Some Aspects of the Feeding and Reproductive Biology of *Oreochromis Niloctus* L. (Pisces: Cichlidae) in Alwero Reservoir, Gambella Regional State, Ethiopia

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Abstract

Nile tilapia, Oreochromis niloticus, is economically one of the most important fish species in Ethiopia. Fish samples were caught using gillnets with 6 cm, 8 cm, 10 cm, 12 cm and 16 cm stretch mesh size. All the nets were set in the late afternoon between 4:00 5:00 pm and retrieved the next morning between 8:00 and 9:00 am. at nine occasions during the wet and dry seasons between September 2012 and March 15. Biological information such as condition factor, food habits, and length-weight relationships are useful for management of fish resources. The sex ratio showed preponderance of females over males (Chi-square 96.14; P<0.01). There was a curvilinear relationship between total length and total weight of O. niloticus in the reservoir ($Y= 0.052X^{2.76}$ and $R^2 = 0.947$). This suggests that the fishes grow isometrically. There was no significant variation in the condition of fish between sexes (P<0.05).Similarly, no significant variation was observed in the condition of fishes between the wet and dry seasons. The size at first maturity (L_{50}) of O. niloticus in Alwero Reservoir (male and female combined = 22.50 cm). In Alwero Reservoir phytoplankton species such as anabena and melosera were the major food items for O. niloticus.

Key words/phrases: Oreochromis niloticus, Alwero Reservoir, Condition factor, Length-weight relationship, L_{50}

1. Introduction

Inland fisheries deliver substantial contributions to income to hundreds of thousands of rural households in Ethiopia. Lake Tana and the Rift Valley Lakes of Ethiopia are the major sources of commercial fisheries of the country (Tesfaye and Wolff, 2014). Manmade reservoirs such as Alwero Reservoir, Gilgle Gibe I and III, Fincha, Koka and Tekeze Reservoirs, which were built either for hydropower generation or irrigation purposes also contribute significant amount of fish to the capture fisheries of the country. Alwero Reservoir was constructed mainly for irrigation purpose and there has been fishing activities using various locally made fish gears (mainly gill nets) and the harvest is either consumed locally or marketed in the nearby towns of Abobo and Gambella.

Nile tilapia*, Oreochromis niloticus,* is among the leading farmed and most commercialized fish species around the world. It ranks among the most preferred fish for local consumption and market in Ethiopia. Nile tilapia contributes about 60% of the annual commercial fishery in the country. For instance, about 90% of Lake Ziway and many of Lake Koka fish landings of capture fisheries were dominated by *O. niloticus* (Tesfaye, 2016) reported that, *O. niloticus* is the most dominant and commercially important species in the Tekeze Reservoir, and accounts for about 82.4% of the total production fish in the reservoir.

However, few studies have been made on the limnology and fishes of other reservoirs compared with the natural lakes in Ethiopia due to their inaccessibility and lack of logistics. Comparative studies on the limnology and biology of Koka and Fincha Reservoirs were conducted by Mesfin *et al.,* (1988) and the biology of fishes in Fincha reservoir (Degefu *et al*., 2011). Some biological aspects of *O. niloticus* and limnological aspects of Koka reservoir were studied by Tesfaye (2008). Teame *et al.,* (2018) studied the reproductive biology of *O. niloticus* in Tekeze Reservoir. In addition, some seasonal variation of phytoplankton in relation to variations in water quality of Legedadi Reservoir was studied by Mesfin (1983). Very recently, population dynamics of fishery target fish species and trophic structure of Koka reservoir were studied by Tesfaye (2016).

One of the most important factors to fishery management is to understand the fundamental biological aspects of fishes. Length-weight relationships provide information on the condition and growth patterns of fishes, for inter-specific and intra-population morphometric comparisons (Pauly, 1993). The length weight relationships of fish population is a basic parameter for any monitoring study of fisheries as it provides important information concerning the structure and function of populations (Anderson and Neumann, 1996). The relationship is important in fisheries and fish biology because it allows the estimation of average weight of fish from given length group by establishing mathematical relationship between them. It can also be used in setting yield equations for estimating the number of fish landed and comparing the population in space and time (Pauly, 1993).

