African Journal of Biotechnology Vol. 9(46), pp. 7955-7960, 15 November, 2010
Available online at http://www.academicjournals.org/AJB
DOI: 10.5897/AJB09.1514
ISSN 1684–5315 © 2010 Academic Journals

Full Length Research Paper

Morphometry and diet of *Chrysichthys nigrodigitatus* (Lacépède) in Epe Lagoon, Nigeria

Muyideen O. Lawal*, Oluwabamise J. Sangoleye and Bola M. Seriki

Department of Marine Sciences, University of Lagos, Lagos State, Nigeria.

Accepted 5 May, 2010

The morphometry and diet of *Chrysichthys nigrodigitatus* in Epe lagoon were investigated between January and July 2008. The major fishing methods employed for collecting the 600 specimens were cast netting and set netting. The total lengths ranged from 11.00 to 30.20 cm (mean size 19.67 ± 4.56 cm) while the standard lengths ranged from 8.30 to 24.50 cm (mean size 15.09 ± 3.39 cm).The length-weight relationship was described by the equation: Log W = 1.5389 + 2.8168 Log L. The value of the coefficient of regression 'b' for this species was nearly 3 thus, indicating isometric growth. The mean condition factors ranged from 1.68 to 1.76. The food organisms consisted of phytoplankton, crustaceans, molluscs, plant materials and fish parts. The population of males was significantly ($p < 0.05$) higher than females in the lagoon.

Key words: Growth pattern, food, feeding habit, sex ratio, Epe lagoon, Nigeria.

INTRODUCTION

The catfish, *Chrysichthys nigrodigitatus* (Lacépède), a siluroid fish of the family Bagridae is widely distributed in fresh and brackish waters in West Africa (FAO, 1969; Holden and Reed, 1991). In Nigeria, *C. nigrodigitatus* is highly valued food-fish and is among the dominant fishes of commercial catches as well as culturable fish species from the wild (Ezenwa et al., 1986, 1990). Available information on *C. nigrodigitatus* is predominantly taxonomic (Reed et al., 1967), comparative racial study in Lagos and Lekki lagoons (Kusemiju, 1975), food and feeding habits in Lagos lagoon (Kusemiju and Olaniyan, 1989), age and growth determination (Ezenwa and Kusemiju, 1981) and Ezenwa et al (1986) on the comparative studies of catfish in three isolated geographical areas in Nigeria for breeding purposes.

Fisheries management parameters such as length-weight relationship, condition factor and sex composition are essentially used to predict the potential yield and determination of size at capture for obtaining optimum yield (Bagenal, 1978; Offem et al., 2008). Food studies reveal the status of foraging, rate of growth and seasonal life history changes in fish species which are useful for rational exploitation of the species (Tudorancea et al., 1988; Ugwumba and Ugwumba, 2007).

Most of the information provided on the biology of the species in Nigeria has been on the Lagos (brackish) and Lekki (fresh water) Lagoons. To date, gaps in current knowledge on the biology of this species, which is of commercial value, is still apparent in Epe lagoon. Therefore, this paper examines the diet, growth pattern, condition factor and sex composition of *C. nigrodigitatus* in Epe (fresh water) lagoon, for proper management and conservation of the fish species in the study environment.

MATERIALS AND METHODS

Study area

Epe lagoon is located in Lagos State, South-West, Nigeria. It lies between longitudes N 06° 33.710′ E 004° 03′.710′ and latitudes N 06° 31.893′ E 003° 31.912′ (Figure 1). It has a surface area of about 243 km^2 with a maximum depth of about 2.8 m (Edokpayi et al., 2008). The lagoon is sandwiched between two lagoons, Lekki lagoon (freshwater) in the east and Lagos lagoon (brackish) in the south with the Oshun River being the main river discharging to the lagoon. Epe lagoon connects to the sea via Lagos harbour and the vegetation around the lagoon is characterized by stilt rooted trees with dense undergrowths of shrubs and herbs; *Raphia sudanica*,

*Correspondence author. E-mail: lawdeen2003@yahoo.com. Tel: 08023825115.

