PARASITES OF BLACK TIGER SHRIMP; *PENEAUS MONODON* COLLECTED FROM IGUORIAKHI RIVER, OVIA NORTH EAST LOCAL GOVERNMENT AREA, EDO STATE, NIGERIA.

BY

Deborah Juliet DAUDA (Miss)

LSC1806098

DEPARTMENT OF ANIMAL AND ENVIRONENTAL BIOLOGY

FACULTY OF LIFE SCIENCES

UNIVERSITY OF BENIN

BENIN CITY

EDO STATE

DECEMBER, 2022.

PARASITES OF BLACK TIGER SHRIMP; *PENEAUS MONODON* COLLECTED FROM IGUORIAKHI RIVER, OVIA NORTH EAST LOCAL GOVERNMENT AREA, EDO STATE, NIGERIA.

BY

Deborah Juliet DAUDA (Miss)

LSC1806098

A DESERTATION SUBMITTED TO THE DEPARTMENT OF ANIMAL AND ENVIRONMENTAL BIOLOGY, FACULTY OF LIFE SCIENCES, UNIVERSITY OF BENIN, BENIN CITY IN PARTIAL FULFILLMENT OF THE REQUIREMENT FOR THE AWARD OF DEGREE OF BACHELOR OF SCIENCE, B.SC(HONOURS) IN ANIMAL AND ENVIRONMENTAL BIOLOGY, UNIVERSITY OF BENIN, BENIN CITY.

DECEMBER, 2022.

CERTIFICATION

This is to certify that this project work was carried out by Miss Deborah Juliet DAUDA, with matriculation number LSC1806098 in the Department of Animal and Environmental Biology, Faculty of Life Sciences, University of Benin, Benin City.

---------- ----------

Prof. (Mrs) A.O AWHARITOMA Date
(Project Supervisor)

---------- ----------

Prof. (Mrs) A.A IMASUEN Date
(Head of Department)

---------- ----------

External Examiner Date

DEDICATION

This noble effort is cheerfully dedicated to the Lord Jesus Christ the beneficent and the merciful who has made this my long-awaited expectation a reality, my supervisor, prof. Mrs A. O Awharitoma, and my loving sister, Miss Dauda Joy, may the blessing of the Lord rest on you all.

ACKNOWLEDGEMENT

It is always hard to know how many and which one's idea has been borrowed, hence, my indebtedness goes to many people both directly and indirectly, many of whom I may not be able to mention here.

To start with, I am grateful to the Lord Jesus Christ, the fountain of all knowledge and wisdom who has brought me this far in life and in my educational pursuit.

Firstly, I wish to thank, my caring and ever supportive mother, Mrs. Dauda Hannah Olarimi for all her prayers, creation of a smooth environment to learn and for guiding me all through. May you live to enjoy the fruit of your labour and may the blessing of Almighty God be upon you.

I am most indebted to my supervisor prof. Mrs. A. O Awharitoma, who despite her tight schedule still found time to guide me through my practical, read through my thesis and make all necessary corrections through her wealth of academic experience.

My profound and unreserved gratitude goes to my uncle, pastor peter olarimi for his fatherly advice and encouragement, Mrs. Anthony Mercy Dauda, Mr. Dauda Gospel Isreal and my beloved sister Miss Dauda Zuma Grace who ensure in spite of all odds that I succeed in my quest for education. May God bless you all.

To my various erudite lecturers who are vast in their individual fields of knowledge and disciplines who has piloted the affairs of the department till date and so many others, time will not permit me to mention, I say for this and other unquantifiable mentorship roles you played in my life as a student may the almighty God bless you abundantly.

I am also grateful to my course mates most especially my dear Rita Chisom for her support, Onodua Ethel, and my well wishers, may the Lord bless you all.

TABLE OF CONTENT

CHAPTER THREE

CHAPTER FOUR

CHAPTER FIVE

LIST OF TABLES

LIST OF TABLE

LIST OF PLATE

ABSTRACT

This study was carried out to investigate the parasites of the shrimp *Panaeus monodon* collected from Iguoriakhi River, near Benin City in Ovia North East Local Government Area located between Longitude 005 °25'55.0 - 005 °29'36.20E and Latitude 06 °23'42.76N - 06 °27'10.15N. Live shrimps were collected from November 2021 to February 2022. A total of 101 shrimps were examined, out of which 49(48.5%) were infected with parasites. A total of 59 trematode metacercaria were extracted from infected shrimps with overall mean intensity of 1.20±0.00. Shrimps examined in February had the highest parasite prevalence of 100 %. The results also revealed that pasitic prevalence increased in shrimps as their sizes increased, however a drastic decline was observed in larger shrimps with length between 711.5 - 15.49. Shrimps with length between 7.5-9.49 had the highest prevalence with an overall mean intensity of 1.03±0.00. The results of this study suggest that the black tiger shrimp is susceptible to parasites that can cause health complications when consumed. Therefore care should be taken to avoid human infection.

CHAPTER ONE

INTRODUCTION

1.0 BACKGROUND OF THE STUDY

Penaeus monodon commonly known as the black tiger shrimp or giant tiger shrimp is a crustacean reared for food due to its high quality protein, mineral and vitamin content. Many of the vitamins found in *penaeus monodon* are essential for healthy skin, bones and teeth. (Nzeako, 2015). All types of aquatic habitats are inhabited by *Penaeus monodon*. while some adults go offshore to develop and reproduce, Juveniles are typically found in shallow coastal estuaries, lagoons, and mangrove habitats. (FAO, 2009). The scientific classification of black tiger shrimp is as follow;

Kingdom: Animalia

Phylum: Arthropoda

Subphylum: Crustacea

Class: Malacostraca

Order: Decapoda

Family: Penaeidae

Genus: Penaeus

Species: *P. monodon*.

