Parasitic infestation of three spotted tilapia (*Oreochromis andosonii*) and red breast tilapia (*Tilapia* r*aendali*) in Karovo community fish farm of the Okavango region.

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1.1 Research title:

Parasitic infestation of three spotted tilapia (*Oreochromis andosonii*) and red breast tilapia (*Tilapia* r*aendali*) in Karovo community fish farm of the Okavango region

Declaration

I hereby declare that this work is the product of my own research efforts, undertaken under the supervision of Mr. M Tjipute and has not been presented elsewhere for the award of a degree or certificate. All sources have been dully and appropriately acknowledged.

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CERTIFICATION

This is to certify that this report has been examined and approved for the award of the degree of Bachelor of Science in Fisheries and aquatic sciences of the University of Namibia.

External supervisor……..

Internal supervisor……

Head of Department……..

Acknowledgement

Would like to thank the University of Namibia faculty of Agriculture and Natural Resources (department of fisheries and aquatic sciences), for providing transport together with my supervisor Mr. tjipute that made sampling possible in the Okavango region. The Kamujonga Inland Fisheries Institution's management and staff, which made their facilities accessible to us and providing accommodation. And as well as the Karovo staff that that assisted tremendously in sampling at the farm.

The author would like to express her gratitude to Mrs. B Kackigunda who assisted in the statistical analysis, without her completion of the report would not have been possible.

Dedication

I would like to dedicate this report to my parents, who encouraged me to apply for this course and for their continuous support without them none of this would have been possible.

List of Abbreviations

KIFI - KAMUTJONGA INLAND FISHERIES INSTITUTE

Erg - Ergasilus spp

Ich - Ichthyophthirius multifilis

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Abstract

The research was conducted in examination of parasitic infestation in Three spotted tilapia (*Oreochromis andosonii*) and red breasted tilapia (*Tilapia* r*aendali*) in Karovo community fish farm of the Okavango region. Fish was caught using a drag net, then scooped into a bucket, in which they were transported to the laboratory. Twenty eight fish were sampled. The external surface of the fish was examined thoroughly using a hand lens. Areas around the fins, nostril, operculum and the buccal cavity were examined for Ectoparasites. Each fish was opened dorso-ventrally and its internal organs examined for parasites using a microscope. There were no significant differences in mean body weight and length between the species, although Redbreast had a higher mean weight (150.5 g) than Tilapia (117.9 g). Seventy one percent (71%) of the Redbreast species had no endoparasites, whilst 93% of Three spot tilapia had Lernaea. The Red breast had a mixed (variety) of parasitic infestation although their frequencies are relatively low making them less prone to outbreaks then the three spot tilapia that has little variety in parasitic infestation but with high frequencies. Lernaea spp dominated the prevalence with 50% infestation, cyst found on the samples where 11% and roundworms found were 4%. The sample had a 36% non infection rate. The three spot tilapia had a higher Lernaea infestation of about 90% whereas the red breast had a percentage infestation of less than 10%. Cyst abundance in the red breast tilapia was 50% more than infestation in The three spot tilapia. Round worms were only found in the Red breast tilapia.

2. Chapter One

Introduction and literature review

2.1 Introduction:

The world population is on the rise, as is the demand for aquatic food products. Production from capture fisheries at the global level is leveling off and most of the main fishing areas have reached their maximum potential. Sustaining fish supplies from capture fisheries will, therefore, not be able to meet the growing global demand. At present, the aquaculture sector

contributes a little over 40 million tonnes (excluding aquatic plants) to the world aquatic food production , where as 80 tonnes are needed **(**FOA, 2005).

Namibia`s has climatic conditions, topography and soil types well situated for sustainable development of aquaculture, both for freshwater and mari-culture (Hempel et al), thanks to the cold Benguela extending from southern tip of Africa to the northern boundary of Namibia with high nutrient rich waters that sustains high productivity in mariculture sector. The northern part of Namibia is have abundant freshwater resources streaming from perennial rivers bordering the northern part with guaranteed all year water supply from the Zambezi, Kavango and the Kunene (Hempel et al). The northern parts have good temperatures as well suitable for the growth of local indigenous species and other potential native species. As Fishery contributes as much as 50% of total inland fish and production supports a population of 400,000 people (Hempel et al).

