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Determination prevalence of cymothoid parasite fish families in Iwofe (Port Harcourt) Rivers state

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Abstract

The aim of this study is to provide information on the morphology of the *Cymothoid* parasites of Haemulidae and Elopidae from Iwofe in Port Harcourt determine physico chemical parameter of study area. To determine the percentage prevalence of *Cymothoid* parasite of both fish families in the study area. To determine the species of the *Cymothoid* parasite in the study area. To compare the structure and morphology of the different life stages of the *Cymothoids.* A total of seventy six (76) fishes from Iwofe landing site were examined, forty six (46) fishes were infected with a prevalence of 68%, *Pomadasys perotetei* had (96.7%), *Pomadasys jubelini* had (57.1%), *Clarias arius* had (50%) and none was also isolated from *Mugil curema.* During the period of study no Elopidae was found in this station, samples were obtained only from Haemulidae. The fishermen said they do not always have that catch because of the kind of net they use in fishing the morphology of the Cymothoid parasites of Haemulidae and Elopidae and the sampling sites was Iwofe water side . The isolated parasite that was collected was Cymothoid parasites and they *Cymothoid sodwana, Cymothoid pleibeia, Cymothoid spp*1*, Cymothoid spp*2*, Nerocila acuminata, Nerocila lomatia* and *Nerocila orbignyi.* The physical chemical parameters of the water was analyzed and the result showed that there was a significant difference in salinity, Dissolved Oxygen (DO) and Electrical Conductivity (EC) across the sampling stations. Pomadasyidae had a higher prevalence of isopods than the other fish hosts and more than one type of parasite was found in the mouth while Elopidae had the parasite on their fins and body wall and none was recorded in the mouth. The cephalon, pereomeres, pleomeres, pleotelson, eyes and marsupium was different in the Cymothoids studied. The parasite also affected the condition of the fish.

Keywords: *Cymothoid parasites, Physicochemical parameters, Fish families, Iwofe*

1. Introduction

Cymothoids are a family of Isopods in the suborder Cymothoida and are found in both marine and freshwater environments Horton and Okamura (2001). They are ectoparasites, usually of fish, and among their number is the bizarre tongue-biter called *Cymothoa exigua* which attaches to a fish's tongue thereby causing it to atrophy, replacing the tongue with its own body (Papapanagiotou and Trilles, 2001). They are protandric hermaphrodites (that is, all juveniles are males before developing into adult females) living on the skin, the gill chambers and the mouth of the fish (Bunkley-Williams and Williams, 1998). The females tends to release up

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to hundred eggs at a time into a brood pouch on the underside of its abdomen (Horton and Okamura, 2001). The eggs hatches and undergoes two or more molts which forms juveniles that are released into the water to seek a host (Saravanakumar *et al*., 2012).

Cymothoid isopods are obligate fish parasites, occurring in all oceans with the exception of polar waters (Horton and Okamura, 2001). The family is primarily marine, with limited occurrence in African and Asian freshwaters, but a moderate diversity in tropical South American river systems and tributaries (Öktener *et al*., 2009). Most cymothoids occur on hosts within the 200 m bathymetric, with fewer than 10 species extending beyond 500 m in depth. The family Cymothoidae is among the larger of the isopod families comprising some 40 genera and more than 380 species (Ahyong *et al*., 2011). Greatest diversity occurs within the tropics, with a rapid attenuation in diversity towards high latitudes.

2. Literatur Review

The family Cymothoidae is extraordinary in being among the primary isopods depicted and being the principal isopod family exposed to a far reaching world amendment (Brusca, 1981). Cymothoids, being moderately vast (10-50 mm), went to the consideration of taxonomists early in the history of crustacean taxonomy, in extensive part through crafted by the early fish taxonomists, outstandingly Pieter Bleeker, who might have seen and gathered this 'by-catch'. Fish collections today are as yet a hotspot for undescribed cymothoids (Saravanakumar *et al*., 2012).

The Cymothoidae contrast altogether from all other free-living isopod families in the vast number of genera and species depicted before 1900 and before 1950. As Poore and Bruce (2012) appeared, there was a spike in the documentation of isopod species in the period 1970-1990.The Cirolanidae are typical of free-living families with 12% and 28% of species described by 1900 and 1950, respectively. In contrast approximately 42% of Cymothoidae (depending on accepted synonymies) were described by 1900, 55% by 1950.William Leach, (1813-1814) Was the first significant contributor naming nine cymothoid species and establishing the family name Cymothoidae Leach. Earlier described species such as *Cymothoa ichtiola*, the first post-Linnaeus species to be described and *Ceratothoa imbricata* (Fabricius, 1793) predate the family and its genera. Leach accomplished specific popularity through naming eight genera dependent on the name Caroline and Carolina (Bruce, 1995). Characteristic history of shellfish including the life structures, physiology and characterization of these animals can be taken as the pragmatic begin to the disclosure of the Isopoda including the Cymothoidae as that publication was the principal world-wide audit of the Crustacea, so, all in all 30 species names of Cymothoidae had been proposed Perty (1833).

