FOOD AND FEEDING HABITS OF *MUGIL CEPHALUS* (GREY MULLET) FROM WETLAND OF OGUN WATER-SIDE LOCAL GOVERNMENT AREA

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ABSTRACT

Investigations were conducted on the food and feeding habits of grey mullet (Mugil cephalus) collected from wetland of Ogun Waterside Local Government Area, Ogun State, Nigeria. M. cephalus is a commercially valued fish in Nigeria and is a member of the Mugilidae. Ninety-one live specimens were caught from the wetland between March and June. The fish were immediately preserved on ice for laboratory analysis, and their total length (cm), standard length (cm), head length (cm), body width (cm) and body weight (g), were measured fresh within 24 hours. The stomach content was assessed to determine its food and feeding habit using combined methods of volumetric, frequency of occurrence and numeric analyses. Numerical and frequency of occurrence methods showed that diatoms were the most abundant food in the diet of M. cephalus(36.93% and 27.52%, respectively). Other food items of importance consumed by the fish included the blue-green algae which were more abundant than green algae by number but least important by occurrence method. Results obtained from the study will contribute to the baseline information for carrying future studies on the production and possible domestication of this species of fish.

Key words: Mugil cephalus, Wetland, Ogun waterside, Food items

INTRODUCTION

Mugil cephalus inhabits coastal waters, estuaries and freshwater in tropical and temperate waters of all seas (Render *et al*., 1995). The adults and juveniles of the grey mullet are hardy, euryhaline, eurythermal and not competitor for food. School The different sizes of fish of same species occur in shallow coastal waters where they enter lagoons and estuaries to feed (Rheman *et al*., 2002). In estuarine waters, grey mullet feed on detritus, diatoms, algae and microscopic invertebrates which they filter from mud and sand through their mouth and gills (Queensland Fish Management Authority,1991; McDonough and Wenner, 2003). A proportion of the sand is ingested to assist in the grinding of food in the muscular stomach (Michaelis, 1993).

The family Mugilidae includes 17 genera and 72 species in the world (Harrison and Senou, 1999; Nelson, 2006). Eight species of Mugilidae inhabit the Mediterranean Sea, and originally classified as part of the single genus *Mugil*, under different names such as *M. cephalus, M. ramada, M. labrosus, M. labeo, M. aurata, M. abu, M. saliens, and M. carinata.*

MATERIALS AND METHODS

Study Area

Ogun estuary is an extension of Lekki Lagoon located in Ogun waterside area, Ogun State, Nigeria. It has border with Lagos Lagoon. Ogun waterside is one of the aquatic habitats in Ogun State, Nigeria. Ogun Waterside Local Government Area, has its Headquarters at Abigi on 60°29'N 40°24'E (NIPOST, 2009).

Collection of samples

The fish samples were collected from fishermen from wetland of Ogun Waterside Local Government Area. A total number of *ninety-one species of M. cephalus* were obtained. Fish specimens were collected from March to

June 2012. The fishermen used a wide range of fishing gear such as cast nets, gill nets, bamboo trap, non-return valve trap and they use outboard engine canoes to convey the fish to landing centre. The specimens were collected in three different sizes. The smallest size with the standard length ranged from 9.5cm-14.8cm while the medium and the largest sizes were 14.8cm-20.1cm and 20.1cm-25.4cm respectively.

After collection, the fish were immediately preserved ice, and their total length (TL, cm), standard length (SL, cm), head length (HL, cm) and body weight (BW, g), were measured fresh within 24 hours. Sexes of the fish were determined from the external features of the gonads and when this could not be done, the gonads were dissected out to reveal the testis for male or ovary for female.

Laboratory Preparation

The fish were transferred to the laboratory within 24 hours of collection. They were preserved in 4% formalin in the laboratory. The total length (cm), standard length (cm), head length (cm) and body width (cm) were measured on a measuring board while the body weights (g) were determined using a sensitive Sartorius balance (Model Eb3).

Determination of Stomach contents

Stomach content was determined in the laboratory using combined methods of volumetric, frequency of occurrence and numeric analyses (Hyslop, 1980). The stomach contents were emptied into a petri dish and examined under the binocular microscope. The state of fullness of each stomach was recorded and expressed as empty $\left(\frac{0}{4}\right)$, one-quarter full $\left(\frac{1}{4}\right)$, half -full $\left(\frac{2}{4}\right)$, three-quarter $\left(\frac{3}{4}\right)$ and full $\left(\frac{4}{4}\right)$.

