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Stomach Contents of the *Clarias gariepinus* (Burchell, 1822) in Lake Geriyo, Yola, Adamawa State, Nigeria

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ABSTRACT

The study of dietary habits of fish based on stomach content analysis is a normal practice. The present study aimed to provide information on the stomach contents of *Clarias gariepinus* in the Lake. On the landing site, fish specimen were randomly sorted and identified using standard keys. In the laboratory. The dissected stomach of each specimen and its degree of fullness was estimated by an arbitrary 0 - 20 point scale: thus 0, 2.5, 5, 10, 15 and 20 points was allotted to empty, trace, quarter-full, half-full, three quarter-full and fully distended stomachs respectively. Stomach contents sorted into categories and analyzed using Relative Frequency (RF) and point's method. A total of one hundred and sixty two (162) *C. gariepinus* was examined, 50 (30.86%) had full stomach, 32 (19.75%) had one-quarter stomach full, 31 (19.14%) had empty stomachs, and 26 (16.05%) had half full stomachs while, 23 (14.20%) had three-quarter full stomachs. The composition and distribution of the stomach content of *C. gariepinus* in Lake Geriyo showed that twenty major classes were identified. The largest group was Chlorophyceae > Cyanophyceae > Branchiopoda > Bacillariophyceae > Copepoda > Zygnematophyceae > Ulvophyceae > Euglenophyta > Dinophyceae > Fragilariophyceae > Ostracoda > Bdelloidea. The Index Food of Significance (IFS) computation showed that almost all the food items were secondary diets (IFS of ≥ 0.1% to <3%) except for *Oscillatoria sp.* and *Moina branchiate* (IFS of <0.1%) which were regarded as incidental diet.

INTRODUCTION

The study of dietary habits of fish based on stomach content analysis has been widely used practice in fish ecology, which serves as an important means of investigating trophic relationships in different aquatic communities. A standard scientific planning and management of any fish species, largely depends on the information of its food and feeding habits and their biological aspects (Sarkar and Deepak, 2009). Food and feeding habits of fishes are studied because of its manifold importance in fishery biology and in fisheries management programme (Sarkar and Deepak, 2009). Fish interacts with the various levels of the food chain due to its mode of feeding, they influence the structures of lakes, streams and estuaries since they are restricted to particular modes of life related to their food sources and reproductive requirements (Ashade *et al.,* 2013).

Generally, fish serves as a good source of animal protein and it provides about 30-80% of the protein intake of the coastal people of Nigeria **(**Adewumi *et al.,* 2015**).** Furthermore**,** Olayemi *et al.* (2011**),** also pointed out that fish is rich in protein with amino acid composition which is essential for the maintenance of a healthy body, and compares very well with egg, milk and meat in the nutritional value of its protein. The quality of fish is affected by many factors such as food availability in the ecosystem, its fertilization processes **(**Hassan, 1996**),** composition of food **(**Javed, *et al.,* 1995), rate of feeding, the water quality of the aquatic environment and the method of processing and preservation. However, there seem to be no studies done on the stomach contents of this species in Lake Geriyo,

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Jimeta Adamawa State. The present study constitutes not only a database by providing preliminary information on the stomach contents of *C. gariepinus* in the Lake, but also a comparison with such species from other water bodies.

MATERIAL AND METHODS

Study Area

The lake is flooded by the river during the raining season such that it receives influx of waters which include pollution load originated from River Benue and from the urban waste dumpsite at the surrounding of the lake. It is a shallow water body of about 250 hectares in size with a mean depth of about 3 meters. Aquatic vegetation on the lake consists of mass of floating weeds such as water spinach, water hyacinth, water Lilly, and water lettuce which move around the lake surface due to the prevailing wind (Ekundayo *et al.,* 2014). The area is in the Sahel region of Northern Nigeria generally semiarid with low rainfall, low humidity, and high temperature. The area experiences two distinctive wet and dry seasons. The wet season starts from May to October, while the dry season commences from November to April, mean daily temperature fluctuates with season from 25°C to 45°C, and mean annual rainfall received is in the range of 150–1000 m. Cold and dusty weather from December to January is followed by intense heat of March to April. The climate is characterized by high evapotranspiration especially during dry season (Adebayo and Tukur, 1999). The area is characterized by dry season which span from October to March, and wet season that span from April to September (Okunlola *et al.,* 2016)

