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Full Length Research Paper

Fish feeding routine in Anwai stream ichthyofauna, Niger-Delta

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The food and feeding habits of some fish fauna in Anwai stream were investigated. Fish samples (160 individual fish in 19 species) were collected using combination of traps, gill nets of various mesh sizes and baited hooks and lines in the three zones (upper, middle and lower reaches) of the stream. Stomach content analysis was carried out using frequency of occurrence, numerical analysis and volumetric analysis. It was observed that *Hemichromis Fasciatus* competed with fish species of commercial importance viz *Tilapia zilli, Christinus guentheri* and *Oreochromis niloticus* for major food items (100 F% of blue green algae, green algae and diatom). Feeding intensity (absolute importance index) of *Hemichromini bimasculatus* (700) and *O. niloticus* (801) remain relatively higher than that of the other fish species during the study.

Key words: Stomach content analysis, frequency of occurrence, absolute importance index, Anwai stream.

INTRODUCTION

Nigeria is blessed with numerous biodiversity and Anwai stream is not excluded. The diversity in the appearance of fish is the product of millions of years of evolution. Appearance such as shape of mouth (Table 3) or length of intestine could be used to an extent for predicting the food and feeding habits of fish. The digestive system of a fish is typical of vertebrate; herbivorous fish tend to have longer intestine than carnivores because plant matter is tough, fibrous and difficult to breakdown (Alderton, 2008). Some related studies in this area include Oboh et al. (2003) who reported about 23 fish species of the ichthyofaunal food habits of the Jamieson River and Agbabiaka (2012) observed the food and feeding habits of 97 samples of *Tilapia zilli* in river Otamiri south-eastern, Nigeria. Allison et al. (2009) observed 18 species of fish in Igbedi Creek, Bayelsa State. The differences in number of species inhabiting the various water systems are largely influenced by the size of the study area, the system basin structure or some correlate of it such as length of the main channel or stream order (Abowei et al., 2008).

Freshwater bodies such as lakes, reservoirs, streams, rivers etc. are critical components in any ecological system (Ajani and Omitoyin, 2009). Ichthyofauna is all about the fishes in a particular water body. Studies of inland water systems within the Niger Delta have focused mainly on major rivers with little attention given to the streams, in spite of their abundance and importance in the region and the entire at large (Onyeche and Akankali, 2013). One such neglected stream is the Anwai Stream, an alternative source of water supply and source of fish to residents along its course located at Oshimili North Local Government Area of Delta State. The

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Ichthyofauna study in this research focuses on the food and feeding habits of 11 families of fish (160 individual fish in 19 species) encountered within 9 months (April 2010– December 2010) of sampling. It is higher than the species previously observed as compared to other studies observed by Reid and Sydenham (1979) in Odo-on stream. There are two tropical seasons in the area – the rainy season, which occurs between April and October, and the dry season which spans from November to March. The rainy season is usually characterized by high humidity and low atmospheric temperature. The reverse is the case for dry season. The vegetation along the bank of the stream consists of bamboo trees (*Bambussa spinosa*) and Awolowo plant (*Odorata spp*), Dongoyaro plant (*Azadiratcha indica*) and palm trees especially the Delta State University palm oil plantation. The purpose of this study was to determine the food and feeding habits in Anwai stream ichthyofauna.

MATERIALS AND METHODS

The Anwai Stream is located between latitude 6° 15N' and 6° 20N' and Longitude 6° 23'E and 6° 06'E (Figure 1). In this study, 9 sampling stations were chosen. Sampling stations were demarcated in an interval of 1 km. The stream was zoned into three (3), each zone is made up of 3 stations constituting a reach, with the upper reaches having stations 1 – 3, the middle reaches were stations 4 – 6, and stations 7 - 9 made up the lower reaches. Samplings were carried out over a period of 9 months.

Identification of fish samples

Fish specimens collected from sample stations (Table 1) were identified to species level using the available identification keys, check list and flesh cards, as well as the taxonomic work of Reed et al. (1967) and Idodo-Umeh (2002). The morphometric measurements of fish samples, meristic counts, squamation and the lengths of each fish sample collected were measured with the aid of a measuring board (Table 3).

