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Diet of *Lates niloticus* (Linné, 1762) Catching in the River N'ZO in the West of Côte D'Ivoire (Central-Eastern Atlantic Zone)

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Abstract **Original Research Article**

The study aims to assess changes in biological parameters, mainly those related to the diet of the predator *Lates niloticus* (Linaeus, 1762) on the N'Zo River, which is strongly impacted by climatic variations. Sampling took place from July to October (rainy season) and March to April (dry season) 2023 at landing sites in the departments of Guiglo (Cavally region) and Duekoué (Guémon region) in Côte d'Ivoire. A total of 121 individuals (including 46 females and 75 males) with standard lengths ranging from 10.5 to 57 cm were analyzed. Analysis of stomach contents revealed that the relative food importance index (RIa) of *Lates niloticus* was composed of two prey categories: fish (73,68%) and insects (12.23%). No cannibalism was recorded. The food spectrum, restricted to 5 prey families (Cichlidae, Cyprinidae, Bagridae, Characydae and Gryllidae), was the same whatever the season. *Oreochromis niloticus* (Cichlidae) was the most consumed species (47.24%), regardless of season or sex. An analysis of variance showed that RIa was not significantly different between seasons (F= 3.23.10 -6; P= 0.999) and also between sexes (F= 1.776.10-8; P= 0.999). However, multinomial logistic regression analysis relating sex, season and stomach contents of *Lates niloticus* showed that crickets were significantly present in the diet of the piscivorous *Lates niloticus* (P = 0.0010339). The insects, Gryllidae, were indeed the most consumed (32.03) in individuals considered immature (<19cm). *Lates niloticus* therefore had a special entomophagous diet during the juvenile (immature) and young adult (19-33 cm) stages, followed by a strictly piscivorous diet in adulthood. There was a positive correlation between intestine length and standard fish length (R2= 0.64; a = 0.76). However, the intestinal coefficient (IC), which was 0.70 ± 0.20, shows that the diet of *Lates niloticus* is highly specialized. It was a fish-eater with omnivorous tendencies.

Keywords: N'Zo River, *Lates Niloticus*, Food Relative Importance Index, *Oreochromis Niloticus*, Gryllidae.

INTRODUCTION

Global warming and the deterioration of water areas as a result of farming and illegal gold mining are disrupting local fishing economies. This is particularly true of inland artisanal fisheries COMHAFAT (2014). In several countries, these sometimes uncontrolled activities have contributed to the rarefaction of the resource (Chikou, 2006; Kiossa, 2011). By undergoing these environmental and anthropogenic pressures, and competition, fish develop effective adaptive strategies against the various constraints (Vandeputte and Prunet, 2002, Paugy, 1995). Therefore, knowledge of the diet and feeding habits of fish in their natural environment is an essential step in understanding their bio-ecology and ethology (ADO, 2018). It makes it possible to assess trophic interactions between species, mortalitý by predation on commercially important stocks, or the indirect effects of stock conservation measures particularly that of predators (Brander and Bennett, 1986). It also provides information on their place and role in the ecosystem (Bradai and Bouain, 1990).

In Côte d'Ivoire, 67% of national demand for fish is met by imports (FAO, 2008). However, the continent's fish stocks are still under-valued. It is also subject to unsustainable exploitation and is therefore threatened with extinction (Sinsin and Kampermann, 2010). The case of the N'ZO River watershed (a tributary of the Sassandra River, straddling the Guémon and Cavally regions) is all the more worrying. Indeed, it is marked by a trend towards drought, which has manifested itself in a drop in water levels and a decline in the qualitý and quantitý of fisheries from the early 1970s onwards (Kouamé *et al*., 2013). Studies on the possible impact of these pressures on fishery resources are still insufficient. It therefore seemed important to carry out a study on the feeding behaviour of fishery resources, in this case predators of commercial interest.

Lates niloticus, also known as Nile perch or freshwater captain, is the only Centropomidae in the N'Zo River. It has the widest geographic range (Lauzanne, 1988) and is highly prized. Because of its remarkable growth (River of Giants, 2012), it is of ecological, commercial and food-security interest to riverside populations. Its problematic introduction into Lake Victoria has given rise to numerous studies, including those on feeding habits in various places, compiled by Moreau (1762). Another study by Lauzanne (1976) referred to seasonal variations in diet in Lake Chad. In Côte d'Ivoire, Kouassi *et al*., (2009) described the prey composition and selectivity of juvenile *Lates niloticus* in captivity. The present study investigates whether the piscivorous diet of *Lates niloticus* has been modified in the N'Zo River, which has been heavily impacted by anthropogenic behavior and climate change.

Location of Study Area

The N'Zo River (Figure 1) is a tributary of the Sassandra left bank. It lies between longitudes West, coordinates 7°15' and 8°05', and latitudes North, coordinates 7°50' and 6°50'. It has a surface area of 4,310 km² and a perimeter of 346 km². The N'Zo has a simple hydrological regime and rises in a mountainous area (between Biankouman and Man), flowing in a general north-south direction before emptying into the Sassandra. The length of its main course is estimated at 124 km (Kouamé *et al*., 2013; Bi Tié *et al*., 2006). It has a minimum in February and a maximum in September. There is a period of low flows from December to May, and a period of high flows from June to November (Andreassian, 2002). The study took place in villages along the N'Zo River, accessible by pirogue and controlled by the Aquaculture and Fishing Offices (BAP) of Guiglo and Duekoué. The landing stage visited was Gbapleu.

