A Study of Clinostomum affecting *Oreochromis niloticus* in small water bodies in Eldoret-Kenya

Ochieng V. O., Matolla G.K., Khyria S.K.

Abstract - Two hundred and seventy nine specimens of *Oreochromis niloticus* from Kerita and Kesses dam were examined for Clinostomum parasites. Four hundred and thirty eight parasites were found on the two hundred and seventy nine fish specimens. This was done between December 2010 and February 2011.

The gut of Ore*ochromis niloticus* were opened and checked for Clinostomum parasites, the number of the parasites found were recorded. The sex, total length and weight of fish were also recorded.

The parasites were mostly found attached to tissue behind the buccal cavity; this was associated to presence of adequate air supply (Coulibay, 1995). This made it more probable that the Clinostomum parasite in this study was Clino*stomum tilapiae*.

The site of attachment on the fish tissue showed a cyst, the metacercariae is suspected to make this cyct as a form of protective mechanism to wall off and prevent displacement. The cyst was also concluded to have been produced by the fish as a defense mechanism to prevent further damage of tissue by the parasite

Kesses and Kerita dam had a parasitic prevalence of 75.71% 59.14% respectively; this difference was associated with the different human activities existing between the two dams, causing water quality differences.

In both dams, Male fish showed high intensity than female fish, this was associated with the breeding habits of *O.niloticus* which has the male fish spending long time in the shallow waters

Index terms: Clinostomum, O*reochromis niloticus*, prevalence, Mean intensity, condition factor.

- *Ochieng O. Vincent is currently pursuing masters degree program in Aquaculture, PH-+254729645504. E-mail: ochieng.vincent@ymail.com*
- *Matolla G. K. is currently a PhD student and a lecturer at Chepkoilel University College.*
- *Khyriah S. K. is currently pursuing masters degree program in fisheries management.*

(All authors are currently in Chepkoilel University College)

1 INTRODUCTION

FISH parasites are important to fish farming since the effects associated with inherent losses can be overwhelming. The environmental modifications and biological factors associated with fish farming in most cases encourage the development of fish pathogens. This has led to the observed cases of fish pathogens being more in farmed conditions unlike in natural ecosystems (Needham, 1978)

It has also been observed a great range of zoonotics associated with fish parasites, which can be managed by an understanding of the parasite diversity in a region. Ichthyozoonoses are other factors that necessitates studies of this kind (Dally, 1991)

The Digenea parasites are the main endo-parasites of teleost fishes; the greater majority of these fish are susceptible to infections with different stages of trematodes parasites (Masengo, 1989). The nature that has led to the poor understanding of the digenea parasites, including their diversity, ecology and biology include; the incomplete collection of tremadotes of fishes, the standard of the taxonomy is highly variable and generally poor, there is a grave lack of underlying life-cycle information for several families and most species, and there have been relatively little work done to investigate these processes (Daly & Singleton, 1994).

There is no general pattern in the evolution of the digeneans (Moller, 1986); some genera appear closely co-evolved whereas others show no discernible fidelity to host taxa. Further, closely co-evolved genera may occur within the same family as others, with only ecological specificity to their hosts. (Needham, 1978).

The essence of this study is therefore to provide a basic framework for future studies and research on the Clinostomum parasites affecting fish in Uasin Gishu County. This was done by enabling a clear illustration and comparison of the parasitic indices between two dams and relating them with the fish health.

2 MATERIALS AND METHODS

2.1 Study Site

The study was carried out in Kesses and Kerita dam in Uasin Gishu district. Laboratory analyses were done in Chepkoilel University College. The dams are located along Eldoret-Nairobi road and the University is situated along Ziwa road.

Important to note is that the conditions around Kerita dam are similar to the ones in Kesses dam. Therefore, reference is only made to Kesses dam.

2.1.1 Location: Kesses and Kerita dam are located in Uasin Gishu district. Uasin Gishu District (Figure 1) shares common borders with other districts like Trans-Nzoia to the north, Marakwet and Keiyo to the east, Koibatek to the south-east, Kericho to the south, Nandi to the west and Lugari to the north-west. Uasin Gishu district extends between longitude 34o 50' and 35o 37' east and 0o 03' and 0o 55' north.

