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Effects of Food and Feeding Habits on Proximate Composition of Silver Catfish, *Chrysichthys nigrodigitatus* (Lacepede) from the Fresh and Brackish Waters of Akwa Ibom State, Nigeria

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ABSTRACT

The food, feeding habits and proximate composition of silver catfish, *Chrysichthys nigrodigitatus* were investigated between February –April, 2017 from artisanal catch landings of the freshwater environment of Itu River and brackish water creeks of Oron in Akwa Ibom State using standard analytical procedures that established the dietary spectrum and nutritive profiles of the fish type. The freshwater catfish samples recorded mean food items of *Euglena sp* (2.51%) *Paramecium sp* (10.25%) for Bluegreen algae/cyanophyceae, *Spirogyra sp* (20.512%) for green algae/chlorophyceae, *Asterionella sp* (2.564%) for diatoms/Bacillariophyceae while Arthropoda had for Crustacea: *Palaemon sp* (2.564%); Insecta: Hemiptera (2.564%) and Cladocera: *Moina sp* (4.025%) and *Bosmia sp* (10.256%). Rotiferans were totally absent in the dietaries, while sand, mud, detritus and unidentified food items occurred in small proportions. The brackish water samples revealed *Euglena sp* (7.142%) and *Paramecium sp* (14.285%) as bluegreen algae/cyanophyta; *Spirogyra sp* (7.142%) for green algae/chlorophyceae; *Keratella sp* (7.142%) for Rotifera; *Navicular sp* (7.142%) as diatoms/bacillariophyceae; while Arthropoda had *Moina sp* (14.285%) and *Bosmia sp* (14.205%) in Cladocera; *Arstacus sp* (7.142%) and *Palaemon sp* (7.142%) as Crustacea; and Insecta with Orthopera (7.142%). The freshwater samples maintained *Moina sp* and *Spirogyra sp* as primary diets; while the brackish water samples had *Paramecium sp*, *Moina sp* and *Bosmia sp*. The proximate compositions derived from the eight dietary materials of freshwater samples revealed a moisture content of (76.63±0.189%), crude protein (63.99±0.270%), crude fat (24.69±0.10%), ash (5.15±0.032%), crude fibre (3.46±0.035%) and carbohydrate (3.05±0.656%), while caloric value was 490.37±2.458kcal. The brackish water samples which fed on ten food items recorded a moisture content of 77.18±0.061%, crude protein (65.16±0.104%), crude fat (23.69±0.056%), ash (5.21±0.010%) and crude fibre (3.55±0.21%). Carbohydrate content and caloric value were 2.39±0.061% and

483.42±0.222kcal respectively. The presence of sand, mud, detritus and unidentified food items in the guts beside other dietary food organisms showed that *Chrysichthys nigrodigitatus* from both aquatic environments is a benthic omnivore with benthopelagic (swimming) ability to gather food materials from the bottom sediment to the water column. Also, the higher proximate values recorded in the study suggest that the brackish water catfish samples of Oron are more intritively richer in food values than the same fish type from the freshwater environment of Itu especially as nutrients richness of the habouring (aquatic) media largely influence proximate contents, growth tendencies, meatiness and marketability of any aquatic outputs used as food.

Keywords: Food, feeding habits, proximate composition, *Chrysichthys nigrodigitatus*, freshwater, brackish water.

INTRODUCTION

The proximate content of any food organism in the aquaria is a reflection of its dietary materials in the habouring media. *Chrysichthys nigrodigitatus* is a commercial food fish of worldwide acceptance, highly cherished for human consumption because of its good flavor, attractive body disposition, nutritive meaty components of the whitish flesh (Etim *et al*., 2016; Idodo-Umeh and Victor, 1990) and a rich chemical composition which makes the fish type much sought for (Akinsanya *et al*., 2007., Salvia, 2008., Olanimoye *et al*., 2009). It is the third most landed fishery in Southeastern Nigeria after Bonga and Croaker; and forms the principal catch of the study areas.