The giant tiger (or black tiger) shrimp *Penaeus monodon*, is the world leader in aquaculture throughout Asia, the Pacific, and to some extent the Mediterranean. Almost all farmed shrimp are of the family penaeidae and only two species, *penaeus vannamei* and *penaeus monodon* account for about eighty percent of all farmed shrimp. *P. monodon* is the world's largest

species of shrimp and has the quickest growth rate among all penaeid species (Chemonics, 2002; ASEAN, 2003). Despite not being native to the region of west Africa *Penaeus monodon* was accidentally introduced and has since become well established and flourished in the coastal waters of Nigeria. (Ayinla *et al*, 2009a).

Nigeria is a country with enormous water resources which includes marine, brackish and fresh waters. Shrimps and prawns are captured for commercial purposes, culturing as well as consumption.

1.1 JUSTIFICATION OF THE STUDY

The food and agricultural organization and the world health organization (FAO/WHO, 2000) state that illness due to contaminated food is the most widespread health problem in the world and an important cause of reduced economic productivity.

In Nigeria, Shrimps are widely accepted, consumed as a delicacy rich in protein and serves as a means of livelihood to commercial fishermen, aquaculturists as well as market men and women. Because of this, There is risk to consumers health when seafoods exposed to bacteria, viruses, parasites, natural poisons, and pollutants are consumed raw, or undercooked. The increasing tendency of eating shrimps, crabs, meat, fish and mollusks raw, undercooked, smoked pickled or dried facilitates the consumption of a number of protozoan, trematode, cestode and nematode parasites which caused zoonoses (Macpherson, 2005).

1.2 AIM

The study was carried out to determine the presence of parasites in the shrimp; *panaeus monodon* and the parasite load in relation to size of *Penaeus monodon*.

CHAPTER TWO

LITERATURE REVIEWS

Parasitic infections of shrimps have been the subject of investigations in many parts of the world. Research on prevalence, incidence and types of parasites has been carried out in recent times, particularly with the increasing recognition of the importance of shrimp production and shrimps as a source of protein, and the role they play in the economy.

The bacteria and fungal content of shrimps from various meat shops in Benin were investigated. Bacteria, Fungi and Yeast were found in a total of 50 isolates. The isolates of bacteria include *Proteus sp, Micrococcus sp, Pseudomonas sp, Streptococcus sp, Escherichia coli, Staphylococcus aureus, Bacillus sp, Enterobacter sp and Staphylococcus epidermidis* while those of fungi include *include Penicillium oxalicum, Aspergillus flavus, Mucor sp, Aspergillus niger, Aspergillus terreus, Penicillium italicum, Neurospora sp, Cladosporium sp, Aspergillus tamari, Rhodotorula sp, Trichoderma sp* and Yeast. (Ehigiator et al., 2014). Ehigiator concluded that all organism isolated from this study are dangerous and are of food processing and public health concern and hence, hazardous and injurious to human health if consumed.

Black tiger shrimp from the sundarbans were found to contain both freshwater and marine protozoan species. Peritrichous ciliates and microsporidians represent the freshwater category while gregarine represents the marine category. The sampled and analysed host *panaeus monodon* contained Protozoans from three groups which are the epibiontic peritrichous ciliates, gut dwelling gregarines and muscle dwelling microsporidians. (Chakraboti et al., 2011). Earlier reports of all these parasites have been reported from different geographical areas of India (Bower et al., 1994; Prasadan and Janardan, 2001; Johny et al., 2006).

The parasites were more prevalent in the summer following the same seasonal pattern as ciliates. Due to the high pathogenicity of this parasite to shrimp, severe infection may result in loss of appetite, stunted growth and finally death of the host in the culture system (Lightner, 1993). When it comes to microsporidian infections, heavy parasite load leads to death. Thus it can be inferred from the discussion above that severe epibiont and parasite infestations are to be anticipated when the rate of transmission is accelerated by high stocking density, variations in environmental factors (such as the amount of ammonium, nitrate, and dissolved oxygen levels) and the effect of pond fertilization (Kautsky et al., 2000). The moulting process is favoured during summer months due to the increased solar radiation intensity (Rhode, 1992; Jayasree et a., 2001), thus enhancing and facilitating the invasion of parasites.

A study was conducted on *Litopenaeus vannamei* cultured in Iran with the aim of identifying the ecto-parasite species and figuring out the prevalence and severity of the infection. In comparison to Acineta sp. or Epistylis sp, Zoothamnium sp had a higher prevalence. The peritrichous ciliates, on the other hand, were more prevalent among pleopods. It appears that shrimp with lesser weights were more vulnerable to Zoothamnium sp. but no discernable difference in severity was seen between the groups. According to the results of prevalences, Acineta sp. was less common in the isolations. (Kakoolaki et al., 2015).

A study carried out to investigate the Parasitic prevalence of fresh water shrimp (*Atya gabonensis*) in lower Benue River, Makurdi. The study revealed that different kinds of parasites were observed to be present in different locations in *A. gabonensis*. They occur in the exoskeleton and gill. *Tetrahymena* species were found on the gill, exoskeleton and intestine, *Piscinoodium* species were found on the gills; *Procamallanus* species were found on the gill, exoskeleton and gills; *Capriniana* species were found on gill, *Apiosoma* species were found on the exoskeleton and gills. *Trichodina* species were found in the faeces,

Capillariia species were found on the exoskeleton; *Ichthyophthirius multifilis* were found on the gill. *Bothricephalus* were found in the intestine. (Okayi et al., 2013).

Trematode metacercariae and other larval helminthes are common in several species of shrimps. (Oscar et al., 2002) reported a digenean trematode *Microphallus turgidus* which is an encysted cyst from the dagger blade grass shrimp *Palaemonetes pugio*. Heard and overstreet (1983) reported that a great population of cysts were found inside the abdomen of the shrimp .

Stromberg et al (1977) studied the distribution of *Paragonimus kellicotti* metacercariae in a mixed population of crayfish from a small central Ohio stream in two seasons. The prevalence in infection was higher in males and mineralization was reported in mature metacercariae.