Kesses Dam lies at an altitude of 2,750 m. a. s. l. and is located 31 km south of Eldoret town and 6 km east of Moi University Main Campus on Cheptiret – Lessos road and 9 km south of the main Nakuru-Eldoret road. Kesses Dam is thus about 43 km from Chepkoilel University College.

2.1.2 Hydrology and size: Kesses Dam receives most of its waters through Rivers Tarakwa and Nderugut and both rivers enter the east of the dam through a swamp of Typha latifolia and Cyperus sp. The dam's only outlet is the Sambul River in the west. The dam has surface area of about 189 hectares and a volume capacity estimated at about 274 m3. It has an average depth of 3 meters. The catchment area is approximately 1,720 hectares and extends as far as northern Tinderet forest and Nabkoi forest.

2.1.3 Fish communities: Tilapiines were the first fishes to be introduced in Kesses Dam with further

addition of about 5,000 fingerlings of Oreo*chromis niloticus* (Linnaeus 1758) in 1990 and 1996 and that Barbus sp were available in the dam. Gambusia sp was also encountered in Kesses Dam (Ochoki, personal communication).

Macrophytes community: The macrophyte community includes Phragmites sp, Nymphaea indica, Cyperus papyrus, Potamogeton sp, *Utricalana folisa,* Ceratophyllum sp and Najas sp. The shallow parts of the dam are covered with dense submerged Ceratophyllum demersum. These in most cases cause obstruction to fishing activities, especially gill netting. The most noticeable aquatic macrophytes in the dam include Typha latifolia, Cyperus sp, Elodia canadensis and Potamogeton sp, which formed a large swamp in the eastern part of the dam and fringe swamps around the remaining parts of the dam. This was similar with Kerita dam although the two dams are quite some distance apart.

2.1.4 Land use: The main human activities in the drainage basin of Kesses and Kerita dam includes majorly subsistence-crop farming, horticulture, agro-forestry, forestry and livestock rearing.

2.2 Fish Sample

During the period December 2010 and February 2011, a total of two hundred and seventy nine fish were sampled from both dams with 186 from Kesses and 93 from Kerita dam for the whole study. The samples were obtained by random sampling of hosts by use of gill net. The gill nets were set overnight and fish removed from them the following morning.

2.3 Parasites

Evisceration was done in the field to avoid the transportation cost that comes with transporting live fish, and it was also reliable working with freshly killed fish to eliminate the possibility of decomposition.

Sex, total length and weight of each fish were recorded; this was to enable calculations of condition factor. Fish was opened by a longitudinal incision along the belly by use of a sharp scissors. The internal cavity of the fish was carefully examined for digenean parasites by use of magnifying lens. The mouth cavity and buccal cavity were also observed.

2.4 Data Analysis

Statistical analysis using Minitab was then done to establish the relationship between parasitic preference and fish sex, difference between the prevalence on the two dams and the relationship between fish condition factor and parasitic mean intensity. Chi square was used to ascertain significance in the tested relationships.

2.5 Determination of Parasite Indices

This was calculated as per the formulae listed below (Bush *et al*, 1997).

Prevalence: This is the number of hosts infected with one of more clinostonum parasite. It is expressed as a percentage and gives the level of population that is infected.

$$\text{prevalence} = \frac{\text{number infected hosts}}{\text{total host population}} \times 100\%$$

Mean Intensity: This is the average intensity of individuals of infected hosts.

$$\text{Mean Intensity} = \frac{\text{Total number of clinostonum parasites in a given host}}{\text{The number of hosts infected}}$$

$$\text{Mean abundance} = \frac{\text{Total number of parasites in a single host}}{\text{Number of examined hosts (both infected /not)}}$$

3 RESULTS

There were observed various differences in the distribution of parasites in the two dams, this is was evident on sex preference as shown in figures 3-6. These differences are attributed to environmental factors and others to the biology of the varied sex as therein explained.

The results also showed that Kesses dam had higher parasitic prevalence than Kerita dam; this could be associated with the low numbers of fish in the dam and the less human activities impacting the area as compared to Kesses dam. This is illustrated in figure 2.