Silver catfish belongs to the order: Perciformes and family, Bagridae. It is seasonal in nature and is fished with bumber catches between October to April with long lines, cast nets and purse seines (Benyami, 1991., Moses, 2002). The body is moderately elongated and silvery coloured, with absence of scales, relatively large armoured head, four pairs of maxillary barbels, adipose fin lobes and caudal fin fortified with a spine (Moses, 2002; Olaosebikan and Raji, 1998; Reed *et al*., 1967; Schneider, 1990; Essien and Ibok, 2016).

Food and feeding habits of fish as revealed by gut analysis are generally two inseparable activities that occur as far as life exists. Feeding habits of fish embody all the methods employed to gather food materials to quench hunger and stimulate growth within the natural aquatic environment. They often vary in fish species with respect to size, age, stages of life

history, available food types, season and type of water body (Joseph, 2014., Essien and Effiong, 2016).
Stomach contents have been widely used by researchers to establish food and feeding habits of fishes (Hynes, 1950., Hyslop, 1980). Nature has provided great diversity of organisms used as food by fishes and these differ in size, composition and taxonomic groupings. Natural foods of fish tend to vary quantitatively (number of organisms) and qualitatively (types of organisms) with seasons of the year, and different fish species tend to adapt to diverse feeding habits at different stages of life development; beginning from fries, fingerlings, juveniles to adult or table size.

Chrysichthys spp are generally reported as omnivorous, planktotrophic, euryphagous and detritivorous, with many ecological adaptations for bentho-pelagic feeding in natural aquatic systems (Offem*et al*., 2008;Yemi *et al*., 2009; Joseph, 2014; Ikusemiju and Olaniyan, 1977; Nwadioro and Okorie, 1987;Idodo-Umeh, 2002); but these tendencies offer vary per fish species, available food types and the water body. Adults of *Chrysichthys nigrodigitatus* from River Ase in Benin City, Nigeria had shown planktotrophic habits by consuming 23% diatoms, 33% chlorophyceans and 22% crustaceans. The juveniles however showed ominivorous feeding habit; in consuming 32% gastropods, 30% nematodes, 14% diatoms and 8% crustaceans (Ajah *et al*., 2006).

Fish species often adapt to available food types in the aquaria. Alfred-Ockya (2001) had observed Gobby fish, *Progobiusschlegelli* from Bonny River, Nigeria as ominivorous on detritus, diatoms and blue-green algae. *Chrysichthys nigrodigitatus*, *C. aurutus, C. filamentosus* and *C.furcatus* were identified as ominivorous bottom feeder in River Ase in Benin City, but no remarkable seasonal differences in dietary composition were observed between the fish types except amongst the different sized groups (Idodo-Umeh, 2000). However, facultative feeding had been observed in Lekki Lagoon, Lagos State with *Chrysichthys walker*; feeding exclusively on insects, *C. filamentosus* on crustaceans and *C. nigrodigitatus* on molluscs (Ikusemiju and Olaniyan, 1977); suggesting active response of the fish types to interspecific competition. The presence of chaoborid and chiromid larvae,

ostracoids, copepods and detritus in the gut of *C. filamentosus* (Nwadioro and Okori, 1987) shows not only a omnivorous habit but ability to switch between benthic and pelagic food sources.

Food and feeding habits of fish are strongly related to the structural morphology of the gut, method of capture and how the food items are digested. Thus, a study of the structural adaptations of fish can provide information on their food habit while stomach contents analysis gives the dietary spectrum to establish trophic relationships for the overall understanding of fish ecology, proper management of pond fish and the fisheries.

Several works on food and feeding habits of *Chrysichthys nigrodigitatus* in natural aquatic ecosystems abound in the literature (Offem *et al*., 2008; Nwadioro and Okorie, 1987; Idodo-Umeh, 2000; Yemi *et al*., 2009); but available data which compare the nutrient richness of the fresh and brackish water ecosystems to match the proximate composition bequeathed to the fish type is relatively scarce or non-existent. This work is aimed to investigate the dietary spectra of the fish type in Itu River (freshwater) and Oron brackish water creeks in order to establish their nutritive status in *Chrysichthys nigrodigitatus*. The implications of the proximates in human nutrition are also discussed in the work.

