

# Occurrence of Nematodes in the Nile *Tilapia Oreochromis niloticus* (Linne) in Lake Wamala, Uganda

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**Key words:** nematode, *Oreochromis niloticus*

## Abstract

*The incidence, intensity and effects of nematode infection in the Nile tilapia, Oreochromis niloticus, in Lake Wamala and their biological characteristics, were investigated. Six hundred and thirty fish were examined using standard techniques and found to harbour nematodes belonging to the genus Contraecaecum concentrated in the pericardial region. The incidence and intensity of infection increased with the length of the host and it was positively correlated with the onset of maturity of the host. Factors responsible for the variation in the prevalence of the helminths, the intensity of infection and their implications are discussed.*

## Introduction

Parasitic infection in fish is detrimental to the fish industry because it lowers the quality and quantity and hence the value of fish. Lake Wamala, in the Lake Victoria basin, was first stocked with *Oreochromis niloticus*, *O. leucostictus* and *Tilapia zilli* in 1956 and opened to commercial exploitation in 1960. Commercial catches then were dominated by *O. niloticus* that attained a maximum size of 32 cm total length (TL). TL at first maturity for the last two species was recorded at 21 cm (Okaronon, 1995).

Since the 1970s a number of changes have taken place in the Lake Wamala fisheries. *O. niloticus*, which formed the major commercial fishery, declined from about 67% of the total landed weight in the 1970s to 50% in the 1980s. The maximum TL decreased from 32 cm to 22 cm. Total length at first maturity decreased from 21 cm to 14 cm. The fish were mature by 20 cm TL. Fish were landed in large quantities but were of small size (<10cm, standard length) and of very low commercial value (Okaronon, 1995).

*O. niloticus* in other Ugandan lakes, for example, Lake Kyoga and Lake Victoria has been reported to grow to larger than 50 cm TL (Okaronon, 1995, Witte and van Denser., 1995). The fact that *O. niloticus* does not attain this size in Lake Wamala, suggested factors limiting their growth; including nematode infections.

Nematodes in fish are metabolically dependent on the host for various requirements, including nutrients, oxygen, enzymes, and even developmental stimuli (Olsen, 1986). They deprive the host fish of nutrients, from food material in the lumen of the digestive tract by outright ingesting undigested food, tissue exudates into the gut, disintegrated tissues and enzymatic fluids (Hyman, 1951 and Smyth, 1994).

A number of conditions may develop after depriving the hosts of nutrients. These include inflammatory and necrotic changes in the tissues surrounding the affected areas, later forming wounds, ulcers or even holes. Other changes include development of cysts,

capsules and granulomae as a result of larval infestation; weight loss and reduction of growth rate.

The present study was under-taken to investigate the occurrence of helminths in *O. niloticus* in Lake Wamala and relate this to the stunted condition of Wamala tilapia