Butler (1980) gave a record of Opecoelid metacercariae of Opecoeloides feliciae in commercial shrimps of South Atlantic Ocean parastizing Cynoscion striatus. Metacercariae of Artemesia longinaris was also found to infect the shrimps. Adults, immature or juvenile worms and metacercariae were recorded with different rates of prevalence and intensity of infection given.

Ealier studies done on the prawn *Machrobrachium vollenhovenii* by a student of the Department of Animal and Environmental Biology, University of Benin revealed that 23.2% of examined prawns from Iguoriakhi river in Edo state and from Warri river were infected. A total of 33 trematode metacercariae were observed from prawns during the month of May, and June 2006, a total of 45 juvenile trematodes were also observed during the months of April and May 2006. He observed that the parasites were mostly found on the gill region, stomach and muscles. He stated that the increase in percentage infection in the month of June is indicative of possible recruitment of parasites into the local population as the month was

associated with high increase in intensity of rainfall which increases the probability of successful contact between infective agent and host. This increase might also be due to the density and distribution of the intermediate hosts during these period of high rainfall. (Osayewe, 2006).

A research work carried out by a student of the Department of Animal and Environmental Biology, University of Benin to investigate and identify the trematode parasites infecting the shrimp *Machrobrachium vollenhovenii* in order to throw more light on its life cycle was conducted. A total of 101 shrimps were shrimps collected from Iyokoro river, Nyokoroma river, Ogbujor river, Fenegbene river, Korokolu river, and Oppprossa river in Delta state and examined out of which 78(77%) were found to be infected, yielding 72 juveniles and 29 metacercariae. The peak of infection with juveniles were recorded in the month of August. (Iyofor, 2010).

2.1 *PENEOUS MONODON* AS A PARASITE HOST

For many parasites, Penaeids serve as both intermediate host and final hosts. These parasitic infections decreases the production of protein and abundance of some species and cases of detrimental effects on parasitized individuals have been documented (Oscar et al., 2002). Both parasitic protozoans and commensals can be found inside and outside the host body. Black tiger shrimp serves as a host to a wide range of protozoans and commensals. (Overstreet., 1973) Cestode trematodes, bacteria, viruses, protozoans, and nematodes are some of the most common parasites of shrimps, however they mostly serve as intermediate hosts for helminth parasites. (Dall.,1991) It is commom knowledge that some parasites that are prevalent in one place may be rare or entirely different in another. Infection levels may be influenced by season of sampling, salinity of the habitat, host body size, host population size and susceptibility of host's population to infective agents.

2.2 PATHOGENS OCCURING IN SHRIMP.

Pathogens are small microbes capable of causing infection and disease to their host. These pathogens are tiny microbes that live inside the organism especially viruses, bacteria, rickettsia and fungi. Other pathogens include protozoa. Although they cause some localized damage and obstruct passage in the inhabited organ, gregarine belonging to the phylum Apicomplexia, class Sporozoea, order Eugreganida are all pathogenic and have serious results. (Sprague et al., 1971)

2.2.1 VIRUSES

Viruses are considered to be the pathogens that affect shrimp the most. Baculoviridae, Parvoviridae, Iridoviridae ,Picornaviridae, Totiviridae, Nodaviridae, Reoviridae, Togaviridae, and Rhabdoviridae are some of the viral pathogens that affect the panaeid shrimp. Among others, Baculoviridae is responsible for the Baculovirus *penaei* (BP) and monodon baculovirus (MBV). *P. monodon* from Taiwan, the Philippines, Malaysia, French Polynesia, and Hawaii have been found to have monodon baculovirus (Brock et al., 1983). Yellow head virus, a virus which causes serious disease of the giant tiger shrimp, *Penaeus monodon* is one of the viral diseases that infect the shrimp. A lot of aquaculture units in Asia have suffered significant losses. The diseased shrimps digestive glands and gills have a pale yellow color. *Penaeus japonicus*, *Penaeus monodon* and *Penaeus penicillatus* have all been demonstrated to exhibit similar symptoms and suffer significant losses from white spot infections caused by viruses with comparable size and structure in Taiwan and Japan. (Brock., 1983).

2.2.2 BACTERIA AND RICKETTSIA

Shrimp disease-causing bacteria can be pathogenic or opportunistic. Opportunistic bacteria may cause disease in shrimp when the environmental conditions are unfavourable for shrimp. vibrosis, filamentous bacterial diseases, necrotizing hepatopancreatitis, mycobacteriosis,

chitinolytic bacterial shell disease and rickettsial infection are some of the most common bacterial diseases in shrimp. (Nunan et al.,2005; Jayasree et al.,2006). The bacterium genus Vibro is the most frequently found contaminated in the bodily fluids of shrimp. *vibro alginolyticus, V. splendidus, V. fluvialis, V. penaeicida, V. parahaemolyticus, V. campbelli, V. vulnificus, V. damsel, V. harveyi and V. anguillarum* are the pathogens that cause fibrosis. (Nunan et al.,2005; Jayasree et al.,2006; lightner., 1996).

2.2.3 FUNGI

Several fungi are recognized as shrimp pathogens. While another group affects the juvenile or larger shrimp, two groups frequently infect larval shrimp. *Lagenidium* and *Sirolpidium* are the most common genera that infect larval shrimp whereas *Fusarium* is the most common genera that affects the juvenile shrimp. *Lagenidium callinectes, Lagenidium marina, sirolpidium spp. Leptoleglegnia marina, Fusarium solani, F.moniliformae, F.incanatum and Phythium spp* are the main pathogenic species. (Lightner, 1996; Alday et al., 1999).

2.2.4 PROTOZOA

Protozoan parasites can be found on the inside or outside the shrimp's body. Protozoan parasites can transmit diseases like cotton shrimp, gregarine disease, black gill disease. Protozoans like *zoothamnium, epistylis, vorticella*, as well as Fusarium fungus and bacteria are linked to black gill disease. *Agmasoma sp*. is the causative agent for cotton shrimp. Gregarine disease is caused by the annelid worm *nematopsis spp.* Gregarines are among the most common microorganisms associated with *P. monodon* larvae. (Gacutan, 1979).

