The Plankton and Fishes of a Tropical Creek in South-Western Nigeria

B.E. Emmanuel[1], I.C. Onyema[1,] *
[1] Department of Marine Sciences, University of Lagos, Akoka, Lagos, Nigeria.

* Corresponding Author: Tel.: +234 08060442323; Fax: -;
E-mail: iconyema@yahoo.com.au

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Abstract

Investigations on the physico-chemical characteristics, phytoplankton, zooplankton, finfish and shell fish component of an estuarine creek in South-western Nigeria was carried out for one year between March, 2003 and February, 2004. The study showed notable seasonal variation in the components investigated. Salinity regime seemed a major determinant of the composition, abundance and seasonal variation of encountered creek biota. Rain events associated with reducing salinities and tidal lagoonal inflow associated with increasing salinities may be key hydro-meteorological forcing operating in the creek. During the study, 82 species of phytoplankton, 18 species of zooplankton, 17 species for finfish, 4 species of shell fish and 7 categories of juvenile forms were recorded. In all, freshwater, estuarine and marine species of all trophic levels investigated were recorded in the creek at one time or the other during the survey. The array of juvenile forms recorded probably points to the suitability of the creeks characteristics to serve as breeding ground and place of refuge for diverse aquatic species.

Key Words: Estuarine, fin fish, shell fish, phytoplankton, zooplankton, physico-chemical.

Introduction

Creeks and lagoons are common hydrological features of South-Western Nigeria and form part of the numerous ecological niches associated with the Nigerian coastal environment (Chukwu and Nwankwo, 2004). Creeks in this region are usually connected to lagoons and find their way to the sea via the Lagos habour all year round (Nwankwo and Akinsoji, 1992). Over the years, tidal creek ecosystems, particularly in the industrialized areas of Lagos metropolis, are enduring stress-induced changes as a result of steadily yet increasing human activities and associated effects (Onyema and Nwankwo, 2006). Unregulated and unrestricted deposition of wastes is the key to most of these imposed human related effects.

In the aquatic ecosystem, the phytoplanktons are the foundation of the food web, in providing a nutritional base for zooplankton and subsequently to other invertebrates, shell and finfish. The ecological significance played by these biological systems in coastal aquatic ecosystems cannot be understated. Ecological and particularly trophic interrelationships are well known to occur among phytoplankton, zooplankton, fin and shell fish in aquatic ecosystems.

There is a dearth of available materials on ecological investigation into the hydroclimatic conditions especially in relation to the composition and distribution of biota at different trophic levels within coastal aquatic ecosystems in Nigeria. For instance, Akpata *et al*. (1993) considered the bacterial, plankton and benthos population at two organically polluted sites in the Lagos lagoon, Kusemiju *et al.* (1993) reported on the phytoplankton, zooplankton and fish of Opobo channel in Rivers state, Nigeria.

We report here on the phytoplankton, zooplankton, fin and shellfish of a tropical tidal creek in Lagos metropolis with the aim of gaining better understanding into aspects of trophic level interrelationship within this estuarine ecosystem.

Material and Methods

Description of the Study Area

The brackish water creek under study is situated within the University of Lagos, Akoka campus, Nigeria and is linked to the Lagos lagoon (Figure 1). The creek is shallow (≤1m), tidal and sheltered. It is fed by water from the adjoining Lagos lagoon at high tide, and at low tide the water ebbs into the lagoon. The region is located in south-western Nigeria and hence exposed to two distinct seasons, the wet (May – October) and dry season (November – April) (Nwankwo, 1996). The creek meanders through a riparian mangrove swamp which is inundated at high tide and partially exposed at low tide. Notable riparian flora of the creek includes *Paspalum orbiquilare*, *Acrotiscum aureum*, *Phoenix reclinata*, *Rhizopohora racemosa*, *Avicenia nitida*, *Drepoanocarpus lunatus* and *Cyperus articulatus*. Notable fauna includes *Periopthalmus* sp., *Balanus pallidus*, *Chthamalus* sp.,