Information of condition factor of fish is a necessary prerequisite to a demographic analysis of fish population. It exhibits variation between species and for the same species with time, sex, age and other variables (Bagenal and Tesch, 1987). For example, it has been used in comparing populations living under similar or different levels of food availability, density and climate. The information is also used in determining the time of sexual maturity, the degree of food source availability and growth pattern in fishes. In fisheries science, the condition factor is used to compare the condition, fatness or wellbeing of fish (Lecren, 1951). Condition factor is also a useful index for monitoring of feeding intensity, age and growth rates in fish. Since the condition of fishes is affected by both biotic and abiotic environmental conditions, the conditions factor can be used as an index to assess the status of the aquatic ecosystem in which fish live (Anene, 2005).

Descriptions of reproductive strategies are fundamental topics in the study of population dynamics of fish species and also for evaluation of the reproductive potential of individual fish species. This will increase our knowledge about the state of a stock and improves standard assessments of many commercially valuable fish species (Murua *et al*., 2003). Moreover, the availability of data on reproductive parameters and environmental variation leads to a better understanding of observed fluctuations in reproductive output and enhances our ability to estimate recruitment (Kraus *et al*., 2002). For example, studies on breeding season and factors associated with it are needed to protect new recruits and predict recruitment variability

Scientific knowledge on food and feeding habits of fish is an important condition for successful fisheries management program and fish culture (Fatema *et al.,* 2013). It is also used for assessment of resource partitioning within and between-species competition, prey selection, predator-prey size relationships, distribution of feeding types with latitude, ontogenetic diet shifts and habitat selection (Pauly, 2000).

Comparatively, there is well documented information on the biology of *O. niloticus* collected from major lakes of Ethiopia (Tesfaye and Tadesse, 2008). However, the reproductive and feeding biology of fishes in Gambella region particularly in Alwero Reservoir have not studied yet. Therefore, the overall objective of this study was to investigate important aspects of the biology of commercially important fish in Alwero Reservoir of the Gambella region.

2. Materials and methods

2.1 Description of the study site

The Gambell region is located in the western tip of Ethiopia between 7°37’17"N latitude and 33°-35°21"E longitude. The regional state of Gambella is divided into three administrative zones (Anywa, Nuer and Majang) and Special district (Itang).

The climate of the study area is characterized by one rainy and one dry season. The average maximum temperature of the region varies between 31.05°C in July and 40°C in March. The average daily minimum varies from 17°C in January to 22.67°C in April (Fig 2).

Alwero Reservoir (7°51'26"N 34°32'10"E) is situated 57 km south of the Gambella town and 6 km from Abobo village at an altitude of 400 m. It is shallow reservoir with a maximum depth of 7 meters and covers total area of 74 km^2. The reservoir was constructed in 1992 by damming the Alwero River mainly for irrigation purpose. Currently, the reservoir is also used for fishing, domestic water supply and livestock watering point for the local communities.

Fig. 1: Maps of (a) Ethiopia, (b) Gambella region and its major rivers, (c) Alewro Reservoir

The shores of the dam are rocky especially in the western part and covered by extensive macrophyte vegetations all along its other shore areas. These littoral regions of the dam provide favorable breeding sites, shelter and foraging sites for fish populations. The reservoir is home to different species of fishes and crocodiles probably predating on fish population in the water.

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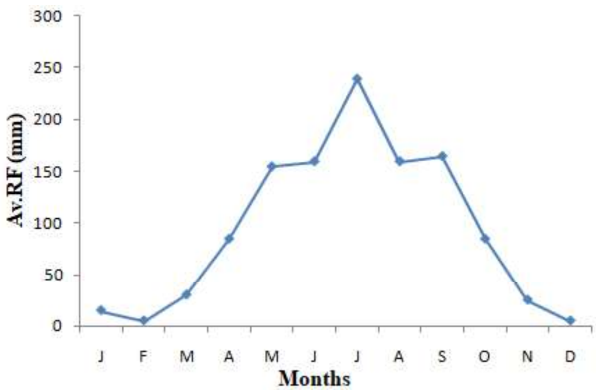

Fig 2: Average Rainfall (mm) rainfall pattern of Alwero Reservoir (Source: National Meterological Agency of Ethiopia)

Perennial open savanna grasses characterize the vegetation of the study area. There are varieties of shrubs and trees scattered uniformly in the tall grasses. The morphometric, physical, chemical and biological communities of the reservoir were not studied prior to this investigation.