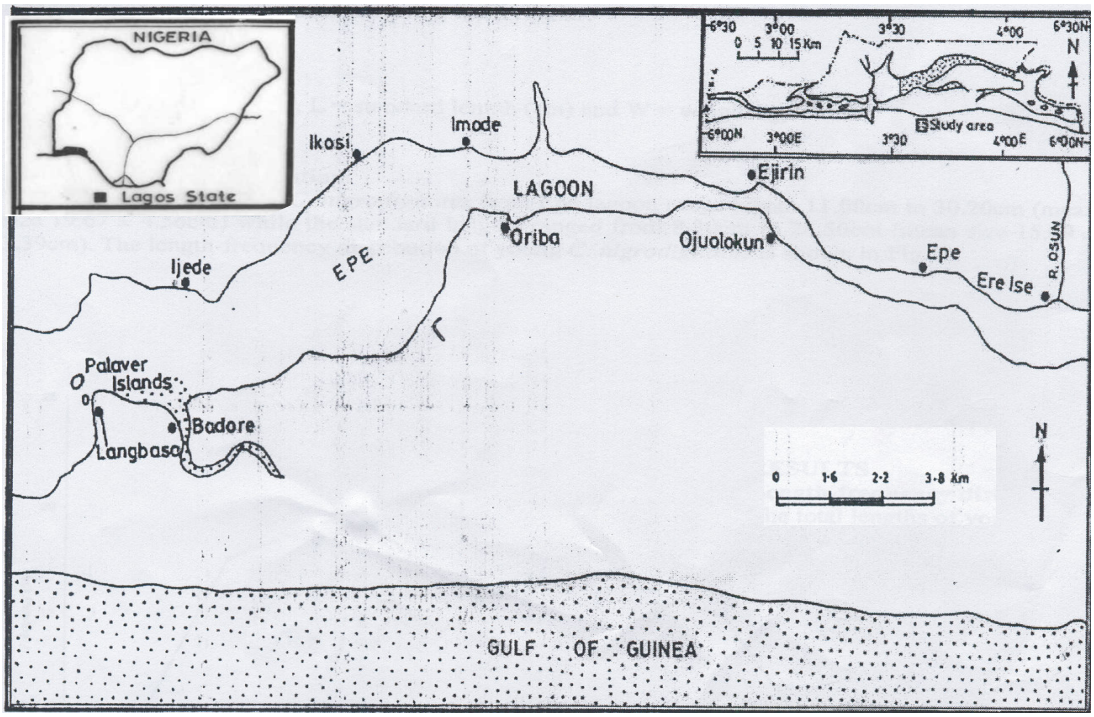

Figure 1. Map showing Lagos State and Epe Lagoon .

Elaeis guineensis and *Cocos nucifera* (Edokpayi et al., 2008).

Collection of specimens

The 600 specimens of *C. nigrodigitatus* used for this study were purchased from local fisher-folks on landing at Epe jetty. The specimens were fished with cast nets and set nets in the lagoon. The specimens were preserved in an ice-chest containing ice cubes in the field and later transferred into a deep freezer (temperature -20°C) in the laboratory prior to further examination.

Laboratory procedures

The preserved specimens were thawed and wiped dried before laboratory analysis. The standard and total lengths (in centimeters) were measured on a measuring board while the weights (in grammes) were determined using a sensitive Sartorious balance (Model 1106). The condition factor was calculated for *C. nigrodigitatus* and examined in relation to size and sex. Each stomach content was emptied into a petri dish and examined under a binocular microscope. The state of fullness of each stomach was recorded and expressed as empty ($^0/_4$), one-quarter full ($^1/_4$), half-full ($^2/_4$), three-quarters full ($^3/_4$) and full ($^4/_4$). The food habits were studied using the numerical and occurrence methods (Hyslop, 1980).

Statistical analysis

The length-weight relationship was expressed by the equation:

Log weight = Log a + b Log length

Where a and b are regression constants.

The condition factor was calculated using the formular:

$K = [100\ W] / L^3$

Where K = condition factor, L = standard length (cm) and W = weight (g).

RESULTS

Length-frequency distribution

The total lengths of *C. nigrodigitatus* from Epe lagoon ranged from 11.00 to 30.20 cm (mean size 19.67 ± 4.56 cm) while the standard lengths ranged from 8.30 to 24.50 cm (mean size 15.09 ± 3.39 cm). The length-frequency distribution of *C. nigrodigitatus* is shown in Figure 2.

