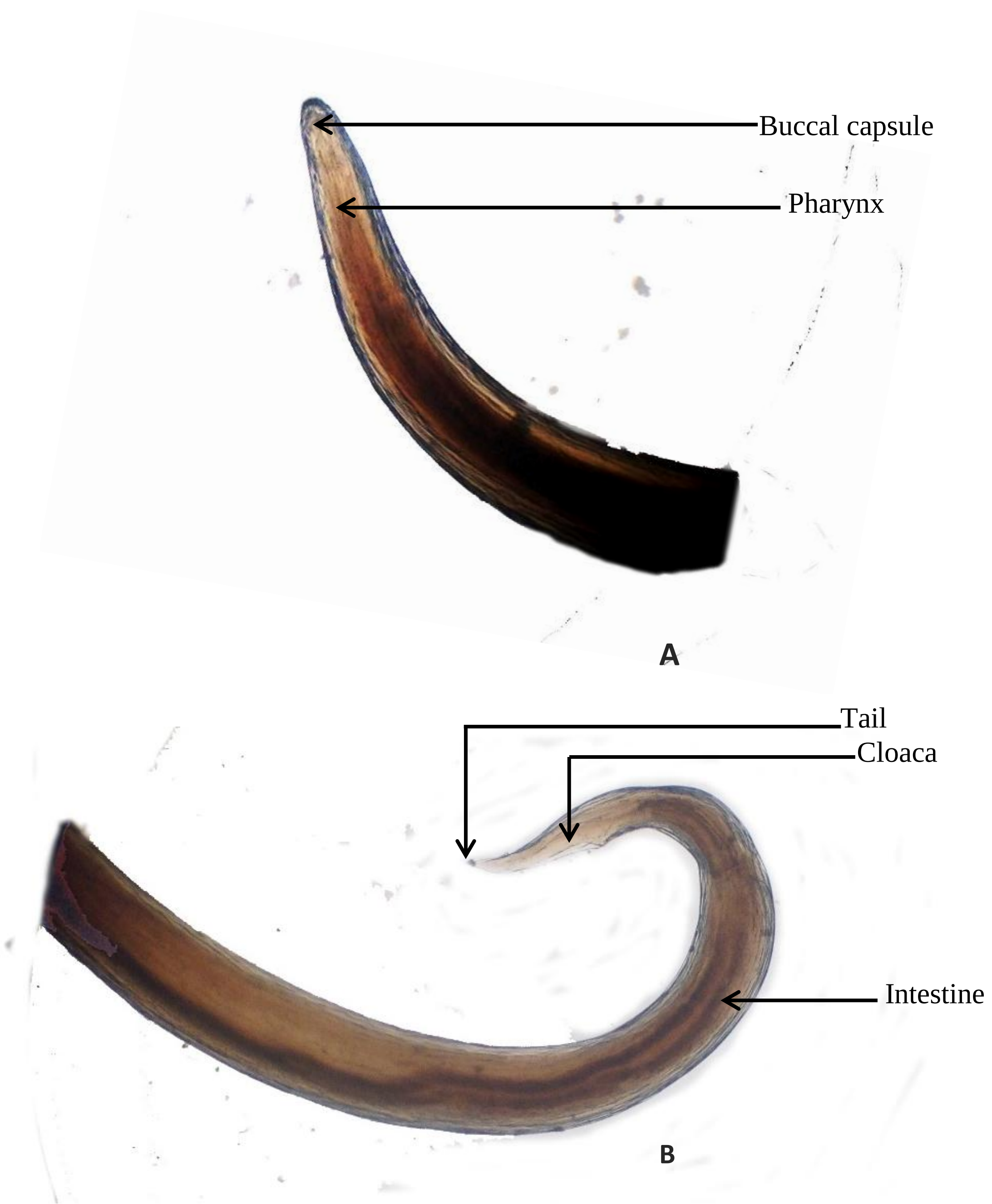


Plate 17: *Spirocamallanus* species

A – Anterior end
B – Posterior end

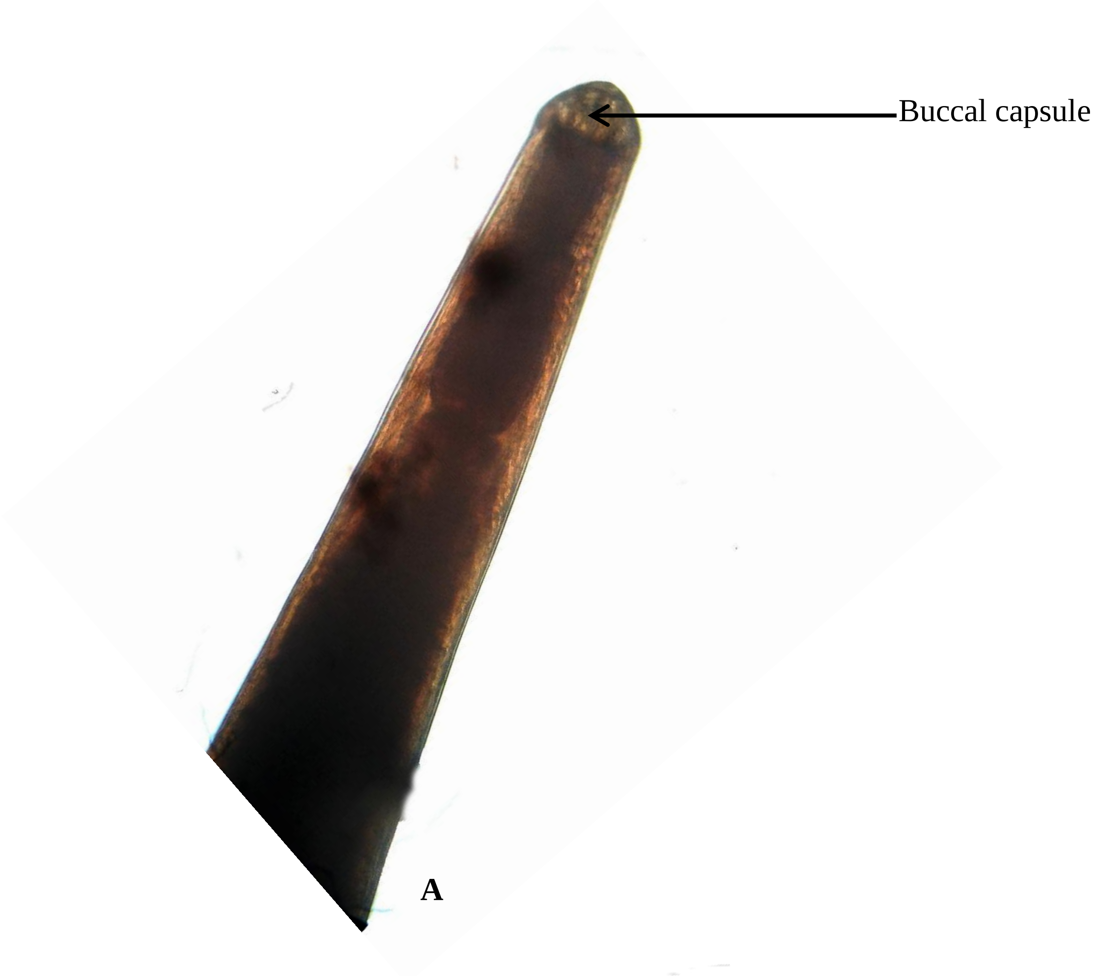


Plate 18: *Procamallanus laeviconchus*

