Comparative Assessment of Proximate Composition of Silver Catfish (*Chrysichthys nigrodigitatus*) and Nile Tilapia (*Oreochromis niloticus*) from Okrika Fish Landing Site, Bonny River, Port Harcourt

Otene, B.B[1], Gossoka, P.M and Ukwe, I.O.K
[1]Department of Fisheries and Aquatic Environment, Rivers State University, Port Harcourt
Corresponding Author: benjaminotene56@yahoo.com

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Abstract
Comparative assessment of the proximate composition of the silver catfish (Chrysichtys nigrodigitatus) and Nile tilapia (Oreochromis niloticus) was carried out. Fish samples were purchased from the Okrika fish landing site of Bonny river, Port Harcourt through the help of the fish mongers within three months, identified with the aid of keys and preserved in domestic deep freezers for further analysis. Samples were prepared and analysed for proximate composition using standard methods of APHA. The result showed that the moisture, crude protein and carbohydrate contents of C. nigrodigitatus ranged from 61.32-65.25%, 16.10-18.09% and 10.24-11.30% with the mean values of 63.61±2.037%, 17.52±1.06% and 10.65±0.07% while that of O. niloticus ranged from 74.06-76.16%,12.15-2.44% and 5.96 - 6.55% with the mean values of 75.19±1.05%,12.94±0.72% and 6.17±0.32%. The moisture content of O. niloticus was significantly higher than that of C. nigrodigitatus but the crude protein and carbohydrate contents of C. nigrodigitatus were significantly higher than that of the O. niloticus at probability level of P<0.05. The proximate composition of the two fish species varied across the months with the highest values of moisture, fat, crude fibre and carbohydrates in both species observed in the Month of June. The results showed that the two species of fish studied have good supply of fish nutrients and should be consumed by people.

Keywords: *Proximate composition, Chrysichthys nigrodigitatus, Oreochromis niloticus, Bonny River*

Introduction

Globally, people are becoming enlightened and conscious of fish quality and its implications on human health (Olopade *et al*.,2015). Fish is easy to digest, low in calories, high in protein and good source of fats and other elements for health and also providing high quality minerals and nutrients for maintenance and growth of human body (Dong,2011).The proximate composition provides essential information on the percentage of essential food constituents such as protein, carbohydrates, lipids, minerals and water. Proximate composition has been used as an indicator of fish quality since it determines the nutrient values and content which varied with fish species. Akande (2011) opined that fish fat contains high level of polyunsaturated fatty acids (PUFA)

proven to lower the occurrence and complication of arteriosclerosis and other heart related diseases.

