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Trophic relationship of fish species in Ogbese River, Ado-Ekiti, South-Western, Nigeria

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This study was conducted to determine the trophic relationship of *Clarias gariepinus*, *Parachanna obscura*, and *Oreochromis niloticus* collected from Ogbese River, Ado Ekiti, South-Western, Nigeria between June and September, 2017. The fish specimens were examined and their stomach contents analyzed. Numerical, frequency of occurrence and volumetric methods were employed in this study. The result of the analysis showed that *C. gariepinus*, *P. obscura* and *O. niloticus* fed on similar food items. These were mainly algae, nematode worms and insects. The stomach content of *C. gariepinus* consisted of animal and plant materials, planktons (phytoplankton and zooplankton) as well as detritus. The dominant animal material found was flying termite *Cryptotermes* species with 55.23% and plant material was maize seed with 16.62%. The stomach of *P. obscura* consists mainly of plant and animal materials, planktons and unidentified food items. Algae represented by *Euglena* species accounted for 66.67% and Nematode worm (22.22%) was the dominant animal material. The stomach of *O. niloticus* consisted of plant and animal materials, detritus and mud. Filamentous algae represented by *Spirogyra* spp. 75.42% was the dominant plant material. Thus, each species depended on more than one food source. However, overlaps existed, fishes were found to feed on more than one type of food item which reduced competition and encouraged coexistence. Based on the food items encountered for the period of study in the stomachs of *C. gariepinus* and *P. obscura* are omnivorous while *O. niloticus* is herbivorous in Ogbese River, Ado-Ekiti. The relative importance index (RI) showed that the most important food items in *C. gariepinus*, *P. obscura* and *O. niloticus* are insect (45.0%), algae (59.91%) and (62.42%), respectively.

Key words: Trophic relationship, fish species, food items, relative importance, Ogbese River.

INTRODUCTION

Understanding food and feeding habits of fish is useful to all scientists who are concerned with any aspect of fisheries. Oribhabor et al. (2019) reported that potential food resources of fish consist of all material present in its environment. Fishes have been known to feed on wide variety of items ranging from sand particles, phytoplankton, zooplankton, leaves, root, crustaceans, insects, insect larvae, worms, fishes, etc (Shalloof and

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Khalifa, 2009; Omondi et al., 2011).

Regarding the aquatic food webs, macro-benthos and plankton are the main components in the trophic dynamics of freshwater ecosystems; also they serve as a bioindicator for the environmental status in a given time (Farrag et al., 2019). Phytoplankton is microscopic organisms that are considered as primary producers and forming a major food source for primary consumers. Zooplankton plays a role in the aquatic food chains, as a resource for higher consumers of trophic levels, including fish and especially fish juveniles (Zakaria et al., 2016; Zakaria et al., 2018). Benthic invertebrates exhibit a marked variation in composition and abundance according to their habitats; they play a vital role in transferring energy to higher trophic level. Benthic invertebrates functionally play big roles in fish production. They are considered as the main food source for many demersal fishes (Mona et al., 2019; El-Naggar et al., 2017).

According to the type of food and mode of feeding, fishes can be divided into four feeding types; herbivores, omnivorous, carnivorous and plankton feeder. Herbivorous fishes: a number of fresh water fishes feed mainly on unicellular algae, filamentous algae and portion of higher aquatic plants along with some mud or sand. Herbivorous fishes are not common. Examples include Parrot fishes (*Scarus frenatus*) and Damsel fishes (*Stegastes variabilis*). In tropical freshwater ecosystem, Tilapias dominate the herbivores, e.g. *Oreochromis niloticus*, *Sarotherodon galilaeus*. Other species include Clupeids: *Pellonula leonensis*, *Ethmalosa fimbriata*.

Omnivorous fishes, a large number of fishes feed on unicellular and filamentous algae and portion of higher aquatic plants, rotifers, insects and their larvae, crustaceans, mud and sand. They are thus regarded as omnivores in habit. Most catfishes fall into this group. Other examples include Clariidae, Mormyridae, *Alestes* species, Mochokids and *Synodontis* species.

Carnivorous fishes, a number of fishes feed on high percentage of animals such as crustaceans, mainly copepods, water bugs, beetles, dragonfly, larvae, etc. Small fishes, tadpoles, etc., are also taken. They are adapted to predatory mode of life because they have jaws, stronger muscles, more agile movement, better balance and improved special senses. Examples include Perch (*Perca flavescens*), Muskie (*Esox masquinongy*), Walleye (*Sander vitreus*), African pike (*Hepsetus odoe*) and Salmon (*Oncorhynchus gorbuscha*).

Plankton feeders feed on phytoplankton and zooplankton through their gill rakers. Example includeS; Mullet (Mugil *cephalus*), Herring (*Clupea harengus*), and Whales (Asuquo and Essien-Ibok, 2019).

Studies on diet composition are important in community ecology because the use of resources by organisms has a major influence on population. Studies on stomach contents could provide useful information on trophic level in their environment and in formulating management strategy option in multispecies fishery (Adeyemi et al., 2009).