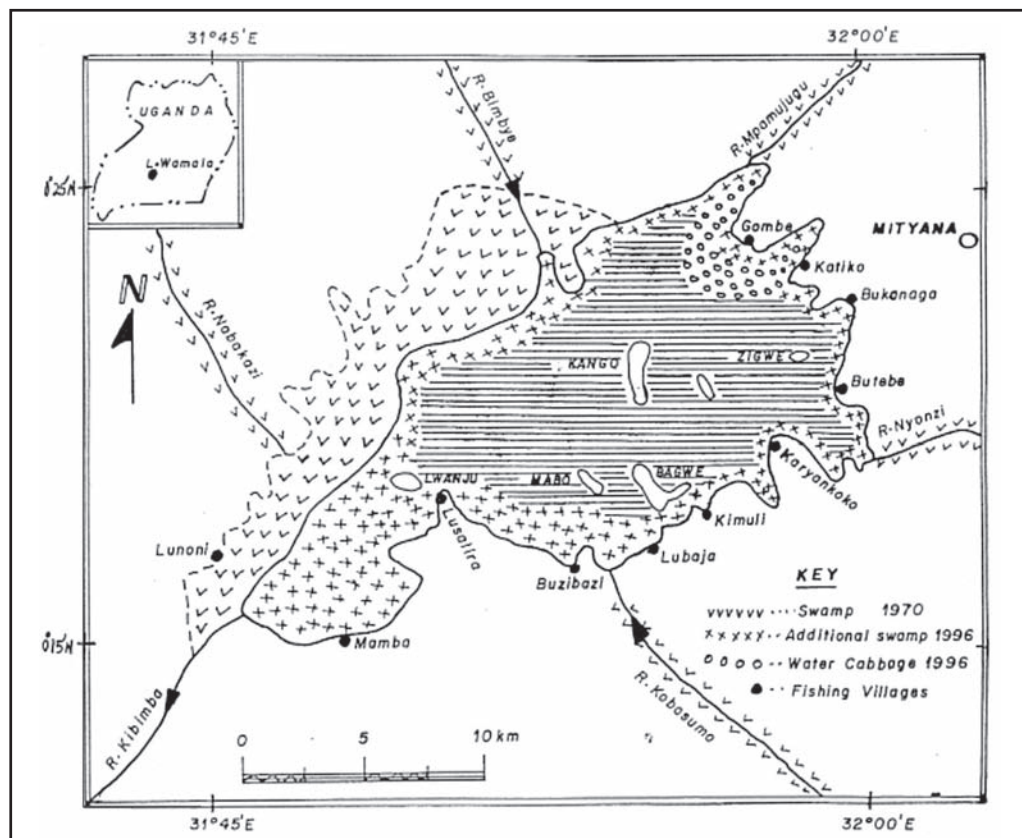
**Materials and Methods**

The study was conducted on Lake Wamala, located in central Uganda. The lake lies between latitudes 0° 15' and 0° 25' N 31° 45' to longitude 32° 00' E, longitude and at an altitude of 1000m above sea level. The surface varies from 100 to 180km<sup>2</sup> depending on the season.

Sampling was done twice every month from December 1997 to July 1998 from three sampling stations namely; Bukanaga, Katiko, and Gombe landing sites (Fig. 1). They were obtained from

experimental gillnets and commercial catches. At each site, three fleets of identical gillnets were used.

Each fleet consisting of 10 gillnets of graded mesh sizes ranging from 5.1cm to 17.8cm at approximately 12.5cm. The nets were set at the shore, next to the macrophytes (herein called inshore); at 50m from the shore (herein called middle); and at about 100m from the shore (herein called offshore). The nets were set at 18:30 and retrieved at 06:00 hours to obtain the night catch. They were set again at 0600 hours and retrieved at 1800 hours to obtain the day catch. Specimens of *O. niloticus* were sorted out each catch. Random sub samples of 5-10 fish were taken. Essential information including, gear, and mesh size of the net used, area fished, time and date of fishing and biometric data of the fish (i.e., total length, standard length, gonad state, sex and weight)

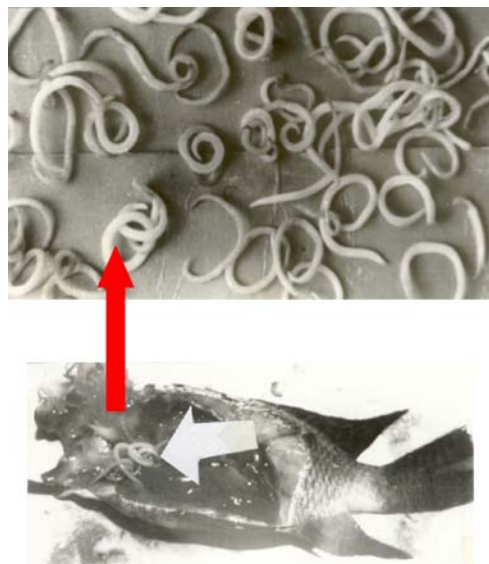


Map of Lake Wamala showing sampling sites

were recorded before opening the fish. After exposing the body cavity, each fish was examined for the presence of nematodes. Thereafter the gut was carefully removed and a longitudinal incision made from the oesophagus to the anal opening to allow the search for parasites. The parasites were removed, counted, rinsed in normal saline and preserved in 70% methanol. The maximum length and width of each nematode were measured using a pair of vernier callipers.