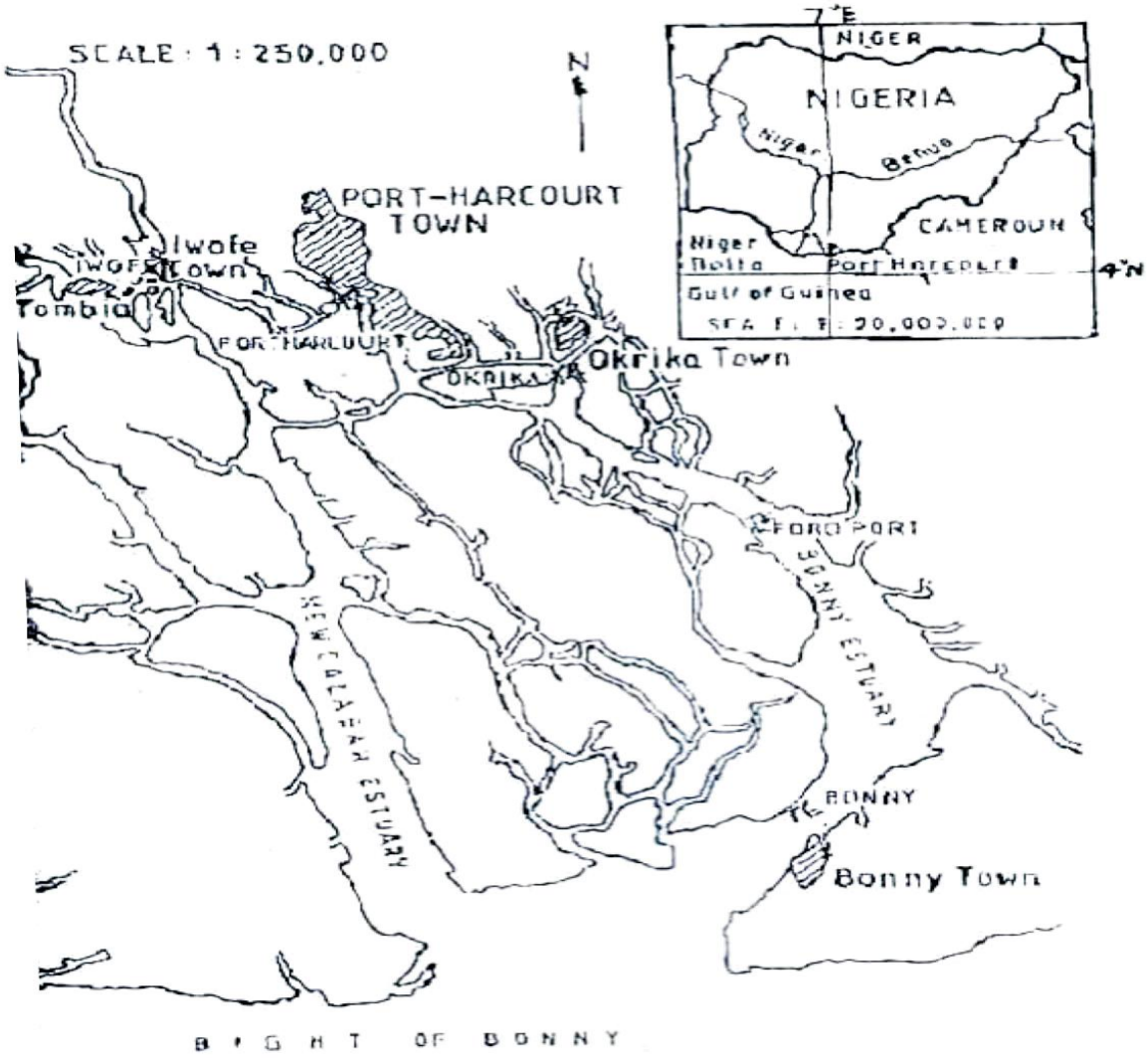
Olopade *et al*.,(2016) reported that proximate composition comprises the estimation of moisture, protein, fat and ash contents of a fresh fish body. The composition of a particular species usually varies from a fishing ground to another, season to season and age but that the basic causes of change in composition are variation in quantity and quality of food consumed and the amount of movement made by the fish. Edun (2012) disclosed that fish processing processes alters its composition and general characteristics depending on the used method. According to Samuel and Chamul (2000) nutritional composition of fishes and their products change from time to time with respect to age, sex, species, food intake, sexual changes, season and environment.

Silver catfish (*C. nigrodigitatus*) of the family Clarotidae and Nile Tilapia (*O. niloticus*) of the family Cichlidae are both highly valued tropical food fish for human consumption among the commercial catches exploited in most rivers in Nigeria and in Rivers State. It has been noticed that a great percentage of research carried out on these two species were basically based on either species composition or heavy metal bioaccumulation. It is on this backdrop that this research is centered on the proximate composition of the said species in Bonny river fish landing site.

Materials and Methods

Study Area

This research was carried out at the Okrika fish landing site, Bonny river, Port Harcourt usually an intertidal wetland lying on the north bank of the Bonny River which is upstream from the Bight of Benin in the Eastern Niger Delta area of Nigeria with rivers and winding creeks intersecting it. It has series of stretches of marshy land having mangrove trees with thick forests of tangled roots. Sampling location and description is as in figure 1 below.



Fish Sampling and Preparation

A total of one hundred and twenty (120) *C. nigrodigitatus and O. niloticus* (60each) were purchased from Okrika fish landing site of Bonny river, Port Harcourt through the help of the fish mongers within three months. Collected samples were identified with the aid of keys (Powel,1982) and preserved in deep freezers for further analysis in the fisheries and Aquatic Environment laboratory, Rivers State University, Port Harcourt. Samples were prepared by removing the parts (gills, guts, fins, viscera, organs and scales/shells and washed using clean water while the edible parts of the fish were blended and homogenized with the aid of mortar, pestle and a blender, packed separately in bottles and tagged accordingly in readiness for further analysis.