The diet of cultured fish species does not provide precise and reliable information on the food and habits and condition factor of such species (George et al., 2013). Hence, most studies which aimed at obtaining such information are based on the analysis of gut contents of fish caught from their natural habitats (George et al., 2013). The study of other food and feeding habits of fish species is a subject of a successful fisheries management programmed on fish capture and culture and because the aquatic ecosystem is dynamic (Imaobong et al., 2014).

Many authors have reported both *C. gariepinus* and *O. niloticus* to be omnivorous in water bodies they studied. These include the works of Adeyemi et al. (2009) in Gbedikere Lake, Bassa Kogi State; Wakil et al. (2014) in Lake Alau, North-Eastern Nigeria; Adewumi et al. (2014) in Egbe Reservoir, Dadebo et al. (2014) in Lake Koka, Ethiopia and Hussein et al. (2019) in River Nile, Egypt. *Parachanna obscura* has been reported to be Idowu and Ugwumba (2006) in Orashi River, River State, Nigeria showed that food items in the stomach of *P. obscura* covered a wide feeding range, juveniles fishes were basically benthic feeding on nematodes worms, fish larvae, tadpole larvae and insect. Adult, *P. obscura* are surface or benthic feeders, feeding mostly on fish, nematode worms, crustaceans, insects and tadpoles. This suggests that *Parachanna obscura* is a carnivore and also considered as piscivore-insectivore-invertivore in feeding habits.

Analysis of stomach content of fish could provide information about the niche of the particular fish in its ecosystem. In the wild, nature offers a great diversity of food including host of animals and plants (Offem et al., 2009). It also enhances the understanding of the growth, abundance, reproductive and distribution of organism.

Studies on food and feeding habits give information on seasonal changes of fish because the type and magnitude of food available as well as the season it occurs plays an important role in the history of the fish (Akpan and Isangedhi, 2005). However, little information exists on the diets of freshwater fishes in Nigeria water despite their commercial importance (Idodo-Umeh, 2002; Inyang and Nwani, 2004).

This study therefore investigates the stomach contents of Catfish (*Clarias gariepinus*), Snake head fish (*P. obscura*) and Nile Tilapia (*Oreochromis niloticus*) being the three most important commercial fish species in the river in order to ascertain the types of food content consumed by the said fish species in Ogbese River, Ado-Ekiti, and also to establish their feeding relationships.

MATERIALS AND METHODS

The study area

This study was carried out in Ogbese River (Figure 1) in Ado-Ekiti

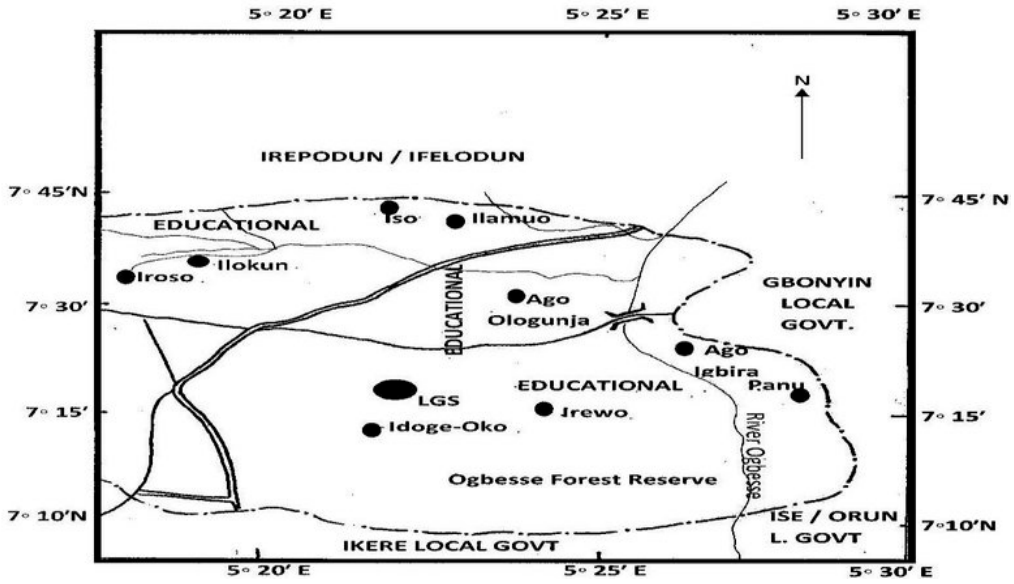

Figure 1. Map showing River Ogbese
Source: https://www.researchgate.net/figure/Map-showing-River-Ogbese_fig2_282459902

Local Government Area, Ekiti State. Ogbese River is a running stream where fishing activities are not restricted. Ogbese River in Ado-Ekiti lies between Latitude 7°45'N and Longitude 5°30'E of the equator within the tropical rainforest of Ekiti State. Ogbese River is one of the major rivers in South-Western Nigeria particularly in Ekiti State where the study was carried out. It has many tributaries such as River Osse, River Elemi, etc. The river cut across three states in Nigeria; Ondo, Ekiti and Kogi. The river plays important roles in the socioeconomic development of the people living beside and near it, such as fishing, farming (Irrigation) and washing.