MATERIALS AND METHODS

The Study Areas

Samples of silver catfish, *Chrysichthys nigrodigitatus* used for this study were obtained from artisamal catch landings at Itu River Headbridge in Ayadehe fishing community, Itu Local Government Area and the brackish water creeks of Oron at Esin Ufot Beach in Oron Local Government Area, all in Akwa Ibom State. The freshwater environment of Itu River lies between latitude 5^0 4^1 30^{II}Nand Longitude $8^0 6^1 O^{II}$E; with a land elevation/altitude of 17.67meters (157.98feet) above sea level (Wikipedia, 2017). The area has a continental mediteranean climate with seasonal variation in rainfall ranging from 2000mm to 2500mm with average of 2195mm per annum and a mean annual temperature of 26.9^0C – 28^0C.

The riparian vegetation of the tropical rainforest consist of Iron wood, *Khaya sp,* Obeche*, Costusafer, Bambosia vulgaris, Alstoniaboonic, Iroko and Raphia*wokeri. Other

macrophytes comprise of *Utricularia sp, Nymphea lotus, Hypone asp* and *Lemmaerecta, Pistia sp, Sagitaria sp, Commelina sp* and elephant grass. These aquatic ferns form the embankment along the river fringes, providing habitats, breeding and nursery grounds for a large variety of fishes such as *Chrysichthys spp*, *Oreochromisniloticus*, *Tilapiaguineensis*, Snapper, *Clariaslazera*, *Heterobranchusbidorsalis* and *Heterotisniloticus*, etc. Fingerlings of *Heterobranchus*, *Clarias*, *Chrysichthys nigrodigitatus* and shellfishes like crayfish, periwinkles, edible crabs, clams and shrimps are also landed at the beach for sales. Apart from the traditional fishing activity, Itu river is a major source of drinking water, transportation, lumbering, dry season vegetable farming and aggregate mining along the banks.

Oron brackishwater environment lies between latitude $4^{0}48^{1}26^{0}53^{11}$ N and Longitude $8^{0}14^{1}15.74^{11}$ E on the Southeastern fringe of Akwa Ibom State. The area has shallow extensive estuarine mangrove swamp vegetation with tidal-wave creeks that receive massive inflow of water from Atlantic Ocean and the Cross River system (Itu River) surface runoffs, as well as large deposits of sand beach ridge silts that form tidal mudflats along the marshy estuarine vegetation of the water fringes.

Assorted fin and shellfishes mostly of salt-tolerant species landed at the beaches include: bongashad, *Chrysichthys spp*. Sharks, sting rays, croakers, tongue soles, jacks, barracudas, pompanos, threadfins and long herrings. Others are shellfishes such as crayfishes, periwinkles, edible crabs and assorted shrimps. Aquatic macrophytes are mostly Nypa palms, black, red and white mangroves, *Khayasp*., Iroko, Obeche, Mahogany and *ferns*. Fishing, lumbering, boat construction, water transportation, palm wine production, groceries, fish processing, smoking and fish mongering activities are the traditional occupation of the people.

The climate is generally the cold humid tropical type, with a surface temperature of $24^{0}C$ – $28^{0}C$ while humidity is around 80%. The soil is seasonally water-logged with severe ecological problems of gully erosion threats on the hilly coastal sand beach silt soil; accelerated by annual rainfall ranging from 2500mm – 4000mm per annum, a land

elevation/altitude of 38.77 meters (127.19 feet) above sea level (Wikipedia, 2017) and the global climate change; which results in heavy rainfall and accumulation of sediments on the lower reaches of the coast.

The entire Akwa Ibom State is underlain by sedimentary formations of late tertiary and Holocene ages. Deposits of recent alluvium and beach ridge sands occur along the coast and the estuaries of the Imo and Qua Iboe Rivers; and along the flood plains of creeks. Inland and a greater part of the state consist of coastal plain sand, now weathered into lateritic layers, especially in Ini, Ikono, Etinan, Ikot Ekpene, Ibiono and a belt of shales associated with sandstones and limestone, north to Nkari and Obotmme extending down toItu. The beach ridge silt soil covers Eket, Ikot Abasi, part of Mbo, Upenekang with an average width of 200m (Wikipedia, 2017).