Length-weight relationship

The weight of C. nigrodigitatus ranged from 11.40 to 201.73 g. Figure 3 illustrates the log length-log weight relationship of the species.

The length-weight relationship reflected a common general increase in weight with increasing length. The least squares common fit of the transformed data gave the following linear equation:

Log W = 1.5389 + 2.8168 Log L
(r = 0.8683, n = 600)

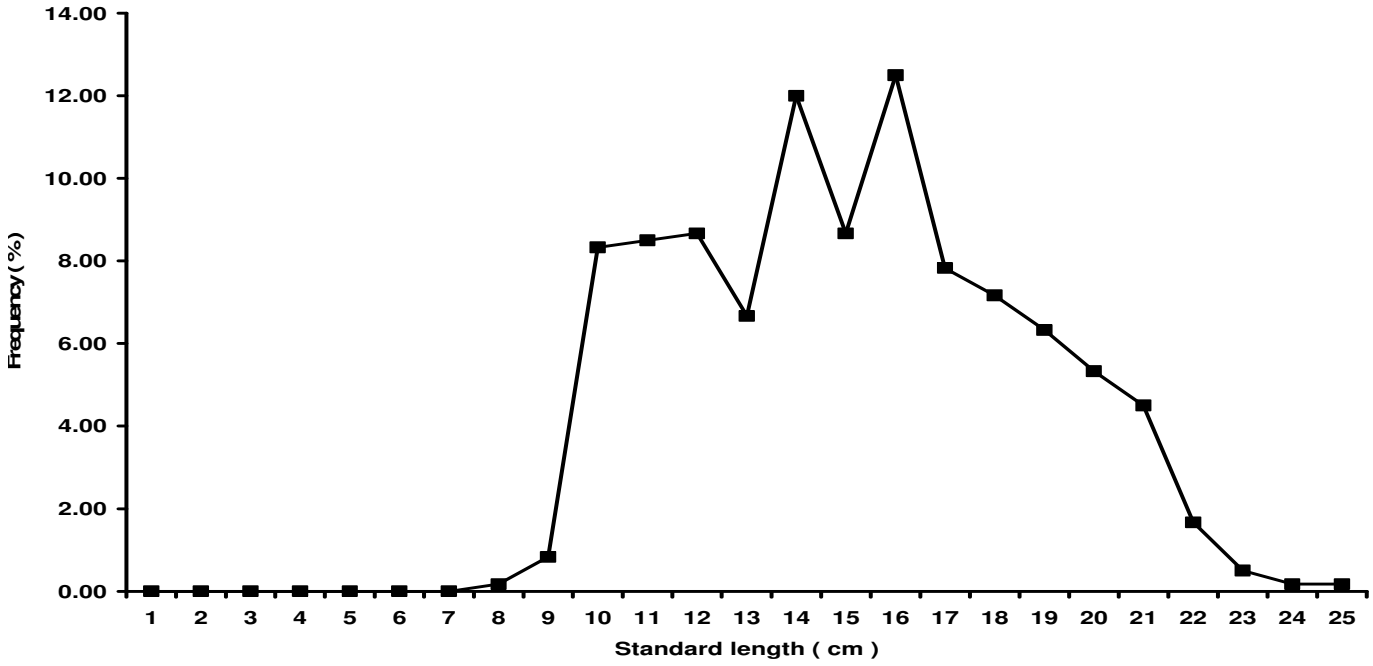

Figure 2. Standard length-frequency distribution of *C. nigrodigitatus* from Epe Lagoon.