Lake Geriyo occupies natural depression near the upper Benue River in north eastern Nigeria. The water from the lake is primarily used in intensive irrigation, fishing and source of water for cattle farmer in the areas, the lake also serve as a source of water for domestic uses to the inhabitant around the lake. Lake Geriyo is expose to contamination from the refuse dumps and automobile mechanic workshops along the path of water inlet, also agro-chemicals used by farmers around the lake add to the contamination of the lake

Three sites was picked; Site A, located on latitude 09°17'31" N and longitude 12°26'06" E (Point of water entry during flooding), Site B, located on latitude 09°18'08" N and longitude 12°25'38" E (Middle point of the lake) and Site C, located on latitude 09°18'50" N and longitude 12°25'06" E (The end point of the lake).

Sampling of Fish Species

The fishers used a wide range of fishing gear such as hook and line, long line, cast nets, gill nets and traps. On the landing site, fish specimen were randomly sorted and identified using keys and descriptions by Olaosebikan and Raji, (1998) and Idodo-Umeh, (2003). Both male and female species were bought and conveyed immediately to the laboratory in plastic containers with ice-block for laboratory analysis on the same day as they were bought. In the laboratory, the Total Length (cm) of each fish was taken from the tip of the mouth to the extended tip of the caudal fin using a measuring ruler to the nearest 0.1 cm. Standard Length (cm) for each fish was taken as measurement from the tip of the mouth to the caudal peduncle to the nearest 0.1 cm. The total body weight in grams was measured for each fish species to the nearest 0.01 g using a top loading Mettler balance.

Each specimen was dissected using a pair of scissors to remove the gut, the entire stomach of the fishes were removed and graded according to fullness. The graded stomach of each specimen was dissected length wise and emptied into a petri-dish for examination and identification. Each stomach content was dispersed with small amount of distil water, sub-samples was taken from the stock and

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observed under a binocular dissecting microscope.

Stomach Content Analysis

The dissected stomach of each specimen and its degree of fullness was estimated by an arbitrary 0 - 20 point scale: thus 0, 2.5, 5, 10, 15 and 20 points was allotted to empty, trace, quarter-full, half-full, three quarter-full and fully distended stomachs respectively. Stomach contents sorted into categories and analyzed using Relative Frequency (RF) and point's method as described by Hyslop, (1980) and used by Chipps and Garvey, (2002). In the RF, the frequency of a particular food item in all stomachs was expressed as a percentage of the frequencies of all food items. For the point's scheme, each stomach was allotted 20 points regardless of the fish size and these was shared amongst the various contents, taking account of their relative proportion by volume. The points gained by each food item in all stomachs examined was computed and expressed as a percentage of the total points of all food items. The point scheme gave an indication of bulk contribution of each food category to the diet composition. % RF and % PP (Percentage of total Points) was then used to determine the Index of Food Significance (IFS) as follows:

Relative Frequency (RF) = f/n x100%. Where,

f= frequency of individual food item

n= frequency of all food items

$$IFS = \frac{\%RFX\%PP}{\sum(\%RFX\%PP)} X100$$

Food with IFS ≥3% will be regarded as primary, ≥ 0.1 to <3% as secondary, whereas food with <0.1% will be regarded as incidental. (Odo *et al.,* 2012)