GUT CONTENT ANALYSIS

The fish samples were collected monthly at both sampling sites from February to April, 2017 during the beginning of wet season and stored in a cooler of ice blocks (Bacchok *et al*., 2004), enroute the laboratory for analysis. Total lengths of the fish samples, beginning from snout to end of tail region (Schineider, 1970) were taken to the nearest 0.1cm by the use of a measuring board. The weight of each fish was taken with an electronic balance to the nearest 1.0g and matched against the corresponding length (cm).The gut of individual fish was carefully cut opened at the abdominal portion with the aid of a sharp knife. The gut, starting from the top of esophagus to the end of the rectum (Lagler *et al*., 1977) was carefully removed by the use of forceps and preserved in specimen bottles containing 5% formaldehyde for 3 days prior to the determination of diet components to enhance coagulation of the dietary constituents for easy identification of food items (Job, 2006).

Numerical estimation of food items described by Hyslop (1980) was used. The contents of each stomach was scrapped with a spatula into a glass petri-dish and examined with a stereomicroscope to identify the diet components of each gut. Food items were sorted into their different taxa. A checklist of each food item encountered in the stomachs were prepared and percentage occurrence of each food item was computed to show mean

frequency of occurrence and percentage abundance (Hynes, 1950., Ogbeidu and Ezeunara, 2002). The integrated importance of each food item was then expressed by the food ponderance index (FPI) described by King (1991) and weighted upon index range of 100%. Food items with FPI ≥ 10% were considered primary dietaries and those with FPI ≥ 1.0 – 9.9%, secondary food items. Food items with FPI ≤ 1.0% were designated incidental food, probably taken along with the main dietary materials.

PROXIMATE ANALYSIS

The proximate composition of moisture, ash, crude fibre, crude fat and crude protein were determined using the standard procedures of AOAC (2004), Secret (1975), Pearson (1976) and Onunwaka (2005). Moisture content was determined by weighing 5.0g of each sample and oven-dried at 105^0C to a constant weight. The loss in weight of the samples was calculated as moisture content. Ash content was determined by incineration of 5.0g of each powdered sample in a muffle furnace at 550^0C. Crude fat was obtained by the soxhlet extraction method while crude protein was determined using the micro jeldhal method. Crude fibre was determined using the acid and alkaline digestion method. Carbohydrate was estimated as the difference obtained after subtracting total organic nitrogen (protein), fat, ash and fibre from the total dry matter. Caloric value was obtained by multiplying the values of crude protein, crude fat and carbohydrate by 4, 9, 4 kcal respectively and taking the sum of the products which was expressed in kilocalories per 100g (kcal/100g).

RESULTS

Numerical analysis of food items encountered in the stomachs of silver catfish (*Chrysichthys nigrodigitatus*) between February - April 2017, from the fresh and brackish water environments of Akwa Ibom State are presented with mean values in tables 1 and 2 and mean proximate composition in table 3.

The trophic spectrum of freshwater sample (table 1) revealed that eight (8) food organisms classified in seven taxa which comprise of blue green algae, green algae, bacillariophyceae (diatoms) and rotifera while Arthropoda had cladocera, crustacea, and insecta; besides sand, mud, detritus and

unidentified food items. *Moina spp* (arthropoda) with 41.02%, *Spirogyra spp* (chlorophyceae) 20.15%, *Paramecium spp* (cyanophyceae) and *Bosmia spp* with 10.25% respectively, constituted predominant and primary food items in the guts of freshwater samples.

Dietary composition of the brackish water sample (Table 2) consisted of ten (10) food organisms classified in seven (7) taxa with Cyanophyta which includes *Paramecium sp* and *Euglena sp*; Chlorophyceae (*Spirogyra sp*); Bacilliariophyceae (*Naviculasp*); Rotifera (*Keratella sp*) and Arthropoda that showed diataries of *Moina sp* and *Bosmia sp* in the class, Cladocera; *Arstacus sp* and *Palaemonsp*in Crustacea; while insecta had orthopterans. Very low percentage of sand, debris and mud in the gut could be attributed to the physiological state of the gut that resulted in complete digestion or the flushing actions of tidal waves coupled with the homeostatic condition of the viscera that was constantly subjected to estuarine salinity of 26-30%.