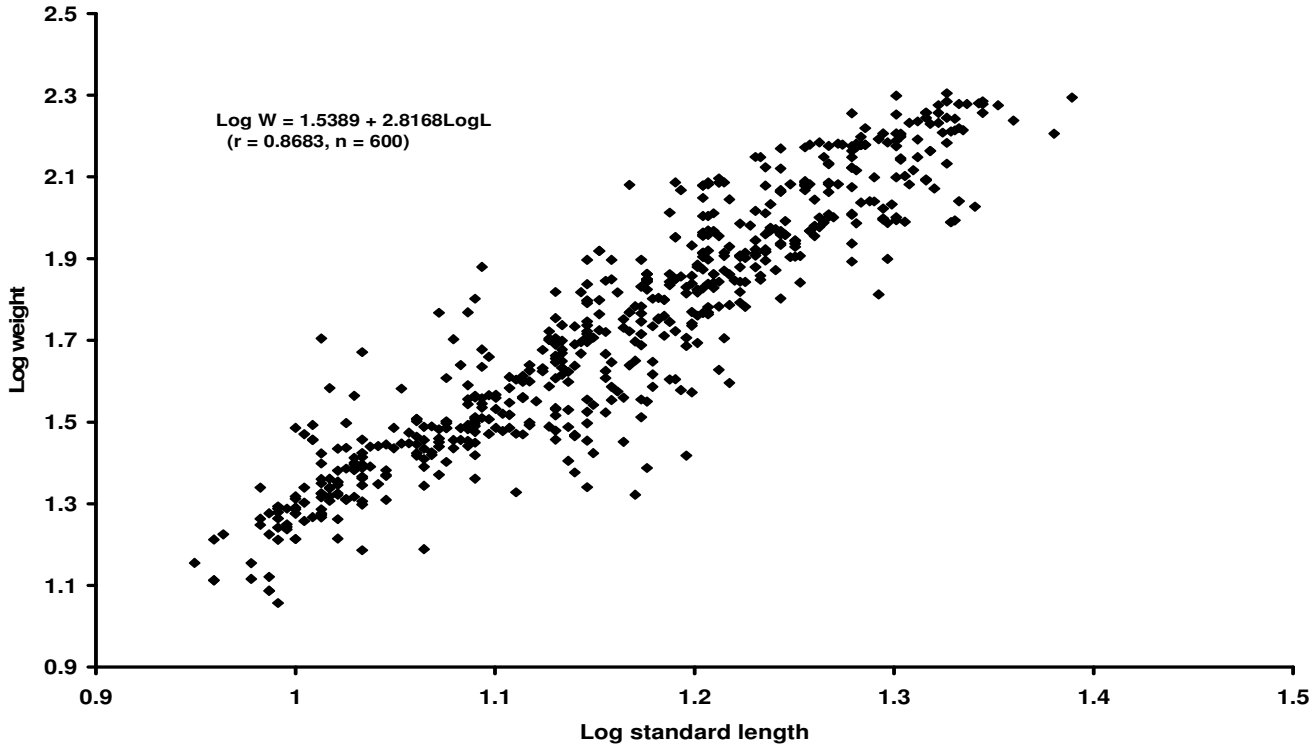

Figure 3. Log length-Log weight relationship of *C. nigrodigitatus* from Epe lagoon.

Condition factor (k)

The K-values ranged from 1.25 – 1.92, 1.72 – 2.25 and 1.25 – 2.09 for males, females and combined sexes respectively. The mean K – values were 1.68, 1.96 and 1.76 for males, females and combined sexes

Table 1. Condition factor of *C. nigrodigitatus* from Epe lagoon.

Size range SL	Male				Female				Combined sexes			
	F	SL	W	K	F	SL	W	K	F	SL	W	K
8.50 - 11.40	84	10.29	20.93	1.92	23	10.59	26.70	2.25	107	10.44	23.82	2.09
11.50 - 14.40	99	13.14	30.02	1.72	65	12.94	41.37	1.91	164	13.04	40.20	1.81
14.50 - 17.40	110	15.96	73.06	1.80	64	15.91	80.89	2.01	174	15.98	76.98	1.90
17.50 - 20.40	71	18.89	118.29	1.75	42	18.71	126.12	1.93	113	18.80	122.21	1.84
20.50 - 23.40	27	21.42	160.22	1.63	13	21.08	160.77	1.72	40	21.25	160.50	1.67
23.50 - 26.40	2	24.30	178.87	1.25	-	-	-	-	2	24.30	178.87	1.25

F = Frequency; SL = mean standard length (cm), W = mean weight (g) and K = mean condition factor.

Table 2. Summary of stomach contents of *C. nigrodigitatus* from Epe lagoon.