The gut content analysis

The fish specimens collected were weighed at the fisheries department, Delta state University laboratory. In the laboratory, the selected fish specimens were dissected and the stomach contents emptied into a Petri dish, sorted and the relative importance food items was using the following standard methods.

Frequency of occurrence

The number of stomachs in which a given category of food item occurs is expressed as a percentage of the total number of nonempty stomachs examined (Windell and Bowen, 1978).

Numerical analysis

The number of food items of a given type that were found in all samples examined was expressed as a percentage of all food items (Windell and Bowen, 1978).

Volumetric analysis

Food items were sorted into different taxonomic categories and the water displaced by a group of items in each category was measured in a partially filled graduated cylinder (Windell and Bowen, 1978). Then, the volume of water displaced by each category of food item was expressed as a percentage of the total volume the stomach contents (Windell and Bowen, 1978).

The frequency of occurrence method entails recording the number of stomach containing a particular food items while in the numerical method, the number of different food items found were counted and recorded. The viscera of each fish was removed and cut open before preservation to ensure penetration of the preservative, which was 10% formalin. The gutted weight of each specimen was determined using a weighing balance (model PN1200) by Samsung. The gutted fish specimens were which were not examined immediately was preserved in 4% formalin for later examination. Before being examined, content of the stomach were placed on filter papers to soak away the excess moisture and by using a clean watch glass of a known weight the stomach contents weight was determined to the nearest kilogram which was then used to calculate the absolute importance index. Increase in weight was then the weight of food present and the value is a percentage of the body weight of each fish (Table 4).

The stomach contents of each fish were then washed to a Petri-dish, using a known volume of clean water and using a calibrated Petri-dish, a haemocytometer, a counting chamber and a microscope, the content of the stomach were examined and identified.

Frequencies of occurrence as well as numerical strength were the two methods of food analysis adopted. Identification of the various food items was carried out using keys by Needham and Needham (1962) and Kadiri (1987). Dietary importance was assessed using the index of relative importance based on the formula:

IRI = (%N + %V) %F (Zelibe 1982)

Where, N = % by number; V = % Volume or % Vol.; F = % frequency of occurrence or % F;

Whereas, absolute importance index (AI) was assessed based on the formula:

AI = %F + %N + %W

Where, W = total weight.

While relative importance (RI) is assessed based on the relationship:

Stomach content analysis

The result of the stomach content analysis is given in Table 4. Seven major groups of food items were identified: blue green, desmids, green algae, diatoms, protozoa, anthropods and crustacean.