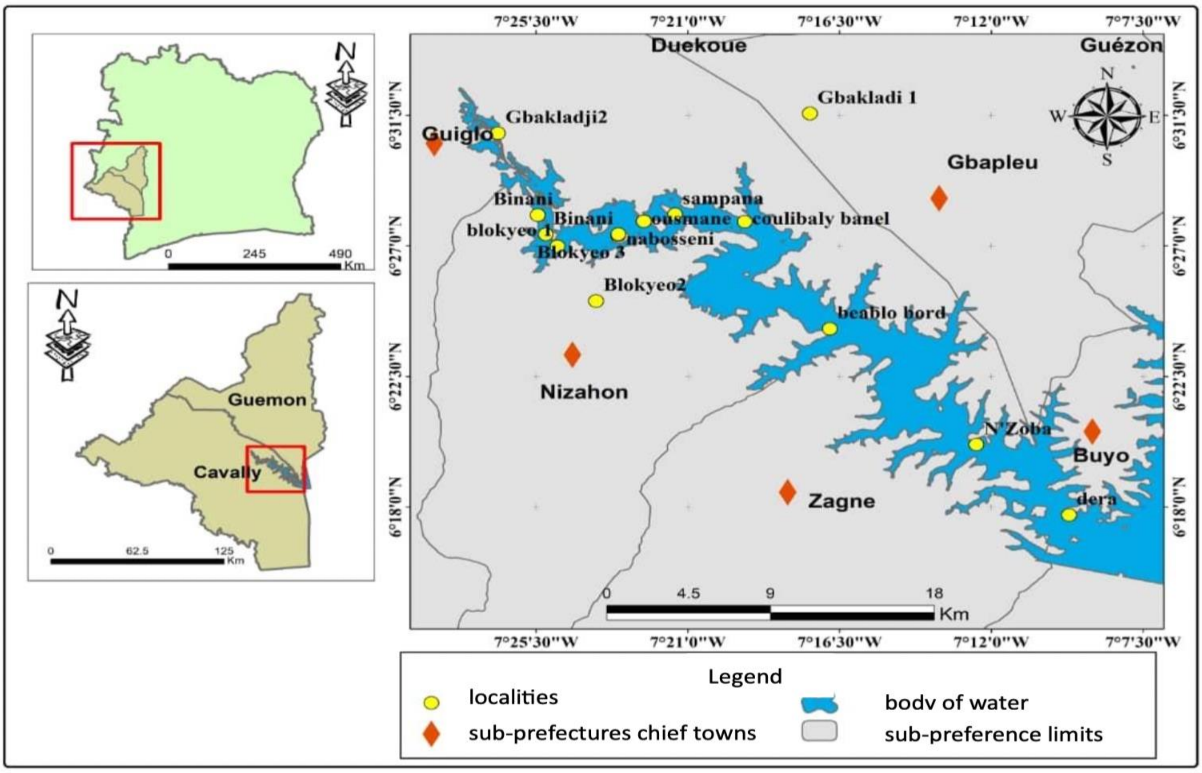

Figure 1: Location of the study area

METHODOLOGY

Data collection covered the two (2) hydroclimatic seasons. It was carried out monthly, precisely in July and October 2022 for the rainy season, and in March and April 2023 for the dry season. The *Lates niloticus* individuals harvested came from artisanal fisheries caught using various techniques. The fish were purchased from the fishermen. Morphometric parameters such as total length (Lt) (distance from the anterior end of the fish to the end of its caudal fin), standard length (Ls) (anterior end at the point where the caudal peduncle can be easily folded) and intestinal length (Li) were measured to the nearest mm using an ichthyometer. Total weight (Pt), empty weight (Pv), full stomach weight (Pep), intestine weight (Pi) were taken using a 5 kg capacity scale and an electronic 0.1 g precision scale. The sex of the fish was identified on the basis of direct observation of the gonads after opening the abdominal cavity. In addition, stomachs were collected and stored in pillboxes containing formaldehyde for transport to the laboratory. In the laboratory, the stomachs were opened and the contents diluted on a 1mm mesh sieve. The contents were then rinsed with water to remove waste before being examined with the naked eye or under a binocular magnifying glass. Observed prey were identified using the identification keys of Fischer *et al*., (1987), Gonzalez perez (1995), Illoris *et al*., (1998) and Boltovskoy (1999). Identified prey were counted, then weighed using a 0.1g precision electronic balance.

Expressions of Results

Several indices were used to describe the diet of *Lates niloticus*. These were the masculinity rate, the percentage of digestive vacuity (V), the intestinal coefficient (CI), the numerical percentage (Cn), occurrence (F), weight (Cp) of prey, the relative dietary importance index (Ria) and the intestinal coefficient. These indices will be presented according to sex season, size class and maturity size. The standard length of the specimens was used for the calculations. The mature size of *Lates niloticus* identified by Roest (1974) at 19 cm standard length (on Lake Kossou) will be used to classify individuals into immature (< 19 cm) and mature (> 19 cm) groups.