Equally, the conversion of the dietary constituents into food values in the fish tissue, revealed mean proximate compositions in freshwater samples (Table 3) of 76.63±0.189% for moisture content. Crude protein was 63.99±0.270% and crude fat (24.69±0.010%). Ash, crude fat and carbohydrates generally recorded low values. The brackish water sample appreciated in moisture content (77.18±0.061%), crude protein (65.16±0.104%) and crude fibre (3.55±0.021%); indicating a higher nutritive profile over the freshwater specimens.

Table 1: Mean Dietary Composition of *Chrysichthys nigrodigitatus* from the freshwater environment of Itu River

Food Items	**Food PonderanceIndex (FPI)**
Taxa/Organism	**% Composition**
Sand, mud, detritus	5.128
Bluegreenalgae/cyanophyceae	
Euglena spp	2.564
Paramecium spp	10.256
Green algae/chlorophyceae	
Spirogyra spp	20.512
Diatoms/Bacellariophyceae	

Naviculaspp	0
Asterionellaspp	2.564
Rotifers/Rotifera	
Keratellaspp	0
Arthropods/Arthropoda	
Cladocera	
Moinaspp	41.025
Bosmiaspp	10.256
Crustacea	
Crayfish (*Astarcusspp*)	0
Crayfish (*Palaemonspp*)	2.564
Insecta (Insects)	
Orthoptera	0
Hemiptera	2.564
Mayfly (Ephemeroptera)	0
Unidentified food items	7.142

Table 2: Mean Dietary Composition of *Chrysichthys nigrodigitatus* from the brackish water creeks of Oron

Food Items **Taxa/Organism**	**Food Ponderance Index (FPI)** **% Composition**
Sand, mud, detritus	0.001
Bluegreenalgae/cyanophyceae	
Euglena spp	7.142
Paramecium spp	14.285
Green algae/chlorophyceae	
Spirogyra spp	7.142
Diatoms/Bacellariophyceae	
Naviculaspp	7.142
Asterionellaspp	0
Rotifers/Rotifera	
Keratellaspp	7.142
Arthropoda:	
Cladocera	

Moinaspp	14.285
Bosmiaspp	14.285
Crustacea	
Crayfish (*Astarcusspp*)	7.142
Crayfish (*Palaemonspp*)	7.142
Insecta (Insects)	
Orthoptera	7.142
Hemiptera	0
Mayfly (Ephemeroptera)	0
Unidentified food items	7.142

Table 3: Mean Proximate Composition (%) of *Chrysichthys nigrodigitatus* from the freshwater of Itu River and brackish water creeks of Oron

Parameters	Body MTL	Lengths MTW	Moisture	Ash	Crude fibre	Crude protein	Crude fat	Carbo-hydrate	Caloric Value (kcal)
Freshwater	43.7cm	0.65kg	76.6	5.15	3.46	63.99	24.69	3.05	490.37
Sample			±0.189	±0.189	±0.035	±0.270	±0.010	±0.656	±2.458
Brackishwater	42.7cm	0.4kg	77.18	5.21	3.55	65.16	23.69	2.39	483.42
Sample			±0.061	±0.010	±0.021	±0.104	±0.056	±0.061	±0.222

Means are triplicates determinations ± SD
NB: MTL = Mean total length; MTW = Mean total weight

DISCUSSION

Food and feeding habits of fish in any aquatic ecosystem primarily depend on the available food items in the aquarium; while the proximate composition of the body tissue is a reflection of the richness of dietary spectrum and feed conversion ratio to form the tissue flesh. The dietary composition encountered in the gut of all samples of *Chrysichthys nigrodigitatus* during the period of analysis generally included: Bluegreen algae (*Euglena sp, Paramecium sp*); Green algae (*Spirogyra sp*); Diatoms (*Nivacula sp, Asterionella sp, Keratella sp*) and Arthropods like Cladocera(*Moina sp, Bosmi asp*) Crustacea (*Astarcus sp, Palaemon sp*) and Insecta (orthopterans and hemipterans). Other dietaries were plant materials, insect's parts, mud, sand, detritus and unidentified food items.