The Namibian mariculture industry is relatively young, dominated by oysters and expansion is market dependent as well as the identification of physical and socio-economic potential by carrying out coastal resources profile which identifies potential sites for mariculture.

Community based fish farmed are aimed mainly for food security, a good protein source at an affordable prices. The Korovo fish farm is situated 120 km west of Rundu. It stared it`s operations in 2002, farming with the three spotted and the red breast tilapia. The broodstock is obtained from the Okavango river with is also the permanent water source for the farm. The farm consist 16 ponds producing around 3 tones of fish per annual. The farm obtains N$27 000 per year from the production with a selling price of N$15 per kilogram. A major problem that effects production on the farm is mainly the floods that can cause half of annual production to be lost and predators such as crocodiles and fish eagles.

Parasitic diseases, either alone or in conjunction with other environmental stresses, may affect aquaculture's economic importance FAO (2009). It therefore, important, that there is information on the occurrence of parasites of freshwater fish and their hosts; although according to FAO (2009) in Africa only inadequate information is available on parasites infesting fish species. Types of parasites include: Protozoa, Monogenean Trematodes, Digenean Trematodes , Nematodes , Cestodes , Parasitic Crustacea and Leeches.

2.2 **Statement of problem:**

Parasitic diseases of fish seem to be one of the major problems confronting fish culturists. Parasitic infestation leads to serious consequences especially to the nutritive devaluation of the fish (Olofintoye, 2006). Affected fish is un-marketable, causing severe economic loss to fishers and fish farmers. In addition to this allergic responses to toxic waste of parasite maybe evident in consumers of infected fish (Olofintoye, 2006) Outbreaks often affect younger fish in particular so that irreversible damage to fish populations and severe loss of biodiversity often occurs.

People are at risk of food insecurity because fish is not only a source of revenue in many rural districts but also a cheap source of good nutrition's in order to maintain a healthy active

lifestyle. Fish diseases have limited response and this will lead to a wider gap between supply and demand and urges quick intervention by government. But the prognosis is not good. Firstly, research is constrained by the small budgetary allocation given to the fishing industry. According to Officials in the department of fisheries say despite their repeated and urgent requests for funding, this has not been forthcoming. This research project aims studying parasitic infestation on the korovo community based fish farms so that monitoring and surveillance can be put in place in order to avoid social, economical and biological impacts in the future.

2.3**Research Objectives**

Parasitic infestation of three spotted tilapia (*Oreochromis andosonii*) and red breast tilapia (*Tilapia* r*aendali*) in Karovo community fish farm of the kavango region.

2.4 **Research Hypothesis:**

To ascertain the abundance of ectoparasites and endoparasites between two tilapia species; three spotted and red breast

To determine the association of type of parasite and organ

To determine the relationship between fish length and parasite abundance

2.5 Literature review:

Almost all groups of animals and plants contain at least a few parasites according to Margaret (2006) and they are typically divided in two major groups: ectoparasites, which live on the outside of the host, host being the fish infected and endoparasites which live in the tissue, blood and organs(including the gastrointestinal tract). The degree or chance of causing illness in a fish depends on various factors such as water quality, stress, lighting, type of filtration system and water chemistries Margaret (2006) states that some parasites are harmful to their host others not, a parasite might be harmful if present in large numbers and might not be harmful if a few have parasitized the host. There exist a host to parasitic relationship that effects prevalence of parasite in the host especially between juveniles and adult of cichlids. Possible reason for differences in prevalence of infection between the juvenile and the adult fish as related to their standard length and body weigh may be due to change in diet from weeds, seeds, Phytoplanktons and Zooplanktons to insect larvae, snails, crustaceans, worms and fish in both juveniles and adulthood respectively (Olofintoye, 2006).Some ectoparasites

such as protozoa and skin/gill flukes are transmitted directly from fish to fish (horizontally transmitted).