❖ **Determining size classes by Sturge's rule**

Size classes were obtained using the sturge rule (Scherrer, 1984) based on the following formula:

$\mathbf{N_c} = 1 + (3{,}3 \log(n))$

$\mathbf{N_c}$: Number of classes; n : represents the total number of specimens examined

with $Ic = \frac{Vmax - Vmin}{Nc}$

$\mathbf{I_c}$: Class interval; Vmax : Maximum size et Vmin : Minimum size.

❖ **The Masculinity Rate (Tm)**

This is the percentage of males in the sampled population. It is determined after microscopic observation of the gonads of individuals in a given population. In this study, it will be presented:

$$Tm = \frac{\mathbf{M}}{\mathbf{F + M}}\ X\ 100$$

With: M = number of males; F = number of females;

Coefficient or Percentage of digestive vacuity (V)

The coefficient or percentage of digestive vacuity (V) expresses the proportion of empty stomachs among all the stomachs analyzed (Derbal and kara, 2007). This coefficient makes it possible to identify periods of low and intense feeding activity of the fish studied over time. Il a été calculé à l'aide de la formule suivante:

$$\mathbf{V} = \frac{\mathbf{Ev}}{\mathbf{N}} \times \mathbf{100}$$

V: Coefficient or vacuity percentage**; Ev:** number of empty stomachs; **N**: total number of stomachs examined.

❖ **Frequency or Percentage of occurrence (F)**

This provides data on the food preferences of different fish. It is the ratio of the number of stomachs in which the item is present (Si) to the total number of full stomachs examined (St). It is expressed as follows **(Djakou and Thanon, 1988)**:

$$\mathbf{F} = \frac{\mathbf{Si}}{\mathbf{St}} \times \mathbf{100}$$

F: Percentage of occurrence; **Si**: Number of stomachs in which the item is present and **St** : Total number of full stomachs examined

❖ **Frequency or Percentage of occurrence (Cn)**

The numerical percentage (Cn) measures the numerical importance of different prey species. It is the ratio between the total number of individuals of a given prey (Ni) and the total number of the various prey inventoried (Nt), expressed as a percentage (Hyslop, 1980). It is expressed as follows (Lauzanne, 1977) :

$$\mathbf{C_n} = \frac{\mathbf{Ni}}{\mathbf{Nt}} \times \mathbf{100}$$

Cn: Numerical percentage of prey; **Ni**: Total number of individuals of a given prey and **Nt**: Total number of various prey inventoried.

❖ **Weight Percentage (Cp)**

This percentage gives no indication of food preferences. It is the ratio between the total weight of a given prey (Pi) and the total weight of the various prey ingested (Pt), expressed as a percentage (Lauzanne, 1977). This percentage is expressed as follows:

$$\mathbf{C_p} = \frac{\mathbf{Pi}}{\mathbf{Pt}} \times \mathbf{100}$$

Cp: Weight percentage; **Pi**: Total weight of a specific prey item and **Pt** : Total weight of various prey ingested.

❖ **Relative Importance of Food (RIa)**

The index of relative importance of the Food (Ria) allows a much more realistic interpretation of the diet by minimizing the biases caused by each of these percentages. The Ria is written as follows:

$$\mathbf{Ria} = \frac{\mathbf{AIa}}{\sum \mathbf{AIa}} \times \mathbf{100}\ \textbf{(George et Hadley, 1979)}$$

Ria = Index of relative importance of food; Ala = % frequency of occurrence of item "a" + prey numerical % + prey weight %; ∑Ala = the sum of Ala. Unidentified prey were not considered in this study.

❖ Intestinal Coefficient

There is a certain correlation between food type and the relative length of the intestine in relation to body length (Fryer et. Iles, 1972). According to Paugy (1994), limnivores and phytophages have longer intestines, but there is no significant difference between the other categories (invertivores, zooplanktonophages, ichthyophages, omnivores), even though omnivores generally have a slightly longer tract. The intestinal coefficient (IC) defined as the ratio of intestinal length to standard fish length was calculated for each specimen according to the following formula:

$$CI = \frac{LI\ (mm)}{Ls\ (mm)}$$ **(Paugy, 1994)**

The average value obtained will be compared with that found by Paugy (1994) in Lake Tanganika for cichlids: Carnivore $0 < CI < 1.6$; herbivore $1.6 > CI < 7.9$; omnivore $0.8 < CI < 3$.

❖ Statistical Processing:

Une analysis of variance ANOVA was used to compare possible variations in the diet of *Lates niloticus* according to sex, size and season using STATISTICA version 10.0 and Past version 1.0 software.