Food items	Numerical method		Occurrence method	
	Number	%	Number	%
Diatoms	17820	47.91	536	99.08
Green algae	6825	18.35	475	87.80
Blue green algae	4550	12.23	382	70.61
Crustaceans	3486	9.37	368	68.02
Molluscs	3318	8.92	392	72.46
Plant materials	708	1.90	480	88.73
Fish parts	489	1.32	312	57.67
Detritus	-	-	208	38.45
Unidentified mass	-	-	194	35.86

respectively (Table 1).

Food habits

A summary of food items that constituted the diet of *C. nigrodigitatus* specimens from the Epe lagoon is given in Table 2 and Figure 4. Of the 600 stomachs examined, fifty-nine stomachs (9.8%) were empty, diatoms remain the most important food item accounting for 47.91% and 99.08 by numerical and occurrence methods while green algae (18.35% in number and 87.80% in occurrence) and blue green algae (12.23% in number and 70.61% in occurrence) made up the next food group in order of importance. The classes' crustacean (9.37% in number and 68.02% in occurrence) and molluscs (8.92% in number and 72.46% in occurrence) were the next group. Other food items encountered in the stomachs were plant materials (1.90% in number and 88.73% in occurrence) and fish parts (1.32% in number and 57.67% in occurrence). Detritus and unidentified mass were 38.45% and 35.86% in occurrence, respectively.

Sex ratio

The monthly sex ratio is shown in Table 3. The overall result shows that, of the 600 specimens examined 393 (65.50%) were males and 207 (34.50%) were females giving a sex ratio of 1: 0.50. The population of males was significantly higher than females in the lagoon. A chi-square analysis of the result shows that there is a significant difference between the preponderance of the male *C. nigrodigitatus* and that of the female ($\chi^2 = 57.66$, $p < 0.05$).

DISCUSSION

The length-frequency distribution showed a triple mode and this depicted that the species were made of three age groups during the study period. The length-weight relationship of *C. nigrodigitatus* reflected an increase in weight with a corresponding increase in length. The value of the regression coefficient (b) is approximately 3 which show that the species exhibit isometric growth in Epe Lagoon (Bagenal and Tesch, 1978). The correlation coefficient (r) of 0.8683 showed a positive correlation between length and weight. Isometric growth pattern exhibited by this species was an indication that this species have homogenous groups in their populations with body weights varying indifferently with the total lengths. Offem et al. (2008) reported similar observations at Zone 11 (3.03) and Zone 111 (2.995) in Cross River.