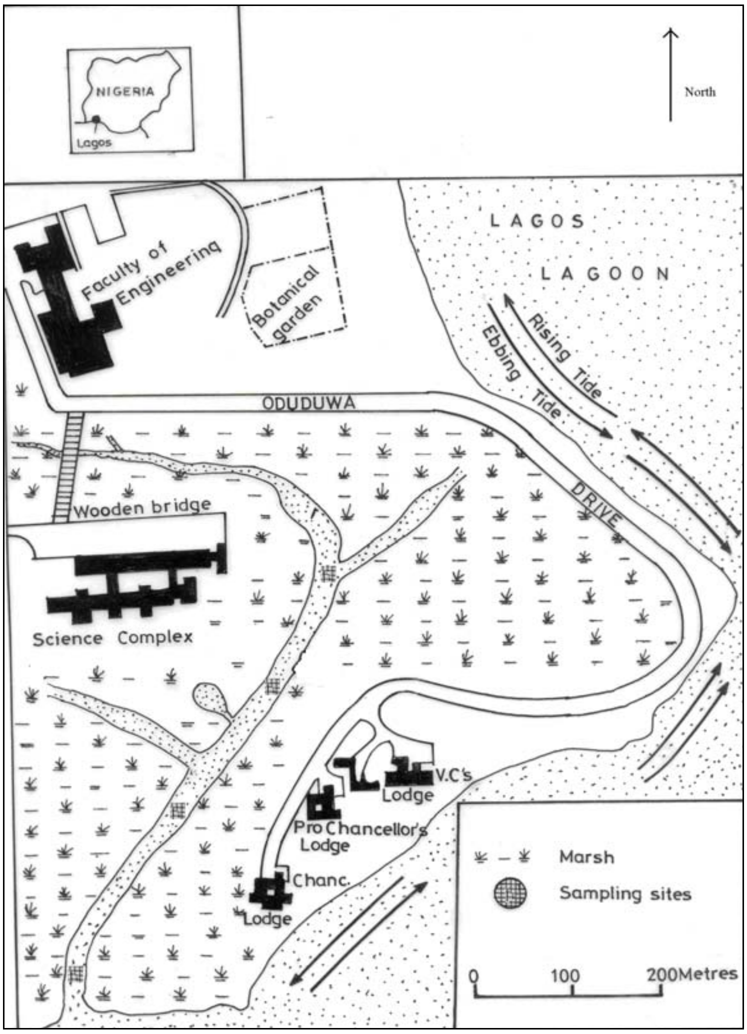

Figure 1. Map of the Abule-Agege creek showing sampling sites.

Uca tangeri, *Seserma huzardi*, *Gryphea gasar*, *Tympanotonus fuscatus* var *radula* and herons that feed on exposed invertebrates at low tide.

Collection of Water and Plankton Samples

Water samples for physico-chemical analyses and plankton analysis were collected monthly between 10h and 13h for twelve consecutive months (March 2003 – February 2004). Surface water samples were collected using a 2.0L non – metallic water sampler just below the water surface. Water samples were collected in well labeled 200ml glass bottles with screw caps and analyzed on getting to the laboratory on the same day. Plankton samples were collected using a 55 µm mesh size standard plankton net by filtering 50 liters of water from the creek at all the sampling stations. Plankton samples were then transferred into properly labeled 250 ml glass bottles with screw caps and preserved in 4% unbuffered formalin.

Collection of Fish Samples

For fish sampling purposes, the creek was divided into three areas, the upper, middle and lower courses. Fishing was done by means of castnet designed and constructed with polyamide material (0.24mm diameter) with hanging ratio of 1:2, three panel and 31mm mesh size. The fishing was also complimented with a funnel entrance traps placed in different locations in the creek.

Fish hauls were done fortnightly at low and high tide for the castnet. The fish samples were transported to the laboratory for preservation in a deep freezer immediately after appropriate labeling and identifications were made with the aid of relevant texts (Tobor and Ajayi, 1979; Fischer *et al.*, 1981; Powell, 1982; Schneider, 1990; Holden and Reed, 1991). The measurement (in centimeter) of the fish (standard and total length), the shrimp (carapace length) and the crab (carapace length and carapace width) species was taken using the method described by Adetayo and Kusemiju (1994), Chindal *et al.*

(2000) and Emmanuel and Kusemiju (2005). The specimens were also weighed on a sartorius weighing balance to the nearest gram.