A – Anterior end
B – Posterior end (male)

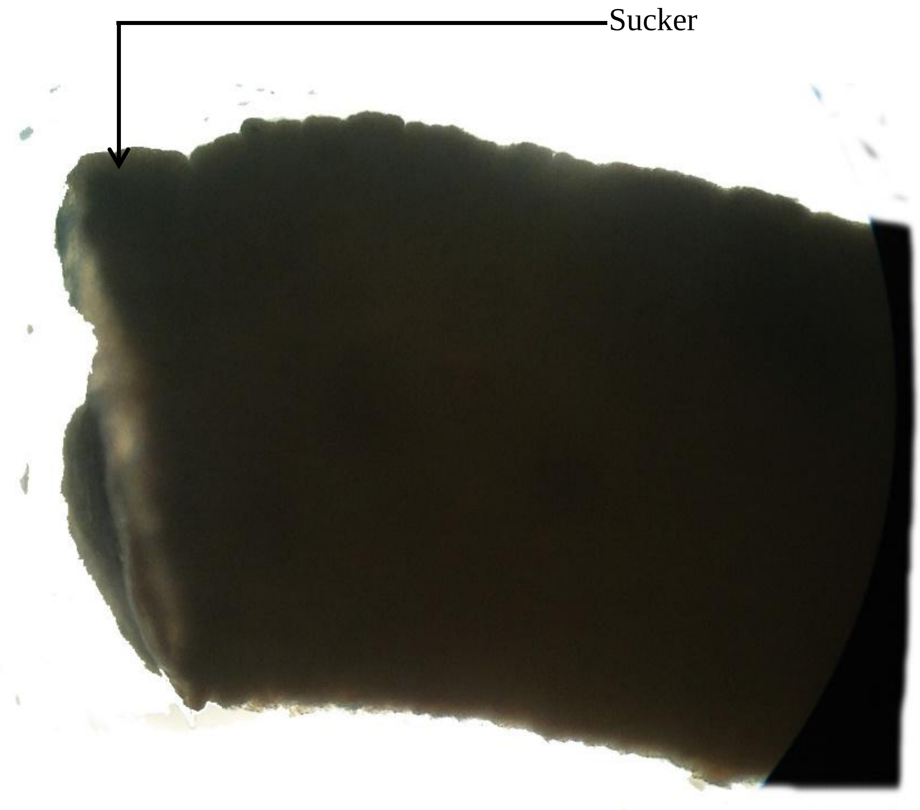
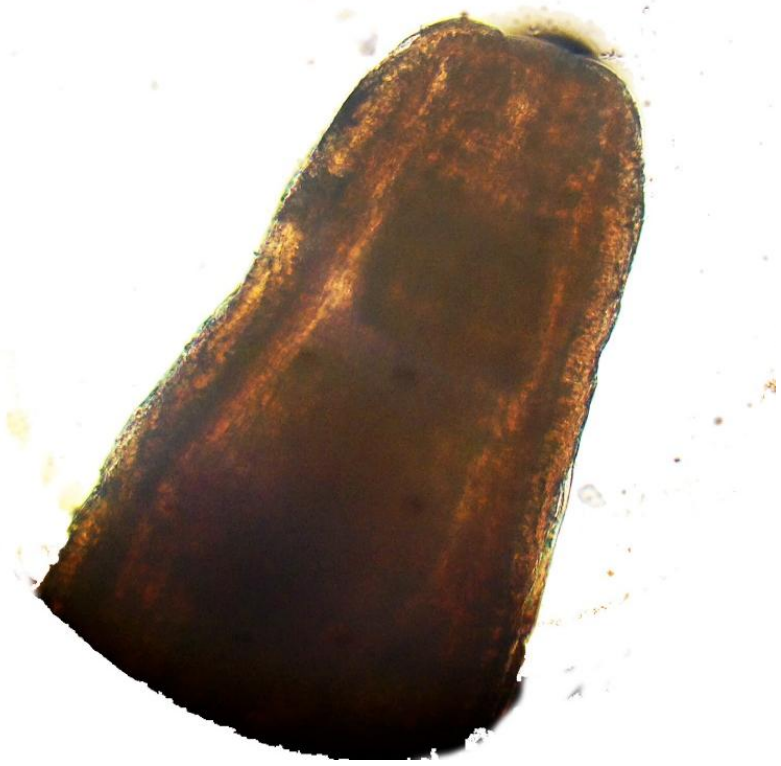
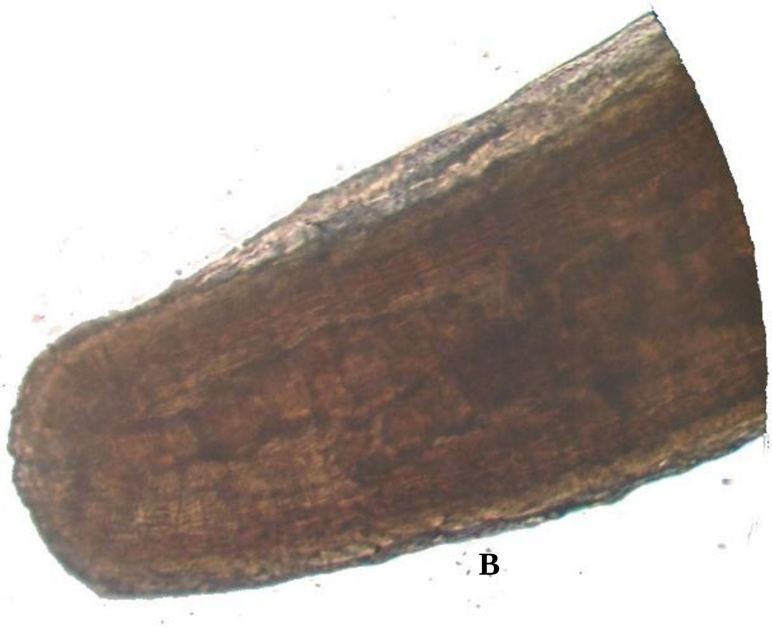