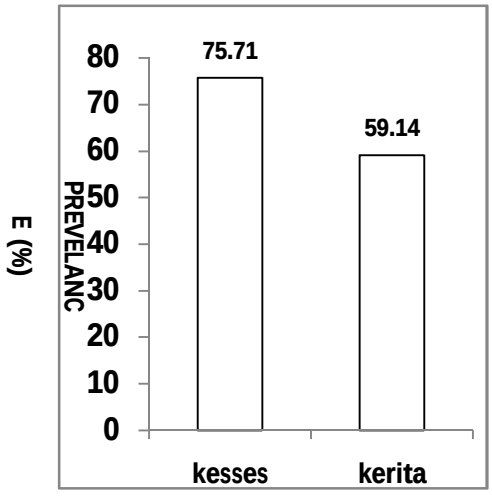


Figure 2: prevalence of infection of tilapia (*O. niloticus*) in Kesses and Kerita Dam by Clinostomum

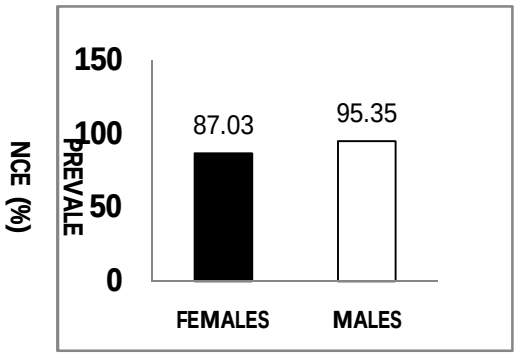
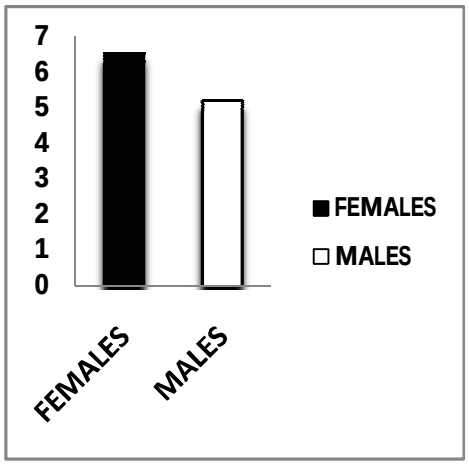


Figure 7: Mean intensity of Clinostomum parasites in males and female fish in Kerita Dam.



The graph bellow shows the preference by indicating the most and least affected sex.

Figure 3: Distribution of Clinostomum parasite in male and female in Kesses dam.

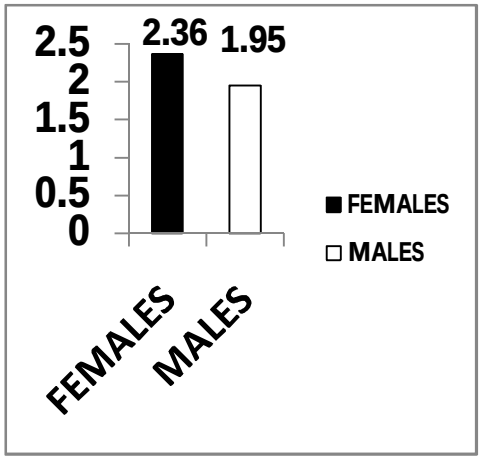


Figure 4: Mean intensity of by sex to show sex preference in Kesses dam results.

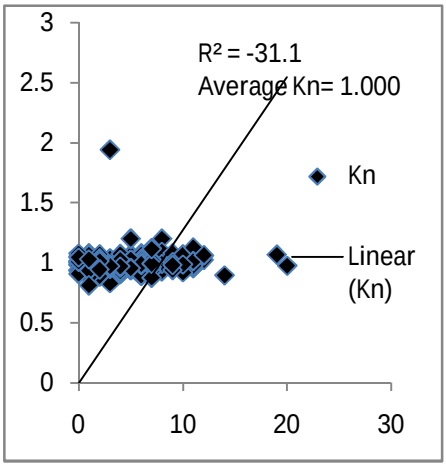


Figure 5: Relationship between condition factor and the number of parasites.