Physical and Chemical Analysis

Surface water and air temperatures were measured using a mercury thermometer. The surface water salinity was measured using salinity bridge meter (Model EES 13-135). Whereas pH was determined with a Griffin pH meter (model 80), dissolved oxygen was estimated using a Griffin oxygen meter (Model 40) and biological oxygen demand was measured using methods according to APHA (1998) for water analysis. Calorimetric methods using a lovibond Nesslerier were adopted for the determination of phosphate-phosphorus and nitrate-nitrogen values. Data on rainfall distributive pattern for the period was obtained from the Federal Meteorological Department Oshodi, Lagos.

Plankton Analysis

In the laboratory, three drops of each sample were investigated at different magnifications (100X, 400X) using a Wild M11 binocular microscope with a calibrated eyepiece after concentration to 10 mls. The microtransect drop count method described by Lackey (1938) was used. The final data were presented as number of organisms (cells, filaments, colonies, and organism) per ml.

Appropriate texts were used to aid identification (Hendey, 1958, 1964; Wimpenny, 1966; Patrick and Reimer, 1966; 1975; Nwankwo, 1990, 2004; Bettrons and Castrejon, 1999; Newell and Newell, 1966; Olaniyan, 1975; Barnes *et al.*, 1993; Waife and Frid, 2001).

Results

Physico-chemical Characteristics

Results on the regime of physico-chemical characteristics at the study site are shown in Table 1. pH throughout the study was alkaline (7.4-8.2). Water temperature ranged from 23.5ºC in July to 30.8ºC in February while air temperature ranged from 23.5-32.9ºC. Also dissolved oxygen levels ranged between 3.4 mg/l in January to 4.5 in May.

Nitrate content was higher during the rains than in the dry season and in all ranged between 2.3 and 5.88 mg/l. Phosphate levels showed no clear monthly variation (3.0-3.5 mg/l). Biological oxygen demand recorded higher values during the rains than in the dry season.

Furthermore, rainfall volumes were higher in the rainy season than the dry season. Salinity levels were higher between the months of February and April (25.5-33.65‰) and lowest between May and September (1.65-11.0‰).

Phytoplankton

Phytoplankton species diversity was higher in the dry season (November – March) than in the wet season (April – October). Nonetheless, abundance was higher during the rains with corresponding reduced diversity. Three major classes of planktonic algae were observed in the creek during the survey: Bacillarophyceae (diatoms), Cyanophyceae (blue-green algae) and Chlorophyceae (green algae). A total of 82 phytoplankton species belonging to 27 genera were observed. Diatoms (69 species from 18 genera), Cyanobacteria (10 species from 6 genera) and green algae (3 species from 3 genera) were recorded (Table 2).

The species diversity was higher among the diatoms than for other classes. Among the diatoms, *Melosira*, *Coscinodiscus*, *Thalassiosira*, *Podosira* and *Cyclotella* were the more frequent forms. Pennate diatoms were represented by more species from *Navicula*, *Nitzschia*, *Synedra*, *Pleurosigma* and *Cocconeis* species. *Melosira granulata*, *M. granulata* var. *angustissima* and *Coscinodiscus* species were key centric diatoms recorded during the survey.

Among the blue-green algae, *Microsytis aureginosa*, *M. flos-aquae*, *Merismopedia* and *Oscillatoria* species represented the group. *M.*

Table 1. Monthly variation in physico-chemical parameters in a tropical creek, Lagos (Mar. 2003 – Feb. 2004)

	2003 →										2004 →	
Parameter	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Jan	Feb
Air temperature (ºC)	32.0	30.7	32.9	28.6	23.5	27	26.5	29.5	29.5	29.8	28.6	30.8
Water temperature (ºC)	28.6	28.7	27.8	26.1	23.5	24.4	26.1	28.5	26.5	26.8	26.9	30.8
Salinity (‰)	22.14	20.56	11.0	8.5	5.3	1.65	2.50	13.5	3.74	13.9	22.14	25.34
pH	7.8	7.6	8.2	7.6	8.0	8.2	7.5	7.4	7.8	7.6	7.4	7.7
Nitrate-nitrogen (mg/l)	5.88	5.44	5.02	4.52	4.50	4.78	4.01	3.78	2.30	4.85	6.23	6.42
Phosphate-phosphorus (mg/l)	0.94	0.87	0.85	0.57	0.50	0.55	0.51	0.42	0.03	0.64	1.09	1.18
Dissolved Oxygen (mg/l)	4.0	4.4	4.5	3.5	4.0	4.0	3.5	3.5	4.4	3.6	3.4	3.5
Biological Oxygen Demand (mg/l)	31	27	60	35	40	40	20	25	14	19	26	24
Rainfall (mm)	23.0	200.0	208.6	383.0	101.7	34.0	230.5	115.0	50.0	0.0	22.0	35.0