Ekiti State covers about 6,353 km² land area. The state is mainly on upland zone rising over 250 m above sea level. It lies in an area underlained by metamorphic rock and dotted with rugged hills. Its vegetation is rainforest with characteristic tall trees and grasses. In terms of fisheries development, there is no stocking of the river; hence the fish in the river are naturally occuring. Examples of the fish species present in Ogbese River include *C. gariepinus, O. niloticus, Heterobranchus bidorsalis, Mormyrus time, Mormyrus macrophythamus, Malapterurus electricus, Hepsetus odoe, P. obscura* and *Tilapia zillii* (Adewumi et al., 2015).

Collection of fish sample

Sampling was done for a period of four months between June, 2017 and September, 2017. Data for this study was based on the record of fish caught by local fishermen. The collection of samples was done once in a week from the landing site of the fishermen. The fishermen used different mesh size of set nets (5-22 mm) and hooks and line. The setting of these gears was mostly done in the evenings by 6.00 pm and left overnight, till 6.30 a.m. The samples were collected, which was taken to the laboratory of the Department of Zoology and Environmental Biology, Ekiti State University, Ado-Ekiti, where the morphometric parameters of each specimen were taken. The fish for those who are alive were killed and dissected to expose the viscera, and the digestive system was removed using forceps. The digestive tract was preserved in 4% formalin pending examination of stomach contents. Stomach fullness was graded by the method of Ugwumba and Adebisi (1992) and the content was emptied into a Petri dish for examination. The organisms were identified and counted under a stereoscopic binocular microscope at varied magnifications.

Food and feeding habits

Analysis was carried out using the numerical, frequency of occurrence and volumetric methods (Hynes, 1950; Lagler, 1956; Hyslop, 1980).

Values from the three different methods were employed in calculating the relative importance index (RI), thus:

$$RI = 100 \times AI / £AI$$

where AI = %N + %F + %V. %N = percentage of food items from numerical method. %F = percentage of food items from frequency of occurrence method. %V = percentage of food items from volumetric method.

RESULTS

A total of 221 specimens of *C. gariepinus,* 113 specimens of *P. obscura* and 111 specimens of *O. niloticus* were examined from June to September, 2017 in Ogbese River. The total length (TL), standard length (SL) and body weight ranged from 23.5 to 39.8 cm, 21.4 to 35.3 cm and 115.3 to 508.6 g in *C. gariepinus.* In *P. obscura,* the standard length ranged between 20.6 and 31.1 cm, total length ranged from 22.0 to 36.1 cm and weight ranged from 137.3 to 401.9 g. Also in *O. niloticus,* size ranged from 13.3 to 26.8 cm total length (TL), 11.1 to 21.9 cm standard length (SL) and 44.9 to 304.6 g body weight.

Table 1 shows the summary of the food items in *C. gariepinus.* The items encountered in the stomach of *C.*

Table 1. Major food items in the stomach of *Clarias gariepinus* from Ogbese River.

Food items	Numerical method		Frequency of occurrence method		Volumetric method	
	No	%	No	%	No	%
Algae						
Spirogyra spp.	55	14.75	0.13	4.22	16	7.71
Zooplankton						
Rotifer	2	0.54	0.06	1.95	1.0	0.48
Filinia spp.	15	4.02	0.13	4.22	6	2.89
Branchionus spp.	10	2.68	0.19	6.17	3.5	1.69
Worm						
Nematode worm	1	0.27	0.06	1.95	2	0.96
Annelid worm	21	5.63	0.25	8.12	10	4.82
Chironomid larvae	1	0.27	0.06	1.95	1	0.48
Insect						
Dragon fly	206	55.23	0.19	6.17	53	25.54
Flying termite	62	16.62	0.13	4.22	27	13.01
Plant						
Maize seed	-	-	0.19	6.17	8.5	4.10
Higher plant	-	-	0.25	8.12	29.5	14.22
Vertebrates						
Fish remains	-	-	0.25	8.12	23	11.09
Crustacean part						
Detritus	-	-	0.13	4.22	8	3.86
Mud	-	-	0.13	10.06	6.5	3.13
Unidentified food items	-	-	11.76	24.35	12.5	6.02

gariepinus examined in Ogbese River include Algae, zooplankton, insect, nematode worms, fish remains, crustaceans, annelid worm, chironomid larvae, higher plant, detritus, plant seed (Maize), mud, and unidentified food items.

Unidentified food items formed the most important diet (24.35%) followed by mud (10.06%) while *Filinia* species annelid worm and dragon fly were the least observed in the frequency of occurrence method. In the numerical method flying termite (55.23%) formed the most important diet followed by maize seed (16.62%) while annelid worm and dragon fly were the least observed with (0.27%), respectively. Flying termite accounted for (25.54%) of the content in volumetric method, followed by fish remains (14.22%) while *Filinia* spp. (0.48%) and dragon fly (0.48%) were the least in the stomach. Based on observation and the result from this study, *C. gariepinus* at Ogbese River is an Omnivore feeding on varieties of both plants and animals species.