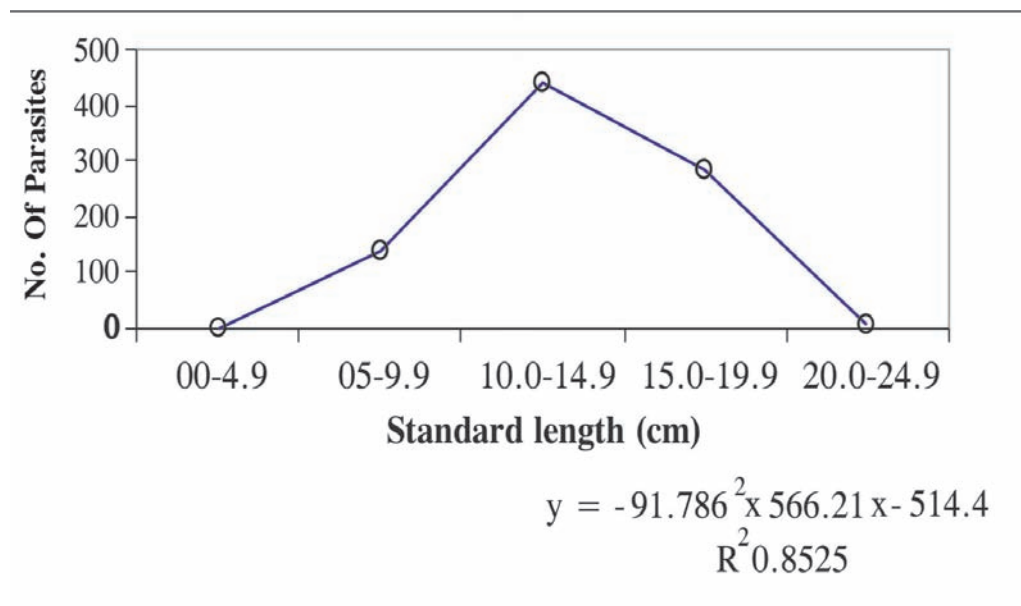
### Results

The results of the study are given in Figures 2 to 5. Out of a total of 630 *O. niloticus* examined, 393 (62 %) were infected with nematodes. The parasites coiled on the surface of visceral organs in the pericardial and gill region, assuming a spiral shape when dead (Fig.3). The nematodes tended to be concentrated around the pericardial region. The average parasites length and weight was 2.45 cm and 0.11g respectively. They were morphologically similar under the microscope with a relatively short, bulbless oesophagus. All the nematodes examined had arms and open sucking mouths at the head tip, suggesting a parasitic mode of existence.



**Fig 4: *Oreochromis niloticus* infected with nematodes with a closer view of the nematodes**

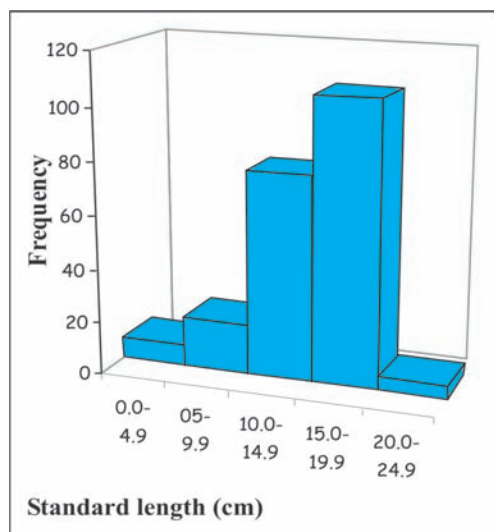
The fish examined ranged in size from 6.0 to 26.2 cm total length. A distinct mode was observed between 10 and 14 cm. Seventy four percent of the fish fell within this range (Fig.5). Infected fish had one to thirteen (1-13) nematodes. The infestation levels in the fish



**Figure 2:** Graph showing relationship between parasite infestation and parasites.

increased after the 5 cm total length (Figure 2). This was followed by a gradual decrease in infestation. For size classes above 5 cm, the infection percentage and worm burden fluctuated and steadily increased with length. Infection levels increased with increase in the size of *O. niloticus*. Infected and uninfected fish of the same age and sex were indistinguishable in appearance and size. Their condition factor did not vary significantly ( $p > 0.05$ ) from the average condition factor of *O. niloticus* that was 2.3 revealing no clear relation between the intensity of infection and the condition of the affected fish. Chi-square analysis showed no significant difference ( $P > 0.05$ ) in the incidence of infection levels of male and female fish. The mean length of fish with infections of more than two nematodes was similar to that in infections with one parasite. Crowding effect showed no indication of influencing parasite size.