RESULTS

A total of one hundred and sixty two (162) *Clarias gariepinus* were examined, based on the content of the stomachs, it was observed that 50 (30.86%) had full stomach, 32 (19.75%) had one-quarter stomach full, 31 (19.14%) had empty stomachs, and 26 (16.05%) had half full stomachs while, 23 (14.20%) had three-quarter full stomachs. The distribution in relation to season and sex showed that; during the dry season, a total of 63 (3 fish from each of the three Sites = 9 fish monthly) that comprises of 35 (55.56%) males and 28 (44.44%) females with various degrees of stomach fullness. The distribution of the stomach fullness in relation to months during the dry season showed that a total of 17 (26.98%) species of *C. gariepinus* had one-quarter full, 15 (23.81%) *C. gariepinus* had full stomach, 13 (20.63%) *C. gariepinus* had empty stomach and 10 (15.87%) *C. gariepinus* had three-quarter, while, 8 (12.70%) *C. gariepinus* had half-full stomachs. The males had 10 (15.87%) *C. gariepinus* species with full and empty stomachs each, 7 (11.11%) *C. gariepinus* species had half-full stomach, while 5 (7.94%) *C. gariepinus* species had one-quarter full stomach, and only 3 (4.76%) *C. gariepinus* species had three-quarter full stomach.

The female *C. gariepinus* species had 10 (15.87%) *C. gariepinus* species with one-quarter full stomach, 7 (11.11%) *C. gariepinus* species had three-quarter full stomach, while 5 (7.94%) *C. gariepinus* species had full stomach and 3 (4.76%) *C. gariepinus* species had half-full and empty stomach each. During the wet season, a total of 99 (3 fish from each Site = 9 fish monthly) *C. gariepinus* species was sampled, which comprises of 50 (50.50%) males and 49 (49.50%) females with various degrees of stomach fullness. The distribution of the stomach fullness in relation to months during the wet season showed that a total of 35 (23.81%) *C. gariepinus* had full stomachs, 18(23.81%) *C. gariepinus* had half-full and empty stomach each, and 15(23.81%) *C. gariepinus* had one-quarter full stomach, while 13(23.81%) had three-quarter full stomach (Table 4.49). the distribution in

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relation to sex showed that; the males had 17 (17.17%) *C. gariepinus* species with full stomach, 10 (10.10%) *C. gariepinus* species had half-full stomach, 8 (8.08%) *C. gariepinus* species had one-quarter full and empty stomachs each, while, only 7 (7.07%) *C. gariepinus* species had three-quarter full stomach. The female *C. gariepinus* species had 18 (18.18%) *C. gariepinus* species with full stomach, 10 (10.10%) *C. gariepinus* species had empty stomach, 8 (8.08%) *C. gariepinus* species had half-full stomach while, 7 (7.07%). *C. gariepinus* species had one-quarter full and 6 (6.06%) *C. gariepinus* species had three-quarter full stomach (Table 1).

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Table 1: Degree of stomach fullness by sex in dry season of *C. gariepinus* in Lake Geriyo

Sex	Full (%)	Three-quarter (%)	Half-full (%)	One-quarter full (%)	Empty (%)	Total (%)
Dry season						
Male	10 (15.87)	3 (4.76)	7 (11.11)	5 (7.94)	10 (15.87)	35 (55.56)
Female	5 (7.94)	7 (11.11)	3 (4.76)	10 (15.87)	3 (4.76)	28 (44.44)
Total	15 (23.81)	10 (15.87)	10 (15.87)	15 (23.81)	13 (20.63)	63 (100)
Wet season						
Male	17 (16.67)	7 (7.07)	10 (10.10)	8 (8.08)	8 (8.08)	50 (50.50)
Female	18 (14.20)	6 (6.06)	8 (8.08)	7 (7.07)	10 (10.10)	49 (49.50)
Total	35 (35.35)	13 (13.13)	18 (18.18)	15 (15.15)	18 (18.18)	99 (100)

The composition and distribution of the stomach content of *C. gariepinus* in Lake Geriyo showed that twenty major classes were identified. The largest group was Chlorophyceae (3), Cyanophyceae (3), Branchiopoda (3), Bacillariophyceae (2), Copepoda (2), Zygnematophyceae (1), Ulvophyceae (1), Euglenophyta (1), Dinophyceae (1), Fragilariophyceae (1), Ostracoda (1), and Bdelloidea (1).