Plate 19: Anterior end of *Weyonia youdeoweii*



A



B

Plate 20: *Neoechinorynchus* species

A - Anterior end
B – Posterior end (female)

Plate 21: *Sandonella sandoni*

Plate 22: Anterior end of *Electrotaenia malapteruri*

APPENDIX 2

Correlations

Correlations

Codes			Weight	M.I.I	M.A
	Weight	Pearson Correlation	.[a]	.[a]	.[a]
		Sig. (2-tailed)		.	.
		N	0	0	0
	M.I.I	Pearson Correlation	.[a]	.[a]	.[a]
.		Sig. (2-tailed)	.		.
		N	0	0	0
	M.A	Pearson Correlation	.[a]	.[a]	.[a]
		Sig. (2-tailed)	.	.	
		N	0	0	0
S. eupterus	Weight	Pearson Correlation	1	.822*	.599
		Sig. (2-tailed)		.045	.209
		N	6	6	6
	M.I.I	Pearson Correlation	.822*	1	.856*
		Sig. (2-tailed)	.045		.030
		N	6	6	6
	M.A	Pearson Correlation	.599	.856*	1
		Sig. (2-tailed)	.209	.030	
		N	6	6	6
S. batensoda	Weight	Pearson Correlation	1	-.775	-.183
		Sig. (2-tailed)		.225	.817
		N	4	4	4
	M.I.I	Pearson Correlation	-.775	1	.471

		Sig. (2-tailed)	.225		.529
		N	4	4	4
		Pearson Correlation	-.183	.471	1
	M.A	Sig. (2-tailed)	.817	.529	
		N	4	4	4
		Pearson Correlation	1	.866	.[a]
	Weight	Sig. (2-tailed)		.333	.
		N	3	3	3
C. anguillaris		Pearson Correlation	.866	1	.[a]
	M.I.I	Sig. (2-tailed)	.333		.
		N	3	3	3

Correlations

Codes			Weight	M.I.I	M.A
C. anguillaris		Pearson Correlation	.[a]	.[a]	.[a]
	M.A	Sig. (2-tailed)	.	.	
		N	3	3	3
		Pearson Correlation	1[a]	-1.000[a]	1.000[a]
	Weight	Sig. (2-tailed)		.	.
		N	2	2	2
		Pearson Correlation	-1.000[a]	1[a]	-1.000[a]
A. occidentalis	M.I.I	Sig. (2-tailed)	.		.
		N	2	2	2
		Pearson Correlation	1.000	-1.000*	1
	M.A	Sig. (2-tailed)	.	.	
		N	2	2	2

	Weight	Pearson Correlation	1[*]	-.803	-.617[*]
		Sig. (2-tailed)		.407	.383
		N	4	3	4
H. longifilis	M.I.I	Pearson Correlation	-.803	1[*]	1.000
		Sig. (2-tailed)	.407		.000
		N	3	3	3
	M.A	Pearson Correlation	-.617	1.000	1
		Sig. (2-tailed)	.383	.000	
		N	4	3	4
H. niloticus	Weight	Pearson Correlation	1	.393	.516
		Sig. (2-tailed)		.261	.126
		N	12	10	10
	M.I.I	Pearson Correlation	.393	1	.971
		Sig. (2-tailed)	.261		.000
		N	10	10	10
	M.A	Pearson Correlation	.516	.971	1[a]
		Sig. (2-tailed)	.126	.000	
		N	10	10	10
M. eletricus	Weight	Pearson Correlation	1	.660	.653[a]
		Sig. (2-tailed)		.225	.232
		N	5	5	5

