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Esenowo IK
Department of Zoology, University of Uyo, Akwa Ibom State, Nigeria

Ogidiaka E
Department of Science and Technology, Fisheries and Fisheries Technology Option, Delta State School of Marine Technology, Burutu, Delta State, Nigeria

Brownson II
Department of Fisheries and Aquaculture, University of Uyo, Akwa Ibom State, Nigeria

Correspondence
Esenowo IK
Department of Zoology, University of Uyo, Akwa Ibom State, Nigeria

Length-Weight relationships of some economic freshwater fishes of Nwaniba River, Southeast Nigeria

Esenowo IK, Ogidiaka E and Brownson II

Abstract
The length-weight relationships of some economic freshwater fishes were analyzed in Nwaniba River, Southern Nigeria. Fish specimens were procured from middlemen at the landing site from January to June, 2014. The mean total length and weight were 15.76 cm and 78.39g respectively. The highest (3.512) and lowest (1.503) "a" value was recorded for *Hemichromis fasciatus* and *Oreochromis niloticus* respectively, while the "b" value ranged from 2.78 and 3.54. The mean condition factor ranged from 1.818 and 2.351. The result obtained in this study showed both negative and positive allometric growth pattern.

Keywords: Length-weight, economic freshwater fishes, condition factor, Nwaniba River

1. Introduction
Fish, especially those in tropical and sub-tropical water system are known to experience growth fluctuations which are due to factors such as changes in environmental parameters and food composition [27, 1, 25]. Apart from changes in these environmental characteristics, the morphometric characteristics are also used to assess growth fluctuation on fish populations. In this regard, it is common to use measurements such as body-length, body depth, head length, eye diameter, jaw length of fishes etc, to not only assess the fish habitat peculiarities and ecological criteria in water bodies, but to also measure discreteness and relationships among various taxonomic categories [19, 26].
Length and weight data of fish are useful parameters in estimating the length and age structures, population dynamic, growth, mortality rates and well-being of the fish [16, 17, 4, 22, 18]. They are also important tools used to obtain information on length frequency distribution [3, 12], fish condition for stock assessment [28, 1] and management of the fish population [31, 7, 13].
Condition factor in fisheries is crucial as a quantitative parameter because the heavier the fish species of a given length, the better the physiological condition of the aquatic organism [6, 33]. It is also an index to understand the life-cycle of a fish by referring to the coefficient values derived from its length-weight relationship data [30]. However, the condition factor of fish is strongly affected by biotic and abiotic environmental variables [20, 29, 4]. Recent studies on the fish fauna in Nwaniba River have been conducted on species richness and diversity of lcthyofaunal and ornamental fish species by some researchers [24, 8, 32, 9], but little or no work on the Length-weight Relationship of the fish species in the study area of Nwaniba River, hence, the need for the present study to provide information on an estimated average weight of fish species of a given length, as well as using this data to assess the relative wellbeing of some fish population in this river.

2. Materials and Methods
2.1 The Study area
Nwaniba River is located between latitude 5°2′51″ N and longitude 5°2′41″ E of Southeast Nigeria. It is one of the freshwater rivers in Uruan Local Government Area of Akwa Ibom State, Nigeria which flows from Itam River in Itu Local Government Area through Mbiakong River. The depth of the river ranged from 0.2 - 8.4m with a mean value of 3.75 ±0.57m. The annual rainfall is about 2500mm with temperature of 32^0C and relative humidity of 75%. The study area comprises dry (November-March) and rainy (April-October) seasons.

The bank of the river is mostly covered with grasses while other portions have swamp vegetation. The occupation of the local people is fishing, farming, trading, saw-milling and canoe construction. Artisanal fishermen within the river mainly exploit the fisheries using wooden dug-out canoes ranging from 5m to 50m long which serves as a means of transportation.