As shown in Table 2, the food of *P. obscura* in Ogbese River includes Algae, rotifers, protozoa, nematode, insects, fish remains and unidentified food items. In the numerical analysis, Algae (Euglena spp.) formed the most important diet (66.67%) followed by Nematode worms (22.22%) while *Filinia* spp. (3.70%) were the least observed in the stomach. Unidentified food items accounted for 45.73% of the content under frequency of occurrence method, followed by insect remains and fish remains (13.57%) while *Amoeba* spp. (4.52%) and *Filinia* spp. (4.52%) appeared to be complementary. In volumetric method, insect remains were the most important food items observed (19.45%) while *Filinia* spp. were the least (1.39%) in the stomach. Based on the food items encountered in the stomach in the course of this study, it was concluded that *P. obscura* in Ogbese River is Carnivorous.

The summary of stomach contents in *O. niloticus* is presented in Table 3. The stomach content of *O. niloticus*

Table 2. Major food items in the stomach of *Parachanna obscura* from Ogbese River.

Food items	Numerical Method		Frequency of occurrence method		Volumetric method	
	No.	%	No.	%	No.	%
Protozoan						
Amoeba spp.	2	7.41	0.09	4.52	1.5	2.08
Algae						
Euglena spp.	18	66.67	0.18	9.05	12	16.67
Rotifer						
Filinia spp.	10	3.70	0.09	4.52	1.0	1.39
Insect						
Insect remains	-	-	0.27	13.57	14	19.45
Vertebrate						
Fish remains	-	-	0.27	13.57	27	37.50
Worm						
Nematode worm	6	22.22	0.18	9.05	5	6.94
Unidentified food items	-	-	0.91	45.73	11.5	15.97

Table 3. Major food items in the stomach of *Oreochromis niloticus* from Ogbese River.

Food items	Numerical method		Frequency of occurrence method		Volumetric method	
	No.	%	No.	%	No.	%
Filamentous Algae						
Spirogyra spp.	5	75.42	0.78	30.59	45	51.14
Insect						
Dragon fly	4	2.85	0.11	4.31	1.5	1.70
Insect larvae	2	2.27	0.11	4.31	8	9.09
Worm						
Chironomid larvae	3	1.14	0.22	8.63	4.5	5.11
Nematode worm	-	1.71	0.11	4.31	2	2.27
Detritus	29	-	0.22	8.63	6.5	7.39
Plant material	-	16.57	0.44	17.25	11.5	13.07
Mud		-	0.56	21.96	9	10.23

in Ogbese River consists of animal and plant materials, mud and detritus. *Spirogyra* species formed the most important diet (30.59%) followed by mud (21.96%) while insect remains, insect larvae and nematode worms were the least observed in frequency of occurrence method. In the numerical method, filamentous algae particularly *Spirogyra* (75.42%), constituted the most important diet of *O. niloticus* followed by plant materials (16.57%) while chironomid larvae were the least (1.14%). *Spirogyra* spp. accounted for (51.14%) of the content in volumetric method, followed by plant materials (16.57%) while insect remains were the least (1.70%). The result of the analysis

Table 4. The relative importance index (RI) of the food items in the diet of *Clarias gariepinus.*

Food items	AI (%N + %F + %V)	RI (%)
Algae	26.68	13.57
Zooplankton	14.10	7.17
Worms	32.29	16.43
Insect	89.64	45.60
Plant seed	33.85	17.22

Table 5. The relative importance index of the food items in the diet of *Parachanna obscura.*

Food items	AI (%N + %F + %V)	RI (%)
Protozoan	14.01	9.08
Algae	92.39	59.91
Rotifer	9.61	6.23
Worms	38.21	24.78

Table 6. The relative importance index of the food items in the diet of *Oreochromis niloticus.*

Food items	AI (%N + %F +&V)	RI (%)
Algae	157.15	62.42
Insect	24.55	9.75
Worm	23.17	9.20
Plant material	46.89	5.91

showed that *O. niloticus* in Ogbese River is herbivorous feeding majorly on plant materials.

Relative importance index (RI)

The relative importance index (RI) indicated that insect is the most important food items of *C. gariepinus* in Ogbese River and constituted 45.60% while plant seed (maize) and worms rank next with 17.22 and 16.43%, respectively (Table 4).

The relative importance index (RI) of the food items in the diet of *P. obscura* in Table 5 indicated that Algae (59.91%) formed the most important diet followed by nematode worms which constituted 24.78%.

The relative importance index (RI) indicated that Algae is the most important food items of *O. niloticus* in Ogbese River and constituted 62.42% followed by other plant materials and insect with 18.62 and 9.75%, respectively (Table 6).

Figure 2 shows the relative importance index (RI) of *Clarias gariepinus*, *Parachanna obscura* and *Oreochromis niloticus* in Ogbese River.

