academicJournals

Vol. 7(6), pp. 402-409, June 2013
DOI: 10.5897/AJEST12.137
ISSN 1996-0786 © 2013 Academic Journals
http://www.academicjournals.org/AJEST

African Journal of Environmental Science and Technology

Full Length Research Paper

Food items and general condition of *Hyperopisus bebe occidentalis* (Lacepede, 1803) caught in Warri River, Nigeria

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Accepted 4 June, 2013

A total number of 202 specimens, comprising 75 females and 127 male specimens of *Hyperopisus bebe occidentalis* were caught from Warri River. This gave a 1:1.7 female to male sex ratio. The total length range for male specimens was 189.2 to 355.0 mm and 246.0 to 376.1 mm for females. The body weight range for male specimens was 51.0 to 448.0 g, while that recorded for female specimens was 106.0 to 400.0 g. The correlation coefficient for length-weight relationship revealed significant differences (P<0.05) for male ('r' = 0.77) and female ('r' = 0.51) specimens, respectively. The slope of the regression co-efficient 'b' was (2.68) for males and 1.76 for females. Both values were less than 3 implying that the fish increased more in total length than in body weight. The condition index was more favorable for male (4.64) than for female (4.14) specimens based on mean value calculated on fresh and gutted body weights.

Key words: Food items, *Hyperopisus bebe occidentalis*, Warri River, condition factor.

INTRODUCTION

Hyperopisus bebe of the family Mormyridae was formally placed under the genus *Mormyrops* (Malami et al., 2002; Olaosebikan and Raji, 1998). This species is well distributed in swamps, lakes and rivers of most Nigerian fresh water bodies (Ogbeibu and Ezeunara, 2005; Idodo-Umeh, 2003; Malami et al., 2002, 2004; Babatunde and Aminu, 2004); where they are far more abundant than other mormyrids. This species has always been consumed for their oily and tasty flesh. Some researchers (Kauamelan et al., 2002; Nwani, 2004; Malami et al., 2002, 2004) studied the food and feeding habit of this species in different bodies of water. They reported a higher occurrence of plant materials in the guts of juvenile than in the guts of adult specimens examined. Food items of plant and animal origins were also consumed indiscriminately when their preferred food items were scarce.

In Anambra River for instance, this species consumed benthos and allochtonous invertebrates mixed with a limited amount of mud (Malami et al., 2002, 2004; Nwani et al., 2006). The study of food and feeding habits enables farmers to have clear understanding of the fish's dietary requirements and to compound appropriate feeds as supplement in aquaculture (Malami et al., 2004). Sufficient food intake aids optimal growth in fish, resulting in production increases and subsequent economic benefits.

Pius and Benedicta (2002) reported on the benefit of gut content analysis for reducing intra- and inter-specific competition of fish in the ecosystems.

Literature review revealed that information on food and feeding habit of *H. bebe* harvested from the Warri River was lacking.

The present study therefore investigates the recent diet composition and general conditions of this commercially important fish species harvested from Warri River.