3. Materials and methods

3.1. Study Area

The study was done in rivers state, Port Harcourt metropolis in the Obio Akpor and Port Harcourt local government area. Port Harcourt is the capital of rivers state in the Niger delta area of the south south geopolitical zone of Nigeria. It is located within latitude 4º 492 273 N and longitude 7º 2' 1"E. The landing sites were Iwofe waterside. Fish was collected from the adjoining estuary to the landing sites. Iwofe is a populated place in Port Harcourt and it is located at an elevation of 395 meters above sea level with latitude 4º49'4" N and 6º57'24"E at Obio Akpor local government area in Rivers state and the river is heavily polluted with refuse dump and illegal refinery waste with high human settlement. Creek road water side is heavily polluted with sewage and refuse dumped into the river, it lies at latitude 4º44'56" N and longitude 7º26"E.

3.2. Collection of sample

3.2.1. Water sample

Water samples were collected from where the fish was caught in the landing sites and were used to measure the following: Salinity, Biological Oxygen Demand (BOD), Turbidity, Total Dissolved Solids (TDS), pH, Dissolved Oxygen (DO), Electrical Conductivity (EC) and temperature. Water samples were collected with the use of sterile containers. All water samples were taken below the water surface. Temperature, DO, Salinity, pH, EC and TDS and depth of water was done *in situ* at landing sites. Measurements were done at the point of sampling the sample bottles was rinsed with the sampling water and the water samples were transported to the laboratory and oxygen content was determined by Winkler's titration method following the method recommended by Azide and APHA (1998).

3.2.2. Physical and chemical characteristics

The physical and chemical parameters measured were Salinity, BOD, Turbidity, TDS, pH, DO, EC and temperature (Figures 1-8).

3.3. Extraction of parasites

The sampled fishes were examined carefully for macro-parasites starting from the gills, body surface, buccal cavity and fins. A pair of forceps was used to remove the parasites from the fishes. The position and location of each parasite on the fish was recorded as well as the number of parasite from each sample. The parasite was collected in small 10 ml vials and fixed in 70% ethanol. A record sheet was used to record the date of collection, station, standard length, fish species, type of parasite, number of parasites, location of parasite within the fish host, and also the type of deformity done on the fish sample when observed.

This was done for each station at every sampling period from January 2018 to April 2018, Photographs of the parasite alone, in/on and in the fish was taken. Where more than one isopod was found, both were removed as specimen from one fish and treated as male (smaller) and female (larger specimen). During the extraction process the fishes were separated according to their species, i.e., Haemulidae and Elopidae from the catch and the different species of isopods were observed and recorded according to their types. The isopods on these two families were noted. The isolated parasites were identified using guides by Ravichandran *et al.* (2009) and Hadfield (2013) based on the shape of head, segments, pleotelson, brood pouch/marsupium and general body structure.

3.4. Statistical analysis

Means, standard deviations and ANOVA were calculated using Microsoft Excel and SPSS (Table 1).

Others include

i. Length weight relationship of infected and non-infected fish

LW relationship from $w = aL^b$

where w = weight

L = length

a = Intercept

b = slope

ii. Test of significance for difference in the size of the pereomere for the different species.

iii. Test of significance of the parts of isopod after separating them into stages/species.

iv. Ratios of each pereomere to the total length to know if there is a significant difference.

v. Ratios of width/length of pleotelson to know the difference in the Cymothoid species studied.

vi. Condition factor of the fish to know the degree of infection of the parasites.

vii. Correlation matrixes of parameters and prevalence of parasites.

Table 1: Mean and SD of physical chemical parameters and results of Turkey separation of means

	pH	Temp °C	DO (mg/l)	BOD (mg/l)	Salinity ppt	Conductivity µm	TDS ppt
Iwofe	6.69±0.25[a]	28.03±0.93[a]	6.37±1.37[a]	2.93±0.81[a]	2.77±0.52[b]	5143.75±1275.07[b]	3891.25±395.78[b]
P	0.62912809	0.1032437	0.000999	0.4970195	< 0.0001	0.000334487	< 0.0001
Significant Difference	No	No	Yes	No	Yes	Yes	Yes

Note: [ab] shows mean comparison are significantly different.