The analysis of the stomach content of *C. gariepinus* in Lake Geriyo during the dry season showed that in Site A, *Volvox beriberi* had the highest bulk (78) with a frequency of 8.94% from 14 stomachs, these gave it the highest Point Percentage (%PP) of 7.91% The food item with the least bulk was *Moina branchiata* (16) with a frequency 1.83%, from 8 stomachs having a %PP of 1.86% The Index Food of Significance (IFS) computation showed that almost all the food items were secondary diets (IFS of ≥ 0.1% to <3%) except for *Oscillatoria sp.* and *Moina branchiate* (IFS of <0.1%) which were regarded as incidental diet. The analysis from the stomachs in Site B, showed a different trend with Site A, *Synedra cyclopum* had the highest bulk (53) with a frequency of 7.28% from 11 stomachs, these gave it the highest Point percentage (%PP) of 7.04% The food item with the least bulk was *Euglena viridis* (18) with a frequency 2.47%, from 6 stomachs having a Point percentage (%PP) of 2.53% The IFS computation showed that all the food items were secondary diets (IFS of ≥ 0.1% to <3%) with no primary or incidental diet.

The stomachs analysis in Site C, showed that, *Ulothrix zonata* had the highest bulk (65) with a frequency of 7.67% from 14 stomachs, these gave it the highest Point percentage (%PP) of 7.24% The food item with the least bulk was *Synedra cyclopum* (25) with a frequency 2.95%, from 8 stomachs having a %PP of 2.96% The IFS computation showed that all the food items were secondary diets (IFS of ≥ 0.1% to <3%) with no primary or incidental diet. The analysis of the stomach content of *C. gariepinus* in Lake Geriyo during the wet season showed that in Site A, *Clodophora vagabunda* had the highest bulk (118) with a frequency of 8.89% from 24 stomachs, these gave it the highest Point percentage (%PP) of 8.39% The food item with the least bulk was *Moina branchiata* (31) with a frequency 2.33%, from 10 stomachs having a %PP of 2.22% The IFS computation showed that almost all the food items were secondary diets (IFS of ≥ 0.1% to <3%) except for *Moina branchiate* (IFS of <0.1%) which were regarded as incidental diet.

The analysis from the stomachs in Site B, showed a different trend with Site A, *Volvox beriberi* had the highest bulk (80) with a frequency of 7.60% from 20 stomachs, these gave it the highest Point percentage (%PP) of 7.36% The food item with the least bulk was *Leptodora kindtii* (26) with a frequency 2.47%, from 11 stomachs having a %PP of

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2.96% The IFS computation showed that all the food items were secondary diets (IFS of ≥ 0.1% to <3%) except for *Synedra cyclopum* and *Leptodora kindtii* (IFS of <0.1%) which were regarded as incidental diet. The stomachs analysis in Site C, showed that, *Clodophora vagabunda* had the highest bulk (123) with a frequency of 10.79% from 19 stomachs, these gave it the highest Point percentage (%PP) of 9.53% The food item with the least bulk was *Oscillatoria sp* (27) with a frequency 2.37%, from 13 stomachs having a %PP of 2.24% The IFS computation showed that all the food items were secondary diets (IFS of ≥ 0.1% to <3%) except for *Oscillatoria sp* and *Moina branchiata* (IFS of <0.1%) which were regarded as incidental diet (Table 3).

