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Effects of Endohelminthson Condition of *Oreochromis Niloticus Baringoensis* (Trewavas, 1983) At River Molo Inlet in Lake Baringo, Kenya

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ABSTRACT

Endohelminths infections in fish cause production and economic losses through direct fish mortality, reduction in growth and condition, reproduction, energy loss, increase in the susceptibility to disease and predation. A study on endohelminths of Oreochromisniloticus baringoensis at the inlet of River Molo in Lake Baringo was conducted between August and December 2015to investigate their effect on condition of the fish. Fishing was done weekly each month. Fish samples were collected and preserved in a cool box, then immediately transported to the laboratory for examination and parasite identification using standard parasitological techniques. Out of 447 fish, 340 were infected with endohelminth parasites of six parasite genera: Contracaecum, Amirthalingamia, Tylodelphys, Apharyngostrigea, Clinostomum and Euclinostomum. The relative condition factor (K_n) for the infected and non-infected fish were 1.06 and 1.07 respectively. Only the Contracaecum parasites had significant relationship with fish condition factor ($F=13.08$, $p< 0.0001$). Amirthalingamia, Tylodelphys and Euclinostomum were inversely related to the fish condition suggesting they were pathogenic to the host.

Keywords: *Oreochromisniloticus baringoensis, endohelminths, Relative condition factor, River Molo inlet, Lake Baringo*

INTRODUCTION

The fish community of Lake Baringo comprises of eight species, namely: *Protopterus aethiopicus* (Heckel, 1851), *Clarias gariepinus* (Burchel, 1822), *Oreochromis niloticus baringoensis* (Trewavas, 1983), *Barbus intermediacy austral is* (Banister, 1973), *Barbus lineomaculatus* (Boulenger, 1903), *Labeo cylindricus* (Peters, 1852), *Aplocheilichthys sp.* and *Enteromiuspalu dinosus* (Peters, 1852) (Aloo, 2002). Five of these species are exploited (*O. n. baringoensis, P. aethiopicus, C. gariepinus, B. intermedius* and *L. cylindricus*) providing an important income for the local population. Aloo, (2002) reported that *O. n. baringoensis* make up to 80% of the total catch in Lake Baringo. The other species are caught in much lower numbers of *P. aethiopicus* (7.6%), *C. gariepinus* (8.9%), *B. intermediacy austral is* (3.1%), and *L. cylindricus* (0.1%) (Hickley *et al*., 2004). *Oreochromis niloticus baringoensis* is an endemic sub-species of *O. niloticus* in Lake Baringo (Hickley *et al*., 2004; Britton *et al*., 2008). It is characterized by its compressed body form and an interrupted lateral line. The fish can grow to a maximum standard length of 39.5 cm (Seegers *et al*., 2003). The dorsal fin contains both spinous (16-17) and soft rays (11-15). It is pelagic and sight-feeder with a diet dominated by phytoplankton and benthic algae (Omondi *et al*., 2013).

Cichlids host major infections which comprise protozoan, helminth and arthropods parasites that can produce harmful effects (Branson and Southgate, 1992). Parasites are both important agents of natural selection and factors contributing to the dynamics of host populations (Marcogliese, 2004).

Condition factor can be defined in energetic terms as the amount of energy available to an individual which may be allocated to various life functions including reproduction, foraging and over-winter survival (Ricker, 1975). The condition factor can be used to evaluate the effects of parasitism on the hosts' health (Guidelli *et al*., 2011). Some parasites seem not to exert negative effects on their hosts, while others can have deleterious effects in the health of the hosts.

The relative condition factor (*Kn)* (Le Cren, 1951) was formulated based on length–mass

relationships (Cone, 1989) to account for the violation of the assumption of isometric growth. Itis based on a scaling power that is derived directly from the population sample. It is assumed that the population scaling pattern reflects the true allometry between length and mass (Cone, 1989).

MATERIALS AND METHODS

The study was conducted in the River Molo Inlet to Lake Baringo, Kenya (Fig.1) during August and December 2015. It lies at an altitude of 915m above sea level, at latitude of 0 º42´4 and 0º 36´2 N and longitude 35º 59´36 E and 36 º 53´8E.The choice of the sampling site was informed by a preliminary observation of high fish catch compared to other river inlets (Personal observation).