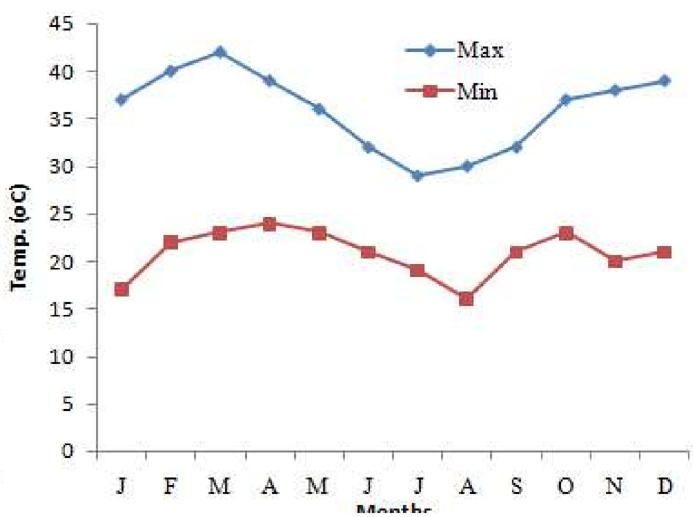

Fig 3: Mean maxima and mean minima monthly air temperature (^{o}C) of Alwero Reservoir.

2.2 Fish sampling and measurment

Fish samples were collected using gillnets (6 cm, 8 cm, 10 cm and 12 cm stretched mesh size) (Gashaw Tesfaye, 2016) set overnight during 2012-2015. On the following morning, the fishes were removed from the nets. Immediately after capture, total length (TL), total weight (TW) of each specimen were measured to the nearest 0.1cm and 0.1gm using measuring board and sensitive balance, respectively. The sex of each specimen was indentified and maturity level of some of the specimens was rated based on five point maturity level determination (Gashaw Tesfaye, 2006) as immature (I), recovering spent or developing virgin (II), ripening (III), ripe (IV) and spent (V). Each gonad was then removed and weighed to the nearest 0.1gm.

2.3. Data analysis

The length-weight relationship of *O. niloticus* was estimated by using the equation $W=aL^b$ (Bagenal and Tesch, 1978) where W= weight (g), L= total length (cm), a= intercept of the regression line and b= slope of the regression line. A logarithm transformation, ln = lna + lnbL, was used to make the relationship linear.

The well being (condition) of *O. niloticus* in Alwero Reservoir was determined using Fulton's Condition Factor (FCF) by the equation suggested by Bagenal and Tesch (1978) as follows; $FCF = TW100/TL^3$ where TW = total weight and TL = total length.

The Gonado-somatic index (GSI) of *O. niloticus* was calculated using the equation:- GSI= Gonad weight X 100/Total weight. The breeding season of *O. niloticus* in Alwero Reservoir was determined from percentages of fishes with ripe gonads collected in the wet and dry seasons during the sampling period.

The length at first maturity (L_{50}) has been defined as the length at which 50% of the total number of individuals of a length group reaches maturity (Willowughby and Tweddle, 1978). It was estimated graphically as describe in Nelson *et al*., (2009) as follows;

$P = A\ (1+e^{(-r.(Lt-L50))})^{-1}$:

Where P is the proportion or ratio of reproductive females for each size class; A is the curve asymptote; r is a rate parameter related the speed of size change from non reproductive to reproductive status; Lt is the total length (cm) and L50 is the size at first maturity (cm).

2.4. Food and feeding habit

A total of 240 gut (95 *O. niloticus*, 50 *Bagrus* sp, 50 *Citharins* and 45 *Hydrocynus forsskali*) samples were analyzed. Preserved stomach contents of fishes specimens were transferred into a petri-dish. Larger food items were identified by eye whereas small-sized food items were microscopically examined using a WILD type stereoscope (magnification 6X to 50X). In addition, smaller food items, such as phytoplankton, were examined at high magnifications (100X to 400X) under a compound inverted research microscope. Each food item was identified to the lowest taxon possible using description, illustrations and keys in the literature (Edington and Hildrew, 1981; Defaye, 1988). After identification, a list of items found in the stomach was prepared.