RESULTS

From the result obtained in Table 2, it can be seen that

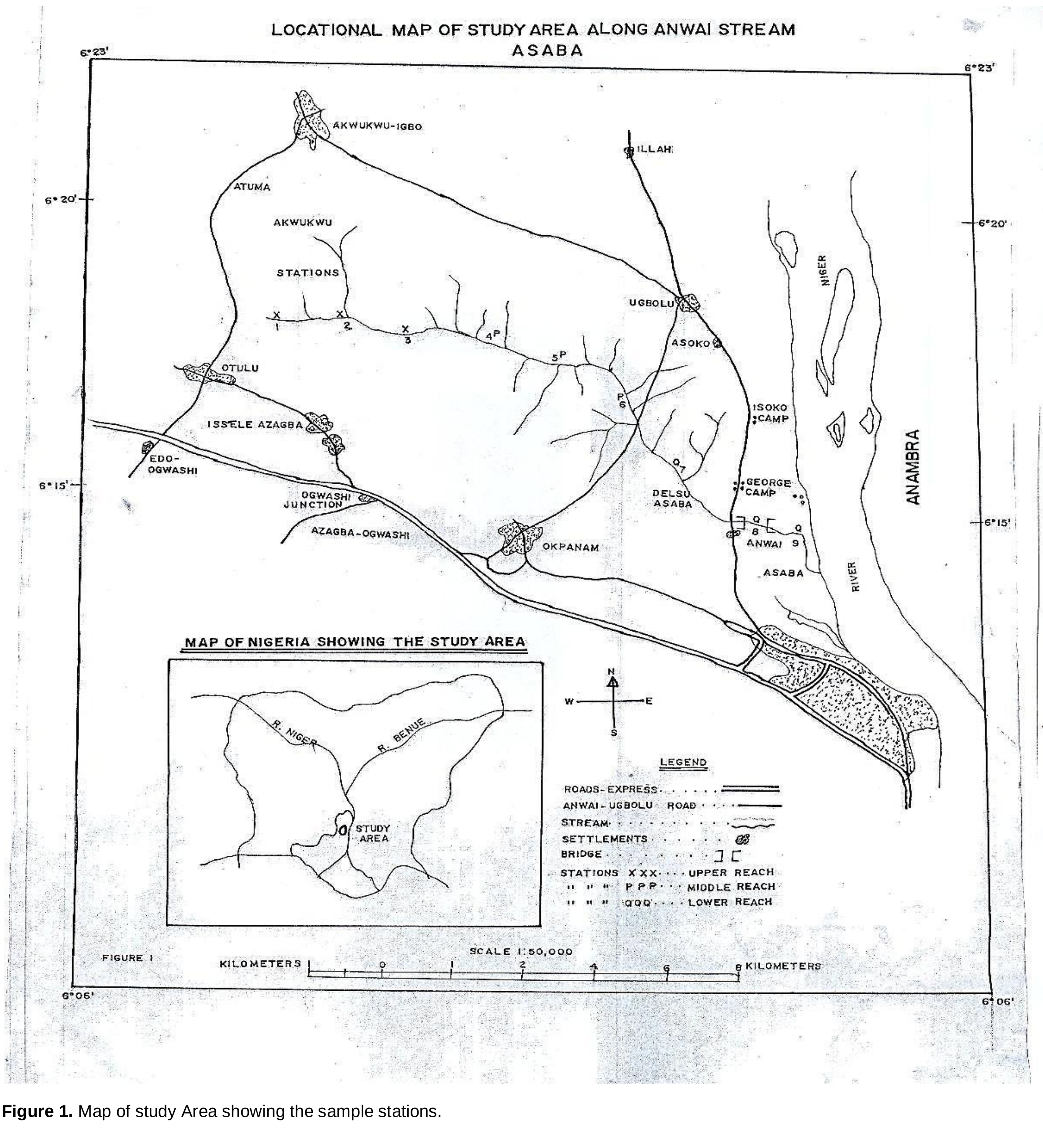

Figure 1. Map of study Area showing the sample stations.

the middle reaches had more number of fish caught with a value of 86, lower reach 49 and upper reach 25. At the upper, middle and lower reach, Cichlidae was the highest caught (21, 9, and 43, respectively) while Gymnarchidae was relatively the lowest in all reaches (1, 0, and 1, respectively).

When analyzed (Table 3), the anatomy of fishes caught to an extent can reveal their feeding habits (Alderton, 2008). From Table 3, comparing Claridae and Cichlidae, *Gnathonemus petersii* had a SNL value of 3.65, with this result it may be said that *G. petersii* is a mid-water feeder since it has an elephant nose (slightly protrusive jaws)

Table 1. Biophysical characteristics of sampling stations.