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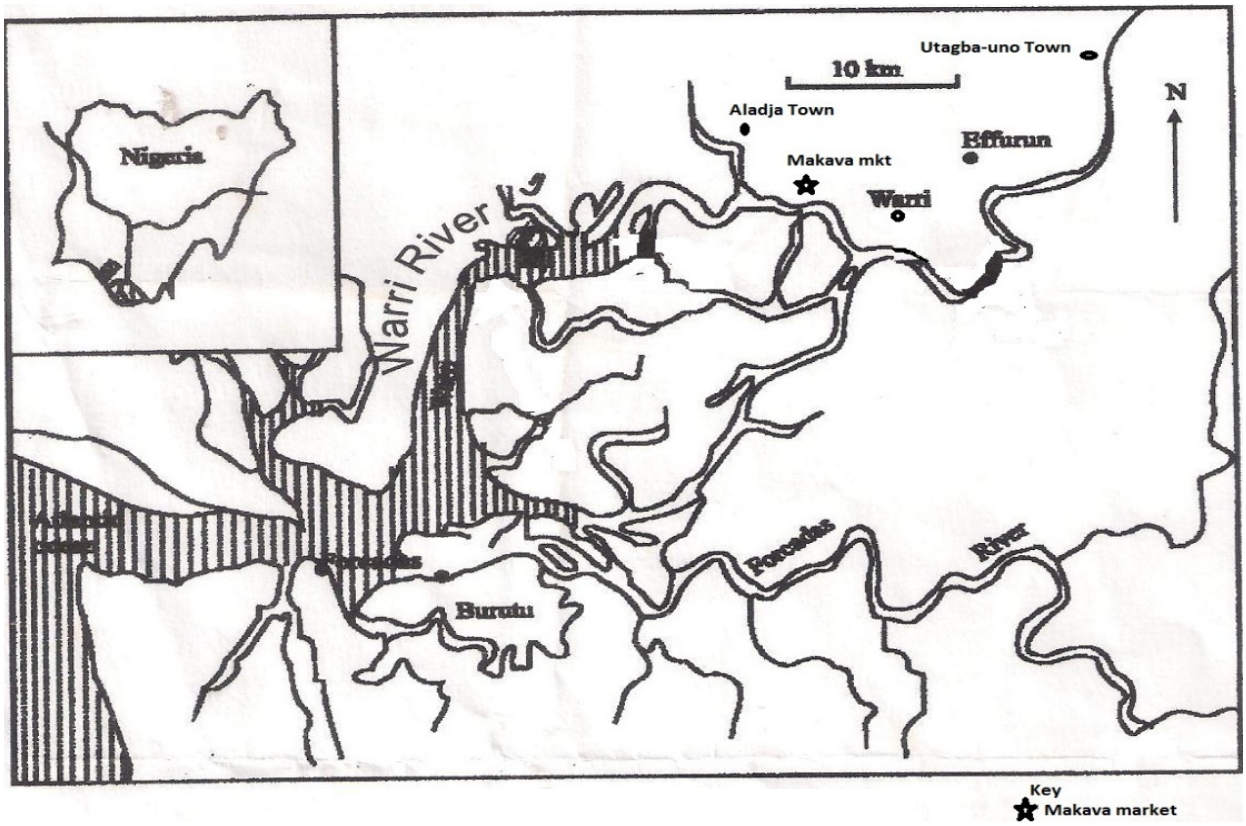

Figure 1. Map of Warri River showing the sample collection station.

MATERIALS AND METHODS

Warri River is one of the most important coastal rivers of the Niger-Delta region. It takes its source about 10 km away from Utagba-Uno which lies North and East of the Equator within latitude 6° 0^{l} N and longitude 5° 2^{l} E (Figure 1). It covers a surface area of 255 km^2 with a length of about 150 km^2 (Olomukoro and Egborge, 2004).

Fish sampling

Fish sampling was conducted on a monthly basis, between April and September, 2010. The gears used were cast nets, traps, fleets of nylon multifilament set gill nets of diverse mesh sizes and other traditional fishing gears, positioned in the morning on each sampling day. Fishes harvested were injected with 5% formalin (in the abdominal region) in order to arrest food digestion during transportation of specimens to the fisheries laboratory located at the Asaba Campus of the Delta State University, where gut content examination was carried out.

Fish identification, length/weight measurements and gut content analysis

Fish specimens were identified to species level with the aid of keys according to Idodo-Umeh (2003) and Nwani (2004) before sorting into male and female sex. Total length and body weight measurements were recorded to the nearest ± 0.01 mm and ± 0.1 g using a measuring board and a triple beam balance (OHAUS 210 Model), respectively. Length weight relationship was calculated with the formula W = aLb according to Nwani et al. (2006) and Erhijowvho (2007). Bodyweight increases more rapidly than total length; hence, the formula was logarithmically transformed for the purpose of data analysis; thus:

$$\text{Log } W = \text{Log } a + b \text{ Log } L$$

Where 'a' was the proportionality constant, 'W' was the weight of fish in grams (g), 'L' was the total length of fish in millimeters (mm) and '*b*' was the allometric growth coefficient.