Correlations

Codes			Weight	M.I.I	M.A
M. eletricus	M.I.I	Pearson Correlation	.660[a]	1[a]	.910[a]
		Sig. (2-tailed)	.225		.032

		N	5	5	5
		Pearson Correlation	.653[a]	.910[a]	1[a]
	M.A	Sig. (2-tailed)	.232	.032	
		N	5	5	5
		Pearson Correlation	1[a]	-.501[a]	-.548[a]
	Weight	Sig. (2-tailed)		.311	.261
		N	6	6	6
		Pearson Correlation	-.501	1*	.985
C. gariepinus	M.I.I	Sig. (2-tailed)	.311		.000
		N	6	6	6
		Pearson Correlation	-.548*	.985	1*
	M.A	Sig. (2-tailed)	.261	.000	
		N	6	6	6
		Pearson Correlation	1	.757*	.765
	Weight	Sig. (2-tailed)		.049	.045
		N	7	7	7
		Pearson Correlation	.757	1	.960
C. obscura	M.I.I	Sig. (2-tailed)	.049		.001
		N	7	7	7
		Pearson Correlation	.765	.960	1
	M.A	Sig. (2-tailed)	.045	.001	
		N	7	7	7
		Pearson Correlation	1	.098	.098
	Weight	Sig. (2-tailed)		.902	.902
C. lazera		N	5	4	4
	M.I.I	Pearson Correlation	.098	1	1.000[a]

		Sig. (2-tailed)	.902		.000
		N	4	4	4
		Pearson Correlation	.098	1.000	1[a]
	M.A	Sig. (2-tailed)	.902	.000	
		N	4	4	4

Correlations

Codes			Weight	M.I.I	M.A
P. annectns	Weight	Pearson Correlation	1[a]	-.239[a]	.[a]
		Sig. (2-tailed)		.536	.
		N	9	9	9
	M.I.I	Pearson Correlation	-.239[a]	1[a]	.[a]
		Sig. (2-tailed)	.536		.
		N	9	9	9
	M.A	Pearson Correlation	.[a]	.[a]	.[a]
		Sig. (2-tailed)	.	.	
		N	9	9	9
S. mystus	Weight	Pearson Correlation	1	-1.000*	.
		Sig. (2-tailed)		.	.
		N	2	2	2
	M.I.I	Pearson Correlation	-1.000*	1	.*
		Sig. (2-tailed)	.		.
		N	2	2	2
	M.A	Pearson Correlation	.	.*	.
		Sig. (2-tailed)	.	.	
		N	2	2	2

	Weight	Pearson Correlation	1	-.368	.
		Sig. (2-tailed)		.330	.
		N	9	9	9
C. nigrodigitatus	M.I.I	Pearson Correlation	-.368	1	.
		Sig. (2-tailed)	.330		.
		N	9	9	9
	M.A	Pearson Correlation	.	.	.
		Sig. (2-tailed)	.	.	
		N	9	9	9
C. citharus	Weight	Pearson Correlation	1	.258	.[a]
		Sig. (2-tailed)		.742	.
		N	4	4	4
	M.I.I	Pearson Correlation	.258	1	.[a]
		Sig. (2-tailed)	.742		.
		N	4	4	4

Correlations

Codes			Weight	M.I.I	M.A
C. citharus	M.A	Pearson Correlation	.[a]	.[a]	.[a]
		Sig. (2-tailed)	.	.	
		N	4	4	4

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

a. Cannot be computed because at least one of the variables is constant.

Correlations

Correlations

V2			Length	M.I.I	M.A
S. eupterus	Length	Pearson Correlation	1	-.132	-.317
		Sig. (2-tailed)		.916	.795
		N	3	3	3
	M.I.I	Pearson Correlation	-.132	1	.982
		Sig. (2-tailed)	.916		.121
		N	3	3	3
	M.A	Pearson Correlation	-.317	.982	1
		Sig. (2-tailed)	.795	.121	
		N	3	3	3
S. batensoda	Length	Pearson Correlation	1	-.866	-.500
		Sig. (2-tailed)		.333	.667
		N	3	3	3
	M.I.I	Pearson Correlation	-.866	1	.866
		Sig. (2-tailed)	.333		.333
		N	3	3	3
	M.A	Pearson Correlation	-.500	.866	1
		Sig. (2-tailed)	.667	.333	
		N	3	3	3
C. anguillaris	Length	Pearson Correlation	1	-.866	.[a]
		Sig. (2-tailed)		.333	.
		N	3	3	3
	M.I.I	Pearson Correlation	-.866	1	.[a]
		Sig. (2-tailed)	.333		.

		N	3	3	3
	M.A	Pearson Correlation	.[a]	.[a]	.[a]
		Sig. (2-tailed)	.	.	
		N	3	3	3
A. occidentalis	Length	Pearson Correlation	1	-1.000**	1.000**
		Sig. (2-tailed)		.	.
		N	3	2	2
	M.I.I	Pearson Correlation	-1.000**	1	-1.000**
		Sig. (2-tailed)	.		.
		N	2	2	2

Correlations

V2			Length	M.I.I	M.A
A. occidentalis	M.A	Pearson Correlation	1.000	-1.000	1
		Sig. (2-tailed)	.	.	
		N	2	2	2
H. longifilis	Length	Pearson Correlation	1	-.866	-.866
		Sig. (2-tailed)		.333	.333
		N	3	3	3
	M.I.I	Pearson Correlation	-.866	1	1.000
		Sig. (2-tailed)	.333		.000
		N	3	3	3
	M.A	Pearson Correlation	-.866	1.000	1
		Sig. (2-tailed)	.333	.000	
		N	3	3	3
H. niloticus	Length	Pearson Correlation	1	.923	.836