The freshwater samples generally fed on eight food organisms (Table

1) and brackish water samples on ten (Table 2). The dietary compositions of the gut indicates a omnivorous feeding habit; while the presence of sand, mud, debris, crustaceans, insects and plant parts in the stomach of *Chrysichthys nigrodigitatus* reveal a bentho-pelagic (swimming) ability of the fish type to gather available food materials from the benthic across the water column in the two aquatic environments. This findings coincide with the works of Idodo-Umeh (2003); Oribhabor and Ogbeibu (2012); Imoh (2014) and Ajah *et al*., (2006), that observed dietaries of sand, mud and diatoms which often constitute the benthos and chlorophyceans, crustaceans, bluegreen algae and insects that are pelagic. The presence of mud, sand, detritus and unidentified food items which generally had low percentage occurrence must have been taken along as incidental food while gathering the main diets. However, the variations in the numerical abundance of food items isolated in the gut of silver catfish samples during the period of analysis could be due to availability or otherwise of a particular diet component on the gut that was not fully digested and assimilated. The occurrence of variety of food items in the stomach are in line with the findings of Atobatele and Ugumba (2011); Idodo-Umeh (2003), Job and Udo (2002); Ajah *et al*., (2006); Fucado and Olaniyan (1973); Alfred-Ockiya (2001) and Olojo *et al*., (2003).

The preference shown by the fish type in selecting a diet component as primary or secondary food source is observed as a biological strategy to discourage competition for available food items amongst the fish species in the two aquatic environments. This also agrees with the works of Job and Nyong (2005) and Olojo *et al*., (2013). The abundance of primary dietaries of *Moina sp* (41.025%) and *Spirogyra* (20.512%) in Itu River or gut of freshwater samples and *Bosmia sp* (14.285%), *Paramecium sp* (14.025%), *Euglena* (7.142%), *Arstacus sp* (7.142%) and *Palaemon sp* (7.142) in the estuarine water or guts of brackish water samples could be attributed to affinity and preferential tolerance for freshwater salinity (0.05%) and brackish water salt content (24-28%), water level fluctuations and recurrent dilutions by tidal-wave actions, often occasioned by global climate change and nutrient enrichments from adjoining aquatic systems and runoffs. However, factors such as

turbidity which reduces the photic depth for photosynthesis and ability to locate food items in the aquaria, predatory organisms, structural morphology of gut apparatus of *Chrysichthys sp*. like gill rakers, inferior mouth position, homodont dentition with incisor teeth designed for tearing and cutting of food, aquatic contaminants from metallic bioaccumulation via aggregate mining in Itu freshwater environment and the effects of crude oil spillage in the brackish water must have contributed to the low diversity or total absence of some food organisms for the fish type in the two environments (tables 1 and 2).

Stomach contents of fishes are studied to ascertain the nutrient richness of the natural habitats and the biotic environments (Adebisi, 1981), understand behaviour of fish for fish stock assessment and ecosystem modeling (Bacchok *et al*., 2004) and develop sampling devices and most efficient gears for fish capture. It is also to better-understand the trophic relationship and biology of predatory-prey interactions (Bruton, 1979; Idodo-Umeh, 2003); for effective management of fish stocks and evaluation of ecosystem status.The differences in feeding habits in the fish samples generally observed as omnivorous, euryphagous, detritivorous and planktivorous; depending on the available food items and parts of water, could be attributed to the general response to interspecific competition with other fish species in the fresh and brackish water to satisfy the food need of the fish type for maximum growth. The richness of the food spectra of the two aquatic media was also reflected on the proximate contents and growth tendencies of the fish species. Equally, the structural morphology of the ventral (inferior) mouth location of *C. nigrodigitatus* with a horny structure (Welcome, 1979), gill rakers and incisor teeth are not only indicative of bottom feeding but are adaptations to accelerate filter feeding, browsing and gnawing of hard plant tissue and insects parts to obtain a rich array of dietary materials that was reflected in the high proximate contents of the samples (table 3).

Fish are mostly gluttonous; with smaller bodied fishes having greater feed maintenance ratio than the large bodied (Lagler *et al*., 1977). Food habits of fish often vary with respect to size, age, life history stage, types of available food,

season, time of the day and habits; while the nature and quality of dietary composition, severally influence body nutrient composition, size, taste, meatiness and acceptability of fish for consumption.