CHAPTER THREE

MATERIALS AND METHODS

3.1 STUDY AREA

The site of collection is ovia river at Iguoriakhi located near Benin city, the capital of Edo State, Nigeria. Ovia river takes its source from the Apata hills in Ekiti state. The river located on Longitude 005 °25'55.0 - 005 °29'36.20E and Latitude 06 °23'42.76N - 06 °27'10.15N is about 23.9km from benin city off Lagos- Benin express road, Nigeria. Ovia river exists year round, the water volume fluctuates with the seasons and increases in volume during the wet season (April-October), but decreases drastically in volume during the dry season (November-March).

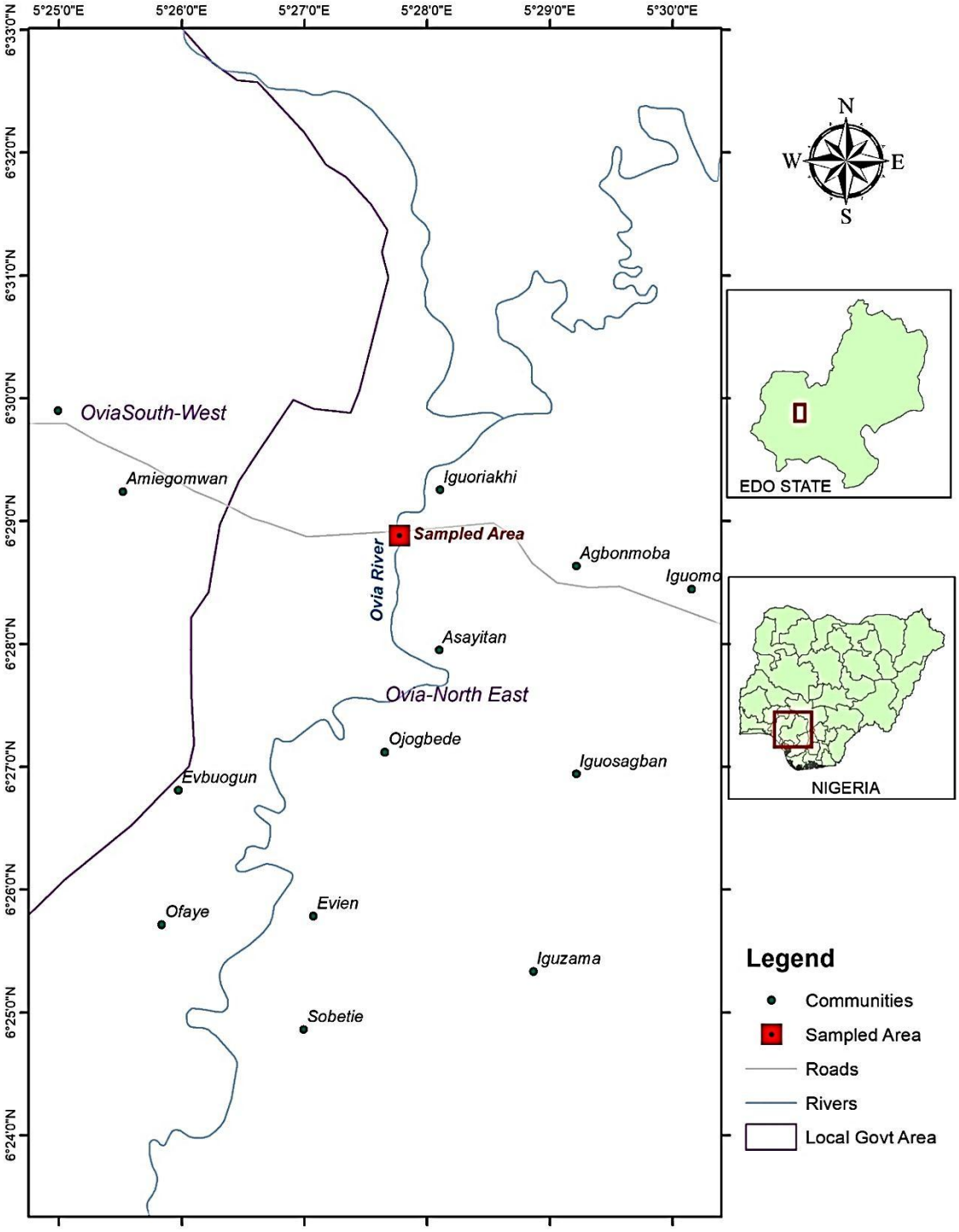

Figure 3.1: Map of study area.

3.2 MATERIALS

The materials used during this project work include: the dissecting miscroscope, compound microscope, 3% formaline, detergent, knife, hand sieve, ruler, measuring cylinder, weighing scale, wine glasses, petri dishes, dissecting sets, laboratory coats, hand gloves, glass slides, cover slips, tissue paper, pipettes, masking tape, waste baskets, preservation bottles, plastic containers, dissecting board, writing materials, air freshner, buckets, torchlight and batteries, water, broom and parker, nylon bags, and digital camera.

3.3 COLLECTION OF SAMPLES

Shrimps were collected from Iguoriakhi river, near Benin city in Ovia north east local government area. They were caught by fishermen and women living close to the river. The shrimps were bought while still fresh and alive and transported to the department of Animal and Environmental Biology laboratory, University of Benin, where they were counted, measured and examined.

3.4 EXAMINATION OF SHRIMPS

Shrimp samples was crushed inside hand sieves in plastic containers and 0.72% normal saline was added until completely flooded with saline. The filterate was then transferred to wine glasses to allow sedimentation. The supernatant was then discarded and more saline added. This process was repeated until the supernatant became clear. The clear supernatant was then discarded and the clear sediment was transferred to a petridish and examined under a dissecting microscope.

3.5 EXTRACTION AND PREPAREATION OF PARASITES

A pipette was used to probe the petridish containing the sample under examination. The part of the petridish under the the field of the dissecting microscope was carefully and critically

searched and any parasite encountered was extracted from the medium with the aid of pasteur pipette onto a slide and further examined under **X10** objective of the compound microscope. Parasites were photographed with a digital camera after which they were preserved in 3% formaline. They were then kept in preservation bottles well labelled.

