LENGTH-WEIGHT RELATIONSHIPS AND FOOD AND FEEDING HABITS OF SOME CHARACIDS (OSTEICHTHYES: CHARACIDAE) FROM ANAMBRA RIVER, NIGERIA

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ABSTRACT

The length-weight relationship of the commonly caught species of characids; Brycinus leuciscus, Hydrocynus vittatus, Alestes baremoze, and Brycinus macrolepidotus is provided in this study along with their percentage relative frequency of food groups. There were positive estimates for coefficient of correlation (r^2) of length-weight relationship whereas the condition factor (K) values depict overall poor being of these species. The lower condition factor (K) range (0.693 – 1.688) was suggestive of poor ecological conditions due to heavy anthropogenic influence on the River. The feed spectrum showed that the four species consumed oligochaetes, detritus, rice bran, adult insects, larvae of insect, groundnut, maize, beans, bambara nut and cassava tuber.

Keywords: Characidae, Anambra River, Tropics, Food reserve, Ecosystem

INTRODUCTION

The members of the family Characidae are only found in African and South American continents, which once existed as parts of a single continental mass termed Gondwana. They are widely consumed as they form important food resource for human communities living along the banks of broad tropical rivers (Orti and Meyer, 1997). The Nigerian people with a population of over 120 million are perhaps the largest consumers of characid species in Africa and frequently caught characids in Nigeria (Echi, 2005). The Characidae is one of the dominant fish groups in African freshwater rivers (Ikomi and Sikoki, 2001). Some attempts have been made towards proving information on general biology of the characids in Nigeria (Ikomi and Sikoki, 2001; Echi and Ezenwaji, 2010). Also, the condition factor of the commonly studied characid *Brycinus nurse* has been observed by (Saliu, 2001).

However, comparatively most studies and information on the aspects of biology of characids is relatively concentrated and even ongoing in Latin American region much more than in African region due to so many obvious reasons. For instance, Marco (2010) chronologically appraised some of the records offered in the literature on fecundity aspect of biology in species of Characidae, which typically emphasizes high level of studies of Characidae in neotropical region.

Nevertheless, as part of imbued efforts to improve data deficient situation in Africa and that the information concerning the length-weight relationship of the commonly caught species of characids at Otuocha sampling port, Anambra River is limited. Therefore, the present effort was to provide length-weight relationships information among the commonly caught specie of characids to bridge the present fissure in information.

Information about length-weight relationship gives insight about state of fish as vital food resource (Rawat *et al.,* 2014). Also, high and low condition factor K for instance, is an expression of overall well being and poor state of the fish respectively (Gupta and Gupta, 2013).

It is understood that fish sampling courses and analyses of fisheries data cannot be complete without comprehensive Length-weight relationship data generation, which is essential set standard in fisheries (Morato *et al.,* 2001; Mendes *et al.,* 2004).

In aquatic science, heavy nature of fish as translated in general suitability of certain length possessed by fish samples relation to living and non living factors influence on fish life and their aquatic ecosystem (Bagenal, 1978; Anene, 2005).

MATERIALS AND METHODS

Fresh samples of commonly caught characids from fishers at Otuocha sampling port in Anambra River Basin, Nigeria were identified according to details in (Leveque *et al.,* 1990; Olaosebikan and Raji, 1998). Based on monthly ecological survey (August 2004 - July 2005) they were measured to obtain each sample's total length (TL), (SL) and body weight (W) to the nearest 0.1 cm and 0.01 g using meter rule and a top loading Mettler balance respectively. Then length-weight relationship using the formula $W = aL^b$, where W is total body weight (g), L the total length (cm), a and b are the coefficients of the functional regression between W and L according the details in Ricker (1973). The 95% confidence interval, CI of b was computed using the equation; $CI = b \pm (1.96 \times SE)$.To confirm whether b values obtained in the linear regressions were significantly different from the isometric value of ±95% CI of b at " = 0.05, t-test was applied as expressed by the equation according to Sokal and Rohlf (1987); $ts = (b-3) / SE$, where ts is the t-test value, b the slope and SE the standard error of the slope (b). All the statistical analyses were considered at significance level of 5% ($p<0.05$).