Proximate Analysis

Fresh samples of *C. nigrodigitatus* and O. niloticus were subjected to chemical analysis according to the procedures of the Association of Official Analysis for Chemists (AOAC,1990,1994 and

2000) in the food science and Technology (FST) laboratory, Rivers State University, Port Harcourt. The parameters were determined as follows:

Estimation of Moisture: The initial weights of the samples were first taken and the samples were dried in an ovun (Memmet 854 Schwabach) at about 105°C for 10 hours until a constant weight was reached and cooled in a desiccator (Bel-art H420580001). The dried samples were reweighed and minced in an electric grinder. The percentage (%) of moisture was calculated from the formular:
% of moisture= Weight loss/Original weight of the sample x100.

Lipid Estimation: The dried fish samples left after moisture determination were finely grounded followed by fat extraction using a non-polar solvent, ethyl ether done by heating the sample in 40ml of Ethyl ether and allowed to cool. After extraction, the solvent was evaporated and the extracted materials were weighed. This was calculated using the formular:
% of fat = (Weight of extract/Weight of sample) × 100

Protein Estimation: Micro-kjeldahl method was used to determine the protein content of the fish samples which involves conversion of organic nitrogen to ammonium sulphate by digestion with concentrated sulphuric acid in a micro-kjeldahl flask. The digest was diluted, made alkaline with sodium hydroxide and distilled water. The liberated ammonia was collected in a boric acid solution and was determined via titration. This was calculated using the formular:
% of protein = (c-b) × 14 × d × 6.25/a × 1000 × 100
where
a = sample weight (g)
b = volume of NaOH required for back titration and neutralize 25ml of 0.1N H2SO4 (for sample)
c = volume of NaOH required for back titration and neutralize 25 ml of 0.1N H2SO4 (for blank)
d = normality of NaOH used for titration, 6.25= conversion factor of Nitrogen to protein

Ash Estimation*:* The residue left after ashing in a muffle furnace (Gerhardt) at about 55°-60° C till the residue turned white is the ash content of a sample. This was calculated as:
% of ash = (Weight of ash / Weight of Sample) × 100

***Estimation of Carbohydrates*:** About 0.2g of sample was homogenized by adding 10ml of 2.5% H_2SO_4 and boiled for 20 minutes, allowed to cool then filtered to get a filtrate of about 20ml. 0.1ml of diluted solution was diluted with 1ml of water, filtered with 0.1% anthrone followed by boiling of the mixture for ten minutes.
Carbohydrate content was calculated as follows:100 – (Weight in grams (protein + fat + water + ash + alcohol] in 100g of food).

Crude Fibre Estimation*:* Percentage crude fibre was obtained by subtracting the sum of total carbohydrate, total lipid content, total protein, ash content and moisture content. Blank is prepared with 1ml of water and 3ml of anthrone, and absorbance is read at 620nm.
Crude fibre = 100 - Carbohydrate% + Lipid% + protein% + ash% + moisture%

Data Analysis

The obtained data were subjected to the Statistical Package for Social Sciences (SPSS) for inferential and differential statistics at probability level of $p<0.05$).

Results

Table 1 showed the overall mean values of the proximate composition of *C. nigrodigitatus* and *O. niloticus* from the study area. The result showed that the moisture, crude protein and carbohydrate contents of *C. nigrodigitatus* ranged from 61.32-65.25%, 16.10-18.09% and 10.24-11.30% with the mean values of 63.61±2.037%, 17.52±1.06% and 10.65±0.07% while that of *O.niloticus* ranged from 74.06 - 76.16%, 12.15-2.44% and 5.96-6.55% with the mean values of 75.19±1.05%, 12.94±0.72% and 6.17±0.32%. The moisture content of *O.niloticus* was significantly higher than that of *C. nigrodigitatus* but the crude protein and carbohydrate contents of *C. nigrodigitatus* were significantly higher than that of the *O. niloticus* at probability level of 0.05 ($P<0.05$). The crude fibre values of both species were the same while the fat content of *C. nigrodigitatus* was significantly higher than that of *O. niloticus* at $P<0.05$. The proximate composition of the two fish species varies across the Months with the highest values of moisture, fat, crude fibre and carbohydrates in both species observed in the Month of June (Figure 2).