Plate 3.1: *Penaeus monodon*

CHAPTER FOUR

RESULTS

4.1 PREVALENCE OF PARASITES IN SHRIMPS *(Panaeus monodon*)

A total of 101 shrimps were examined during the course of this study. 49(48.5%) were infected with parasites. (Table 4.1)

A total of 59 trematode metacercariae with overall mean intensity of 1.20±0.00 were extracted from infected shrimps. Shrimps examined in the month of February had the highest parasite prevalence while no parasite was found in shrimps examined in the month of November. One (8.33%) of twelve shrimps sampled and examined in October was observed to be infected with one metacercaria with a mean intensity of1.00±0.00. No parasite was observed in the month of November. Nine (45%) of twenty shrimps sampled and examined in December were observed to be infected with eleven metacercariae with a mean intensity of 1.22±0.02. Fourteen (93.33%) of fifteen shrimps examined in January were observed to be infected with fourteen metacercariae with a mean intensity of 1.00±0.00. Twenty five (100%) of 25 sampled and examined in February were found to be infected with fifty-nine matacercariae with a mean intensity of 1.32±0.17.

4.2 PREVALENCE OF PARASITES IN RELATION TO LENGTH

In the course of this study it was observed that parasite prevalence increased in shrimps with length between 3.5 to 9.49 and a drastic decline was observed in shrimps with length between 9.5 to 15.49 as shown in table 4.2. Shrimps with length between 7.5 to 9.49 had the highest parasite prevalence while no parasite was found in shrimps with length between 11.5 to 15.49. Fifteen shrimps with length between 3.5-5.9 were examined, one was found to be infected with one metacercaria with a mean intensity of 1.00±0.00. Twenty-one shrimps with length

between 5.5-7.49 were examined, seventeen was found to be infected with twenty-three metacercaria with a mean intensity of1.35±0.02. Thirty-five shrimps with length between 7.5-9.49 were examined, thirty was found to be infected with thirty-one metacercaria with a mean intensity of 1.03±0.00. Fourteen shrimps with length between 9.5-11.49 were examined, one was found to be infected with two metacercaria with a mean intensity of 2.00±0.00. No parasites were observed in shrimps with length between 11.5-13.49 and 13.5-15.49. (Table 4.2 and Fig. 4.2)

Table 4.1: Data on Collection and Prevalence of parasites in shrimps

Month	No of shrimps examined	No of shrimps infected	Prevalence (%) of infection	No of Metacercariae	Mean Intensity
October	12	1	8.33	1	1.00±0.00
November	29	0	0.00	0	0.00±0.00
December	20	9	45.00	11	1.22±0.02
January	15	14	93.33	14	1.00±0.00
February	25	25	100.00	33	1.32±0.17
Total	101	49	48.50	59	1.20±0.00

Table 4.2: Data on prevalence of parasites in relation to length

Length	Number examined	No of shrimps infected	Prevalence (%) of infection	No of Metacercariae	Mean Intensity
3.5-5.9	15	1	6.66	1	1.00±0.00
5.5-7.49	21	17	80.95	23	1.35±0.02
7.5-9.49	35	30	85.71	31	1.03±0.00
9.5-11.49	14	1	7.14	2	2.00±0.00
11.5-13.49	9	0	0.00	0	0.00±0.00
13.5-15.49	7	0	0.00	0	0.00±0.00
Total	101	49	48.5	59	1.20±0.00