		Sig. (2-tailed)		.077	.164
		N	4	4	4
		Pearson Correlation	.923	1	.958
	M.I.I	Sig. (2-tailed)	.077		.042
		N	4	4	4
		Pearson Correlation	.836	.958	1[a]
	M.A	Sig. (2-tailed)	.164	.042	
		N	4	4	4
		Pearson Correlation	1	.693	.803[a]
	Length	Sig. (2-tailed)		.512	.407
		N	3	3	3
		Pearson Correlation	.693[a]	1[a]	.986[a]
M. eletricus	M.I.I	Sig. (2-tailed)	.512		.106
		N	3	3	3
		Pearson Correlation	.803	.986**	1**
	M.A	Sig. (2-tailed)	.407	.106	
		N	3	3	3
		Pearson Correlation	1**	-.636	.115**
C. gariepinus	Length	Sig. (2-tailed)		.561	.927
		N	3	3	3

Correlations

V2			Length	M.I.I	M.A
C. gariepinus		Pearson Correlation	-.636	1	.693
	M.I.I	Sig. (2-tailed)	.561		.512
		N	3	3	3

		Pearson Correlation	.115	.693	1
	M.A	Sig. (2-tailed)	.927	.512	
		N	3	3	3
C. obscura	Length	Pearson Correlation	1	.936	.858
		Sig. (2-tailed)		.064	.142
		N	4	4	4
	M.I.I	Pearson Correlation	.936	1	.984
		Sig. (2-tailed)	.064		.016
		N	4	4	4
	M.A	Pearson Correlation	.858	.984	1
		Sig. (2-tailed)	.142	.016	
		N	4	4	4
C. lazera	Length	Pearson Correlation	1	.258	.258
		Sig. (2-tailed)		.742	.742
		N	4	4	4
	M.I.I	Pearson Correlation	.258	1	1.000[a]
		Sig. (2-tailed)	.742		.000
		N	4	4	4
	M.A	Pearson Correlation	.258	1.000	1[a]
		Sig. (2-tailed)	.742	.000	
		N	4	4	4
P. annectns	Length	Pearson Correlation	1[a]	-.131[a]	.[a]
		Sig. (2-tailed)		.805	.
		N	6	6	6
	M.I.I	Pearson Correlation	-.131	1[**]	.[**]
		Sig. (2-tailed)	.805		.

		N	6	6	6
		Pearson Correlation	.[**]	.	.[**]
	M.A	Sig. (2-tailed)	.	.	
		N	6	6	6

Correlations

V2			Length	M.I.I	M.A
S. mystus	Length	Pearson Correlation	1	-.866	.
		Sig. (2-tailed)		.333	.
		N	3	3	3
	M.I.I	Pearson Correlation	-.866	1	.
		Sig. (2-tailed)	.333		.
		N	3	3	3
	M.A	Pearson Correlation	.	.	.
		Sig. (2-tailed)	.	.	
		N	3	3	3
C. nigrodigitatus	Length	Pearson Correlation	1	-.354	.
		Sig. (2-tailed)		.559	.
		N	5	5	5
	M.I.I	Pearson Correlation	-.354	1	.
		Sig. (2-tailed)	.559		.
		N	5	5	5
	M.A	Pearson Correlation	.	.	.
		Sig. (2-tailed)	.	.	
		N	5	5	5
C. citharus	Length	Pearson Correlation	1	1.000	.[a]

		Sig. (2-tailed)		.	.
		N	2	2	2
		Pearson Correlation	1.000	1	.[a]
	M.I.I	Sig. (2-tailed)	.		.
		N	2	2	2
		Pearson Correlation	.[a]	.[a]	.[a]
	M.A	Sig. (2-tailed)	.	.	
		N	2	2	2

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

a. Cannot be computed because at least one of the variables is constant.

APPENDIX 3

Weight Correlation with MII and MA

Fish Species		M.I.I	M.A
S. eupterus	Pearson Correlation	.822[*]	.599
	Sig. (2-tailed)	.045	.209
	N	6	6
S. batensoda	Pearson Correlation	-.775	-.183
	Sig. (2-tailed)	.225	.817
	N	4	4
C. anguillaris	Pearson Correlation	.866	.[a]
	Sig. (2-tailed)	.333	.
	N	3	3
A. occidentalis	Pearson Correlation	-1.000[**]	1.000[**]
	Sig. (2-tailed)	.	.
	N	2	2
H. longifilis	Pearson Correlation	-.803	-.617
	Sig. (2-tailed)	.407	.383
	N	3	4
H. niloticus	Pearson Correlation	.393	.516
	Sig. (2-tailed)	.261	.126
	N	10	10
M. eletricus	Pearson Correlation	.660	.653
	Sig. (2-tailed)	.225	.232
	N	5	5
C. gariepinus	Pearson Correlation	-.501	-.548
	Sig. (2-tailed)	.311	.261
	N	6	6
C. obscura	Pearson Correlation	.757[*]	.765[*]
	Sig. (2-tailed)	.049	.045
	N	7	7
C. lazera	Pearson Correlation	.098	.098
	Sig. (2-tailed)	.902	.902
	N	4	4
P. annectns	Pearson Correlation	-.239	.[a]
	Sig. (2-tailed)	.536	.
	N	9	9
S. mystus	Pearson Correlation	-1.000[**]	.[a]
	Sig. (2-tailed)	.	.
	N	2	2
C. nigrodigitatus	Pearson Correlation	-.368	.[a]
	Sig. (2-tailed)	.330	.
	N	9	9
C. citharus	Pearson Correlation	.258	.[a]
	Sig. (2-tailed)	.742	.
	N	4	4