Table 2 showed the correlation coefficient of proximate composition of the fish species in the area. Ash and fat contents both showed negative and weak correlation with moisture (-0.171) but fat correlated positively and strongly with ash (0.886). Similarly, there were positive and strong correlations between carbohydrates and ash content (0.943), fat (0.943) and crude protein (0.943) at probability level of 0.01 and 0.05.

Table 3 showed the Analysis of variance (ANOVA) in proximate composition of the two samples. Apart from the crude fibre content there were significant differences in proximate composition between the two fishes at $P<0.05$.

Table 1: Overall Mean Values of Proximate Composition (%) of Fish Species in the Study Area

Sample	Moisture	Ash	Fat	Crude Fibre	Crude Protein	Carbohydrate
A	63.61 ± 2.037^{b}	3.94 ± 0.094^{a}	3.61 ± 0.27^{a}	2.45 ± 0.180^{a}	17.52 ± 1.06^{a}	10.65 ± 0.65^{a}
Range	61.32-65.25	3.83-4.01	3.34-3.88	2.23-2.55	16.10-18.09	10.24-11.30
B	75.19 ± 1.05^{a}	2.81 ± 0.06^{a}	1.47 ± 0.11^{b}	2.45 ± 0.02^{a}	$12.94\text{-}0.72^{b}$	6.17 ± 0.32^{b}
Range	74.06-76.15	2.76-2.88	1.35-1.57	2.41-2.44	12.15-13.55	5.96-6.55

Note: Difference in superscripts across the row indicates significant difference

Key: A= *Chrysichtys nigrodigitatus*, B= *Oreochromis niloticus*

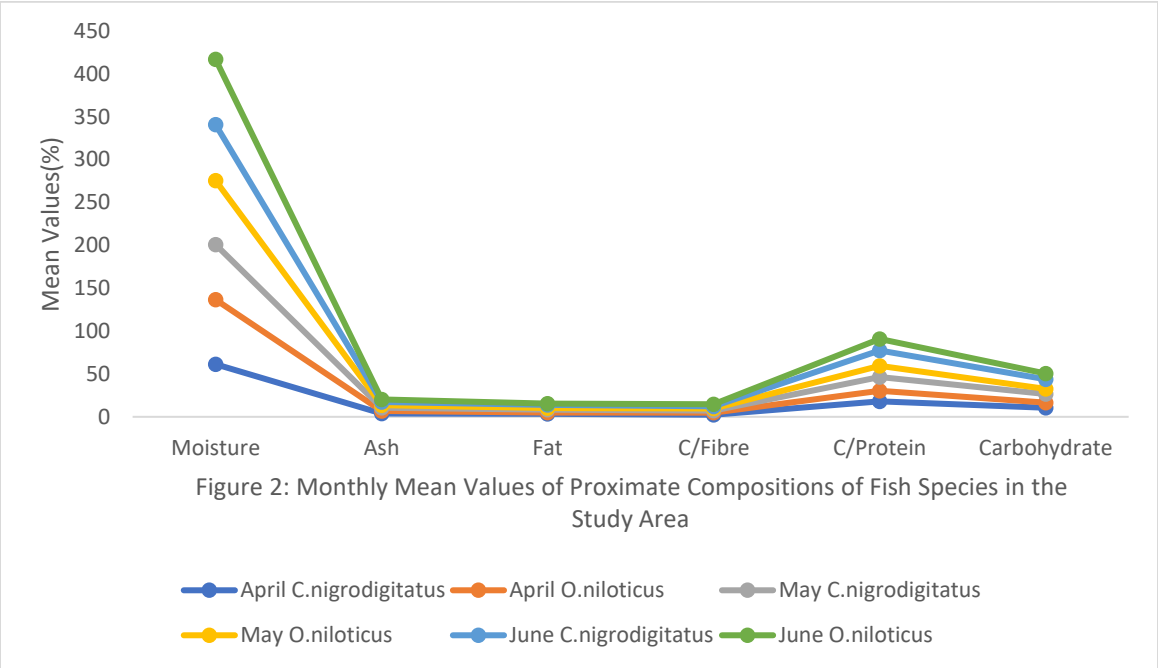


Figure 2: Monthly Mean Values of Proximate Compositions of Fish Species in the Study Area

Table 2: Correlation Coefficient of Proximate Composition of the Fishes in the Area