Table 2: Index Food of Significance during Dry season in Lake Geriyo

	SITE A			SITE B			SITE C		
Content	**R.F**	**%PP**	**IFS**	**R.F**	**%PP**	**IFS**	**R.F**	**%PP**	**IFS**
Chlorophyceae									
Volvox beriberi	8.94	7.91	0.71	6.73	5.72	0.38	6.85	6.13	0.42
Ulothrix zonata	8.26	7.36	0.61	5.36	5.89	0.32	7.67	7.24	0.56
Chlorella vulgari	4.70	5.06	0.24	5.49	5.27	0.29	5.31	5.18	0.27
Zygnematophyceae									
Spirogyra fluvialitis	5.50	4.76	0.26	5.36	4.53	0.24	4.72	4.78	0.22
Ulvophyceae									
Clodophora vagabunda	4.36	4.03	0.17	5.49	4.84	0.26	6.37	6.10	0.39
Euglenophyceae									
Euglena viridis	3.78	4.14	0.16	2.47	2.53	0.06	4.25	4.73	0.20
Bacillariophyceae									
Cyclotella striata	5.62	5.91	0.33	4.94	5.22	0.26	6.96	5.99	0.42
Diatoma vulgaris	6.88	6.69	0.46	3.71	4.12	0.15	5.19	5.75	0.30
Dinophyceae									
Ceratium furca	5.39	5.92	0.32	6.73	6.72	0.45	4.96	5.77	0.28
Fragilariophyceae									
Synedra cyclopum	4.24	4.52	0.19	7.28	7.04	0.51	2.95	2.96	0.09
Cyanophyceae									
Oscillatoria sp	1.95	2.14	0.04	4.53	4.95	0.22	3.66	4.09	0.15
Microcystis aeruginosa	4.01	3.93	0.16	5.22	4.62	0.24	4.37	4.24	0.18
Nostoc sp	4.24	4.65	0.20	5.91	5.44	0.32	4.48	4.48	0.20
Ostracoda									
Cypridopsis vidua	4.82	5.33	0.26	4.39	5.39	0.24	4.72	4.53	0.21
Bdelloidea									
Rotaria sordid	4.58	4.41	0.20	4.67	4.39	0.20	4.84	4.71	0.23
Copepoda									
Cyclops bicuspidatus	5.50	5.88	0.32	3.71	3.77	0.14	5.31	5.31	0.28
Metacyclops postojnae	5.16	4.69	0.24	4.67	5.31	0.25	4.13	4.04	0.17
Branchiopoda									
Moina branchiata	1.83	1.86	0.04	4.81	4.59	0.22	3.89	4.27	0.17

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Daphnia puplex	5.73	5.28	0.30	4.53	5.02	0.23	4.60	4.44	0.20
Leptodora kindtii	4.47	5.48	0.24	3.98	4.62	0.18	4.72	5.23	0.25
	100	100		100	100		100	100	

Table 3: Index Food of Significance during Wet season in Lake Geriyo

	SITE A			SITE B			SITE C		
Content	**R.F**	**%PP**	**IFS**	**R.F**	**%PP**	**IFS**	**R.F**	**%PP**	**IFS**
Chlorophyceae									
Volvox beriberi	6.63	6.99	0.46	7.60	7.36	0.56	3.86	3.95	0.15
Ulothrix zonata	4.59	4.86	0.22	4.18	4.50	0.19	7.63	7.04	0.54
Chlorella vulgari	3.84	3.97	0.15	5.13	5.31	0.27	5.09	4.59	0.23
Zygnematophyceae									
Spirogyra fluvialitis	5.80	5.39	0.31	6.94	7.55	0.52	6.84	6.36	0.43
Ulvophyceae									
Clodophora vagabunda	8.89	8.39	0.75	5.51	5.13	0.28	10.79	9.53	1.03
Euglenophyceae									
Euglena viridis	5.35	5.21	0.28	3.52	4.20	0.15	3.07	3.84	0.12
Bacillariophyceae									
Cyclotella striata	5.57	5.70	0.32	5.32	4.49	0.24	5.79	5.65	0.33
Diatoma vulgaris	5.80	5.65	0.33	7.03	6.68	0.47	4.03	3.59	0.14
Dinophyceae									
Ceratium furca	5.88	5.58	0.33	6.56	7.01	0.46	6.14	6.52	0.40
Fragilariophyceae									
Synedra cyclopum	3.92	3.95	0.15	3.04	3.15	0.09	4.38	4.45	0.19
Cyanophyceae									
Oscillatoria sp	3.47	3.23	0.11	4.47	4.47	0.20	2.37	2.24	0.05
Microcystis aeruginosa	4.29	4.11	0.18	4.75	4.83	0.23	5.44	5.86	0.32
Nostoc sp	5.95	5.83	0.35	4.18	4.50	0.19	5.44	6.07	0.33
Ostracoda									
Cypridopsis vidua	4.22	4.52	0.19	5.99	5.69	0.34	3.86	4.08	0.16
Bdelloidea									
Rotaria sordid	3.69	3.38	0.12	7.51	6.39	0.48	3.59	3.85	0.14
Copepoda									
Cyclops bicuspidatus	5.57	6.03	0.34	4.08	3.43	0.14	5.53	5.67	0.31
Metacyclops postojnae	3.77	3.59	0.13	5.23	5.16	0.27	4.74	4.69	0.22
Branchiopoda									
Moina branchiata	2.33	2.22	0.05	3.23	3.88	0.12	2.45	2.41	0.06
Daphnia puplex	4.22	4.99	0.21	3.23	3.28	0.11	4.30	5.14	0.22
Leptodora kindtii	6.18	6.39	0.39	2.47	2.96	0.07	4.65	4.44	0.21
	100	100		100	100		100	100	