Multinomial regression was also used to examine the simultaneous impact of season and sex on the stomach contents of *Lates niloticus*. This regression method can handle more than three categories of qualitative variables by comparing each category to a reference category. We selected the "Empty_stomach" category as the reference for our analysis. The model was specified in R 4.2.0 as follows:

Stomach contents = Rain season + Dry season + Female + Male (1)

RESULTS

A total of 121 specimens were sampled during the wet and dry seasons. The standard length (SL) of the individuals ranged from 10.50 cm to 57 cm in both seasons. Sturge's rule was used to categorise individuals into seven (7) size classes, namely 10-16 cm (C1), 17-23cm (C2), 24-30cm (C3), 31-37cm (C4), 38-44cm (C5), 45-51cm (C6) and 52-57cm (C7). The length of the intestine (LI) varied between 3 and 48.4cm. The ANOVA test for standard length and intestine length showed significant effects according to season, size class and sex (Table 1).

Table 1: Analyses of variance of study parameters according to sex and season; P<0.05 is significant.

Variables	Season		Sexe		Size classes	
	F	**P**	**F**	**P**	**F**	**P**
LS (cm)	4.373	0.0386	17.789	0.000048	328.748	0.000000
LI (cm)	6.436	0.0125	14.608	0.000212	29.745	0.000000

Thus, Tukey's HSD test showed that the average size of individuals during the rainy season was significantly greater than that of individuals during the dry season. The opposite significant effect was observed for mean intestinal length. Females were significantly larger than males. Their intestines were also significantly larger than those of males (Table 2).

Table 2: Average standard lengths (LS) and intestinal lengths (LI) of individuals

Average	Rainy season	Dry season	Female	Male
Numbers	**27**	**94**	**46**	**75**
LS (Cm)	23,055b ± 10,73	26,77a ± 7,234	29,724a ± 0,90	23,62b ± 6,92
LI (Cm)	14,9b1 ± 8,87	19,63a ± 8,42	22,24b ± 9,74	16,32a ± 7,21

The average standard lengths and intestinal lengths by size class are shown in Table 3.

Table 3: Average standard lengths and intestinal lengths of individuals in the size classes

Size classes	Numbers	Average LS (cm)	Average LI (cm)
C1	7	14,767 ± 1,644	7,79 ± 2,50
C2	40	19,892 ± 1,768	13,845 ± 4,583
C3	12	27,010 ± 1,972	20,221 ± 5,594
C4	39	33,526 ± 2,245	22,779 ± 7,396
C5	19	39,506 ± 2,33	32,714 ± 9,018
C6	1	47,16 ± 3,4037	37,300 ± 0,888
C7	3	57 ± 0,000	38 ± 0,0000

Sex Ratio

The overall sex ratio of *Lates niloticus* was in favour of males (Figure 2). There was no significant difference (F = 0.32; P = 0.57) in the sex ratio over the seasons (Figure 3). Males were dominant in the extreme size classes, i.e. between 17-30 cm and over 52 cm. Females were dominant in the intermediate size classes up to 52 cm (Figure 4). These sex dominances in the different size classes were not significant (F= 0.318; P= 0.573).

Vacuity Percentage

The overall vacuity percentage was 35.54%. The vacuity percentage was significantly higher in the rainy season for females (F=15.168; P=0.00163). During the dry season, it was significantly higher for males (F= 16.331; P= 0.000095). The vacuity percentage tended to fall as size increased for both sexes in the rainy season (Figure 5 a et b). In the dry season, it shows a downward trend for both sexes. The consumption rate is different for males from one season to the next, while it is more or less the same for females (Figure 6).

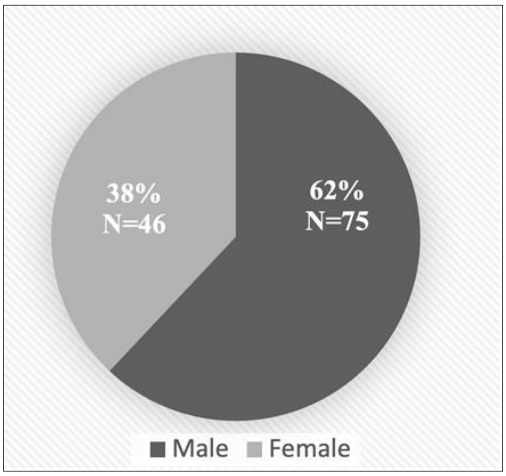

Figure 2: Sex ratio of *Lates niloticus* in all seasons. M=Male; F=Female

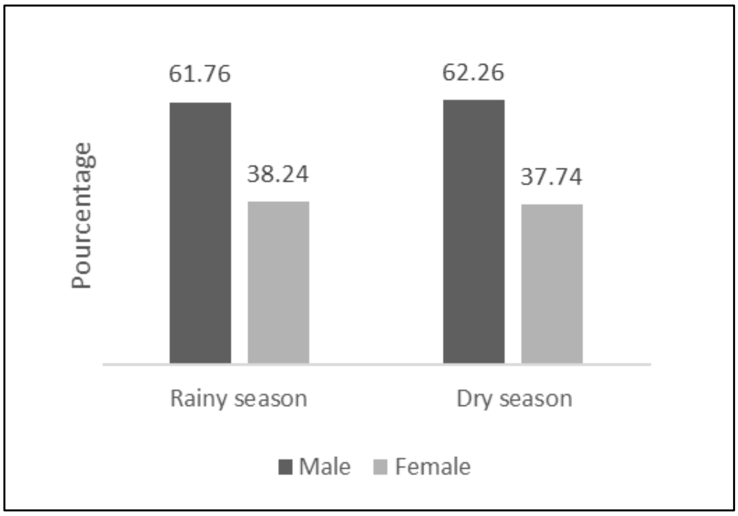

Figure 3: Sex ratio of *Lates niloticus* during the seasons. Rainy season: M=42; F=26. Dry season: M=33; F=20

