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Full Length Research

Parasitological examinations and food composition in the gut of feral African carp, *Labeo coubie* in the Cross River, Southeastern, Nigeria

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The food composition and the parasitic infections of the African carp (*Labeo coubie*) were investigated. Analysis of stomach content of 445 specimens of *L. coubie* in the Cross River shows that it as a detritivore/herbivore, as well as a benthic feeder with a wide feeding range. There was no significant difference in seasonal variation of the food composition of *L. coubie* as virtually all the food items appeared in the stomach all year round. The prominent food items in the gut of *L. coubie* included detritus, annelid worms, nematodes, plant tissues, decapods, copepods, Daphnia, some rotifers, insects and insect larvae. Ten parasite species belonging to 5 phyla were identified from 120 specimens. The parasites were *Gyrodactylus, Clinostomum, Lytocestus, protocephalus, Procamallanus, Capillaria, Acanthocepalus, Batrachobdella, Argulus, Dolops,* and *Ergasilus*. Of all the parasites, the more prominent in decreasing order of percentage prevalence are *Acanthocepalus* (81.7%), *Batrachobdella* (74.6%), *Procamallanus* (62.5%), *Argulus* (60%), and *Dolops* (40.8%). The platyhelminthes had the lowest infection prevalence.

Key word: Parasitology, food composition, parasitic fauna, African carp, *Labe coubie* Cross River.

INTRODUCTION

It is important to study the parasite and disease conditions of fish under natural condition because it serves as a basis for information on the potential risk of diseases expected under intensive culture. This is because fingerlings, juveniles and sometimes the parent brood stock of the most cultivated fish species in Africa are collected from the wild (Fagbenro et al., 1993). Parasite and disease reduce fish production by affecting the normal physiology of fish (Kabata, 1985) and which, if left uncontrolled, can result in mass mortalities, or in some cases, infection of man and other vertebrate that consumed them. Works on parasitic infestation in Nigeria include, protozoan parasite of pond culture *Heterobranchus bidorsalis* from southeastern Nigeria reported by Obiekezie and Okaeme (1987) and feral *H. bidorsalis* from southwestern Nigeria Reported by Fagbenro et al. (1993).

Most studies of food and feeding habits of fishes, from varying habitats, have showed that those of any one species differ in time and space and at different stage of growth, thereby emphasizing the need to study in more detail the food habit of a species (Staples, 1975). The study of dietary habits of fish, based on stomach content analysis, is widely used in fish ecology as an important means of investigating tropic relationship in the aquatic communities (Fagbenro et al., 2000).

Of the four species of African carp belonging to the genus Labeo (*Labeo senegalensis, Labeo pseudocoubie, Labeo rohita* and *L. coubie*), *L. coubie* is the commonest of all the member of genus. They have elongated, subcylindrical bodies and grow to about 700 mm in length and at least 10 kg in weight. *L. coubie* is extremely fecund, with the ovaries amounting to as much as 20% by weight of the fish (Reed et al., 1972). Interest in culturing *L. coubie* has increased, and research on the biology and physiology of *L. coubie* was initiated with the

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goal of establishing basic and applied data that qualify its aquacultural potential. There is a paucity of information on its food and parasite of *L. coubie*. This paper reports the qualitative and quantitative composition of food items in the gut of *L. coubie* specimens and parasitic fauna obtain from fresh catches of fishermen in the Cross River in Southeastern Nigeria. Such information will serve as a standard for physiological and pathological studies as well as being useful in practical aquaculture of *L. coubie,* under various culture environments and system.

MATERIALS AND METHODS

Study area

The Cross River system is located at 7° 30' – 10° 00' E and 4° 00'-8° 00' N. The Cross River covers an area of 54,000 km^2, 39,500 km^2 of which lie within Nigeria and 14,500 km^2 in the Republic of Cameroon (Nawa, 1980). The river is subject to seasonal flooding, the flood occurring between July and October. The total area liable to flood in Cross River basin is 8,303 km^2 and Cross River estuary is relatively highly productive in term of primary and secondary production (Moses, 1980). There is a high dependence on tertiary production that militates against the optimal exploitation of the estuary, because low net energy output is realized at high tropic level (Nawa, 1980).