Table 2. Composition and abundance of species of phytoplankton species in terms of numbers per ml in a tropical estuarine creek (March, 2003 – February, 2004)

Months	2003 →									2004 →	
Class	March	April	May	June	July	August	September	October	November	December	January	February
Bacillanophyceae												
Amphora ovalis	-	-	-	-	-	-	-	-	-	20	-	-
Cocconeis scutellum	-	150	-	-	-	-	-	-	-	-	-	-
Coscinodiscus centralis	-	-	-	-	-	-	-	-	-	-	40	-
Coscinodiscus radiatus	-	-	-	-	-	-	-	-	-	-	60	30
Cyclotella menighniana	30	-	-	-	-	-	-	-	-	-	-	-
Gryrosigma balticum	-	-	20	-	-	70	-	-	-	-	-	-
Hantzschia amphioxys	-	-	-	-	-	-	-	-	-	-	-	30
Melosira granulata	-	-	2240	800	800	80	1860	310	-	-	-	-
Melosira granulata var. *angustissima*	-	-	980	5940	6810	-	780	250	-	-	-	-
Melosira moniliformis	40	-	-	-	-	-	-	-	-	-	-	-
Navicula cryptocephala	-	-	-	180	-	-	-	-	-	-	-	-
Navicula cuspidata	-	970	-	-	-	-	-	-	-	60	-	-
Navicula mutica	-	-	-	-	-	-	-	-	-	-	30	30
Navicula pusilla	-	520	-	-	-	-	-	-	-	-	-	-
Nitzschia closterium	-	1120	-	-	-	-	-	-	10	-	-	-
Nitzschia longissima	-	110	-	-	-	-	-	-	-	-	-	-
Nitzschia sigma	-	-	-	-	140	-	-	40	-	20	-	-
Nitzschia sigmoidea	-	-	-	-	-	40	-	-	-	-	-	-
Pleurosigma angulatum	30	-	-	-	-	220	-	-	-	-	-	-
Podosira stelligera	-	180	-	-	-	-	-	-	-	-	-	-
Skeletonema coastatum	10	-	-	-	-	-	-	-	-	-	-	180
Surirella ovata	-	-	-	250	250	-	-	-	-	-	-	-
Synedra ulna	-	-	-	-	-	30	-	50	30	-	30	-
Tabellaria fenestrata	-	-	-	-	-	-	-	-	10	20	-	-
Thalassiosira decipens	130	-	-	-	-	-	-	-	-	-	-	40
Triceratium favus	-	-	-	-	-	-	-	-	-	-	20	-
Cyanophyceae												
Microcystis aureginosa	-	-	120	-	-	-	220	-	-	70	-	-
Merismopedia gluca	-	-	-	-	-	-	-	-	30	-	-	-
Microcystis flos-aquae	-	-	-	-	-	-	200	-	-	70	-	-
Chlorophyceae												
Gonatozygon sp.	-	-	-	500	780	-	-	-	-	-	-	-
Spirogyra sp.	-	-	40	-	-	-	30	-	-	-	-	-

aureginosa and *M. flos-aquae* were dominant species in November and December respectively. The green algae were represented by two species, namely *Spirogyra* sp. and *Gonatozygon* species.

Zooplankton

Two phyla of zooplankton (Crustacea and Rotifera) were encountered during this investigation with the former being more diverse and abundance. For the phyla Arthropoda, the sub-class Brachipoda (Cladocera) and Copepoda (Calanoid, Cyclopoid and Harpacticoid copepods) were recorded. The phylum Rotifera was represented by species from the Order Ploima. A total of 18 zooplankton species, 1.e. 6 calanoid, 6 cyclopoid and 1 harpacticoid copepods were recorded. 2 cladoceran and 3 rotifers species were also recorded (Table 3).