The Fulton's condition factor (Ricker1975) was calculated using the formula: $k = (W/L^3)100$, where k is the Fulton's condition factor, W is the weight of fish (grams), and L the total length of fish (centimeters). The visceral was opened; the stomach was sectioned into in a Petri dish containing normal saline. Then the stomach of each sample was further cut longitudinally to expose the partly digested food contents (Echi, 2005).

RESULTS

The analyses involving a total 996 samples of four commonly caught characid species', number of specimens, length-weight relationship parameters a and b, 95% confidence interval for b, correlation coefficient (r), condition factor, mean length, mean weight and growth type (negative allometric type) are presented.

The sample size for the fish species varied from 63 *H. vittatus* (female) to 194 *B. leuciscus* (male) whereas the value of b ranged from 1.997 in *B. leuciscus* (Female) to 3.221 in *B. macrolepidotus* (Female). The lowest condition factor (K) (0.693) was recorded in *A. baremoze* (Female) whereas the highest value (1.688) was observed in *B. leuciscus* (male). The values of correlation coefficient (r^2) varied from 0.256 in *B. leuciscus* (Female) to 0.783 in *A. baremoze.* Except *H. vittatus* (male) 0.384, *B. leuciscus* (male) 0.386 and *B. leuciscus* (Female) 0.256 had correlation coefficient (r^2) < 0.5 whereas others had correlation coefficient (r^2) ≥ 0.5.The t-test showed that all the fish species had negative allometric growth (Table 1).

The River is typically, seasonally flooded during wet seasons with the experience of volume contraction during dry season months. This is a means of incorporating various organic matters into it. The influx of organic materials into the River plays role in the feeding pattern of these characids.

For instance, percentage relative frequency of the food groups consumed by the characids indicated that the following items form their feed: oligochaetes, detritus, rice bran, rice, adult insect, larvae of insect, groundnut, maize, beans, bambara nut, fry, cassava tuber and wheat.

Table 1: Length-weight relationship of the commonly caught characids in Anambra River, Nigeria

Species	N	a	b	95% CI for b	r^2	K	Mean L (cm)	Mean W (g)	Growth Type
***Alestes baremoze* (Female)**	133	-2.778	2.254	2.011- 2.496	0.72	0.693	20.2225	8.955	Negative allometric
***Alestes baremoze* (Male)**	176	-2.583	2.199	2.026 - 2.372	0.783	0.748	19.803	59.542	Negative allometric
***Brycinus leuciscus* (Female)**	109	-0.772	1.505	1.013 - 1.997	0.256	1.648	9.548	14.198	Negative allometric
***Brycinus leuciscus* (Male)**	194	-1.902	2.009	1.648 - 2.370	0.386	1.688	9.475	14.181	Negative allometric
***Brycinus macrolepidotus* (Female)**	113	-3.829	2.734	2.246 - 3.221	0.527	1.053	19.845	87.535	Negative allometric
***Brycinus macrolepidotus* (Male)**	105	-2.662	2.309	1.882 - 2.736	0.527	0.958	19.414	71.068	Negative allometric
***Hydrocynus vittatus* (Female)**	63	-1.696	1.973	1.541- 2.404	0.578	0.971	19.039	66.942	Negative allometric
***Hydrocynus vittatus* (Male)**	103	-0.832	1.654	1.241- 2.067	0.384	0.958	18.743	60.621	Negative allometric

N = Sample size; a and b = regression coefficient; CI = confidence interval; r^2 = correlation coefficient; K = condition factor; L = total length; W = weight

Table 2: Percentage relative frequency of food groups in the commonly caught characids in Anambra River, Nigeria