Dietary habit

A total of 445 *L. coubie* collected from fresh landing of artisanal fishermen using drag and gill net of 3 cm mesh were collected once in three months over 12 months. Each specimen was measured for standard length, and ranged between 20.20 – 28.0 cm and body weight ranged between 98.0 – 237 g. After dissection, its stomach was removed and immediately preserved in 5% formaldehyde solution in a separate container. The number of empty stomach was recorded. Individual stomachs were examined under a stereo-dissecting microscope and the component food items were identified. Food items encountered were later analyzed by a combination of frequency of occurrence (%O) and numerical (%N) methods (Bagenal, 1978). In the frequency of occurrence method, the number of stomachs containing each food items is expressed as percentage of all non-empty stomach (Dunn, 1954). Though this method is quick and required minimal apparatus, it gives little indication of the relative quantities of each food categories present in the stomach. In the numerical method, the number of individuals in each food category is expressed as a percentage of the total individual in all food categories (Crisp et al., 1978). This method has two limitations that it over-emphasizes the importance of small prey items found in a large in a large number of fish (Hynes, 1950). For many stomach, it is difficult to identify the number in each food category because of mastication of the food. It is also not suitable for dealing with food items such as fragments and detritus that do not occur in discrete units. Occasionally, some food were observed, crushed and others were at varying stages of digestion. Consequently, it was not possible to identify these at the species level (Oloja et al., 2003).

Parasite fauna

A total of 120 adults *L. coubie* were purchased from direct landings of fishermen and the live fish were subjected to parasitological examination within 24 h of collection. Wet mounts of scraping from the skin, opercula and gill were prepare and examined under a compound microscope for protozoan. The gills were removed and each gill filament separated. The gill arches, stomach and intestines were split open and scrape into separate beakers filled with distilled water, the contents were allowed to settle and the supernatant poured off. This procedure was repeated until clear solution was obtained. The sediment was then examined for parasites under dissecting microscope. The kidney, liver, gallbladder and brain were examined separately under a dissecting microscope for microscopic cysts and helminthes. Parasites were identified from taxonomic keys and description of Paperna (1980), Kabata (1985) and Fagbenro et al. (1993). Monogeneans, digeneans and cestodes were preserved in 70% alcohol, stained in Semichon's carmine and mounted in Canada balsam. Nematodes and copepods were preserved in 2% glycerine in 70% alcohol, cleared by evaporation and examined in glycerine.

RESULTS AND DISCUSSIONS

Dietary habit

The results presented in Table 1 show that *L. coubie* has wide feeding range. There is no significant seasonal variation in food composition of *L. coubie*; nearly all the food items in the stomach of *L. coubie* appeared throughout the season. The prominence food items in the gut of *L. coubie* include whole worm, worm part, nematode, mud, plant part, unidentified items, and detritus. Other food item food present in small quantities includes Rotifera (*Kerattela* sp., *Polyarthera* sp. and *Philodina* sp.) and Crustacean (*Copepod* sp., *Decapods* sp. and *Daphnia* sp.).

A summary of frequency of occurrence of food items is presented in Table 2. Among the rotifers, *Keratella* sp. is the most frequently occurring. Among crustaceans identified, decapods were most prominent followed by *Daphnia* sp. The copepods were relatively a minor component of the crustaceans. The result presented in this work is similar to that obtained by Ugwumba (1988) who worked on the food and feeding habits of juvenile and cultivable freshwater fishes and stated that, their food cover wide spectrum ranging from various types of planktons to invertebrates and fish. The worms were the single most prominent food group. It is likely that being a detritivore, *L. coubie* forages the river bottom. In the process it catches worm and this may account for the prominence of worm and worm parts in its food.

The presence of plant tissue (68.7% occurrence) shows that *L. coubie* is able to digest plant matter, making it also herbivorous. The wide range of food exploited due to its ability to function as an omnivore as well as a detritivore may account for why *L. coubie* can attain large sizes of up to 700 mm in length and 10 kg in weight (Reed et al., 1972). The food items identified in the stomachs of *L. coubie* were rotifers, crustaceans, worms, mud, insects, plant material and detritus.

The presence of detritus in the food diet of *L. coubie* throughout the year shows that it is detritivorous. Insect and insect larvae occurred in the food of *L. coubie*

Table 1. Composition of stomach contents of an African carp (*Labeo coubie*) by months. (January 2004 - January 2005; n = 445).