Guts were opened surgically, and weighed with and without food materials contained in them. Food items in those guts that could not be examined immediately were preserved in sterilized labeled vials containing 1% formalin. Large food items, easily recognized with the naked eyes, were counted, while microscopic ones were teased to disperse their aggregates in accounting chamber. They were examined and counted under a binocular microscope at a magnification of X 10. All recognized food items were identified according to methods described by Kadiri (1987, 2002). Food items were analyzed using three methods of gut content analysis described as follows:

Frequency of occurrence method

The number of guts in which each food item occurred was listed and expressed as a percentage of the total number of guts examined. The proportion of the fish population that fed on a particular food item was estimated according to Odun and Anuta (2001) and Inyang and Nwani (2004).

Table 1. Mean value for total length and body weight of *Hyperopisus bebe* sampled during the study.

Month	Sample size: Male	$\bar{x}$ T_L (mm)	$\bar{x}$ B_W (g)	Sample size: Female	$\bar{x}$ T_L (mm)	$\bar{x}$ B_W (g)	Sex ratio
April	19	279.0	210.0	0	281.0	210.0	1:0
May	25	274.4	163.0	3	280.0	165.0	8.3:1
June	15	313.0	262.0	18	302.7	249.0	1:12
July	20	292.0	187.0	20	312.3	276.0	1:1
August	27	288.7	177.0	13	293.8	176.0	2:1
September	20	285.7	191.0	20	288.5	209.0	1:1
Total	127			75			1:1.7

Note: mm = millimeters, g = gram, $\bar{x}$ T_L = mean total length, $\bar{x}$ B_W = mean body weight.

Numerical method

The total number of each food item from each gut was summed up for all guts and expressed as a percentage of the total number of all food items as expressed by Odun and Anuta (2001) and Inyang and Nwani (2004).

Point method

One hundred points were shared among the food items present in each gut according to their sizes, and expressed in percentage according to Inyang and Nwani (2004).

Condition factor

The condition factor (K), describing the wellbeing of a fish was calculated according to Erhijivwo (2007) thus:

$K = 100\ W/L3$

Where K = condition factor, L = standard length of fish in mm, and W = body weight of fish in grams.

Feeding intensity

Feeding intensity of each specimen was calculated according to Erhijivwo (2007):

$$\text{Feeding intensity} = \frac{\text{Gut weight} \times 100}{\text{Body weight} \times 1}$$

RESULTS

Fish population, length-weight relationship and sex ratio of specimens

Two hundred and two (202) specimens, comprising 127 males and 75 females were examined. Thus, the overall proportion of 1:1.7 female to male sex ratio was calculated (Table 1). Total length ranged between 189 to 379 mm, while body weights varied from 50 to 499 g. The male specimens exhibited both highest and lowest total length frequencies measured (300 to 309 and 180 to 189 mm, respectively, Figure 2). At the weight range of 200 to 249 g, male specimens accounted for the highest population proportion (37 specimens), while at a weight range of 400 to 449 g, only one specimen was encountered. For female specimens, at the highest (350 to 399 g) and lowest (150 to 159 g) body weight ranges, 231 specimen were measured, respectively (Figure 3). Features of *H. bebe* involving body weight and total length measurements were described by the correlation coefficient relationship transformed logarithmically and expressed as log W = aLb, where the 'r' value was 0.77 for males (Figure 4) and 0.51 for females (Figure 5).

Both values were statistically significant at $p<0.05$. The '*b*' value for males (2.68) was higher than that for females (1.76). However, both values indicate negative allometric growth, because they were lower than the value of three.