Station	Biophysical characteristics
Station 1 (Upper Reach)	Towards the Head stream. It is sandy and shallow, extending over a distance of 0.3 km along a narrow course with a mean maximum depth of 1.21 m. The substrate is predominantly sandy. Aquatic plants present in station 1 include *Nymphae lotus* linneaus, commonly known as water lily, found floating in the back waters of the stream; *Azolla pinnata* (water velvet); *Pistia stratioles linneaus* (water lettuce); and *Salvinia molesta* (ferns). Fringing the shoreline of this station is a dense population of *Panicum subalbidum*
Station 2 (Upper Reach)	It is very shallow and has a narrow course extending over 1 km distance with a mean maximum depth of 1.43 m during the dry season and rainy season. The fringing vegetation and aquatic plants are similar to those found in station 1 and the substrate is muddy
Station 3 (Upper Reach)	This is shallow extending over 1.50 km with a mean maximum depth of 1.5 m during the dry and rainy season, respectively. The fringing vegetation is similar to those found in stations 1 and 2.
Station 4 (Middle Reach)	Consist of a shallow area extending beyond 1.85 km. The substrate is muddy with a mean maximum depth of 1.5 m. The fringing vegetation is similar to those of stations 1 to 3
Station 5 (Middle Reach)	This station is shallow and narrow extending over 0.85 km with a mean maximum depth of 1.85 m during both the dry and rainy season. It has similar fringing vegetation to those of station 1 to 4
Station 6 (Middle Reach)	Predominantly shallow, with a course stretching over 0.53 km long with a mean maximum depth of 2.1 m during the dry season and rainy season. The fringing vegetation is same as observed in stations 1 to 5
Station 7 (Lower Reach)	The length is 0.25 km and it has a mean maximum depth of 3.8 m. The surrounding vegetations are bamboo trees (Bambosa spinosa), Awolowo plant (Odorata spp), while the fringing vegetation is similar to that in the other stations (1 to 6)
Station 8 (Lower Reach)	Its course stretches over a distance of 0.35 km with a mean maximum depth of 4.3 m. The fringing vegetation although similar, but are very scanty compared to other stations
Station 9 (Lower Reach)	This has the widest course with silting and muddy substrate. The water velocity is high. It stretches over a distance of 0.15 km with a mean maximum depth of 4.5 m.The fringing vegetation is similar to all the other stations, with the exception of station 8 in terms of scantiness

perhaps for easy catching of passing food particles. *C. gariepinus* (Claridae) had a higher Snout Length (SNL) value of 4.55, *T. zilli* 1.3 while *C. kingsleyae* (tailspot fish) had the lowest value of 0.9. This may be an indication that the most of the species in the family Claridae are mostly bottom feeders since they have suckerlike mouths for scraping food and algae from rocks, and scavenging from the bottom of the stream while Anabantidae and Cichlidae are more of surface feeders since they have relatively short upper jaw, which enables them to grab invertebrates such as desmid and diatoms at the water's surface easily. Based on the large size of their mouth (SNL), *C. gariepinus* and *G. petersii* might be said to be predators. Predators tend to have much larger mouths than omnivores. This is in support to Alderton (2008).

Occurrence of food item in excess 25% in more than one fish species is indicative of interspecific competition (Johnson, 1977). The AI and RI for *Xenomystus nigri* and *Erpetoichthys* are pointers to interspecific competition for desmids. Green algae are relatively and absolutely important in the diet of *Erpetoichthys*. Diatoms are absolutely and relatively important in the diet of *X. nigri* and *Erpetoichthys*. Similar, Arthropods, crustaceans are absolutely and relatively important in the diet of all the fish species caught except in *X. nigri.* In the same vein, protozoans are absolutely important in the diet of all the fish species.

Dragovitch (1970) used the criteria of frequency of occurrence and number of individual food items to assess dietary importance while Tyler (1972) and Hyslop (1980)

Table 2. Number of fishes caught and the calculated biomass (kg) during the study.