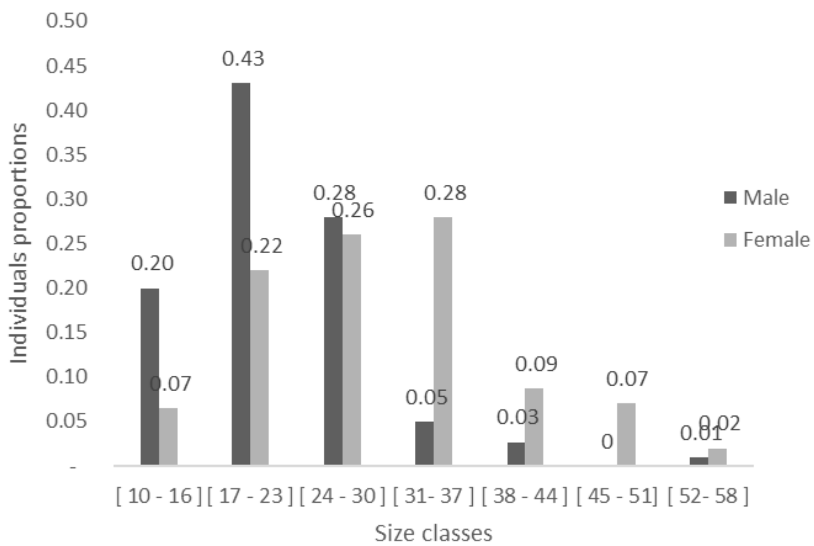

Figure 4: Histogram of masculinity rate according to size classes

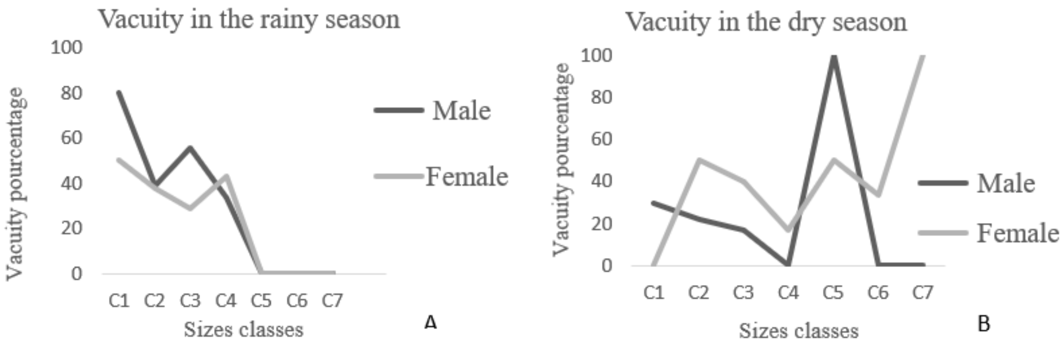

Figure 5: Percentage of male and female vacuity by size classes

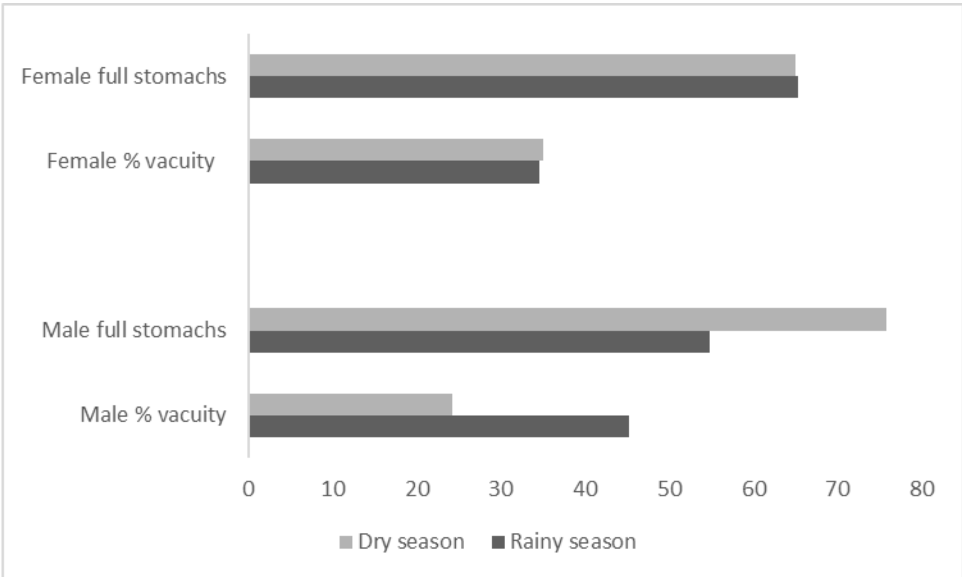

Figure 6: Percentage of empty and full stomachs by sex and season

Relative Importance of Food Items (Ria) in *Lates Niloticus*

There was no cannibalism observed in the diet of *Lates niloticus*. The relative importance of food items (Table 4) revealed a diet based on animal prey presenting two (2) categories of prey which are fish and insects. The insect category is the least represented (12,13%). The items identified (Table 4) in these two prey categories represent five (5) species belonging to five (5) families. These were the Cichlidae, Bagridae, Characidae, Cyprinidae and an insect family (Gryllidae). Among fish, the Cichlidae family was the most consumed (47.24%), while the Characidae family was the least consumed (6.09%).