3. Results and discussions

3.1 Sex ratio

A total of 1019 *O. niloticus* specimen were examined from Alwero Reservoir in nine occasions between September 2004 E.C and February 2007 E.C.

Table1: The number of females, males and sex ratio of *O. niloticus* caught from Alwero Reservoir

Season	Female	Male	sex ratio (Female : Male)	X^2
Wet season	419	261	1:0.62	0.04
Dry season	249	84	1:0.34	0.24
Total	668	345	1:0.52	

Studies on sex ratio would provide information on the proportion of female to male, indicates the dominance of sex in a population and information necessary for fish reproduction and stock size (Agbugui, 2013). According to the sex ratio model of Fisher (1930), animals should produce offspring of a balanced sex ratio (1:1). Population with an imbalanced sex ratio due to unusual environmental condition can be considered as a disturbed or maladapted for the given condition (Bohlen *et al*., 2008). In many fish species, unusual ecological condition changes can cause shifts in the sex ratio (Devlin and Nagahama, 2002). Temperature is the most important cue affecting sex but density, pH and hypoxia have also been shown to influence the sex ratio of fish species (Budd *et al.,* 2015). In the present study, female specimens were more numerous (X^2, $P < 0.05$) than males (Tables 1 and 2). Similar findings were reported for *O. niloticus* from Lakes Babogaya (Abera, 2012), Hayq (Worie and Getahu, 2014) and Tekze Reseroir (Tsegaye *et al.*, 2018). However, it is in contrary to the report for Amerti Reservior in Ethiopia (Hailu, 2014).

Table 2: The number of females, males and sex ratio in sample of *O.niloticus* caught from Alwero Reservoir.

Length class (cm)	Females	Males	Sex ratio (male :Female)	X^2	P-value	
9 - 13	4	3	1:1.33	0.14	0.705	ns
13 - 17	1	4	1:0.25	1.80	0.180	ns
17 - 21	2	6	1:0.33	2.00	0.157	ns
21 - 25	10	4	1:2.50	2.57	0.109	ns
25 - 29	82	39	1:2.10	15.28	0.000	***
29 - 33	171	87	1:1.97	27.35	0.000	***
33 - 37	303	106	1:2.86	94.89	0.000	***
37 - 41	81	58	1:1.40	3.81	0.051	ns
41 - 45	11	29	1:0.38	8.10	0.004	**
>45	1	17	1:0.06	14.22	0.000	***
Total	666	353	1:1.89	96.14	0.000	***

*** (P<0.001), ** (P<0.01), * (<0.05), ns = not significant (P>0.05)

3.2 Length-weight relationship

A total of 1019 specimen of *O. niloticus* ranging in size from 9-48 cm were examined based on nine months sampling program. The mean total length (TL) and standard deviation were 32.94±4.22 for females and 33.32±6.23 for males. The length-weight relationship of *O. niloticus* in the reservoir was curvilinear (Fig 4) and best described by the regression equations; $Y= 0.052X^{2.76}$; N=1019, and $R^2 = 0.947$; N= 1019 for the sexes combined.

The regression equation result calculated separately for the two sexes was also curvilinear (Table 2) and described by the equations $Y= 0.051X^{2.78}$; $R^2 = 0.9560.956$ (males) and $Y= 0.060X^{2.72}$; R^2

= 0.91 (Females). This study showed that there was no marked difference in the length-weight relationship between the two sexes of *O. niloticus* in the Alwero Reservoir.

In fishes, the regression coefficient b = 3 describes isometric growth. The value is exactly 3 if the fishes retain the same shape and their specific gravity remains unchanged during life-time (Ricker, 1975). However, some fishes have values greater or less than 3, a condition described as positive allometric growth and negative allometric growth respectively. As it can be seen in fig. 4 *O. niloticus* in Alwero Reservoir showed a slight deviation from the theoretical isometric growth (b = 2.76), i.e the weight of these fishes increases nearly as the cube of length. This shows that the growth of the *O. niloticus* in Alwero Reservoir was nearly isometric i.e fishes grow symmetrically or the fish would not be thinner with increase in their length.