Trophic relationship among fish species studied in Ogbese River

The trophic relationship among species of fish studied is illustrated in Figure 3. The three species of fish, namely: *C. gariepinus, P. obscura* and *O. niloticus* are found to ingest the same three major food items, which are Algae, nematode worms and insect. *C. gariepinus* and *P. obscura* fed on Rotifers and fish remains majorly while *C. gariepinus* and *O. niloticus* both fed on mud, plant materials and chironomid larvae. Thus, each species depended on more than one food source. However, overlaps existed; fishes were found to feed on more than one type of food item which reduced competition and encouraged coexistence. Apart from major food items *C. gariepinus* was found to feed on Annelids worms and plant seeds while *P. obscura* fed on protozoan in the trophic relationship of freshwater fish species in Ogbese River, Ado-Ekiti, Nigeria.

DISCUSSION

Food is the main source of energy and plays an important role in determining the rate of growth, condition of fishes and the abundance of population (Adewunmi et al., 2014).

The study of the trophic ecology is useful and fundamental to understand the functional role of the fish within their ecosystems (Abdel-Aziz and Gharib, 2007). Fish species have been classified based on stomach contents. This grouping varies depending on a number of factors, such as type and part of water body the fish was caught, region, season, month, hydrological cycle, and developmental stage of the fish, researcher, and adopted methods, among others. Hence, there seems to appear overlaps, where one species may be described more than one way based on the gut content identified.

The stomach content of *C. gariepinus* in Ogbese River indicated that they fed on a wide variety of food items ranging from plants and animals materials and planktons as well as detritus, thus considered as Omnivorous which is in line with the findings and observations made by Burton (2004), Wakil et al. (2014) and Adewumi et al. (2014) who stated that *C. gariepinus* is considered to be omnivorous displaying both scavenging and predatory behaviour.

The stomach content of *C. gariepinus* in Ogbese River was found to contain high percentage of unidentified food items which may be detritus. This confirmed its name "mud fish" indicating the fish is a bottom dweller, as was also observed by Abayomi et al. (2005) and Adewunmi et al. (2014)

The data obtained in this study indicated how successful the fish population has been in exploiting the available food resources in the river. Also, the fifteen food items found in the stomach of *C. gariepinus* in Ogbese River were higher than thirteen food items recorded for

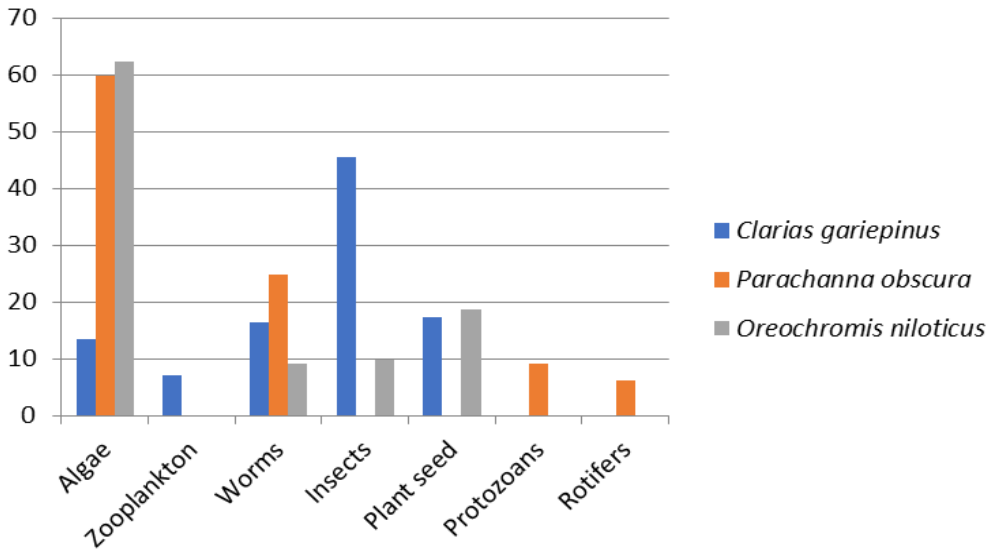

Figure 2. The relative importance index (RI) of *Clarias gariepinus, Parachanna obscura and Oreochromis niloticus* in Ogbese River.