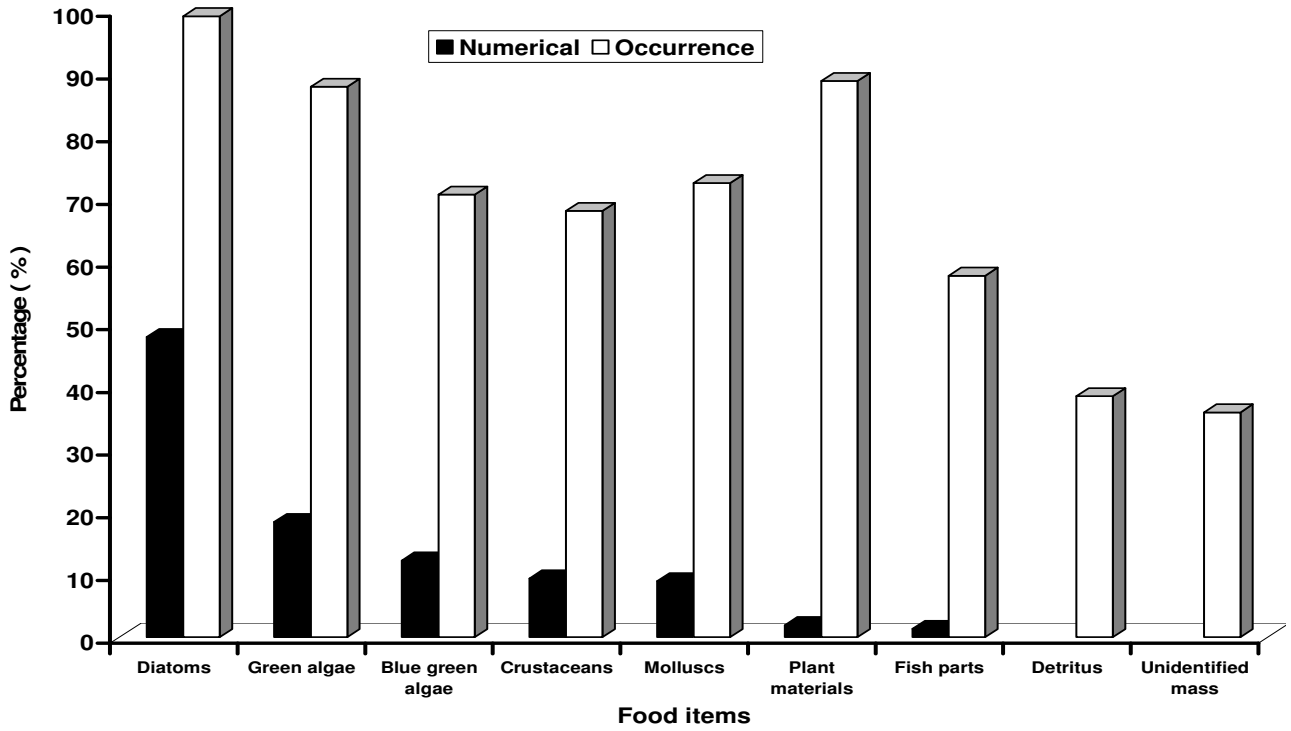

Figure 4. Distribution of food items in the stomachs of *C. nigrodigitatus* from Epe lagoon.

Table 3. Monthly variation in sex ratio of *C. nigrodigitatus*.

Month	Male	Female	Ratio		Correlation × 2 on sex – ratio
			Male	Female	
January	88	12	1 :	0.14	57.76*
February	74	26	1 :	0.35	23.04*
March	59	41	1 :	0.69	3.24*
April	51	49	1 :	0.69	0.04*
May	64	36	1 :	0.56	7.84*
June	57	43	1 :	0.75	1.96*

*Significant at 5%, 1df

There was a general decrease in condition factor with increasing length of the specimens. This is due to the landing of mainly sexually immature and juvenile fish which are in active growth stage of their lifecycles. However, the mean condition factor of 1.80 obtained for the population of *C. nigrodigitatus* in Epe lagoon is higher than 0.9673, 0.9159 and 0.7859 reported for Badagry Lagoon, Warri River and Imo River respectively (Ezenwa et al.,1986) and 0.996 reported for Cross River (Offem et al., 2008). This is an indication of the good condition of the specimens (Bannister, 1976), therefore *C. nigrodigitatus* population from Epe lagoon would provide excellent brood stocks for aquaculture elsewhere.

C. nigrodigitatus in the lagoon feed on variety of food items of which phytoplankton (mainly algae and diatom), crustaceans and molluscs are of primary importance. Other food items that probably serve as supplements are plant materials and fish parts indicating that *C. nigrodigitatus* is an omnivorous feeder. Similar results have been obtained for *C. nigrodigitatus* from Abidjan (Oteme, 1987) and from Lekki lagoon (Ugwumba and Kusemiju, 1994). The wide food spectrum of *C. nigrodigitatus* is an indication of flexibility in trophic level which gives the fish ecological advantage to feed effectively on different categories of diet based on the availability of the food items (Warren, 1993; Offem et al., 2008).

The overall sex ratio values showed that population of males was significantly higher than the females. Similar observation was reported in population of *C.*

nigrodigitatus in some Nigerian water bodies by Fagade and Adebisi (1979) and Offem et al. (2008). Large number of the male specimens over the female specimens recorded in this study could be due to the fact that fishing gears were not set close to the breeding ground. In African water bodies it is common, that in the population of fish the males dominate because, they generally present more growth than females without this representing a risk situation for the fishery (Fagade and Adebisi, 1979). The sex ratio varies monthly and the variation observed might be a reproductive strategy to ensure successful spawning over certain environmental conditions.

REFERENCES

Bagenal TB (1978). Aspects of fish fecundity. In: Methods of Assessment of Ecology of Freshwater fish production (Ed. Gerking SD). Blackwell Scientific Publication, Oxford, pp. 75-101.