The b value obtained in this study was comparable to the b value of *O. niloticus* (b=2.74) in Lake Tana and Lake Langeno (Tadesse, 1999). However, it is not in agreement with the b value of *O. niloticus* obtained from Lake Hawassa (b =3.01) (Admassu, 1990), from Lake Ziway (b = 3.03) (Tadesse, 1988), from Lake Koka (b = 2.89) (Tesfaye and Tadesse, 2008), and from Lake Chamo (b= 2.98) (Teferi and Admassu, 2002).

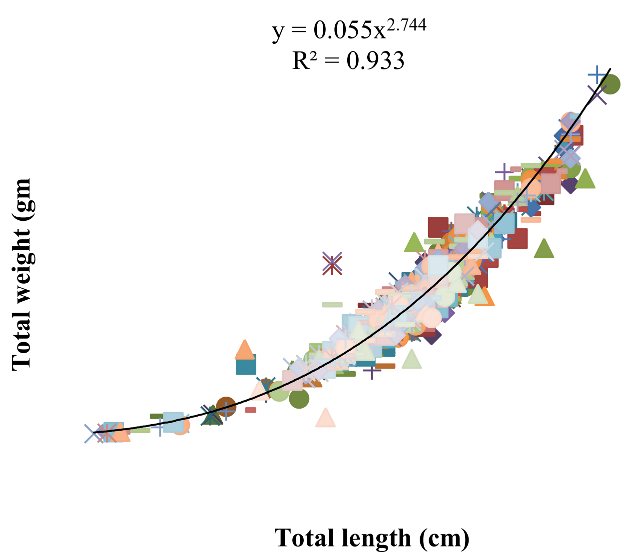

Fig 4: Length-weight relationship of *O. niloticus* in Alwero Reservoir (both sexes combined).

The b value computed for female and male *O. niloticus*was 2.72 and 2.78, respectively and there is no significant difference in the mean b values between sexes (Table 3).

Table 3: The length-weight relationship of *O. niloticus* in Alwero Reservoir

Sex	Y	R^2	No.
Male	$0.051X^{2.78}$	0.956	353
Female	$0.060X^{2.72}$	0.91	666

3.3 Fulton's Condition Factor (K)

The body condition of *O. niloticus* in Alwero Reservoir is described in tables 4 and 5. The average Fulton's Condition Factor value of *O. niloticus* in Alwero Reservoir was 2.29±0.35 for the sexes combined. The Fulton's condition factor of females was 2.28±0.33 and 2.29±0.37for males. It revealed that there is no significant variation (P>0.05) between sexes and between seasons. It was 2.24±0.32 in the wet season (May - October), 2.35±0.35 in the dry season (November - April).

Table 4: Fulton's condition factor (K) of *O. niloticus* in Alwero Reservoir in wet and dry seasons.

Season	**K**±Sd	**N**
Wet season	2.248±0.32	681
Dry season	2.35±0.35	338
Total	2. 285±0.35	1019

Seasons and environmental factors such as stresses, availability of food and food quality, feeding rate, degree of parasitism and reproductive activity are linked to the condition of fishes (Tefera, 1987). The mean K value obtained for *O. niloticus* in this study was higher than value reported for the same species from Koka Reservoir (Tesfaye and Tadesse, 2008), Lake Ziway (Tadesse, 1988), Lake Beseka (Beyene, 2005), and Fincha Reservoir (Degefu *et al*., 2012). However, the K value obtained for *O. niloticus* in this study was lower than the value obtained from Lake Chamo (Teferi and Admassu, 2002).

Table 5: Average Fulton's condition factor of *O. niloticus* from different water bodies of the country.

Water body	K	Sources
LakeZiway	1.03	Zenebe Tadesse (1988)
Lake Beseka	1.*65*	Gashaw Beyene (2005)
Lake Chamo	2.35	Yirgaw Teferi and Demeke Admassu (2002)
Lake Langano	1.67	Zenebe Tadesse (1999)
Koka Reservoir	1.87	Gashaw Tesfaye and Zenebe Tadesse (2008)
Lake Ziway	1.89	Gashaw Tesfaye and Zenebe Tadesse (2008)
Fincha Reservoir	2.29	Fassil Degefu and Fikadu Tefera (2006)
Tekeze Reservoir	1.91 (M) and 1.82 (F)	Tsegaye Teame *et al*., (2018)

The Fulton's condition Factor is based on the hypothesis that heavier fish of a particular length are in a better physiological condition (Bagenal and Tesh, 1978). It is strongly influenced by both biotic and abiotic environmental conditions. It can be used as an index to assess the status of the aquatic ecosystem in which fish live (Anene, 2005). Therefore, it appears that *O. niloticus* in the present study is in better body condition compared to the condition of same species in other fresh waters of the country (Tables 4 and 5).