Parameter	Jan		Mar		Jun		Aug		Nov		Feb.	
No. Examined	86		105		52		45		66		90	
% empty Stomach	17.5		24.8		36.5		11.1		27.3		15.5	
FOOD ITEMS	%N	%O	%N	%O	%N	%O	%N	%O	%N	%O	%N	%O
ROTIFERA												
Kerattela Sp.	1.9	22.4	0.9	21.5	0.2	22.6	-	-	-	-	1.1	62.3
Polyarthera Sp.	0.7	15.4	1.2	32.6	-	-	-	-	-	-	0.3	28.6
Philodina Sp.	1.0	45.2	0.5	22.4	0.1	15.2	0.1	12.2	-	-	3.8	62.5
CRUSTANCEA												
Copepod Sp.	0.02	24.5	0.2	24.1	-	-	-	-	-	-	1.0	67.4
Decapods Sp.	2.5	36.8	2.3	55.2	-	-	3.3	60.6	-	-	2.1	56.4
Daphnia Sp.	0.01	23.5	2.4	35.9	-	-	1.5	53.4	0.01	52.2	0.3	62.5
WORM												
Whole worm	1.2	82.6	2.5	63.4	2.2	32.5	13.5	89.5	18.1	78.6	10.3	94.8
Worm Part	2.5	78.5	1.2	95.2	0.8	24.5	12.2	36.8	11.1	45.9	2.3	45.6
Nematode	1.3	95.3	2.1	36.1	0.2	63.2	2.5	54.7	2.1	62.5	2.5	55.6
MUD	10.2	100.0	17.2	100.0	15.2	100.0	12.3	100.0	13.5	100.0	12.2	100.0
INSECTS												
Insect Larvae	0.1	45.6	-	-	-	-	2.0	45.2	0.2	21.9	0.01	25.5
Adult Insect	1.0	10.2	-	-	-	-	-	-	0.01	45.6	11.2	39.1
PLANT												
Plant part	6.4	72.4	10.2	100.0	14.0	100.0	19.2	100.0	10.4	96.2	9.8	96.6
Plant tissue	4.3	59.3	-	-	-	-	2.3	95.3	2.3	53.2	-	-
Unidentified Items	4.1	83.2	2.0	60.7	6.6	100.0	10.2	100.0	5.6	99.5	6.2	78.2
Detritus	10.2	100.2	13.2	100.0	12.3	100.0	9.6	89.5	9.0	100.0	8.5	89.6

%N = Percentage numerical
%O = Percentage occurrence

throughout the year with a peak in July when the river overflows its banks. At that time, *L. coubie* like other freshwater fish will spread into the inundated forest where a lot of food in the form of insects, insect larvae, other vertebrates and leaves of higher plants has become abundant (Moses, 1983). Insect larvae and detritus have been reported to be significant in the food of river fish including *Heterotis niloticus* (Fagbenro et al., 2002)

Parasitic fauna

Altogether, 11 parasite species were identified from 120 specimens (Table 3) comprising two cestoda, one each for digenea and monogenea, two nematoda, one hirudinea and two crustancea. The hirudina and nematode were the most commonly encountered taxa in collection (> 60% prevalence). Follows by crustacean (20 - 60% prevalence). While cestoda, monogean and digenea had low infection prevalence (< 30% prevalence). Fagbenro et al. (1993) reported parasitological examination conducted on the skin and internal organ on *H. bidorsali* and reported the incidence of parasites which included three protozoan, two monogenean, six digenean, four nematode, two annelids and four copepods. The parasite fauna identified for *L. coubie* is presented in Table 3. A total of 10 parasites belonging to 5 phyla were identified. The phylum Platyhelminthes was represented by a monogenean (*Gyrodactylus*) and a digenean (*Clinostomum*) and two cestodes (*Lytocestus* and *Protocephalus*). The phylum Nematoda was represented by two members (*Procamallanus* and *Lytocestus*) and from the Phylum Acanthocephala, *Acanthocephalus* sp. was identified. The phylum Annelida represented by *Batrachbdella* sp. infected the skin. Three species were identified from the Phylum Rotifera (*Argulus*, *Dolops* and *Ergasilus*).

Assor and Arene (2000), stated that the site of infection varied with the parasite. But the site most affected generally is the intestine. Half of the parasite species (two cestodes; *Clinostomum*, *Procama-llanus*) and *Acanthcephalus* affected the intestine. The crustancean parasites attacked the gills in addition to affecting the opercular. Only Gyrodactylus also affected the gills in

Table 2. Summary of frequency of occurrence of food items in the stomach of *L. coubie* sampled in cross river.