Condition factor

Our analysis revealed that male specimens (K = 4.64) were in a better condition than the female specimens (K = 4.14) based on mean values calculated for fresh and gutted body weights (Table 2).

Gut fullness, food items analyzed and seasonal variation in feeding habits

Out of the 202 specimens examined for food items in the gut, only four guts were empty, accounting for 1.9%. Twenty-four specimens had full guts accounting for 11.9%, 46 specimen had three quarter full guts (22.8%), 87 specimen had half-full guts (43.1%), and 41 specimens had quarter-full gut content accounting for 20.3%. The three methods used for the analysis of gut contents revealed that the most dominant food item identified were Bacillariophyta. This family contributed 22.8% by numerical method and 23.4% by frequency of

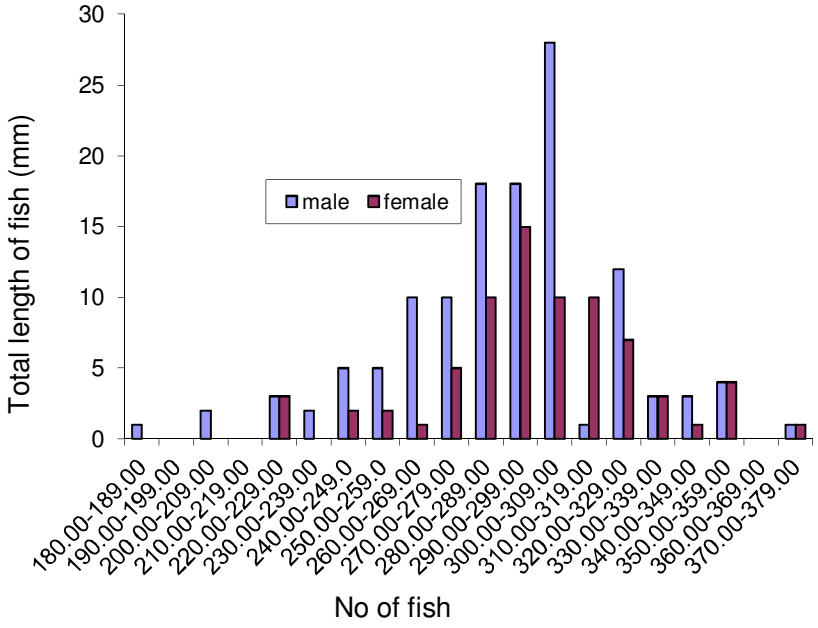

Figure 2. Length frequency distribution of male and female specimens of *H. bebe*.

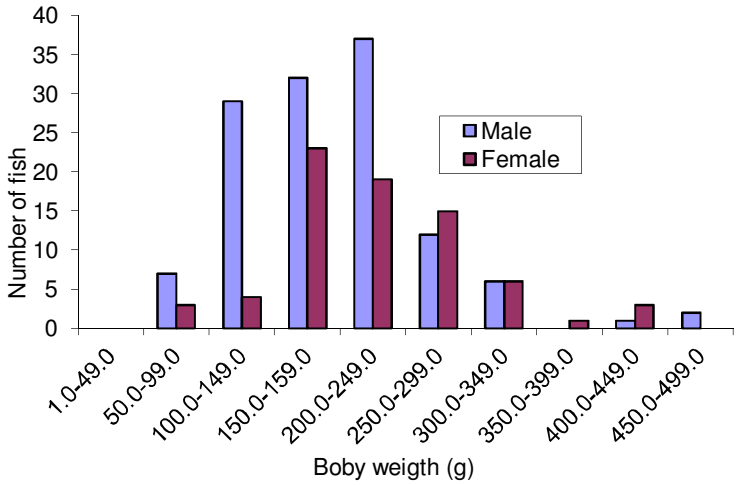

Figure 3. Body weight frequency distribution of male and female *H. bebe*.