S/N	Family name	Species	STATION 1-3 UPPER REACH		STATION 4-6 MIDDLE REACH	Biomass of fish caught (kg)	STATION 7-9 LOWER R.	Biomass of fish caught (kg)	Fish caught	Biomass (kg)
			No. of fish caught	Biomass of fish caught (kg)	No. of fish caught		No. of fish caught		Total no. of fish caught	Total biomass of fish caught (kg)
1	Anabantidae	*Ctenopoma kingsleyae*	2.00	0.50	3.00	1.00	0.00	0.00	5.00	1.50
2	Bagridae	*Auchenoglanus biscutatus*	0.00	0.00	4.00	1.70	2.00	0.65	6.00	2.35
3	Channida	*Channa Obscura*	0.00	0.00	6.00	2.50	3.00	0.80	9.00	3.30
4	Cichlidae	*Chromidotilapia quentheri*	0.00	0.00	7.00	2.10	3.00	0.80	10.00	2.90
		Hemichromis bimaculatus	1.00	0.35	1.00	0.30	0.00	0.00	2.00	0.65
		Hemichromis fasciatus	0.00	0.00	7.00	2.70	3.00	0.95	10.00	3.65
		Tilapia mariae	4.00	1.10	6.00	1.70	3.00	1.40	13.00	4.20
		Tilapia zilli	0.00	0.00	5.00	1.88	3.00	1.65	8.00	3.53
5	Claridae	*Clarias gariepinus*	3.00	0.75	6.00	1.70	6.00	1.94	15.00	4.39
6	Mochokidae	*Syndontis filamentosus*	4.00	1.55	9.00	3.40	5.00	1.88	18.00	6.83
		Syndontis membranaceus	4.00	1.40	6.00	2.00	4.00	1.30	14.00	4.70
		Syndontis clarias	0.00	0.00	6.00	1.89	4.00	1.45	10.00	3.34
7	Gymnarchidae	*Gymnarchus niloticus*	0.00	0.00	1.00	3.50	0.00	0.00	1.00	3.50
8	Malapteridae	*Malapterurus electricus*	1.00	0.10	2.00	1.50	1.00	0.20	4.00	1.80
9	Mormyridae	*Gnathonemus petersil*	0.00	0.00	2.00	0.65	0.00	0.00	2.00	0.65
		Mormyrus macrothalmus	1.00	0.30	2.00	0.50	1.00	0.30	4.00	1.10
10	Hepsetide	*Hepsetus odoe (Afrikan pike)*	2.00	0.70	5.00	1.55	3.00	0.95	10.00	3.20
11	Notopteridae	*Xenomystus nigri*	2.00	0.60	5.00	1.90	3.00	0.70	10.00	3.20
12	Polypteridae	*Erpetrichthys (calamachthys)*	1.00	0.30	3.00	0.95	5.00	1.04	9.00	2.29
		Total	25.00	7.65	86.00	33.42	49.00	16.01	160.00	57.08

considered important items as major food-energy sources and specific levels of occurrence. From the experiment carried out, arthropods and crustaceans were found to be absolutely important in diet of all the fish species except for *C. kingsleyae.* Flesh digested (nektons) was important in the diet of *Gymnarchus niloticus* (Figure 2).

The above observation supports all the findings of Johnson (1977) on the frequency of occurrence and numerical methods for the gut content analysis. There is therefore interspecific competition among the fish species, because the various food categories are either absolutely important, or relatively important, or both absolutely and relatively important to the various fish species.

All fish species caught apart from *X. nigri, G. niloticus, Erpetoichthys* and *H. odoe* competed for blue green algae. The completion was strongest among cichlids (Figure 2). Similarly, they all competed for desmids except *S. filamentous*, *S. membranaceus, S. clarias, H. odoe* and *G. niloticus* while all but *G. niloticus* competed for diatoms and protozoa only. All other species competed for diatoms, protozoa, anthropods, crustaceans and dead food (nektons).

DISCUSSION

From Table 3, it is observed that the SNL of the different fish samples varied. This gives an insight

Table 3. Mean of some morphometric measurement of fish caught and identified.

S/N	Parameters	*C. kingsleyae*	*A. biscutanus*	*C. obscura*	*C. guentheri*	*H. bimaculatus*	*H. fasciatus*	*T. zilli*	*T. mariae*	*C. gariepinus*	*G. niloticus*	*G. petesii*	*M. electricus*	Average mean
1	TL	16.23	15.79	24.74	12.53	8.30	14.48	13.12	12.85	19.90	29.01	22.90	19.06	17.41
2	SL	12.98	10.47	22.39	9.66	6.70	11.50	10.36	9.94	17.16	29.00	17.40	16.03	14.47
4	BD	4.86	2.53	3.38	3.38	2.55	4.13	5.09	4.21	2.83	3.60	4.75	4.10	3.78
9	SNL	0.90	1.71	1.57	1.62	2.90	1.63	1.30	1.11	4.55	1.50	3.65	1.77	2.02

TL = Mean of total length (cm); SL = Mean of standard length (cm); BD = Body depth; SNL = Snout length; BD - % against SL; SNL - % against HL.