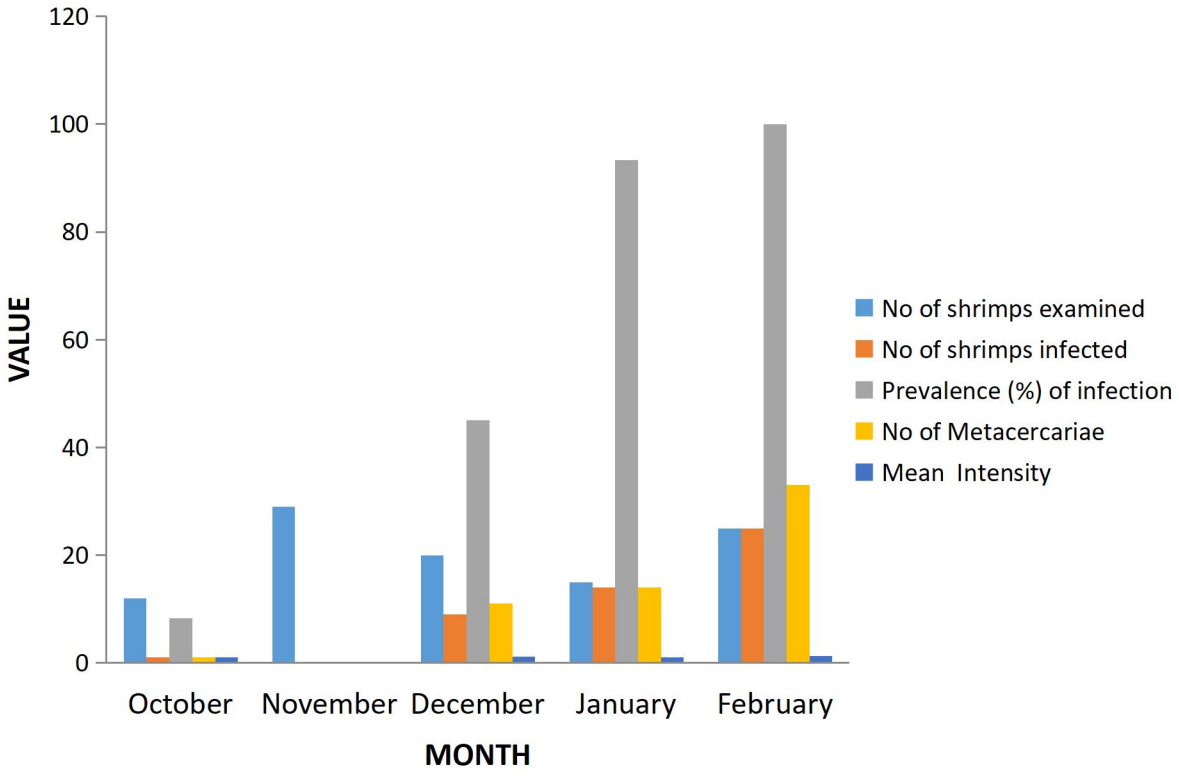

Figure 4.1: Prevalence of parasites in shrimps

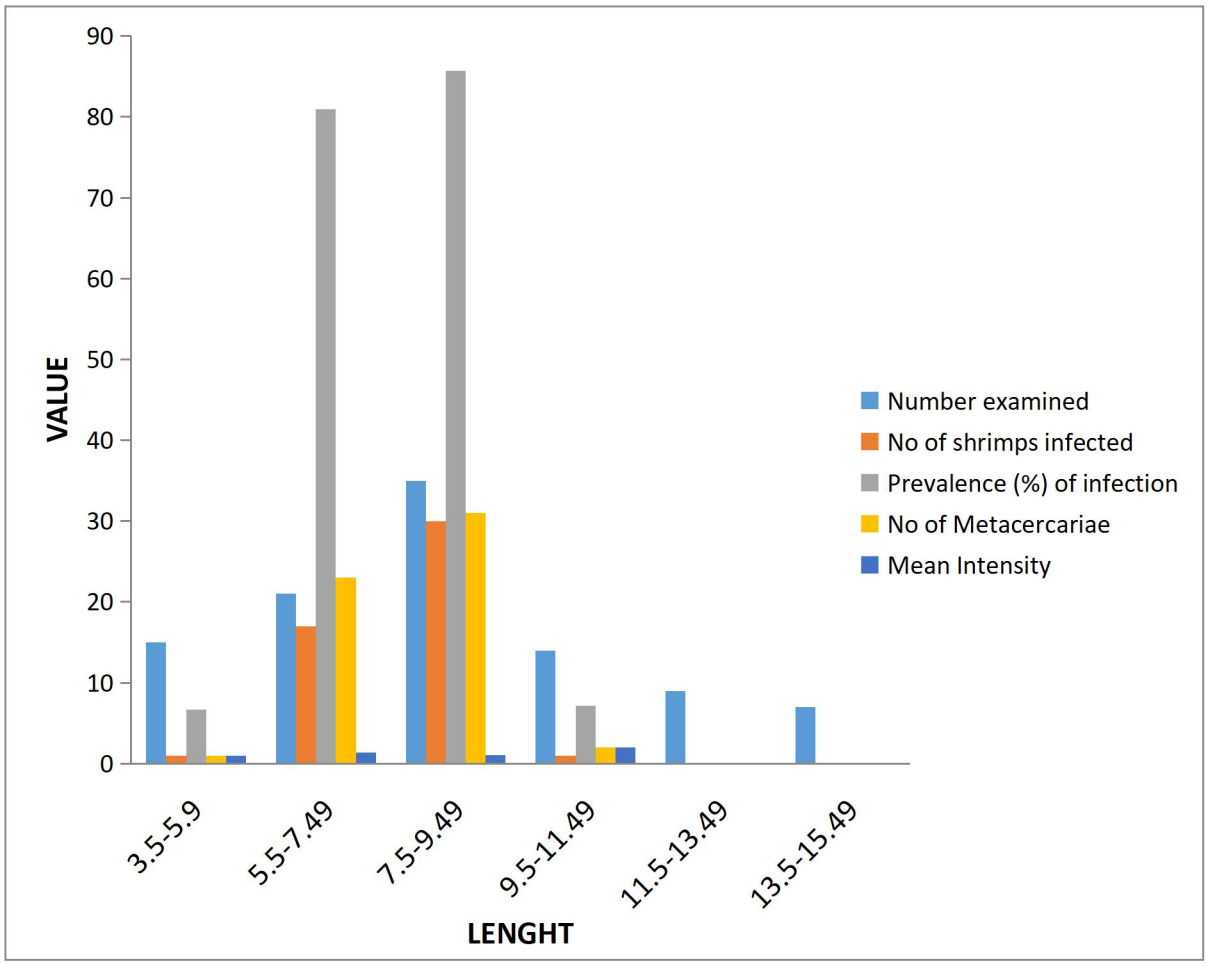

Figure 4.2: Prevalence of parasites in relation to size of shrimp

Scale bar: 0.5 mm

Plate 4.1: Metacercariae isolated from shrimp *panaeus monodon*

Scale bar: 0.5 mm

Plate 4.2: Metacercariae isolated from shrimp *penaeus monodon*

CHAPTER FIVE

DISCUSSION

The black tiger shrimp; *penaeus monodon* has been found to be infected with trematode parasites. This is in agreement with the findings of Heard and Overstreet (1973) who reported that a great population of cysts were found in the abdomen of shrimp. It also agrees with the findings of Oscar (2002), who reported a digenean trematode *Microphallus turgidus* which is an encysted cyst from the Dagger blade grasss shrimp *Palaemonetes pugio*. Iyofor (2010), also recorded 72 juveniles and 29 metacercariae from the shrimp Machrobrachium vollenhovenii collected from Iyokoro river, Nyokoroma river, Ogbujor river, Fenegbene river, Korokolu river, and Oppprossa river in Delta state. The presence of parasites could be attributed to the anthropogenic activities carried out in the water body. The heavy infection of protozoans apicomplexa and sarcomastigophora indicate that some water body has a low health integrity which may be appropriate for parasite transmission (Tarnowski,2003 : Dungan et al., 1995).