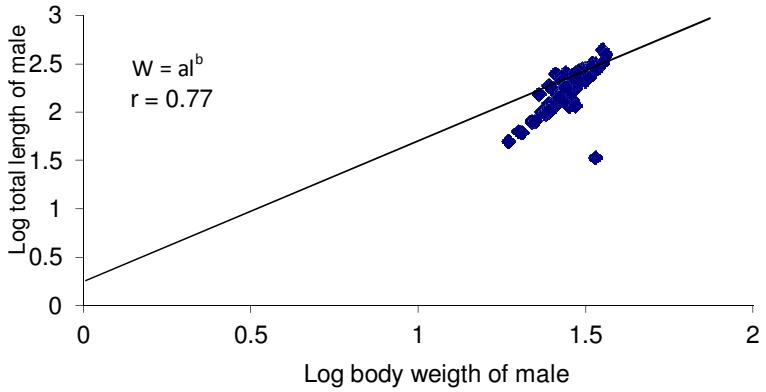

Figure 4. Log relationship between total length and body weight of male *H. bebe.*

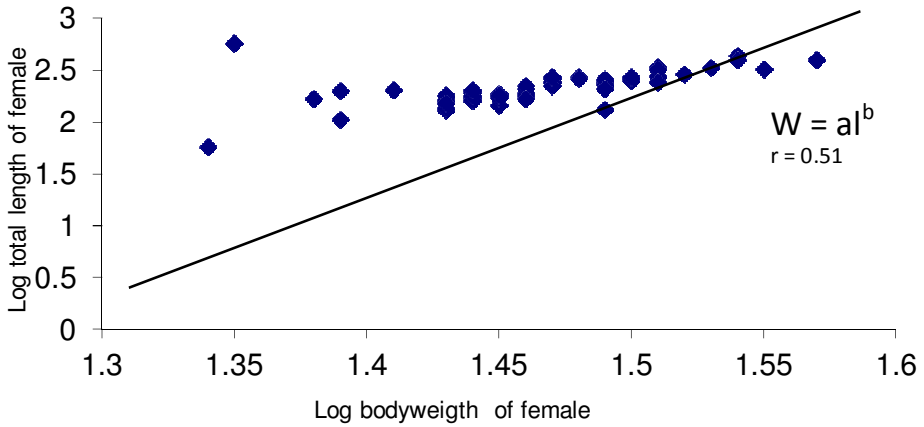

Figure 5. Log relationship between total length and body weight of female *H. bebe*.

Table 2. Mean condition factor for fresh and gutted body weights of *H. bebe*.

Sex	No of specimen	Mean k for fresh body weight	Mean k for gutted body weight
Male	127	0.87	4.64
Female	75	0.68	4.14
Male + Female	202	1.55	8.78

K = Condition factor.

occurrence method to the total diet of the fish analyzed. Dinoflagellates contributed 16.2%, by the numerical method and 20.4% by the point method. Chlorophyta made up 10.4% by numerical method, while insect parts were the least dominant food item contributing 0.7% both by numerical and frequency of occurrence methods (Table 3). No strong seasonality of food items consumed was observed, as the examined fish specimens grazed on those food items which were available throughout the sampling period. However, the diet composition and frequency of food items varied slightly. The fish guts were generally well-filled throughout the study period. The fullest guts were found during the months of April, May and June, when the specimens fed more on green algae, seed grains and Bacillariophyta. Specimens equally fed on dinoflagellates and root hairs within the months of July, August and September. Variations in diet composition were found to be size rather than sex-dependent.

This observation suggests that the plasticity in food abundance and diet composition exhibited by both sexes enables them to exploit various food sources. Thus, they are capable of not only maintaining their distribution in the present habitats, but also to colonize wider habitats.