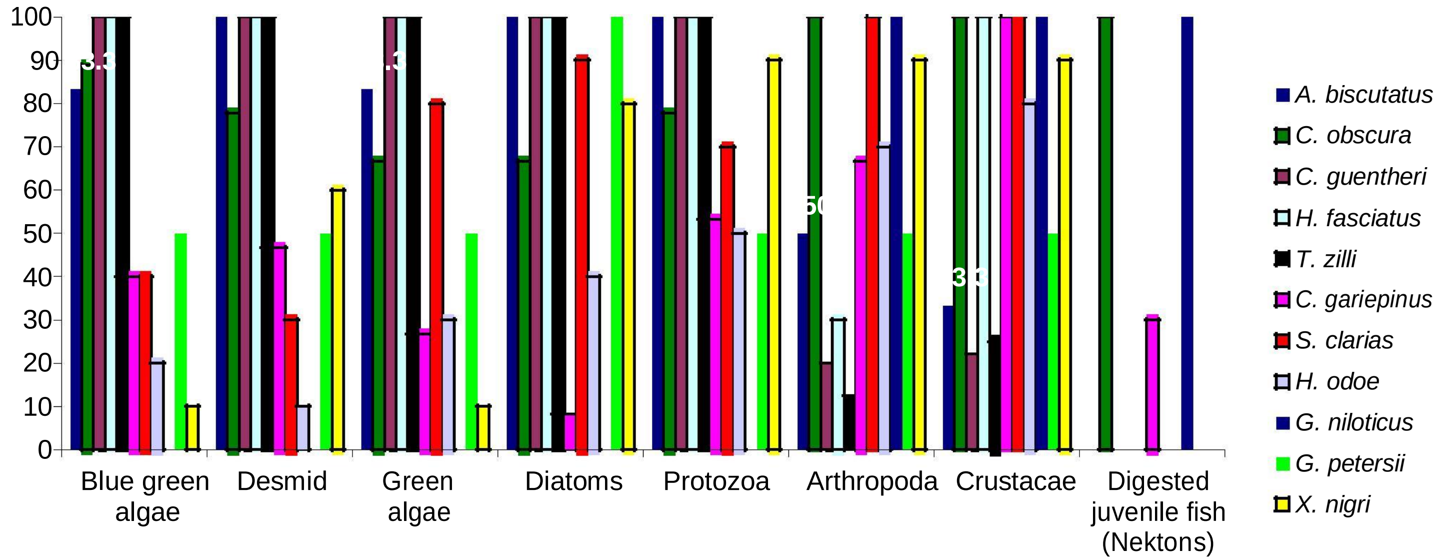

Figure 2. Some food category identified during the stomach content analysis.

to the different size of food items they can consume. At the back of the throat of some fish samples were tooth-like structures perhaps for grinding food before it is swallowed, making it more accessible to digestive enzymes. The stomach analysis was easily carried out because; food is stored in the stomach of the fishes. Once the swallowed food passes into the intestinal tract, nutrients are absorbed.

Predators tend to have larger mouth than omnivores. *Claridae* and *G. petersii* had barbells at the side of their mouths as sensory feelers helping them to locate edibles hidden in the substrate. *Tilapia* has terminal mouth with a short snout for this would be for easy picking of phytoplankton. *Hemichromis fasciatus* also had a terminal mouth but wider than that of *H. bimasculatus. M. electricus* have a terminal mouth and the snout is rounded with 3 pairs of barbells. *G. petersii* had dorsally situated mouth (oblique) at the base of the pointing upper jaw. It can be

Table 4. Absolute importance and relative importance indices of food categories.