Parasites in fish are a natural occurrence, common and dangerous especially among fishes living in confined space such as aquarium, hatcheries, stocking ponds and tanks (Khan et al, 2003). Fishes have mixed infections of parasites. According to Khan et al, (2003). the degree of damage by is influenced to a large extend by the type and number of parasite present, parasite can affect fish population by causing mortality, reduction in growth populations, weight loss and suppression of reproduction activity. *Lernaea spp* and *Argulus spp* arethe most found parasite occurring in fish farms, they have caused several mortalities in fish farms and are responsible for creating health problems at fish hatcheries in Pakistan and other parts in the world(Khan et al, 2003).

Flukes, Trematodes, are the most common reported parasite living freshwater fish because they are easy to see (Sindermann 1970). Parasites make fish look and taste unappetizing, very few fish parasites can be transferred to humans, even when obvious signs are exhibited (Sindermann 1970). By far the most encounted parasite is the organism responsible for ich (white spot disease) caused by a one-celled protozoan called *Ichthyophthirus multifiliis* characterized by small white spots found on gills, fins and gills each spot caused by a parasite just beneath the fish epithelium and can infect all freshwater fish (Sindermann 1970).Anchor worms (*Lenaea spp*) a type of copepod are also amoung the common type of freshwater parasite (Sindermann 1970).

Several cestodes (tapeworms) and trematodes (flukes) are parasites on fresh water fish. Most fish in the wild carry some parasite; these are sometime obvious but more often difficult to

detect other than by specialist technique and usually appear to have little effect on the host fish (Hill, 2008). Furthermore, according to Hill (2008) however in times of stress, resistance of fish is often lowered and some parasites may greatly increase in abundance and affect the health of the fish, causing the fish lose condition, making them more susceptible to predation, or may even die from the effects of parasites. Fish that arte injured in some way, such as after an attack by a predator, may carry a wound which is then infected by parasites (Hill, 2008).

Lernaeid population found only on jaws of *Tilapia (Oreochromis)* spp, *lernaea* is based mainly on the morphology of the holdfast organ (anchors) of the parasitic females. The growth and branching of the latter, however, is greatly affected by the consistency of the tissue into which the holdfast organ is anchored (Aloo 2002). In the East African lakes, different fish species serve as preferential hosts for copepodites and adult *Lernaea*. Copepodites of *L. cyprinacea*, infecting cichlid fish in L. Victoria at the adult female-stage, develop in *Bagrus docmac. B. docmac* of L. George and *B. bayad* of L. Albert host copepodites of *L. barnimiana*, whose adult female stages attach to *Barbus altianalis*, cichlids and *Lates albertianus* Pathogenicity of lernaeids largely depends on their host size and their attachment site preferences. Infection by a single or 2–3 females is very damaging or even deadly to young or small fish (<40 mm long).

Ectoparasites (flagellates and Ciliate) affects wide range of fish species from most families. Ubiquitous or opportunistic species (*Ichthyobodo necator*, *Chilodonella* spp., and some species of *Trichodina*, *Ambyphrya* and *Scopulata (Scyphidia)* are particularly common in juvenile cichlids and carp. The ubiquitous ectoprotozoans are cosmopolitan or trans-continentally dispersed via translocation of their cultured fish hosts (carp and tilapia in particular). Trematodes consist over 50 species occurring in a varity of *Sanguinicola* (the blood fluke) infect *Synodontis schall* and *Auchenoglanis occidentalis* in the Sudan (Khalil,

1969) and *Clarias lazera* (Paperna,and *Oreochromis* spp). in Israel (Aloo 2002). Nemetoda Prevalence infection among tilapia in a contaminated pond often approaches 100%, usually with 1–4 worms per fish, these parasites are linked with migration of piscivorous birds (Aloo 2002).