Food items	No. of occurrences	Percentage occurrences
ROTIFERA		
Keratella sp.	94	24.5
Polyarthra sp.	74	19.3
Philodina sp.	75	19.6
CRUSTACEA		
Copepods	62	16.2
Decapods	155	40.5
Daphnia sp.	123	34.5
WORMS		
Whole worms	273	71.3
Worm part	218	56.9
Nematodes	240	62.7
Mud	383	100
INSECTS		
Insect larvae	157	41.0
Adult insects	105	27.4
PLANT	263	68.7
Plant parts	263	68.7
Plant tissues	339	88.5
Unidentified items	383	100

addition to affecting the skin and the eyes. The parasite species with the highest prevalence (81.7%) was *Acanthocephalusss,* affecting 98% of the 120 specimens examined. This was followed by *Batrachobdella* (74.2%), *Procamallanus* (62.5%) and *Argulus* (60%).

There was a relatively low incidence of ectoparasitic infection owing probably to the all year round flowing of the river, which makes it difficult for the spread of ectoparasite protozoans (Jegede, 1989). *Clinostomum* is a parasite associated with tilapia (infact one species is called *Clinostomum tilapae*; Ukoli, 1966). Their presence on *L. coubie* could have been acquired by direct contact with tilapia with which they share the river environment.

Although the presence of the parasites on the *L. coubie* examined did not reveal visible pathological damage, it is certain that the normal functioning of their various organisms must have been affected in some way. Points of attachment of different parasites to the different organ of the body create injuries that will serve as entry point to bacteria. A detailed follow-up study on the histopathology of this species in an experimental setting is warranted to provide information that will help in the culture of *L. coubie*. This is because diseases cause production and economic losses from mortality, reduction in growth during and after an outbreak and from the high cost of treatment (Ukoli and Jeje, 1992).

CONCLUSION

This study shows the food composition and parasitic infestation of feral African carp *L. coubie* in Cross River Southeastern Nigeria. The prominence food items in the gut of *L. coubie* include whole worm, worm part, nematode, mud, plant part, unidentified items, and detritus. Other food item food present in small quantities includes Rotifera (*Kerattela* sp., *Polyarthera* sp., *Philodina* sp.) and Crustacean (*Copepod* sp., *Decapods* sp., *Daphnia* sp.). The high prevalence of rotifers, a component of zooplankton, whish play an important part in the diet of *L. coubie* in the wild, means that there are bright prospects for the culture of this fish species in the pond where production of phytoplankton and zooplankton can be significantly influenced through fertilizer application. A total of 10 parasites belonging to 5 phyla were identified. The hirudina and nematode were the most commonly encountered taxa in collection (> 60% prevalence). Follows by crustacea (20 - 60% prevalence). While cestoda, Monogean and Digenea had low infection prevalence (<30% prevalence). With proper management of the nutrient budget of the pond, it should be possible to introduce *L. coubie* in pond culture. This study provides information on the food and feeding habit as well as parasite of *L. coubie*. This information should aquaculturists who may

Table 3. Number of fish infested and percentage prevalence of parasite from feral *Labeo coubie* in cross river (n = 120).

Parasite clasification	Genus	Site of infection	Number of fish infected	Prevalence %
Phlum: Platyhelminthes				
Class: Monogenea	Gyrodactylus	Skin, gill, eyes.	35	29.2
Class: Digenea	Clinostomum	Muscle, Stomach, Intestine,	16	15.8
	Lytocetus			
	Proteocephalus	Intestine,	23	19.2
Class: Cestoda		Intestine	15	12.5
Phylum: Aschelminthes			75	62.5
Class: Nematoda	Procamallanus	Intestine	45	37.5
	Capillaria			
			98	81.6
		Liver, gall bladder		
Class: Acantocephala	Acanthocephalus			
Phylum: Annelida				
Class: Hirudinea			89	74.2
Phylum: Arthopoda		Intestine, Stomach		
Class: Crusatacea			72	60
			49	40.8
			32	26.7
	Batrachobdella			
		Skin		
	Argulus	Gill		
	Dolops	Opercula		
	Eraasillus	Gill		

wish to include *L. coubie* among fish used for pond culture.

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