Table 4: Relative importance of food items (Ria) in *Lates niloticus*

Items	Cn %	Cp %	F	Ria	total categories of prey
Cichlidae					73.68
Oreochromis niloticus	46.94	77.16	46.94	47.24	
Bagridae				12.23	
Chrysichthys sp	12.24	10.77	12.24		
Characidae					
Brycinus sp	6.12	3.26	6.12	6.09	
Cyprinidae					
Barbus sp	8.16	4.08	8.16	8.12	
Gryllidae					12.13
Gryllus sp	12.24	0.49	12.24	12.13	
Undetermined	14.3	4.24	14.3	14.19	14.19

Cn: Numerical percentage, Cp: Percentage by weight, F: Percentage of occurrence and Ria: Relative dietary importance.

Relative Importance of Food Items (Ria) in *Lates Niloticus* Over the Seasons

Identical species were consumed in both seasons. Cichlidae were the most dominant in the diet whatever the season. In contrast, Characidae were the least consumed. Gryllidae consumption was higher in the dry season than in the rainy season (Table 5). However, there was no significant difference between rainy and dry season diets (F= 3.23. 10-6; P= 0.999).

Table 5: Relative importance of food items (Ria) in *Lates niloticus* over the seasons.

Season	Rainy				Dry			
Prey	**Cn %**	**Cp %**	**F**	**Ria**	**Cn %**	**Cp %**	**F**	**Ria**
Cichlidae								
Oreochromis niloticus	50	83.61	12.82	51.23	44.83	72.9	16.67	45.54
Bagridae								
Chrysichthys sp	15	7.38	3.85	14.74	10.34	13.01	3.85	10.42
Characidae								
Brycinus sp	10	6.56	2.56	9.86	3.45	1.08	1.28	3.38
Gryllidae								
Gryllus sp	10	0	2.56	9.63	13.79	0.81	5.13	13.46
Cyprinidae								
Barbus sp	5	0.82	1.28	4.84	10.34	6.23	3.85	10.25
Undetermined	10	1.63	76.93	9.7	17.25	5.97	69.22	16.95

Cn: Numerical percentage, Cp: Percentage by weight, F: Percentage of occurrence and Ria (Relative dietary importance

Relative Importance of Food Items (Ria) in *Lates Niloticus* by Sex

Males and females eat the same species. The species eaten most by both sexes is *Oreochromis niloticus*. *Brycinus sp* is the species eaten least by males and *Barbus sp* by females. Males consumed twice as much *Gryllus sp* as females (Table 6). However, there was no significant difference between the diets of females and males (F= 1.776. 10-6 ; P= 0, 999).

Tableau 6: *Relative importance of food items* (Ria) of *Lates niloticus* by sex

	Sexes							
	Males				**Females**			
Prey	**Cn %**	**Cp %**	**F**	**Ria**	**Cn %**	**Cp %**	**F**	**Ria**
Cichlidae								
Oreochromis niloticus	20.41	25.61	12.82	**45.09**	26.53	51.55	16.67	**71.62**
Bagridae								
Chrysichthys sp	08.16	06.53	05.13	**15.19**	04.08	04.24	02.56	**08.22**
Characidae								
Brycinus sp	02.04	01.96	01.28	**04.05**	04.08	01.31	02.56	**06.01**
Cyprinidae								
Barbus sp	06.12	02.77	03.85	**09.76**	02.04	01.31	01.28	**03.5**
Gryllidae								
Gryllus sp	08.16	0.33	05.13	**10.44**	04.08	0.16	02.56	**05.14**
Undetermined	55.11	62.8	71.79	**15.47**	59.19	41.43	74.37	**5.51**

Cn: Numerical percentage, Cp: Percentage by weight, F: Percentage of occurrence and Ria: Relative dietary importance.

Relative Importance of Food Items (Ria) in *Lates Niloticus* as a Function of Size Class

Gryllus is heavily consumed between 10 and 17 cm. The consumption of Gryllus tends to disappear as size increases. Bagridae consumption increases with size. *Oreochromis niloticus* is eaten in all size classes, with a consumption peak between 34 and 41 cm (Table 7).