Eustrongylides larvae in cichlids, when unencysted, migrate under the skin and in the muscle causing extensive inflammation and necrosis (Komar, 2007). Encysted worms in the visceraliver, spleen and the gonads - cause severe pathological changes in the adjoining tissue. In the spleen, the tissue is replaced by lipid cells. Infection in the testes or ovaries causes severe pressure necrosis, degeneration of the spermatogenous and follicular tissue, being either replaced by lipid cells or undergoing complete necrosis, ultimately resulting in castration. The incidence and the degree of damage to the gonads was positively correlated with the overall burden of infection in the fish (Komar, 2007). Parasite diagnosis should start by an external gross observation of the fish to check for the presence of larger parasites such as leeches and crustacean copepods. In addition, an infestation with a digenean trematode might be suspected when yellow or white grubs are seen on the skin. Then, parasite screening should be continued by observation of a skin and gill scrape by light microscopy. Major parasites in tilapia and their epidology are (as shown in the table below):

Table 1. Komar,(2007). Major parasites in tilapia and their epidology

parasites	Disease signs
Ichthyophthirius multifilis	Appearance of white spots on skin Thick mucus on skin Stunted growth and mortality
Amyloodinium spp.	Decreased appetite Flashing Accumulation of mucus
Digenena *(Clinostomum spp)*	Grubs (yellow or white) on the skin. Skin haemorrhage and death if mass penetration of the parasite
Monogenean *Dactyolgyrus spp*	Skin darkening Fin erosion Excessive mucus Rapid movement of operculum Emaciation in young fish
Argulus sp. (adult from fish skin)	Skin irritation Loss of condition Associated secondary skin bacterial infection
Lernea spp. (adult from fish skin)	Rub against sides of container Whitish spots of curled up worms embedded in the skin
Leeches	High number of leeches on an adult fish induce anemia

3 Chapter Two

3.1Materials and methods:

Study area: Karovo fish farms: located in the Kavango Region, Kangonga:S17°56.249` E021°10.270.