Intensity of nematode infection increased from a mean number of 1.4 in the 5 – 9 length class to 1.6 in the 10-14 length class and 1.8 nematodes in the 15 – 19 length class, and then gradually decreased (Table 1). The smallest fish examined measured 4.5 cm standard length, was immature; weighed 3g and was free from



**Figure 5:** Standard length of *Oreochromis niloticus*

nematode infection. The highest number of nematodes found on a single host was 13 (Table 2). This was found in a male (gonad state 6), weighing 385g.

### Discussion

The increase in the number of nematodes with size up to maturity observed in this study may be related to physiological factors where parasites synchronise their maturity with that of the fish. This phenomenon was observed by Symth (1994). He explained that physico-chemical factors in the fish host could stimulate some escheatment in some nematode larvae.

The distribution of nematode larvae within the host showed two features of particular interest, namely, lack of preference for male or female fish, and increased preference for larger fish. Similarly nematode preference for either sex of *O. niloticus* indicated that both males and females had equal chances of being infected. The confinement and accumulation of infection to larger fish had also been observed by other workers, namely, Paperna, (1974) working on *Oreochromis spp*; and Mbahinzireki (1980) working on *Haplochromis spp*. These researchers observed that high infection rates of more than 10 larvae per host did not greatly affect the condition factor of the fish. It is known that a value of condition factor greater than one indicates healthy specimens (Nikolsky, 1963). Therefore, the average condition factor of 1.8 observed in the present study indicated that the specimen were healthy. In this way, nematodes in *O. niloticus* in Lake Wamala might be deriving maximum benefit without killing their host, an indication of commensalisms.

The incidence of infection observed in the present study may be attributed to the maturity of the fish, as most fish infected were beyond gonad stage three level of development (Kaddumukasa, *et al.*, 1999). Paperna (1979), working on monogeneans in lakes George and Victoria found that infection increased with increasing age of the fish. Increase in the

**Table1:** Intensity of nematode infection from *Oreochromis niloticus* from Lake Wamala.

Class	No. of fish	No. infected	Parasites	Mean parasites
0.0-4.9	12	1	2	0.2
0.5-9.9	102	58	141	1.4
10.0-14.9	284	173	467	1.6
15.0-19.9	224	157	398	1.8
20.0-24.9	8	4	8	1.0
<b>Grand Total</b>	<b>630</b>	<b>393</b>	<b>1016</b>	-

number of nematodes per host and the rate of infection with increasing length was attributed to a number of factors. Some of these included: the bigger quantity of food consumed by larger fish and the fact that they preyed on other organisms (Paperna, 1980). Some of these were probably intermediate hosts for the nematodes because the fish preyed upon bigger food item carrying the infective stages especially after the el-Niño rains. Increase in the number of parasite larva in larger fish would also be a cumulative process, occurring over a long period of time. Smaller fish had a lighter infection compared to larger ones. It appears therefore that increase in the rate of infection and worm load with increasing length of the fish is often characteristic of host-nematode.

In the present study, the intensity of infection may have varied in relation to other factors pertaining to fish behaviour. These may include changing food habits, as the fish grows larger, and breed and other physiological characteristics of various sizes of *O. niloticus*. Aderounmu *et al.*, (1972), working on cestodes from a pond at Ile-Ife, Nigeria, also noted that infection of *Anomataenia* spp of cestodes in *Hemichromis fasciatus* increased with age and size of the host. They attributed the rise in infestation, incidence and intensity to the increase in consumption of a large size of infected prey, as the predators grew older.

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