Whereas *Acartia clausii*, *A. discaudata*, *Paracalanus parvus*, *P. pymaeus*, *Diaptomus* sp. and *Rhincalanus* sp. were the dominant calanoid copepods, *Cyclopina longicornis*, *Cyclopina* sp., *Cyclops strenus*, *Cyclops* sp., *Halicyclops*, *Mesocyclops* species recorded higher outcomes for the cyclopoid copepods and *Enterpina acutifrons* represented the harpacticoid copepods. *Diaphanosoma excisum*, *Diaphanosoma* sp. (Cladocera) and *Branchionus calyciflorus*, *Branchionus* sp., and *Lecane bulla* (Rotifera) were also recorded during the study.

Meroplanktonic forms encountered include juvenile stages of copepod, cladoceran, barnacles, crabs, shrimp, fish eggs and larval planktonic stages. There were two peaks for egg/juveniles abundance within the creek; they were March/April and September/October for the period under consideration.

Fin and Shell Fish

Fin and shell fish species, their size ranges and weight ranges are presented in Table 4. Seventeen fin fish and four shell fish were encountered in the creek during the survey.

Four species of cichlidae were identified. Three of them *Sarotherodon melanotheron*, *Hemichromis fasicatus* and *Tilapia guineensis* are the important food species. They all attained up to 16.50 cm (74.27 g), 13.90 cm (42.63 g) and 15.20 cm (133.08 g) as total length respectively in the creek. The family Gobidae was represented by *Bathygobius soporator*, *Eleotris vitata*, *Batanga lebretonis* and *Gobioides africanus*.

The family Ophichthiidae was represented by a sole species, *Ophichthus rufus*. Two species of Clariidae, *Clarias gariepinus* and *Heterobranchus bidosarlis* were also encountered.

The Bagridae was represented by *Chrysichthys nigrodigitatus*. The families of Carangidae, Channidae and Citharidae were represented by *Caranx hippos, Channa obscura* and *Citharus linguatula*, respectively. Mugilidae was represented by two species, *Mugil cephalus* and *Liza falcipinnis*.

The shellfish were represented by three families, Palaemonidae, Penaeidae and Portunidae. Palaemonidae was represented by *Macrobrachium vollenhoevenii* and *Macrobrachium macrobrachion*. These also attained adult size in the creek. Penaeidae was represented by *Penaeus notialis* and Portunidae by *Callinectes amnicola*.

Discussion

The present information on the seasonality of hydrological characteristics of this tidal creek confirms earlier observations similarly observed in the adjoining Lagos lagoon. The regime of ecological factors operating in the Lagos lagoon has been documented by several investigators over the years (Webb, 1958; Hill and Webb, 1958; Olaniyan, 1969; Nwankwo, 1988, 1996; Onyema *et al*., 2003). Further to this higher salinity in the dry season in the Lagos lagoon has been associated to increased tidal seawater incursion, coupled with reduced flood, water inflow from associated rivers, creeks and freshwater lagoons. Hence hydro-meteorological forcing may be implicated in the control of the hydroclimatic conditions of the study creek, namely freshwater associated to rains inflows and seawater incursion.

High air and water temperatures recorded during the study are typical for the region (Nwankwo *et al*., 2003). The high biological oxygen demand value may be a reflection of the amount of decompositional materials within the creek and arising from the surrounding rich riparian mangrove vegetation. Higher plankton diversity was recorded in the dry season as against the wet periods. The algae assemblage of *Melosira granulata*, *M. granulata* var. *augustissima*, *Microcystis aureginosa*, *Microcystis flos-aquae*, *Gonatozygon* and *Spirogyra* species has been implicated in studies in the Lagos lagoon over the years especially during the rains (Nwankwo, 1988, 1996; Onyema *et al*., 2003).

More stable conditions including flow characteristics, increased light penetration and marine situation experienced in the dry season could have encouraged the development of a richer plankton community. Similar observations have been made by Nwankwo (1988) and Onyema *et al*. (2003) for the Lagos lagoon.