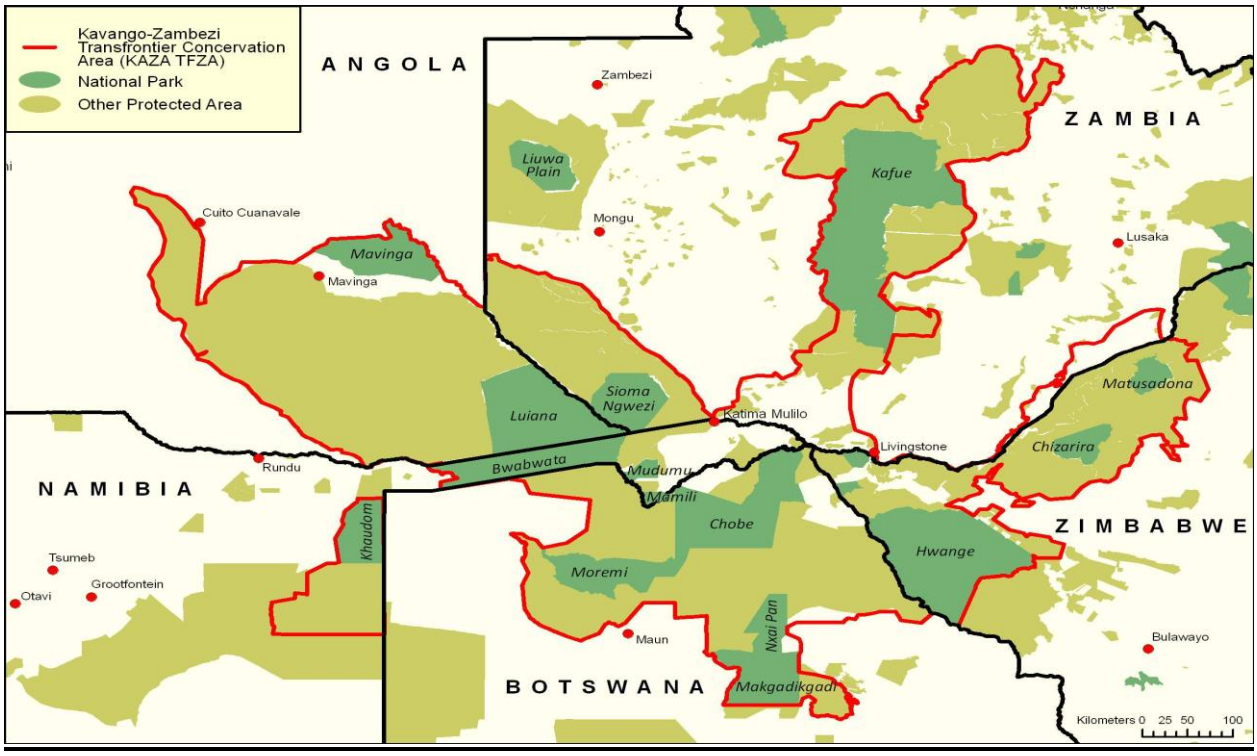

Figure 1 showing the location of Karovo fish farm

Sampling Method:

Fish sampling was done in September.

The fish is caught using a gill net. The net is placed on opposite sides of the pond, with a few men holding on each end, some men enter the pond towards the interior of the net to help hold and drag the net while the men on the sides are enclosing the net in circular motion. The net is drag in this circular motion until it forms a small circle. A bucket is filled with water from the pond and the fish from the gill net is scooped using a scoop net in the bucket, in which the fish is transported back to the laboratory.

Figure 2 showing fish being sampled

3.1.1Laboratory procedure

Identification of parasites:

The samples are taken one at a time .First weight, length measured and recorded on data recording sheet.

(a) (b)

Figure 2. (a,b) fish being measured and weight

Sample are taken and first examined for ectoparasites, by using scalpel or blade the mucous on the body, fins are scrapped of and fixed on different slides respective of the ecto organ. The samples are then viewed under the microscope in attempt to find parasites in the samples.

Figure 3 showing student viewing sample under a microscope

Fish is then cut open and internal organs were examined in attempt to find parasites. Parasites found were identified to specie level. The species that could not be identified are fixed in alcohol for further identification. Samples should be probably labeled with the following information: date of sample, type of tissue (for example skin, gills, kidneys) collected, locality, type of specie, name of collector, and type of fixation.

Chapter Three

Results

Twenty eight fish were sampled.

Table 2: Summary of fish weight (g)

Species	Count		Mean	Minimum	Maximum
Redbreast	14	150.5	65.30	194.9	
tilapia	14	117.9	89.30	190.2	
Margin	28	134.2	65.30	194.9	

There were no significant differences in mean body weight between the species (=0.053), although Redbreast had a higher mean weight (150.5 g) than Tilapia (117.9 g).

Table 3: Summary of fish body length (cm)

	Count	Mean	Minimum	Maximum

Species				
Redbreast	14	190.2	104.2	370.0
tilapia	14	253.1	160.0	420.0
Margin	28	221.7	104.2	420.0

There were no significant differences in mean body length between the species (=0.052), although Tilapia had a higher mean body length (253.1 cm) than Redbreast (190.2 cm).

Table 4: Distribution of the different types of endo-parasites between the two species (counts)

Type of endoparasite	Redbreast	Tilapia	Total

None	10	0	10
Cyst	2	1	3
Lenera	1	13	14
Roundworm	1	0	1
Total	14	14	28

Table 5: Distribution of the different types of endow-parasites between the two species (percentages)

Type of endoparasite	Redbreast	Tilapia	Total
None	71	0	36
Ich	14	7	11
Lenera	7	93	50
Erg	7	0	4
Total	100	100	100

Seventy one percent (71%) of the Redbreast species had no endoparasites, whilst 93% of Three spot tilapia had Lernaea. The Red breast had a mixed (variety) of parasitic infestation although their frequencies are relatively low making them less prone to outbreaks then the three spot tilapia that has little variety in parasitic infestation but with high frequencies.