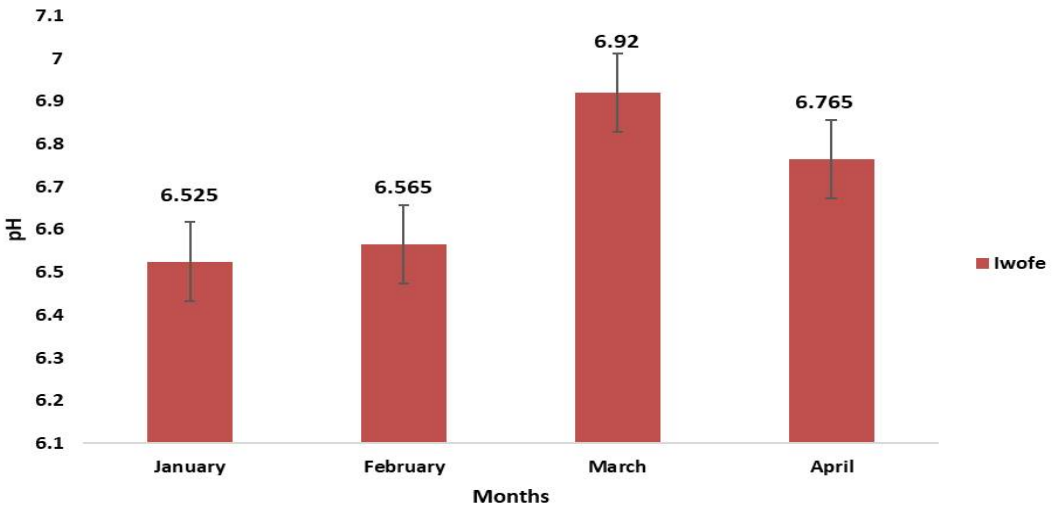

Figure 1: pH of Iwofe River

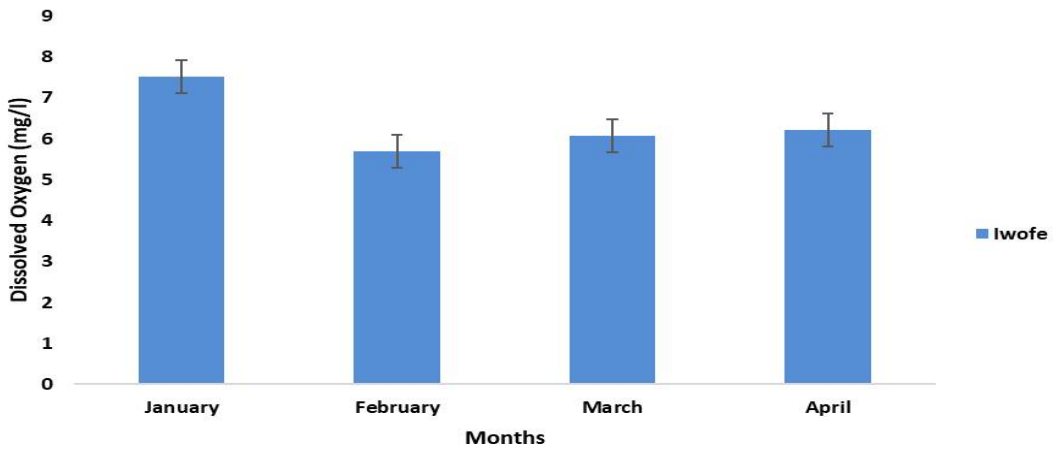

Figure 2: Dissolved Oxygen level of Iwofe River

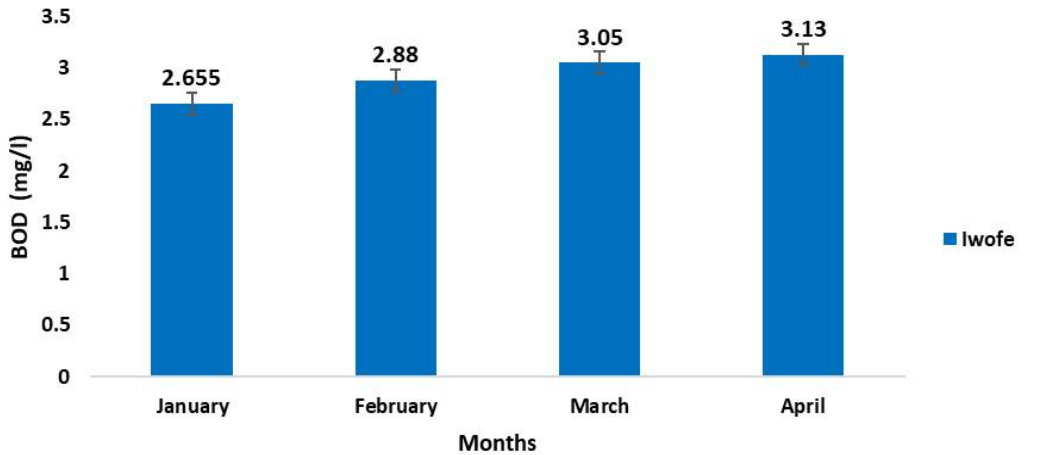

Figure 3: Biological Oxygen Demand level of Iwofe River

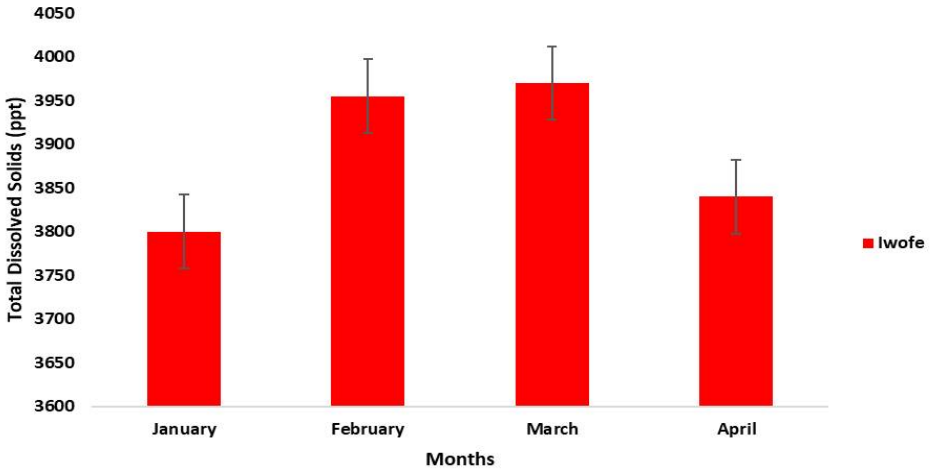

Figure 4: Total Dissolved Solid levels of Iwofe River

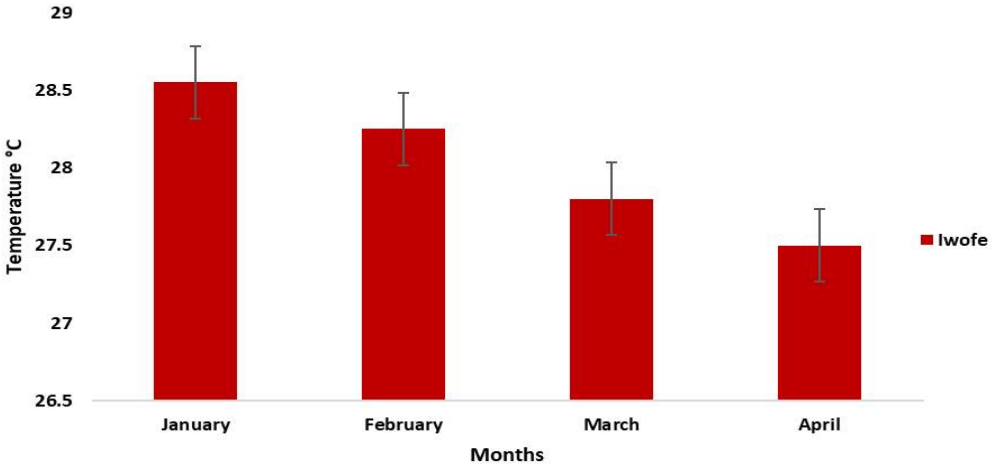

Figure 5: Temperature of Iwofe River

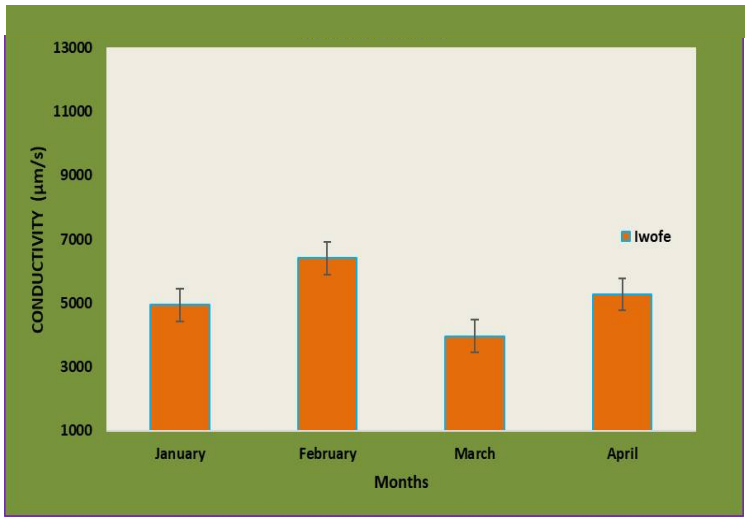

Figure 6: Conductivity of Iwofe River

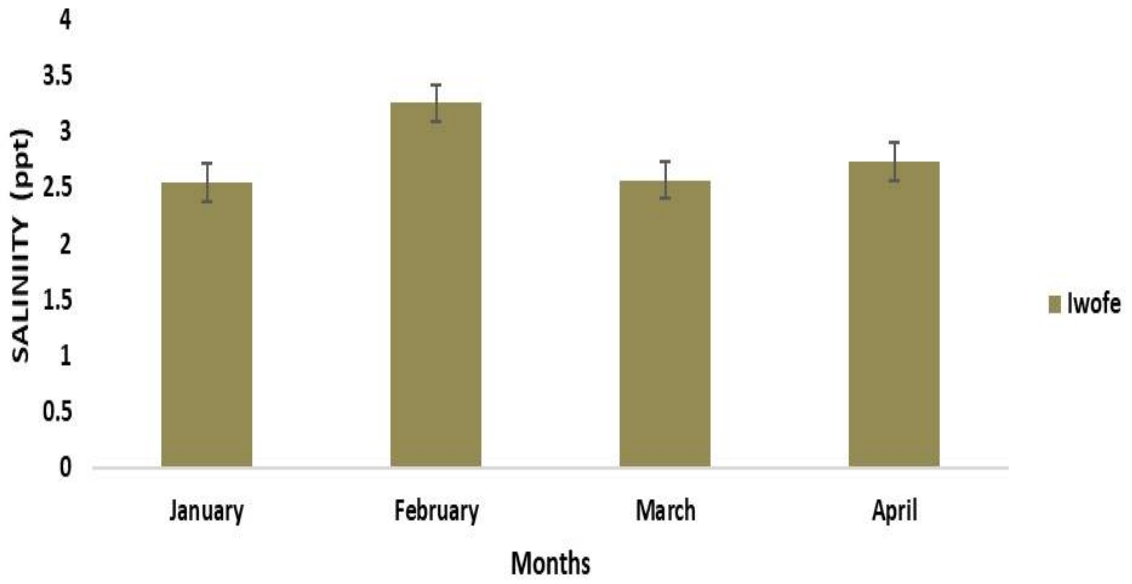

Figure 7: Salinity level of Iwofe River

Table 2: Isopod parasite of fish in Iwofe