In this study, it is suggested that there are likely three broad feeding groups of fish, namely planktophagus, predatory and deposit feeders within the creek. This is in consonance with Fagade and Olaniyan (1974). Furthermore, a direct relationship between increasing salinity, plankton diversity and fish species and abundance was also recorded. It is possible that an increased diversity of phytoplankton and hence zooplanktonic forms observed during the dry season gave rise to a richer fin and shellfish

Table 3. Composition and abundance of zooplankton species in terms of numbers per ml in a tropical estuarine creek (March, 2003 – February, 2004)

	2003 →									2004 →	
Species	March	April	May	June	July	September	October	November	December	January	February
Crustacea	20	-	30	-	-	-	50	50	60	-	20
Acartia clausii	20	-	-	-	-	-	40	40	60	-	10
Acartia discaudata	20	20	20	-	-	-	-	-	-	-	-
Centropages sp.		50	-	-	-	-	-	-	-	-	-
Corycaeus obtusus	30	90	-	-	-	-	-	-	-	-	-
Cyclopina longicornis	-	-	-	-	-	-	-	-	-	30	-
Cyclopina sp.	-	-	-	20	-	40	-	-	-	-	-
Cyclops strenus	-	-	-	-	-	-	-	-	-	-	-
Cyclops sp.	-	-	-	10	-	-	-	-	-	-	-
Diaphanosoma excisum	-	-	-	-	120	-	-	-	-	-	-
Diaphanosoma sp.	-	-	-	10	-	60	-	-	-	-	-
Diaptomus sp.	-	-	20	-	-	-	70	-	270	250	-
Enterpina acutiformis	-	-	-	-	20	-	-	-	-	40	-
Halicyclops sp.	-	-	-	-	20	30	-	-	-	-	-
Mesocyclops sp.						90	-	-	-	-	-
Microcalanus sp.	-	-	-	-	-	-	-	20	20	-	--
Microsetella novegia	-	30	-	-	-	-	-	-	-	-	-
Oithona sp.	-	-	70	-	-	-	-	-	-	-	-
Paracalanus parvus	-	-	70	-	-	-	-	70	80	100	40
Paracalanus pygmaeus	-	10	-	-	-	-	60	80	-	170	30
Pseudocalanus sp.	-	-	-	-	20	-	-	-	-	-	-
Rhincalanus sp.	-	-	-	-	-	-	70	-	-	-	-
Temora sp.	-	-	20	-	-	-	-	-	-	-	-
Rotifera											
Branchionus calyciflorus	-	-	-	-	60	-	-	-	-	-	-
Branchionus sp.	200	-	-	30	-	-	-	-	-	-	-
Enterpina acutifrons	-	-	-	-	-	-	-	-	-	-	-
Lecane bulla						20	-	-	-	-	-

Table 4. Fin Fish and Shell Fish Caught in a West African estuarine creek in South-western Nigeria

Class/Suborder/Family/Species	Number	Total length range (cm)	Weight range (g)
Actinopterigii			
Labroidei			
Cichlidae			
Sarotherodon melanotheron (Ruppell)*	555	5.40 - 16.50	3.59 – 74.27
Hemichromis fasciatus (Peters)*	49	6.30 – 13.90	3.63 – 42.63
Tilapia guineensis (Bleekers)*	20	8.60 – 15.20	10.53 – 133.08
Tilapia zillii (Gervais)	5	8.30 – 12.00	16.23 – 35.00
Actinopterigii			
Gobioidei			
Gobiidae			
Bathygobius soporator (Valenciennes)	27	12.90 – 14.60	24.76 – 40.00
Eleotris vittata (Dumeril)	26	12.60 – 15.60	24.50 – 42.00
Gobioides africanus (Gilfay)	1	11.60	6.35
Batanga lebretonis (Herre)	20	4.20 – 8.10	3.56 – 6.52
Actinopterigii			
Congroidei			
Ophichthidae			
Ophichthus rufus (Linnaeus)	20	26 - 32	26.70 – 46.00
Actinopterigii			
Knerioidei			
Clariidae			
Clarias gariepinus (Burchell)*	1	26.10	80.0
Heterobranchus bidorsalis (Geoffrey St. Hilaire)*	2	20.0 – 22.0	60.10 – 70.10
Actinopterigii			
Knerioidei			
Bagridae			
Chrysichthys nigrodigitatus (Lacepede)*	2	15.0 – 16.10	50.50 – 53.00
Actinopterigii			
Percoidei			
Carangidae			
Caranx hippos (Linnaeus)	2	8.00 – 8.56	16.00 – 18.00
Actinopterigii			
Channoidei			
Channidae			
Channa obscura (Steindachner)	1	16.80	70.80
Actinopterigii			
Pleuronecoidei			
Citharidae			
Citharus linguatula (Linnaeus)	1	10.30	9.00
Actinopterigii			
Ogcocephalioidei			
Mugilidae			
Mugil cephalus (Linnaeus)*	2	14.10 – 14.50	22.78 – 23.23
Liza falcipinnis (Valenciennes)*	1	12.90	23.76
Malacostraca			
Pleocyemata			
Palaemonidae			
Macrobrachium vollenhoevenii (Herklots)*	30	5.50 – 10.00	5.68 – 12.6
Macrobrachium macrobrachion (Herklots)	27	4.90 – 9.00	5.00 – 11.90
Malacostraca			
Dendrobranchiata			
Penaeidae			
Penaeus notialis(Perez fenfant)*	10	4.90 – 8.50	4.68 – 6.56
Malacostraca			
Pleocyemata			
Portunidae			
Callinectes amnicola (DeRoche burne)*	38	3.30 – 10.50**	3.22 – 65.53