In the present study, the largest fish caught was 48 cm (TL) (average 33.25±5.01) and about 2 kg total weight (average 872.99±321.01 sd gm) probably one of the largest *O.niloticus* fish ever caught from Ethiopian fresh waters. One of the probable reasons for the better body condition of *O. niloticus* in Alwero Reservoir could be related to the phytoplankton community composition in the reservoir. It has been observed that there are quite diversified phytoplankton species in the Alwero Reservoir (personal observation). The relatively high water temperature (mean ±sd28.08±1.09^{o}C) in Alwero Reservoir is conducive for the fish to digest and absorb food more efficiently than fish in other cooler waters (Tefera, 1993). Therefore, the combined effect of good food quality and quantity and better water temperature, optimum pH and other physico-chemical conditions in the Alwero reservoir is likely for better body condition of *O. niloticus*. Similarly the absence of variation in the body condition of the fish in the dry and wet season could be attributed to suitable habitat condition of the reservoir.

3.5 Length at first maturity (L_{50})

The average length at first maturity is defined as the length at which 50% of the individuals of fishes reach maturity (Willoughby and Tweddle, 1978). In the present investigation, the percentage of female and male *O.niloticus* having gonad maturity stages III, IV and IV were plotted against length (Tesfaye, 2006). The smallest mature female sampled was 20.5 cm and weighed 443gm while the smallest mature male caught was 27.5 cm weighted 603 gm. The size at first maturity of *O. niloticus*in Alwero Reservoir was 22.50 ± 1 sd TL cm for sex combine.

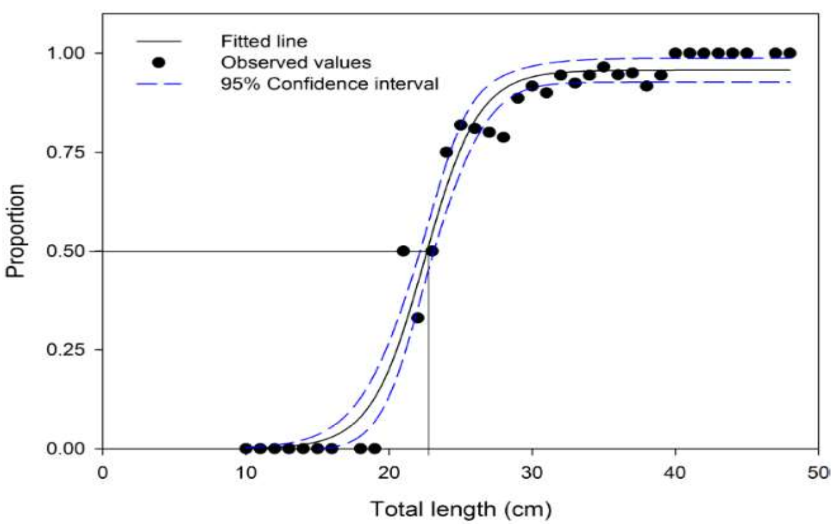

Fig.5: L_{50} of *O. niloticus* in Alwero Reservoir (n = 629).

The size at first maturity of *O. niloticus* obtained for *O.niloticus* (Fig 5) in this study was higher than those reported for the same fish species by other investigators in Lakes Ziway(18.10TL cm for females and 19.6TL cm for male) and Langano(19.50 TL cm for both sexs). But the value is lower than the value obtained from Lake Koka (23.90 TL cm for both sexs) (Tesfaye, 2006), Fincha Reservoir (Degefu, *et al*., 2011), Lake Hayq (Worie, 2014) (Table 6). According to Wooton (1998); Teferi and Admassu (2002), size at first maturity is inversely correlated to the degree of fishing mortality. They noted that L_{50} is related with the condition of the fish and the fish individuals that are in good conditions tend to breed at larger sizes than those in poor conditions. Accordingly, *O. niloticus* in Alwero Reservoir tend to breed at larger size than *O. niloticus* in some other lakes in Ethiopia.