There was an increase in prevalence of infection of metacercariae in the months of December (45%), January (93.33%) and February (100%) but the peak of infection was recorded in the month of February 2022. The increase in percentage infection of parasites could be attributed to the increase in water temperature. This agrees with the findings of Rhode (1992), and Jayasree et al.,(2001) who reported that the increasing metabolism and molting of decapods host in summer months occurred due to heavy amount of solar energy thus enhancing the invasion of parasite.

The prevalence of 48.5% recorded for black tiger shrimp in this study is lower than 97.09% previously recorded for black tiger shrimp from Isaka River, Okirika Local Government Area, Rivers State, Nigeria. (Nzeako et al., 2015). The differences in prevalence can be explained

largely in terms of location of sampling, area of sampling, water quality, salinity of the habitat, host population size, frequency of contact between infective agents and susceptibility of hosts population to infective agents. (Chapman, 2005). The prevalence is higher when compared with the results of Osayewe (2006) who reported that 23.2% of the prawn *Machrobrachium machrobrachion* from Iguoriakhi river in Edo state and from Warri river in Delta state were infected with a total of 33 trematode matacercariae observed during the months of April and May 2006 and a total of 45 juvenile trematodes observed during the months of May and June. He stated that the increase in percentage infection in the month of June was associated with high increase in intensity of rainfall which increases the probability of successful contact between infective agents and the hosts.

Iyofor (2010) reported that out of the 101 *Machrobrachium vollenhovenii* shrimps examined, 78(77%) were infected. A total of 72 juveniles were extracted from infected shrimps and 29 trematode metacercariae were isolated during the months of August, November, and December. She recorded marked differences in percentage infection between shrimps collected from Iyokoro river, Nyokoroma river, Ogbujor river, Fenegbene river, Korokolu river, and Oppprossa river in Delta state. She stated that the differences in percentage infection could be as a result of water quality, water salinity, population density of shrimps, differences in rate of transmission, and frequency of contact between infective agents and hosts.

In this study it was observed that there was a steady increase in parasite prevalence in relation to length of shrimps. However, a drastic decline was observed in shrimps with length class 6.9 to 15.49. This result is contrary to the result of Nzeako (2015) that recorded that larger prawns (±14-15.66 cm) harbored more parasites than the smaller prawns (±6-13.99 cm). The differences in result could be as a result of susceptibility of host population to infective agents (Chapman,2005). The quest for survival and the random selection between host and

parasite might have played a vital role in the reducing percentage of parasite infection in larger shrimps. Another important factor that may be responsible for this is the physico-chemical properties of the water. Again, the physco-chemical characteristics of the water body support the transmission pattern of parasites of the shrimps as stated by Ray et al, (1995) and Tarnowski (2005).

5.1 Conclusion

The results of this study reveal that the black tiger shrimp is susceptible to parasites that can be injurious to health when consumed. Since shrimp is of great economic value to man, it is recommended that care is taken to reduce risk of being infected by parasites, some of which includes cooking of shrimps properly before eating, Eating of raw and undercooked shrimp should be discouraged, Dumping of human faeces and urine into water bodies should be discouraged, and proper personal hygiene should be practiced.

REFERENCES

Alday de Graindorge, V. and Flegel, T.W., (1999). Diagnosis of shrimp diseases with emphasis on the black tiger shrimp (*Penaeus monodon*). *Multimedia Asia Co. Ltd. Bangkok 10400, Thailand.*

ASEAN. (2003).Water quality management- ASEA Good shrimp farm management practice manual. *Fisheries publication series* **1**:21-24.

Ayinla, O.A., P.E. Ayanwu, B.B. Solarin, B. Hamzat and B.I. Ebonwu (2009a). collection and maturation of broodstock of black tiger shrimp, *penaeus monodon* in Nigeria. *Proceedings of the 24th annual conference of fisheries of Nigeria, (FN'09), Nigeria* Pp91-95. Chakraborti J. & Bandyapadhyay PK (2011). Seasonal incidence of protozoan parasites of the black tiger shrimp (*Penaeus monodon*) of Sundarbans, West Bengal, India. *Journal of Parasitic Diseases* **35**, 61-65.

Bower, S.M., McGladdery S.E. Price I.M. (1994) Synopsis of infectious diseases and parasites of commercially exploited shellfish. *Annual Review of Fish Diseases* **4**:1–199.

Brock, J.A., Lightner, D.V., Bell T.A. (1983). A review of four virus (BP, MBV, BMN and IHHNV) diseases of penaeid shrimp with particular reference to clinical significance, diagnosis and control in shrimp aquaculture. *International Council for the Exploration of the Sea. C.M.*

Butler, T. H. (2005). Opecoelid metaceriae in commercial shrimps of south Atlantic ocean. *Journal of fisheries and aquatic sciences* **202**:11-15

Chapman, R. H, (2005). The bopyrid isopod parasites of mud shrimps. Beeth publishers, New York. 215pp

Chapman, R. H. (2005). *The mud shrimp;its ecological importance* . Beeth publishers, New York. 145pp

Chemonics (2002). *Subsector assessment of the Nigerian shrimp and prawn industry.* USAID **812**:85

Dall, W., B. J. Hill., P. C. Rothlisberg., D. J. Sharples.(1991). Advances in marine biology. *Academic press* **27**:379-390.

Dungan CF, and Hamilton R .M. (1995) Use of a tetrazolium-based cell proliferation assay to measure effects of in vitro conditions on *Perkinsus marinus* (Apicomplexa) proliferation. *Journal of Eukaryotic Microbiology* **42**:379-388

Ehigiator, A.R., Akise OG., Eyong, M.M. (2014) Bacteria and fungi load of raw processed shrimps from different meat shops in Benin Metropolis. *Nigerian Journal of Agriculture, Food and Environment* **10**(3):1-7.

FAO., (2009). *Panaeus monodon. In cultured aquatic species fact sheets* Pp. 3

FAO/WHO Codex Alimentarius Commission 2000. Recommended Code of Practice Shrimps/ prawns (CAC/RCP 17 -1978; Quick Frozen shrimps/ prawns (Revised 1 – 1995).