APPENDIX 4

Length correlation with MII and MA

Fish Species		M.I.I	M.A
S. eupterus	Pearson Correlation	-.132	-.317
	Sig. (2-tailed)	.916	.795
	N	3	3
S. batensoda	Pearson Correlation	-.866	-.500
	Sig. (2-tailed)	.333	.667
	N	3	3
C. anguillaris	Pearson Correlation	-.866	.[a]
	Sig. (2-tailed)	.333	.
	N	3	3
A. occidentalis	Pearson Correlation	-1.000**	1.000**
	Sig. (2-tailed)	.	.
	N	2	2
H. longifilis	Pearson Correlation	-.866	-.866
	Sig. (2-tailed)	.333	.333
	N	3	3
H. niloticus	Pearson Correlation	.923	.836
	Sig. (2-tailed)	.077	.164
	N	4	4
M. eletricus	Pearson Correlation	.693	.803
	Sig. (2-tailed)	.512	.407
	N	3	3
C. gariepinus	Pearson Correlation	-.636	.115
	Sig. (2-tailed)	.561	.927
	N	3	3
C. obscura	Pearson Correlation	.936	.858
	Sig. (2-tailed)	.064	.142
	N	4	4
C. lazera	Pearson Correlation	.258	.258
	Sig. (2-tailed)	.742	.742
	N	4	4
P. annectns	Pearson Correlation	-.131	.[a]
	Sig. (2-tailed)	.805	.
	N	6	6
S. mystus	Pearson Correlation	-.866	.[a]
	Sig. (2-tailed)	.333	.
	N	3	3
C. nigrodigitatus	Pearson Correlation	-.354	.[a]
	Sig. (2-tailed)	.559	.
	N	5	5
C. citharus	Pearson Correlation	1.000**	.[a]
	Sig. (2-tailed)	.	.
	N	2	2

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

a. Cannot be computed because at least one of the variables is constant.

APPENDIX 5

Table 6: Mixed infections involving different species of helminth parasites in fishes

Fish hosts	Parasites	Location	No examined	No infected	Frequency
H. niloticus	*T. niloticus* and *S. sandoni*	Intestine	147	25	17.00
	S. sandoni and *P. laeviconchus*	Mid-int Rectum	147	2	1.36
	T. niloticus and *Dujardinascaris* species	Post-int	147	2	1.36
	T. niloticus, *S. sandoni* and *P. laeviconchus*	Post-int	147	2	1.36
	Neoechinorhynchus speciesand *T. niloticus*	Caecum Int.	60	2	3.33
S. batensoda	*Neochinorhynchus* species and *W. youdeoweii*	Int.	60	2	3.33
	Spirocamallanus species and *Neoechinorhynchus* species	Rectum	60	1	1.67

APPENDIX 6

Seasonal variation in the prevalence of helminth infections in fish

Parasite taxa	Parasite species	Fish hosts	Season	N.E	N.I	P(%)	N.P.R	M.I.I.	M.A.
Cestoda	*Weyonia* species	*S. eupterus*	Dry	17	2	11.76	10	5.00	0.60
			Rainy	26	0	0.00	0	0	0
	Weyonia youdeoweii	*S. eupterus*	Dry	17	3	17.64	5	1.67	0.30
			Rainy	26	1	3.85	1	1.0	0.04
		S. batensoda	Dry	36	3	8.33	9	3.00	0.25
			Rainy	24	1	4.12	1	1.00	0.04
	Weyonia synodontis	*S. batensoda*	Dry	36	2	5.56	14	7.00	0.39
			Rainy	24	0	0.00	0	0.0	0.0
	Plerocercoid larva	*C. anguillariis*	Dry	10	2	20.0	2	1.00	0.20
			Rainy	5	0	0.00	0	0.0	0.0
	Polyonchobothrium	*C. anguillaris*	Dry	10	2	20.00	2	1.00	0.20
	clarias		Rainy	5	0	0	0	0.0	0.0
		C.lazera	Dry	12	2	16.67	6	3.00	0.50
			Rainy	2	0	0	0	0.0	0.0
	S. sandoni	*H. niloticus*	Dry	106	39	36.79	135	3.50	1.30
			Rainy	41	16	39.02	24	1.50	0.60
	E. malapteruri	*M. electricus*	Dry	30	16	53.33	110	6.90	3.70
			Rainy	2	0	0	0	0.0	0.0
	Unidentified	*A. occidentials*	Dry	18	6	33.33	32	5.33	1.80
			Rainy	14	0	0.00	0	0.0	0.0
		H. longifilis	Dry	2	0	0.00	0	0.0	0.0
			Rainy	10	2	20.00	2	1.00	0.20
Trematoda	*Emoleptalae* species	*C.gariepinus*	Dry	10	2	5.00	8	4.00	0.80
			Rainy	21	0	0.00	0	0.0	0.0
Nematoda	*P. laeviconchus*	*C. obscura*	Dry	39	10	25.64	60	6.00	1.54
			Rainy	34	11	32.35	59	5.40	1.74
		H. niloticus	Dry	106	0	0.00	0	0.0	0.0
			Rainy	41	4	9.76	20	5.00	0.05