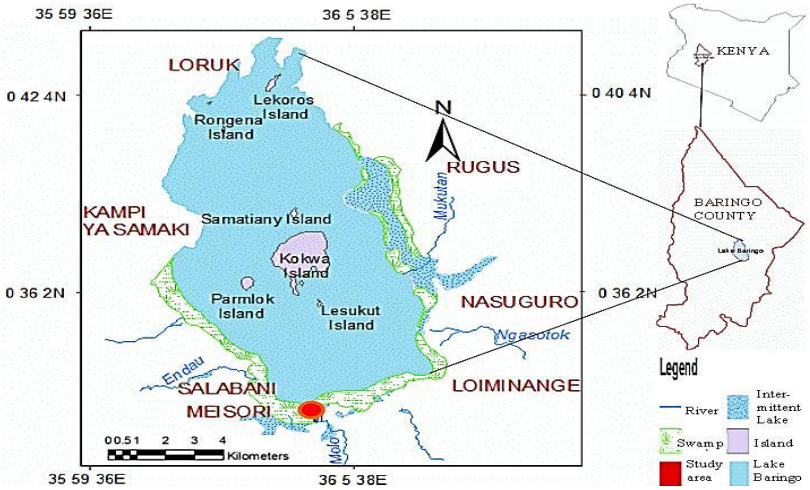

Figure1. *A map of Lake Baringo showing the study area (modified from KMFRI)*

Fishing was done using nylon gillnets of mesh sizes 2.5-4.0 inches, 60 m long and 1.5 m wide. After every week, the nets were set in the evening and retrieved in the morning to collect the catch. A total of 447 fresh fish collected were preserved in a cool box with ice blocks and then transported to the laboratory for clinical and parasitological analyses within 48 hours.

Laboratory Analyses

In the laboratory, the total length (TL) of the fish specimens were measured to the nearest centimeter (cm) using a meter rule, while weight (W) measured to the nearest grams (g) using an electronic balance (Gebr. Bosch, D-7455; Made in Germany). Postmortem and parasitological examination was made. Each fish was laid on its back on plastic dissecting tray and the abdominal cavity was cut open using a scalpel and a pair of surgical scissors which was inserted through the urogenital opening and a slit was made to the pelvic bones following methods described by Olurin and Samorin (2006). Fish organs (eyes, digestive tract, heart, liver, gills, kidney, swim bladder, spleen, gonads, peritoneal and body cavities) were then extracted and each placed in properly labeled sterile petri-dishes filled with normal saline (0.9% salt concentration). Thin transparent sections of the organs were cut using scalpels and dissecting needles to expose contents which were examined at (X100) magnifications and the counts of parasite species per individual fish was recorded. Identification of the parasites was done using taxonomic keys of fresh water fish parasite pictorial guides by Woo (1995) and Paperna (1996).

Data Analysis

The relative condition factor (*Kn*) was calculated following the formula of Le Cren, (1951):

$$Kn = \frac{W}{a\ x\ TL^b}$$

Where *Kn* = The relative condition factor; *W* = Weight (g) of fish in grams; *a* = Exponent describing the rate of change of weight with length; b= The slope of the regression line (also referred to as the allometric coefficient); *TL* = Total length of fish in centimeters Intensity (of infection, I) is the number of individuals of a particular parasite species (or taxonomic group) in a single host (expressed as a numerical range).Statistical analysis used significance at 95% confidence level using Minitab statistical software, version 17. Effect of parasite intensity on fish condition factor was determined by linear regression.

RESULTS

Results in Figure 2 shows the relationships of fish condition factor and intensity of parasites. The findings indicated that there are direct relationships among the parasite intensities' of *Contracaecum* (F=13.08, p< 0.0001), *Clinostomum* (F=0.02, p=0.894) and *Apharyngostrigea* (F= 0.05, p= 0.815) with the condition of *Oreochromisnilo ticusbaringoensis*; with their regression models explaining 2.9, 0.0 and 0.0% of the relationships respectively. Further, the intensities of *Amirthalingamia* (F=0.57, p=0.450), *Tylodelphys* (F=2.19, p=0.140) and *Euclinostomum* (F=0.18, p= 0.675) were inversely related to the fish condition; with their models explaining 0.1, 0.5 and 0.0 % of the relationships respectively. All the inversely related parasites suggest that they were pathogenic to the host. Only the *Contracaecum* parasites had significant relationship with the fish condition factor.