S/N	Food categories	Blue Green				Desmid				Green Algae				Diatoms				Protozoa				Arthropods				Crustacean				Total
	Fish species	F%	N%	AI	RI	F%	N%	AI	RI	F%	N%	AI	RI	F%	N%	AI	RI	F%	N%	AI	RI	F%	N%	AI	RI	F%	N%	AI	RI	AI
1	*Ctenopoma kingleyae*	60	13	73	15	80	6.3	86	18	80	25.3	105	22	40	19	59	12.3	80	31.6	112	23	20	1.3	21	44	20	3.8	23.8	5	480
2	*A. biscutatus*	83.3	9.3	93	14	100	46.2	146	22	83.3	30.8	114	18	100	6.2	106	16.3	100	3.1	103	16	150	1.5	52	7.9	35.5	3.1	38.6	5.9	653
3	*C. obscura*	88.9	26	115	17	77.8	12.9	91	13	66.7	23.2	89.9	13	66.7	10	77	11.4	77.8	4.8	87.6	13	100	10.3	110	16	100	7.7	108	16	678
4	*C. guentheri*	100	6	106	17	100	15.1	115	18	100	18.1	118	18	100	27	127	19.8	100	6	106	17	20	9	29	4.3	22.2	19	40.9	6.4	642
5	*H. bimaculatus*	100	11	111	16	100	6.4	106	15	100	25.5	126	18	100	11	111	15.8	100	31.9	132	19	50	10.6	61	8.7	50	4.3	54.3	7.8	700
6	*H. fasciatus*	100	12	112	17	100	6	106	16	100	18	118	18	100	24	124	19	100	29.8	130	20	30	6	36	5.5	20	4.8	24.8	3.8	650
7	*T. mariae*	100	14	114	17	100	18	118	18	100	16.2	116	18	100	27	127	19.2	92.3	9	101	15	38.5	7.2	46	6.9	30.8	9	39.8	6	662
8	*T. zilli*	100	13	113	18	100	15.1	115	18	100	25.2	125	20	100	25	125	19.6	100	13.4	113	18	12.5	4.2	17	2.6	25	4.2	29.2	4.6	637
9	*C. ganepinus*	40	6.9	47	10	46.7	11.1	58	12	26.7	13.9	40.6	8.7	33.3	8.3	41.6	8.9	53.3	20.8	74.1	16	66.7	27.8	95	20	100	11	111	24	467
10	*S. filamentosus*	38.9	10	49	8.7	44.4	11.5	56	10	50	14.4	64.4	12	55.6	14	69.3	12.3	77.8	14.4	92.2	16	94.4	21.6	116	21	100	14	114	20	561
11	*S. membranaceus*	42.9	37	80	16	28.6	7.5	36	7	35.7	18.7	54.4	11	42.9	3	45.9	8.9	71.4	13.4	84.8	17	92.9	9	102	20	100	11	111	22	515
12	*S. clarias*	40	9.3	49	8.1	30	14	44	7.2	80	32.7	113	19	90	13	103	16.9	70	15	85	14	100	11.2	111	18	100	4.7	105	17	610
13	*H. odoe*	20	4.8	25	6.2	10	7.6	18	4.4	30	4.8	34.8	8.7	40	9.7	49.7	12.4	50	11.4	61.4	15	70	42.9	113	28	80	19	99	25	400
14	*G. niloticus*	100	1.8	102	13	100	3	103	13	100	1.2	101	13	100	5.9	106	13.1	100	5.9	106	13	100	58.8	159	20	100	24	124	15	801
15	*G. petersii*	50	5.6	56	11	50	16.7	67	13	50	20	70	14	100	13	113	22.7	50	11.1	61.1	12	50	17.8	68	14	50	16	65.6	13	444
16	*M. electricus*	25	8.2	33	4.1	25	5.9	31	3.9	50	21.2	71.2	8.9	25	18	42.6	5.3	25	5.9	30.9	3.9	25	29.4	55	6.9	25	12	36.8	4.6	301
17	*M. macrophthalmus*	25.8	8	33	11	50	14.4	64	21	25	2.4	27.4	9.1	50	12	62	20.6	25	3.2	28.2	9.4	100	32	132	71	100	28	128	48	432
18	*Xenomystus nigir*	10	9.8	20	11	60	7.5	68	37	10	11.5	21.5	12	80	14	93.8	50.8	90	20.7	111	60	90	12	102	55	90	20	110	59	526
19	*Erpetoichthys*	22.2	16	38	16	100	12	112	48	33.3	14.4	47.7	20	22.2	9.6	31.8	13.6	77.7	16	93.7	40	66.6	20	87	37	55.5	12	67.5	29	478

F= frequency, AI = Absolute importance index; ——, N % = percentage of individual items; RI = relative importance index.

concluded that the jaws of these fishes enable them to dig quite effectively. *G. niloticus* had a terminal mouth with upper jaw projected slightly beyond the lower jaw. *C. gariepinus* has large terminal mouth and four pairs of barbells a distinct feature of its cannibalistic nature.