Table 7: Relative importance of food items (Ria) in *Lates niloticus* by size class

Size class	(10 -17)				(18 -25)				(26 -33)				(34 -41)				(42 -49)			
Prey	**Cn%**	**Cp%**	**F**	**Ria**	**Cn%**	**Cp%**	**F**	**Ria**	**Cn%**	**Cp%**	**F**	**Ria**	**Cn%**	**Cp%**	**F**	**Ria**	**Cn%**	**Cp%**	**F**	**Ria**
Cichlidae *Oreochromis niloticus*	02.04	0.33	01.28	**21.4**	08.16	11.26	05.13	**34.29**	24.49	39.48	15.38	**73.64**	10.24	23.49	06.41	**81.26**	02.04	02.61	01.28	**35.96**
Bagridae *Chrysichthys* sp	00	00	00	**00**	02.04	0.33	01.28	**05.1**	04.08	05.22	02.56	**11.01**	04.08	02.61	02.56	**18.74**	02.04	02.61	01.28	**35.96**
Characidae *Brycinus* sp	00	01.28	00	**00**	04.08	02.61	02.56	**12.92**	02.04	0.65	01.28	**03.68**	00	00	00	**00**	00	00	00	**00**
Cyprinidae *Barbus* sp	02.04	0.16	01.28	**20.4**	02.04	0.33	01.28	**05.1**	02.04	02.28	01.28	**05.2**	00	00	00	**00**	02.04	01.31	01.28	**28.08**
Gryllidae *Gryllus* sp	01.27	02.45	02.56	**36.81**	04.08	00	02.56	**09.28**	04.08	0.33	02.56	**06.47**	00	00	00	**00**	00	00	00	**00**
Undetermined	94.65	95.78	94.88	**21.39**	79.6	85.5	87.19	**33.31**	63.27	52.0	76.94	**0**	85.68	73.9	91.03	**0**	93.88	93.47	96.16	**0**

Cn: Numerical percentage, Cp: Percentage by weight, F: Percentage of occurrence and Ria: Relative importance of food.

Multinomial Regression

Multinomial logistic regression analysis relating sex, season and stomach contents of *Lates niloticus* showed that crickets were significantly present in the diet of the piscivorous *Lates niloticus* (Table 8).

Table 8: Multinomial logistic regression to investigate the relationship between the sex and season of *Lates niloticus* and their stomach contents.

Modalities	Variables	Odds ratio	2.5 %	97.5 %	p-value	
Insecte	(Intercept)	3.7146e-01	2.0559e-01	6.7120e-01	0.0010339	**
	Rain season	5.4469e-01	1.4120e-01	2.1012e+00	0.3777725	
	Dry season	6.8197e-01	2.5622e-01	1.8151e+00	0.4434645	
	Female	5.8640e-01	2.0989e-01	1.6383e+00	0.3085679	
	Male	6.3346e-01	2.6306e-01	1.5254e+00	0.3085736	

Signif. codes : 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' '

The Intestinal Coefficient

There was a positive correlation (R2= 0.64; a = 0.76) between the length of the intestine of *lates niloticus* and its standard length (Figure 7). The mean intestinal coefficient was 0.70 ± 0.20. It ranged from 0.21 < 0.70 < 1.29. This value corresponds to a strictly carnivorous or omnivorous diet. However, gryllidae were found in the diet of *Lates niloticus*. Thus, for this study, *Lates niloticus* was a fish-eater with a tendency to be omnivorous.

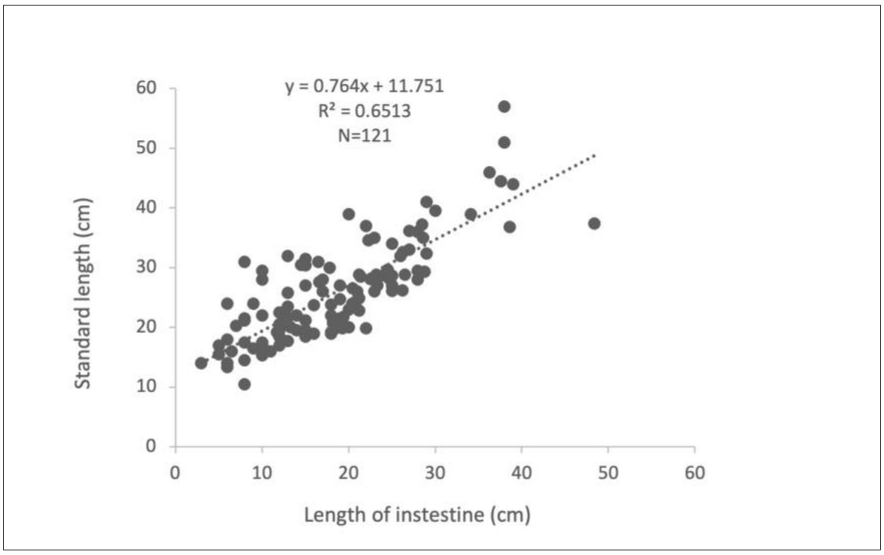

Figure 7: Correlation between standard length and intestinal length

DISCUSSION

The study of the diet of *Lates niloticus* showed that females were significantly larger than males. This result is in agreement with the study by Roest (1974) and Okedi (1970) carried out on Lake Kossou in Côte D'Ivoire. Daget (1964), in the Niger River and Hopson (1972), in Chad, had made the same observation. This observation could be an adaptation to unfavourable environmental conditions, with a view to the females becoming more fecund than the males. In fact, in some gonochoric fish, size has a favourable effect on the fecundity of females more than that of males (Baroiller, 1998).