	Dujardinascaris	*H. niloticus*	Dry	106	0	0.0	0	0.0	0.0
	Species		Rainy	41	2	4.88	18	6.00	0.44
	Spirocamallanus	*S. batensoda*	Dry	36	0	0.00	0	0.0	0.0
	Species		Rainy	24	1	4.17	1	1.00	0.04
		C. gariepinus	Dry	10	0	0.00	0	0.0	0.0
			Rainy	21	1	4.76	2	2.00	0.10
	Neoechinorynchus	*S. eupterus*	Dry	17	2	11.76	10	5.00	0.60
	Species		Rainy	26	5	19.23	31	6.20	1.20
Acanthocephalan		*S. batensoda*	Dry	36	1	2.78	8	8.00	0.22
			Rainy	24	4	16.67	36	9.00	1.50
	T. niloticus	*H. niloticus*	Dry	106	43	40.57	249	5.80	2.40
			Rainy	41	2	4.88	6	3.00	0.12
		S. batensoda	Dry	36	0	0.00	0	0.0	0.0
			Rainy	24	2	8.33	2	1.00	0.10
		M. electicus	Dry	30	2	6.67	2	1.00	0.10
			Rainy	2	0	0.00	0	0.0	0.0
	Unidentified	*P. annectens*	Dry	24	2	8.33	4	2.00	0.20
			Rainy	20	0	0.0	0	0.0	0.0
		S. mystus	Dry	38	2	5.26	2	1.00	0.07
			Rainy	0	0	0.00	0	0.0	0.0
		C. nigrodigitatus	Dry	29	2	6.89	2	1.00	0.07
			Rainy	10	0	0.00	0	0.0	0.0
		A.occidentalis	Dry	18	2	11.11	16	8.00	0.90
			Rainy	14	0	0.00	0	0.0	0.0

APPENDIX 7A

Monthly Variation in the Physicochemical Parameters of the River Basin in Wet and Dry Season

Physicochemical Parameters	Location	Wet Months					Dry Months			
		May	Jul.	Sept.	Oct.	Mean	Nov.	Jan.	Mar	Mean
pH	Nsugbe	6.33	6.33	6.36	6.4	6.36	6.55	6.51	6.50	6.52
	Otuocha	6.40	6.42	6.42	6.44	6.42	6.70	6.66	6.65	6.67
	Enugwu Otu	6.28	6.29	6.30	6.33	6.30	6.72	6.69	6.66	6.69
Temperature (^{o}C)	Nsugbe	24.95	25.0	25	25.05	25.00	27.62	27.61	27.57	27.60
	Otuocha	25	26	27	29	27.00	28.01	28.00	27.99	28.00
	Enugwu Otu	27.04	27.1	27.1	27.16	27.01	30.05	30.12	30.17	30.10
Chloride (Mg/L)	Nsugbe	132	134	133	133	133	147	146	142	145
	Otuocha	134	136	136	138	136	148	147	146	147
	Enugwu Otu	130	136	132	130	132	142	141	137	140
Nitrate (Mg/L)	Nsugbe	4.1	4.1	4.1	4.1	4.10	2.49	2.46	2.46	2.47
	Otuocha	6.06	6.08	6.08	6.1	6.08	3.24	3.26	3.28	3.26
	Enugwu Otu	4.0	3.9	4.0	4.1	4.0	2.98	2.99	3.03	3.0
Dissolved Oxygen (DO)	Nsugbe	4.12	4.10	4.1	4.08	4.10	5.0	5.0	5.03	5.01
	Otuocha	3.91	3.91	3.90	3.88	3.90	5.66	5.65	5.64	5.65
	Enugwu Otu	4.62	4.61	4.60	4.57	4.60	5.41	5.40	5.39	5.40
Conductivity	Nsugbe	27.02	27.0	27.01	27.01	27.01	30.02	30.03	30.07	30.04
	Otuocha	27.03	27.01	27.00	26.96	27.00	31.00	31.00	31.00	31.00
	Enugwu Otu	18.84	18.79	18.80	18.77	18.80	24.71	24.71	24.68	24.70
Turbidity (NTU)	Nsugbe	140.45	140.55	140.50	140.5	140.50	112	111	107	110.00
	Otuocha	120	120	120.00	120	120.00	102	101	103	102.00
	Enugwu Otu	113	112	110.00	105	110.00	110.10	110.05	110.15	110.10

APPENDIX 7B

Location, Season and Annual Mean of some Physicochemical Parameters of River Anambra

Physicochemical Parameters	Location			Seasons		Annual Mean	WHO standard 1984
	Nsugbe	Otuocha	Enugwu-Otu	Wet	Dry		
Ph	6.43±0.09	6.53±0.14	6.47±0.21	6.36±0.06	6.63±0.09	6.50±0.19	65.85
Temperature (^oC)	26.12±1.39	27.41±1.39	28.42±1.6	26.40±1.19	28.60±1.34	27.50±1.56	30^oC
Chloride (Mg/L)	138.14±6.62	140.71±6.02	135.43±4.96	133.67±2.08	144.00±3.61	138.84±7.30	≤200Mg/L
Nitrate (Mg/L)	3.40±0.87	4.87±1.51	3.57±0.54	4.73±1.17	2.90±0.40	3.82±1.29	≤10Mg/L
Dissolved Oxygen demand (DO)	4.49±0.49	4.65±0.94	4.94±0.43	4.20±0.36	5.35±0.32	4.78±0.81	≥6
Conductivity	28.31±1.62	28.71±2.14	21.33±3.15	24.27±4.74	28.58±3.39	26.43±3.05	500
Turbidity (NTU)	127.43±16.37	112.29±9.64	110.04±2.52	123.50±15.55	107.37±4.65	115.43±11.41	≤200ppm

APPENDIX 8

CHI-SQUARE ANALYSIS

***Weyonia youdeoweii* fish hosts * Prevalence**

		Prevalence		Total	Chi-square (P-value)
		Not infected	Infected		
Weyonia youdeoweii fish hosts	*S. eupterus*	39	4	43	0.243
	S. batensoda	56	4	60	(0.622)
Total		95	8	103	

***Procamallanus laeviconchus* * Prevalence rate**

		Prevalence rate		Total	Chi-square (P-value)
		Not infected	Infected		
Procamallanus laeviconchus	*Channa obscura*	52	21	73	32.85
	Heterotis niloticus	143	4	147	(0.000)
Total		195	25	220	