Parasite Species	Iwofe
Cymothoa pleibeia	*Pomadasys peroteti*
Cymothoa spp2	*Pomadasys peroteti* *Pomadasys jubelini* *Tilapia spp* *Clarias arius* *Gerres*
Cymothoa sodwana	–
Cymothoa spp1	*Pomadasys perotetei* *Pomadasys jubelini*
Nerocila acuminata	*Clarias arius*
Nerocila lomatia	–

Table 3: Parasitological index of the *Cymothoid* parasites isolated for the period of study

Host Species/ Parasite	Number of Fish Examined	Range of Fish Size (cm)	Number of Fish Infected	Prevalence NFI/NFE x 100	Location on/in Host	Stations Found
Family: Haemulidae *Pomadasys jubelini*	74	11-20	65	87.8		Creek road, Iwofe
Cymothoa spp2			27	36.5	Body	
Cymothoa pleibeia			29	39.2	Mouth	
Cymothoa spp1			9	12.1	Pharyngeal cavity	

Table 4: Parasitological index of the Cymothoid parasites isolated from fishes at Iwofe station

Host Species/ Parasite	Number of Fish Examined	Range of Fish Size (cm)	Number of Fish Infected	Prevalence NFI/NFE x 100	Location on/in Host
Family: Pomadasyidae *Pomadasys perotetei*	31	11-23	30	96.7	
*Cymothoa spp*2			11	35.4	Pectoral fin
Cymothoa pleibea			11	35.4	Mouth and gills
*Cymothoa spp*1			8	25.8	Pelvic fin
Family: Pomadasyidae *Pomadasys jubelini*	14	14-20	8	57.1	Skin, mouth
*Cymothoa spp*2			5	35.7	Mouth
*Cymothoa spp*1			3	21.4	Pelvic fin