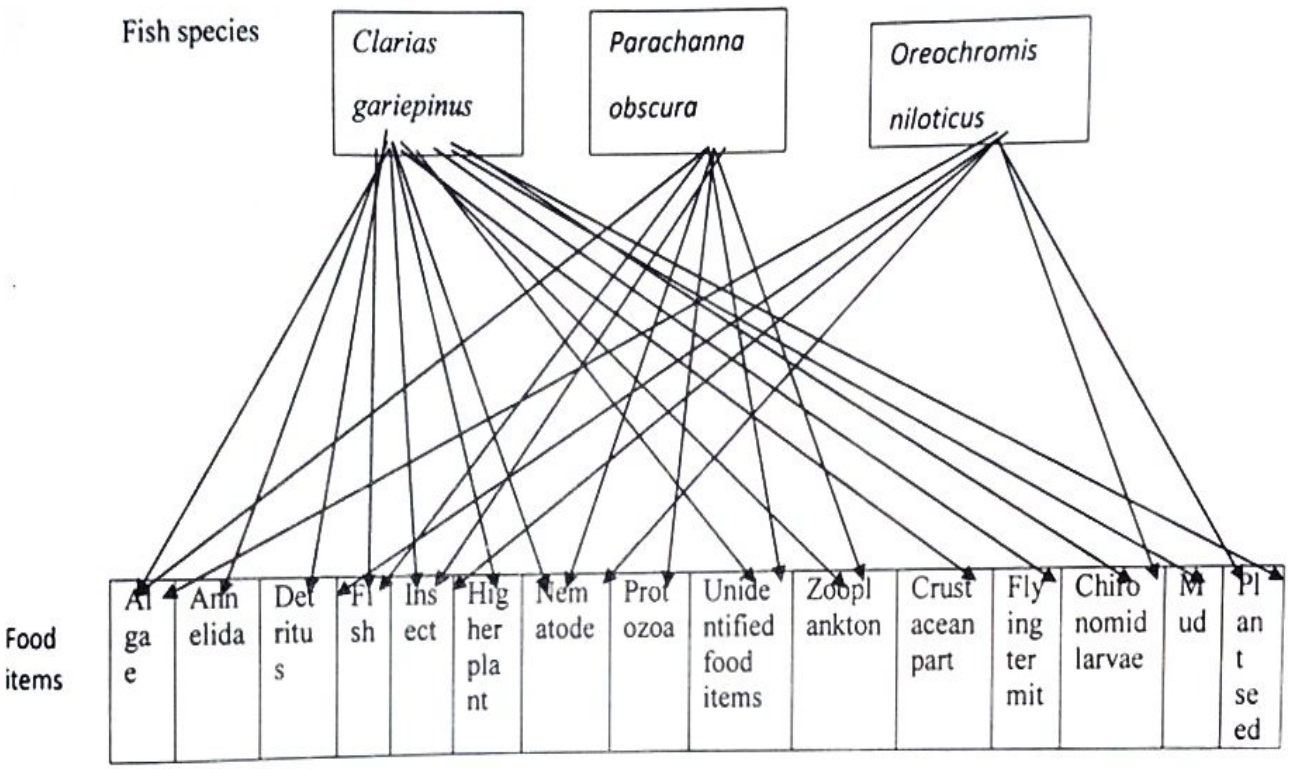

Figure 3. Trophic relationship of Clarias gariepinus, Parachanna obscura and Oreochromis niloticus in Ogbese River, Ado-Ekiti.

the species in Opa Reservoir by Abayomi et al. (2005).

P. obscura as shown by its food items is a general carnivorous feeder as regards both size range and diversity of organism that are consumed by the fish, thus they are obligate piscivores. Ecologically, the species is an insectivore - piscivore - invertivore in feeding habits (Jamabo et al., 2013). *P. obscura* fed mostly on Algae, nematode worms, fish and insects. The variety of food

items of *P. obscura* in the present study was higher in number than Walter et al. (2004) and Abayomi et al. (2005) who reported plant materials and detritus for the species only.

The ability of *P. obscura* to feed at a number of different trophic levels coupled with potential for fast growth makes this species a promising candidate for commercial culture (Jamabo et al., 2013). The species is widely used as human food throughout the area in which it occurs; it could easily be incorporated into. Based on the food items encountered for the period of study in the stomach of *P. obscura*, it is omnivorous in feeding habits in Ogbese River.

O. niloticus have been reported to be plankton, plant, animal and deposit feeders (Oso et al., 2006; Agbabiaka, 2012; Adewunmi et al., 2014). The general low numbers of zooplankton in the stomach of *O. niloticus* could probably be attributed to turbidity of the water at the period of study. The lack of clear zooplankton species selectivity pattern could be due to importance of other food items. O'Brien (2007) reported that *O. niloticus* fed mainly on detritus, insects and plant materials in Ikpoba River. David et al. (2010) observed that the presence of tiny unicuspid teeth in the mouth of the fish suggest that fish species fed on plants, leaves, buds and seeds of water lilies and are thus herbivorous fishes. Shalloof and Khalifa (2009) reported that *O. niloticus* and *Sarotherodon galilaeus* were observed to be herbivores having highest percentage frequency of occurrence of higher plant remains as 49.2 and 60.3%, respectively. The present study agrees with earlier reports for these fish species found in some other water bodies.

Apart from the major food items, they also picked variety of other food items. This further confirms that, Teleost including cichlids were able to exploit more than one source of food. This ability to exploit different varieties of food majorly algae and higher plant material having highest percentage frequency of occurrence as 30.59 and 17.25%, respectively makes *O. niloticus* to be herbivorous in Ogbese River, Ado-Ekiti.