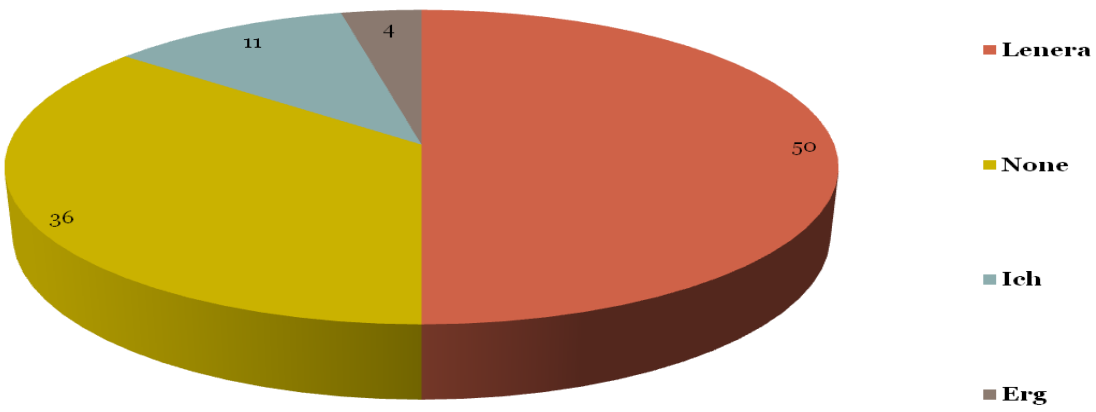

Fig 4: Summary distribution of endoparasites type for both fish species

Lernaea spp dominated the prevalence with 50% infestation, cyst found on the samples where 11% and roundworms found were 4%. The sample had a 36% non infection rate.

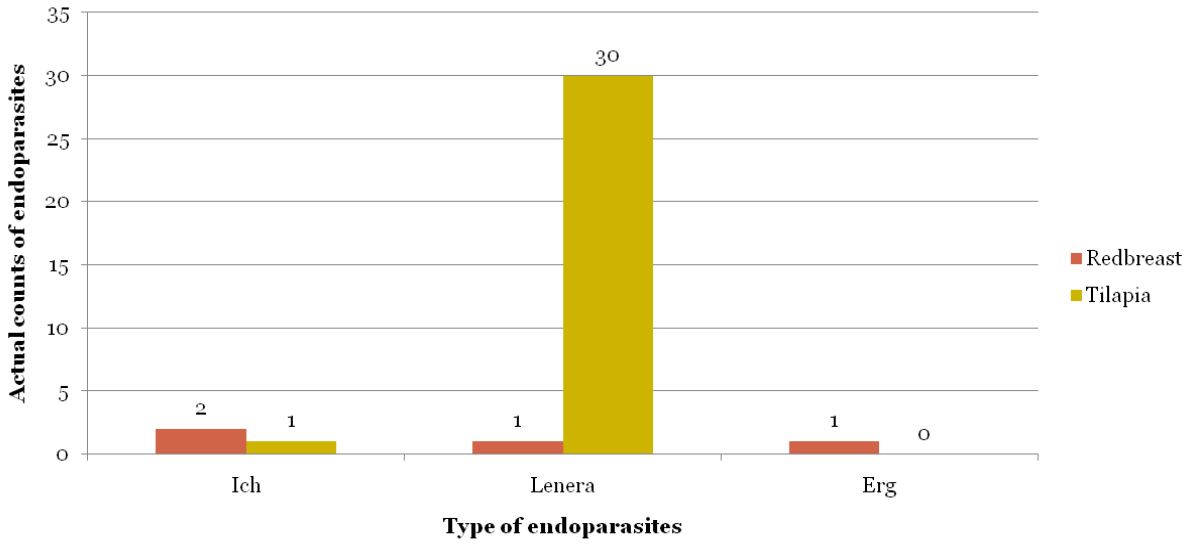

Fig 5: Actual counts of endoparasites by fish species

Lernaea is the most dominant endoparasites.