RESULTS

Empty Stomach Analysis

Of ninety-one specimens of *M. cephalus* that were examined for food and feeding habits, 17 (18.67%) of them were with empty stomach (Table 1). Analysis of monthly variation in empty stomachs (Table 2) showed that the highest occurrence of empty stomachs was noted in March and April (29.4%), while the lowest was noted in May (17.6%).Variation in empty stomach by size group indicated that the small size group of *M. cephalus* had the highest number of empty stomach (82.35%), while the large size group had no empty stomach (0%) (Table 3)

Table 1: Monthly variation in empty stomachs of *M. cephalus*

Month	Number examined	Number with empty stomachs	%Empty stomachs
Mar-12	23	5	29.41
Apr-12	21	5	29.41
May-12	23	3	17.64
Jun-12	24	4	23.52
Total	91	17	99.98

Table 2: Variation in empty stomachs by size of *M. cephalus*

Size/ Standard length (cm)	Number examined	Number with empty stomach	%
Small- sizes fish (9.5-14.8)	55	14	82.35
Medium-sized fish (14.8-20.1)	30	3	17.65
Large-sized fish (20.1-25.4)	6	0	0

Food Items in the Stomach of *M. cephalus*

The results of the stomach contents of *M. cephalus* are presented in Table 3 and the summary of the items is illustrated in Figure 1.The stomach contents were made up of eight major categories of food. These were blue-green algae, green algae, desmids, diatoms, crustaceans, annelids, fish part and sand grains.

Diatoms were the most important food items recorded by numerical method (36.93% and also were frequently consumed food items by occurrence method (27.52%).

Blue-green algae (*Anabaena sp.,Nostoc sp., Oscillatoria sp. and Aphanacapsa sp.*) constituted 17.28% and 11.98% by numerical and occurrence methods respectively. Green algae (*Mougeotia sp., Richterallasp., Spirogyra sp., Zygnema sp. and Protococcus sp.*) constituted 15.54% and 15.55% by numerical and occurrence methods respectively. Diatoms (*Melosira sp., Eunotia sp., Achnanthes sp., Gyrosigma sp., Navicula sp., Cocconeis sp., Nitzschia sp., Frustulia sp., Epithemia sp.*) constituted 36.93% and 27.52% by numerical and occurrence methods, respectively. Desmids (*Closterium sp., Desmidium sp., Penium sp., Gonatozygon sp. and Genicularia sp.*) constituted 17.14% and 13.45% by numerical and occurrence methods, respectively. Crustaceans (*Cyclops sp. and Camptocercus sp.*) constituted 3.34% and 3.78% by numerical and occurrence methods respectively. Fish part constituted 7.67% and 8.19%, respectively. The least consumed food items in the stomach of *M. cephalus* were the Annelids (Nematode worm) which constituted 2.09% and 3.99% respectively by numerical and occurrence methods.

Table 3: The stomach contents of *M. cephalus* in wetland of Ogun Water side Local Government Area

Food items	Numerical method		Occurrence method	
	No	%	No	%
BLUE-GREEN ALGAE	248	17.28	57	11.98
Anabaena sp.	71		14	
Nostoc sp.	72		17	
Oscillatoria sp.	68		18	
Aphanaca.psa sp.	37		8	
GREEN ALGAE	223	15.54	74	15.55
Mougeotia sp.	68		16	
Richteralla sp.	43		14	
Spirogyra sp.	32		23	
Zygnema sp.	55		15	
Protococcus sp.	25		6	
DESMIDS	246	17.14	64	13.45
Closterium sp.	57		18	

Table 3 contd

Food items	Numerical method		Occurrence method	
	No	%	No	%
Desmidium sp.	76		16	
Penium sp.	59		15	
Gonatozygon sp.	38		11	
Genicularia sp.	16		4	
DIATOMS	530	36.93	131	27.52
Melosira sp.	76		16	
Eunotia sp.	45		13	
Achnanthes sp.	39		9	
Gyrosigma sp.	82		20	
Navicula sp.	78		22	
Nitzschia sp.	96		18	
Cocconeis sp.	39		11	
Frustulia sp.	47		12	
Epithemia sp.	28		10	
CRUSTACEANS	48	3.34	18	3.78