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DISCUSSION

In the present study it showed that more *C. gariepinus* had stomach content with various degree of fullness, which was higher when compared with the reports of Shinkafi *et al.* (2010), which reported 30.1 % had half full stomach, 19.4% had three-quarter full, 18.4% had empty, 17.5% had one quarter full, and 14.6% had full stomach from Catfish in River Rima, Sokoto, Nigeria and Umaru *et al.* (2014), who examined the stomach content of *C. gariepinus* from June to December, 2013 covering two seasons in Lake Alau, reported 38.29% had an empty stomach. But a much higher value was reported than the present study. Yem *et al.* (2009), who examined catfish in lake Kainji and recorded 35.83% of the stomachs were full, 5.0% were three-quater full, 22.5% were half full, 7.5% almost empty and 29.17% were empty. The relatively high percentage of full stomach suggests that food was abundant throughout the period of study. This indicates that there was high feeding intensity. This is in line with the finding of Ogbeibu and Ezeunara, (2005), who reported that if percentage of full stomach was more than that of empty stomach there is high degree of feeding intensity, which is in line with this study.

The stomach content identified in the present study was slightly different from what Umaru *et al.* (2014), who identified and reported that the stomach contents consisted mainly of animal materials, plants materials, planktons, (zooplanktons and phytoplankton) and other. The stomach content of the species in the present study showed some similarity with the findings of Shinkafi *et al.* (2010), who reported two Phytoplankton families, Chlorophyceae and Bascillariophyceae accounted for a large percentage of the food items, this could be due to the fact that plankton composition found in most freshwater are similar. But the findings in the present study differ from that of Yem *et al.* (2009), who reported that the cat fish species in Kainji lake fed on the following; fish fry, insects especially chironomid and choaborus larvae and pupae, crustacean, sand/mud, algae, vegetable matter, mollusc, detritus, nematode and other unidentified items. Sturm, (1984), did report chironomid larvae and organic debris as most important constituents in the food of this species in Tiga Lake.

Ikomi and Odum, (1998), reported that the species fed predominantly on insects, fish and aquatic macrophytes with crustaceans and algae as minor part of the diet. Umaru *et al.* (2014), reported that Animal's material, fish in particular was the dominant prey 51.75 % with a mean contribution of 32.4 % by volume and plants materials consists of leaves and offal contributed 6.2 % by volume. They recorded that other important components of the diet of the species were phytoplankton mainly blue and green algae, these food items contributed 27.44 % of the diet by volume. While zooplanktons were made up of Copepods, Cyclops and Rotifera contributed 19.16% of the diet by volume. Other food items in stomach are sand, mud and detritus, which contributed 4.1% by volume.

The variety of food items showed that the species could feed at different levels in the column of the lake. Ajayi, (1987), did reported that catfish fed both at the surface and bottom of the lake, and that the juveniles fed largely on detritus, insects larvae, crustaceans eggs, copepods and cladocerans while the adults preferred detritus, volvox, higher plants, bivalves and a variety of insect. Welcomme, (2001), reported that unspecialized feeders such as catfish eat insects, zooplankton, detritus and plant matter according to their abundance, while Strum, (1984), reported catfish as a non-selective bottom feeder, and many authors have reported that African catfish feed on a variety of food items including phytoplankton, zooplankton, insects, detritus,

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macrophytes, fish parts, gastropods and nematodes (Dadebo, 2000; 2009; Dadebo *et al*., 2014; Admasu *et al*., 2015), which is in line with the findings of this study.