DISCUSSION

Size frequency distribution

The size class frequency distribution of specimens used for this study reveals differences in body weight, size class and maturity stages within the population of specimens examined. This observation is similar to those of previous studies (Nwani, 2004; Ogheneochuko, 2007; Omorinkoba and Fatuiti, 2009). Omorinkoba and Fatuiti (2009) stated that the size class or body weight of a fish determines the spectrum of food items it will consume. Understanding the relationship between body size/structure and fish food is therefore important for interpreting the fish's diet and feeding mechanisms. Hence, the type of food available in an area influences the distribution, abundance and rate of growth (size) of the fish (Ogheneochuko, 2007).

Sex ratio

Male specimens were caught more than females in April and May. This finding is most likely due to season as female migrate into deeper waters for spawning during this period (Nwani, 2004).

Length weight relationship

There was a significant correlation between body weight and total length of specimens found in this study. Increases in total length resulted in corresponding increases in body weight, as reported (Nwani et al., 2006). According to Olurin and Aderibigbe (2006),

Table 3. Results of gut content analyzed using three methods of analysis of gut content.

Food item	Numerical method		Frequency of occurrence		Point method	
	No	%	No	%	No	%
Bacillariophyta: *Navicula* spp.	182	8.5	103	7.9	120	8.5
Ulothrix spp.	159	7.4	118	9.1	120	8.5
Tabellaria spp.	144	6.7	77	5.9	101	7.1
Coscinodiscus spp.	6	0.2	6	0.5	15	1.0
Total	491	22.8	304	23.4	356	25.1
Chlorophyta: *Closterium* spp.	116	5.4	78	6.0	55	3.9
Cosmarium spp.	63	2.9	42	3.2	30	2.1
Spirogyra spp.	46	2.1	34	2.6	21	1.5
Total	225	10.4	144	11.8	106	7.5
Dinoflagellates: *Gomyaulax* spp.	185	8.6	114	8.8	125	8.8
Ceratium spp.	27	1.3	23	1.8	50	3.5
Merismopedia spp.	136	6.3	88	6.8	115	8.1
Total	348	16.2	225	17.4	290	20.4
Crustaceans: Shrimp parts	10	0.5	9	0.7	21	1.5
Crayfish parts	71	3.3	42	3.2	70	4.9
Total	81	3.8	51	3.9	91	6.4
Chironomid larva	186	8.6	113	8.7	65	4.6
Coleoptera: Whole beetle	100	4.6	71	5.5	70	4.9
Beetle parts	94	4.4	38	2.9	58	4.1
Total	194	9.0	109	6.4	128	9.0
Insects: Whole parts	15	0.7	9	0.7	25	1.8
Root hairs	179	8.3	96	7.4	120	8.5
Sand and stones	146	6.8	51	3.9	44	3.1
Seed grains	141	6.6	68	5.4	98	6.9
Unidentified	145	6.7	117	9.0	95	6.7
Grand total	2,151	100	1,297	100	1,418	100

differences in total length and body weight distributions are dependent of sex and developmental stages of the fish. Aliakbar and Ali (1978) and Kunda et al. (2008) proposed that fluctuations observed in certain length groups might be due to variation in sample size, sex, gonad condition and amount of gut content. Length-weight relationship measurements are important for the estimation of weight where only length data are available, as well as a condition index of fauna (Haimovici and Velasco, 2000). Length-weight relationship has also been shown to be useful in estimating standing stock biomass and densities of various organisms in the aquatic habitat. Specimens used for this study exhibited negative allometric growth having a '*b*' value lower than 3. Olele and Obi (2004) reported positive allometric growth where the '*b*' value for *Citharinus citharus* caught in Onah Lake was higher than 3 (3.1). Other '*b*' values reported were either lower or higher than 3, as been reported by Arawomo (1981) thus (2.8) and (Baijot et al., 1997) (2.5 to 3.5). Differences in '*b*' values may be influenced by sex, maturity stages, seasonality and the time of day the food was consumed by the fish when fullness of gut content is measured.

Fagade and Adebisi (1979) reported that in cichlids, an increase in body weight was associated with an increase in standard length. They reported a '*b'* value of 2.9 and 3.4 for *Tilapia melanotheron* and *T. guinensis*, respectively.