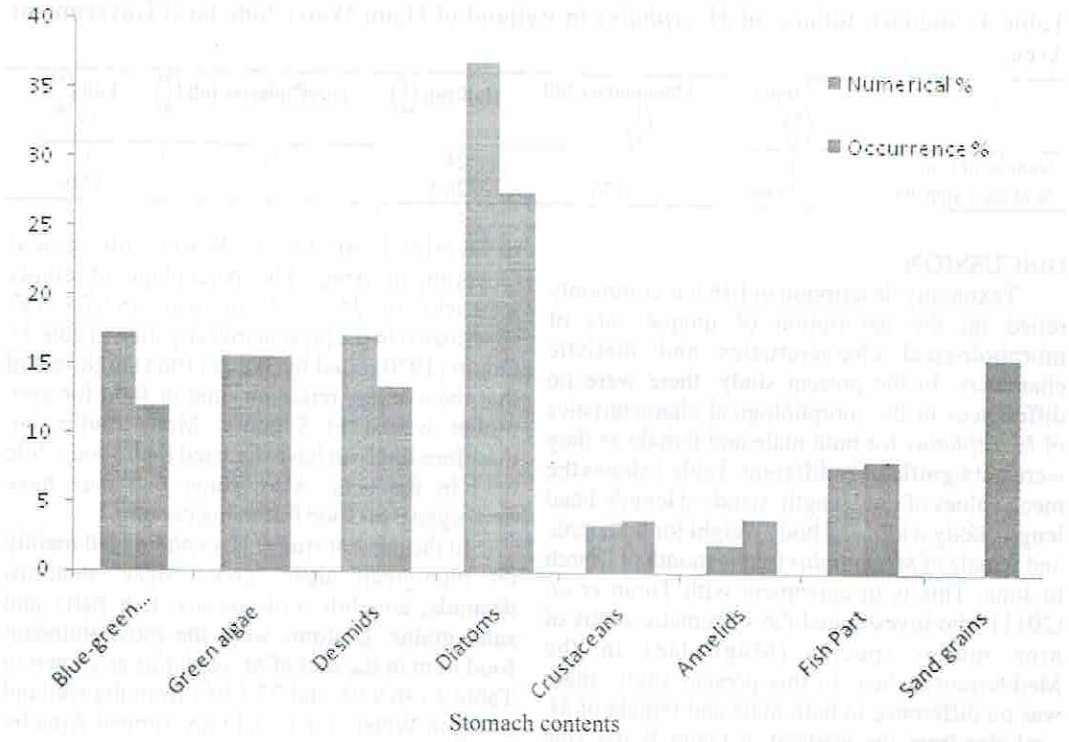

Figure1: Summary of the stomach contents of M. cephalus in wetland of Ogun Water side Local Government Area.

Diatoms were the most eaten food items. They were most prominent and abundant by occurrence methods. They contributed the highest percentage of food items throughout the study period. The percentage of diatoms ingested by the fish species was high using the numerical and occurrence methods. Sand grains were the food items next in abundance after the diatoms by occurrence method. Annelids constituted the least consumed food items both by occurrence and numerical methods. Other food items of importance consumed by this fish included the blue-green algae (*Anabaena sp., Nostoc sp., Oscillatoria sp. and Aphanacapsa sp.*) which were more abundant than green algae by number but least important by occurrence method. *Mougeotia sp., Richterallasp., Spirogyra sp., Zygnema sp.* and *Protococcus sp.* were the most abundant green algae. The desmids were more abundant both by number and occurrence than fish parts. Crustaceans (*Cyclops sp.* and *Camptocercus sp.*) were very few in abundance with only a little above the annelids (nematode worm) by number but less in occurrence. Generally, the contents of the stomachs showed a clear pattern of distribution of food items with the diatoms, sand grains and blue-green algae occurring in most months during the study period.

Size of Fullness of *M. cephalus*

Table 4 shows the result of sizes of fullness of M. cephalus from wetland of Ogun Water side Local Government Area. During the month of March to June, the state of fullness of each stomach was expressed as empty $\left(\frac{0}{4}\right)$, one-quarter full $\left(\frac{1}{4}\right)$, half-full $\left(\frac{2}{4}\right)$, three-quarter $\left(\frac{3}{4}\right)$ and full $\left(\frac{4}{4}\right)$ and the percentage were 17%, 28%, 24%, 11% and 11% respectively.

Table 4: Stomach fullness of *M. cephalus* in wetland of Ogun Water-Side local Government Area.