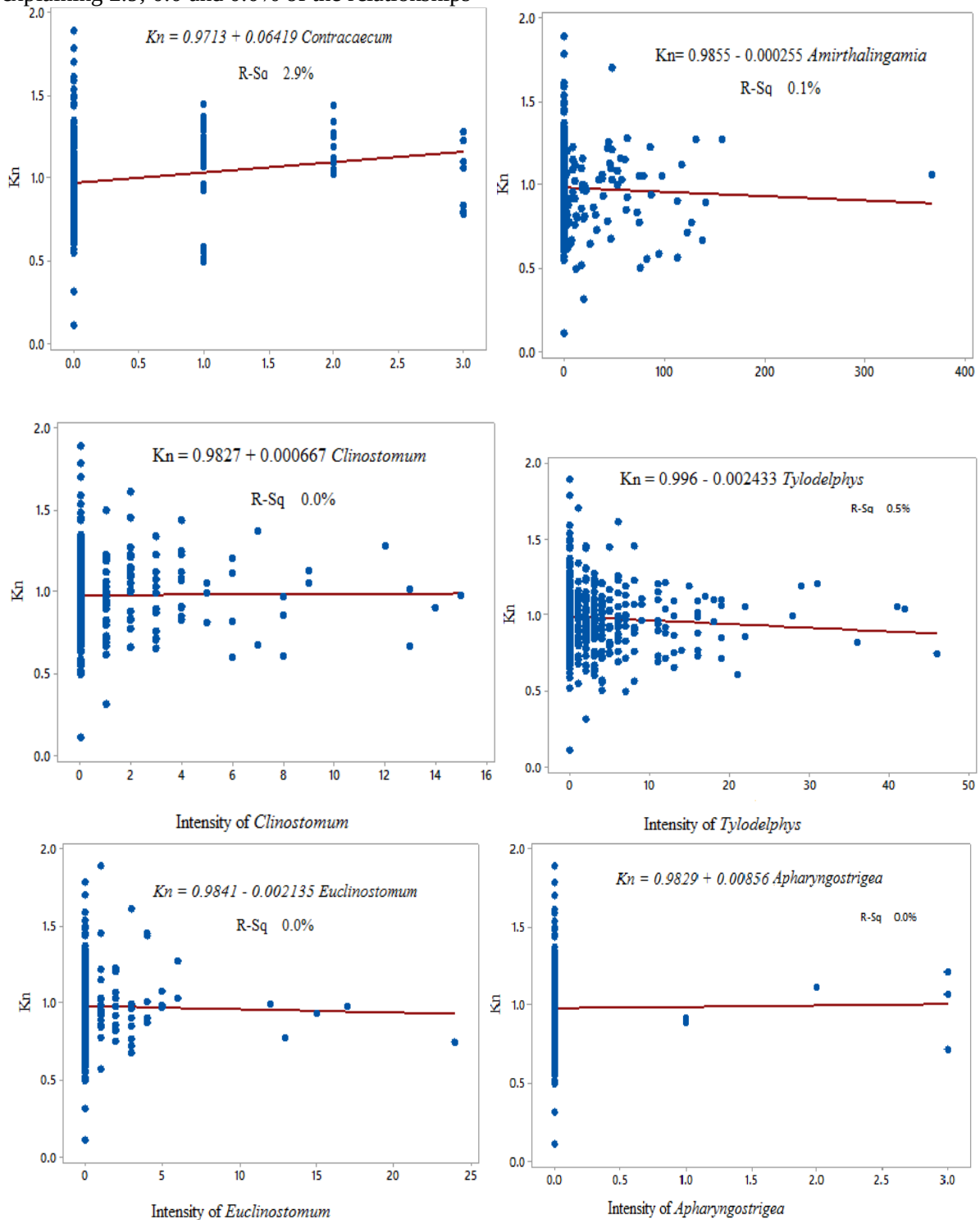

Figure2. *Linear relationships of parasites intensity and fish condition factor (Kn).*

DISCUSSION

Tylodelphys, *Euclinostomum* and *Amirthalinga mia species* showed inverse relationships' with the fish condition factor, implying that they are pathogenic to the host. *Tylodelphys species* affects negatively the well-being of *O. n. baringoensis*, and possibly predisposes the host to predation and inefficiency in fish foraging. Eye flukes are associated with emaciation, blindness, and death in fish (Chappell, 1995).

Amirthalingamia sp. Affects their hosts negatively through competition for food contents in the intestinal tract, thus depriving the host sufficient nutrients for healthy growth. Their presence may therefore explain observations of fish specimens collected with general stunted growth. Negative effects of endo helminths on the condition of the hosts are widely known and expected (Bauer, (1970) and Lemly (1980).However, *Contracaecum sp.*, *Apharyngostrigea sp.* and *Clinostomum sp.* showed proportional relationship with the fish condition factor, suggesting that there is a balance in the parasite–host relationship. Paperna (1996) reported that the parasite does not kill the intermediate host and reaches its final host to complete the life cycle.

Fish from any aquatic system as in the wild population have a wide range of parasites, but most of these parasites either exist as commensals or they live at equilibrium in their aquatic hosts (Marcogliese, 2004 and 2005; Iwanowicz *et al*., 2006). Chubb (1965) reported that in the natural environment, parasites are always in a complex equilibrium with their hosts as long as the environment is not disturbed and the fish (hosts) are not subjected to any stressful conditions; normally posing no harmful effects to their hosts. In Lake Baringo, therefore, the relationships among these parasites and *O. n. baringoensis* may be more of commensalism rather than true parasitism. According to Williams and Jones (1994) and Whittington *et al*. (2000) fish have effective immune mechanisms against end parasites. Similar results of positive relationship between parasite intensity and condition factor among fishes infected with end parasites have also been reported by (Machado *et al*., 2005).

In the tropical waters, nematode parasites have been reported to be harmless to their hosts (Tompkins, 1976; Mbahinzireki, 1984). Paperna (1980) pointed out that nematodes may not be too harmful to their fish hosts but the marketability of the fish is greatly reduced. This may further be explained by the fact that hosts that acquire resistance to parasites through adaptation may also not be affected with regard to their body conditions (Guidelli *et al.*, 2011; Tavares-dias *et al.*, 2014), depending on the organ infected and the parasite species, abundance and pathogen city.

In conclusion, only *Amirthalingamia*, *Tylodelphys* and *Euclinostomum* sp. were pathogenic to the fish.

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