The Cichlids – *C. guentheri, H. bimasculatus, T. mariae, T. zilli,* preferred phytoplankton, the catfishes*, C. gariepinus, S. membranaceus, and S. clarias* preferred zooplankton. *G niloticus* preferred crustaceans and fish flesh (nektons). *M. electricus* had greater appeal for phytoplankton and zooplankton, arthropods and crustaceans whereas; *Mormyrus macrophthalmus* had greater preference for the arthropods and crustaceans. *X. nigri* had greater preference for desmids, diatoms, protozoa, arthropods and crustacean, while *Erpetoichthys* had preference for protozoa, arthropods and crustaceans. Hence there is healthy competition for food items among the fishes.

All fish species caught apart from *X. nigri, G. niloticus, Epertoichthys* and *Hepsetus odoe* competed for blue green algae the competition was strong among Cichlids. Cichlids are plant eating but from the results shown in Table 4, it is evident that they also act as predators on crustaceans and arthropods.

Similarly, they all competed for desmids except *S. filamentous*, *S. membranaceus, S. clarias, H. odoe* and *G. niloticus* while all but *G. niloticus* competed for diatoms and protozoa only. All other species competed for diatoms, protozoa, anthropods, crustaceans and dead food (nektons).

Green algae are relatively and absolutely important in the diet of *Erpetoichthys*. Diatoms are absolutely and relatively important in the diet of *X. nigri* and *Erpetoichthys.* Similarly, arthropods, crustaceans are absolutely and relatively important in the diet of all the fish species caught except in *X. nigri*. In the same vein, protozoans are absolutely important in the diet of all the fish species.

Arthropods and crustaceans were found to be absolutely important in the diet of all the fish species except for *C. kingsleyae.* Digested fish was absolutely important in the diet of *G. niloticus*.

The above observations support all the findings of Johnson (1977) on the frequency of occurrence and numerical methods for the gut content analysis. There is therefore interspecific competition among the fish species, because the various food categories are either absolutely important or relatively important, or both absolutely and relatively important to the various fish species.

The 19 species observed in this study was lower than the number identified by Reid and Sydenham (1979) of lower Benue River (120 species) Victor and Tetteh (1988) of Ikpoba river, Benin-City (58 species), while Imevbore and Okpo (1975) on River Niger (70 species) but higher than them all in terms of total individual fish (160). The most abundant species were *Claridae* (53), *Cichlidae* (43), *Mormyridae* (16) and *Notopteridae* (10). The least common was *Gymnarchus* (1). However, the biomass placed the *Gymnarchus sp.* third even though only one was caught because of its size. Yet, the fish with the highest biomass were *Claridae* (53), *Cichlidae* (14.93), and *Mormyridae* (4.95) (Table 2).

The specie composition does not agree with the result of other similar studies; Lowe-McConnell (1964) encountered 44 species on the Rupenninme River and Okereke (1990) in her study of Otamiri River, Imo state, observed 46 species in 20 families and Alfred-Ockiya (1996) encountered 41 species in Kolo Creek, river state.

The reason for this may be a result of longer time in sampling (9 months) compared to other similar studies. Secondly, the high number of specie directly caught from Anwai stream which is a tributary of the River Niger experiences increased flooding during the rainy season from the river Niger, thus bringing in more fish species into its fishery. The seasonal flooding enriches the stream with food and acts as a trigger for breading. This high species during increase flooding could also be attributed to less fishing activities on the stream by fishermen in the area.

Conclusion

The results of the present study showed that the middle reach had 85, lower reach 49 and upper reach 25 fishes this may imply that the stream is productive or there is low fishing pressure and seasonal flooding enriches the stream with both fishes and fish foods. Nevertheless, there is healthy interspecific competition for food items among the fishes since the various food categories were either absolutely important or relatively important or both absolutely and relatively important to various fish species. The food and feeding habits results of the common fishes in Anwai stream suggests that they can be used as culture species since their food and habits are known.

RECOMMENDATIONS

Based on the results of the study, it is recommended that:

1. As a viable fishing area more studies are required to confirm this high number of fish species encountered,
2. The lower reach of the stream with the high human activities such as washing of cars, rugs, canopies, chairs, bicycles, motor cycles, clothes, plates, bathing, fetching of water and human defecations and effluents from the cassava fermentation needs more studies so as to provide / assess the water quality.

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