	Empty $\left(\frac{0}{4}\right)$	One-quarter full $\left(\frac{1}{4}\right)$	Half-full $\left(\frac{2}{4}\right)$	Three-quarter full $\left(\frac{3}{4}\right)$	Full $\left(\frac{4}{4}\right)$
Number of Fish	17	28	24	11	11
% of each Stomach	18.68	30.76	26.37	12.08	12.08

DISCUSSION

Taxonomy description of fish has commonly relied on the description of unique sets of morphological characteristics and meristic characters. In the present study, there were no differences in the morphological characteristics of *M. cephalus* for both male and female as they were not significantly different. Table 1 shows the mean values of total length, standard length, head length, body width and body weight for both male and female of *M. cephalus* for the month of March to June. This is in agreement with Turan *et al*, (2011) who investigated the systematic status of nine mullet species (Mugilidae) in the Mediterranean Sea. In this present study, there was no difference in both male and female of *M. cephalus* from the wetland of Ogun Water side Local Government Area. The meristic characteristics of both male and female of *M. cephalus* were DF_1 IV (M/F), DF_2 7 – 9 (M/F), PVF I5 (M/F) respectively. Table 5. This is in accordance with Turan *et al*, (2011).

Growth of fish can be described as either allometric or isometric depending on the exponent b (regression coefficient) of the length – weight relationship, which is normally between 2.0 or 4.0. The value b = 3.0 indicates that the fish grows symmetrically or isometrically while values other than 3.0 indicate allometric growth (Tesch, 1971). In isometric growth, the shape of the fish is maintained throughout life while aspect of growth in populations that exhibit allometric growth may be out of proportion or the adults may appear different from the young ones (Tesch, 1971). In the present study, the grey mullets were grouped into male, female and combined sexes, the growth pattern for male species indicate negative allometric which have b value of 2.53. The growth patterns for female and combined sexes were isometric which have b value of 2.88 and 2.80 respectively. These findings indicate the weight of the fish were not too much for the length. This may be responsible for its robustness in wetland of Ogun Water-side Local Government Area. The percentage of empty stomachs of *M. cephalus* was 18.67% (17 specimens) in the present investigation (Table 4). Odum (1970) cited by Wells (1984) highlighted that the average retention time of food for grey mullet was 4 to 5 hours. Many mullet are therefore likely to have digested their food while held in the nets. Also, some fish may have disgorged their food following capture.

In the present study, *M. cephalus* fed mainly on blue-green algae, green algae, diatoms, desmids, annelids, crustaceans, fish parts and sand grains. Diatoms were the most abundant food item in the diet of *M. cephalus* as shown in Table 4 (36.93% and 27.52%) from the wetland of Ogun Water side Local Government Area by number and occurrence methods respectively. Soyinka, (2008) reported that plant materials were the most abundant food items in the diet of *M. cephalus* from Lagos Lagoon by number while detritus was most abundant by occurrence method (57.24%) and (44.81%) respectively. Odum (1970) cited by Wells (1984) hypothesized that green grey mullets show a distinct difference for live plant materials (Algae) over the plant detritus when both are plentiful. Whereas, Wells (1984) suggested that grey mullet in the area studied – Waikato River Lake Waahi, showed little or no preferences for Algae over macrophyte detritus and that their diet reflected the availability of these food types in the two environments.

Consequently, the degree of fullness in stomach of mullet is unlikely to represent the intensity of the feeding as shown in Table 6. Odum (1970) established that *M. cephalus* features a long intestine to assimilate the element of a diet based on diatoms and detritus. (Romer and McLachan 1986) confirm the energetic importance of certain types of diatoms, which were studied in relation to *Liza richardsoni*. Also, Thomson (1966) cited by Wells (1984)

reported the composition and quantitative description of the diet of this species in respect of the microalgae, algae, diatoms, detritus and debris.

Conclusion

This study provides some important information on biological aspects of *M. cephalus* that will be useful for fisheries' biologist to propose adequate regulation for sustainable fisheries management, ecology and conservation of these commercially and economically valued fish species in wetland of Ogun Water-side Local Government Area. This study revealed that diatoms are the most abundant food in the diet of *M. cephalus* in wetland of Ogun Waterside Local Government Area. The knowledge of morphological and meristic characteristics has greatly contributed to the understanding of the population structure of the species in wetland of Ogun Waterside Local Government Area. It has also provided useful information on the growth pattern.

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