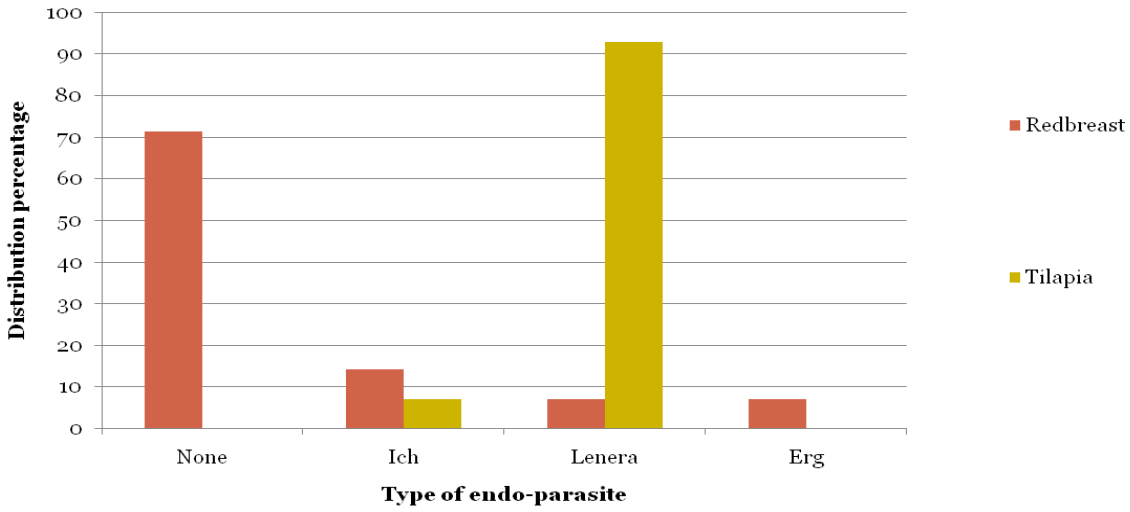

Fig 6: Summary distribution of endoparasites type for by fish species

The three spot tilapia had a higher Lernaea infestation of about 90% whereas the red breast had a infestation of less than 10%. Cyst abundance in the red breast tilapia was 50% more than infestation in The three spot tilapia. Round worms were only found in the Red breast tilapia.

Chapter Four

Discussion

From 28 fish that were investigated for parasites. No Ectoparasites were found; this might be that the parasite left the host, immediately as the host was removed from the pond. Three endoparasites were found *Lernaea spp*, *Ichthyophthirius multifilis* and *Ergasilus* spp. *Lernaea spp* and *Ergasilus* spp are both copepods whereas *Ichthyophthirius multifilis* is a protozoen (kumar, 2007).

The three spot tilapia had a 64 % infestation rate compared to a 14 % infestation rate of Lernaea in the Red breast tilapia might be because of the growth and branching *lernaea spp,* which, is greatly affected by the consistency of the tissue into which the holdfast organ is anchored (Aloo 2002). *Lernaea spp* finds tissue of the three spot tilapia better suited for its attachment then the Red breast tilapia therefore making the despite the fact that both species were cultured in the same pond, more resistant to parasitic infestation then the three spot tilapia.

Parasites were identified to species level only. Lenaea (anchor worm) a type of copepod had high parasitic abundance in three spot tilapia and the redbreast. There were no significant differences in mean body weight and length between the species, although Redbreast had a higher mean weight (150.5 g) than Tilapia (117.9 g). The three spot tilapia had a weight range of 90-189 g and the length of 160-355mm, where the bigger fish had the highest count of endoparasites compared to the small fish. This could be attributed to accumulation of parasites year by year as explained by (Bichi et al 2009). The differences in prevalence of infection between the juveniles and the adults as related to their length and weight may be due to changes in their diet from weeds, seeds, phytoplankton's and zooplankton to insect larvae, crustacean and worm in both juveniles and adult respectively (Bichi et al 2009).

The mouth was the organ dominating the parasitic abundance that was investigated .This might be attributed to fact that the mouth are in great contact to the external water surrounding as a result of their feeding activities (Bichi et al 2009). An earthen pond with aquatic vegetation is for instance prone to parasites such as crustacean copepods and leeches since it contains suitable breeding grounds for them (Bichi et al 2009). Earthen ponds are also appreciated by animals that acts as intermediate hosts for certain parasites; many digenean trematodes such as *Clinostomum spp* that uses snails as intermediate hosts (Bichi et al 2009).Other organs include the vascular cavity and the gills.