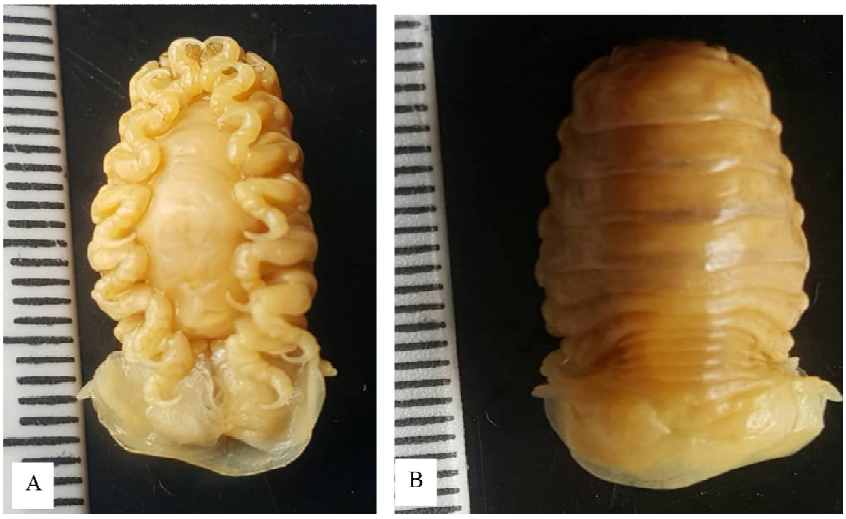

Plate 1: (a) Brood pouch of female specimen; (b) female *Cymothoa sodwana*

Plate 2: Pomadasys peroteti of 9.6cm (SL) infested with *Cymothoa Sodwana*

4. Results

4.1. Prevalence of Isopod Parasite on Fish from Iwofe Waterside Station

A total of seventy six (76) fishes from Iwofe landing site were examined, forty six (46) fishes were infected with a prevalence of 68%, *Pomadasys perotetei* had (96.7%), *Pomadasys jubelini* had (57.1%),*Clarias arius* had (50%) and none was also isolated from *Mugil curema*. During the period of study no Elopidae was found in this station, samples were obtained only from Haemulidae. The fishermen said they do not always have that catch because of the kind of net they use in fishing (Table 4).

5. Discussion

The physical chemical parameters of water are the most important factors that influence the structure of lives in aquatic ecosystem. Temperature measured was 27.5 ^{o}C to 29.9 ^{o}C which was in agreement with the findings of Ugbomeh and Nwosu (2017). The values observed are considered to be normal for the Niger Delta, as Alabaster and Lloyd (1980) reported that temperature of natural inland waters in the tropics varies between 25 ^{o}C and 35 ^{o}C .The pH is a measure of the free hydrogen ion and hydroxyl ions in the water. pH can also be an important water indicator that is changing chemically. pH values were 6.5-8.5 making the water slightly acidic or alkaline, these observed values were attributed to the tidal brackish water environment as noted by Ajao and Fagade (2002).

Iwofe 2.77 ± 0.52. This tidal flow of water and influx of fresh water from the upper reaches of the river influences the salinity of estuarine creeks. The salinity was highest at Creek Road waterside this record confirms and agrees with other researchers where it recorded high salinity (Ugbomeh, 1987).

TDS is directly related to the purity of water and it include organic solutes such as hydrocarbons and urea in addition to the salt ions (Hickin, 1967). The values of TDS obtained from the stations were 7800 ppt for Creek Road waterside, 4500 ppt for Iwofe and 6500 ppt for Eagle Island respectively. This agrees with result of (Nweke, 2000) that reported high TDS due to anthropogenic and dredging activities and wave current that altered the benthos. Agricultural runoff, discharge of domestic waste and other anthropogenic activities around the river can be one of the primary sources for higher TDS. (Alabaster and Lloyd, 1980).

DO is a very important parameter for water. It is necessary for good water quality. The lower the concentration the greater the oxidative stress (Djukic *et al.,* 1994). Oxygen is supplied to the water by diffusion from its surrounding air, by aeration and as waste product of photosynthesis. The values obtained for DO was significantly different among the sampling stations as Iwofe recorded the highest amount at mean value of 6.37 ± 1.37, followed by Eagle Island at 6.26 ± 2.37 and Creek Road had the lowest value of DO obtained. Water with DO of 6 mg / l supports fish and other aquatic forms while less than 2 mg / l oxygen supports decomposers majorly. The values agrees with those of Vincent and Nwachukwu (2016) with a value of 9.6 ± 0.6 but contrasts with Abowei (2010) that had higher DO upstream than downstream. The higher DO value has been reported to be impacted by temperature and abattoir waste by (Davies *et al.,* 2006).

BOD value is defined as the oxygen that is required to undergo biological decomposition by micro-organisms of dissolved solids in waste water under aerobic conditions. The BOD mean value was reported highest at Eagle Island at 3.67 ± 1.18, followed by Creek Road waterside 3.25 ± 1.59 and lowest at Iwofe 2.93 ± 0.81. The variation in the value could be as a result of addition of high volume of waste along with rain water from the surrounding into the river as it flows to its mouth. This agrees with the work of Nwosu and Ugbomeh (2017) and Kaniz *et al.* (2014).

EC is the ability for water to transmit electrical current and it functions as a tool to assess water purity (Murugesan *et al.,* 2016). The ability also depends on the presence of ions, their mobility, valence and temperature of measurement. According to Fekhaoui (1983), high conductivity shows most often at a high salinity and normal pH. The values obtained were between 10250 ± 3230.56 μm and 5143.75 ± 1275.07 μm and it agrees with results of Ugbomeh and Nwosu (2017) who observed that EC increases gradually from upstream to downstream. There was significant difference of EC across the stations during the study.