Condition factor

The condition factor calculation for *Hyperopisus* specimens based on fresh and gutted body weights analysis revealed that those for males were higher than those for females. This observation could indicate that

the former fed better than the latter at all times. Such conditions may also be responsible for a better survival of male specimens, as was previously reported (Nwani, 2004).

Analysis of food items

Food items identified were both of plant and animal origins, suggesting that the fish acted as an omnivore. This assertion was already proposed by Malami et al. (2004). Much of the variation in diet composition of this species depended on the availability of food items, which has also been previously described (Ogbeibu and Ezeunara, 2005).

Fullness of gut content

The overall results of the gut fullness analyses revealed that 2% of guts were empty, while varying quantities of food items were found in 98% of guts. The observance of higher non empty guts may have resulted from the immediate arrest of food digestion through the injection of formalin in the gut region of the fish before their conveyance to the laboratory for examination. This result is in line with those of Malami et al. (2004) on the same species. The greater number of guts with food is generally attributed to a successful feeding strategy adopted by the specimens (Haroon, 1998; Nwani, 2004), and additionally benefitting from good food abundance during the sampling season. It was observed that more food items were recorded during the rainy and flood seasons. During this period, insects and grains/seeds occured in higher numbers. This observtion is supported by the study of Nwani (2004), who reported on active feeding behavior of *H. bebe* in the River Rima during the early rainy season.

Kouamelan et al. (2002) investigated the food and feeding habits of *Mormyrus rume* in Bia River Cote de' voir, Ghana. They report that young specimens feed more on Chironomid larvae and Bacilliarophyta, while adult specimens feed more on other food items both during the dry and rainy season.

Conclusion

H. bebe belongs to the family of Mormyridae, which is one of the largest groups of fishes in the Nigerian waters. Their ability to feed on a wide range of organisms at different trophic levels (food chain) is the most likely reason for full guts in the majority of analyzed specimens. Thus, they may be described as euryphagous, feeders that consume any food item that could readily come across, particularly when many/different food items are not available. This might also explain their fast growth. Furthermore, the knowledge on the feeding habits of this species resulting from this study should be of benefit in the formulation of supplementary diets necessary for mass production. This will help to meet local demands as well as generate foreign exchange for the country.

REFERENCES

Aliakbar M, Ali ML (1978). Length-weight relationship of *Macrobrachium rosenbergii* (DeMan) of Dakatia River. Bangladesh J. Aquat. 1(1):74-78.

Arawomo GAO (1981). The growth of *Heterotis niloticus* in Opa Reservoir, University of Ife. Proc. of the 2nd Ann. Conf of the Fisheries Society of Nigeria. pp. 34-41

Babatunde DO, Aminu R (2004). Field guide to Nigerian fresh water fishes, second Edition. pp. 61.

Baijot E, Moreau J, Bouda S (1997). Hydrobiologica aspects of fisheries in small reservoirs in Sahel region. Technical Centre for Agricultural and rural co-operation ACP-Eu. pp. 200.

Erhijivwo CA (2007). Food and feeding habits of *Heterotis noliticus* caught in Onah Lake Asaba, Nigeria. B. Sc. Thesis. Department of Animal science and fisheries, Delta State University. Asaba, Delta State, Nigeria.

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

Haimovici M, Velasco G (2000). Length-weight relationship of marine fishes from southern Brazil Naga, International center for living Aquatic Resources management. Quarterly 23:19-23.

Haroon AS (1998). Diet and Feeding ecology of two species of *Barbodes gonionotus* and *Oreochromis niloticus* in rice field in Bangladeh. Naga, the ICLARM Quarterly pp. 13-18.

Idodo-Umeh G (2003). Freshwater fisheries of Northern Nigeria. (Taxonomy, Ecological Notes, Diet and Utilization). ISBN 978-8052-01-0.

Inyang WM, Nwani CD (2004). Food and feeding habits of *Distichodous* spp (Osteichthyes Distichodontidae) in Anambra River. J. Biol. Res. Technol. 4:34-43.