Examination of the diet of these three species showed that they picked a variety of other food items and apart from the major food items which are Algae, nematode worm and insect, they also picked a variety of other food items. Generally, fishes are not rigid regarding the particular type of food they eat and will utilize the most readily available food item.

In view of the food and feeding habits of the three species which are *C. gariepinus, P. obscura* and *O. niloticus*, the trophic relationship can be established as in Figure 3 in which the dietary components are diversified. Offem et al. (2009) observed that the ecological advantage of trophic relationship is that it enables a fish to switch from one category of food to another in response to fluctuation in their abundance. This leads to the ability of the species to utilize many different food items, respectively.

Despite the wide food overlaps, the competition for food is probably minimal, because all the fish species feed on wide range of dietaries and also because of the abundance of main preys. In a similar study (Shep et al., 2013) reported the studied fishes exhibited a general feeding strategy. Hence, the occurrence of overlap even to a high degree does not necessarily mean that competition is present, if the resources are not limited.

The data on different food items consumed by *C. gariepinus, P. obscura* and *O. niloticus* eventually result in identification of stable food preference and in creation of trophic models as a tool to understand complex ecosystem (Bachok et al., 2004). Studies of species food and feeding can be used in understanding factors controlling the distribution and abundance of organisms in an ecosystem. Food and feeding habits of fishes have a great significance in aquaculture practice. It helps in selection of such species of fishes which will utilize all the available potential food resources of the water bodies, with less competition with one another (Begum et al., 2008).

It is important to emphasize that the effect of seasonality should always be considered in the studies on natural feeding of fish, because the temporal change of biotic and abiotic factors alters the structure of the food web along the year and as a consequence, the fish often shows seasonal diet shifts (Gupta and Banerjee, 2015)

In conclusion, the feeding habits of all the three species (*C. gariepinus, P. obscura* and *O. niloticus*) studied in River Ogbese, based on their stomach content analysis revealed that they are all primary consumer within the food web.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

REFERENCES

Abayomi OS, Arawomo GAO, Komolafe OO (2005). Distribution, food and feeding habits of a catfish, *C.gariepinus* (Burchell 1822) in Opa Reservoir, Ile Ife, Nigeria. Science Focus 10(1):62-67.

Abdel-Aziz NE, Gharib SM (2007). Food and feeding habits of round sardinella (*Sardinella aurita*) in El-Mex Bay, Alexandria, Egypt. Journal of Aquatic Research 33:201-221.

Adewumi AA, Idowu OE, Bamisile ST (2014). Food and feeding habits of *Clarias gariepinus* (Burchell 1822) in Egbe Reservoir, Ekiti State, Nigeria. Animal Research International 11(3):2041-2047.

Adewumi AA, Idowu EO, Adeniji AA (2015). Some aspects of the ichtyofauna of Ogbese River South-West, Nigeria. International Journal of Sciences 4(7):1-5.

Adeyemi SO, Bankole NO, Adikwu IA, Akombu PM (2009). Food and feeding habits of some commercially important fish species in Gbedikere Lake, Bassa, Kogi state, Nigeria. International Journal of Lakes and Rivers 2(1):31-36.

Agbabiaka LA (2012). Food and feeding habits of *Tilapia zillii* (Pisces: Cichlidae) in River Otamiri South-Western, Nigeria. Bioscience Discovery 3(2):46-148.

Akpan AW, Isangedihi R (2005). Dynamics in the length-weight relationship and condition index of three species of *Pseudotolithus* (Pisces: Sciaenidae) in three tropical river estuaries Livestock Sysstems and. Sustainable. Development 5:33-43.

Asuquo IAK, Essien-Ibok MA (2019). Trophic ecology of the reed fish, *Erpetoicthys calabaricus* from Niger Delta Creek, Nigeria. Asian Journal of Biological Sciences 12:543-549.

Bachok Z, Mansor MI Noordin RM (2004). Diet composition and food habits of demersal and pelagic marine fishes from Terenggau waters, east coast of Peninsula, Malaysia, Naga. The ICLARM Quarterly 27:41-47.

Begum M, Alam MJ, Islam MA, Pal HK (2008). On the food and feeding habits of an estuarine catfish (*Mystus gulio* Hamilton) in the south-west coast of Bangladesh. University Journal of Zoology Rajshahi 27:91-94.

Burton MN (2004). The Biology of *Clarias gariepinus* (*Burchell* 1822) in Lake Sibaya, Kwazulu with emphasis on the role as the predator. Unpublished, Department of Zoology Institution for Freshwater studies, Rhodes University.

Dadebo E, Aemro D, Tekle-Giorgis Y (2014). Food and feeding habits of the African catfish *Clarias gariepinus* (Burchell, 1822) (Pisces: Clariidae) in Lake Koka, Ethiopia. African Journal of Ecology 52(4):471-478.

David DL, Edward A, Adass PA, Jesse C (2010). Some aspects of water quality and biology of *Clarias gariepinus* in Vimtim stream, Mubi, Adamawa State, Nigeria. World Journal Fish Marine Science 2(2):129-133.