The average standard length in the rainy season was greater than in the dry season. The same observation was made in the Lake Chad basin by Hopson, 1972. He explained this by the fact that during the low-water period, the adults moved and sought the shallows to get through the low-water period, so that the average length of the fish caught fell constantly. This result can also be justified by the fact that seasons of low temperature are seasons of greater growth for individuals (Baroiller, 1998). This thermosensitivity did not influence the sex ratio of *Lates niloticus* since the rate of masculinity was not significantly different during the seasons. Hopson (1992), who worked on the species in Lake Victoria, made the same observation. This phenomenon can be explained by the fact that there is no seasonality in reproduction (Molinari & Soriano, 2014), social organisation or dispersal of this population (Senior *et al*., 2005; Raghuram *et al*., 2006; Godlevska & Gol'din, 2014).

Emptiness was significantly higher during the rainy season. This result would mean that fish, being poikilothermic, would accelerate their metabolism when water temperatures fall (ELIOTTE, 1975). This activity could be amplified by flooding and a reduction in trophic potential. On the other hand, the low rate of emptying observed during the dry season is explained by the increase in the speed of gastric transit following the rise in water temperature and low water levels. It thus increases the intensitý of fish predation (Koné *et al*., 2007). Also, the length of intestines was significantly smaller in the rainy season than in the dry season. The length of fish intestines according to Sturmbauer *et al*., 1992, is a function of the diet and the digestibility capacity of the prey. Thus, this result would indicate that *Lates niloticus* in the N'Zo River digested more rapidly in the rainy season than in the dry season. The decrease in the number of empty stomachs as size increased would indicate that adult *Lates niloticus* are more agile than juveniles, whatever the season.

No cannibalism has been observed in *Lates niloticus*. Loiselle (1972) in his study on Lake Volta reported canibalism in *Lates niloticus*. This alternative strategy is not used in *Lates niloticus* in the N'Zo River certainly because it possesses the sensory capacities necessary to avoid the attack of its congeners or presents morphological limitations which do not allow it to carry out the act of predation on its species (Baras, 1998).

Its intestine was relatively short and positively correlated with its standard length. According to Paugy (1994), the short intestine corresponds to a guild of fish whose intestine is less than three times longer than the standard length of the fish. Lagler *et al*., (1962) state that the intestine is short in carnivorous species and longer in herbivores because animal prey is digested more quickly than plant prey. This study showed that *Lates niloticus* was indeed a carnivore. However, its diet included insects, albeit to a lesser extent. Our results are not consistent with those of Bishai (1975) in the Jebel in Sudan and Lauzanne (1974) from Lake Chad who found that *Lates niloticus* consumed crustaceans in addition to fish and insects. It was therefore a carnivore rather than a strict fish-eater (Paugy, 1994). This finding highlights the opportunistic nature of the species studied. It could therefore be a fish-eater with omnivorous tendencies.

Insects were more present only in the stomachs of young individuals. The work of Hashem and Hussein (1973) agrees with our results which show that neither insects nor crustaceans were found in the stomachs of fish longer than 31 cm. The study carried out by Loiselle (1972) on Lake Volta shows, on the contrary, that young Lates niloticus were strictly piscivorous. This dietary preference for insects in juveniles could be transient before acquiring their definitive diet mainly composed of fish at adult size.

Insect consumption higher in the dry season than in the rainy season. These gryllids are very prolific terrestrial nocturnal insects. If in the dry season they are consumed in abundance, this could be due to the spreading of insecticides on the banks (Vidy, 1976). Despite these observations, there were no significant differences in diet across seasons and between sexes. This result could reflect a relative stability in the availability of prey in the sampled environment (Tidiani *et al*., 2007).

In this study, the prey consumed was effectively identical regardless of the season. This probable stability may also reflect the decline in trophic spectra of biomass and catches which were recorded by Gascuel (2002) and Diallo *et al*., (2002) throughout the Gulf of Guinea.

The analysis of the dietary indices of the prey families made it possible to note that in the Cichlidae family, *Oreochromis niloticus* was the preferential prey. This result is in agreement with that of Hamblyn (1966) but in disagreement with the studies of Petr (1967) and Latif and Khallaf (1974) where in their study the preferential prey were Clupeidae and *Hydrocynus forskalii* respectively. This preference for cichlids could be linked to their availability in the environment (Gabriela *et al*., 2003).

The sex-specific diet showed that both sexes feed primarily on the Cichlidae family. This could be explained by the fact that males and females feed in the same areas, concentrating the same food resources (Gabriela *et al*., 2003).

The diets of male and female specimens as well as the different maturity sizes, season and size class of

Lates niloticus did not differ. This could be explained by the fact that different seasons, sexes, and size classes feed in the same areas, concentrating the same food resources (Gabriela *et al*., 2003).

CONCLUSION

The diet of *Lates niloticus* in the River N'Zo did not reveal any cannibalism by the species. The range of prey identified in its diet was limited. It is a fish-eater with omnivorous tendencies, mainly during the juvenile stage.

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