Table 6: L_{50} of *O. niloticus* in different water bodies of Ethiopia and some other countries

Lake	Country	Male (TL, cm)	Female (TL, cm)	Reference
Alwero	Ethiopia		22. 50*	Present study
Awassa	Ethiopia	19.8	18.80	Demeke Admasu (1994)
Tana	Ethiopia	20.7	18.10	Tesfaye Wudneh (1998
Chamo	Ethiopia	42.2	42.00	Yirgaw Teferi *et al*., (2001)
Victoria	Kenya	34.5	30.80	Njiru *et al*., (2006)
Albert	Uganda	14.0	12.00	Trewaves (1983)
Koka	Ethiopia	23.1	23.90	Gashaw Tesfaye (2006)
Ziway	Ethiopia	19.4	18.10	Gashaw Tesfaye (2006)
Langano	Ethiopia	19.4	19.70	Gashaw Tesfaye (2006)

* Sexes combined

3.4 Gonado-somatic Index (GSI) and breeding season

The average GSI calculated for female *O.niloticus* in Alwero reservoir was 1.235 (n=355). It was calculated for fish ranging in length from 26cm 47cm total length. The GSI varied significantly (ANOVA, $P<0.001$) between seasons. GSI value of females ranged from 1.32±0.04 to 5.098±0.04 and those of males ranged from 0.32±0.047 to 1.32±0.047.

O. niloticus with ripe gonads were caught in all the sampling months. However, the peak activity was recorded in the dry (January - February) season. Balarin and Hatton (1978) stated that environmental factors such as water temperature and photoperiod influence gonadal development in tilapia. In tropical regions, seasonal fluctuations in temperature and photoperiod are very low;

this might be favorable for tropical fishes to spawn at any time of the year (MeConnel, 1982). In Alwero Reservoir, temperature (above 27^{o}C throughout the year) and solar radiation are probably some of the reasons why *O. niloticus* breed throughout the year. Another environmental factor that triggers spawning in tropical tilapian fishes is rainfall (Admasu, 1997). However, the rainy months were not in coincident with the peak breeding activities in the present study. Although its bi-modal breeding peaks, *O. niloticus* in Lake Small Abaya, spawn throughout the year (Asaminew *et al*., 2011). Studies conducted in some of the rift valley lakes of Ethiopia (Tadesse, 1988) indicated that *O. niloticus* spawn throughout the year. In Lake Turkana, the same species spawn through the year (Stwart 1988), and these are in agreement with the present study. However, similar studies conducted in other water bodies of the country revealed that *O. niloticus* breeding months were between December and March in Lake Ziway (Tadesse, 1889) and January and March in Lake Hawssa (Admassu, 1996).

3.7 Food and feeding habit

3.7.1 Stomach content analysis

The phytoplankton *Anabena, Melosera* and *Synedra* species are more encountered in the gut of *O. niloticus* and *Citharinus* fishes (Table 7). Detritus are also abundantly encountered in the guts of *Citharinus*sp and *O. niloticus* in this investigation. However, zooplankton food items were less frequently encountered compared to phytoplankton food items from the gut of *O. niloticus* (Table 7). On the other hand, phytoplankton species were not identified from the gut of Bagrus and Hydrocinus species in this study (Table 6). Unidentified macrophyte fragments, *Synedra*, *Melosera* and *Coelastrum* were frequently observed from the gut of *Citharinus*. In addition to these, detritus materials were observed from the gut of the fish. The guts of *Bagrussp* consists of unidentified fish scale whereas whole fish and fish scales were observed in the gut of *H. forskalli*(Table 7).