El-Naggar HA, El-Gayar EE, Mohamed ENE, Mona MH (2017). Intertidal Macro-benthos diversity and their relation with tourism activities at Blue Hole Diving Site, Dahab, South Sinai, Egypt. SYLWAN 161(11):227-251.

Farrag MM, El-Naggar HA, Abou-Mahamoud MM, Alabssawy AN, Ahmed HO, Abo-Taleb HA, Kostas K (2019). Marine biodiversity patterns off Alexandria area, Southeastern Mediterranean Sea Egypt. Environmental Monitoring Assesment 191:367.

George UU, Idung JU, Andem AB, Okorafor KA, Mowang D (2013). Diet composition and condition factor of *Ethmalosa fimbriata* in the Cross River Estuary. Greener Journal Biological Science 3(6):244-252.

Gupta S, Banerjee S (2013). Studies on some aspects of Reproductive Biology of *Amblypharyngodon mola* (*Hamilton-Buchanan*. 1822). International Research Journal of Biological Science 2(2):69-77.

Hynes HBN (1950). The food of freshwater Stickle backs (*Gasterosteus acculealis* and *Pygosteus pungitisu*) with a review of method used in studies of the food of fishes. Journal of Animal Ecology 19:36-58.

Hyslop J (1980). Stomach content analysis, a review of the methods and application. Journal of Fish Biology 17:411-429.

Idodo-Umeh GJ (2002). The feeding ecology of the *Bagrid species* in River Asi, Niger Delta, Southern, Nigeria. Tropical Freshwater Biology 11:119.

Inyang MM, Nwane CD (2004). Food and feeding habits of *Distichodus species* in Anambra River Basin, Nigeria. Biology Research 2:181.

Jamabo NA, Agokei EI, Njoku CC (2013). Aspects of the food and feeding habits of African Snakehead *Parachanna obscura* (*Gunther*, 1861) in Orashi River, Nigeria. Continental Journal of Fisheries and Aquatic Science 7(1):1- 7.

Lagler KF (1956). Freshwater Fishery Biology. 2nd Edition, Wan v. Brown Company Limited, USA.

Mona MH, El-Naggar HA, El-Gayar EE, Masood MF, Mohamed EN (2019). Effect of human activities on biodiversity in Nabq Protected Area, South Sinai, Egypt. Egyptian Journal of Aquatic Research 45:33-43.

O'Brien WJ (2007). Planktivorous of fish: thrust and parry in pelagia: pp 3-16. In predation and indirect effect on aquatic communities W.C. Kerfoot & Asih (eds), University press of New England, Hanover P 480.

Offem BO, Samsons YA a Omoniyi IT (2009). Trophic ecology of commerciallyimportant fishes in Cross River, Nigeria. The Journal of Animal and Plant Sciences 19(1):37-44.

Omondi R, Yasindi AW, Magana AM (2011). Spatial and temporal variations ofzooplankton in relation to some environmental factors in Lake Baringo, Kenya. Egerton. Journal of Science and Technology 11:29-50.

Oribhabor BJ, Akpan AE, David GS (2019**).** The Food and Feeding Habits of Fishes of a Coastal Nigeria River. Scientific Research Journal 7(2):43-63.

Oso JA, Ayodele IA, Fagbuaro O (2006). Food and feeding habits of *Oreochromis niloticus (L.)* and *Sarotherodon galilaeus* (L.) in a Tropical Reservoir. World Journal of Zoology 1(2):118-121.

Shalloof KAS, Khalifa N (2009). Stomach contents and feeding habit of *Oreochromis niloticus (L.)* from Abu-zabal Lakes, Egypt. World Application Science Journal 6(1):1-5.

Shep H, Konan KM, Ouattara M, Ouattara A, Gourene G (2013). Comparative analysis of diet of two sympatric species of *Tilapia* in Ayame Man-made Lake. Livestock Research for Rural Development 25(9):305-312.

Ugwumba AA, Adebisi AA (1992). The food and feeding ecology of *Sarotherodonmelanotheron* (Rupell), in a small freshwater reservoir in Ibadan, Nigeria. Archives of Hydrobiology 124(3):367-382.

Wakil BU, Haruna AB, Mohammed GA, Ndirmbita WL, Yachilla BM, Kumai MU (2014). Examinations of the stomach contents of two fish species *(Clarias gariepinus* and *Oreochromis niloticus)* in Lake Alau, North-Eastern Nigeria. Nigeria Journal of Agriculture, Forestry and Fisheries 3(5):405-409.

Zakaria HY, Hassan AM, El-Naggar HA, Abou-Senna FM (2016). Abundance, distribution, diversity and zoogeography of epipelagic copepods off the Egyptian Coast (Mediterranean Sea) Egyptian Journal of Aquatic Research 42(4):459-473.

Zakaria HY, Hassan AM, El-Naggar HA, Abou-Senna FM (2018). Plank tonic protozoan population in the Southeastern Mediterranean off Egypt Egyptian Journal of Aquatic Research 44:101-107.