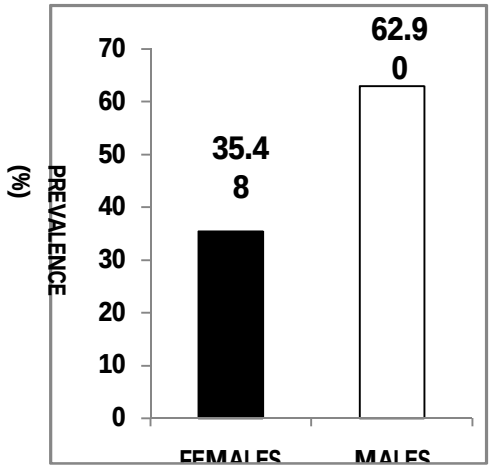


Figure 6: Prevalence of Clinostomum parasites in males and female fish in Kerita dam.

4 DISCUSSIONS

The study found out that the parasitic prevalence was higher in Kesses dam, 75.71%, than in Kerita dam, 59.14%. This meant that a greater proportion of fish in Kesses dam were more affected by the *Clinostomum* parasite.

This difference is highly associated with the presence of an urban center and School both releasing waste waters in Kesses dam. Kerita dam is quite off the effects of urban life and therefore the water quality expected to be of fewer disturbances.

The parasitic intensity in Kesses dam was approximately 3 while that of Kerita dam was 1. This could also be associated with the water quality difference due to the influence of the urban center between the two dams and the presence of fewer aquatic birds observed in Kerita dam.

Clinostomids infection can have several effects on fish; among them being reduced growth, offset weight loss and prominent exophthalmia (Garacia *et al*, 1993; Yamaguti, 1933) however the results obtained in this study showed that the condition factor was not affected in any way by the parasites since there was observed a Pearson correlation value of 0.080 which represents no significant correlation between the number of parasites and the fish's condition. Equivalently, there was an average condition factor of 1, which is a reliable figure for well being.

Sex preference was observed in both dams with the male *O. niloticus* being favored by the Clinostomum parasite. This phenomenon is however still unclear but can be associated with the breeding habit of *O. niloticus*.

During breeding, male fish takes care of a territory around the nest, keeping off other fish (females not spawning included). During this period the males spend more time than the females in the shallow waters where the snails harboring the cercaria of *Clinostomum* are mostly found, and this is probably why the males had higher prevalence.

In this study the cysts were obtained behind the baccal cavity near the optic nerves. Ractiliffe, (1968) found that *C. tilapia* in reality has the physiologically adapted to turn upwards towards the mouth instead of going into the intestine because of the oxygen requirement. This conclusion by Ractiliffe therefore leads to an assumption that the *Clinostomum*

observed in the two dams were *Clinostomum tilapia*.

The observations also lead to a conclusion that the specie in question is *Clinostomum niloticus*; this is as provided by Ractiliffe, (1968).

The parasite on the fish may have a range of effects to the fish, and may stimulate other related responses to avoid damage to tissues; this may vary from mild inflammations to extremely severe narcotizing wound which may be critical (Hunter & Hunter, 1934). The cyst formed in the fish, may die off if its life cycle is not completed by predation on the fish by birds, the final hosts (Adeyemo et al, 2007).

In this study, the body cavity of Clinostomum was found as cysts, on the niloticus, shown in figure 8. Trematodes normally injure their host by mechanical damage resulting from consuming host tissues (Bullock, 1978). The parasite's cyst are produced by the fish tissues in reaction to attack by the parasite, this may conversely result into irritation of the affected area and surplus mucus reaction at the spot of attachment (Ukoli, 1866). The skin produces the cyst in a bid to prevent further penetration of the parasite into its tissues.

The position which the parasite decides to attach is majorly determined by availability of resources it requires for optimum survival. Amlacher (1966) observed that adult trematodes may not attack host organs by implanting in the tissues but only affix to well-situated sites where all required nutrients may be acquired with ease.