* Fish of economic importance to artisanal fishery in the region.
** Carapace width

assemblage within the creek. Nwankwo (1996, 2004) has also reported higher microalgal abundance in the wet season but associated with unfavourable condition for higher faunal trophic levels within the lagoon. Fagade and Olaniyan (1974) also reported higher fish species diversity in the Lagos lagoon in the dry season (December to May) than in the wet season (June to November). A similar observation has also been reported by Solarin and Kusemiju (2003) and Solarin (1998) for the Lagos lagoon.

Among the zooplankton, whereas cladocerans and cyclopoid copepods were clearly the dominant forms in fresh/low brackish water situations, the calanoid copepods were clearly the dominant forms in higher brackish water situation. Similarly, according to Tackx *et al*. (2004), in an investigation into the zooplankton of Schelde estuary (Belgium), whereas the brackish water zone was dominated by calanoid copepods, cyclopoid copepods together with several cladocerans species dominated the freshwater and low brackish water transect of the estuaries.

The presence of an array of and developmental stages in the plankton of known lagoonal and marine species may point to the suitability of the shallow tidal creek as a nursery and feeding ground for a variety of aquatic organisms.

In total 21 species of fish from 12 families were recorded for the creek; such low fish diversity and quantity is a good indicator of a possibly stressed ecosystem (Leveque, 1995). It is commonly agreed that the higher the fish diversity, the more stable the fish community (Leveque, 1995). Results from this study agree with Albaret and Lae (2003) in Ebrie Lagoon in West Africa. According to this report, the occurrence of marine species like *Caranx hipos, Mugil cephalus, Liza falcipanis* and *Penaeus notialis* indicated that these species live and reproduce from nearly freshwater to hyperhaline waters or conditions. These species are also known to be true migratory fish species. The effect of intense artisanal fishing within the creek may have resulted in a decrease in the composition, abundance and size of fish in the creek per unit time. These effects have been documented in other coastal areas of the world including the Gulf of Thailand (Simpson, 1982), South Africa (Tomlin and Kyle, 1998) and Lagos lagoon, Nigeria (Solarin, 1998).

The sizes and weight of fish encountered throughout the study were much smaller than those reported for the Lagos lagoon; hence the creek may be acting as a nursery ground for fish assemblages. For instance, Emmanuel and Kusemiju (2005) reported that most fish caught in the creek were juveniles. A similar situation was recorded for the fish biota of the creek.

In stressful situations, fish like *S. melanotheron, H. fasciatus, T. guineensis, B. siporator, E. vittaa, B. lebretonis, O. rugus, M. vollenhoevenii, M. macrobrachion,, P. notialis* and *C. amnicola* have demonstrated that their capacity to adapt is very high, which allows them to grow at the expense of species that are less plastic. A similar finding has been reported by Albaret and Lae (2003) for the Ebrie lagoon. The occurrence in one and two of species like *C. gariepinus*, *H. bidorsalis*, *C. nigrodigitatus*, *C. obscura*, *C. linguatula*, *C. hippos*, *M. cephalus* and *L. falcipinnis* may indicate that these species are opportunistic dwellers.

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