Gacutan, R.Q. (1979). Diseases of prawns (pests and diseases of sugpo). Technical Consultation on Available Aquaculture Technology in the Philippines;*SEAFDEC Aquaculture Department* 170-179.

Gacutan, R.Q. and Baticados, MCL., (1979). Notes on *Lagenidium* from larvae of *Penaeus monodon Fabricius*. 1. Isolation and culture in artificial media. *Fish. Res. J. Philipp*. **4**(l):24-38.

Heard, R. W. and Overstreet, R.M (1983) Taxonomy and life histories of two north American species of microphalidae. Proc. Heminthol. Soc. Wash 50(1):170-174

Iyofor, O. M. (2010) A Desertation presented to the Department of Animal and Environmental Biology in partial fulfillment of the requirement of the degree of Bachelor of science, University of Benin, Benin City, Nigeria.

Jayasree L., Janakiram P., Madhavi .R. (2001) Epibionts and parasites of Macrobrachium rosenbergii and Metapenaeus dobsoni from Gosthani estuary. *Journal of National History* **35**:157–167

Jayasree, L., Janakiram, P. and Madhavi, R. (2006). Characterization of *Vibrio* spp. Associated with diseased shrimp from culture ponds of Andhra Pradesh (India). *Journal of the World Aquaculture Society,* **37** (4):523.

Johnson, S. K. (1995) Handbook of Shrimp Diseases: *Aquaculture Department of Wildlife and Fisheries Sciences, Texas A and M University*, USA.1-27pp

Johny, S, Kanginakudru S., Muralirangan M.C. and Nagaraja J. (2006) Morphological and molecular characterization of a new microsporidian (Protozoa: Microsporidia)

isolated from *Spodoptera litura* (Fabricus) (Lepidoptera: Noctuidae). *Parasitology* **92**(2): 59–65.

Kakoolaki S. and M. Afsharnasab (2015) Prevalence and intensity of protozoan ectoparasite of the white leg shrimp (*penaeus indicus*) in Helleh site, South of Iran. *Iranian Journal of Aquatic Animal Health* **2** (1):17-23

Kautsky N., Ro¨nnba¨ck P, Tedengren M., Troell M. (2000) Ecosystem perspectives on management of diseases in shrimp pond farming. Aquaculture **191**:145–161

Lightner, D.V. (1993) Diseases of cultured peneaid shrimp. *crustacean aquaculture*. CRC Press, Boca Raton, pp 303–346.

Lightner, D.V., (1996). A hand book of shrimp pathology and diagnostic procedures for diseases of penaeid shrimp. *World Aquaculture Society*, Baton Rouge, LA, USA, 304 p.

Macpherson., C.N.L (2005). Human behaviour and the Epidemiology of Parasitic Zoonoses. *International Journal of Parasitology*. **35**(11-12):1319-1331.

Norma A., Lo´pez-Te´llez, Vidal-Martı´nez V.M., Overstreet R.M. (2009) Seasonal variation of ectosymbiotic ciliates on farmed and wild shrimps from coastal Yucatan, Mexico. *Aquaculture* 287:271–277

Nunan, L.M., Lightner, D.V., Oduori, M.A., Gasparich, G.E.(2005) Spiroplasma penaei sp nov., associated with mortalities in Penaeus vannamei, Pacific white shrimp. *Int. J. Syst. Evol. Microbiol*. **55**: 2317-2322

Nzeako S. O., F. O. Nduka., M. N. Wogu1 and J. I. Monye(2015) Isolation of Parasites from Black Tiger Prawn; Peneaus monodon from Isaka River, Okirika Local Government Area, Rivers State, Nigeria. *Annual Research & Review in Biology* **8**(1): 1-11

Okayi R. G., Ayuba, V. O. and Akisani C. (2013) Parasitic prevalence of fresh water shrimp (*Atya gabonensis*) in lower Benue River, Makurdi. *International Journal of Fisheries and Aquaculture* Vol. **7**(1):1-8.

Osayewe, T. O. (2006) A Desertation presented to the Department of Animal and Environmental Biology in partial fulfillment of the requirement of the degree of Bachelor of science, University of Benin, Benin City, Nigeria.

Oscar, J., Pung, Ritindra N, Stephen P. Vivea and Casey B.Walker (2002) prevalence,geographic distribution and fitness effects of Microphallus turgidus(Trematoda:Microphillidae) in grass shrimp (*Palaemonetes spp*) from coastal Georgia. *Journal of parasitology*: vol **88**(1):89-92.

Overstreet, R.M. (1973). Parasites of some penaeid shrimps with emphasis on reared hosts. *Aquaculture*, **2**:105-140.

Phuoc, L.H., Corteel, M., Nauwynck, H.J., Pensaert, M.B., Alday-Sanz, V., Van den Broeck, W., Sorgeloos, P. and Bossier, P. (2009). Effect of dose and challenge route of Vibrio spp. on co-infection with white spot syndrome virus in Penaeus vannamei. *Aquaculture* **290**: 61-68.

Prasadan., P.K. Janardan, P.K. (2001) Three new species of gregarines (Apicoplexa: Sporozoea: Porosporidae) in the Estuarine crabs from Kerala, India. *Acta Protozool* **40**:303–309.

Ray, S.M., Chandler. A.C. (1955)Parasitological reviews: Dermocystidium marinum, a parasite of oysters. *Exptlanatory Parasitology* **4**:172-200.

Rhode K., (1992) Latitudinal gradients in species diversity: the search for the primary cause. *Oikos* **65**:514–527

Sprague V, and Couchi J.(1971) An annotated list of protozoan parasites, Hyper-parasites and commensals of Decapod crustacean. *Journal of Protozoology* 18:526–537.

Stromberg, D. C., Toussant, M. J and Dubey, J. P.(1997) population biology of paragonimus kellicotti metacercariae in central Ohio. *Parasitology*. **8**(2):13-18

Tarnowski M., (2005) Maryland Oyster Population Status Report: 2003 and 2004 Fall Surveys. *Maryland Department of Natural Resources Publication* No. 17-1072005-62.