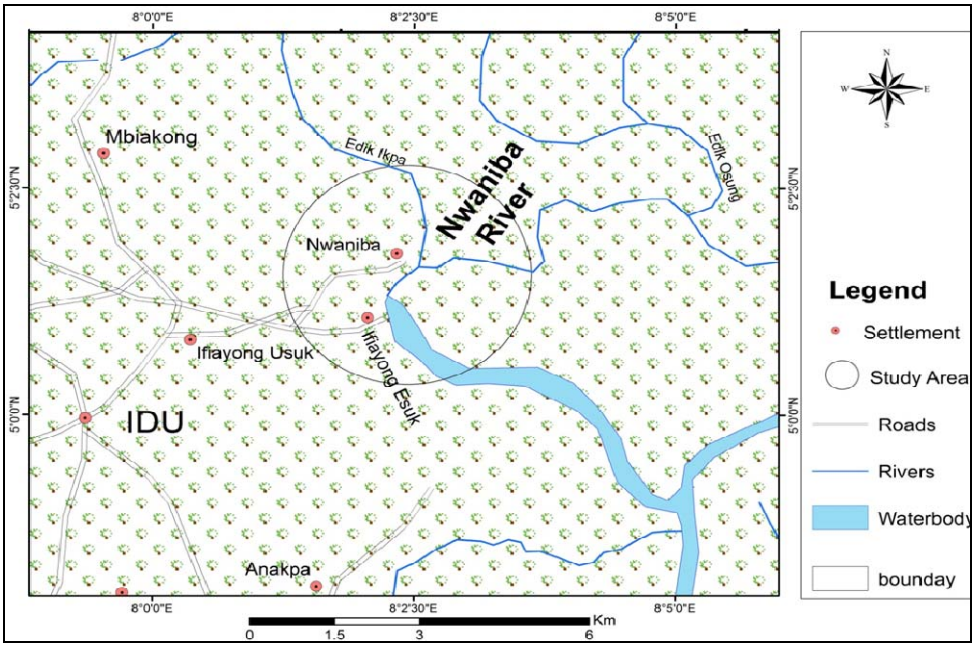

Fig 1: Map showing Nwaniba River

2.2 Collection of samples

Fish specimens were procured from middlemen at the landing site from January to June, 2014. The fishermen used a wide range of fishing gear such as hook and line, long line, cast nets, gill nets and traps. Fish specimens were randomly chosen and identified using keys and descriptions by [15]. The length-weight relationship was calculated using the least square regression on log transformation of the equation:

Log W= log a + b log L

Where W = Weight, TL = Total Length, a = exponent describing the rate of change of weight with length (intercept), b = Slope

The Condition factor, k was calculated using this formula; K=100W/L3 while the Pearson correlation coefficient was used to determine the strength of relationship between the weight and length of each fish.

3. Results

The results of the measured standard lengths (TL) and body weights (TW) of the fishes examined are presented in Table 1. The values of the regression coefficients *a* & *b* and the condition factors obtained are presented in Table 2.

Table 1: The Standard lengths and body weight of fishes examined

Fish	Total Length (TL) (cm)		Total Weight (TW) (g)	
	Size Range	Mean	TW Range	Mean
Chromidotilapia guntheri guntheri	14.4-18.2	16.18±1.15	59.9-105.37	80.4±15.86
Coptodon guineensis	8.3-20.0	14.71±2.23	10.05-157.89	74.69±29.90
Coptodon zilli	13.5-21.3	16.03±3.56	41.62-179.52	83.83±64.21
Hemichromis fasciatus	13.3-16.9	14.60±1.16	42.2-112.97	63.04±26.20
Oreochromis niloticus	8.0-19.7	15.40±3.04	9.98-132.85	67.89±31.55
Sarotherodon melanotheron	16.6-19.5	17.68±1.33	79.2-134.50	100.5±24.79