***Spirocamallanus* species * Prevalence**

		Prevalence		Total	Chi-square (P-value)
		Not infected	Infected		
Spirocamallanus species	*S.batensoda*	58	1	59	0.219
	C. gariepinus	30	1	31	(0.640)
Total		88	2	90	

***Neoechinorynchus* species * Prevalence of infection**

		Prevalence of infection		Total	Chi-square (P-value)
		Not infected	Infected		
Neoechinorynchus species	*S. eupterus*	36	7	43	1.536
	S. batensoda	55	5	60	(0.215)
Total		91	12	103	

Tenuisentis niloticus * Prevalence of infection

		Prevalence of infection		Total	Chi-square (P-value)
		Not infected	Infected		
Tenuisentis niloticus	*C. citharus*	68	2	70	42.100 (0.000)
	H. niloticus	101	46	147	
	S. batensoda	58	2	60	
	M. electricus	30	2	32	
Total		257	52	309	

Unidentified Acanthocephalan * Prevalence

		Prevalence		Total	Chi-square (P-value)
		Not infected	Infected		
Unidentified Acanthocephala	*P. annectens*	42	2	44	0.110 (0.991)
	Schibemystus	36	2	38	
	C. nigrodigitatus	37	2	39	
	A. occidentis	30	2	32	
Total		145	8	153	

APPENDIX 9

Maximum permissible limits in water

S/N	PARAMETER	NAFDAC	SON	FEPA	NSDW	WHO	EU	USEPA
1	Conductivity	1000	1000	70	1000	-	-	-
2	TDS	500	500	500	500	1000	-	500
3	pH	6.5-8.5	6.5-8.5	6.0-9.0	6.5-8.5	6.8	6.5-9.5	6.5-8.5
4	Total hardness	100	100	-	150	100	-	-
5	Total alkalinity	100	100	-	-	100	-	-
6	Nitrate	10	10	20	50	50	50	10
7	Water Temp	-	-	26	-	40	-	-
8	Dissolved Oxygen	-	-	$\geq$4	-	$\geq$ 6	-	-

Source: Oketola *etal*., 2006; Chinedu *et al*., 2011; Muhibbu *et al*., 2011; Adejuwon and Adelakun, 2012. Where : NAFDAC – National Administration for foods, Drugs and Control, SON – Standard Organization of Nigeria, FEPA – Federal Agency, EU – European Union and WHO – World Health Organization.

APPENDIX 10

Oneway

Descriptives

Weights (g)

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
1	13	384.77	850.090	235.773	-128.94	898.47	20	2300
2	1	20.00	.	.	.	.	20	20
3	2	80.00	28.284	20.000	-174.12	334.12	60	100
4	7	6638.57	9183.548	3471.055	-1854.79	15131.94	20	23850
5	43	3051.79	4309.483	657.190	1725.53	4378.05	40	21970
6	5	3963.60	5378.997	2405.560	-2715.31	10642.51	38	10400
7	5	35182.00	6095.746	2726.101	27613.13	42750.87	26530	43270
8	1	9500.00	.	.	.	.	9500	9500
9	1	21940.00	.	.	.	.	21940	21940
10	1	21250.00	.	.	.	.	21250	21250
11	3	2153.33	150.444	86.859	1779.61	2527.06	1980	2250
12	3	2000.00	365.923	211.266	1091.00	2909.00	1620	2350
13	1	3350.00	.	.	.	.	3350	3350
Total	86	5198.92	9250.468	997.504	3215.61	7182.22	20	43270

ANOVA

Weights (g)

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	5714162045.425	12	476180170.452	22.292	.000
Within Groups	1559386789.005	73	21361462.863		
Total	7273548834.430	85			

APPENDIX 11

FISH SPECIES LENGTH AND WEIGHT CORRELATION

Fish species	**Correlation coefficient**	
	Weight	**Length**
S. eupterus	0.096	-0.518*
S. batensoda	-0.434*	-0.383*
C. anguillaris	0.993*	-0.982*
A. Occidentalis	0.994*	-0.069
H. longifilis	-0.775*	-0.908*
H. niloticus	0.144	-0.096
M. electricus	0.193	0.866*
C. gariepinus	-0.501*	-0.655*
C. Obscura	0.842*	0.976*
C.lazera	0.00	0.00
P. annectens	0.000	0.000
S. mystus	0.00	0.00
C.nigrodigitatus	0.00	0.00
C. citharus	0.00	0.00

*significant at P<0.05

APPENDIX 12

Oneway

Descriptives

N.P.R

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Cestoda	11	31.55	52.778	15.913	-3.91	67.00	2	159
Nematoda	5	32.00	49.422	22.102	-29.37	93.37	1	119
Acanthocephalan	9	39.33	82.730	27.577	-24.26	102.93	2	255
Total	25	34.44	62.154	12.431	8.78	60.10	1	255

ANOVA

N.P.R

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	337.433	2	168.716	.040	.961
Within Groups	92378.727	22	4199.033		
Total	92716.160	24			

Post Hoc Tests
Homogeneous Subsets

N.P.R

Duncan

Parasite taxa	N	Subset for alpha = 0.05
		1
Cestoda	11	31.55
Nematoda	5	32.00
Acanthocephalan	9	39.33
Sig.		.829

Means for groups in homogeneous subsets are displayed.

a. Uses Harmonic Mean Sample Size = 7.462.

b. The group sizes are unequal. The harmonic mean of the group sizes is used. Type I error levels are not guaranteed.

1-77,79-81,84,86,87,90-91,94,97-g166,179-204

1-77,79-81,84,86-87,90-91,94,97-133