Food group	***Alestes baremoze***	***Hydrocynus vittatus***	***Brycinus leuciscus***	***Brycinus macrolepidotus***
Oligochaetes	19.6	13.7	13.3	15.7
Detritus	10.9	7.8	26.7	13.7
Rice bran	17.4	3.9	13.3	5.9
Rice	-	2	2.2	-
Adult insects	13	19.6	-	9.8
Insect larvae	10.9	23.5	-	9.8
Groundnut	10.9	3.9	11.1	11.8
Maize	6.5	2	2.2	3.9
Beans	-	3.9	15.6	15.7
Bambara nut	6.5	2	6.7	5.9
Fry	-	13.7	-	-
Cassava tuber	4.3	3.9	8.9	3.9
Wheat	-	-	-	3.9

The feed spectrum showed that the four species consumed oligochaetes, detritus, rice bran, adult insects, larvae of insect, groundnut, maize, beans, bambara nut and cassava tuber. From the study, only *H. vittatus* consumed fry (13.7%), *B. macrolepidotus* consumed wheat (3.9%), *A. baremoze* did not consumed beans whereas the others consumed beans, *H. vittatus* and *B. leuciscus* consumed rice (2%), (2.2 %) respectively. Also, larvae of insects and adult insects were consumed by the three other species except *B. leuciscus* (Table 2).

Conclusion: Although, some contribution towards providing data on length-weight relationship of some Nigeria fish in the various aquatic ecosystems have been provided by some authors (Bakare, 1970; Saliu, 2001; Fafioye and Oluajo, 2005;

Agboola and Anetekhai, 2008), thitherto the present study on the commonly caught characids at Otuocha, Anambra River was lacking.

In Nigeria, members of the characids comprise 7 (Seven) genera and 19 (Nineteen) species (Olasebikan and Raji, 1998). This study therefore provides information on the length-weight relationships of the commonly caught characids as plumb line information to study other characid species as individual species occur differentially, relatively or predominantly in different aquatic ecosystems. Also, the differential feed material/s directly or indirectly determines the type of parasitic organisms that associate with them (Echi, 2005). For instance, comparatively, the occurrence of helminthes parasites in *B. macrolepidotus, H. vittatus* and *A. baremoze*, as well as *Myxobolus* sp. was high whereas the other parasites in *B. leuciscus* and *B. macrolepidotus* has much lower values (Echi and Ezenwaji, 2010). The condition factors (K) range (0.693 – 1.688) was outside the range (2.9 – 4.8) recommended as suitable for matured freshwater fish by Bagenal and Tesch (1978). This could have been caused by adverse environmental factors (Anene, 2005). Nevertheless, the active anthropogenic influence on the ecological parameters of the River from its bank should be a concern. For instance, complex human activities at the bank have increased influx of mainly organic materials example food materials, human excreta etc into the River and this keeps the pH range (5.5 – 7.0) at fairly constant (Echi and Ezenwaji, 2010). In such aquatic ecosystems the pH range is an indication of predominating high carbonic acid content. Also, this is characteristic of water body that is heavily infested with heavy organic materials from its surroundings resulting in low alkalinity value/s. The carbonic acid formed after dissolution of carbon dioxide gets dissociated into Bicarbonate ($HCO_3^{-)}$ and Carbonate (CO_3^{-2}) ions (Gupta and Gupta, 2013).

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REFERENCES

AGBOOLA, J. I. and ANETEKHAI, M. A. (2008). Length-weight relationships of some fresh and brackish water fishes in Badagry Creek, Nigeria. *Journal of Applied Ichthyology,* 24: 623 – 625.

ANENE, A. (2005). Condition factors of four cichlid species of a man-made lake in Imo state, Southeast, Nigeria. *Turkish Journal of Fisheries and Aquatic Sciences,* 5: 43 – 47.

BAGENAL, T. B. (1978). Aspects of fish fecundity. Pages 75 – 101. In: GERKING, S. D. (Ed.), *Ecology of Freshwater Fish Production*. Blackwell Scientific Publications, Oxford.