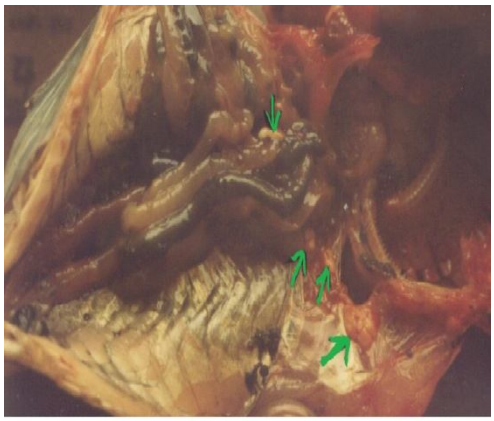


Figure 8: Body cavity of *O. niloticus* infested with Clinostomum parasites. Olsen, O.W (1985)

5 CONCLUSIONS

There was observed sex preference in the prevalence of the parasite. Generally, male fish had a higher prevalence than the female fish. This is associated with the male's behavior during breeding.

The parasitic indices for Kesses dam were generally higher than those in Kerita Dam, this was majorly associated with the environmental and human activities involved therein.

The parasitic abundance had no significant effect on the well being of fish, this was as represented by the 0.080 value of the Pearson correlation which a showed that there was no significance in correlation.

6 RECOMMENDATIONS

There need to be undertaken more studies on other existing parasites in the region to provide for more comparative study globally.

The study of Clinostomum parasites and other digeneans should be coupled with molecular biology to enable a more accurate description of their diversity and occurrences. This should lead to management solutions to control of these and other parasites in ways practical to the region.

ACKNOWLEDGMENT

The authors wish to thank Chepkoilel University College for the provision of facilities required during the study.

References

Adeyemo A.O1 and Agbede, S.A2 (2007): Histopathology of Tilapia tissues harbouring Clinostomum tilapiae parasites. African Journal of Biomedical Research, Vol. 11 (2008); 115 – 118

Amlacher E. (1996): Textbook of Fish Diseases. Translated by Canroy D.A and Herman, R.L.T.F.H publication inc. 308pp

Bullock, A.M. (1978): Laboratory Methods. In fish Pathology. Roberts, R.J. (Editor).Bailliere Tindall Publ.235-266p

Bush, A.O., Lafferty, K.D., Lotz, J.M., and Shostak, A.W. 1997. Parasitology meets ecology on its own terms: Margolis et al. revisited. J. Parasitol. 83: 575–583.

Coulibay, N.D. et al. (1995): Larval Clinostomosis In Cichlid Fish in River Mahjong.

Daly, J. J., B. DeYoung, and T. Hostetler. (1991): Hyperinfestation of smallmouth {Micropterus dolomieui) by the trematode Clinostomum marginatum in stream black bass. Proc. Arkansas Acad. Sci. 45:123.

Daly,J. J., and j. Singleton. (1994): Estimating populations of yellow grub (Clinostomum marginatum) inchannel catfish (Ictalurus punctatus). Proc. Soc. Exptl. Biol. Med. 206:454.

Garacia, M.L.J; Osorio, S.O and Constantino, F. (1993): Prevalence of parasites and the histological lesions they produce in Tilapia from Amela Lakes. Tecoman Colima. Vet Mex.

Hunter, W.S. & Hunter, G.W. III (1934): Themiracidium of Clinostomum marginatum. Rud. Journal of Parasitology, 20, 132. Lake Kompeinga, Burkina Faso. A threat to Fishing and public Health. Francophones Sante

Mashego, S.N (1989). Nematodes Parasites of Barbus species in Lebowa and Venda,

Moller, H. and Anders, K. (1986). Diseases and parasites of Marine fishes. Kiel: Moller

Needham, T and Wooten, R. (1978) Parasitology of Telesot in Fish Pathology. Robber

Olsen, O.W (1985): Animal parasites. Their biology and Life Cycles Burgress Public Co. Minnesota. 100-106pp.

Ractiliffe, , R.J. and Sommerville, C. (1968) "Disease of tilapias In: The biology and culture of tilapias (eds) R.S.V. Pullin and R.H. Lowe-McConnell). ICLARM Conference proceedings, Manilla Phillippines 7: 247-263 14 South Africa S. Afr. J. Wild Res. 9(1): 35-37

Ukoli, F.M.A. (1966): Clinostomum tilapiaen. sp., and C. phalacrocoracis Proc. Soc. Exptl. Biol. Med.

Yamaguti, S. (1933): Studies on the helminth fauna of Japan. Part 1. Trematodes of Birds, Reptiles and Mammals. Japanese Journal of Zoology, 5, 1–134.