The Relative Frequency showed that the variety of food substances found in the stomach of the species showed that the species is an omnivore feeding on all types of phytoplanktons and zooplanktons and crustaceans that are typical of bottom fauna. The ventral location of the mouth is also a further indication of bottom feeding, while the simple horny structures around the mouth enable the species to adopt to filter feeding at the bottom and at the same time, enable the species to gnaw at any hard plant tissue or insect parts which form part of its rich diet.

The Index Food Significance (IFS) of *C. gariepinus* from the present study provided a confirmatory reports from what Admasu *et al*. (2015), they reported that the African catfish feed on a variety of foods based on the environment in which they live. But a different finding was made by Agumassie, (2018), who reported that the foods of animal origins were the most consumed food items by the fish in the water body. Dadebo, (2000), Dadebo, (2009), and Admasu *et al*., (2015), indicated that insects, fish prey, zooplankton, detritus and macrophytes were the most consumed food items by African catfish. These differences in diet by *C. gariepinus* could be tied to the availability of food materials and the possession long, numerous and compact gill rakers to filter large amount of zooplankton such morphological adaptation important to shift from one kind of feeding habit to the other depends on the availability of food items in the lake as well as zooplankton production depends on water productivity and temperature. Dadebo *et al.* (2014), reported that, detritus, insects, zooplankton, macrophytes and fish prey were the most consumed in the diet of the fish occurred in (79.6%), (63.6%), (56.2%), (63%) and (>20%) respectively. Yem *et al.* (2009), reported that the prey importance index in Kainji Lake showed that Detritus had the highest index (51%). This indicates that it is the most relevant item in the diet of the species. This was followed by plant tissues / remains (44.88%), chironomid larvae and pupae (31.3%), fish fry (26.40%), while the least was *Spirotaenia* spp (0.05%). The reliance on volvox could be due to its abundance, preference or the species being able to feed at any level of the lake.

The availability of food dynamics throughout the year in tropics due to the seasonality of foods availability and the feeding habit of fish also changes on the seasonal bases (Ballesteros *et al.,* 2009). But from the reports of the present study, there is no much seasonal variation on the diets consumed by the species in Lake Geriyo, this is different from the findings of Yem *et al.* (2009), who reported that, Seasonal variation influences the abundance and diversity in the diet of most tropical fishes. They reported that during the rainy season in Lake Kainji *Bosmonia* spp, stone particles, S*pirotaenia* spp, *Pila* spp, *Planorbis* spp, *Limnaea* spp and *Bulinus* spp were not ingested, these was diiferent from the planktons found in the present study. The availability of such items during these seasons in their study could account for this differences. Ogbeibu and Ezenuara, (2005), did report that seasonal diversity of food items could influence food habits, diet and feeding intensity of fish. However, studies showed that the ingestion of these food items indicated the ability of the species to possess both benthic and surface habitats and accidentally ingested while the fish was searching other prey organisms. The high proportion of zooplankton during the wet season in the present study may be associated with the period of low water temperature and flooding time. Low water temperature is a prerequisite condition to the hatching of zooplankton in natural water. This is in line with the findings of Mergeay *et al.* (2006). In addition, the seasonal flooding can contribute to high zooplankton population in the water through

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bringing nutrients from the environment, and help in mixing autochthonous nutrients amongst the different strata of lake, which trigger the increasing of phytoplankton production and consequently zooplankton productivity.

CONCLUSION

C. gariepinus was found to be omnivorous in its feeding habits in the Lake Geriyo. Its food items are majorly phytoplanktons, this may be due to its abundance in the lake. Other component of food items in the stomach of the fish indicates that the species is opportunistic in its diet selection, it also showed that the species feed at different levels in the column of the lake and most of its diet recorded are secondary diet with only few incidental

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