Bagenal TB, Tesch FW (1978). Age and growth. In: Methods of Assessment of Fish Production in Freshwater (Bagenal TB ed). Blackwell Science Publication Oxford, pp. 101-136.

Bannister JVC (1976). The length-weight relationship, condition factor gut contents in the dolphin fish *Coryphaena hippurus* (L) in the Mediterranean. J. Fish Biol. 9: 335-338.

Edokpayi CA, Uwadiae RE, Asoro AO, Badru AE (2008). Phytomacrofauna arthropod associated with the roots of water hyacinth (*Eichhornia crassipes*) in Epe lagoon Southern Nigeria. Ecol. Environ. Cons. 14(2-3): 241-247.

Ezenwa BIO, Kusemiju K (1981). Age and growth determination in the catfish, *Chrysichthys nigrodigitatus* (Lacepede) by the use of dorsal spine. J. Fish Biol. 19(3): 345-351.

Ezenwa BIO, Alegbeleye WO, Anyanwu PE, Uzukwu, EO (1990). Culturable Fish Seeds in Nigerian Coastal Waters. A research Survey (Second Phase: 1986-1989). Nigerian Institute for Oceanography annd Marine Research. (N.I.O.M.R.) Tech. p. 66, 37.

Ezenwa BIO, Kusemiju K, Olaniyan CIO (1986). Comparative studies of the catfish, *Chrysichthys nigrodigitatus* (L) in three isolated geographical areas in Nigeria for breeding purpose. Aquat. Res. Afr. Reg. J. 1: 258-262.

Fagade SO, Adebisi AA (1979). On the Fecundity of *Chrysichthys nigrodigitatus* (Lacepede) of Asejire dam, Oyo State, Nigeria. Nig. J. Nat. Sci. 1: 127-131.

FAO (1969). Fisheries survey in the western and mid-western regions of Nigeria. FAO/SF74/NIR6.

Holden M, Reed W (1991). West African Freshwater Fish. Longman Publishers Ltd., Singapore. p. 68.

Hyslop EP (1980). Stomach content analysis: a review of methods and their application. J. Fish Biol. 17: 41-429.

Kusemiju K (1975). A comparative racial study of *Chrysichthys nigrodigitatus* (Lacepede) from Lagos and Lekki lagoons, Nigeria. Bull. Del'I.F.A.N. 37(4): 887-898.

Kusemiju K, Olaniyan CIO (1989). The length-weight relationship, condition factor and feeding habits of the catfish, Chrysichthys nigrodigitatus (L) in Lagos lagoon, Nigeria. Nig. J. Nat. Sci. 4(1-2): 144-149.

Offem BO, Akegbejo-Samsons Y, Omoniyi IT (2008). Diet, Size and Reproductive Biology of the silver catfish, *Chrysichthys nigrodigitatus* (Siluformes: Bagridae) in the Cross River, Nigeria. Rev. Biol. Trop. 56(4): 1785-1799.

Oteme ZJ (1987). Regime alimentaire des alevins de *Chrysichthys nigrodigitatus* en etang. Note a Diffusion Restreinte, Centre Rech. Oceanogr. Abidjan, NDR 04/87, p. 2.

Reed W, Burchard J, Hopson AJ, Jenness J, Yaro I (1967). Fish and Fisheries in Northern Nigeria. Ministry of Agriculture Northern Nigeria, Zaria, Nigeria. p. 226.

Tudorancea C, Fernando CH, Paggi JC (1988). Food and feeding ecology of *Oreochromis niloticus* (Linnaeus, 1758) juveniles in Lake Awassa (Ethiopia). Arch. Hydrobiol. Suppl. 79(2-3): 267-289.

Ugwumba AAA, Kusemiju K (1994). The food and feeding habits of the non-cichlid fishes of Lekki Lagoon, Nigeria. Nig. J. Sci. 28(4): 281-384.

Ugwumba AAA, Ugwumba OA (2007). Food and feeding ecology of fishes in Nigeria. Jodetan Ventures, Ibadan. p. 91.

Warren WG (1993). Changes in the within-survey spatial temporal structure of the northern cod (*Gadus morhua*) population. Can. J. Fish. Aquat. Sci. 54(1): 139-148.