Table 2: The regression coefficient and condition factors of fishes examined

Fish	a	b	r	K
Chromidotilapia guntheri guntheri	1.514	2.82	0.9753	1.891
Coptodon guineensis	1.642	2.99	0.9661	2.351
Coptodon zilli	1.915	3.14	0.9989	2.047
Hemichromis fasciatus	3.512	3.54	0.9742	1.985
Oreochromis niloticus	1.503	2.78	0.9913	1.856
Sarotherodon melanotheron	1.991	3.20	0.9919	1.818

The exponent (b) values for *Chromidotilapia guntheri guntheri*, *Coptodon guineensis* and *Oreochromis niloticus* were less than 3, indicating negative allometric growth pattern while the exponent (b) values for *Coptodon zilli*, *Hemichromis fasciatus* and *Sarotherodon melanotheron* were greater than 3 indicating positive allometric growth. The correlation coefficients values (r) ranged between 0.96617 and 0.99895 in all six fishes and this showed a high degree of positive correlation between the SL and BWT.

4. Discussions

The sizes of *S. melanotheron* and *C. guntheri guntheri* examined were larger than those of *C. guineensis*, *C. zilli*, *H. fasciatus* and *O. Niloticus* in this study. The variation in the length and weight could probably be attributed to their faster

growth rates and voracious predatory and carnivorous feeding habits [14, 2]. Oni *et al*., [23] also reported that feeding and growth were the major factors responsible for the size variations of these fish species in River Galma, Zaria Dam. However, it was observed that the large size fishes were adult, probably with full-laden stomachs or with matured eggs which are due to gear non-selective techniques resulting in samples ranging from immature to fully matured fishes [11].

Chromidotilapia guntheri had a mean condition factor of 1.891 despite having a mean body length and mean body weight of 16.18±1.15 cm and 80.4±15.86 respectively. Anene [4] reported a relatively lower condition factors for relatively large sizes, while relatively higher condition factors were recorded for rather smaller fish. The reason for this result may likely be that adults spend a part of their energy in reproduction, hence the higher condition factor for larger fishes as reported by [5].

The b value for *S. melanotheron* in this result of b = 3.20 varies with juveniles of *S. melanotheron* and adults *S. melanotheron* of b = 2.85 and b= 2.87 respectively from Lake Nokoué and Ahémé as reported by [21]. Also, the "b" values obtained during this study for the same species is higher than 2.8 as reported by [5] in Eleiyele Lake and same with 2.2 by [24] in Ntak Inyang stream, Ikpa River. However, the values of the regression coefficient (b) for all the fish species for the entire period of study were significantly different ($p>0.05$) from 3.0 which is an indication that they exhibited different growth pattern, ranging from positive allometric to negative allometric. The growth pattern observed in this work implies that the fish species may be longer than its weight or weight increases faster than its length. This may be attributed to over-fishing by the natives owing to easy accessibility to the sampling stations, hence making it difficult for the species to grow to a sizeable population. Similar report by [10] show *Sarotherodon galilaeus* exhibiting allometric growth pattern in Opa Reservoir.

The mean condition factors of 1.81 recorded is lower than 4.66 and 4.45 for *S. melanotheron* as reported by [21] in Lakes Nokoué and Ahémé respectively, but similar with k value as reported by [5] in Eleiyele Lake, Southwestern Nigeria. According to [6], k value for fish must range from 2 - 4 and this is similar with the k values ranging from 2.78- 3.54 in this study. This suggests that the condition of some fish from Nwaniba River only favour *Coptodon guineensis* and *Coptodon zilli* species most especially.

5. Conclusion

The predominant growth pattern exhibited by the sampled fish species was both negative and positive allometry growth pattern and this could be due to over-fishing by the native's community. The mean condition factor for all species investigated was greater than 1, which indicates that the fish were above average condition in the river. This study therefore, provides baseline information on the length-weight relationship of some economic fishes in Nwaniba River that will be useful in fisheries resource management of the water body.

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