			Moisture	Ash	Fat	Crude/ Fibre	Crude/ Protein	Carbohydrate
Spearman's rho	Moisture	Correlation	1.000					
		Sig. (2-tailed)	.					
	Ash	Correlation	-.771	1.000				
		Sig. (2-tailed)	.072	.				
	Fat	Correlation	-.771	.886*	1.000			
		Sig. (2-tailed)	.072	.019	.			
	Crude Fib	Correlation	.395	.091	.273	1.000		
		Sig. (2-tailed)	.439	.864	.600	.		
	Crude Pro	Correlation	-.771	1.000**	.886*	.091	1.000	
		Sig. (2-tailed)	.072	.	.019	.864	.	
	Carbohyd	Correlation	-.657	.943**	.943**	.334	.943**	1.000
		Sig. (2-tailed)	.156	.005	.005	.518	.005	.

*. Correlation is significant at the 0.05 level (2-tailed).
**. Correlation is significant at the 0.01 level (2-tailed).

Table 3: Analysis of Variance (ANOVA) of the Proximate Compositions of the Fishes

			Sum of Squares	df	Mean Square	F	Sig.
Moisture * Sample	Between Groups	(Combined)	208.400	1	208.400	88.933	.001
	Within Groups		9.373	4	2.343		
	Total		217.773	5			
Ash * Sample	Between Groups	(Combined)	1.893	1	1.893	297.17	.000
	Within Groups		.025	4	.006		
	Total		1.918	5			
Fat * Sample	Between Groups	(Combined)	7.286	1	7.286	329.86	.000
	Within Groups		.088	4	.022		
	Total		7.375	5			
Crude Fib * Sample	Between Groups	(Combined)	.001	1	.001	.383	.570
	Within Groups		.013	4	.003		
	Total		.014	5			
Crude Pro * Sample	Between Groups	(Combined)	28.711	1	28.711	35.004	.004
	Within Groups		3.281	4	.820		
	Total		31.992	5			
Carbohyd * Sample	Between Groups	(Combined)	29.482	1	29.482	124.65	.000
	Within Groups		.946	4	.236		
	Total		30.428	5			

Discussion

The observed variations in proximate composition of the species in this study is in agreement with the findings of Ukwe *et al.*,(2018) in Amadi Creek landing site, Port Harcourt and Silver and Chamul (2000) which was attributed to difference in species feed intake, age, sexual changes, seasons, metabolic efficiency and environmental factors. Olopade *et al*.,(2016) and Shearer (1994) attributed variations in proximate composition in fish to profound influence of environmental factors such as temperature, salinity, pressure and food on the biochemical composition of fish. The observed difference in protein and moisture contents in this study is in line with the finding of Krzynowek and Murphy (1987) who reported moisture content of 82% and a protein content of 17.4% for fresh fillet/fish. The observed crude protein of *C. nigrodigitatus* in this study is contrary to that reported by Kerema and Amakiri (2013) but compared favourably with that of Alfred-Ockiya and Ndiome (1998). The moisture content in this study tallied with the findings of John and James (2017) who reported 65.30% for shrimp in Okoro river, South East Nigeria. The observed significant difference in moisture, crude protein and carbohydrate contents in this study

is in line with the assertion that higher water/moisture is present in the fish with low fat content (Osman *et al*.,2007). The high values of moisture, crude fibre, carbohydrate and ash in the Month of June could be attributed to the influence of rainfall and other environmental factors which must have affected their feeding and biochemical status.

The observed higher but non-significant difference in value of ash in *C. nigrodigitatus* than *O. niloticus* in this study has been predominantly attributed to high level of chitin strengthened by mineral such as calcium metal in the endoskeleton of *C.nigrodigitatus* (Adeyeye,2002). Hanan *et al*.,(2009) in a research attributed the high ash content in fish to richness of the food in terms of element composition.
The strong and negative correlation between ash and moisture content in this study is in line with the finding of Ukwe, *et al*.,(2018). The observed negative but weak correlation between fat and moisture contents in this study is in agreement with the assertion that higher moisture content is present with low fat (Osman *et al*.,2007).

Conclusion and Recommendation

Despite the difference in proximate compositions of C. nigrodigitatus and O.niloticus they are therefore both considered to be good sources of nutrients for human consumption.
It was recommended that there should be more researches of this nature on the proximate composition of other species to create awareness among the fish farmers and consumer/buyers on the nutrient value of fishes so as to create interest in investing in fish business.

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