The prevalence of isopod parasite varies from fish to fish and may depend on varying factors. The prevalence values recorded were 69.1% for Pomadasyidae, 8.83% and Elopidae. The results agrees with the work of Ugbomeh and Nwosu (2017) who recorded 65% prevalence for Pomadasyidae and none for Mugillidae. The result also agrees with those of Aneesh *et al.* (2015) that worked on Cymothoid isopod parasitizing the belonid fish from Malabar Coast where they recorded prevalence of 68.65% of *Cymothoa frontalis* on *Strongylura strongylura.*

Sarig (1975) observed host specificity while he was working on the disease of fishes, prevention and treatment. *Cymothoa sodwana* was found in the mouth of *Pomadasys peroteti* while *Nerocila* species were all found on fins (pectoral and pelvic of *Clarias anguilaris* and *Psuedotolithus elongatus). Cymothoa spp*1, *Cymothoa spp*2 and *Cymothoa pleibeia* were found on the body wall, mouth, and pharyngeal cavity of the fish host (Pomadasyidae and Elopidae). Pomadasyidae seems to have a higher prevalence than the other fish hosts and more than one type of parasite was found in its mouth, Cichlidae also recorded more than one parasite in their mouth and there was no site specificity among the Cymothoa parasites and fishes. The Nerocila observed in this study was site specific as they were not found in the mouth or pharynx. This agrees with the findings of other researchers (Nwosu and Ugbomeh, 2017), Hadfield *et al.* (2014a) and Morton (1974) recorded the attachment site of *Nerocila phaeopleura* as overlying the lateral line in the posterior third of the body, which suggest that site specificity maybe controlled by the needs of the parasite and can be limited by the morphology and habits of the host. In *Elops lacerta* it was recorded that the isopods were found on the fins and body wall and none was recorded in the mouth and the species found were *Cymothoa pleibeia* and *Cymothoa sp2. Pomadasysidae* recorded more infection by the isopods as they were found more in the mouth and also on the fins which may be due to the shape of their mouth and mouth size that allows easy access of the isopods into their buccal cavity / pharynx.

6. Conclusion

A survey of isopod parasites of fishes from three fish landing sites in Port Harcourt as carried out to provide information on the morphology of the Cymothoid parasites of Haemulidae and Elopidae and the sampling sites was Iwofe water side and Eagle Island. The isolated parasite that was collected was Cymothoid parasites and they *Cymothoid sodwana, Cymothoid pleibeia, Cymothoid spp*1*, Cymothoid spp*2*, Nerocila acuminata, Nerocila lomatia* and *Nerocila orbignyi*. The physical chemical parameters of the water was analyzed and the result showed that there was a significant difference in salinity, DO and EC across the sampling stations. Pomadasyidae had a higher prevalence of isopods than the other fish hosts and more than one type of parasite was found in the mouth while Elopidae had the parasite on their fins and body wall and none was recorded in the mouth. The cephalon, pereomeres, pleomeres, pleotelson, eyes and marsupium was different in the Cymothoids studied. The parasite also affected the condition of the fish.

Recommendation

Based on the findings from the study I recommend that:

- A study be done to check for multi infection and its effect on fish.
- More research is needed on the biology of brood pouch / oostegites of Cymothoid parasites so that identification can be easy.
- A specific study should be done to understand the resistance of *Pomadasys jubelini* to the Cymothoid parasite because the presence of the parasite on the fish did not affect weight significantly.

Contribution to Knowledge

- First detailed study of *cymothoid* parasites of fish in the area.
- Baseline research to build on for further studies.
- First appearance of *Cymothoa sodwana, Nerocila accuminata* and *Nerocila orbigyni* in Nigerian waters, etc.

References

Abowei, J., (2010). Salinity, Dissolved oxygen, pH and surface water temperature conditions in Nkoro River, Niger Delta, Nigeria. *Advance Journal of Food Science and Technology*. (2), 36-40

Ahyong S.T., Lowry, J.K., Alonso, M., Bamber, R.N., Boxshall G.A., Castro, P., Gerken, S., Karman, G.S., Goy J.W., Jones,D.S.,Meland, K., Rogers,D.C., & Svavarsson J.(2011). Subphylum Crustacea Brunnich,1772. In Zhang Z. Q. (Ed.). 3148, 165-191. Animal Biodiversity: An Outline of Higher-Level Classification and Survey of Taxonomic Richness. Zootaxa.

Alabaster,J.S. and Lloyd, R. (1980). *Water Quality Criteria for Fresh Water Fish FAO Publication Butter Worths* London-Boston.

Aneesh, P.T., Sudha, K., Heina, A.K., Anilkumar, G. and Trilles, J. P. (2015). Cymothoa frontalis, a cymothoid isopod parsiizing the belnid fish Strongylura Strongylura from the Malabar Coast (Kerala, India): Redescription, description, prevalence and life cycle. *Zoological Studiesvolume.* 54.