Kadiri MO (1987). Algea and primary productivity studies of Ikpoba Reservoir. Ph.D thesis. University of Benin, Benin City. pp. 298.

Kadiri MO (2002). Periphyton of Ikpoba River in Benin City, Edo State. B.Sc thesis, University of Benin, Benin City. pp. 45.

Kouamelan PE, Juegels GG, Ollevier F (2002). Feeding habits of *Mormyrops anguiloides* (mormyridae) in lacustrine and riverine habitat of a West African basin. Cybium 24 (i) 69-79.

Kunda M, Dewan S, Uddin MJ, Karim M, Kabir S, Uddin MS (2008). Length-weight relationship, and condition factor of *Macrobrachium rosenbergii* in the rice fields. Asian Fish. Sci. 21:451-456.

Malami GZ, Ipinjolu JK, Hassan WA, Magawata I (2004). Feeding adaptations of ten fish species in river Rima, North Western Nigeria. A paper presented at the 2004 Annual conference of Zoological Society of Nigeria held at the Institute of Developmental Research, Ahmadu Bello University, Zaria. pp. 115.

Malami GZ, Ipinjolu JK, Hassan WA, Magawutu F (2002). Food and feeding habits of freshwater mormyrid (*Hyperopisus bebe occidentalis*, Gunther) in River Rimo and Goronyo Dam, Nigeria. FISON conference proceeding (2007). pp. 120 -126.

Nwani CD (2004). Aspects of the biology of mormyrids in Anambra River, Nigeria. Ph.D Thesis University of Nigeria Nsukka. pp. 194.

Nwani CD, Ezenwanji H, Maduka GE, Effiong J, Emmanuel F (2006). Length - weight relationship and condition factor of four mormyrid species of Anambra river. Department of applied Biology, Ebonyi state University PMB 53, Abakaliki, Ebonyi State, Nigeria - Fisheries Hydrobiology Research Unit. Department of Zoology, University of Nigeria, Nsukka.

Odun O, Anuta M (2001). The food and feeding habits of Musansorgi (Boulenger) from Warri River. Niger. J. Aquat. Sci. 21:16-18.

Ogbeibu AE, Ezeunara PU (2005). Studies on the food composition and feeding pattern of fish communities in the Ikpoba River, Southern Nigeria. J. Aquat. Sci. 20 (2):117-129.

Ogheneochuko OS (2007). Food and feeding habits of *Parachanna*

obscura in Anwai River. A tributary of River Niger in Asaba. B.Sc. Thesis. Department of Fisheries, Delta State University, Asaba Campus. pp. 10.
Olaosebikan BD, Raji A (1998). Field guide to Nigerian fresh water fisheries. Federal College of Freshwater Fisheries Technology, New Bussa Niger State, Nigeria. pp. 106.
Olele NF, Obi A (2004). Reproductive biology of *Citharinus citharus* in Onah Lake, Asaba. Delta State of Nigeria. Trop. Freshw. Biol. 13:119-129.
Olomukoro JO, Egborge ABM (2004). Hydrobiological Studies on Warri River, Nigeria part 11: Seasonal trend in physiochemical limnology. Trop. Freshw. Biol. 12/13:9-23.
Olurin KB, Aderibigbe OA (2006). Length-weight relationship and condition factor of pond reared juvenile *Oreochromis niloticus*. World J. Zool. 2:82-85.
Omorinkoba WS, Fatuiti EO (2009). Food and feeding habits of *Heterotis niloticus*. Swim up advanced fry from the Kainji Freshwater Reservoir. Department of Fisheries. Niger. J. Fish. Sci. Technol. 1:89-92.
Pius MO, Benedicta OO (2002). Food and feeding inter-relationship. A preliminary indicator to the formulation of the feed of some *Tilapia* fishes. Trop. J. Anim. Sci. 5(1):35-41.