Table 7: Composition of gut content of *O. niloticus, Bagrus*sp, *Citharinus* and *H. forskalii* from Alwero Reservoir

Food items (Phytoplankton)	Fish species			
	O. niloticus	*Bagrussp*	*Citharinussp*	*Hydrocynussp*
Macrophyt fragments	+	+	+++	-
Euglena	+	-	-	-
Anabena	+++	-	-	-
Syenedra	++	-	++	-
Coelastrum	+	-	++	-
Pediastrum	+	-	++	-
Peridinium	+	-	-	-
Microcysists	+	-	-	-
Eudorina	+	-	-	-
Senedesmus	+	-	++	-
Difflugia	+	-	+	-
Cosmarium	+	-	+	-
Melosera	+++	-	+++	-
Stereptoccocus	+	-	-	-
Aphnocpsa	+	-	-	-
Navicula	+	-	++	-

+++ = Dominant ++ = Abundant + = Scarce - = No food

Diet composition of *B.docmak* in Lake Chamo consisted of insects, mollusks and different fish species such as *H. forskali, Labeohorie, O. niloticus* and small *Synodonisschall* (Anja and Mengistou 2001). Accordingly, in this study the gut of same species in Alwero Reservoir consisted of unidentified fishes that have already been partially digested. Since the gillnets were set overnight (set late in the afternoon and lifted the next morning between, 8:00-9:00), regurgitation and digestion of the food items might have taken place. This might have led to the occurrence of fragmented food items such as fish scales in the guts of *Bagrussp* and tiger fishes in the reservoir. High regurgitation rate has been observed for *B. docmak* (Corbet. 1961) in Lake Victoria.

Table 8: Composition of gut content of *O. niloticus, Bagrus*sp, *Citharinus* and *H. forskalii* from Alwero Reservoir

Food items (Zooplankton)	Fish species			
	O. niloticus	*Bagrussp*	*Citharinussp*	*Hydrocynussp*
Fish scales	-	+++	-	++
Fish skeleton	-	+	-	-
Amphipod	-	+	-	-
Zooplankton fragments	+	+	-	-
Mud	+	+	++	-
Naupuli	+	-	-	-
Brachionus	+	-	-	-
Keratella	+	-	-	-
Copepod	+	-	-	-
Whole fish	-	-	-	+++

+++ = Dominant ++ = Abundant + = Scarce - = No food

This study showed that *O. niloticus* in the reservoir feeds on varieties of plankton species. The fish ingested different groups of phytoplankton, zooplankton, macrophytes and detritus. Tadesse (1988) stated that tilapia is opportunistic which is capable of shifting from one diet to another depending on temporal and spatial variations in availability of the diet in the habitat.

Some of the food items ingested by *O. niloticus* in the Alwero Reservoir were also reported for the same fish species in other Ethiopian water bodies in Koka Resrvoir (Engdaw *et al*., 2013), in Lake Awassa and Lake Ziway respectively. This study showed that *O. niloticus* mainly feeds on phytoplankton and rarely on zooplankton (Table 6 and 7) and macrophytes. Tefera (1987) reported that most zooplanktons are consumed by adult of *O. niloticus* on regular basis. Accordingly, some species of zooplankton were indentified from the gut of the fish in the present study (Table7 and 8). Mud/sand grains were also encountered significantly in the gut of the fish in the present investigation. A study conducted by Wakjira (2013) has also shown similar result for the same species in Gilgel Gibe Reservoir.

4. Conclusions and recommendations

The length-weight relationship of *O. niloticus* in Alwero Reservoir was found to be $TW= 0.052TL^{2.76}$. The b value obtained (b=2.74) in this study is showed no significant deviation from theoretical cube value. This indicates that the fish increases nearly as the cube of length i.e., the fish grows symmetrically or the fish would not be thinner with increase in their length in the reservoir.

The condition factor calculated value (K = 2.29) of *O. niloticus* in the reservoir was relative higher than the values in Rift Valley Lakes of Ethiopia.

The food of *O. niloticus* in the Alwero Reservoir was composed of a variety of food items. The blue-green algae, zooplankton fragments and detritus were ingested by the fish. However; the blue-green algae, *Microcysts*species were the most important food item.

O. niloticus breed throughout the year in the reservoir however; January and February are peak breeding seasons.

This study presents some biological aspects of *O. niloticus* in Alwero Reservoir for the first time. Prior to this investigation, nothing has been studied about the limnological aspects and biological communities of the reservoir. In general, little is known about the reservoir. Therefore, detailed investigations and studies are required on various aspect of the reservoir.

5. References

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