American Public Health Association (APHA), (1998). Standard methods for the examination of water and wastewater (Eds.: Clesceri, L.S., Greenberg, A.E and Eaton, A.D. 20th Edition, ISBN: 0875532357. American Public Health Association. Washington, D.C., 1325.

Bruce, N. L. (1995). Comments on the proposed conservation of Lironeca Leach, 1818. Crustacea, Isopoda) as the correct original spelling (Case 2915). *Bulletin of Zoological Nomenclature*. 52, 69.

Brusca, R. C. (1981). A monograph on the Isopoda Cymothoidae (Crustacea) of the eastern Pacific. *Zoological Journal of the Linnean Society*, 73 (2), 117-199.

Bunkley-Williams, L. and Williams, E. H. (1998). Ability of Pederson cleaner shrimp to remove juveniles of the parasitic cymothoid isopod, Anilocra haemuli, from the host. *Crustaceana*. 71, 862-869.

Djukic, N., Maletin, S., Pujin, V., Ivanc, A. and Milajonovic, B. (1994). Ecological assessment of water quality of Tisze by physico-chemical and biological parameters. Tisca Szeged, 28 (1), 37-40.

Fabricius, J.C. (1793). Entomologica systemica amended and acute, Second classes, orders, genera, species, adding synonymous names, places, and with observations of described above. Copenhagen C.G. Proft. 2 (viii), 519.

Fekhaoui, M. (1983). *Toxico-cinétique de trois polluants métalliques majeurs chez la truite arc-en-ciel (Salmo gairdneri): le chrome, le cuivre et le zinc (Doctoral dissertation). Universite*. De Claude Bernard, Lyon, 125.

Hadfield K.A., Bruce N.L. and Smith, N.J. (2013). Review of the fish-parasitic genus Cymothoa Fabricius, 1783 (Isopoda, Cymothoidae, Crustacea) from the south-western Indian Ocean, including a new species from South Africa. *Zootaxa*. 3640, 152-176.

Hickin, N.E. (1968). *Caddis larvae: Larvae of the British Trichoptera*. Fairleigh Dickinson University Press.

Horton, T. and Okamura, B. (2001). Cymothoid isopod parasites in aquaculture: A review and case study of a Turkish sea bass (Dicentrarchus labrax) and sea bream (Sparus auratus) farm. *Diseases of Aquatic Organisms*, 46 (3), 181-188.

Kaniz, F, Wan Maznah, W.O. and Mansor, M.I. (2014). Spatil and Temporal Variation of physico chemical parameters in the Merbok Estuary, Kedh, Malaysia.*Tropical Life Science Research*, 25 (2), 1-19.

Murugesan, A, Ramu, A. and Kannan N (2006). Water quality assessment from Uthamapalayam municipality in Theni District, Tamil Nadu, India. *Pollution Research.* 25, 163-166.

Öktener, A., Trilles, J. P., Alas, A., & Solak, K. (2009). Cymothoid (Crustacea, Isopoda) records on marine fishes (Teleostei and Chondrichthyes) from Turkey. *Bulletin of the European Association of Fish Pathologists*. 29 (2), 51-57.

Papapanagiotou, E. P. and Trilles, J. P. (2001). Cymothoid parasite Ceratothoa parallela inflicts great losses on cultured gilthead sea bream Sparus aurata in Greece. Diseases of Aquatic Organisms, 45 (3), 237-239.

Ravichandran, S. Rameshkumar, G. and Kumaravel, K. (2009). Variation in the morphological features of isopod fish parasites. *World Journal of Fish and Marine Sciences.* 1 (2), 137-140.

Saravanakumar, A., Balasubramanian, T., Raja, K. and Trilles, J. P. (2012). A massive infestation of sea snakes by cymothoid isopods. *Parasitology Research*, 110 (6), 2529–2531.

Sarig, S.(1975). The Status of Information of Fish Diseases in Africa and Possible means of their Control. Symposium on Aquaculture in Africa.

Ugbomeh , P. A. (1987). The Biology and Aquaculture Potential of the Mullet Species in the Bonny Estuary. M.Phil Thesis, Rivers State University of Science and Technology, Port Harcourt

Ugbomeh, P.A. and Nwosu. O.R.(2016). Survey of the Cymothoid Parasites Associated with some Estuarine Fishes (Actinopterygii) from the Upper Reaches of the Bonny Estuary Nigeria: Their use in Ecotoxicological Studies. *Research Journal of Soil Biology*. (4), 34-41.

Vincent –Akpu, I.F. & Nwachukwu, L.C (2016). Comparative Water Quality Assessment of Nembe Bonny and Iwofe Ferry terminals in Port Harcourt, *Nigeria Journal of Environmental Science, Toxicology and Food Techn.*

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