BAGENAL, T. B. and TESCH, F. W. (1978). Age and growth. Pages 101 – 136. *In:* BAGENAL, T. (Ed.), *Methods of Assessment of Fish Production in Freshwaters.* Blackwell Scientific Publication, Oxford.

BAKARE, O. (1970). Bottom deposits as food of inland freshwater fish Pages 89 – 95. *In:* VISSER, S. A. (Ed.), *Kainji Lake, A Nigerian Man-Made Lake, Kainji Lake Studies, Volume 1, Ecology.* Nigerian Institute of Social and Economic Research, Ibadan, Nigeria.

ECHI, P. C. (2005). *The Parasites of Characids (Osteichthyes: Characidae) in Anambra River, Nigeria*. M. Sc. Project Reports, Department of Zoology, University of Nigeria, Nsukka.

ECHI, P. C. and EZENWAJI, H. M. G. (2010). The parasite fauna of characids' (Osteichthyes: Characidae) Anambra River, Nigeria. *African Journal of Ecology,* 48: 1 – 4.

FAFIOYE, O. O. and OLUAJO, O. A. (2005). Length-weight relationships of five fish species in

Epe Lagoon, Nigeria. *African journal of Biotechnology*, 4: 749 – 751.

GUPTA, S. K. and GUPTA, P. C. (2013). *General and Applied Ichthyology (Fish and Fisheries*). S. Chand and Company PVT, Limited, Ram Nagar, New Delhi, India.

IKOMI, R. B. and SIKOKI, F. D. (2001). Studies on the distribution, abundance, growth pattern and dietary habits of *Brycinus nurse* Ruppel, 1832 (Osteichthyes: Characidae) in the River Jamieson, Nigeria. *Acta Ichthyologica Etpiscatoria*, 31(1): 27 – 44.

LEVEQUE, C., PAUGY, D. and TEUGELS, G. G. (1990). *The Freshwater and Brackish Water Fishes of West Africa.* Volume 1, Musee Royale de l'Afrique Centrale, Tervuren, Belgique.

MARCO, A. A. (2010). Reproductive characteristics of characid fish species (Teleostei: Characiformes) and their relationship with body size and phylogeny. *Iheringia Série Zoologia*, *Porto Alegre,* 100(4): 469 – 482.

MENDES, B., FONSECA, P. and CAMPOS, A. (2004). Weight-length relationships for 46 fish species of the Portuguese west coast. *Journal of Applied Ichthyology*, 20: 355 – 361.

MORATO, T., AFONSO, P., LOIRINHO, P., BARREIROS, J. P., SANSTOS, R. S. and NASH, R. D. M. (2001). Length-weight relationships for 21 costal fish species of the Azores, North-eastern Atlantic. *Fisheries Research,* 50: 297 – 302.

ORTI, G. and MEYER, A. (1997). The radiation of characiform fishes and the limits of resolution of mitochondrial ribosomal DNA sequences. *Systematic Biology,* 46: 75 – 100.

RAWAT, M. S., BANTWAN, B., SINGH, D. and GUSAIN, O. P. (2014). Length-weight relationship and condition factor of brown trout (*Salmo truttafario* L.) from River Asiganga, Uttarakhand (India). *Environment Conservation Journal,* 15(3): 41 – 46.

RICKER, W. E. (1973). Linear regressions in fishery research. *Journal of Fisheries Research Board of Canada,* 30: 409 – 434.

SALIU, J. K. (2001). Observation on the condition factor of *Brycinus nurse* (Pisces: Cypriniformes, Characidae) from Asa Reservoir, Ilorin, Nigeria. *Tropical Freshwater Biology,* 10: 9 – 17.

SINOVCIC, G., FRANICEVIC, M., ZORICA, B. and CILES-KEC, V. (2004). Length-weight and length-length relationships for 10 pelagic fish species from the Adriatic Sea (Croatia). *Journal of Applied Ichthyology,* 20: 156 – 158.

SOKAL, R. and ROHLF, F. (1987). *Introduction to Biostatistics.* 2nd Edition, Freeman Publication, New York.