The brackishwater samples of silver catfish were more nutritively richer in proximate composition than samples from freshwater of Itu. This is in line with the findings of Adebayo-tayo *et al*., (2006); Essien and Ibanga, (2014); that observed higher nutritional values in brackishwater periwinkles over the freshwater counterparts; as a result of differences in dietary materials in the aquaria. The Oron brackishwater creeks receive nutrients input from river flows of the Cross River system otherwise known as Itu River, Atlantic Ocean and rain runoffs with high primary productivity, sewage, all ochthonous food materials trapped in the marshy mangrove swamps during flood regime and organic debris that make the estuarine creeks exceptionally productive (Houde and Rutherford, 1993; Duxbury *et al*., 2002; Adebayo-tayo, 2006). The richness of aquatic ecosystem especially in nutrient concentrations can influence the proximate and mineral compositions of aquatic animals (Etim *et al*., 2016).

Fish generally play significant roles in human nutrition, income generation, employment, poverty alleviation and foreign exchange earnings. Silver catfish is a commercial food fish widely accepted for consumption by humans. Thus, measurement of proximate composition of this fish type is inevitable to provide information on nutritional contents of the fish type from the two aquatic environments. It is also to create awareness on the nutritional endowments; and to ensure that the catfish meat offered for sale meets food requirements that promote growth and commercial specifications of marketability and consumption as a good dietary material. The quality of silver catfish as a commodity offered for sale and consumption does not only depend on the size, taste, attractive body disposition, flavor and meatiness of the whitish flesh but also on the proximate composition of the fish tissues.

This preliminary investigation reveals that silver catfish is a good dietary food fish because of its rich

nutritional contents; and choosing the brackishwater sample for a meal is the best option. Nutritional experts assert that protein from fish and shellfishes is better than that of beans plant. Fish and shellfishes contain excellent essential amino acids such as methionine, tryptophan (found in fish only) and lysine, hence fish protein is regarded as first class protein (Lagler *et al*., 1977; Alfred, 1985). The fish samples investigated generally recorded a protein content of over 60% which is well over 30% classified under high protein category and a crude fat of over 5% which indicates that the fish type is not a lean fish (Standsby, 1982).Protein is a body-building food capable of repairing worn-out tissues. Carbohydrates and fats in the fish samples are good sources calories. Ash content of over 5.1% in the fish samples expresses the mineral richness of the fish type; while crude fibre of 3.4% and 3.5% in the fresh and brackishwater respectively, indicate good digestibility of the fish flesh during consumption. Higher moisture content of over 70% in both samples is an index of the keeping quality of the food fish. It also indicates that the fish type cannot keep long in the fresh form without spoiling or deteriorating in value except preserved by cold storage or smoked-dried to prolong the shelf-life.

CONCLUSION

The silver catfish, *Chrysichthys nigrodigitatus* obtained from the fresh and brackish water environment of Akwa Ibom State is a mudfish with benthic mode of existence and omnivorous feeding habits. These tendencies give the fish greater potentials of gathering numerous food items from wider sources (benthic and pelagic) to constitute the meaty components of the body tissue.

Variations in the food values of the fresh and brackish water samples investigated, remain mostly a function of nutrient richness of the habouring aquatic media bequeathed to the fish types. Thus, the dietary spectrum of brackish water samples with ten food organisms over eight items in freshwater samples made the brackish water catfish samples more nutritively richer in proximates (protein, fibre, ash) than the freshwater counterpart. The food richness of the two aquatic ecosystems suggests intra and interspecific competition among the

fishes. The freshwater samples maintained *Paramecium, Spirogyra, Bosmia, Moina*as primary diets and *Euglena, Asterionela, Palaemon, Hemipterans* as secondary; while the brackish water samples consumed *Paramecium, Moina, Bosmia* as primary dietaries and *Euglena, Spirogyra, Navicular, Keratera, Arstacus* and *Palaemon* as secondary food items. These dietaries together with the incidental food material impacted positively on the nutritional profile of the fish type inhabiting the two aquatic environments.

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