The red breast tilapia had 6 samples infested with parasites out of the 12 that was investigated, where most *lenaea spp* found anchored in the vascular cavity. The weight and length ranged from 11.5-189 grams and 90-370 mm respectively. Smaller fish had a higher parasitic infestation compared to the adults, this might attributed by the fact that adult fish is more adopted and resistant to the parasite then the juveniles.

Conclusion

The findings of this study indicates that there was little/no diversity in parasitic infestation in red breast tilapia and three spot tilapia respectively the, although the frequency is high in the three spot tilapia and lower in the red breast.

Tilapias are mouth breeders and the infestation of Lernaea spp. can have a negative effect on mouth breeding in tilapia. Although parasites occur naturally, their infestation can be reduced, since their presence cannot be avoided. The degree of infestation is not only influenced by environmental factors such as salinity, water quality and culture system; but also biological factors such as age, stress ;stress as well as fish with a low nutritional diet and high stocking densities causes the fish to have a low immune system and therefore prone to parasitic infestation.

Recommendation

For this research, I would recommend that regular surveillance should be done on the fish farm in order to detect infestation early so that treatment can be applied or if infestation is severe, infected fish must be removed from the uninfected fish in the pond. Furthermore my recommendation would be that fish from the wild should be quarantine first and only be added to the ponds after examinations is done on them and no threats are found. Finally I would recommend that further studies should be done on the life cycle of parasite, because adult stages of some parasites such as trematodes (*Clinostomum spp*) Birds and snails can increase the risk, especially because species are cultured in earthen pond systems. It might therefore be necessary to prevent snails and birds from accessing the growing unit and remove or eradicate the present snail population from the water.

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Appendices

Table of Results

Fish no.	Species	Body weight	Body length	Location on fish	Endo_type	Endo_count
1	tilapia	158	420	Mouth	lenera	2
2	tilapia	108.6	240	Gills	lenera	4
3	tilapia	108.6	240	Vascular_cavity	Ich	1
4	tilapia	190.2	350	Mouth	lenera	1
5	tilapia	90.1	350	Mouth	lenera	3
6	tilapia	98.7	350	Mouth	lenera	1
7	tilapia	96.1	160	gills	lenera	1
8	tilapia	96.1	160	Vascular_cavity	lenera	3
9	tilapia	96.1	160	Mouth	lenera	1
10	tilapia	89.3	180	gills	lenera	1
11	tilapia	155.9	210	Mouth	lenera	2
12	tilapia	134	199	Mouth	lenera	2
13	tilapia	127	355	Mouth	lenera	7
14	tilapia	102.6	170	Mouth	lenera	2
	Fish no.	Species	Body weight	Body length	Location on fish	Endo_type
15	Redbreast	65.3	151	Vascular cavity	Ich	1
16	Redbreast	67.9	160	Non	non	0
17	Redbreast	83.9	170	Non	non	0

18	Redbreast	185	104.2	Mouth	lenera	1
19	Redbreast	185	104.2	Vascular_cavity	Ich	1
20	Redbreast	185	104.2	Muscles	Erg	1
21	Redbreast	189	217	Non	non	0
22	Redbreast	86.3	170	Non	non	0
23	Redbreast	134.4	370	Non	non	0
24	Redbreast	175.7	220	Non	non	0
25	Redbreast	177.7	210	Non	non	0
26	Redbreast	183	240	Non	non	0
27	Redbreast	193.4	230	Non	non	0
28	Redbreast	194.9	212	Non	non	0

******* Analysis of variance *******

ANOVAs: Output for species and location for endocount.

Source of variation	d.f.	s.s.	m.s.	v.r.	F pr.
Species	1	4.587	4.587	2.02	0.175

Residual	16	36.357	2.272
Total	17	40.944	

Appendix